DRAFT

ENVIRONMENTAL IMPACT REPORT

LODI SHOPPING CENTER

STATE CLEARINGHOUSE NO. 2003042113

Prepared for

CITY OF LODI

Prepared by

PMC

PACIFIC MUNICIPAL CONSULTANTS

AUGUST 2004

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<u>Socioeconomic Reports</u>

Prepared by

Applied Development Economics (ADE)

June and July 2004

Economic Impacts Of The Proposed Lodi Shopping Center On Downtown Lodi

JUNE 2004

Prepared for
Browman Development Company

Prepared by
Applied Development Economics
2029 University Avenue, Berkeley, CA 94704
1029 J Street, Suite 310, Sacramento, CA 95814
www.adeusa.com

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1. PROJECT SETTING

The City of Lodi has invested a substantial sum of money in downtown public improvements in order to improve the area's economic viability. Design and streetscape improvements have been completed, and the train station has been transformed into a multi-modal transportation facility. In addition, a new 12-screen movie theater has recently opened in the downtown, along with a parking garage for moviegoers and downtown shoppers.

For the most part downtown retailers serve Lodi residents. However, the movie theater and appliance stores attract customers from out of the community. The delivery of services and customized products to Lodi consumers allows downtown retailers to compete with Target, Wal-Mart, and Kmart, all of which sell some product lines that compete with products sold at downtown stores.

Downtown Lodi's jewelry shops and bookstores have been able to resist, if not overcome, the economies of scale advantages owned by the big box general merchandise stores. For example, downtown jewelry stores sold $1.42 million in products in 2001, which was competitive with the $1.54 million of jewelry sold at Lodi's Target, Wal-Mart, and Kmart as shown in Figure 1. Similarly, downtown bookstores earned $726,000 in sales in 2001, which competed well with the $450,000 of books sold at the three discount stores.[1]

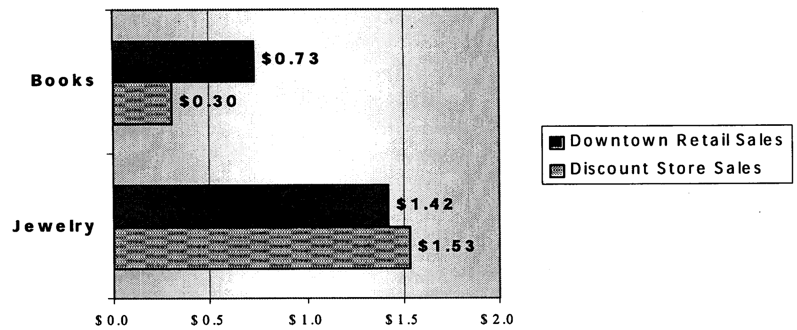
Thus, the downtown bookstores and jewelry shops have adjusted to competition with discount retailers by finding and occupying a niche, establishing quality customer relations, and maintaining customer loyalty. Other specialty retailers in downtown Lodi have also adjusted to the competition from the three discount stores by creating their own distinct market niche. Downtown stores that did not adjust to this competition have either gone out of business or suffered greatly from sales loss to competition.

1.1 DOWNTOWN'S SHARE OF LODI'S RETAIL SALES

Businesses located in Downtown Lodi earn approximately $40.6 million in sales, which amounts to 6 percent of the city's retail sales as shown in Table 1. The relative strengths and weaknesses of downtown Lodi retailers are summarized below.

[1] See Appendix Table A-1 for estimate of discount store sales of books and jewelry. Estimates of discount store actual sales are based on taxable sales data provided by the City of Lodi.

FIGURE 1
Strength of Downtown
Specialty Retailers by Selected Items
($ Million)



Source: Applied Development Economics.

Note: See Appendix Table A-1 for estimates of discount store sales by products. Taxable sales data for downtown establishments provided by City of Lodi

Strengths

Downtown Lodi is located in a relatively isolated area away from the highway oriented commercial strips. Downtown's strengths relative to the entire city are listed below.

- Downtown apparel retailers sold $1.6 million of products, which accounts for 13 percent of all apparel sales citywide. Forty-two percent of all shoes and 28 percent of all women's apparel are sold downtown.
- Downtown drug stores earn $9.9 million of sales, which accounts for 22 percent of all drug store sales.
- Specialty retail strengths among downtown establishments include gift and novelty stores, books, and jewelry. Other types of specialty retail stores are extremely weak.
- Specialty food retailers in the downtown account for $3.9 million in sales, which represents 55 percent of all specialty food store sales in Lodi.
- Furniture and home furnishing retailers downtown sold $4.7 million in goods, which accounts for 60 percent of all home furnishing sales in Lodi.
- Specialty downtown garden and supply establishments earn $1.6 million of sales, which amounts to 52 percent of all sales in Lodi.
- Stores that sell boat and motorcycle parts in the downtown area earn $2.5 million of sales, which amounts to 56 percent of all sales in Lodi.

TABLE 1
Actual Sales Earned by Downtown and All Retail Establishments in Lodi 2000

RETAIL STORE TYPE	CITY OF LODI ACTUAL SALES	DOWNTOWN ACTUAL SALES	DOWNTOWN ACTUAL SALES AS % OF LODI ACTUAL SALES
TOTAL	**$733,572,362**	**$40,565,561**	**6%**
Apparel Store Group	**$12,541,498**	**$1,644,546**	**13%**
Discount Stores	**$105,221,975**		
Other General Merchandise	$3,974,303		
Department Stores	$24,798,264		
Drug & Proprietary Stores	$45,187,981	$9,886,138	22%
Specialty Retail Group			
Gifts & Novelties	$1,822,012	$562,282	31%
Sporting Goods	$4,503,017	$5,275	
Florists	$1,004,306	$35,005	3%
Photographic Equipment	$3,058,773	$0	
Records & Music	$1,920,039	$1,928	
Books & Stationery	$1,813,877	$726,039	40%
Office Supplies/Computer Equipment	$7,396,631	$848,395	11%
Jewelry	$2,051,645	$1,417,252	69%
Misc. Specialty Retail	$10,954,313	$767,379	7%
Food, Eating and Drinking Group			
Supermarkets & Convenience Stores	$137,436,035	$72,052	0.1%
Specialty Food Stores	$7,053,575	$3,870,853	55%
Liquor Stores	$8,511,434		
Eating Places			
Full-Service Restaurants	$19,555,124	$2,622,630	13%
Other Eating Places	$35,158,808	$1,413,064	4%
Drinking Places	$9,193,444	$2,496,247	27%
Furniture & Home Furnishings	$7,824,718	$4,706,089	60%
Household Appliances & Electronics	$14,632,348	$1,829,686	13%
Building Materials Group			
Garden Equipment & Supply Stores*	$3,064,774	$1,581,454	52%
Hardware, Lumber, & Other Materials*	$33,517,662	$0	%
Paint & Wallpaper*	$4,651,844	$719,870	15%
Automotive Group			
Car Dealers	$157,649,640	$438,528	0%
Gasoline Service Stations	$49,378,333	$0	%
Mobile Homes & Trailers	$593,787	$0	%
Auto Parts & Accessories	$14,588,264	$2,405,994	16%
Boats & Motorcycles	$4,513,937	$2,514,854	56%

Source: Applied Development Economics

Weaknesses

Downtown's primary weakness relates to its isolated location. Downtown is simply not an appropriate area to locate big box retailers that are attracting regional spending to Lodi. For example:

- There are no discount and general merchandise retailers in downtown Lodi. These big box store types are not an appropriate fit in the downtown area.
- There are no anchor department store retail attractions.
- There are no grocery stores or supermarkets in the downtown area.
- Car sales are earned outside the downtown area

1.2 LODI RETAIL SALES TRENDS

Since 1997, taxable sales in the City of Lodi have increased annually by 6 percent, for a cumulative growth of 29 percent for the five-year period between 1997 and 2001 as shown in Table 2. In 1997, Lodi recorded $451.1 million in taxable sales, which increased to $581.7 million by 2001.

Taxable sales in Lodi grew at a rate faster than that for the state of California. However, Lodi's growth rate lagged behind growth rates for the City of Stockton and San Joaquin County. Taxable sales grew annually by 7 percent and 8 percent, respectively, for Stockton and the County during the five-year period between 1997 and 2001. Moreover, in 1997 Lodi's taxable sales represented 13 percent of taxable sales in San Joaquin County. By 2001, Lodi's share of county taxable sales declined slightly to 12.2 percent.

TABLE 2
Five-year Taxable Sales Trends
Lodi, Stockton, and San Joaquin County, 1997 – 2001 ($2001)

	1997	1998	1999	2000	2001	1997 - 2001	Annual
Lodi	$451.1	$467.5	$510.6	$546.0	$581.7	29%	6%
Stockton	$1,647.3	$1,731.2	$2,500.2	$2,154.0	$2,222.5	35%	7%
San Joaquin County	$3,457.7	$3,605.0	$4,042.8	$4,518.7	$4,768.8	38%	8%
California	$238,973.5	$250,053.1	$270,924.7	$295,700.3	$296,077.8	24%	5%
Lodi As Percent of SJ County	13.0%	13.0%	12.6%	12.1%	12.2%		

Source: Applied Development Economics, California Board of Equalization (1997-2001), and City of Lodi (2001)

1.3 LODI AS A REGIONAL RETAIL CENTER

Retailers in Lodi successfully attract regional spending that greatly exceeds spending by Lodi residents. Data in Table 3 indicates that Lodi households spend approximately $361 million at retail stores.[2] However, Lodi retailers sold approximately $734 million during the same period of time. Thus, Lodi retailers capture $403 million of regional sales. This means that a significant number of people from the surrounding regional are traveling to shop at Lodi's discount stores, restaurants, supermarkets, and other supporting retail stores.

[2] There are 21,800 households in Lodi with an average household income of $58,000.

TABLE 3
Estimate of Household Spending, Sales, and Spending Leakages in Lodi
2001

RETAIL GROUP	TOTAL HOUSEHOLD DEMAND	TAXABLE SALES	ACTUAL SALES	SALES LEAKAGES	REGIONAL SALES CAPTURE
Total	**$361,843,172**	**$581,714,630**	**$733,572,361**	**$31,659,569**	**$403,388,759**
Apparel Store Group	**$21,447,816**	**$12,541,498**	**$12,541,498**	**$8,906,318**	
General Merchandise Group	**$63,238,053**	**$141,937,037**	**$179,182,523**		
Discount Store and Superstore					
Discount Store	$20,899,721	$98,803,434	$105,221,975	$0	$84,322,253
Superstores	$13,316,099	$0		$13,316,099	
Department Stores	$14,200,259	$23,285,570	$24,798,264	$0	$10,598,005
Misc. General Merchandise	$4,325,908	$2,947,728	$3,974,303	$351,605	
Drug & Proprietary Stores	$10,496,066	$16,900,305	$45,187,981	$0	$34,691,915
Specialty Retail Group	**$25,005,541**	**$33,955,997**	**$34,117,830**		
Gifts & Novelties	$1,967,121	$1,798,326	$1,822,012	$145,108	
Sporting Goods	$2,701,132	$4,498,514	$4,503,017	$0	$1,801,885
Florists	$635,729	$999,284	$1,004,306	$0	$368,577
Photographic Equipment	$323,053	$3,058,773	$3,058,773	$0	$2,735,720
Records & Music	$1,452,070	$1,920,039	$1,920,039	$0	$467,970
Books & Stationery	$1,750,598	$1,813,877	$1,813,877	$0	$63,279
Office Supplies/Computer Equipment	$4,262,404	$7,396,631	$7,396,631	$0	$3,134,226
Jewelry	$2,493,413	$2,049,593	$2,051,645	$441,769	
Misc. Specialty Retail	$9,420,021	$10,420,959	$10,547,530	$0	$1,127,509
Food, Eating and Drinking Group	**$99,273,978**	**$106,250,511**	**$216,908,420**	**$0**	**$117,634,443**
Supermarkets and Convenience Stores	$65,240,958	$36,283,113	$137,436,035	$0	$72,195,078
Specialty Food Stores	$2,018,592	$4,084,020	$7,053,575	$0	$5,034,983
Liquor Stores	$2,840,529	$8,366,740	$8,511,434	$0	$5,670,905
Eating Places	$29,173,899	$57,516,639	$63,907,376	$0	$34,733,477
Full-Service Restaurants	$13,918,461	$17,599,611	$19,555,124	$0	$5,636,662
Other Eating Places	$14,120,999	$31,642,927	$35,158,808	$0	$21,037,809
Drinking Places	$1,134,439	$8,274,100	$9,193,444	$0	$8,059,005
Building Materials and Home Furnishings Group					
Furniture & Home Furnishings	$15,747,464	$7,809,068	$7,824,718	$7,922,746	
Household Appliances & Electronics	$6,390,893	$14,632,348	$14,632,348	$0	$8,241,455
Used Merchandise	$982,707	$406,783	$406,783	$575,924	
Nurseries & Garden Supply Stores	$3,026,338	$3,058,645	$3,064,774	$0	$38,436
Lumber & Other Building Materials	$5,501,515	$15,546,291	$15,546,291	$0	$10,044,776
Home Centers and Hardware Stores	$3,826,711	$17,953,400	$17,971,371	$0	$14,144,661
Paint & Wallpaper	$283,238	$4,651,844	$4,651,844	$0	$4,368,606
Automotive Group	$117,118,918	$222,971,207	$226,723,960	$0	$109,605,043
New Cars, RVs and Used Car Dealers	$81,183,122	$157,649,640	$157,649,640	$0	$76,466,518
Gasoline Service Stations	$30,906,386	$45,625,580	$49,378,333	$0	$18,471,947
Auto Parts & Accessories	$2,730,719	$14,588,264	$14,588,264	$0	$11,857,544
Mobile Homes, Trailers, Boats & Motorcycles	$2,298,690	$5,107,724	$5,107,724	$0	$2,809,034

Source: Applied Development Economics.
Note: See Appendix B for description of industry.

The existing Wal-Mart, Kmart, and Target discount stores are significant regional attractions that capture an estimated $84.2 million of regional retail sales. Essentially, the discount stores rely on regional sales for 80 percent of their spending as displayed in Figure 2.[3]

The discount stores draw customers from a very large geography that extends south to Marsh Lane in Stockton and north to the edge of the Sacramento County-San Joaquin County border. The market area also includes customers from the rural communities along Highway 12, east of Rio Vista, and to the Sierra foothill communities of Ione and Jackson as shown in Figure 3. The market area could be

FIGURE 2
Estimate of Regional Sales Captured by Lodi's Discount Stores

Source: Applied Development Economics
Actual sales derived from sales tax data provided by the City of Lodi. Data estimates combined sales earned by Target, WalMart and KMart

expanded significantly if new retail tenants are attracted to the proposed project. Higher end tenants such as Michaels Crafts, Trader Joes, or Pier One Imports could expand the market area and attract customers from Stockton neighborhoods that are currently oriented toward competitive shopping centers.

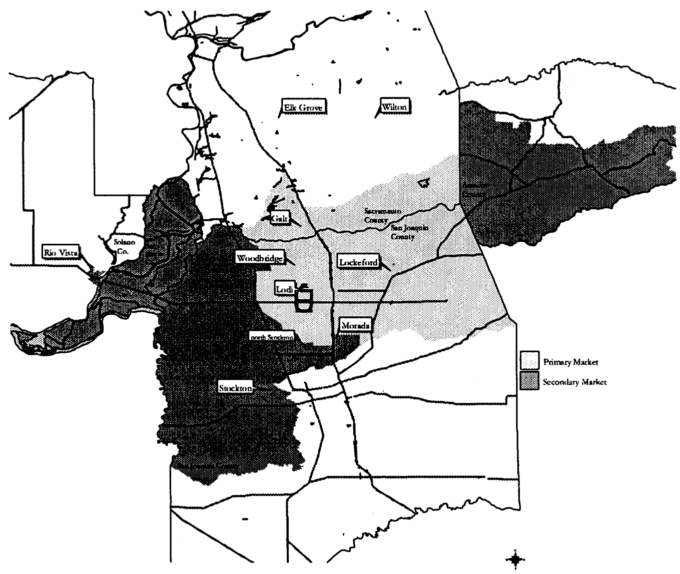
In addition to Lodi's discount stores, other store type anchors that attract regional spending are summarized below.

- Supermarkets and convenience stores rely on regional spending for $72 million of sales. Local spending accounts for only $65.2 million of grocery store sales.

[3] Data in Appendix Table A-2 shows that Lodi's discount stores are competing for $230 million of regional spending at discount stores, superstores, and traditional department stores.

- Eating-places attract $34.7 million of regional sales. Local spending at eating out establishments accounts for $29.2 million of sales.

FIGURE 3
Lodi Discount Store Trade Area



- Car dealers attract $76.4 million of regional sales, and have $80 million of local spending available to capture.
- Nearly all other retail store types have benefited from the regional draw of the anchor tenants.

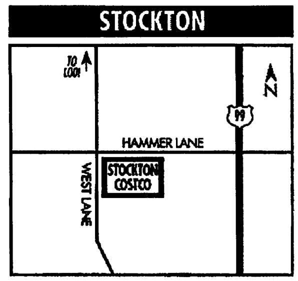
1.4 OPPORTUNITIES TO CAPTURE SPENDING LEAKAGES

New retailers that establish themselves at the Lower Sacramento and West Kettleman intersection serve an expanded market area that attracts regional spending into the community. Conversely, the market opportunities to capture $31.7 million of spending leakages are limited to four store types, as described below.

Apparel Stores

Lodi has approximately $8.9 million of spending leakages among specialty apparel stores. This is a store type that is successful when they locate adjacent to an anchor retailer such as a discount or department store. Specialty apparel stores also do well in vibrant downtown districts.

FIGURE 4
Newest Costco Competitive With Lodi Discount Stores



1616 E Hammer Lane

Supercenters, Warehouse Clubs, and Mass Merchants

Wal-Mart, Target, and Kmart are already established in Lodi. To date, Lodi still lacks Costco and the large supercenters that combine groceries and discount retail under one roof. Thus, a proposal to develop a superstore in Lodi could capture spending leakages currently captured by the Costco located on Hammer Lane in Stockton, as displayed in Figure 4.[4]

Jewelry

Jewelry stores are the only specialty retail store type with spending leakages, estimated to be $442,000.

Furniture and Home Furnishings

The furniture and home furnishings store type category is not capturing approximately $8 million of local spending. This represents a market opportunity to expand this store type and capture local spending.

[4] Costco offers a distinctly different store type product than offered by the Wal-Mart and Target superstores. Consequently, the establishment of a superstore in Lodi will only capture some of the spending leakages in the superstore category.

2. DESCRIPTION OF PROPOSED PROJECT

The Browman Development Company has proposed to develop a new retail center on a 35-acre site located at the corner of Kettleman Lane and Lower Sacramento Road. The proposed Lodi Shopping Center will form the western boundary of a retail strip that extends along Kettleman Lane, from the project site to Highway 99. The location of the proposed project is consistent with City policies to locate new large-scale retailers to the four corners area. The proposed project has been scaled down to 339,966 square feet of commercial space, of which 226,868 square feet is set aside for a Wal-Mart Supercenter store. The analysis and findings discussed below are for the project as originally conceived. The proposed commercial uses are displayed in Table 4, and described below.

TABLE 4
Browman Development Project
Proposed Space Use in the City of Lodi

	PROPOSED PROJECT (SF)
Wal-Mart Supercenter	226,868
Pharmacy	14,788
Other Retail	67,960
Restaurant (Sit Down)	7,500
Fast Food	9,690
Gas Station	
Personal Services	3,000
Business and Professional Services	5,000
Financial Institutions	5,160
TOTAL	**339,966**

Source: Applied Development Economics, based on information provided by Browman Development Company

General Merchandise Superstore

The project sponsor seeks approval to attract a 226,868 SF Wal-Mart Supercenter store that combines the sale of grocery products with standard discount retailing. It is estimated that the proposed Wal-Mart may allocate as much as 70,000 SF of space for grocery store sales. The existing Wal-Mart will vacate the existing space and the vacant space will need to be re-tenanted, which may bring in additional tax revenues to the City of Lodi.

Pharmacy

Another key component of the proposed project is the development of 14,788 SF that will attract a store such as Rite Aide, Walgreen's, Longs, or another similar national chain drug store.

Other Retail

The proposed project will develop no more than 67,9000 SF of retail space, which will be designed to attract well-known specialty retailers such as Michael's, Pier One, Cost Plus, Circuit City, or other national chain stores. Some commercial spaces will also be developed for retail tenants that require between 1,000 and 5,000 SF

Restaurants and Fast Food Establishments

The proposed project will include no more than 9,690 SF of space for fast food restaurants with drive-thru windows that typically occupy approximately 2,000 S.F each. Up to 7,500 SF of additional restaurant space will also be developed for sit down establishments.

Gas Station

The proposed project will not include a gas station component.

Non-Retail Uses

The proposed project will also include no more than 13,160 SF of space for businesses not engaged in the area's retail trade competition. No more than 3,000 SF of space will be developed for small personal service establishments such as hairdressers and beauty shops. Up to 5,000 SF of space will be developed for business service or professional office uses, and not more than 5,160 SF will be developed for financial institutions.

3. PROJECT IMPACTS

An analysis of the proposed project's impacts depends significantly on the market demand for its uses. Is there excess consumer spending that the proposed project can absorb? Or, does the market viability of the proposed project rely on taking away sales from existing stores? Accordingly, the information below estimates the amount of new sales that the proposed project will attract to Lodi, the sales that will be taken from existing stores, and the sales that will be taken away from downtown establishments.

The economic impact analysis below was performed on the basis of the original amount of square footage envisioned for the project, or 389,100 square feet of commercial space. Since completion of the report in summer 2003, the project has been scaled down to 339,966 square feet of commercial space, of which 226,868 square feet is set-aside for a general merchandise superstore. The analysis and findings discussed below are for the project as originally conceived.

3.1 ESTIMATE OF SALES EARNED BY PROPOSED PROJECT

The data in Table 5 indicates that the proposed project will earn $111.5 million in sales as described below.

- The proposed Wal-Mart Supercenter is estimated to capture $79.4 million in sales during its first years of operation. The potential earnings by Wal-Mart are obviously achievable, based on the fact that the existing discount stores earn $105 million of sales, and the existing supermarkets earn $135 million of sales.5 Thus, the proposed superstore should earn at least $350 per SF of sales at the Lodi location. The market sales already exist, and the proposed project will shift some sales to a larger format discount store, and attract some new customers to the market area.
- It is estimated that the proposed pharmacy will earn $6.5 million of sales, which is equivalent to the earnings of an average Walgreen's Drug Store.[6] Lodi's existing drug stores earn $45.2 million of sales. So, market demand can be captured at the proposed project given the attraction of the new superstore.
- The additional space proposed to accommodate national chain store retailers will need to earn $300 per SF in order to pay the required rents while maintaining profitability. If successful, the other retail businesses attracted to the Lodi Shopping Center should earn $20.4 million of sales.

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5 See Appendix Table A-3, which shows that the established discount stores earn $345 per SF of sales, and the established grocery stores earn $377 per SF of sales.

6 Source: Walgreen's

- It is anticipated that the proposed restaurant space will achieve $300/SF in sales, which will amount to $2.3 million.[7]
- Three proposed fast food fast food establishment should earn $1 million of sales each for a total of $3 million.

TABLE 5
Maximum Sales Earned by Retailers Attracted to Proposed Lodi Shopping Center

	Proposed Space (SF)	Sales Per SF	Sales
Wal-Mart Supercenter	226,868	350	$79,403,880
Pharmacy	14,788	438	$6,477,144
Other Retail	67,960	300	$20,388,000
Restaurant (Sit Down)	7,500	300	$2,250,000
Fast Food	9,690	313	$3,000,000
Personal Services	3,000		$0
Business & Professional Services	5,000		$0
Financial Institutions	5,160		$0
Total	**339,966**		**$111,518,944**

Source: Applied Development Economics, based on information provided by Browman Development Company

3.2 ESTIMATED CITYWIDE IMPACTS OF PROPOSED PROJECT

Data in Table 6 suggests that the proposed Wal-Mart will capture $34.5 million of additional sales once the new large format superstore is established at the Lodi Shopping Center. The analysis indicates that the proposed Wal-Mart will capture $13.5 million of local spending currently leaving Lodi, then $15.0 million will be captured from grocery stores, and $6.4 million from the established discount stores. Thus, the proposed superstore will add $13.5 million to Lodi's sales tax base, and take $21.2 million away from existing stores.

The capacity for the proposed superstore to continue to attract North Stockton spending will depend on the competitive impacts of the proposed 750,000 SF Power Center located at the I-5 Eight Mile Road off-ramp. This center will be anchored by a Target and Costco, which will directly compete with box retail at Lower Sacramento and West Kettleman.[8]

The emerging competition will make it nearly impossible for the proposed superstore to expand the market area boundaries across a broader geography. Instead, the big box retailers located at the intersection of Lower Sacramento and

7 Restaurants such as Apple Bees earn $300/SF of sales restaurants such as Coco earn $250/SF of sales. A mixture of national chain restaurants is assumed for the proposed Lodi Shopping Center.

8 Information on new power center developed on I-5 at Eight Mile Road was provided by Greg Folsom with the Stockton Economic Development Division.

West Kettleman will need to work hard to retain their current market share in light of the expanding competition.

TABLE 6
Estimate of Sales Retained and Taken Away from Existing Business by Proposed Project

	Proposed Project (1)	Total Sales Earned by Proposed Project (2)	New Sales Earned by Proposed Project (3)	Established Store Earnings (4)	Spending Leakages Retained (5)	Spending Taken from Established Stores (6)
General Merchandise Superstore	226,868	$79,403,880				
Discount Store Component	36,868		$10,500,000	$105,221,975	$4,050,000	$6,450,000
Grocery Store Component	70,000		$24,500,000	$134,631,011	$9,450,000	$15,050,000
Pharmacy	14,788	$6,477,144	$6,477,144	$45,187,981	$0	$6,477,144
Other Retail [a]	67,960	$20,388,000	$20,388,000	$110,757,457	$17,457,353	$2,930,647
Restaurant (Sit Down)	7,500	$2,250,000	$2,250,000	$17,599,611	$0	$2,250,000
Fast Food	9,690	$3,000,000	$3,000,000	$31,642,927	$0	$3,000,000
Personal Services	3,000	$0	$0	$0	$0	$0
Business & Professional Services	5,000	$0	$0	$0	$0	$0
Financial Institutions	5,160	$0	$0	$0	$0	$0
Total	**339,966**	**$111,519,024**	**$67,115,144**	**$445,040,962**	**$30,957,353**	**$36,157,791**

Source: Applied Development Economics
Notes: Column (1) data consistent with data in Table 11
Column (2) data consistent with data in Table 8. Assumes that new project will relocate Target or Wal-Mart to the Lodi Shopping Center. Proposed Superstore will create 70,000 SF of new grocery store space and 30,000 SF of new discount store space
Column (3) data consistent with data in Table 4 (Column 3)
Column (4) data consistent with data in Table 8 and Table 4 (Column 4). Assumes that 70 percent of captured discount store sales leakages will be groceries, and 30 percent will be discount store products
Row [a] data measures spending at apparel stores, specialty retail, building materials, and home furnishings

The data analysis also estimates that the other 67,960 SF of proposed retail space will retain $17.5 million of spending leakages currently leaving Lodi, assuming that the project sponsor attracts apparel, home furnishings, and specialty retail establishments, which can be attracted to Lodi without taking sales away from existing establishments.

However, the estimated sales earned by the proposed pharmacy, fast food and sit down restaurants will be taken away from existing Lodi establishments because the new Wal-Mart Supercenter store will not expand Lodi's market area, and attract new customers to the community. Thus, the new stores will compete with existing stores for a limited supply of sales.

4. DOWNTOWN IMPACTS

It is estimated that the proposed project will take $2.1 million of sales away from downtown establishments, which amounts to 5.1 percent of all downtown sales as displayed in Table 7 and described below.[9]

TABLE 7
Estimated Loss of Sales Among Downtown Establishments Created by Proposed Project

	Proposed Space (SF) (1)	Estimated Sales (2)	Potential Sales Taken from Established Businesses (3)	Percent Downtown Sales (4)	Potential Sales Loss Downtown (5)
General Merchandise Superstore	226,868	$79,403,880	$21,500,000	0%	$0
Pharmacy	14,788	$6,477,144	$6,477,144	22%	$1,424,972
Other Retail	67,960	$20,388,000	$2,930,647	10%	$293,065
Restaurant (Sit Down)	7,500	$2,250,000	$2,250,000	13%	$292,500
Fast Food	9,690	$3,000,000	$3,000,000	4%	$120,000
TOTAL		**$111,519,024**	**$36,157,791**		**$2,130,536**

Source: Applied Development Economics

- The general merchandise superstore will not take any sales away from downtown establishments because downtown has already adjusted to competition with the national discount retailers.
- The largest loss of sales will be at the downtown pharmacy, which currently captures 22 percent of all drug store sales in Lodi. It is estimated that the pharmacy will lose $1.4 million of sales.
- Other Downtown retail stores will lose $293,065 of sales to the proposed project assuming that the project sponsor attracts store types that absorb existing spending leakages and do not directly compete with downtown retailers
- Downtown Lodi has 13 percent of the city's sit down restaurant market share. New restaurants that locate at the proposed project are anticipated to take $292,500 of sales away from downtown restaurants.
- Downtown Lodi has only four percent of the city's fast food market share. New fast food establishments that locate at the proposed are anticipated to take $120,000 of sales away from downtown fast food establishments.

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[9] Column (3) quantifies the sales taken away from established businesses throughout the City as described in the previous section. Column (4) displays downtown Lodi's relative strength at capturing its share of local spending. For example, the downtown pharmacy captures 22 percent of the City's drug store sales. Sit down restaurants capture 13 percent of the City's sales, specialty retail captures 10 percent, and fast food captures 4 percent. Column (5) measures the loss of sales among downtown establishments that will be created by the proposed project.

APPENDIX A: SUPPLEMENTAL TABLES

Table A-1 Estimate of sales by merchandise line item at Lodi's discount stores, 2001

Table A-2 Regional Household Spending and Actual Sales Earned by Lodi Retail

Table A-3 Estimate of Sales per SF Earnings by Lodi's Discount and Grocery Stores

TABLE A-1
Estimate Of Sales By Merchandise Line Item At Lodi's Discount Stores, 2001

MLNO	Merchandise Line Items	Allocation	Discount Store Sales By Merchandise Line Items
	Total	**100%**	**$105,221,975**
100	Groceries & other food	5.9%	$8,233,922
120	Meals and snacks	0.5%	$472,397
130	Alcoholic drinks	0.0%	$0
140	Packaged alcoholic beverages	0.0%	$16,527
150	Cigars, cigarettes, and tobacco	1.2%	$969,577
160	Drugs, health aids & beauty aids	13.9%	$9,098,150
180	Soaps, detergents, & household cleaners	4.6%	$4,507,750
190	Paper and related products	2.3%	$2,045,395
200	Men's wear	6.4%	$6,900,587
220	Women's, juniors' and misses' wear	10.5%	$10,941,492
240	Children's wear	7.1%	$15,203,279
260	Footwear, except infants' & toddlers	2.3%	$1,959,803
270	Sewing, knitting & needlework goods	0.7%	$710,237
280	Curtains, draperies & dry goods	4.5%	$6,001,716
300	Major household appliances	0.7%	$376,305
310	Small electrical appliances	2.2%	$2,580,814
320	Televisions, video recorders, and tapes	4.9%	$3,470,632
330	Audio equipment, musical instruments & supplies	4.1%	$1,061,500
340	Furniture and sleep equipment	1.4%	$2,083,890
360	Floor coverings	0.2%	$358,056
370	Computer hardware, software/calc. equip., supp.	0.3%	$43,375
380	Kitchenware & home furnishings	4.0%	$5,634,487
400	Jewelry	1.7%	$1,540,025
420	Books	0.4%	$457,875
440	Photographic equipment & supplies	1.0%	$1,194,548
460	Toys, hobby goods & games	5.5%	$7,874,463
490	Optical goods	0.2%	$177,813
500	Sporting goods	2.4%	$2,576,791
580	Recreational vehicles	0.0%	$0
600	Hardware, tools & plumbing & electrical supplies	0.5%	$532,874
620	Lawn & garden equipment & supplies	2.7%	$1,879,418
640	Lumber & building materials	0.4%	$5,020
670	Paint & related preservatives & supplies	0.3%	$25,084
680	Manufactured (mobile) homes	0.0%	$0
700	Cars, trucks & powered vehicles	0.0%	$0
720	Automotive fuels	0.0%	$0
730	Automotive lubricants	0.0%	$72,782
740	Auto tires, batteries & accessories	1.5%	$294,934
780	Household fuels	0.0%	$0
800	Pets, pet foods, & supplies	2.0%	$1,980,390
850	All other merchandise	4.0%	$3,682,744
890	Unclassified merchandise	0.0%	$257,323

Source: Applied Development Economics

TABLE A-2
Regional Household Spending and Actual Sales Earned by Lodi Retail

Retail Group	Total Household Demand (1)	Taxable Sales (2)	Actual Sales (3)
Total	$1,715,755,122	$581,714,630	$733,572,361
Apparel Store Group	$102,131,131	$12,541,498	$12,541,498
General Merchandise Group			
Discount Store	$99,450,676	$98,803,434	$105,221,975
Department Stores	$67,754,129	$23,285,570	$24,798,264
Superstore	$62,728,330		
Misc. General Merchandise	$20,600,019	$2,947,728	$3,974,303
Drug & Proprietary Stores	$48,994,836	$16,900,305	$45,187,981
Specialty Retail Group	**$119,533,068**	**$33,955,997**	**$34,117,830**
Gifts & Novelties	$9,365,942	$1,798,326	$1,822,012
Sporting Goods	$13,080,985	$4,498,514	$4,503,017
Florists	$3,053,776	$999,284	$1,004,306
Photographic Equipment	$1,563,829	$3,058,773	$3,058,773
Records & Music	$7,008,817	$1,920,039	$1,920,039
Books & Stationery	$8,290,602	$1,813,877	$1,813,877
Office Supplies/Computer Equipment	$20,446,417	$7,396,631	$7,396,631
Jewelry	$12,054,906	$2,049,593	$2,051,645
Misc. Specialty Retail	$44,667,795	$10,420,959	$10,547,530
Food, Eating and Drinking Group	**$466,625,739**	**$106,250,511**	**$216,908,420**
Grocery Stores	$305,694,330	$36,283,113	$137,436,035
Specialty Food Stores	$9,459,563	$4,084,020	$7,053,575
Liquor Stores	$13,406,994	$8,366,740	$8,511,434
Eating Places	$138,064,853	$57,516,639	$63,907,376
Full-Service Restaurants	$65,897,988	$17,599,611	$19,555,124
Other Eating Places	$66,728,804	$31,642,927	$35,158,808
Drinking Places	$5,438,061	$8,274,100	$9,193,444
Building Materials And Home Furnishings Group	**$172,184,103**	**$64,058,379**	**$64,098,129**
Furniture & Home Furnishings	$76,187,862	$7,809,068	$7,824,718
Household Appliances & Electronics	$30,398,732	$14,632,348	$14,632,348
Used Merchandise	$4,694,690	$406,783	$406,783
Nurseries & Garden Supply Stores	$14,529,561	$3,058,645	$3,064,774
Lumber & Other Building Materials	$26,588,837	$15,546,291	$15,546,291
Home Centers and Hardware Stores	$18,431,360	$17,953,400	$17,971,371
Paint & Wallpaper	$1,353,061	$4,651,844	$4,651,844
Automotive Group	**$555,753,090**	**$222,971,207**	**$226,723,960**
New Cars, RVs and Used Car Dealers	$386,756,438	$157,649,640	$157,649,640
Gasoline Service Stations	$145,072,740	$45,625,580	$49,378,333
Mobile Homes, Trailers, Boats and Motorcycles	$11,102,136	$5,107,724	$5,107,724
Auto Parts & Accessories	$12,821,776	$14,588,264	$14,588,264

Source: Applied Development Economics
Note: Column (1) data based on number of households and incomes earned among residents in regional market area as displayed in Figure 3; columns (2) and (3) are taxable and actual sales earned by Lodi businesses. Data does not include business sales earned outside the City of Lodi.

TABLE A-3
Estimate of Sales per SF Earnings by Lodi's Discount and Grocery Stores

	SF (1)	Actual Sales (2)	Sales/SF
Discount Store	304,800	$105,221,975	$345
Grocery Stores	365,000	$137,436,035	$377

Source: Applied Development Economics
Notes:
Column (1) Square Footage data provided by the City of Lodi
Column (2) Actual Sales data from Table 3

APPENDIX B: PREPARERS OF THE REPORT

Browman Development Company

100 Swan Way, Suite 206, Oakland, California
Darryl Browman

Applied Development Economics

2029 University Avenue, Berkeley, California 94707, (510) 548-5912

Project Manager: Stephen Wahlstrom, Managing Principal

Contributors:

Tony Daysog, Associate
Claudette Carr, Production Manager
Joanne Taeuffer, Production Associate
Aba Owens, Administrative Assistant

Socio-Economic Impact Analysis Of The Proposed Lodi Shopping Center

July 2004

Prepared for
Pacific Municipal Consultants
And the
City of Lodi

Prepared by
Applied Development Economics
2029 University Avenue • Berkeley, California 94704 • (510) 548-5912
1029 J Street, Suite 310 • Sacramento, California 95814 • (916) 441-0323
www.adeusa.com

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1. PROJECT SETTING

The City of Lodi has established the intersection of Lower Sacramento and West Kettleman for big box commercial shopping on all four corners, designed to attract regional retail spending. The strategically located intersection connects Lodi with the north Stockton neighborhoods, Interstate 5, and job centers in East Contra Costa County. Of course, commercial shopping centers have been developed at two corners of the intersection, and new private investment has been attracted to develop commercial shopping centers proposed for the other two corners as displayed in Figure 1 and described below.

DEVELOPED SHOPPING CENTERS

- The Sunwest Plaza was first developed in 1992 on the southeast corner of the intersection. The center has 265,000 SF of commercial space anchored by Wal-Mart and the Food 4 Less supermarket.

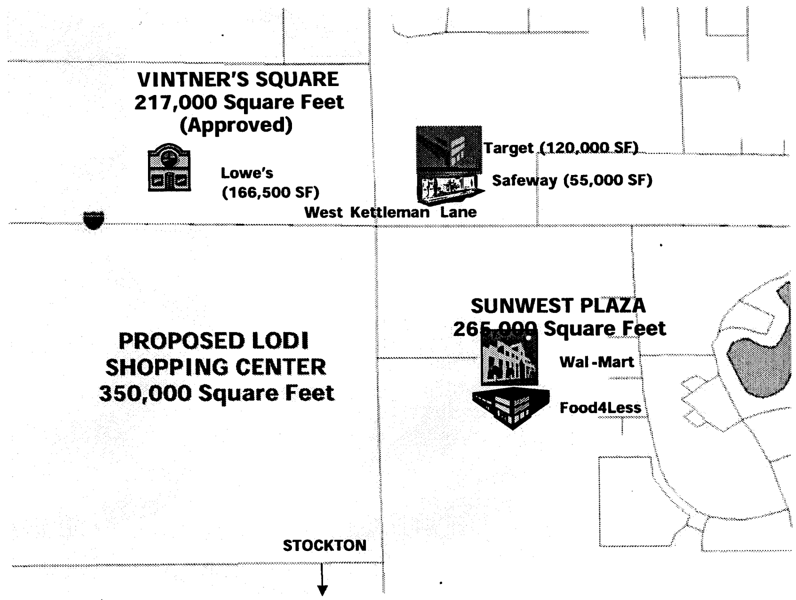
- A second retail center was developed on the northeast corner of the intersection, anchored by 120,000 SF Target store and a 55,000 SF Safeway.

PROPOSED SHOPPING CENTERS

- The Vintner's Square Center has been approved for the northwest corner of the intersection. The project will develop 217,000 SF of new retail space, which will be anchored by 166,500 SF Lowe's big box home center.

- Finally, the Lodi Shopping Center is proposed for the southwest corner of the intersection. This project is proposed to develop nearly 339,860 SF of new commercial space, anchored by a 226,868 Wal-Mart Supercenter Store.

FIGURE 1
Shopping Centers at the Intersection of West Kettleman Lane And Lower Sacramento Road



1.1 POPULATION AND HOUSING CHARACTERISTICS

Population in the City of Lodi and the region surrounding this city increased significantly during the 1990s due to the supply of affordable housing and increased employment between Sacramento and Stockton. Table 1 shows double-digit population growth for Lodi, Stockton, and San Joaquin County, which grew by 10 percent, 15 percent, and 17 percent, respectively. To the immediate north, the population of Sacramento County expanded by 18 percent during the 1990s. By comparison, the State of California's population expanded by 14 percent. To be sure, Lodi's population increased during the 1990s, but it did not grow as rapidly as Stockton or San Joaquin County as a whole.

The number of housing units in Lodi expanded by 9 percent between 1990 and 2000, as shown in Table 2. However, Lodi's rate of housing growth was slower than in Stockton and San Joaquin County, where housing expanded by 13 and 14 percent, respectively. Housing units increased by 15 percent in Sacramento County

TABLE 1
Population Trends in Lodi, Stockton, San Joaquin County
1990 - 2000

	1990	2000	Change	% Change
Lodi	51,874	57,037	5,163	10%
Stockton	210,943	242,714	31,771	15%
San Joaquin County	480,628	563,598	82,970	17%
Sacramento County	1,041,219	1,223,499	182,280	18%
California	29,760,021	33,871,648	4,111,627	14%

Source: Applied Development Economics based on data collected from US Census, 1990 and 2000

TABLE 2
Housing Units Trends in Lodi, Stockton and San Joaquin County
1990 - 2000

	1990	2000	Change	% Change
City of Lodi	19,676	21,400	1,724	9%
City of Stockton	72,525	82,125	9,600	13%
San Joaquin County	166,274	189,160	22,886	14%
Sacramento County	417,574	474,814	57,240	14%
California	11,182,882	12,214,549	1,031,667	9%

Source: Applied Development Economics based on data collected from US Census, 1990 and 2000

1.2 TAXABLE SALES TRENDS

Taxable sales in the City of Lodi have increased annually by 6 percent, for a cumulative growth of 29 percent between 1997 and 2001 as shown in Table 3. In 1997, Lodi recorded $451.1 million in taxable sales, which increased to $581.7 million by 2001. The rate of retail sales growth in Lodi is significantly faster than either population or housing growth rates, reflecting the success of the "big box" retailers to attract regional spending. However, Lodi's taxable sales growth rate was slightly slower than in the City of Stockton and San Joaquin County, where taxable sales expanded annually by 7 percent and 8 percent between 1997 and 2001 (Table 3).

TABLE 3
Five Year Retail Sales Trends in Lodi, Stockton and San Joaquin County
1997-2001 ($2001)

	Lodi	Stockton	San Joaquin County	Lodi as Percent of County
1997	$451,100,100	$1,647,319,300	$3,457,746,600	13%
1998	$467,453,040	$1,731,215,390	$3,604,992,970	13%
1999	$510,563,840	$2,500,171,120	$4,042,825,160	13%
2000	$546,049,350	$2,153,979,260	$4,518,629,570	12%
2001	$581,714,630	$2,222,538,191	$4.768,799,181	12%
1997-2001	29%	35%	38%	
Annual	6%	7%	8%	

Source: City of Lodi and California Board of Equalization

1.3 LODI'S SUCCESS AS A REGIONAL RETAIL CENTER

The development of large amounts of commercial space along West Kettleman Lane and Lower Sacramento has attracted significant spending from the neighborhoods of North Stockton and beyond. Data in Table 4 suggests that Lodi households spend approximately $361 million at retail stores. However, Lodi retailers earned approximately $734 million of sales during the same period of time, which means that there are a significant number of people from the surrounding region that shop at Lodi's discount stores, restaurants, supermarkets, and other supporting retail stores. The estimate of sales captured from people that live outside of Lodi is summarized below:

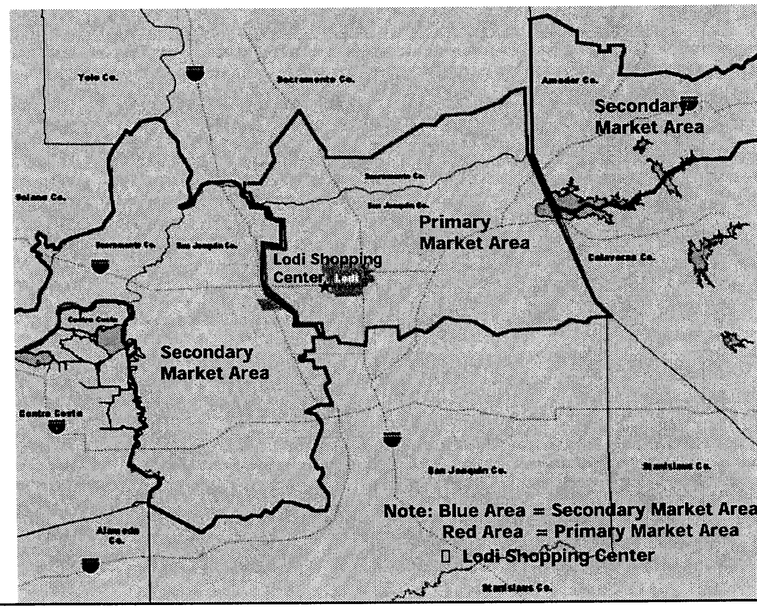
- Discount stores attract $84 million of regional spending
- Department stores attract $10.6 million of regional spending
- Drug stores attract $34.7 million of regional spending
- Specialty retailers attract $9.1 million of regional spending
- Grocery stores attract $72.1 million of regional spending
- Eating places attract $34.7 million of regional spending
- Building materials and home furnishings attract $36.8 million of regional spending, and
- Car dealers attract $94.9 million of regional spending.

TABLE 4
Regional Retail Sales Capture And Retail Sales Leakages In City Of Lodi

Retail Group	Total Household Demand	Taxable Sales	Actual Sales	Sales Leakages	Regional Capture
Total	**$362,146,720**	**$581,714,630**	**$733,572,361**		
Apparel Store Group	**$21,466,907**	**$12,541,498**	**$12,541,498**	**$8,925,409**	
Women's Apparel	$4,845,859	$2,049,593	$2,049,593	$2,796,266	
Men's Apparel	$1,752,194	$0	$0	$1,752,194	
Family Clothing	$10,712,239	$8,549,117	$8,549,117	$2,163,122	
Shoe Stores	$4,156,615	$1,942,788	$1,942,788	$2,213,827	
General Merchandise Group	**$63,291,276**	**$141,937,037**	**$179,182,523**		
Discount Store and Superstore	$34,244,694	$98,803,434	$105,221,975		$70,977,281
Discount Store	$20,918,268	$98,803,434	$105,221,975		$84,303,707
Superstores	$13,326,425			$13,326,425	
Department Stores	$14,213,291	$23,285,570	$24,798,264		$10,584,973
Misc. General Merchandise	$4,329,764	$2,947,728	$3,974,303	$355,461	
Drug & Proprietary Stores	$10,503,527	$16,900,305	$45,187,981		$34,684,454
Specialty Retail Group	**$25,028,939**	**$33,955,997**	**$34,117,830**		**$9,088,890**
Gifts & Novelties	$1,968,863	$1,798,326	$1,822,012	$146,851	
Sporting Goods	$2,703,983	$4,498,514	$4,503,017		$1,799,033
Florists	$636,348	$999,284	$1,004,306		$367,958
Photographic Equipment	$323,399	$3,058,773	$3,058,773		$2,735,374
Records & Music	$1,453,612	$1,920,039	$1,920,039		$466,427
Books & Stationery	$1,752,165	$1,813,877	$1,813,877		$61,713
Office Supplies/Computer Equipment	$4,266,448	$7,396,631	$7,396,631		$3,130,182
Jewelry	$2,496,128	$2,049,593	$2,051,645	$444,484	
Misc. Specialty Retail	$9,427,992	$10,420,959	$10,547,530		$1,119,538
Food, Eating and Drinking Group	**$99,348,591**	**$106,250,511**	**$216,908,420**		
Grocery Stores	$65,287,930	$36,283,113	$137,436,035		$72,148,105
Supermarkets	$62,482,854				
Convenience Stores	$2,805,024				
Specialty Food Stores	$2,020,050	$4,084,020	$7,053,575		$5,033,525
Liquor Stores	$2,842,825	$8,366,740	$8,511,434		$5,668,609
Eating Places	$29,197,787	$57,516,639	$63,907,376		$34,709,590
Full-Service Restaurants	$13,929,928	$17,599,611			
Other Eating Places	$14,132,319	$31,642,927			
Drinking Places	$1,135,540	$8,274,100			
Building Materials and Home furnishings Group	**$35,795,877**	**$64,058,379**	**$64,098,129**		
Furniture & Home Furnishings	$15,765,327	$7,809,068	$7,824,718	$7,940,609	
Household Appliances & Electronics	$6,396,497	$14,632,348	$14,632,348		$8,235,851
Used Merchandise	$983,630	$406,783	$406,783	$576,848	
Nurseries & Garden Supply Stores	$3,029,266	$3,058,645	$3,064,774		$35,508
Lumber & Other Building Materials	$5,507,083	$15,546,291	$15,546,291		$10,039,208
Home Centers and Hardware Stores	$3,830,568	$17,953,400	$17,971,371		$14,140,803
Paint & Wallpaper	$283,505	$4,651,844	$4,651,844		$4,368,340
Automotive Group	**$117,215,129**	**$222,971,207**	**$226,723,960**		**$109,508,831**
New Cars & RVs	$75,750,813	$137,015,418	$137,015,418		$61,264,605
Used Car Dealers	$5,501,912	$20,634,222	$20,634,222		$15,132,310
Gasoline Service Stations	$30,928,727	$45,625,580	$49,378,333		$18,449,606
Mobile Homes & Trailers	$20,360	$593,787	$593,787		$573,427
Auto Parts & Accessories	$2,732,654	$14,588,264	$14,588,264		$11,855,610
Boats & Motorcycles	$2,280,664	$4,513,937	$4,513,937		$2,233,273

Source: Applied Development Economics

FIGURE 2
Lodi Shopping Center's Primary And Secondary Market Areas



THE REGIONAL MARKET AREA

The economic success of the proposed Lodi Shopping Center will depend on its ability to continue to attract customers from a very large geography that extends south to Hammer Lane in Stockton and north to the edge of the Sacramento County-San Joaquin County border. The market area also includes customers from the rural communities along Highway 12 east of Rio Vista, and to the Sierra foothill communities of Ione and Jackson as shown in Figure 2.

The proposed shopping center will primarily compete for the spending by Lodi and nearby Stockton residents. The location is actually convenient for North Stockton residents as shown in Figure 3. It takes about 11 minutes to travel from North Stockton to Wal-Mart in Lodi, which is slightly faster than the 12 minutes it takes to get from North Stockton to the Wal-Mart and Costco on Hammer Lane. It takes West Stockton residents 16 minutes to travel to Lodi's Wal-Mart, and it takes 14 minutes to travel to the big box retailers along Hammer Lane. Consumers prefer uncongested roadways and, therefore, are more attracted to the Lodi commercial centers even if Hammer Lane is slightly closer to the west and north Stockton residential areas.

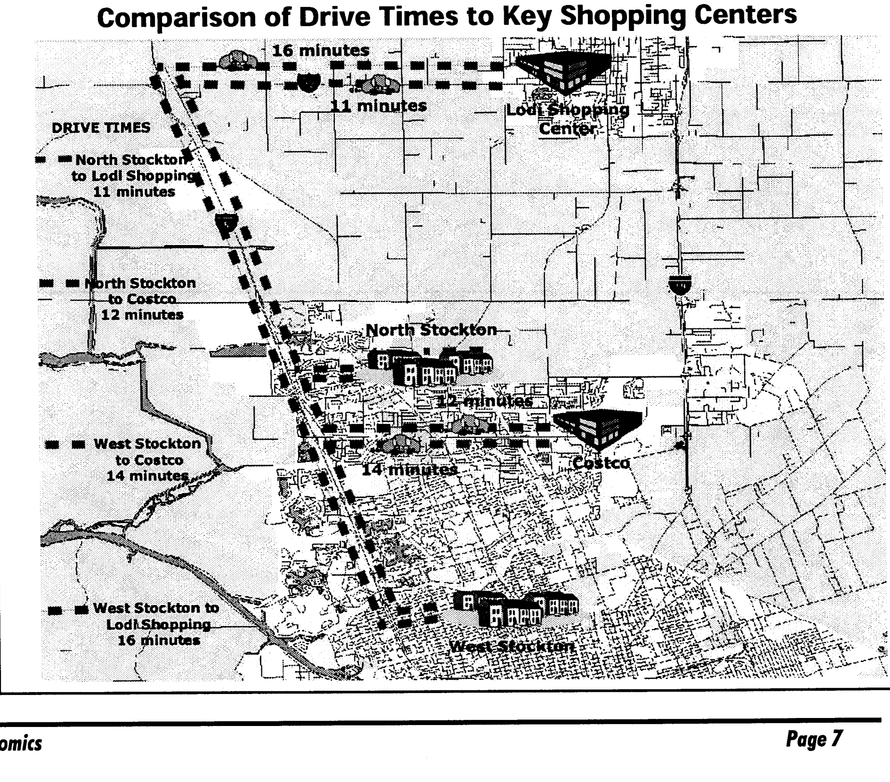
1.4 RETAIL SPENDING LEAKAGE OPPORTUNITIES

Although the proposed Lodi Shopping Center will need to capture regional sales, there are a few store types that the proposed project can attract to capture spending leakages. The store types that could capture spending leakages if attracted to the proposed project are quantified in Table 4, and are discussed below in more detail.

Apparel Stores. Lodi is losing $8.9 million in apparel store sales to retailers outside of the City. Thus, the potential attraction of apparel stores could capture spending leakages now leaving the City. Apparel stores are usually successful when they locate adjacent to an anchor retailer such as a discount or department store.

Super Discount Stores. Residents of Lodi are spending approximately $13.3 million at superstores outside of the City. Most all of the current superstore spending is being captured by the Costco located on Hammer Lane since neither Wal-Mart, Kmart, nor Target have established a superstore within reasonable traveling distance of Lodi. The attraction of a super Wal-Mart or Target to Lodi could capture some superstore spending leakages currently leaving

FIGURE 3
Comparison of Drive Times to Key Shopping Centers



the community.

Furniture and Home Furnishings. The City of Lodi has a number of home furnishing stores, several of which are located in the downtown area. Residents of Lodi spend approximately $7.8 million in home furnishings outside of the City.

1.5 PROPOSED PROJECT'S COMPETITION

The proposed project will primarily compete with other retailers located in Lodi. In particular, the addition of Vintner's Square and the Lodi Shopping Center at the intersection's four corners will create as overall supply of nearly 1.1 million SF of commercial space that will include a discount store, a superstore, a big box home center, and two stand alone supermarkets. This significant clustering of retail will attract regional shoppers, but it will also create additional competition among retailers for a finite amount of consumer spending.

The primary local competition for the Lodi Shopping Center anchor store will be from among other general merchandise stores and supermarkets, as displayed in Figure 4. The K-Mart is located on South Cherokee Lane adjacent to Highway 99. The Target and Wal-Mart are located across the street from the proposed project. It is likely that Wal-Mart will vacate its existing space and relocate to the more spacious superstore proposed for the Lodi Shopping Center. Thus, the super Wal-Mart will continue to compete with the Target located at the same intersection.

Data in Table 5 shows that the established discount stores occupy approximately 300,000 SF of space. The combined sales of the three discount stores are approximately $105 million, which means that the established discount stores earn approximately $345 of sales per SF

FIGURE 4
Key Retail Site Locations in City of Lodi, 2003

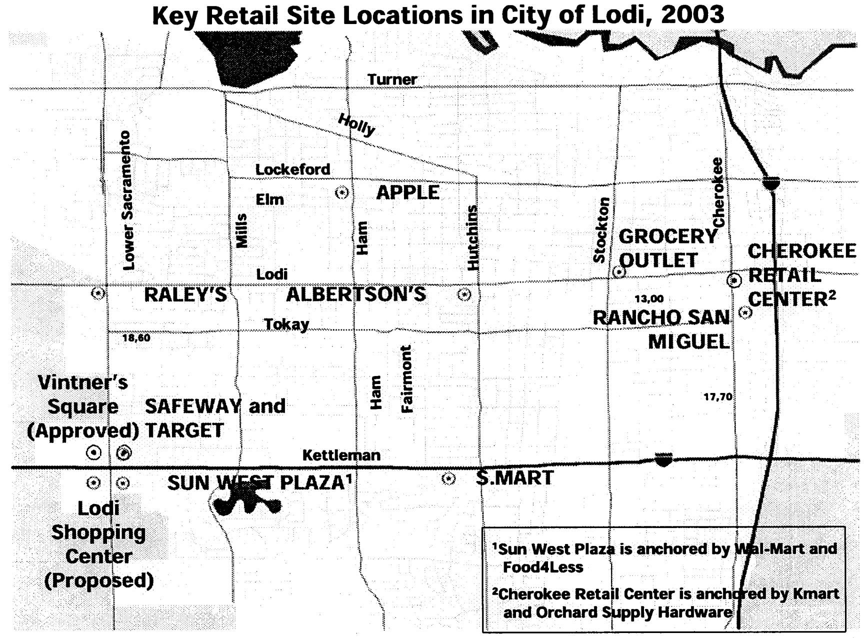


TABLE 5
Estimate of Sales per SF by Established Discount Stores in Lodi, 2002

	Store Size
Wal-Mart	120,352
Target	115,746
Kmart	68,743
Total SF	304,841
Estimated Sales	$105,221,975
Sales/SF (Estimate)	$345.17

Source: Applied Development Economics
Notes: Store size data provided by City of Lodi
See Table 4 for discount store sales estimates based on sales tax data.

There are also eight established grocery stores in Lodi that will compete with the proposed anchor tenant. They range in size from a 63,000 SF Raley's located on Lower Sacramento Road at the Lodi Avenue intersection to the 19,000 SF Grocery Outlet located at the corner of Lodi Road and Stockton Avenue. The combined total of grocery store space that has been developed in Lodi amounts to 365,000 SF It is estimated that all of the grocery stores earn $134.6 million of sales, which amounts to just under $370 of sales per SF, as displayed in Table 6.

TABLE 6
Estimate Of Sales Per SF Earned By Established Grocery Stores In Lodi, 2002

	Size
Raley's	63,000
Ranch San Miguel	40,000
Albertson's	55,000
Smart Foods	48,000
Safeway	55,000
Food 4 Less	57,000
Apple Market	28,000
Grocery Outlet	19,000
Total SF	**365,000**
Estimated Sales	$134,631,011
Sales/SF (Estimate)	$368.85

Source: Applied Development Economics.
Notes: Store Size data provided by the City of Lodi. See Table 4 for grocery store sales estimates based on sales tax data

COMPETITION OUTSIDE OF LODI

There are no large format discount stores such as a Super Target, Super K-Mart, or Super Wal-Mart in the market area. Therefore, the proposed project will create an anchor store type that can attract regional consumers. However, there are a number of "big box" retailers in Stockton that will also compete with the proposed project as shown in Figure 5. There are two K-Mart stores in Stockton, and the K-Mart store that is located near the geographic center of Stockton attracts some customers from the North Stockton neighborhoods. There is also a Target store located in the geographic center of Stockton that is not well located to compete for the customers attracted to the Lodi Target store. Finally, both Costco and Wal-Mart have located stores on Hammer Lane that will compete with the proposed anchor store for North Stockton spending.

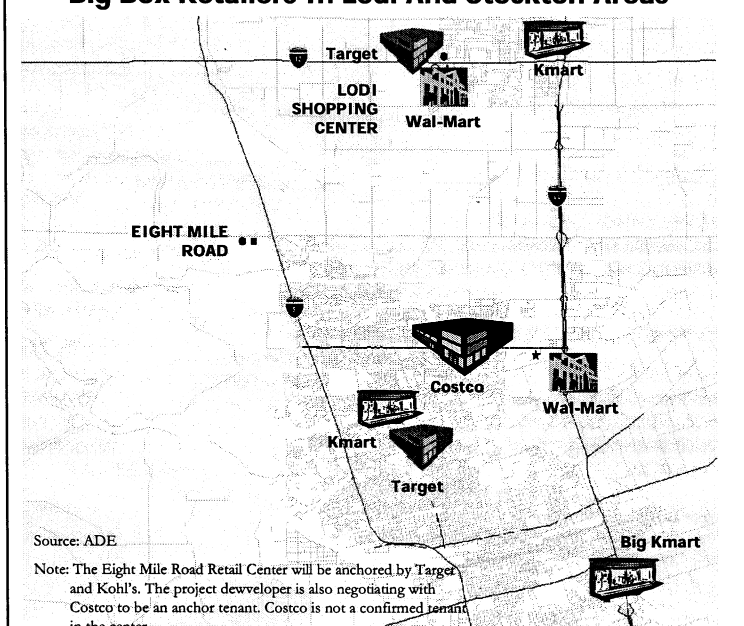
Most importantly, a new "power center" has opened recently at Eight Mile Road in north Stockton. This shopping mall will compete for the consumer spending of West and North Stockton residents. The center is anchored by Target and Kohl, which are now open, and, when fully complete, will contain between 650,000 and 700,000 square feet of rental. Eight Mile Road is also negotiating with Costco to be a tenant. However, Costco has not yet committed to the site.

1.6 REGIONAL ROADWAYS AND TRAFFIC COUNTS

The "big box" retailers have established themselves in Lodi in part because of their close proximity to two major highways, Interstate 5 and State Highway 99. The discount stores and large grocery stores have located on Lower Sacramento Road to capture the spending by the expanding number of Lodi and North Stockton residents who commute on I-5 or Highway 99 to jobs centers in the East Bay or the Sacramento metropolitan area.

Data in Table 7 demonstrates that the volume of regional traffic along West Kettleman had increased over time, including at the key intersection of West Kettleman and Lower Sacramento. The annual average daily traffic count at West Kettleman and Lower Sacramento was 16,500 in 1997. By 2000, the traffic volumes had increased by 48 percent to 24,100 trips per day. The rate of growth translates into an increase of almost 10 percent per year. The increase in traffic at this intersection by far outpaced the increase in population and housing in Lodi, Stockton, and San Joaquin County, suggesting that commuters passing this intersection come from distances as far away as Amador and Sacramento Counties.

FIGURE 5
Big Box Retailers In Lodi And Stockton Areas



Source: ADE

Note: The Eight Mile Road Retail Center will be anchored by Target and Kohl's. The project dewveloper is also negotiating with Costco to be an anchor tenant. Costco is not a confirmed tenant in the center.

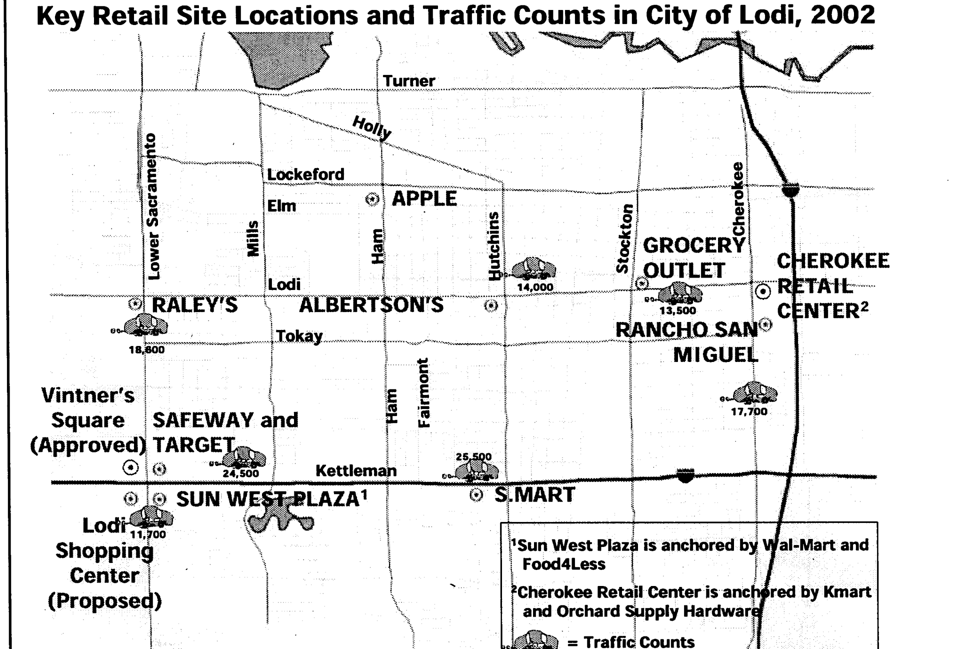
Table 7
Annual Average Daily Traffic Volume: West Kettleman Lane

	Kettleman and Lower Sacramento Road	Kettleman and South Ham Lane	Kettleman and South Hutchins Street	Kettleman and Cherokee Lane
1997	16,500	22,700	24,800	17,000
1998	17,800	25,500	26,000	17,300
1999	24,100	25,000	27,500	18,400
2000	24,100	25,000	27,500	18,400
2001	24,500	25,500	28,000	18,700
Five Year Average	21,400	24,340	26,760	17,960
Five Year % Change	48%	12%	13%	10%
Annual % Change	10%	2%	3%	2%

Source Applied Development Economics based on data by the State of California Department of Transportation (CalTrans)

The average annual traffic counts for a variety of intersections in the City of Lodi are displayed in Figure 6. The data demonstrates the locational value of Lower Sacramento Road and Kettleman Lane, which has an average daily traffic flow of more than 24,000 vehicles. The regional traffic flowing through West Kettleman Lane tends to remain on this street. Traffic volume on0 West Kettleman Lane is twice as high as traffic volume on local-serving Lodi Avenue, which parallels and is a half-mile north of West Kettleman Lane.

FIGURE 6
Key Retail Site Locations and Traffic Counts in City of Lodi, 2002



2. DESCRIPTION OF PROPOSED PROJECT

The Browman Development Company has proposed to develop a new retail center on a 35-acre site located at the corner of Kettleman Lane and Lower Sacramento Road. The proposed Lodi Shopping Center will form the western boundary of a retail strip that extends along Kettleman Lane, from the project site to Highway 99. The location of the proposed project is consistent with City policies to locate new large-scale retailers to the four corners area. The proposed commercial uses are displayed in Table 8, and described below.

TABLE 8
Browman Development Project Proposed Space Use in the City of Lodi

	Square Feet
General Merchandise Superstore	226,868
Pharmacy	14,788
Other Retail	67,960
Restaurant (Sit Down)	7,500
Fast Food	9,690
Gas Station	
Personal Services	3,000
Business and Professional Services	5,000
Financial Institutions	5,160
Total	**339,966**

Source: Applied Development Economics, based on information provided by Browman Development Company

The proposed project has been scaled down to 339,966 square feet, of which 226,868 square feet is set-aside for a Wal-Mart Supercenter store. The proposed retail space that will complement the Wal-Mart is described below.

PHARMACY

Another key component of the proposed project is the attraction of a national chain drug store such as Rite Aide, Walgreen's, and Longs. The footprint of the proposed pharmacy will be no larger than 14,788 SF (Wal-Mart will also include an in-store pharmacy area with a total floor area of approximately 1,300 square feet).

OTHER RETAIL

The proposed project will develop no more than 67,960 SF of retail space, which will be designed to attract well-known specialty retailers such as Michael's, Pier One, Cost Plus, Circuit City, or other national chain stores. Some commercial spaces will also be developed for retail tenants that require between 1,000 and 5,000 SF.

RESTAURANTS AND FAST FOOD ESTABLISHMENTS

The proposed project will include no more than 9,690 SF of space for fast food restaurants with drive-thru windows that occupy approximately from 3,000 to 5,000 S.F each. Up to 7,500 of additional restaurant space will also be developed for sit down establishments.

NON-RETAIL USES

The proposed project will also include no more than 13,160 SF of space for businesses not engaged in the area's retail trade competition. No more than 3,000 SF of space will be developed for small personal service establishments such as hairdressers and beauty shops. Up to 5,000 SF of space will be developed for business service or professional office uses, and not more than 5,160 SF will be developed for financial institutions.

3. PROJECT IMPACTS

An analysis of the proposed project's impacts depends significantly on the market demand for its uses. Is there excess consumer spending that the proposed project can absorb. Or, does the market viability of the proposed project rely on taking away sales from existing stores? Accordingly, the information below estimates the amount of new sales that the proposed project will attract to Lodi, the sales that will be taken from existing stores, and the sales that will be taken away from the established general merchandise retailers and supermarkets.

3.1 ESTIMATE OF SALES EARNED BY PROPOSED PROJECT

The data in Table 9 indicates that the proposed project will earn up to $111.5 million in sales as described below.

- The proposed Wal-Mart Supercenter Store is estimated to earn at least $350 per SF of sales, and capture $79.4 million of sales during its first years of operation. The potential sales earned by the proposed Wal-Mart Supercenter store is obviously achievable, based on the fact that the existing discount stores earn $105 million of sales, and the existing supermarkets earn $135 million of sales.[1] The proposed project will shift some sales toward a supercenter store and away from standard discount stores, and supermarkets. There should be some shift of spending by all consumers in the market area.
- It is estimated that the proposed pharmacy will earn $6.5 million of sales, which is equivalent to the earnings of an average Walgreen's Drug Store.[2] Lodi's existing drug stores earn $45.2 million of sales. So, market demand can be captured at the proposed project given the attraction of the new superstore.

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1 See Appendix Table A-3, which shows that the established discount stores earn $345 per SF of sales, and the established grocery stores earn $377 per SF of sales.

2 Source: Walgreen's

- The other proposed retail space will attract national chain specialty stores that will need to earn $300 per SF in order to pay the required rents. If the full 67,960 SF of retail space is built, then the tenants attracted to the Lodi Shopping Center should earn $20.4 million of sales.

- The full service restaurants should earn $2.2 million of sales if the total space is developed.

- Three proposed fast food fast food establishment should earn $1 million of sales each for a total of $3 million.

TABLE 9
Maximum Sales Earned by Retailers Attracted to Proposed Lodi Shopping Center

	Proposed Space (SF)	Sales Per SF	Sales
Wal-Mart Supercenter	226,868	350	$79,403,880
Pharmacy	14,788	438	$6,477,144
Other Retail	67,960	300	$20,388,000
Restaurant (Sit Down)	7,500	300	$2,250,000
Fast Food	9,690	313	$3,000,000
Personal Services	3,000		$0
Business & Professional Services	5,000		$0
Financial Institutions	5,160		$0
Total	**339,966**		**$111,518,944**

Source: Applied Development Economics, based on information provided by Browman Development Company

3.2 ESTIMATE OF SALES LEAKAGES RETAINED BY PROPOSED PROJECT

Data in Table 10 indicates that the proposed project will earn $111.5 million of sales. The proposed project will retain $31 million of spending that is leaking away from Lodi. Approximately $13.5 million of spending leakages will be retained by the superstore anchor tenant. The retention of sales that would otherwise leave Lodi represents a net gain of new sales revenues to be recycled into the local economy and tax dollars for the City of Lodi. The assumptions that provide a foundation for the analysis are listed below.

- It is assumed that the proposed Wal-Mart Supercenter will expand grocery store space by 70,000 SF, and discount store space by 36,868 SF.

- It is assumed that the proposed Wal-Mart Supercenter will capture 100 percent of the spending leakages currently captured by the Costco, at Hammer Lane in Stockton. If there are fewer sales retained in Lodi, then the proposed Wal-Mart will take additional sales away from the established discount stores and supermarkets.

- It is assumed that the other retail space built at the proposed project will be designed to capture all remaining spending leakages, and compete with established retailers for a share of regional spending. It is also assumed that the project sponsor will develop the full 67,960 SF of additional retail space. Apparel, home furnishings, and specialty retailers can retain up to $17.5 million of retail sales leakages within Lodi.

TABLE 10
Estimate of Sales Retained and Taken Away from Existing Business by Proposed Project

	Proposed Project (1)	Total Sales Earned by Proposed Project (2)	New Sales Earned by Proposed Project (3)	Established Store Earnings (4)	Spending Leakages Retained (5)	Spending Taken from Established Stores (6)	Percent Sales Loss (7)
General Merchandise Superstore	226,868	$79,403,880					
Discount Store Component	36,868		$10,500,000	$105,221,975	$4,050,000	$6,450,000	6%
Grocery Store Component	70,000		$24,500,000	$134,631,011	$9,450,000	$15,050,000	11%
Pharmacy	14,788	$6,477,144	$6,477,144	$45,187,981	$0	$6,477,144	14%
Other Retail [a]	67,960	$20,388,000	$20,388,000	$110,757,457	$17,457,353	$2,930,647	3%
Restaurant (Sit Down)	7,500	$2,250,000	$2,250,000	$17,599,611	$0	$2,250,000	13%
Fast Food	9,690	$3,000,000	$3,000,000	$31,642,927	$0	$3,000,000	9%
Personal Services	3,000	$0	$0	$0	$0	$0	0%
Business & Professional Services	5,000	$0	$0	$0	$0	$0	0%
Financial Institutions	5,160	$0	$0	$0	$0	$0	0%
Total	**339,966**	**$111,519,024**	**$67,115,144**	**$445,040,962**	**$30,957,353**	**$36,157,791**	

Source: Applied Development Economics
Notes: Column (1) data consistent with data in Table 11
Column (2) data consitent with data in Table 8. Assumes that new project will relocate Target or Wal-Mart to the Lodi Shopping Center. Proposed Superstore will create 70,000 SF of new grocery store space and 30,000 SF of new discount store space
Column (3) data consistent with data in Table 4 (Column 3)
Column (4) data consistent with data in Table 8 and Table 4 (Column 4). Assumes that 70 percent of captured discount store sales leakages will be groceries, and 30 percent will be discount store products
Row [a] data measures spending at apparel stores, specialty retail, building materials, and home furnishings

3.3 ESTIMATE OF SALES TAKEN FROM ESTABLISHED BUSINESSES

It is estimated that the proposed project will take $36.2 million of sales away from established business assuming that the superstore anchor tenant is relocated from across the street.

Approximately $6.4 million of sales will be taken away from the two remaining discount stores, $15 million of sales will be taken away from established supermarkets. Established discount stores will lose approximately 6 percent of their sales. Established grocery stores will lose approximately 11 percent of their sales.

Data in Table 11 provides an indication that the proposed Wal-Mart supercenter will capitalize on consumer shopping trends that favor superstores at the expense of grocery and standard discount stores. Shopping at the large superstores allows consumers to reduce their shopping stop frequencies by purchasing groceries and general merchandise items at a single stop. The data indicates that consumer trips to superstores expanded by 40 percent between 1999 and 2002. During the same time period the number of trips to standard discount stores declined by 15.4 percent, and grocery store trips declined by 12 percent. The other types of stores that will lose sales to the proposed project are described below

TABLE 11
Frequency of Household Shopping Trips
Spending Patterns by Store Type
1999 to 2002

	Household Shopping Trips Per Year				
Store Type	**1999**	**2000**	**2001**	**2002**	**Percent Change 1999 - 2002**
Grocery	83	78	75	73	-12.0%
Mass Merchandise	26	25	23	22	-15.4%
Drug	15	15	15	15	0.0%
Supercenter	15	17	18	21	40.0%
Warehouse Clubs	9	10	10	10	11.1%
Convenience/Gas	13	14	15	14	7.7%

Source: Applied Development Economics, based on Data Collected from ACNielsen Homescan 52 weeks ending 12/28/02

The proposed pharmacy is estimated to earn $6.5 million by competing with local establishments for a share of regional sales. Thus, it is estimated that the proposed pharmacy will take all their sales away from established businesses. This represents 14 percent of total sales earned by Lodi's established pharmacies and drug stores.

The proposed 67,960 SF of general retail space is estimated to take $2.9 million of sales away from Lodi's established retailers. This represents three percent of total sales earned by Lodi's established general retail stores.[3] This estimate assumes that the project sponsor will attract apparel, gifts, jewelry, furniture, and home furnishings retailers to capture $17.4 million of existing spending leakages. The additional sales earned by general retailers will compete with established businesses for regional spending, and they will need to take sales away from established businesses.

The proposed restaurant space will also compete with established businesses for existing regional sales. Thus, new

[3] It is possible that the project sponsor can attract unique retailers such as the Gap or Cost Plus, and could expand the market area by attracting customers that are usually oriented toward other geographies. If so, then less sales will be captured from existing establishments.

restaurants attracted to the proposed project are estimated to take $2.2 million of sales away from established restaurants that amounts to 13 percent of the current sales earned by established restaurants.

Finally, the proposed fast food space will also compete with existing fast food establishments for regional sales. Thus, new fast food establishments attracted to the Lodi Shopping Center should take $3 million of sales away from established fast food businesses. The estimated loss of sales to the proposed project will take 13 percent of sales away from the established restaurants.

The proposed project is unlikely to result in the closure of established business given the low percentage of lost business for the above categories.

3.4 ESTIMATED IMPACTS OF PROPOSED PROJECTS ON ESTABLISHED SUPERMARKETS

There are currently eight supermarkets that occupy 365,000 SF of space in Lodi. The National Chain Store supermarkets include Raley's, Albertson's, Safeway, and Food for Less, which occupy 230,000 SF of space, or 63 percent of Lodi's total supermarket space. The remaining four stores are either independent or small regional chain stores, including Ranch San Miguel, Smart Foods, Apple Market, and Grocery Outlet. The annual sales for all Lodi grocery stores amount to $134.6 million. Thus, Lodi supermarkets earn $369 per SF of sales, which is exactly the same as the $370 per SF national average of supermarket earnings.

Data in Table 12 shows that the grocery store component of the proposed superstore is estimated to capture $15 million of sales away from the existing stores. This means that the sales earned by the established supermarkets will decline to $119.6 million, as grocery store sales will shift toward the superstore. Thus, the sales earned by established supermarkets will decline to $328/ SF, and Lodi's established grocery stores will earn 89 percent of the national average after the proposed superstore has been established. This is relatively small loss of sales that is unlikely to result in any supermarket closures. In fact, future population and housing growth in Lodi should allow the established supermarkets to regain their sales lost, and approach the national average of sales

TABLE 12
Capacity to Absorb Additional Supermarket Sales in Lodi

Current Conditions	
Lodi Supermarket Sales [1]	$134,600,000
Sales/SF Earned [2]	$369
Median Sales/SF (U.S. Community Shopping Centers) [3]	$370
Percent of National Median	100%
Superstore Impacts	
Estimate of Sales Captured Away from Established Supermarkets [4]	$15,000,000
Lodi Supermarket Sales (After Superstore)	$119,600,000
Sales/SF Earned (After Superstore)	$328
Percent of National Median	89%

Source: Applied Development Economics

Notes: [1] Data consistent with Table 6
[2] Data consistent with Table 6
[3] See Dollars and Cents of Shopping Centers, Urban Land Institute, 2002
[4] Data consistent with Table 12

3.5 POTENTIAL TO ATTRACT NEW OCCUPANTS TO VACANT BIG BOX RETAIL SPACE

The relocation of Wal-Mart to the proposed Lodi shopping center will leave behind approximately 120,000 SF of vacant big box space to be re-occupied. The proposed Wal-Mart supercenter will add 106,868 SF of space to Lodi's existing supply of Wal-Mart space. In addition, the existing 120,000 SF Wal-Mart store will be vacated, and the owner will recruit new tenants. The project sponsor also proposes to develop 99,930 SF of other retail space within the Lodi Shopping Center.

In total, the proposed project will add 326,806 SF to Lodi's supply of retail space, as shown in Table 13. Capturing spending leakages can absorb only 56,220 SF. Therefore, the Lodi Shopping Center will need to capture sufficient regional spending to support the next expansion of 270,586 SF of additional space. The project sponsor's ability to attract name brand retailers is critical to the success of attracting customers from throughout the region.

The project sponsor will own the vacant big box space at the Sun West Plaza and, therefore, has a strong financial incentive to maintain the space in good condition in order to attract new occupants. It is reasonable to assume that the project sponsor will succeed at attracting national brand name chain store tenants based on his experience and proven track record.

Table 13
Potential Sales Leakages to be Captured by New Development or Vacant Space

	Sales Leakages [a]	Sales Per SF [b]	Space Absorbed [c]
Apparel Stores	$8,925,409	$300	29,751
Home Furnishings	$7,940,609	$300	26,469
Total Leakages [1]	**$16,866,018**		**56,220**
Wal-Mart Expansion [2]			106,868
Other Space Proposed at Lodi Shopping Center [3]			99,938
Vacant Wal-Mart at Sun West Plaza [4]			120,000
Total New and Vacant Retail Space [5]			326,806
Space Required for Regional Sales [4]			270,586

Source: Applied Development Economics

Notes: Column [a] is consistent with data in Table 4
Column [b] assumes earnings by new stores attracted to Sun West Plaza or Lodi Shopping Center
Column [c] assumes all spending leakages can be captured
Row [1] Amount of space that could be supported if spending lakage gaps were filled
Row [2] Is consistent with data in Table 8; accounts for Wal-Mart's expanded space 226,868 SF store and less the 120,000 SF existing Wal-Mart that will be vacated
Row [3] Does not include the proposed 15,160 SF of space to be developed for service and financial institutions
Row [4] Vacant Wal-Mart space
Row [5] Sum of rows 2, 3, and 4
Row [6] Row 5 minus row 1

APPENDIX A: PREPARERS OF THE REPORT

APPLIED DEVELOPMENT ECONOMICS
2029 University Avenue, Berkeley, California 94707, (510) 548-5912

Project Manager: Stephen Wahlstrom, Managing Principal
Contributors: Tony Daysog, Associate
Claudette Carr, Production
Aba Owens, Administrative Assistant

APPENDIX C

Geology and Soils Report

Prepared by

Twining Laboratories

May 2004

May 21, 2004 E20103.01-01

Mr. Philip O. Carter
Pacific Municipal Consultants
585 Cannery Row, Suite 304
Monterey, CA 93940

Subject: Geologic and Geotechnical Feasibility Study
Proposed Lodi Shopping Center
SWC Kettleman Lane and Lower Sacramento Road
Lodi, California

Dear Mr. Carter:

We are pleased to submit this Geologic and Geotechnical Feasibility Study report prepared for the proposed Lodi Shopping Center to be located on the southwest corner of Kettleman Lane and Lower Sacramento Road, in the City of Lodi, San Joaquin County, California. The contents of this report include the purpose of the investigation, scope of services, background information, our findings and evaluation, conclusions, and limitations.

The Twining Laboratories, Inc. (Twining) was authorized on February 24, 2002, by Mr. Philip O. Carter with Pacific Municipal Consultants to conduct this Geologic and Geotechnical Feasibility Study. This authorization was a written agreement between Twining and Pacific Municipal Consultants.

Purpose and Scope

The purpose of our investigation was to research the site soil conditions and regional geologic setting, conduct a surface site reconnaissance, and provide a Geologic and Geotechnical Feasibility Study report to be used in conjunction with the Environmental Impact Report (EIR) being prepared for the proposed Lodi Shopping Center. The Lodi Shopping Center is to be located on the southwest corner of Kettleman Lane and Lower Sacramento Road, in the City of Lodi, California.

The information required for the EIR is summarized below:

1. A description of the general soil conditions and geologic setting at the site;

2. Identification and description of the Natural Resources Conservation Service (NRCS) soil types and typical soil properties;

3. Description of fault zones or traces in the vicinity having a potential to impact the project;

4. Identification of geologic hazards or seismic hazard zones which may impact the site;

5. Discussion of the potential impacts of soil expansiveness and/or mitigation measures; and,

6. Discussion of potential seismic impacts and mitigation measures.

The intent of this study was not to provide geotechnical engineering design parameters for use in project design, or to satisfy the requirements of the 2001 California Building Code (CBC), Chapters 18 and 33, related to geotechnical studies. A design level geotechnical investigation should be conducted prior to design and construction.

The actions undertaken during the investigation are summarized as follows.

I A marked up map showing the location of the project, provided by Mr. Bert Verrips, was reviewed.

II. A site plan for the proposed project, prepared by Phillippi Engineering, dated June 26, 2002, was reviewed.

III. A Preliminary Geotechnical Engineering Investigation report (Twining reference number: TLP 492-0072-01), prepared by Twining for the proposed shopping center proposed to be constructed in the eastern portion of the subject site, dated April 10, 1992, was reviewed.

IV. A Geotechnical Engineering Investigation report (Twining reference number: D05031.01-01), prepared by Twining for the proposed shopping center to be located north of the subject site, was reviewed.

V. An analysis of local seismicity and a literature search of geologic data was conducted to provide information regarding the geologic setting and seismicity of the site.

VI. Mr. Bert Verrips was consulted during the investigation.

VII. A site reconnaissance was conducted.

VIII. The data obtained from the previous investigations and research were evaluated to develop an understanding of the soils and geologic conditions.

IX. This report was prepared to present the purpose and scope, background information, findings, evaluation, and conclusions.

Background Information

The following background information was provided by Mr. Verrips, or was based on our site reconnaissance and/or research.

Site Reconnaissance: The site reconnaissance consisted of walking the site and noting visible surface features. The reconnaissance was conducted by Mr. Vasiliy V. Parfenov on April 19, 2003. The features noted are described below.

Site Description: The project site is an approximately 40-acre property located on the southwest corner of Kettleman Lane and Lower Sacramento Road, in the City of Lodi, California.

A site location map is presented on Drawing No. 1 in Appendix A. The site was bound to the north by Kettleman Lane and agricultural property beyond; to the east by Lower Sacramento Road with a shopping center and residential properties beyond, to the south by an agricultural property, and to the west by vacant agricultural property. A site plan is presented on Drawing No. 2 in Appendix A.

According to the 7 ½ minute series topographic map (Lodi South), produced by the United States Geological Survey (USGS), the elevation of the site is approximately 32 feet above mean sea level.

At the time of the site reconnaissance, the topography of the project site was relatively level. The site was covered with alfalfa. A water well was noted in the northeastern portion of the site. An irrigation ditch was noted along Kettleman Lane. Also, overhead power lines were located along Kettleman Lane and Lower Sacramento Road.

Proposed Construction: We understand that the proposed construction will include a 216,212 square foot major retailer store building including a 9,233 square foot garden center. In addition, twelve (12) outlot pads ranging in size from 3,200 to 35,000 square feet (a total of approximately 113,000 square feet of building pad). The project will also include construction of a new street to the west of proposed Lodi Shopping Center, widening of the south side of the Kettleman Lane and the west side of the Lower Sacramento Road, and construction of a 3.65-acre storm water retention basin to be located off-site, adjacent to the southwest corner of the site. It is our understanding that the basin will be 10 feet deep and basin embankments will be sloped no steeper than 4 horizontal to 1 vertical. Appurtenant construction will include asphaltic concrete paved parking areas and underground utilities.

The structural details of the proposed buildings were not provided, however, it is anticipated that the proposed construction will consist of single and two-story buildings with masonry, concrete tilt-up, wood or metal frame walls and concrete slab-on-grade floors.

Previous Studies

In April of 1992, Twining prepared a Preliminary Geotechnical Engineering Investigation report for a shopping center proposed to be constructed in the eastern portion of the subject site. During the 1992 investigation, twenty (20) borings were drilled to depths of 15 to 21½ feet below site grades (BSG). In addition, four bulk samples of soil were obtained for Resistance R-value and moisture density relationship tests. The soils encountered generally consisted of soft to hard sandy silts to the maximum depth explored, 21½ feet BSG. The sandy silts were interbedded with loose to dense silty sands and poorly graded sands in the northern and southeastern portions of the site investigated. Groundwater was not encountered in the test borings drilled.

The sandy silts exhibited low to moderate compressibility characteristics and high shear strength in the in-situ conditions. The near surface soils exhibited poor to fair support characteristics for pavements. The analytical results of soil sample analyses indicate that the soils exhibit a "mildly corrosive" corrosion potential to buried metal objects. The results of a soil sample analyses indicate "none-detected" concentrations of sulfate (detection limit of 0.01 dry weight percent) and chloride (detection limit of 0.001 dry weight percent).

Any other previous engineering, geological, or environmental studies conducted for this site were not provided for review during this investigation. If available, these reports should be provided for review and consideration for this project.

Geologic Setting

San Joaquin County is located in the Sacramento Valley in the central portion of California. The Sacramento Valley occupies the northern portion of the Great Valley geomorphological province. The Great Valley province is bordered by two mountain ranges. To the east lies the Sierra Nevada Range of the Sierra Nevada Geomorphological province consisting chiefly of crystalline rocks, and to the west lies the Diablo Range tier of the Coast Ranges geomorphological province consisting of sedimentary and metamorphosed sedimentary rocks.

The Coast Ranges, forming a barrier between the Great Valley and the Pacific Ocean, evolved as a result of folding, faulting, and accretion of diverse geologic terrains and are composed chiefly of sedimentary and metamorphic rocks that are sharply deformed into complex structures. They are broken by numerous faults, the San Andreas Fault being the most notable structural feature.

The Sierra Nevada block (including the Sierra Nevada Range) has been tilted westward, caused by faulting and uplifting of the eastern edge. The western side of the Sierra Nevada Block is overlain by the sedimentary deposits of the valley.

Large coalescing alluvial fans have developed along each side of the valley. The larger and more gently sloping fans on the east side consist of deposits derived from crystalline rock sources, whereas the smaller and more steeply sloping fans on the west side were built up by the material originating as sedimentary rocks of the Coast Range. As a result, the valley floor consists mainly of two kinds of alluvial materials that differ widely in provenance and their respective engineering properties.

Lodi is predominantly located on Recent alluvial fan deposits of the Mokelumne River. Surface soils in the Lodi area also comprise small areas of Recent stream channel deposit along the current channel of the Mokelumne River.

Groundwater Conditions

Groundwater was not encountered during the 1992 investigation (maximum depth explored 21½ feet BSG). The Department of Water Resources (DWR) web site was consulted for groundwater level data. The Department of Water Resources monitoring network web site identifies a water well in the northeast portion of the subject property (well number: 03N06E15C004M, well coordinates: N121.3069 degrees, W38.1153 degrees). A summary of the groundwater elevation data for the well is presented in Table 1.

Table No. 1
Range of Groundwater Elevations from Spring 1991 to Spring 2003 - Spring Measurements
Proposed Lodi Shopping Center

Map Date	Groundwater Elevation; Feet Above Mean Sea Level	Groundwater Depth; Feet Below Site Grade*
Spring 1991	-20	52
Spring 1992	-21	53
Spring 1993	-22	54
Spring 1994	-19	51
Spring 1995	-20	52
Spring 1996	-17	49
Spring 1997	-14	46
Spring 2000	-10	42
Spring 2001	-13	45
Spring 2002	-14	46
Spring 2003	-16	48

* Elevation of the site is approximately 32 feet above mean sea level
Depths and elevations rounded to the nearest 1 foot.

The historical groundwater data indicates that groundwater levels ranged between 42 and 54 feet below site grade (BSG) during the ten year period ending in 2001. A groundwater depth of 42 feet BSG, representing the highest groundwater table indicated between 1991 and 2001, was selected for evaluation of secondary seismic hazards.

It should be recognized that water table elevations fluctuate with time, since they are dependent upon seasonal precipitation, irrigation, land use, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered both during the construction phase and the design life of the project. The evaluation of such factors was beyond the scope of this investigation and report.

Tectonics and Seismicity

The project site is located in a tectonically and seismically active region. The Sierra Nevada Mountains to the east and the Coast Ranges to the west possess major active and potentially active faults. The Sierra Nevada Fault Zone bounds the eastern edge of the Sierra Nevada Mountains and accommodates uplift of the Sierra Nevada tectonic block. Within the Coast Ranges, the San Andreas Fault Zone, and San Juan faults predominantly accommodate right-lateral, strike-slip displacement across the Pacific and North American tectonic plate junction. The convergent, compressional component of plate interaction occurring in the Coast Range area west of the site appears to be largely accommodated along the Great Valley Fault system.

An "active fault" is defined, for the purpose of this evaluation, as a fault that has had displacement within Holocene time (about the last 11,000 years). A potentially active fault is widely defined as showing evidence of displacement older than 11,000 years and younger than 1.6 million years (Pleistocene). Faults showing evidence of displacement older than 1.6 million years are usually classified as "inactive".

The following subsections briefly describe the "active" or "potentially active" faults or fault systems capable of producing the highest levels of ground motion at the site.

Western San Joaquin Valley: In the western portion of the San Joaquin Valley, a series of events referred to as the Coalinga Earthquake Sequence were initiated on May 2, 1983 with a 6.7 magnitude earthquake centered in Coalinga. In a perhaps related event, a 5.5 magnitude earthquake was generated near Avenal on August 15, 1985. The main shocks for both earthquakes occurred in close proximity to late-Cenozoic crustal folds and have similar hypocenter depths and fault-plane solutions (California Department of Conservation, Division of Mines and Geology, Special Publications 66). The Great Valley Fault System (GVFS) is a topic of ongoing research which primarily commenced with the Coalinga Earthquake of 1983, attributed to the zone. The GVFS, formerly termed the Coast Range-Sierra Nevada boundary zone and the Coast Range - Central Valley boundary zone, is believed to be a fundamental tectonic boundary between the Coast Range province and Sierran block. Fault plane solutions for the Coalinga Earthquake sequence suggest a northeast strike with either a steep northwest dip or shallow northwest dip (Eaton et al., 1983). Eaton (1983c) proposed that the main Coalinga earthquake as well as the 1985 North Kettleman Hills earthquake (Eaton, 1985b) occurred on a shallow westward dipping thrust fault and slip was induced on northwest and southwest dipping reverse faults in the plate overlying the thrust fault. Namson and Davis (1988) interpreted an approximately 125 mile (200 km) long zone of folds (anticlines and synclines) along the southwest margin of the San Joaquin Valley as an actively developing fold thrust belt. Namson and Davis (1988) attributed the seismically active Coalinga and Kettleman Hills North Dome anticlines to fault-bend folding above a thrust, which does not reach the surface (blind thrust).

The aforementioned fault plane solutions and tectonic interpretations of Namson and Davis are generally consistent with solutions for a number of earthquake events occurring along the GVFS boundary zone between the San Luis Reservoir and Willows, California (Wong et al. 1988). Wong et al. (1988) indicated that geologic evidence suggests that the boundary zone is not a single fault but a complex zone of faulting with the potential of generating large earthquakes (such as the Richter Magnitude 6.7 Coalinga earthquake) over most of its length. Wakabayashi and Smith (1994) postulated that the GVFS may comprise 18 to 25 segments from 12 to 57 kilometers in length, and that the characteristic earthquake for the average length segment may be a magnitude 6.3 to 6.4.

The California Geological Survey (CGS) California Fault Parameter database lists six Great Valley Fault System segments within approximately 76 miles (121 km) of the site. It is estimated that the closest segment (Segment No. 5) lies approximately 24 miles (39 km) west of the site. Upper Bounds Magnitudes of 6.3 to 6.7 for the individual segments are indicated by the database. A slip rate of 1.5 millimeters per year (mm/yr) was used for all segments (Lienkaemper, 1996).

Foothills Fault System: The term "Foothills Fault System" has been used for the major fault zones in the western Sierra Nevada. The Melones and Bear Mountain fault zones are the most important components of this system south of the Cosumnes River. The faults of this system generally consist of vertical to steeply east-dipping zones of sheared rock with linear mapped traces. Many of the faults are delineated wholly or in part by lenses of sheared serpentine or schist. The fault system is located approximately 26 miles (41 km) east of the site.

Prior to the Oroville earthquake (Magnitude 5.7) of August 1, 1975, the Foothills Fault System was regarded as seismically inactive. This earthquake occurred within the northern extension of the Bear Mountain Fault zone and suggested the possibility of reservoir (Oroville Dam) induced seismicity. Micro-earthquake data and geodetic surveys show that the two main branches of the Foothills Fault System (Bear Mountain and Melones Fault Zones) display active movement, at least in the area between Oroville and Folsom.

Calaveras Fault: Calaveras Fault segments (North of Calaveras Reservoir and South of Calaveras Reservoir) are located approximately 44 miles (70 km) and 54 miles (87 km) southwest of the site, respectively. The Calaveras Fault is considered active over a distance of more than 80 miles from Danville on the north to Hollister on the south. Tectonic creep also occurs episodically along the fault, mainly from Coyote Lake to Hollister. Seismic activity along the Calaveras Fault (M6.2) in the vicinity of Morgan Hill has been felt in the central San Joaquin Valley as recently as April, 1984. Horizontal accelerations (1.3g) were measured near the epicenter and ground shaking was experienced at least as far south as Fresno.

Hayward: The Hayward Fault is part of the complex plate boundary system in central California and is a major branch of the San Andreas Fault System. The fault is a right lateral, strike-slip fault, which extends from San Jose about 74 miles (120 km) northward along the base of the East Bay Hills to San Pablo Bay. Near Hollister, the Calaveras Fault branches off from the San Andreas fault toward a more northerly direction, and further north, the Hayward Fault branches off from the Calaveras Fault toward the northwest. A large earthquake, estimated to have been about Magnitude 7, occurred on the Hayward Fault in 1868 and was the "great" earthquake of the Bay Area prior to 1906. The fault, which ruptured along 52 km of its length, with an average offset of 1.9 m of right-lateral strike-slip motion, caused considerable damage in the East Bay and San Francisco. This earthquake was known as the Great San Francisco earthquake until that title was assumed by the 1906 earthquake.

The California Geological Survey (CGS) California Fault Parameter database three (3) segments of the Hayward Fault, each about 52 to 55 miles (about 83 to 88 km) from the site. The individual segments were assigned magnitudes of 6.4 to 7.1. Slip rates indicated in the database range from 3 to 9 millimeters per year (mm/yr).

Ortigalita Fault: The Ortigalita Fault is located approximately 58 miles (93 km) southwest of the site. According to the Merced County General Plan, this fault has not been active in modern times (i.e., no recorded slippage in modern time). However, this fault is indicated as geologically active on the Fault Activity Map of California and Adjacent Areas (Jennings, 1994). A magnitude of 6.9 and a slip rate of 1.0 mm/yr were indicated by the CGS California Fault Parameter database.

San Andreas Fault: The San Andreas Fault is associated with two of the largest earthquakes that have occurred in California during historic time: the 1857 Fort Tejon earthquake (magnitude 8.3) on the south-central portion of the fault and the 1906 San Francisco earthquake (magnitude 8.3) on the northern portion of the fault. The nearest segment of the San Andreas Fault is located approximately 71 miles (113 km) west of the site. Due in part to the length of the fault, approximately 625 miles (1,000 km), various portions of the San Andreas Fault can be characterized by distinctly different seismic behavior related to rupture location, length, and expected repeat time (e.g. Wallace, 1970; Allen, 1968; Sieh and Jahns, 1984). Wesnouski (1986) describes multiple segments, of which four are located within 76 miles (121 km) of the site.

Geologic Hazards

The potential geologic hazards of flooding, landslides, seiche, tsunamis, and volcanic activity are evaluated in the following subsections.

Flooding: Based on the Flood Insurance Rate Maps, distributed by the Federal Emergency Management Agency the proposed site area is in Zone B. Zone B denotes "Areas between 100-year and 500-year flood; or certain areas subject to 100-year flooding with depths less than 1 foot; or where the contributing area is less than one square mile; or areas protected by levees from base flood".

Landslides: Due to the relatively flat relief at the site, the potential for landslides on this site is considered to be low.

Seiches and Tsunamis: A seiche is a wave generated by the periodic oscillation of a body of water whose period is a function of the resonant characteristics of the containing basin as controlled by its physical dimensions. These periods generally range from a few minutes to an hour or more. Since no bodies of water are located near the site, seiches are not considered a potential hazard at the site.

Tsunamis are waves generated in oceans from seismic activity. Due to the inland location of the site, tsunamis are not considered a potential hazard.

Volcanic Activity: The closest areas of Quaternary volcanism are Dardanelles, in northern Tuolumne County, located approximately 81 miles (130 km) east of the site, Sutter Buttes located approximately 79 miles (126 km) north of the site, Mono Lake located approximately 110 miles east of the site, and the Mammoth Lake area located approximately 120 miles southeast of the site (Jennings, 1994). These areas contain basalt, hornblende-biotite rhyodacite, hornblende-biotite andesite, and dacite dated as young as 1890 (Jennings, 1994). No other areas of volcanism are located within 120 miles (160 km) of the site (Jennings, 1994). Based on the distance of the aforementioned volcanic areas from the site and age of activity, the prospect for lava flows or significant ash falls at the site during the design life of the structures is considered low.

Seismic Hazards

The potential seismic hazards of groundshaking, ground rupture, liquefaction, and seismic settlement are evaluated in the following subsections.

Groundshaking: The California Building Code indicates that the site is in Zone 3. Therefore, the structures should be designed using a Z factor of 0.3 for determining the minimum lateral forces using the static force procedure.

A more detailed analysis was conducted using two different methods, historic and probabilistic. Discussion of the analyses and the results are presented in the following subsections.

Historic Seismic Activity: The general area of the site has experienced recurring seismic activity. Based on historical earthquake catalogs published by the California Division of Mines and Geology, supplemental data from Townley and Allen (1939), and the U.S. Geological Survey's earthquake data base system (data base updated through 2001), approximately 517 historical earthquakes with magnitude 4.0 or greater were recorded from 1900 through 2001 within a 100-mile radius of the site. The location of the project site in relation to the approximate historical earthquake epicenter locations is presented on Drawing No. 3 in Appendix A.

The peak horizontal ground accelerations that may have occurred at the site from each of the historical earthquakes within the 100-mile search radius was estimated using an attenuation relationship developed by Boore et al. (1993).

The source data presented includes: latitude, longitude, date, time, depth, Richter Magnitude, computed site acceleration, computed site Modified Mercalli intensity, and the approximate earthquake-to-site distance in miles and kilometers. This analysis was performed by a computer program titled EQSEARCH (1989).

The seismic event with the nearest epicenter found during the search occurred in 1909 approximately 21 miles west of the site (Magnitude 4.5; peak acceleration 0.04g). The largest magnitude earthquake identified in the search was the Magnitude 8.25 San Francisco earthquake that occurred in 1906, approximately 74 miles west of the site. The analysis indicates that the San Francisco event also produced the highest acceleration since 1900 (estimated to be about 0.12g).

Probabilistic Seismic Analysis: Section 1627 of the California Building Code (CBC) defines the "Upper Bounds Earthquake" and the "Design Basis Ground Motion" for design criteria. The "Upper Bounds Earthquake" is defined as the seismic ground motion having a 10 percent probability of being exceeded in a 100 year period. The "Design Basis Ground Motion" is defined as the seismic ground motion having a 10 percent probability of being exceeded in a 50-year period. Determination of the Upper Bounds Earthquake and Design Basis Ground Motion requires probabilistic methods.

The computation of attenuated ground motion is based on the closest distance between the site and various measures of potential fault-plane ruptures along selected faults. The twenty-four (24) faults and fault segments selected for this analysis are illustrated on Drawing No. 4 in Appendix A, and listed in Table No. 2. These selected faults comprise the local potentially active faults and large regional faults with higher activity and magnitudes, located within approximately 121 km (76 miles) of the site. The computations were conducted using FRISK (McGuire, 1978). The computer program FRISKSP version 3.01B program (Blake, 1995 in references) was used to set up the input data files and generate the output.

The locations and fault parameters (such as fault length, magnitude and rupture area) of faults capable of impacting the site were determined from published geologic papers and the CGS database entitled "California Fault Parameters". Due to the relative age of the faults and the paucity of historic event data, probabilities were estimated based on empirically derived relationships which include slip rates. The slip rates and maximum magnitudes for each fault used in the analysis are included in Table No. 2.

TABLE NO. 2
Summary of Fault Source-Model Parameters
Seismic Sources within Approximately 121 kilometers of the site
Proposed Lodi Shopping Center, Lodi

FAULT NAME	SLIP RATE (millimeters per year)	Design Level Magnitude	Site to Fault Distance, km
Great Valley 5	1.5	6.5	39
Great Valley 6	1.5	6.7	40
Great Valley 7	1.5	6.7	47
Great Valley 4	1.5	6.1	56
Great Valley 8	1.5	6.1	77
Great Valley 3	1.5	6.3	87
Foothill Fault System	0.05	6.5	41
Greenville	2.0	6.9	53
Concord - Green Valley	6.0	6.9	64
Calaveras:			
North of Reservoir	6.0	6.8	70
South of Reservoir	15.0	6.2	87
West Napa	1.0	6.5	82
Hayward:			
Total Length	9.0	7.1	83
South	9.0	6.9	83
North	9.0	6.9	84
SE Extension	3.0	6.4	89
Hunting Creek -Berryessa	6.0	6.9	87
Rodgers Creek	9.0	7.0	90
Ortigalita	1.0	6.9	93
San Andreas:			
1906	24	7.9	113
Peninsula	17	7.1	113
North Coast	24	7.6	118
Santa Cruz Mountains	14	7.0	121

The ground motion attenuation relationship used in the analysis to estimate site response values was developed by Boore et al. (1997). The relationship for a random component plus one standard deviation (as opposed to mean) was used. Boore et al. (1997) defines a class for each site based on the soil properties. The analysis was conducted using a Type S_D soil anticipated for the site (soil density represented by average N-values in the upper 100 feet ranging from 15 to 50 blows per foot).

The design basis horizontal site acceleration that has a 10 percent probability of being exceeded in 50 years was determined to be 0.24g. The Upper Bounds Earthquake ground motion that has a 10 percent probability of being exceeded in 100 years was determined to be 0.27g. Drawing No. 5 in Appendix A presents the Probability of Exceedance vs. Acceleration for exposure periods of 25, 50, 75, and 100 years. In addition, Drawing No. 6 in Appendix A (Average Return Period Vs. Acceleration) charts the average return period versus ground acceleration.

Ground Rupture: Earthquakes are caused by the sudden displacement of earth along faults with a consequent release of stored strain energy. The fault slippage can often extend to the ground surface where it is manifested by sudden and abrupt relative ground displacement. Damage resulting from fault rupture occurs only where structures are located astride the fault traces that move. The site is not located in an earthquake fault zone designated pursuant to the Earthquake Fault Zoning Act. The potential for surface rupture at the site is considered low.

Liquefaction and Seismic Settlement: Liquefaction in this instance describes a phenomenon in which a saturated, cohesionless soil loses strength during an earthquake as a result of excessive pore water pressures induced by shearing strains. Lateral and vertical movement of the soil mass, combined with loss of bearing strength, usually results. Research has shown that liquefaction potential of soil deposits depends on soil types, void ratio, groundwater conditions, duration of shaking, and confining pressure over the potentially liquefiable soil mass. Fine, well sorted, loose sand, high groundwater conditions, higher intensity earthquakes, and particularly long duration of groundshaking are the requisite conditions for liquefaction.

Studies of liquefaction potential during earthquakes address the liquefaction "susceptibility" and "opportunity" of a given site. Liquefaction susceptibility is a function of the mechanical properties of the underlying soils and groundwater, particularly grain size distribution and relative density determined from standard penetration blow counts and depth to groundwater below the ground surface. Liquefaction opportunity expresses the probability of exceeding a critical level of shaking and is described in terms of a function which accounts for peak ground acceleration, or accelerations plus duration. Accelerations of at least 0.10g and groundshaking durations of at least 30 seconds are needed to initiate liquefaction.

Seismic settlement can occur in both saturated and unsaturated granular soils. Seismic settlement occurs as saturated and unsaturated granular soils rearrange resulting in a volume reduction. The magnitude of seismic settlement is a function of the relative density of the soil and the magnitude of cyclic shear stresses caused by seismic ground motion.

The potential for the occurrence of an earthquake with the intensity and duration characteristics capable of promoting liquefaction and seismic settlement (opportunity) is moderate considering an assumed 50 year life span of the proposed facility. The historic trend in depth to groundwater suggests that the groundwater table will not likely rise to less than 40 feet BSG (typically, the maximum depth to groundwater which could promote liquefaction is 50 feet). Accordingly, significant settlement due to liquefaction below the water table is not anticipated and the potential for total seismic settlements and differential seismic settlements across individual building pads to exceed 1 and ¼ inch, respectively, is low. The potential for surface deformation resulting from liquefaction and seismic settlement is expected to remain low during the design life of the structure.

Liquefaction and seismic settlement studies specific to individual buildings should be conducted in conjunction with design level investigations. Based on the anticipated soil and groundwater conditions and Twining's general experience in the Lodi area, total seismic settlements exceeding ½ inch are not anticipated in the area of the proposed development. Settlements are not anticipated to exceed tolerances for conventional shallow spread foundations and slabs-on-grade. Accordingly, provisions for reducing seismic settlements or the impacts of seismic settlements, such as deep ground modification or deep foundation systems are not anticipated for the project. In the event that the design level geotechnical report reveals relatively high seismic settlements, measures to reduce the effects of differential seismic settlement could be implemented. If predicted settlements are predominantly the result of near surface loose soils, these soils could be entirely or partially removed from below the bottom of footings and replaced with engineered fill. If seismic settlements are predominantly the result of relatively deep loose soils (liquefaction below the water table), measures to reduce the effects of differential seismic settlements would include supporting structures on quasi-rigid foundation systems or deep foundation systems (piles, etc.).

Lateral spreading can occur with seismic ground shaking on slopes with saturated soils. It is anticipated that the proposed development would be on virtually flat surfaces, and that the development would not create significant slopes. In general, the potential for the occurrence of lateral spreading should be considered low. Design level investigations should consider the potential instability of embankments of the retention basin and recommend appropriate building setbacks, if warranted. Setback distances would depend on the type and depth of structures and the maximum anticipated water level in the basin. Preliminary estimates suggest that setbacks would be on the order of 30 to 60 feet for buildings with typical shallow spread foundations.

The site is not located within a Seismic Hazard Zone for liquefaction hazards or seismically induced landslides as specified by the State of California (Seismic Hazard Mapping Act of 1990).

Soil Conditions and Mineral Resources

The soil conditions at the site were investigated using two sources: 1) review of the Soil Survey of San Joaquin County, compiled by the U.S. Soil Conservation Service, Department of Agriculture,

Natural Resources Conservation Service (NRCS); and 2) Twining's previous experience in the vicinity of the site.

Review of the of the Soil Survey of San Joaquin County, compiled by the U.S. Soil Conservation Service, Department of Agriculture, NRCS indicated that most of the near-surface site soils are classified as Acampo sandy loam with some areas of Tokay fine sandy loam in the north-central portion of the proposed development.

The soil composition information provided indicates that the Acampo sandy loam is classified as silty sand by the Unified Soil Classification system and has a low shrink-swell potential, moderately rapid permeability, fines contents between 35 and 50 percent, clay contents between 7 and 18 percent, organic matter contents between 1 and 3 percent, and a pH ranging between 6.1 and 8.4. The Acampo sandy loam contains near the surface thin layers of cemented soil (commonly referred as a "hard pan"). The hazard listed in the NRCS documentation for building site development for this soil type is a high corrosivity to steel. The listed considerations for the identified hazards are to reduce the risk by using corrosion resistant materials, coatings, and cathodic protection for buried steel. The NRCS documentation indicates that Acampo sandy loam has "moderate" limitations that affect shallow excavations and construction of dwellings with basements (presence of a "hard pan" layer) and "slight" limitations that affect construction of dwellings without basements, small commercial buildings, local road and streets, and lawns and landscaping. The NRCS documentation, also, indicates that Acampo sandy loam rated as a "fair" source of the material for a road fill due to presence of the "hard pan" layer.

The Tokay fine sandy loam is classified as silty sand by Unified Soil Classification system and has a low shrink-swell potential, moderately rapid permeability, fines contents between 35 and 50 percent, clay contents between 8 and 18 percent, organic matter contents between 1 and 3 percent, and a pH ranging between 6.1 and 8.4. The hazards listed in the NRCS documentation for building site development for this soil type are a high corrosivity to steel and moderate corrosivity to concrete. The listed considerations for the identified hazards is using corrosion resistant materials, coatings, and cathodic protection for buried steel and using sulfate-resistant material to prevent corrosion of concrete. The NRCS documentation indicates that Tokay fine sandy loam has "slight" limitations that affect shallow excavations and construction of dwellings with or without basements, small commercial buildings, local road and streets, and lawns and landscaping. The NRCS documentation, also, indicates that Tokay fine sandy loam rated as a "good" source of the material for a road fill.

Based on visual observations, the surface soils observed during the site visit consisted of silty sands and sandy silts.

The soils encountered during 1992 investigation generally consisted of soft to hard sandy silts to the maximum depth explored, 21½ feet BSG. The sandy silts were interbedded with loose to dense silty sands and poorly graded sands in the northern and southeastern portions of the site investigated.

The sandy silts exhibited low to moderate compressibility characteristics and high shear strength in the in situ conditions. The near surface soils exhibited poor to fair support characteristics for pavements. The analytical results of soil sample analyses indicate that the soils exhibit a "mildly corrosive" corrosion potential to buried metal objects. The results of a soil sample analyses indicate "none-detected" concentration of sulfate (detection limit of 0.01 dry weight percent) and chloride (detection limit of 0.001 dry weight percent).

Also, Twining prepared Geotechnical Engineering investigation for a commercial project to be located northwest of intersection of Lower Sacramento Road and Kettleman Lane, in Lodi, California (adjacent to the subject site). During this investigation, one hundred-twelve (112) test borings were drilled to depths of between 10 and 51½ BSG. The Geotechnical Report indicates the soils encountered generally consisted of interbedded very loose to very dense silty sands and medium stiff to hard sandy silts with sporadic layers of poorly graded sands, clayey sands, and sandy lean clays to depths of 51.5 feet below site grade (BSG), maximum depth explored. Groundwater was encountered at depths in the range of 41 to 43 feet BSG.

The Geotechnical Report also indicated the soils within the zone of influence of the buildings of the proposed commercial project were anticipated to exhibit good shear strength, low to moderate compressibility and collapse characteristics and fair to good support characteristics for pavements.

Review of the CGS publications list indicates the proposed development area does not include locally important or other known mineral resources.

Conclusions

The scope of this feasibility investigation did not reveal geologic or geotechnical issues which would prevent construction of the project utilizing conventional earthwork measures, typical for the area and the type of development proposed.

Based on the data collected, we present the following general conclusions:

1. Geologic or geotechnical issues were not identified which would prevent the use of conventional shallow spread foundations and slabs-on-grade.

2. The soil survey map indicates that most of the site soils are Acampo sandy loam with some areas of Tokay fine sandy loam in the north-central portion of the proposed development. These soils are indicated to have moderately rapid permeability and low shrink-swell potential. The hazards listed in the NRCS documentation for building site development are, a high corrosivity to steel and a moderate corrosivity to concrete.

3. The soils within the estimated zone of influence of the proposed structures were anticipated to exhibit low to moderate consolidation settlement, low to moderate collapse (abrupt settlement upon wetting of the soils - "moisture induced collapse"), moderate shear strength, and fair to good support characteristics for pavements.

4. The site is not located in a Special Studies Zone designated in response to the Earthquake Fault Zoning Act. The potential for ground rupture associated with a known fault is low.

5. Based on an estimated depth of groundwater at the site of about 42 feet below site grade, and the relatively level nature of the site, the potential for surface deformation due to liquefaction, or landslides on the native slopes are low. The site is not located in a Seismic Hazard Zone (Seismic Hazard Mapping Act of 1990) designated for liquefaction and landslide hazards.

6. Based on the anticipated soil and groundwater conditions and Twining's general experience in the Lodi area, total seismic settlements exceeding ½ inch are not anticipated in the area of the proposed development. It is anticipated that static settlements can be reduced to tolerable limits for design (1 inch total and ½ inch differential) by placement of engineered fill below foundations and slabs.

7. The proposed development area does not include locally important or other known mineral resources.

Mitigation of Geologic and Geotechnical Impairments

Geologic or seismic impairments requiring special mitigation measures are not anticipated for the project site.

The effects of the anticipated moderate consolidation and collapse potential of the near-surface soils can be mitigated by placing shallow spread foundation on a uniform thickness engineered fill which, at a minimum, extends below the zone disturbed by post plowing operations. Recommendations for the actual depth of over-excavation should be included in the design level report based on building structural loads and testing of site soils.

The effects of the expansive soils can be mitigated by providing non-expansive sections below floor slabs and by extending foundations to depth where the soil moisture contents remain essentially constant throughout the year; thus, the soils with swell/expansion potential would not undergo a significant volume change below this depth.

The soil corrosivity to steel and concrete can be mitigated by using corrosion resistant materials, coatings, and cathodic protection for buried steel and using sulfate-resistant material to prevent corrosion of concrete.

Limitations and Notifications

This report presents the results of a Feasibility level geologic/geotechnical investigation only and should not be construed as a complete geotechnical investigation for use in design and construction, or an environmental audit or study.

The conclusions and recommendations contained in this report are valid only for the site discussed in the Site Description. The use of the information contained in this report for other sites is not recommended. The entity or entities that use or cause to use this report or any portion thereof for another site not covered by this report shall hold Twining, its officers and employees harmless from any and all claims and provide Twining's defense in the event of a claim.

This report is issued with the understanding that it is the responsibility of the client to transmit the information and conclusions of this report to consultants and other parties having interest in the project so that the information and conclusions can be considered by the appropriate party.

This investigation report should not be used in the preparation of a Storm Water Pollution Prevention Plan (SWPPP). Use of this report or any data included in the report in preparation of a SWPPP would be at the owner's sole risk.

Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally-accepted engineering principles and practices in San Joaquin County as of May 2004. This warranty is in lieu of all other warranties either expressed or implied.

<u>Closing</u>

We appreciate the opportunity to be of service to Pacific Municipal Consultants. If you have any questions regarding this report, or if we can be of further assistance, please contact us at your convenience.

Sincerely,
THE TWINING LABORATORIES, INC.

Vasiliy V. Parfenov
Staff Geologist
Geotechnical Engineering Division

Kenneth J. Clark, CEG
Engineering Geologist
Geotechnical Engineering Division

James M. Kellogg, RCE
Manager
Geotechnical Engineering Division

JMK/KJC/pc

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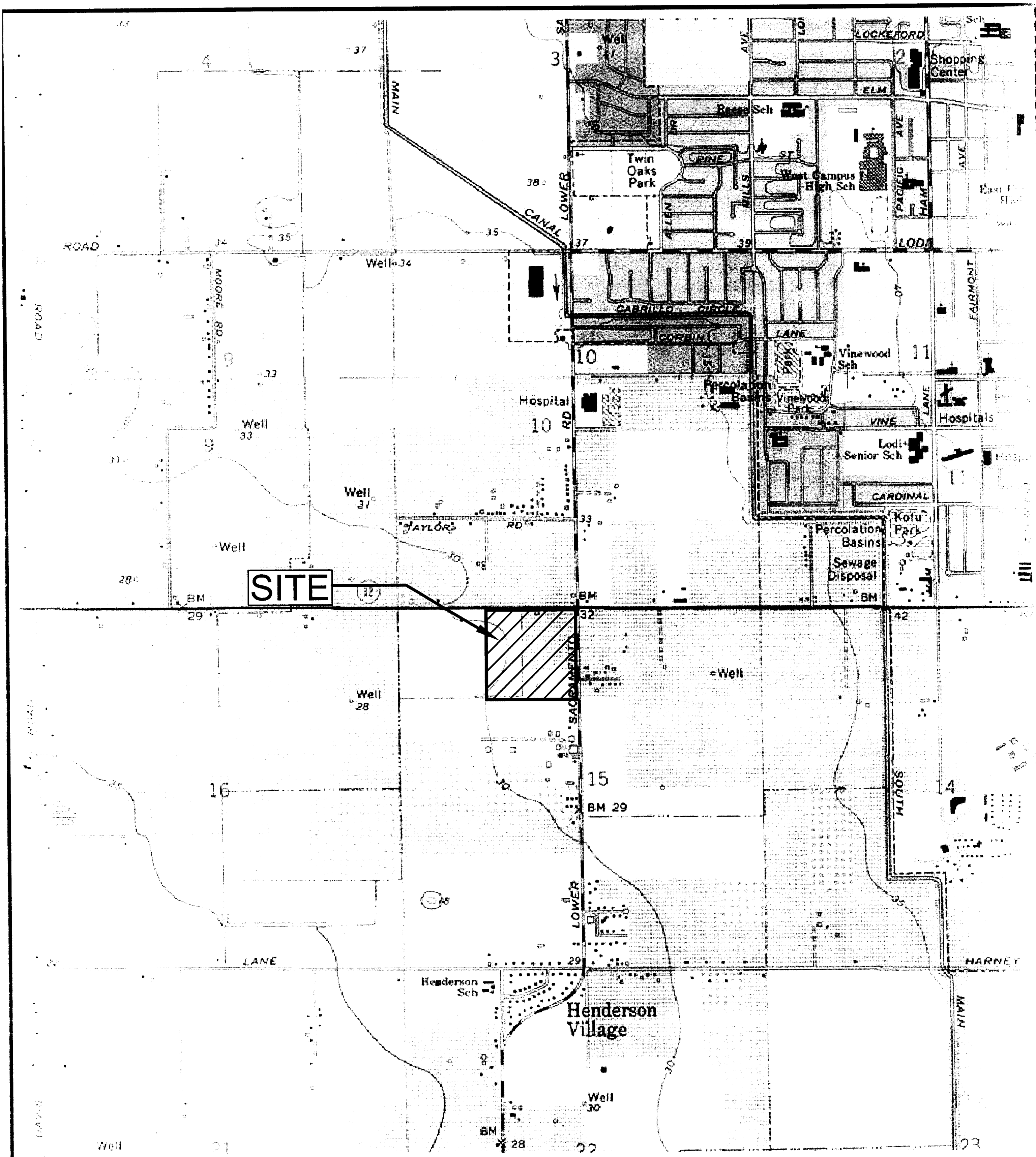
APPENDIX A

DRAWINGS



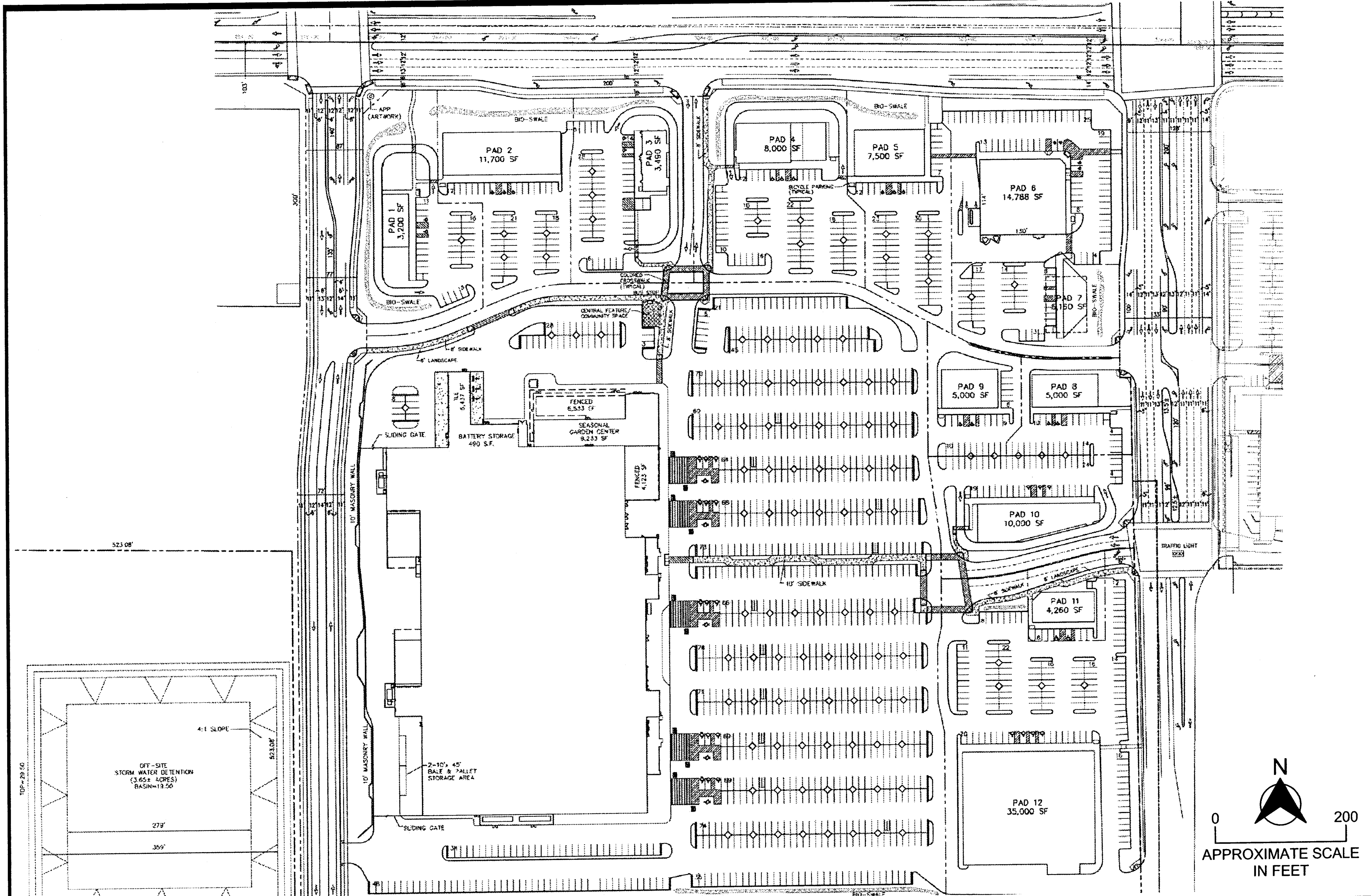
SOURCE: U.S.G.S. TOPOGRAPHIC MAP, 7.5 MINUTE SERIES
LODI SOUTH, CALIFORNIA QUADRANGLE, PHOTOREVISED 1976

0 2000
APPROXIMATE SCALE
IN FEET

SITE LOCATION MAP
PROPOSED RETAIL CENTER
SWC OF LOWER SACRAMENTO RD. AND KETTLEMAN LN.
LODI, CALIFORNIA

FILE NO.: 20103-01	DATE: 04/16/03
DRAWN BY: WME	APPROVED BY:
PROJECT NO. E20103.01	DRAWING NO. 1

TL EST.1898 THE TWINING LABORATORIES, INC.
FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY



SITE PLAN
PROPOSED LODI SHOPPING CENTER
SWC LOWER SACRAMENTO ROAD AND KETTLEMAN LANE
LODI, CALIFORNIA

FILE NO.	DATE DRAWN:
20103-02	05/21/04
DRAWN BY: WME	APPROVED BY: [signature]
PROJECT NO. E20103.01	DRAWING NO. 2

THE TWINING LABORATORIES, INC.
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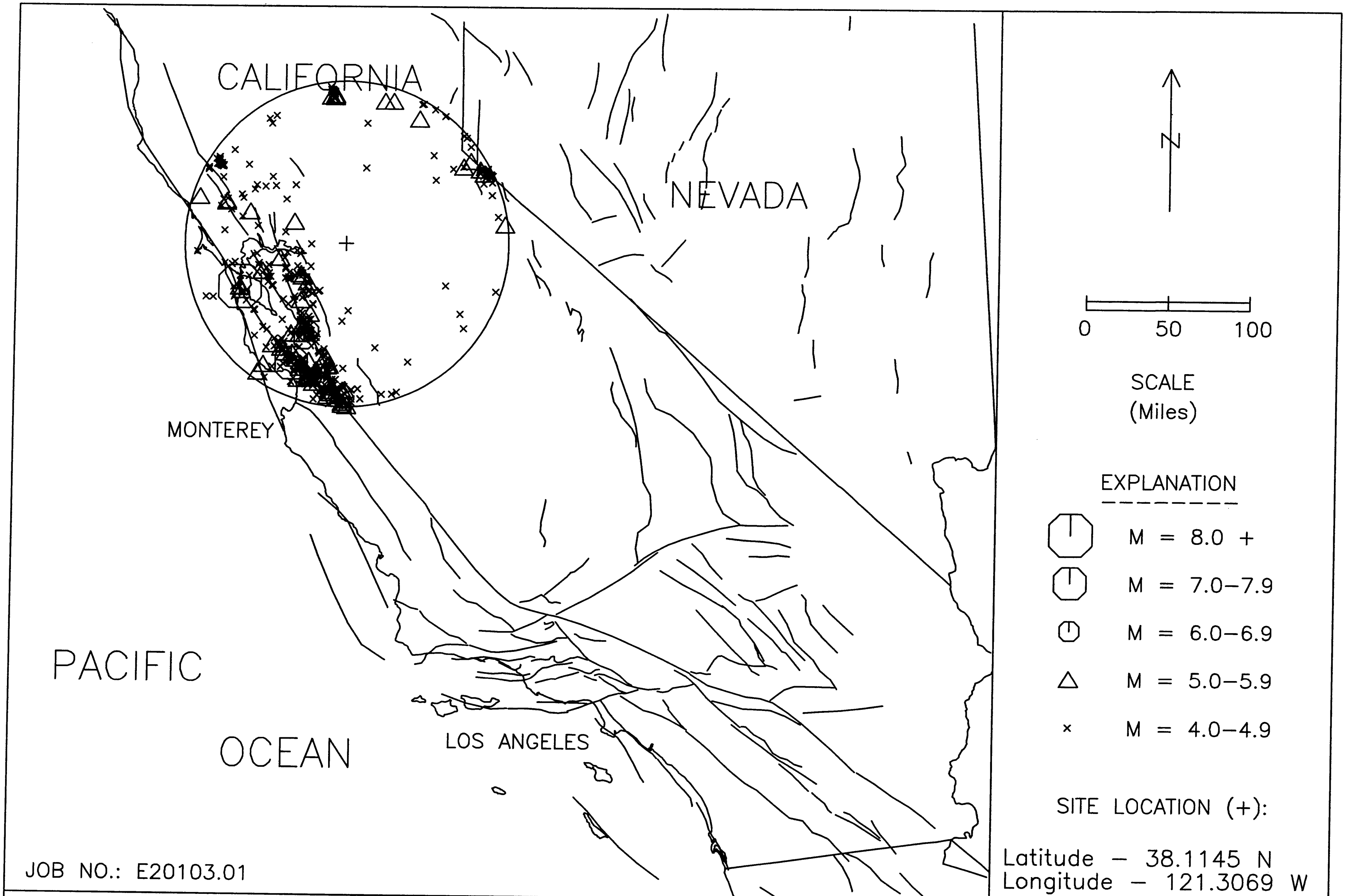
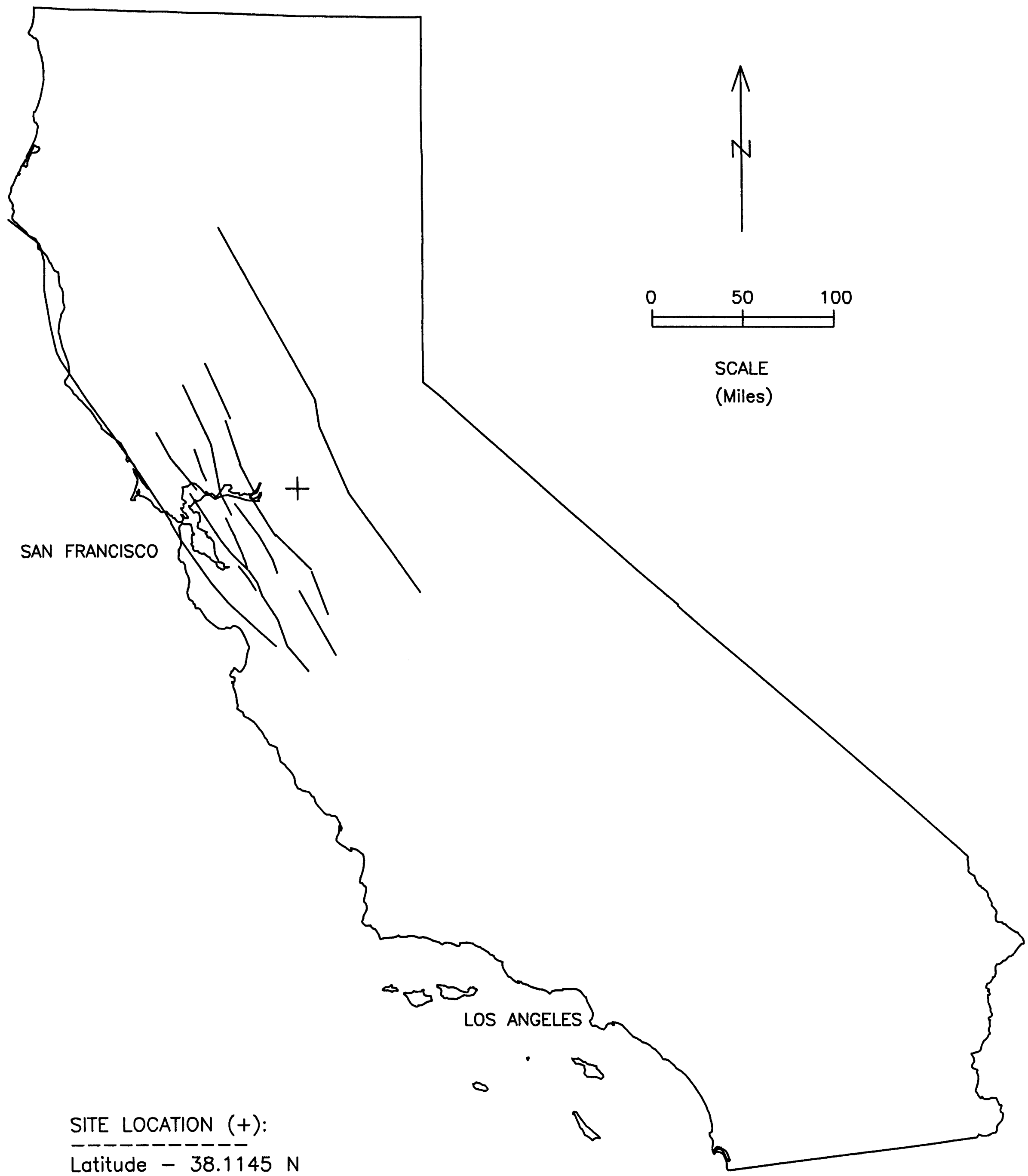


HISTORICAL EARTHQUAKES 1900 TO 2002

HISTORICAL EARTHQUAKE EPICENTER LOCATIONS
PROPOSED RETAIL CENTER
SWC LOWER SACRAMENTO ROAD AND KETTLEMAN LANE
LODI, CALIFORNIA

FILE NO. 20103-MP	DATE DRAWN: 04/21/03
DRAWN BY: WME	APPROVED BY:
PROJECT NO. E20103.01	DRAWING NO. 3

THE TWINING LABORATORIES, INC.
EST.1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY



SITE LOCATION (+):

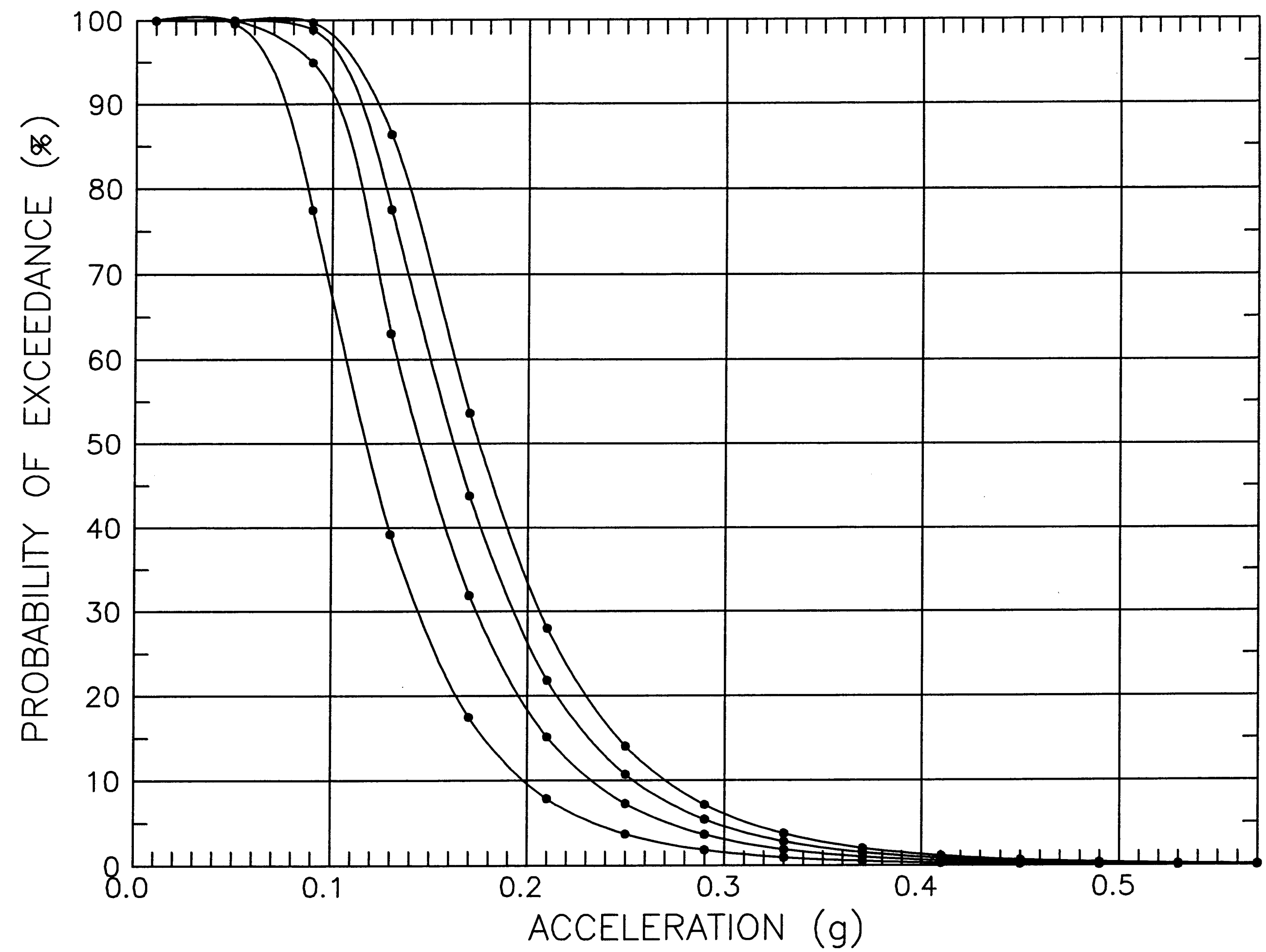
Latitude – 38.1145 N
Longitude – 121.3069 W
Retail Center, Lodi

FRISKSP FAULT MAP

JOB No.: E20103.01

MAP OF FAULTS RELATIVE TO THE SITE PROPOSED RETAIL CENTER SWC LOWER SACRAMENTO RD. AND KETTLEMAN LN. LODI, CALIFORNIA	FILE NO. 20103-MF	DATE DRAWN: 04/21/03	THE TWINING LABORATORIES, INC. EST.1898 FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY
	DRAWN BY: WME	APPROVED BY: KC	
	PROJECT NO. E20103.01	DRAWING NO. 4	

PROBABILITY OF EXCEEDANCE vs. ACCELERATION



EXPOSURE PERIODS:
25 years
50 years
75 years
100 years

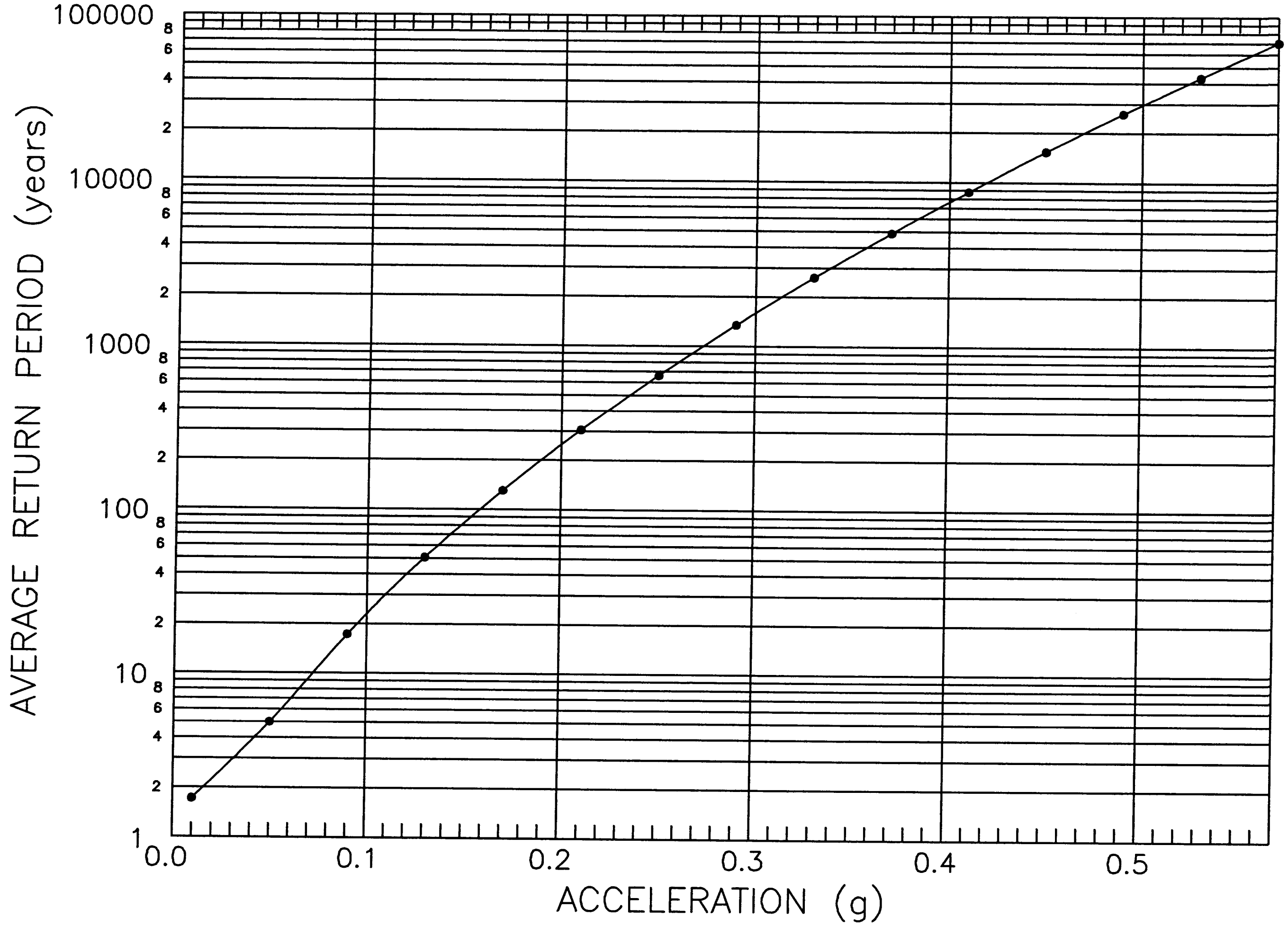
BOORE ET AL(1997) NEHRP D (250)

JOB No.: E20103.01

PROBABILITY OF EXCEEDANCE VERSUS ACCELERATION FOR EXPOSURE PERIODS OF 25, 50, 75, AND 100 YEARS PROPOSED RETAIL CENTER SWC LOWER SACRAMENTO ROAD AND KETTLEMAN LANE LODI, CALIFORNIA	FILE NO. 20103-P	DATE DRAWN: 04/21/03
	DRAWN BY: WME	APPROVED BY: KC
	PROJECT NO. E20103.01	DRAWING NO. 5

THE TWINING LABORATORIES, INC.
EST.1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY

AVERAGE RETURN PERIOD vs. ACCELERATION



Retail Center, Lodi

BOORE ET AL(1997) NEHRP D (250)

JOB No.: E20103.01

AVERAGE RETURN PERIOD VERSUS GROUND ACCELERATION PROPOSED RETAIL CENTER SWC LOWER SACRAMENTO ROAD AND KETTLEMAN LANE LODI, CALIFORNIA	FILE NO. 20103-R	DATE DRAWN: 04/21/03
	DRAWN BY: WME	APPROVED BY: KC
	PROJECT NO. E20103.01	DRAWING NO. 6

THE TWINING LABORATORIES, INC.
EST. 1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY

APPENDIX D

Hydrology and Drainage Report

Prepared by

Phillippi Engineering

May 2004

PEI

Phillippi Engineering, Inc.
CIVIL ENGINEERING – LAND SURVEYING

LODI CENTER SOUTHWEST CORNER OF KETTLEMAN AT LOWER SACRAMENTO

DRAINAGE STUDY

Submitted to

BROWMAN DEVELOPMENT

November 2002
Revised May 16, 2003
Revised February 18, 2004
Revised May 14, 2004

Prepared by

Phillippi Engineering, Inc.

I. SITE LOCATION AND AREA DESCRIPTION

The property is located at the southwest corner of Kettleman Lane at Lower Sacramento Road in the City of Lodi. The property which comprises 44.55 acres for drainage purposes, is bounded by the centerline of Lower Sacramento Road to the east, the centerline of Kettleman Lane to the north, future residential property to the south and western boundary of future Road 'A' to the west. The site generally drains from north to south, with the drainage being collected in a ditch along Lower Sacramento and being conveyed to the south.

In addition, the property includes a 3.65-acre easement area at the southwest corner of the property, which will be used as a temporary detention basin.

II. PURPOSE AND OVERVIEW

This study was undertaken to analyze drainage impacts of a proposed shopping center on the above-described property. Specifically, the purpose of this study is to determine the sizing of the temporary detention pond that will serve the site and ascertain if any adverse impacts will result from development of the property.

Per Section 3.702 of the City of Lodi Standards for Temporary Detention Basins, the design of on-site detention basins shall adhere to the following criteria:

> ***A 48-hour, 10-year storm, total rainfall of 3.3 inches shall be used if reasonable outlet is provided. If no disposal other than evaporation, percolation or irrigation is provided a 48-hour, 100-year storm, total rainfall of 4.8 inches shall be used.*** (In this case, there is currently no storm drain line in Lower Sacramento Road, which can serve as an outlet. Also, a new facility in Lower Sacramento Road may not be available in the foreseeable future due to State Funding difficulties.)
>
> ***The maximum water surface of the basin shall be 1 foot below the elevation of the top of curb at the lowest catch basin inlet within the tributary area and a maximum of 1 foot above the design hydraulic grade line at the basin.*** The lowest top of curb on site is expected to be 29.5. Therefore, the maximum water surface elevation for the basin shall be 28.5.
>
> ***Fencing shall be provided around all basins greater than 3 feet in depth.***
>
> ***Adequate all-weather access shall be provided.***
>
> ***The tributary drainage system shall be designed to connect to the City's future storm drainage system.***
>
> ***Any Additional requirements placed, as a condition of approval shall be incorporated into the design.***

Presently, a 12" storm drain line in Lower Sacramento Road stubs out to the property. This line runs east into a storm drain manhole where it connects to a 21" line that runs easterly through the existing shopping center on the southeast corner of Kettleman at Lower Sacramento. This 21" line does not have adequate capacity for drainage of the entire subject property. However, this line could be used for eventual emptying of the temporary detention basin.

III. FEMA FLOODPLAIN INFORMATION

Per the Federal Emergency Management Agency (FEMA) Flood Insurance Map (FIRM) for the City of Lodi, San Joaquin County California, Community Panel Number 0602990285B, the site is in flood zone B. This zone indicates areas between 100-year and 500-year flood; or certain areas subject to 100 year flooding with depths less than 1 foot; or where the contributing area is less than one square mile; or areas protected by levees from base flood.

III. SCOPE OF WORK

The scope of work for this study consisted of the following tasks:

1. Conduct a field reconnaissance of the site.
2. Research existing hydrologic information and other available data regarding mean annual precipitation, tributary size, etc.
3. Determine detention basin size assuming the pond is emptied. Draining the basin would be done either by gravity flow into the 21" pipe or by pumping from the basin into the 21" line.
4. Meet with client and City to discuss results.
5. Prepare final report.

IV. METHODOLOGY

1. Using the data gathered, calculate the Detention Basin Size. The Coefficient of Runoff for the site is as follows: Pavement areas 0.95; roof areas 0.80; pond area 1.0 and landscape areas 0.20. For purposes of this analysis the following areas were based on the latest submitted site plan (May, 2004): landscape area 5.0 acres; pond area of 3.65 acres; and roof area 7.80 acres. The remainder of the site is assumed to be pavement (concrete of asphalt) for total pavement acreage of 28.10 acres. The City of Lodi design intensity is 4.8 inches. As mentioned previously, the only method for draining the basin would be through use of a pump to the existing 21" in Lower Sacramento Road. Present the findings.

V. FINDINGS

1. The pre-development run-off in a 10-year storm event is as follows: Q=CiA where "C" is the coefficient of run-off, "i" is the storm intensity, and "A" is the area. For the lawn and open area the "C" required in the City of Lodi is 0.20. The area, as discussed previously, is 44.55 acres (of which approximately 2 acres is existing street pavement). The intensity, for a time of concentration of 30 minutes, is 0.65. Therefore, the pre-development run-off is 6.77 cfs.
2. The post-development runoff for the site is as follows: "C" factors are for pavement areas 0.95, roof areas 0.80, and landscape areas 0.20. Pavement areas comprise 28.1 acres, roof areas 7.80 acres, and landscape area 5.0 acres. The rainfall intensity time changes to 10 minutes, which corresponds to an intensity value of 1.29. Therefore, the post-development run-off is 44.72 cfs.
3. No rainfall intensity levels for a 100-year storm event are given in the City of Lodi standards. The standards do, however, list the criteria for storm detention for a 100-year storm event.

V. DETENTION POND SIZING TEMPORARY BASIN (100-YEAR STORM EVENT

Shed	Land Use	Area "A" (Acres)	Runoff Coefficient "C"	Runoff (48 hr) Q=CIA (4.8xCxA)
1	Landscaping	5.00	0.20	4.80
2	Roofs	7.80	0.80	29.95
3	Pavement	28.10	0.95	128.14
4	Pond	3.65	1.00	17.52
		44.55		180.41

Total Run-off = 180.41 ac-in = 15.03 ac-ft

Required volume:

The required volume of the detention basin per section 3.702 of the city of Lodi Improvement Standard equals 100% of 10-year 48-hour runoff when "a reasonable outlet is provided." In this case, no outlet is available; therefore, basin design will assume 100% capture with no outlet. Because the proposed basin will rely on pump it is anticipated that the required storage will be a 100-year 48-hour event, therefore the required volume is15.03 ac-ft.

Depth of Basin:

Because of maintenance issues, the ideal depth for a detention basin would be 6-10 feet. Basins shallower than this will require large surface areas while basins deeper than 10 feet will create difficulties in accessing the bottom for repairs and cleaning.

The City of Lodi standards require 4:1 side slopes for detention basins. The total area of the basin shall be 3.65 acres assuming the following: a square basin; a depth of 10 feet; 4:1 side slopes; 2 foot freeboard; 10-foot wide all-weather aggregate base rock access road; 10 feet of exterior landscaping.

As mentioned earlier, some percolation of the basin may be desired feature for the following reasons:

1) Having the bottom of the basin lower than the pump inlet by 1-2 feet allows for sediment to fall out of the water thus addressing the issue of storm water pollution; and,

2) Increasing the depth allows for a reduced surface area.

APPENDIX E

Biological Resources Report

Prepared by

Live Oak Associates

July 2004

LIVE OAK ASSOCIATES, INC.

an Ecological Consulting Firm

LODI SHOPPING CENTER
BIOLOGICAL EVALUATION

LODI, SAN JOAQUIN COUNTY, CALIFORNIA

Prepared by:

LIVE OAK ASSOCIATES, INC.

Rick A. Hopkins, Ph.D., Principal and Senior Wildlife Ecologist
Melissa Denena, M.S., Assistant Project Manager and Wetland/Wildlife Ecologist

Prepared for:

Bert Verrips
Pacific Municipal Consultants
225 K Cannery Row
Monterey, CA 93940

July 1, 2004

Project Number 495-01

TABLE OF CONTENTS

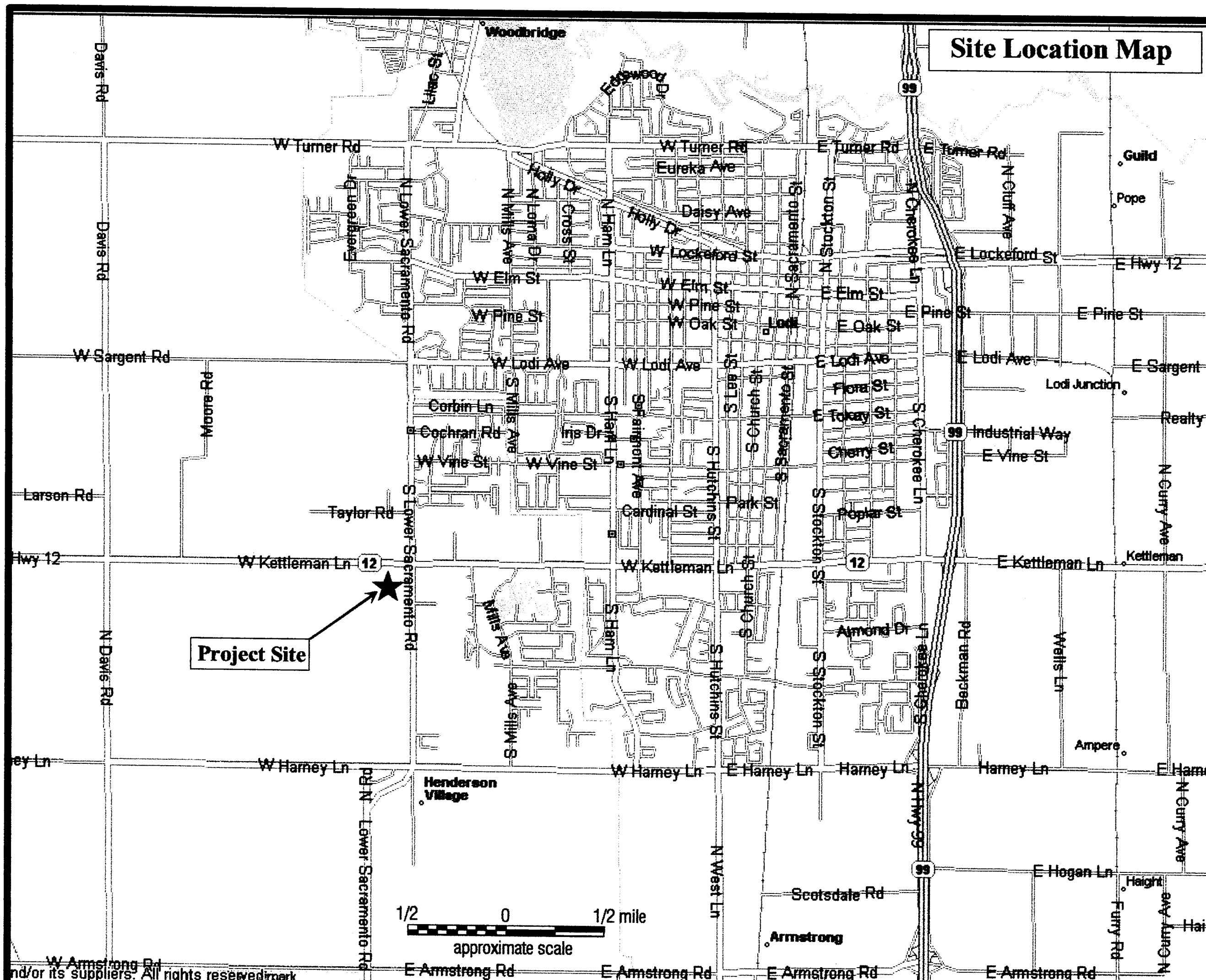
1.0 INTRODUCTION

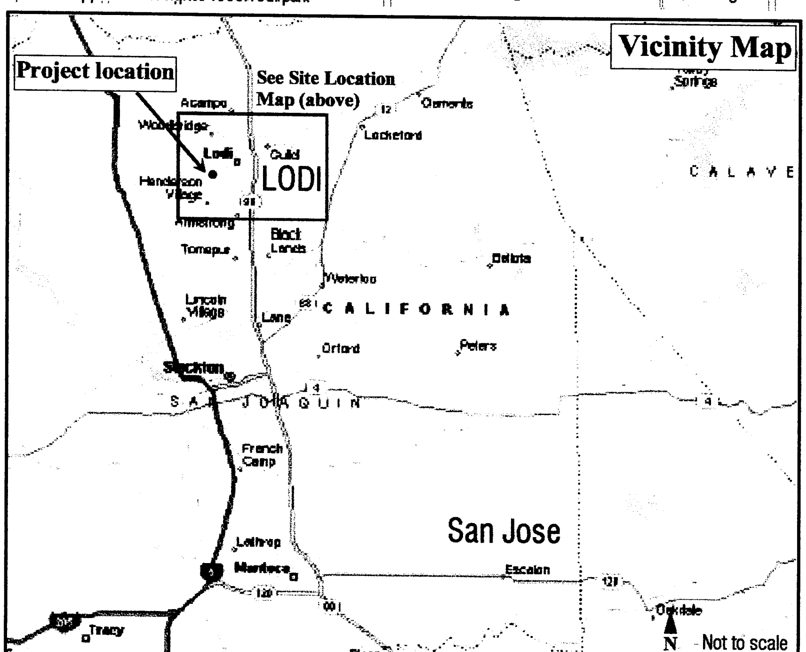
The technical report that follows describes the biotic resources of a site in northern San Joaquin County, California, and evaluates possible affects the proposed project may have on the biotic resources of the site and region. The site is located on Kettleman Lane or Highway 12 at the junction of Lower Sacramento Road in Lodi, California (Figure 1). The location of the site can be found on the Lodi South U.S.G.S. 7.5' quadrangle. The only habitat to occur on the site is ruderal habitat.

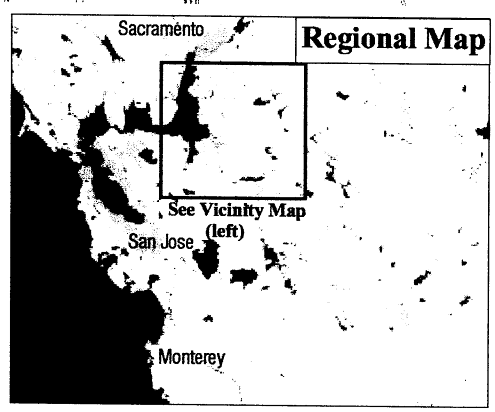
Site development of undeveloped parcels (even those consisting of rendered or non-native habitats) can damage or modify biotic habitats used by sensitive plant and wildlife species. In such cases, site development may be regulated by state or federal agencies, subject to provisions of the California Environmental Quality Act (CEQA), or some combination of the three. This report addresses issues related to sensitive biotic resources occurring on the study area, the federal, state, and local laws related to such resources, and mitigation measures which could be required to reduce the magnitude of anticipated impacts.

The analysis of impacts, as discussed in Section 3.0 of this report, was based on the known and potential biotic resources of the study area (discussed in Section 2.0). Sources of information used in the preparation of this analysis included: (1) the *California Natural Diversity Data Base* (CDFG 2002); (2) the *Inventory of Rare and Endangered Vascular Plants of California* (CNPS 2001); (3) the *San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP)* (San Joaquin County 2000); and (4) manuals and references related to plants and animals of the San Francisco Bay region.

Field surveys were conducted within the study area on February 19, 2003 by Melissa Denena, at which time the principal biotic habitats of the site were identified and the constituent plants and animals of each were noted.







LIVE OAK ASSOCIATES, INC.

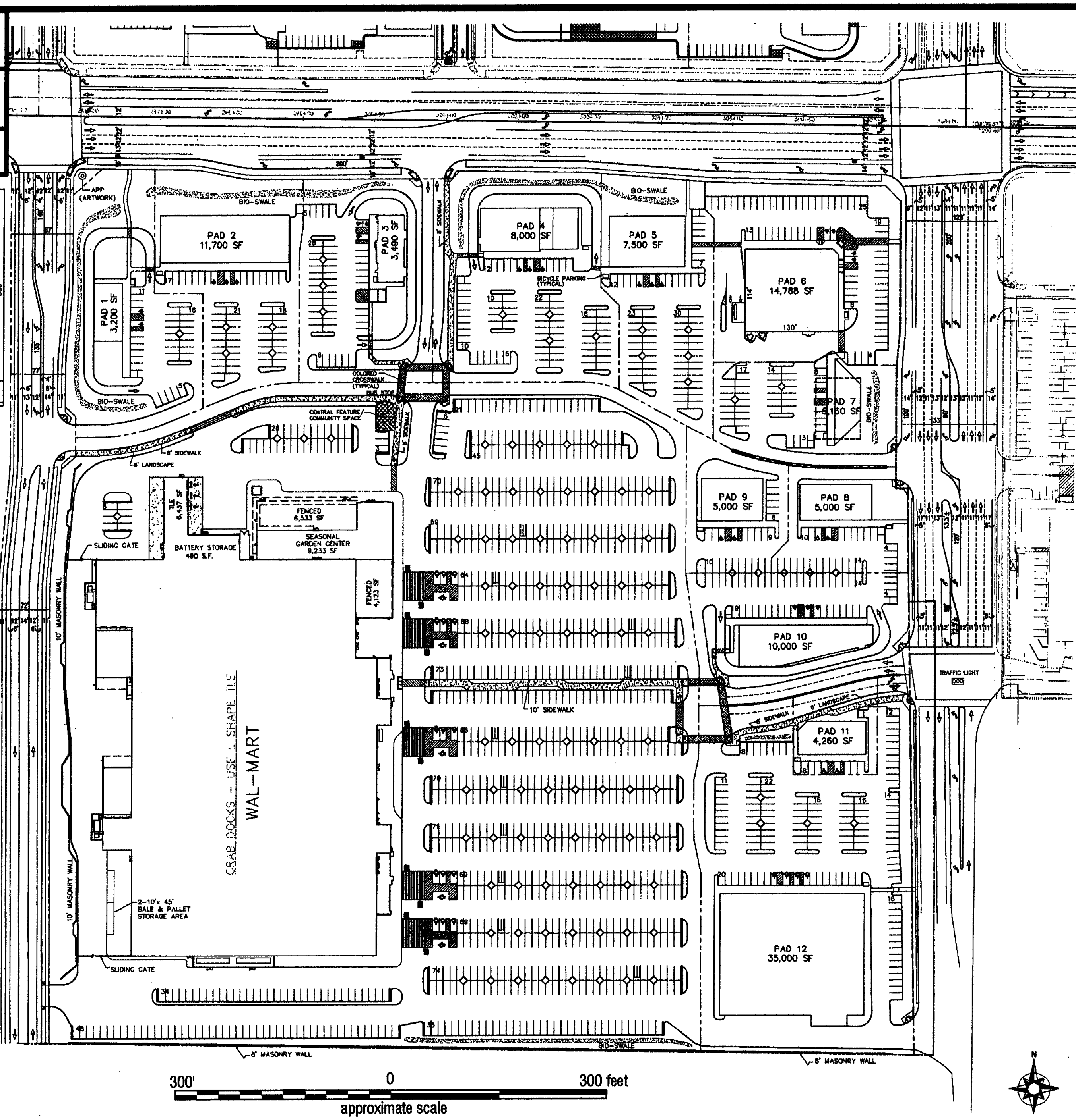
Lodi Shopping Center
Site / Vicinity Map

Date	Project #	Figure #
2/20/03	495-01	1

1.1 PROJECT DESCRIPTION

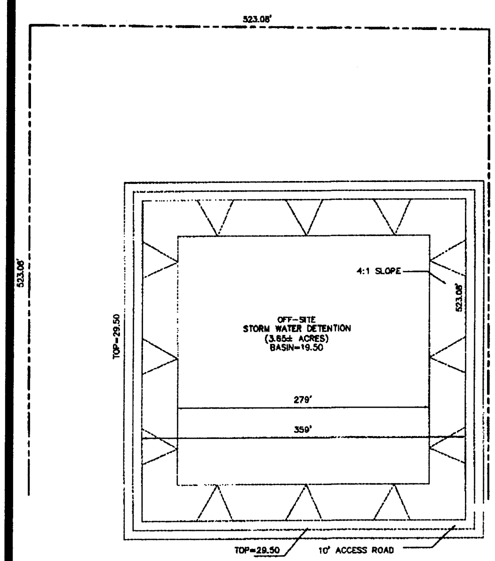
The proposed project will construct a shopping center and associated facilities (roads, parking lots, etc.) on the approximate 40-acre site. An additional off-site storm water detention area consisting of approximately six acres will also be evaluated. This area is located directly west of the southwestern corner of the site. The proposed plan will not preserve any portion of the approximate 46-acre study area as open space (Figure 2). The existing open space is characterized as ruderal habitat.

Live Oak Associates, Inc.		
Lodi Shopping Center Proposed Development		
Date 5/25/04	Project # 495-01	Figure # 2



LODI III PARKING SUMMARY

LOCATION	TOTAL BLDG SIZE	SPACES PROVIDED	AVERAGE PER 1000
PAD 1	3,200	32	10.00
PAD 2	11,700	56	4.79
PAD 3	3,490	53	15.19
PAD 4	8,000	78	9.75
PAD 5	7,500	72	9.60
PAD 6	14,788	60	4.07
PAD 7	5,150	42	8.14
PAD 8	5,000	28	5.60
PAD 9	5,000	25	5.00
PAD 10	10,000	47	4.70
PAD 11	4,260	8	1.88
PAD 12	35,000	135	3.86
WAL-MART (includes TLE & Garden Center)	210,212	990	4.71
TOTALS	**323,310**	**1,636**	**5.06**



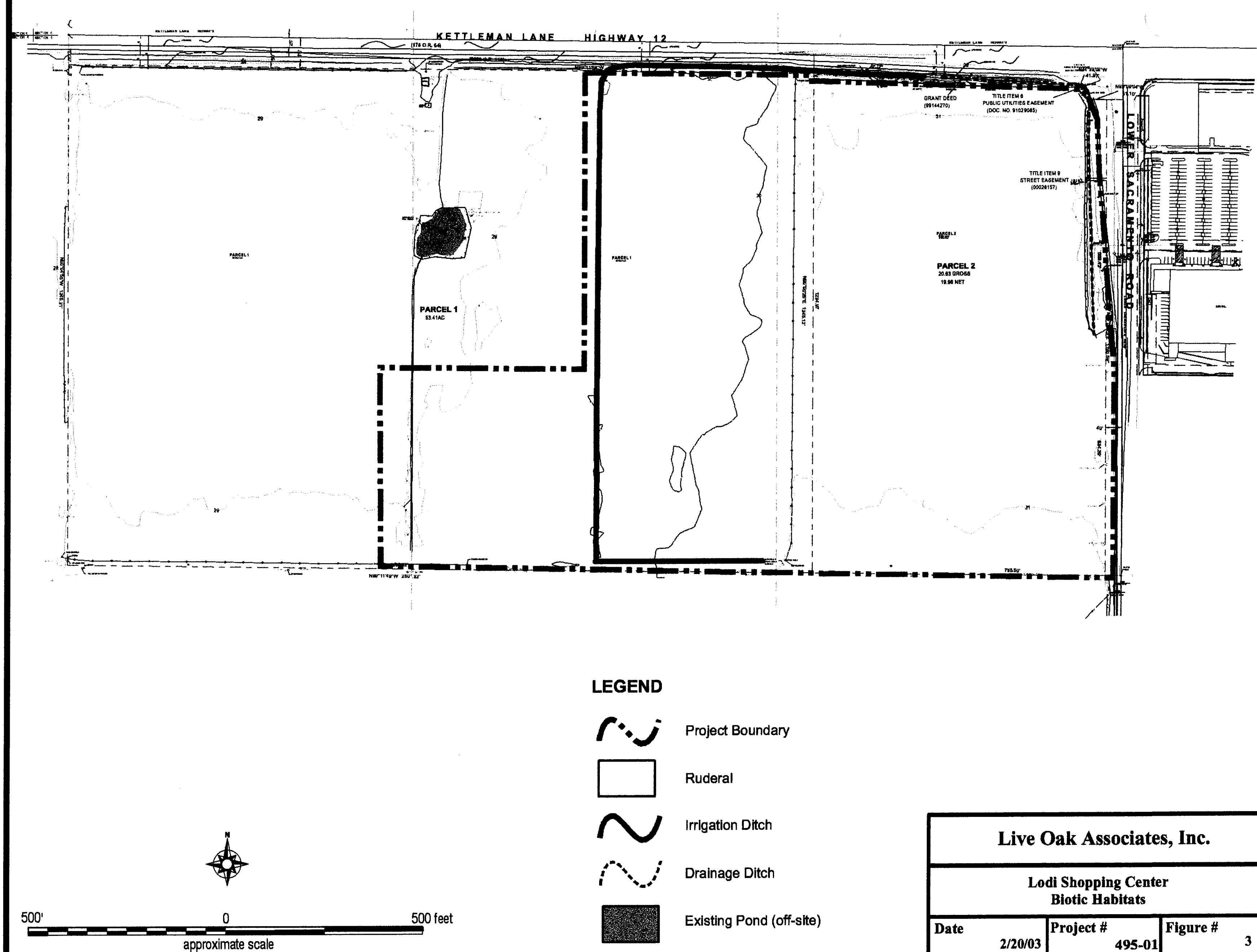
2.0 EXISTING CONDITIONS

The study area is located in the City of Lodi in northern San Joaquin County, California. The lands beyond the western, northern, and southern boundaries of the study area consist of open ruderal habitat, agriculture, and a few single-family residences. In the ruderal habitat directly to the west of the study area, a small pond exists with species of rush (*Juncus* sp.) and sedge (Cyperaceae sp.). The eastern boundary is developed, consisting of a shopping center. The study area consists of an open field, which had been recently been disced at the time of the field survey in February 2003. Elevations range from approximately 29 feet NGVD (National Geodetic Vertical Datum) to 32 feet NGVD. Two soil-mapping units, Acampo sandy loam, 0 to 2 percent slopes, and Tokay fine sandy loam, 0 to 2 percent slopes, have been identified on the site (NRCS 1992). The Acampo sandy loam consists of moderately well drained soils and is deep to a hardpan. The Tokay fine sandy loam consists of very deep, well-drained soils. Both soil types are nearly level soils on low fan terraces and are formed in alluvium derived from granitic rock sources. These two soil types are not considered to be hydric.

Average annual precipitation in the study area is about 17.5 inches, almost 85% of which typically falls between the months of October and March. Virtually all precipitation falls in the form of rain. Stormwater runoff readily infiltrates into the soils of the site, but when field capacity has been reached, gravitational water empties into the drainage and irrigation ditches surrounding the boundaries of the site.

2.1 BIOTIC HABITATS

One biotic habitat was identified on the study area. For purposes of this report, this biotic habitat has been defined as ruderal. This habitat has been mapped in the following Figure 3. Also, an irrigation ditch runs in a north to south direction through the western portion of the parcel and along portions of the northern and southern boundaries of the site, and a human-made drainage ditch runs along portions of the northern and eastern boundaries (Figure 3).



Live Oak Associates, Inc.		
Lodi Shopping Center Biotic Habitats		
Date 2/20/03	Project # 495-01	Figure # 3

2.1.1 Ruderal Habitat

Ruderal habitats, consisting of disturbed land, usually support low species diversity. The term "ruderal" refers to areas which are periodically disturbed by anthropogenic influences. These habitats are characterized by a predominance of non-native grasses and forbs of European origin. Native vegetation is typically sparse to non-existent. This habitat was surrounded along the boundaries by small drainage and irrigation ditches which contained little to no water at the time of the field survey in February 2003.

Dominant vegetation observed within this habitat on the site included non-native grasses such as wild oats (*Avena fatua*), barnyard barley (*Hordeum murinum*), ripgut brome (Bromus diandrus), and annual bluegrass (*Poa annua*). Common exotic forbs occurring in this habitat include clovers (*Medicago* sp.), fiddlenecks (*Amsinckia* sp.), redstem filaree (*Erodium cicutarium*), shepherd's-purse (*Capsella bursa-pastoris*), common chickweed (*Stellaria media*), plantains (*Plantago* sp.), Persian speedwell (*Veronica persica*), henbit (*Lamium amplexicaule*), birdsrape mustard (*Brassica rapa*), radish (*Raphanus* sp.*)*, Russian thistle (*Salsola tragus*), yellow star thistle (*Centaurea solstitialis*), mallow (Malvaceae sp.) and the native miner's lettuce (*Montia perfoliata*).

Few trees occur on the study area. A small patch of young cottonwoods (*Populus fremontii*) was found in the irrigation ditch on the northern boundary of the site. Eight mature trees were located along and within the eastern and southern boundaries of the site. These included two walnuts (*Juglans* sp.) and a young coast live oak (*Quercus agrifolia*) along the eastern boundary and Lower Sacramento Road. There were five larger trees along the southern boundary. These included two almonds (*Prunus* sp.) and three walnuts (*Juglans* sp.), and were probably remnant volunteers from an orchard. A number of additional almond and walnut trees, approximately five, had been cut to stumps along the eastern and southern boundaries. Directly west of the site, there are an additional seven trees (walnuts, almond, and coast live oaks) along the boundary of the ruderal habitat. There are also four mature trees adjacent to the small pond to the west of the project site.

Disturbed land provides very little habitat for terrestrial vertebrates. Native and non-native animals use ruderal habitat primarily for cover and foraging. The study area had been recently disced at the sitme of the February 2003 field survey, which left the land barren of vegetation and therefore provided little cover for most terrestrial vertebrates. Reptiles that are expected to occur on the study site include gopher snakes (*Pituophis melanoleucus*), western fence lizards (*Sceloporus occidentalis*), and southern alligator lizards (*Gerrhonotus multicarinatus*).

Such land may be used as foraging habitat by a variety of birds including killdeer (*Charadrius vociferus*), American crows (*Corvus brachyrhynchos*), western meadowlarks (*Sturnella neglecta*), Brewer's blackbirds (*Euphagus cyanocephalus*), and European starlings (*Sturnus vulgaris*). Migratory birds could include western kingbirds (*Tyrannus verticalis*) in the summer and American pipits (*Anthus spinoletta*) and savannah sparrows (*Passerculus sandwichensis*) in the winter. Avian predators such as American kestrels (*Falco sparvarius*), white-tailed kites (*Elanus caeruleus*), red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*Buteo swainsoni*), merlins (*Falco columbarius*), northern harriers (*Circus cyaneus*) and loggerhead shrikes (*Lanius ludovicianus*) are likely to be seen foraging over ruderal and agricultural lands of the Lodi area.

Small mammals common to ruderal habitat include California ground squirrels (*Spermophilus beechi*), house mice (*Mus musculus*), deer mice (*Peromyscus maniculatus*), and Botta's pocket gophers (*Thomomys bottae*), among others. Coyotes (*Canis latrans*) are also attracted to such habitats by the many small mammals that occur in them. Portions of the site with little vegetation are probably visited by feral and household cats *(Felis cattus)* and domestic dogs (*Canis familiaris*). None of the above mammalian species were observed on the study site during the February 2003 field survey; although, a few ground squirrel burrows were observed around the perimeter of this habitat.

2.1.2 Irrigation/Drainage Ditch

An irrigation ditch runs in a north to south direction through the western portion of the project site, and along portions of the northern and southern boundaries. This linear drainage ditch appears to have been constructed for agricultural irrigation purposes. A shallow human-made drainage ditch also runs along portions of the northern and eastern boundaries of the site. At the time of the field visit in February 2003, water was absent from these ditches, and vegetation was consistent with that of the surrounding ruderal habitat.

2.2 MOVEMENT CORRIDORS

The area proposed for development on the site consists of one biotic habitat. A diverse assemblage of wildlife species uses this habitat. The movements of various species on- and off-site vary depending on the species in question.

Assessing the importance of an area as a "movement corridor" depends on differentiating between animals' consistent use patterns. Animal movements generally can be divided into three major behavioral categories:

- Movements within a home range or territory.
- Movements during migration.
- Movements during dispersal.

While no detailed study of animal movements has been conducted for the study area, knowledge of the site, its habitats, and the ecology of the species on-site permits sufficient predictions about the types of movements occurring in the region and whether proposed development would constitute a significant impact to animal movements. No identified or known "animal corridor" presently exists on the site, thus development is not expected to have a significant impact on corridor-type movements within the region.

However, development of open parcels results in secondary effects on regional wildlife populations by fragmenting habitats in ways that either create barriers to movement or substantially alter the ability of wildlife to move through a region (even through ruderal habitat) in order to access more suitable habitats. Even poor quality habitat (in this case ruderal habitat) can and are used by species as movement corridors. This site however, does not facilitate regional movement of wildlife in a disproportionate way.

2.3 SPECIAL STATUS PLANTS AND ANIMALS

Several species of plants and animals within the state of California have low populations, limited distributions, or both. Such species may be considered "rare" and are vulnerable to extirpation as the state's human population grows and the habitats these species occupy are converted to agricultural and urban uses. As described more fully in Section 3.2, state and federal laws have provided the California Department of Fish and Game (CDFG) and the U.S. Fish and Wildlife Service (USFWS) with a mechanism for conserving and protecting the diversity of plant and animal species native to the state. A sizable number of native plants and animals have been formally designated as threatened or endangered under state and federal endangered species legislation. Others have been designated as "candidates" for such listing. Still others have been designated as "species of special concern" by the CDFG. The California Native Plant Society (CNPS) has developed its own set of lists of native plants considered rare, threatened or endangered (CNPS 2001). Collectively, these plants and animals are referred to as "special status species."

A number of special status plants and animals occur in the vicinity of the study area. These species, and their potential to occur in the study area, are listed in Table 1 on the following pages. Sources of information for this table included *California's Wildlife, Volumes I, II, and III* (Zeiner et al. 1988-1990), *California Natural Diversity Data Base* (CDFG 2003), *Endangered and Threatened Wildlife and Plants* (USFWS 2002), *Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants* (CDFG 2002), and *The California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California* (CNPS 2001). This information was used to evaluate the potential for special-status plant and animal species to occur on site. Figure 4 shows the location of special status species found by the California Natural Diversity

Data Base (CNDDB). It is important to note that CNDDB is a volunteer database and therefore, it may not contain all known or unofficial literature records.

A search of published accounts for all of the relevant special-status plant and animal species was conducted for the Lodi South USGS 7.5 minute quadrangle in which the project site occurs, and for surrounding quadrangles (Lodi North, Thornton, Lockeford, Waterloo, Terminous, Holt, Stockton West, and Stockton East) using the California Natural Diversity Data Base Rarefind 2001. All plant species listed as occurring in these quadrangles on CNPS Lists 1A, 1B, 2, or 4 were also reviewed.

TABLE 1. LIST OF SPECIAL STATUS SPECIES THAT COULD OCCUR IN THE PROJECT VICINITY

This list represents a subset of the species listed in the SJMSCP. Only those species that could or may occur in the habitats on-site were included in this present list.

PLANTS (adapted from CDFG, 2003 and CNPS, 2001)

Species Listed as Threatened or Endangered under the State and/or Federal Endangered Species Act

Species	Status	Habitat	*Occurrence in the Study Area
Succulent Owl's-Clover (*Castilleja campestris* ssp. *succulenta*)	FT, CE, CNPS 1B	Vernal pools that are often acidic.	**Absent.** Suitable habitat does not exist on the study area.
Delta Button-Celery (*Eryngium racemosum*)	CE, CNPS 1B	Found in riparian scrub in vernally mesic clay depressions.	**Absent.** Suitable habitat does not exist on the study area.
Mason's Lilaeopsis (*Lilaeopsis masonii*)	CR, CNPS 1B	Brackish or freshwater marshes and swamps, and riparian scrub.	**Absent.** Suitable habitat does not exist on the study area.

Other special status plants listed by CNPS

Species	Status	Habitat	*Occurrence in the Study Area
Suisun Marsh Aster (*Aster lentus*)	CNPS 1B	Brackish or freshwater marshes and swamps.	**Absent.** Suitable habitat does not exist on the study area.
Alkali Milk-Vetch (*Astragalus tener* var. *tener*)	CNPS 1B	Playas, adobe clay valley and foothill grasslands, and alkaline vernal pools.	**Absent.** Suitable habitat does not exist on the study area.
Bristly Sedge (*Carex comosa*)	CNPS 2	Coastal prairies, lake margins of marshes and swamps, and valley and foothill grasslands.	**Absent.** Suitable habitat does not exist on the study area.
Slough Thistle (*Cirsium crassicaule*)	CNPS 1B	Chenopod scrub, marshes and swamps (sloughs), and riparian scrub.	**Absent.** Suitable habitat does not exist on the study area.

** See last page of Table 1 for detailed footnote.*

TABLE 1. LIST OF SPECIAL STATUS SPECIES THAT COULD OCCUR IN THE PROJECT VICINITY

Other special status plants listed by CNPS (cont.)

Species	Status	Habitat	*Occurrence in the Study Area
Round-Leaved Filaree *(Erodium macrophyllum)*	CNPS 2	Cismontane woodlands and clay valley and foothill grasslands.	**Absent.** Suitable habitat does not exist on the study area.
Rose-Mallow *(Hibiscus lasiocarpus)*	CNPS 2	Freshwater marshes and swamps.	**Absent.** Suitable habitat does not exist on the study area.
Delta Tule Pea *(Lathyrus jepsonii* var. *jepsonii)*	CNPS 1B	Brackish or freshwater marshes and swamps.	**Absent.** Suitable habitat does not exist on the study area.
Legenere *(Legenere limosa)*	CNPS 1B	Vernal pools.	**Absent.** Suitable habitat does not exist on the study area.
Delta Mudwort *(Limosella subulata)*	CNPS 2	Marshes and swamps.	**Absent.** Suitable habitat does not exist on the study area.
Sanford's Arrowhead *(Sagittaria sanfordii)*	CNPS 1B	Assorted shallow freshwater marshes and swamps.	**Absent.** Suitable habitat does not exist on the study area.
Blue Skullcap *(Scutellaria lateriflora)*	CNPS 2	Mesic meadows and seeps and marshes and swamps.	**Absent.** Suitable habitat does not exist on the study area.

ANIMALS (adapted from CDFG 2003 and USFWS 2002)

Species Listed as Threatened or Endangered under the State and/or Federal Endangered Species Act

Species	Status	Habitat	*Occurrence in the Study Area
Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*)	FT	Lives in mature elderberry shrubs of California's Central Valley and Sierra Foothills.	**Absent.** Suitable habitat for this species does not exist in the form of elderberry shrubs on the study area.
California Red-legged Frog (*Rana aurora draytonii*)	FT, CSC	Rivers, creeks and stock ponds of the Sierra foothills and coast range, preferring pools with overhanging vegetation.	**Absent.** Suitable habitat for this species does not exist on the study area.
California Tiger Salamander (*Ambystoma californiense*)	FC, CSC	Vernal pools and stock ponds of central California.	**Absent.** Suitable habitat for this species does not exist on the study area. The pond on the adjacent parcel does not support suitable breeding habitat for this species due to the hydrologic conditions (pond does not appear to support water for the necessary period of time) and steep sloped banks.

** See last page of Table 1 for detailed footnote.*

TABLE 1. LIST OF SPECIAL STATUS SPECIES THAT COULD OCCUR IN THE PROJECT VICINITY

Species Listed as Threatened or Endangered under the State and/or Federal Endangered Species Act (cont.)

Species	Status	Habitat	*Occurrence in the Study Area
Giant Garter Snake (*Thamnophis gigas*)	FT,CT	Occurs in slow-moving water of emergent wetlands in the San Joaquin and lower Sacramento Valleys.	**Absent.** Suitable habitat for this species does not exist on the study area.
Swainson's Hawk (*Buteo swainsoni*)	CT	Forages in open grasslands of the Central Valley. Requires large trees nearby for nesting.	**Possible.** This species may forage on the study area, but no nesting habitat is present. There have been two CNDDB occurrences of this species within a three mile radius of the study area.
San Joaquin Kit Fox (*Vulpes macrotis mutica*)	FE, CT	Saltbush scrub, grassland, oak woodlands, savanna, and freshwater marsh.	**Absent.** Suitable habitat for this species does not exist on the study area. The nearest CNDDB or USFWS documented occurrence is greater than ten miles from the site.

Federal Candidate Species and State Species of Special Concern

Species	Status	Habitat	*Occurrence in the Study Area
Western Pond Turtle (*Clemmys marmorata*)	CSC	Open slow-moving water of rivers and creeks of central California with rocks and logs for basking.	**Absent.** Suitable habitat for this species does not exist on the study area.
Foothill Yellow-legged Frog (*Rana boylii*)	CSC	Found primarily in swiftly flowing creeks.	**Absent.** Suitable habitat for this species does not exist on the study area.
Western Spadefoot Toad	CSC	Open grasslands, savannahs, and chaparral with sandy to gravelly soil. Breeds in vernal pools or intermittent streams.	**Absent.** Suitable habitat for this species does not exist on the study area.
White-tailed Kite (*Elanus caeruleus*)	CSC	Open grasslands and agricultural areas throughout central California.	**Possible.** This species may forage on the study area, but nesting habitat is marginal to non-existent.
Northern Harrier (*Circus cyaneus*)	CSC	Frequents meadows, grasslands, open rangelands, freshwater emergent wetlands; uncommon in wooded habitats.	**Possible.** This species may forage on the study area, but no nesting habitat is present on-site.

** See last page of Table 1 for detailed footnote.*

TABLE 1. LIST OF SPECIAL STATUS SPECIES THAT COULD OCCUR IN THE PROJECT VICINITY

Federal Candidate Species and State Species of Special Concern (cont.)

Species	Status	Habitat	*Occurrence in the Study Area
Sharp-shinned Hawk (*Accipiter striatus*)	CSC	Breeds in the mixed conifer forests of the northern Sierra Nevada. This species winters in a variety of habitats of the state.	**Absent.** Foraging and nesting habitat are absent from the study area.
Cooper's Hawk (*Accipiter cooperii*)	CSC	Breeds in oak woodlands, riparian forests and mixed conifer forest of the Sierra Nevada, but winters in a variety of lowland habitats.	**Absent.** Foraging and nesting habitat are absent from the study area.
Merlin (*Falco columbarius*)	CSC	This falcon, which breeds in Canada, winters in a variety of California habitats, including grasslands, savannas, wetlands, etc.	**Possible.** This species may forage on the study area, but no nesting habitat is present on-site.
Golden Eagle (*Aquila chrysaetos*)	CSC	Typically frequents rolling foothills, mountain areas, sage-juniper flats and desert.	**Possible.** This species may forage on the study area, but no nesting habitat is present on-site.
Prairie Falcon (*Falco mexicanus*)	CSC	Distributed from annual grasslands to alpine meadows; requires cliffs or rock outcroppings for nesting.	**Possible.** This species may forage on the study area, but no nesting habitat is present on-site.
Burrowing Owl (*Athene cunicularia*)	CSC	Found in open, dry grasslands, deserts and ruderal areas. Requires suitable burrows. This species is often associated with California ground squirrels.	**Possible**. Burrowing owls breed locally and could forage on the site if breeding nearby. Limited nesting habitat is present on the site in the form of ground squirrel burrows. No individuals were observed during the February 2003 field visit.
Loggerhead Shrike (*Lanius ludovicianus*)	CSC	Nests in tall shrubs and dense trees, forages in grasslands, marshes, and ruderal habitats.	**Possible.** This species may forage on the study area, but no nesting habitat is present on-site.
California Horned Lark (*Eremophila alpestris actia*)	CSC	Short-grass prairie, annual grasslands, coastal plains, open fields.	**Possible**. This species inhabits a variety of open habitats, usually lacking in trees and shrubs. It is possible that this bird could nest or forage on-site.
Tricolored Blackbird (*Agelaius tricolor*)	CSC	Breeds near fresh water in dense emergent vegetation.	**Absent.** Suitable habitat for this species does not exist on the study area.

** See last page of Table 1 for detailed footnote.*

TABLE 1. LIST OF SPECIAL STATUS SPECIES THAT COULD OCCUR IN THE PROJECT VICINITY

Federal Candidate Species and State Species of Special Concern (cont.)

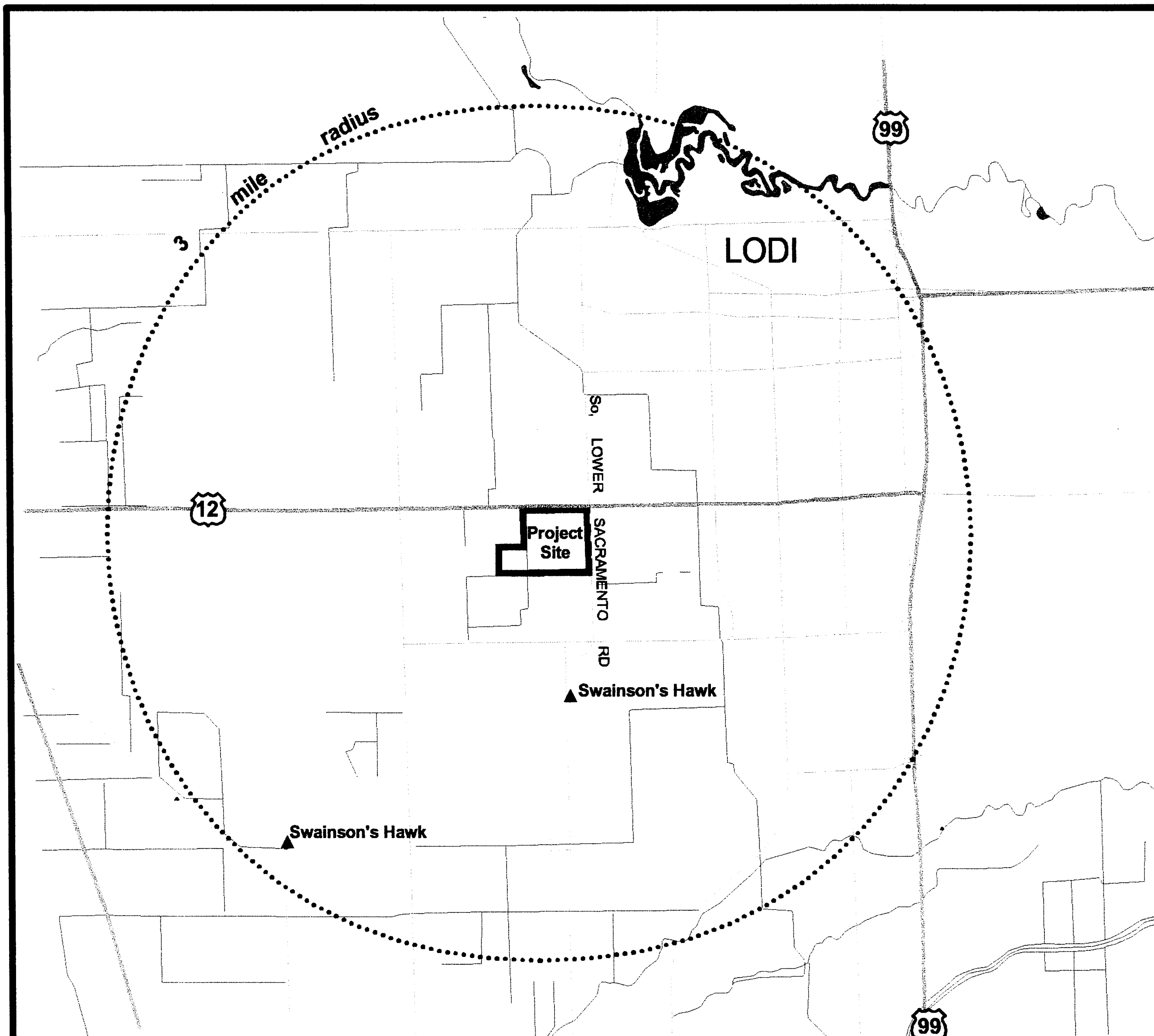
Species	Status	Habitat	*Occurrence in the Study Area
Pacific Western Big-eared Bat (*Plecotus townsendii townsendii*)	CSC	Primarily a cave-dwelling bat that may also roost in buildings. Occurs in a variety of habitats of the state.	**Possible.** The site does not provide suitable roosting habitat; the species may rarely to occasionally forage over the site.
California Mastiff Bat (*Eumops perotis californicus*)	CSC	Forages over many habitats, requires tall cliffs or buildings for roosting.	**Possible.** The site does not provide suitable roosting habitat; the species may rarely to occasionally forage over the site.
Ringtail (*Bassariscus astutus*)	CP	Occurs in riparian and heavily wooded habitats near water.	**Absent.** Suitable habitat for this species does not exist on the study area.

Present: Species observed on the sites at time of field surveys or during recent past.
Possible: Species not observed on the sites, but it could occur there from time to time.
Unlikely: Species not observed on the sites, and would not be expected to occur there except, perhaps, as a transient
Absent: Species not observed on the sites, and precluded from occurring there because habitat requirements not met.

STATUS CODES

FE	Federally Endangered	CE	California Endangered
FT	Federally Threatened	CT	California Threatened
FPE	Federally Endangered (Proposed)	CR	California Rare
FC	Federal Candidate	CP	California Protected
		CSC	California Species of Special Concern

CNPS	California Native Plant Society Listing		
1A	Plants Presumed Extinct in California	3	Plants about which we need more information – a review list
1B	Plants Rare, Threatened, or Endangered in California and elsewhere	4	Plants of limited distribution – a watch list
2	Plants Rare, Threatened, or Endangered in California, but more common elsewhere		



LEGEND

- ▲ Approximate location of California Natural Diversity Database (CNDDB) observation
- Lakes and Streams
- Roads and Highways

1 mile 0 1 mile
approximate scale

Live Oak Associates, Inc.		
Lodi Shopping Center CNDDB Observations for Special Status Species		
Date 5/22/03	Project # 495-01	Figure # 4

2.4 THREATENED, ENDANGERED OR SPECIAL STATUS PLANTS AND ANIMALS THAT DESERVE FURTHER DISCUSSION

Most of the special status plant and animal species listed in Table 1 may occur rarely or occasionally on site and sufficient information exists to evaluate the potential impacts the project may or may not have on them. All 14 of the plant species in Table 1 were considered to be absent from the site. A total of 11 out of the 23 animal species were considered to be possible. These include seven raptor species, two songbirds, and two bats. Five out of the seven raptors (white-tailed kite, northern harrier, merlin, golden eagle, and prairie falcon) and one out of the two songbirds (loggerhead shrike), and the two bat species (Pacific western big-eared bat and California mastiff bat) are expected to forage on the site, but there is no nesting habitat present.

The remaining species that had the potential to occur on site required additional survey effort to conduct a more informed impact assessment. These species include the Swainson's hawk (California threatened), the burrowing owl (California species of special concern), and the California horned lark (California species of special concern). Below are detailed discussions that include an analysis of their legal status, ecology, and the suitability of the site to support them.

2.4.1 Swainson's Hawk (*Buteo swainsoni*). Federal listing status: None; State listing status: Threatened.

Swainson's hawk is listed as California threatened. This decision was based on the fact that their population has been greatly reduced due to primarily habitat loss (development, conversion of open farm lands into vineyards and orchards, etc.), but also through hunting, pesticides, and competition.

The Swainson's hawk is a medium-sized hawk that averages a height of 21 inches, has an average wingspan of 52 inches, and weighs an average of 30 ounces. This species historically was found throughout the lowlands of California with the exception of portions of the desert regions. Today they are restricted to portions of the Great Basin and Central Valley regions. Swainson's hawks require areas that contain both suitable foraging and nesting habitat. Foraging habitat consists of grasslands, pastures, and low croplands. Nesting habitat consists of riparian habitat or groves of trees. Swainson's hawks breed in California and winter in Mexico and South America.

Life History and Ecology. The Swainson's hawk feeds on various small mammals, birds, and insects. Swainson's hawks breed in California during the summer months. Clutch size varies from two to four eggs which are incubated for approximately 28 days with both parents caring for the young. The young remain in their nest for up to four weeks.

In the early 1900's, Swainson's hawk populations were estimated as 17,000 pairs in California. In 1994, this number was reduced to 800 pairs. The conversion of natural lands and low-lying croplands into commercial and residential development and croplands such as vineyards, orchards, corn, and rice has reduced the available habitat suitable for this species to survive.

Potential To Occur On-Site. The Swainson's hawk is expected to only periodically forage or pass over the study area. There were not a large number of small mammal burrows observed on the site, limiting the likelihood that this species would be a frequent forager. Suitable nesting habitat was absent on or adjacent to the site. There have been two CNDDB documented occurrences of this species within a three mile radius of the site, one mile south and the other 2.5 miles southwest (Figure 4).

2.4.2 Burrowing Owl (*Athene cunicularia*). Federal listing status: None; State listing status: California Species of Concern.

The burrowing owl is considered a California species of special concern since it was listed in 1983. This decision was based on the fact that the burrowing owl's population levels were decreasing due to habitat destruction, roadside nesting (vulnerability to human interference) and indirectly, ground squirrel poisoning.

The burrowing owl is a small, long-legged, semi-fossorial bird that averages a height of 9.5 inches, has an average wingspan of 23 inches, and weighs an average of 5.25 ounces.

Burrowing owls are unique, as they are the only owl that regularly lives and breeds in underground nests. In California, these birds typically occur in the Central and Imperial Valleys, primarily utilizing ground squirrel burrows (or the burrows of other animals, e.g., badgers, prairie dogs and kangaroo rats) found in grasslands, open shrub lands, deserts, and to a lesser extent, grazing and agricultural lands. Burrowing owls in this region are typically found in lower elevations, and have strong site fidelity. Pairs have been known to return to the same area year after year, and some pairs are known to utilize the same burrow as the previous year.

Life History and Ecology. Burrowing owls feed on various small mammals including deer mice, voles, and rats. They also prey on various invertebrates including crickets, beetles, grasshoppers, spiders, centipedes, scorpions and crayfish. Peak hunting periods occur around dusk and dawn.

The breeding season for the burrowing owl runs from February to August, with a peak between April and July. Clutch size varies from six to 12 eggs, with an average of seven to nine eggs. Females generally produce only one clutch per year. The female incubates the eggs for a month, while the male provides her food. The male continues to provide food during the brooding period. The young remain in their burrow for approximately two weeks after hatching, and become fully independent of their parents between eight to ten weeks of age. Burrowing owls are a fairly short-lived species, with an average life expectancy of 4.8 years. The oldest known wild burrowing owl was eight years and eight months old at the time of its death.

Burrowing owls are subject to predation by larger mammals (e.g., feral cats, bobcats, fox and coyotes). They are also susceptible to anthropogenic effects such as collisions with automobiles, and destruction or disruption of their nests, especially during the breeding season. The burrowing owl may also be affected by ground squirrel eradication efforts.

Burrowing owl numbers have been in decline over the past 30 to 40 years, in California. The decline in numbers is due mainly to habitat destruction by way of development and agricultural practices.

Potential To Occur On-Site. The study area contains ground squirrel burrows which provide suitable nesting habitat for this species. Ground squirrel burrows were found along the boundaries of the site. No burrowing owls or evidence of them were observed during the field survey, but this species could occur on or near the study site in future years.

2.4.3 California Horned Lark (*Eremophila alpestris actia*). Federal listing status: None; State listing status: California Species of Concern.

The California horned lark is considered a California species of special concern. This decision was based on the fact that the California horned lark's population levels were decreasing due to habitat destruction and predation by mammals, snakes, and domestic and feral cats.

The California horned lark is a small, ground nesting bird that averages a length of 7.25 inches and has an average wingspan of 13 inches. This species is distinct in that it has black "horns" which are feathers on the crown of the birds head. In California, these birds historically occurred from northern coastal California, south to Mexico, and east to the Central Valley. Their current distribution is unknown. This species prefers grasslands and open woodlands with sparse vegetation and uses the vegetation and rocks as a means of cover while foraging on the ground. California horned larks feed on seeds, plant matter, insects, spiders, and snails during daylight hours. This species walks along the ground while feeding.

Life History and Ecology. The breeding season for the California horned lark runs from March to July, with a peak in May. Nests are built in the open and are made up of grasses. Clutch size varies from two to five eggs, with an average of three to four eggs. Females generally produce two broods per year. The eggs are incubated for 10 to 14 days, with both parents tending to the young. The young leave the nest in nine to 12 days and can fly three to five days later.

California horned lark are subject to predation by larger mammals (e.g., domestic and feral cats, bobcats, fox and coyotes) and snakes. They are also susceptible to anthropogenic effects such as destruction or disruption of their nests, especially during the breeding season, and habitat destruction.

Potential To Occur On-Site. It is possible that the California horned lark could occur on the project site. This species prefers a variety of open space habitats, including agricultural fields that are not continually disturbed. No individuals or evidence of the California horned lark were observed during the field survey.

2.5 WETLANDS AND OTHER "JURISDICTIONAL WATERS"

Natural drainage channels and wetlands may be considered "Waters of the United States" (hereafter referred to as "jurisdictional waters"). The U.S. Army Corps of Engineers (USACE) regulates the filling or grading of such waters under the authority of Section 404 of the Clean Water Act. The extent of jurisdiction within drainage channels is defined by "ordinary high water" marks on opposing channel banks. Wetlands are habitats with soils that are intermittently or permanently saturated or inundated. The resulting anaerobic conditions select for plant species known as hydrophytes that show a high degree of fidelity to such soils. Wetlands are identified by the presence of hydrophytic vegetation, hydric soils (soils saturated intermittently or permanently saturated by water), and wetland hydrology according to methodologies outlined in the 1987 Corps of Engineers Wetlands Delineation Manual (USACE 1987).

The California Department of Fish and Game (CDFG) has jurisdiction over the bed and banks of natural drainages according to provisions of Section 1601 and 1603 of the California Fish and Game Code (CDFG 2002). Activities that would disturb these drainages are regulated by the CDFG via a Streambed Alteration Permit. These permits typically stipulate that certain measures will be implemented to protect the habitat values of the drainage in question.

The irrigation and drainage ditches that partially run on the study site would probably be exempt from the jurisdiction of USACE and the CDFG. Human-made ditches are generally exempted from federal jurisdiction. The ditches seem to have been constructed for agricultural irrigation purposes, and the area does not appear to have had natural, historic drainages on-site. Also, water and hydrophytic vegetation were absent from these areas during the February 2003 field visit.

3.0 IMPACTS AND MITIGATIONS

3.1 SIGNIFICANCE CRITERIA

Under the California Environmental Quality Act (CEQA), specific project impacts to biological resources may be considered "significant" if they will:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance;
- Conflict with the provisions of an adopted Habitat Conservation Plan, or other approved local, regional, or state habitat conservation plan.

3.2 RELEVANT GOALS, POLICIES, AND LAWS

3.2.1 Threatened and Endangered Species

State and federal "endangered species" legislation has provided the California Department of Fish and Game (CDFG) and the U.S. Fish and Wildlife Service (USFWS) with a mechanism for conserving and protecting plant and animal species of limited distribution and/or low or declining populations. Species listed as threatened or endangered under provisions of the state and federal endangered species acts, candidate species for such listing, state species of special concern, and some plants listed as endangered by the California Native Plant Society are collectively referred to as "species of special status." Permits may be required from both the CDFG and USFWS if activities associated with a proposed project will result in the "take" of a listed species. "Take" is defined by the state of California as "to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture or kill" (California Fish and Game Code, Section 86). "Take" is more broadly defined by the federal Endangered Species Act to include "harm" (16 USC, Section 1532(19), 50 CFR, Section 17.3). Furthermore, the CDFG and the USFWS are responding agencies under the California Environmental Quality Act (CEQA). Both agencies review CEQA documents in order to determine the adequacy of their treatment of endangered species issues and to make project-specific recommendations for their conservation.

3.2.2 Migratory Birds

State and federal law also protect most bird species. The federal Migratory Bird Treaty Act (MBTA: 16 U.S.C., sec. 703, Supp. I, 1989) prohibits killing, possessing, or trading in migratory birds, except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs.

3.2.3 Birds of Prey

Birds of prey are also protected in California under provisions of the State Fish and Game Code, Section 3503.5, (1992), which states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto." Construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered "taking" by the CDFG.

3.2.4 Wetlands and Other "Jurisdictional Waters"

Natural drainage channels and wetlands may be considered "Waters of the United States" (hereafter referred to as "jurisdictional waters"). The U.S. Army Corps of Engineers (USACE) regulates the filling or grading of such waters under the authority of Section 404 of the Clean Water Act (Wetland Training Institute, Inc.1990). The extent of jurisdiction within drainage channels is defined by "ordinary high water marks" on opposing channel banks. Wetlands are habitats with soils that are intermittently or permanently saturated, or inundated. The resulting anaerobic conditions select for plant species known as hydrophytes that show a high degree of fidelity to such soils. Wetlands are identified by the presence of hydrophytic vegetation, hydric soils (soils saturated intermittently or permanently saturated by water), and wetland hydrology according to methodologies outlined in the 1987 Corps of Engineers Wetlands Delineation Manual (USACE 1987).

All activities that involve the discharge of fill into jurisdictional waters are subject to the permit requirements of the USACE (Wetland Training Institute, Inc. 1990). Such permits are typically issued on the condition that the applicant agrees to provide mitigation that result in no net loss of wetland functions or values. No permit can be issued until the Regional Water Quality Control Board (RWQCB) issues a certification under Section 401 of the Clean Water Act (or waiver of such certification) that the proposed activity will meet state water quality standards. The RWCQB is also responsible for enforcing National Pollution Discharge Elimination System (NPDES) permits, including the General Permit for Discharges of Storm Water Associated with Construction Activity. All projects requiring federal money must also comply with Executive Order 11990 (Protection of Wetlands).

The California Department of Fish and Game has jurisdiction over the bed and bank of streams according to provisions of Section 1601 and 1603 of the California Fish and Game Code (CDFG 1995). Activities that would disturb streams are regulated by the CDFG via a Streambed Alteration Permit. Such an agreement typically stipulates that certain measures will be implemented to protect the habitat values of the stream in question.

3.2.5 San Joaquin County Multi-Species Habitat Conservation and Open Space Plan

The Lodi project area is within the Central Zone of the San Joaquin County Multi-Species Habitat Conservation and Open Space Plan (SJMSCP). The goal of the SJMSCP (as noted in the *Executive Summary*, page 1-1 of the SJMSCP) is to provide a strategy for balancing the need to conserve Open Space and the need to Convert Open Space to non-Open Space uses while protecting the region's agricultural economy; preserving landowner property rights; providing for the long-term management of plant, fish and wildlife species, especially those that are currently listed, or may be listed in the future, under the Federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA); providing and maintaining multiple-use Open Spaces which contribute to the quality of life of the residents of San Joaquin County; and accommodating a growing population while minimizing costs to Project Proponents and society at large.

The SJMSCP was compiled after years of conflict regarding development versus conservation. In 1990 and 1993, draft habitat conservation plans were adopted for the Swainson's hawk and San Joaquin kit fox, respectively. The San Joaquin Council of Governments was designated in 1993 to make a more regional plan to address biological issues for San Joaquin County. In 1994, a steering committee was established to guide in the planning process. A number of county, state, federal, and local agencies worked together to produce the final SJMSCP in November 14, 2000.

As noted in the SJMSCP (page 5-16 of the SJMSCP) projects should forward "Advisory Agency Notices" to the Joint Powers Authority (JPA) to ascertain if no incidental take minimization measures are required or not. If minimization measures are required, the plan provides for four types of preconstruction surveys (see page 5-18 of the SJMSCP):

1. Preconstruction surveys to verify vegetation types affected by the project and determine if SJMSCP Covered Species are present;

2. Preconstruction surveys conducted prior (or, for some Incidental Take Minimization Measures) ground-disturbing activities;

3. Preconstruction surveys conducted in compliance with current U.S. Fish and Wildlife Service protocol, to determine the presence or absence of conservancy fairy shrimp (*Branchinecta conservatio*) and/or longhorn fairy shrimp (*Branchinecta longiantenna*) within vernal pools or other wetlands located southwest of I-580 in the Southwest Zone (not applicable to this project; Lodi is in the Central Zone); and

4. Preconstruction surveys for several special status plant species (species that apply to the Central Zone and their habitat include: Delta button celery/riparian scrub; Sanford's arrowhead/water features, channel islands, and riparian forests; and slough thistle/water features and riparian forests); no special status plant species are expected to occur on the project site.

If impacts to SJMSCP Covered Species are deemed unavoidable, habitat-based mitigation measures would need to be taken to compensate for any loss through the establishment, enhancement and management-in-perpetuity of Preserves. These Preserves will primarily consist of productive agricultural lands within the county with easements purchased from landowners (see page 5-1 of the SJMSCP).

As noted in the *Measures to Mitigate Impact* (*Section 5.3* of the SJMSCP), the required compensation ratio for converting the agricultural lands of the project site to developed uses is a 1:1 ratio (page 5-52 of the SJMSCP). The project site consists of two parcels. The entirety of Parcel 2 is within the project boundary. This area is designated as "Conversion of Multi-Purpose Open Space Lands" which is Category B and within Pay Zone A ($862 per acre [2004]). A small portion of Parcel 1 will be used for the storm water detention area. This area is designated as "Conversion of Agricultural Habitat and Natural Lands" which is Category C within Pay Zone B ($1,724 per acre [2004]). Fees vary within the county depending on the location of the site, prior land designation, and annual adjustments.

The SJMSCP allows that projects less than or equal to 350 acres need to collect fees prior to or at the time of issuance of Building Permits so long as site disturbance without compensation (i.e., grading or vegetation removal has occurred with or without permits, but Building Permits have not yet been issued) does not exceed 500 acres total at any time during the term of the SJMSCP for SJMSCP Permitted Activities undertaken by project proponents opting for coverage pursuant to the SJMSCP (page 5-54 of the SJMSCP).

3.3 POTENTIAL IMPACTS AND MITIGATIONS

3.3.1 Loss of Habitat for Special Status Plants

Potential Impact. Of the 14 special status plant species occurring within the project vicinity, none are expected to occur on the site (see Table 1). All 14 of these species are considered to be absent from the study area. It can be assumed that there would be no loss of special-status plant populations, resulting in a less-than-significant impact.

Mitigation. None would be required.

3.3.2 Loss of Habitat for Special Status Animals

Potential Impact. Twenty-three special-status animal species occur, or once occurred, regionally (see Table 1). Of these, 12 species are absent or unlikely to occur in the study area. Eight other species may rarely or occasionally occur on site as foragers. These include five raptors, one songbird, and two bats. The proposed project would have no effect on the breeding success of any of these species, and would only result (at most) in a small reduction of foraging and/or roosting habitat available to them regionally. Therefore, the project would result in a less-than-significant impact on these species.

The three remaining species, the Swainson's hawk, burrowing owl, and California horned lark, are more likely to occur on the site. While the burrowing owl and California horned lark are presently absent (i.e. lack of secondary evidence or observations) from the site, as a volant species, they could breed on the site in future years. Swainson's hawk would not nest on or adjacent to the study site, but may rarely to occasionally forage on the site due to the proximity of documented occurrences in the area (i.e., one mile south and 2.5 miles southwest).

While conversion of this agricultural habitat into developed land would result in a small reduction of foraging habitat available to these three species regionally, the SJMSCP was developed to compensate for such losses. Therefore, compliance with the provisions of the SJMSCP is expected to offset any impacts to habitat loss for these three species.

Both state and federal law provide additional protections to ensure that raptors are not harmed, injured, or killed. Therefore, implementation of pre-construction surveys to ensure that wintering or breeding burrowing owls (Swainson's hawks will not nest on the site) have not colonized the site prior to construction need to be employed (see *Section 3.3.7 Disturbance to Active Raptor Nests from Land Use Change Activities*). Surveys would also need to be conducted to ensure that the California horned lark, a migratory songbird protected under the Migratory Bird Treaty Act, are not present on the site prior to construction.

Mitigation. The applicant would need to comply with the provisions of the SJMSCP in regards to the Swainson's hawk, burrowing owl, and California horned lark, all three of which are species covered by the SJMSCP. This mitigation would involve having to conduct pre-construction surveys for these three species under the guidelines outlined in Section 3.3.7. The Swainson's hawk and California horned lark would only need to be surveyed for if construction were to commence during their breeding season (February 1 through August 31 in order to cover both species). Although the California horned lark is not a raptor, this species should be surveyed using the same measures used when surveying for raptors. The burrowing owl would require pre-construction surveys to be conducted year round.

If a Swainson's hawk, burrowing owl, or California horned lark were found on the site or within 250 feet of the boundary of the site during the appropriate surveys, a construction free buffer would need to be set in order to protect all three during the breeding season and the burrowing owl in the non-breeding season.

3.3.3 Loss of Habitat for Native Wildlife

Potential Impacts. The project will result primarily in the loss of ruderal habitat. This habitat has low wildlife value and is relatively unimportant for local wildlife. Some species may disperse through the site, but most wildlife presently using the site do so as part of their normal movements for foraging, mating, and caring for young. In other words, the site comprises a portion of the wildlife's home range or territory. Individuals of the various amphibian, reptile, and small mammal species that presently occupy the site would be displaced or lost from the development area. Therefore, the proposed project would represent a loss of some habitat for the wildlife species that presently use the site. This loss of this habitat for wildlife would be a less-than-significant impact because the site is used almost exclusively by relatively common wildlife species.

Mitigation. None would be required.

3.3.4 Interference with the Movement of Native Wildlife

Potential Impacts. While development would convert the natural ruderal habitat of the site to urban use, it would not act as a "substantial" barrier for wildlife species that presently use these habitats. In other words, as with most open space parcels, wildlife will move through the site from time to time, and build out of the site will not substantially alter the opportunities that local wildlife have to move regionally; therefore, this project's impact on the movement of native wildlife would be less than significant.

Mitigation. None would be required.

3.3.5 Disturbance to Waters of the United States or Riparian Habitats

Potential Impacts. Based on the biological field survey of February 2003, there is no evidence that waters of the United States or riparian habitats are present within the study area and thus are assumed to be absent from the site; therefore, there will be no significant affect to these natural resources.

Mitigation. None would be required.

3.3.6 Degradation of Water Quality in Seasonal Drainages, Stock Ponds and Downstream Waters

Potential Impacts. Site development will require the construction of additional roads, parking areas, building pads, and the installation of utility lines. Construction of this kind often requires grading that leaves the soil of construction zones barren of vegetation and, therefore, vulnerable to sheet, rill or gully erosion during the rainy season. Eroded soil is generally carried as sediment in surface runoff to be deposited in natural creek beds, canals, and adjacent wetlands. Upon project completion, urban runoff generated by development is often polluted with grease, oil, residues of pesticides and herbicides, heavy metals, etc. These pollutants may eventually be carried to sensitive wetland habitats used by a diversity of native wildlife species. The deposition of pollutants and sediments in sensitive wetland habitats would be considered a potentially significant adverse environmental impact.

Mitigation. The applicant must comply with the provisions of the City's grading permit for the project, including standard erosion control measures that employ best management practices (BMPs). The applicant would also need to develop a Storm Water Pollution

Prevention Plan (SWPPP) per the State Water Quality Control Board's General Permit for Discharges of Storm Water Associated with Construction Activity.

3.3.7 Disturbance to Active Raptor Nests from Land Use Change Activities

Potential Impacts. A few trees that could provide nesting habitat for more common raptors, such as red-tailed hawks (*Buteo jamaicensis*) and red-shouldered hawks (*Buteo lineatus*), are found sparsely around the eastern and southern boundaries of the study area and off-site. It is not expected that any of the special-status raptors listed in Table 1 would nest in any of these trees.

Suitable nesting habitat for burrowing owls in the form of several California ground squirrel burrows is also available along the site boundaries. Additionally, construction activities that would harm or kill a burrowing owl during the non-breeding season, would also constitute a significant impact. While a similar legal prohibition exists for tree-nesting raptors, these birds are not subject to unintended harm or injury during the non-breeding season, as they roost in trees and can evacuate when threatened.

Nesting raptors were not observed during the February 2003 field surveys, raptors could nest on or adjacent to the site prior to project development. If so, construction activities could result in the abandonment of active nests or direct mortality to these birds. Federal and state laws protect raptors (see discussion in *Section 3.2.3*). Construction activities that adversely affect nesting, or result in mortality of individual birds, would be a violation of state and federal law, and would be considered a significant adverse impact.

Mitigation. The implementation of the following measures would ensure that raptors (hawks and owls) are not disturbed during the breeding season.

- ❖ A qualified ornithologist will conduct a pre-construction survey for nesting raptors (including both tree and ground nesting raptors) on site, and within 250 feet of the project site boundaries, within 30 days of the onset of ground disturbance, if ground disturbance is to occur during the breeding season (February 1 to August 31). These surveys will be based on the accepted protocols (e.g., as for the burrowing owl) for the target species. These surveys will explicitly consider the burrowing owl as a potential target species and pre-construction efforts will be conducted according to the most recent protocol. If a nesting raptor were to be detected, then the ornithologist would, in consultation with CDFG, determine an appropriate construction buffer (usually a minimum of 250 feet) around the tree that contains the nest or the burrow in which the owl is nesting. Actual size of buffer would depend on species, topography, and type of construction activity that would occur in the vicinity of the nest. The setback area must be temporarily fenced, and construction equipment and workers shall not enter the enclosed setback until the conclusion of the breeding season.

- ❖ If ground disturbing activity is to convene during the non-breeding season (September 1 to January 31), a qualified ornithologist will conduct pre-construction surveys for burrowing owls. Pre-construction surveys during the non-breeding season are not necessary for tree nesting raptors, as they are expected to abandon their nests voluntarily during construction. If pre-construction surveys determine that burrowing owls have occupied the site prior to construction, then a passive relocation effort (blocking burrows with one-way doors and leaving them in place for a minimum of three days) may be necessary to ensure that the owl is not harmed or injured during construction. Once it has been determined that owls have vacated the site, the burrows can be collapsed and ground disturbance can proceed.

Implementation of the above measures will fully mitigate impacts to nesting and burrowing raptors.

3.3.8 San Joaquin County Multi-Species Habitat Conservation and Open Space Plan

Potential Impacts. The project has the potential of conflicting with an adopted HCP (SJMSCP); therefore certain measures will need to be complied with according to this plan. While a number of species in Table 1 are considered covered species by the

SJMSCP, only one has the potential of breeding on the study site, the burrowing owl. Another species, the Swainson's hawk, may forage more regularly on-site due to the fact that there are two documented occurrence of this species within a three miles radius of the site. Other raptors listed by the SJMSCP that might also forage on the study site include the white-tailed kite, northern harrier, merlin, prairie falcon, and golden eagle. Measures would need to be taken to comply with the adopted SJMSCP, as identified below.

Mitigation. In order to comply with the provisions defined in the SJMSCP, the applicant would need to do the following:

1. Pay the appropriate fees ($845 per acre for Parcel B and $1,690 for Parcel A) or demonstrate to the City of Lodi and the Joint Powers Authority (JPA) that fees have already been deposited.

2. Forward "Advisory Agency Notices" to the JPA regarding any required minimization measures and subsequent preconstruction surveys. This could possibly involve conducting surveys for verification of vegetation types, addressing the possibility of incidental take, addressing vernal pools, and special status plant species.

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APPENDIX F

Cultural Resources Report

Prepared by

Basin Research Associates

May 2004

BASIN
RESEARCH
ASSOCIATES

1933 DAVIS STREET
SUITE 210
SAN LEANDRO, CA 94577
VOICE (510) 430-8441
FAX (510) 430-8443

May 14, 2004

Mr. Bert Verrips
Pacific Municipal Consultants
585 Cannery Row, Suite 304
Monterey, CA 93940

RE: Archaeological/Paleontological Resources Assessment
Lodi Shopping Center Project, City of Lodi, San Joaquin County

Dear Mr. Verrips,

Please let this letter serve as our archaeological and paleontological resources assessment report for the Lodi Shopping Center Project located in the southwestern part of the City of Lodi, San Joaquin County. This assessment was requested in order to fulfill the various mandates of the California Environmental Quality Act (CEQA) and cultural resources and planning directives of the City of Lodi. This report provides the results of an archival records search, a literature and map review, a systematic field inventory of the parcel, and presents management recommendations.

PROJECT LOCATION AND DESCRIPTION

The proposed Lodi Shopping Center Project (Project) is located in the vicinity of other existing and proposed shopping centers in the southwestern part of the City of Lodi, north central San Joaquin County. The Project will be sited on the west side of Lower Sacramento Road (San Joaquin County Road 10) and the south side of W. Kettleman Lane (State Highway 12) bounded by a dirt access road on the south. An off-site storm water detention pond is also part of the proposed project. This 3.65-acre pond is to be excavated adjacent to the southwest corner of the 35-acre shopping center parcel and parallel to the southern boundary of the Project (USGS Lodi South, Calif. 1976; T 3N, R 6E, Center: NE 1/4 of the NW 1/4 of Section 15; Pond: SE 1/4 of SE 1/4 of NW 1/4 of Section 15) [Figs. 1-2].

The project consists of the construction an approximately 325,000 square foot shopping center on a 35-acre site with a major discount retailer occupying 210,000 square feet, and 12 other pads/locations for smaller users, and parking (Pacific Municipal Consultants (PMC) 2002-2003).

RESEARCH SOURCES CONSULTED

A prehistoric and historic site record and literature search was conducted by the Central California Information Center (CCIC), California State University, Stanislaus, Turlock (CCIC File No. 4852 L dated February 11, 2003). In addition, reference material from the CCIC and material on file at Basin Research Associates, San Leandro was also reviewed.[1]

The Native American Heritage Commission (NAHC) was contacted for a search of the *Sacred Lands Inventory* and individual Native Americans recommended by the NAHC were contacted (Busby 2003a-l). The California Valley Miwok Tribe (Rashel Reznor, Secretary/Treasurer, 3/3/03) has no issues with the project area but requested that the group be kept apprised of any Miwok artifacts that might be found at the location. No local agencies, groups or individuals were contacted regarding local landmarks, potential historic sites or structures in or near the project.

The University California Museum of Paleontology (UCMP) at Berkeley database was reviewed for any fossil localities within or adjacent to the proposed project.

CULTURAL CONTEXT

NATIVE AMERICAN

Prehistoric

The northern San Joaquin Valley and Delta regions have been the focus of archaeological research since the early 20th century with investigations continuing up to the present. The general area was occupied as early as 8,000-12,000 years ago with settlement centered around marshes, rivers, and lakes. The complexity of the archaeological record has resulted in the development of local sequences with specific cultural traits and chronologies. The three general patterns postulated for the prehistoric lifeway from approximately 3000 B.C. to contact consist of the Windmiller Pattern [Late Horizon] (ca. 2600 B.C. to 1000 B.C. (?)); the Berkeley Pattern [Middle Horizon] (ca. 1000 B.C. [Stockton area] to A.D. 1000 (?)); and, the Augustine Pattern [Late Horizon] (ca. A.D. 1000 to contact). These patterns differ in terms of primary subsistence activities and increasing social stratification (Moratto 1984:207-211). As noted by Wallace (1978:463), "Despite certain disadvantages, such as the periodic flooding of the bottomlands, intense summer heat, and the ever-present annoyance of mosquitoes, the lower San Joaquin provided a favorable environment for aboriginal habitation." For a general discussion on the prehistory of the region and adjacent counties see Napton (1981), Moratto (1984) and Moratto and Jackson (1990).

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1. Specialized listings consulted include the National Register of Historic Places, *California Historical Landmarks* (CAL/OHP 1990), *California Points of Historical Interest* (CAL/OHP 1992) and their updates in the *Historic Properties Directory* (CAL/OHP 2003); the *California History Plan* (CAL/OHP 1973); *California Inventory of Historic Resources* (CAL/OHP 1976); *Five Views: An Ethnic Sites Survey for California* (CAL/OHP 1988); and, historic maps.

Ethnographic

Ethnographic data as well as Spanish reports identify the subgroup known as the *Muqueleme* (*Muquelemne, Moquelemnes Mokelumni, Mokalumne*) as present along the south side of the Mokelumne River.[2]. The *Muqueleme* were the largest of the Eastern Miwok or Plains Miwok groups.[3] Eight known *Moquelemnes* villages were situated along the south side of the Mokelumne River between its mouth and the foothills. In particular, there were four major *Muqueleme* villages, the tribelet center of *Mokel* or *Muk-kel* about 1.25 miles west of Lockeford (about 10 miles northeast of the project), and unnamed villages at Staple's [Staples] Ferry (4 miles west of Lockeford), Benedict's Ferry (just north of Lodi), and Wood's Ferry (at Woodbridge, west bank). After missionization, the *Muqueleme* also maintained control of the Calaveras River and by 1852 the *Muqueleme* had a village at Athearn's Ferry on the Calaveras River (just east of Bellota, ca. 17 miles southeast of the project in Yokuts territory). By 1907 all villages had been abandoned[4] (Kroeber 1908:377; Kroeber 1925:445 and Plate 37; Schenck 1926:139-140, Fig. 1-2; Bennyhoff 1977:114, 116, 165, Map 3 six definitely located, two approximate; Latta 1977:frontspiece #13 and 102; Levy 1978:399, Fig. 1).

Mission San Jose, the mission established in present-day Fremont in 1797, had the most impact on Native Americans in the study area. In 1817, Mission San Jose had about 1500 recorded neophytes while an estimated 3,000-4,000 *Muqueleume* may have occupied villages along the south side of the Mokelumne River. Apparently the *Muquelume* had horses by 1819 and were a center of "determined and successful resistance" against the Spanish. An 1824 Topographic Map of the Mission of San Jose[5] illustrates the gentile village (non-Christian) of *Muqueleme* and no Christian villages in the vicinity of the project. By 1846, the *Muqueleme* were the largest organized tribelet which had been missionized. Prior to 1834 only 26 *Muquelume* neophytes were recorded, but between 1817-1835, 143 had been baptized. Most of the baptisms, 111 occurred in 1834 following a devastating pestilence which swept through the San Joaquin Valley in 1832-1833 and a disastrous battle (Schenck 1926:140; Cook 1962:205; Bennyhoff 1977:114-116, 1977:167, Map 4b; Levy 1978:399, Fig. 1, #17; (Hart 1987:324).

As a result of introduced diseases, the impact of missionization, and displacement by gold seekers, limited information is available about aboriginal inhabitants of the lower or northern San Joaquin Valley (Anonymous 1824; Thompson and West 1879:13-14; Schenck 1926:131;

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2. Thompson and West (1879:13-14) refer to the *Mo-kel-um-a-che River Indians* situated along their namesake river, the Mokelumne River.

3. Latta (1977) places the *Mokelumne* within the Ethnographic group known as the Yokuts (e.g., Northern Valley Yokuts).

4. Into the early 1900s Knights Ferry on the Stanislaus River, about 28 miles southeast of Stockton, was the principal Indian settlement in the northern San Joaquin Valley (Bennyhoff 1977:135).

5. The mission established in present-day Fremont in 1797 which would have had the most impact on the study area (Bennyhoff 1977:115; Hart 1987:324).

Bennyhoff 1977:127-128, 132, 137, 158, Maps 2-3 after various; see also Kroeber 1908:377; Kroeber 1925:485-486). [see Hispanic Era below]

HISTORIC PERIOD
Hispanic Era

The routes of the early explorers, even though they cannot be determined with total accuracy, had a profound effect on the indigenous populations in central California. The San Joaquin Valley was subject to a number of Hispanic expeditions and later EuroAmerican expeditions. The Spanish philosophy of government in northwestern New Spain was directed at the founding of presidios, missions, and secular towns with the land held by the Crown (1769-1821), while the later Mexican Period (1822-1848) policy stressed the individual ownership of land. After the secularization of the missions by Mexico in 1834, vast tracts of mission lands were granted to individual citizens (Hart 1987).

Juan Crespi with Pedro Fages in March 1772 were the first EuroAmericans to see the San Joaquin River and named it the *San Francisco*. Jose Joaquin Moraga probably reached the vicinity of the mouth of the Calaveras River in September 1776. The 1796 Hermenegildo Sal expedition apparently went into both the Stockton and the *Rió de la Pasión* (Calaveras River) areas. In 1806, Gabriel Moraga and Padre Muñoz party traveled along the San Joaquin and turned back at the *Rió de la Pasión* (Calaveras River; Schenck 1926:126; Cook 1960:241-242, 247-250, 282).

In October 1811, Father Ramon Abella (and Sergeant Sanchez) explored the lower portions of the Sacramento and San Joaquin rivers and observed *". . . a village, which according to count could contain 900 persons, although they were segregated in three villages, each some distance from the others"* just west of Stockton. Father Narciso Duran accompanied by Father Ramon Abella and by Luis Arguello (for part of the expedition) passed through the study area in 1817 and reportedly met mixed *Muqueleme* and *Yatchicumne* Yokuts near the mouth of the Calaveras River Yokuts territory, some of whom ". . . were painted and armed as for war" (Schenck 1926:128; Cook 1960:260-263, 273, 275, 287).

The *Muqueleme* were formidable opponents who were not easily subdued and incorporated into the mission system. Various encounters appear in the literature. In October 1819 Sergeant Jose Sanchez attacked the *Muquelemes* [*sic*] near the confluence of the Calaveras and San Joaquin rivers, killing 27 Indians, wounding 20 more, took 16 captives[6] and recovered 49 horses. As early as the 1820s Anglo-American mountain men followed many of routes of Spanish explorers through the San Joaquin Valley. These early interlopers included Peter Skene Ogden, the first Canadian to visit California in 1826.

In May 1827, Antonio Soto raided the *Mokelumne* and soon after, the *Muqueleme* attacked Jedediah Strong Smith, the first white man to cross the Sierra in 1827, on the Stanislaus River. Once the Smith party were found not to be Mexicans, peace ensued. Smith viewed the

6. Taken to San Francisco Presidio (McCarthy 1958:146).

Muquelme tribe center, probably Staple's Ferry (4 miles west of Lockeford) and noted 50 houses. Other parties of Mountain Men through the study area include the Ewing-Young expedition[7] who trapped along the Kings and San Joaquin rivers in 1832-1833. After the theft of horses, they burned a *Mokelumne* village (40 houses) on the middle Mokelumne River. Sebastian Peralta extracted up to 27 horses from Young who had acquired the horses in good faith, but which reportedly had been stolen by the *Muqueleme* from various missions. Peralta also met with *Muqueleme* neophyte runaways from Mission San Jose. When the *Muqueleme* refused to return, they were attacked by Peralta, killing 22, capturing 2 neophytes and 12 horses. In addition, Joseph Reddeford Walker and his group - the first white men to cross the central Sierra westward, view Yosemite and also travel along the San Joaquin River - went through the study area in 1833. John Marsh and his party followed in 1836-1837. In 1837 Jose de Jesus Vallejo conducted an expedition which resulted in the murder of the chiefs of two *Muqueleme* villages.

In 1838, the *Muqueleme* were defeated by Mariano Vallejo at the mouth of the Napa Valley. Later, in 1843, one *Muqueleme* village moved to the south bank of the Cosumnes River near McConnell and "practiced" agriculture there until at least 1855. In 1844, John C. Fremont remarked upon the "beautiful bottom at the ford of the '*Rio de los Mukelemnes*'" at Staples' Ferry. In 1845, John Sutter had about 100 *Muqueleme* in support of Governor Manuel Micheltorena. *Muqueleme* chiefs were also involved in plots to assassinate Sutter and in response the *Muqueleme* were attacked in 1846 and fled to the Calaveras River. One chief and 12 "*Machelemes*" were also involved in the Bear Flag Revolt (June 10-July 9, 1846; Schenck 1926:129; Cook 1962:188, 190-191; Hoover et al. 1966:373; Beck and Haase 1974:#43; Bennyhoff 1977:114-116 [20 killed not 27]; Hart 1987:40)

The namesake rancho *Sanjon*[8] *de los Moquelumnes* was situated north along Dry Creek (mostly in Sacramento County). The project area and vicinity were situated in ungranted lands (USGS 1976 Lodi North, Calif., USGS 1978 Thornton, Calif.; Beck and Haase 1974:#28).

American Era

In the mid-19th century, most all of the rancho and pueblo lands were subdivided as a result of population growth, the American takeover, and the confirmation of property titles. The initial population explosion was associated with the Gold Rush (1848), followed later by the construction of the transcontinental railroad (1869). Still later, the development of the refrigerator railroad car (ca. 1880s), used for the transport of agricultural produce to distant markets, European immigration, and the subsequent development of agriculture and ranching and associated food processing industries had an impact on population growth in the area (Hart 1987).

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7. Colonel J.J. Warner of the group commented on the numerous Indian villages and the evident devastating depopulation (Thompson and West 1879:11-12). See also Ethnographic above.

8. *sanjon* - ditch, large drain.

San Joaquin County, one of the original 27 counties, was created in 1850 with Stockton as the county seat. The development of the county in general, and Lodi, in particular, has been linked primarily to a agricultural land use pattern and transportation - trails/roads, ferries, bridges, and the railroads.

The first Anglo-European settlement in the general study area was located at French Camp, situated about 4 miles south of what was to become Stockton. French-Canadian trappers of the Hudson's Bay Company set up camp at this location in 1832 and departed abruptly in 1845. It was notable as the southernmost regular camp of the Hudson's Bay Company and the terminus of the Oregon Trail. Richard P. Hammond plated the townsite in 1850 as Castoria for Charles David Weber, but the name French Camp has persisted to date. French Camp Road was a key winter road and, as a result, French Camp was an important staging and freighting center in the early 1850s. A post office was established a French Camp in May 1854, discontinued in November 1862 and re-established in 1865, again discontinued in April 1870, and re-established in June 1874 (Schenck 1926:130-131; Hoover et al. 1966:368; Beck and Haase 1974:#43; Napton 1981; Hart 1987:360, 479-480, 546, 573; Gudde 1998:58-59). French Camp is California State Landmark #668 and on the *California History Plan* and *California Inventory of Historic Resources* under the theme of Exploration/Settlement (CAL/OHP 1973:157, 1976:135, 260, 1990:211).

Stockton is about 14 miles south of Lodi. In 1847, Charles Weber laid out the town of Tuleburg north of French Camp on the south side of the Laguna, now known as the Stockton Channel. After the discovery of gold at Coloma in 1848, Weber decided to create a town and supply center for the miners traveling to the Mother Lode mines. The town was resurveyed and renamed Stockton, after Commodore Robert F. Stockton, in the spring of 1849. By the winter of 1849 Stockton had a population of 1000; by 1850 the population had increased to 5000. The city soon become the largest transportation, commercial, industrial, economic, and social center in the northern San Joaquin Valley. Later with the decline of gold mining, the introduction of agriculture and the coming of the railroads, Stockton still remained the focal point of the San Joaquin Valley. Grain warehousing, food processing, farm implement manufacturing, boat building became important local industries. A measure of the importance of Stockton was the move of the University of the Pacific to Stockton in 1924.[9] The Port of Stockton, opened in 1933, was the first inland seaport in California and has also facilitated growth in the study area (e.g., Hammond 1849; Goddard 1857 [Castoria]; Thompson and West 1879:Map Number two; Hoover et al. 1966:269, 369-371; Hart 1987:444, 503, 535; Patera 1991:78 [French Camp], 206 [Stockton], Shebl 1993:63-64, 166-169; Hillman and Covello 1985:6, 19).

Mokelumne River and Project Vicinity

In 1851, many EuroAmericans arrived in the study area and settled along the rich river bottom of Mokelumne River. What was to become **Staple's** [Staples] Ferry, the site of a former Native

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9. Founded in 1851 as the California Wesleyan College in San Jose. College of Pacific is on the *California History Plan* and *California Inventory of Historic Resources* under the theme of Social/Education (CAL/OHP 1973:157, 1976:206, 260).

American village, located about 4 miles west of Lockeford, was crossed by John C. Fremont in March 1844 and later by Captain Weber en route between Sutter's Fort and Stockton (e.g., Sacramento Road). In 1844, the first wagons across the ferry were associated with the Murphy-Townsend-Stevens party. The first settler at the ferry, Thomas Pyle arrived in November 1846 and by 1849 the ferry was known as "Laird's Ferry." By February 1850, Staples, Nichols and Company had acquired the ferry which then became known as Staples' Ferry. Staples, Nichols and Company built a toll bridge to the west of the Staples ferry in the fall of 1850 which until 1854 was crossed by all stagecoaches through the study area. The first post office, Staples' Ranch, was established in 1851. By 1880 Staples' Ferry was known as Miller's Ferry (Hoover et al. 1966:372-374; Patera 1991:205).

In 1850 **Wood's Ferry** and later **Woodbridge** was located about three miles from Lodi and 17 miles north of Stockton on the Sacramento Road. In 1852, Jeremiah H. Woods and Alexander McQueen built a cabin and established a ferry which replaced Staples' Ferry except during flooding. The Wood's Ferry post office was established April 25, 1857 and renamed Woodbridge on October 7, 1862 after the wooden bridge built in 1858/1859. Wood's Ferry and Wood's Bridge is on the *California Plan* and *California Inventory of Historic Places* under the theme of economic/industrial is also California State Landmark. The Town of Woodbridge has also received the same recognition under the theme of exploration/settlement (Hoover et al. 1966:374-375; CAL/OHP 1973:157, 1976:119, 260, 1990:209-210, #163 [ferry/bridge] #164 [town]; Hoover et al. 1966:374; Patera 1991:235-236; Gudde 1998:426).

Benedict's Ferry was located about midway between Wood's and Staple's ferries. This ferry was established in 1850 by C.L. Benedict and merited a post office in 1852, the same year a sawmill was built there, but removed only two years later (Hoover et al. 1966:374-375). Unlike a number of former ferry locations in the study area, it has not received State of California recognition.

Benson's Ferry, further to the west and located about three miles north of Thornton and 0.3 miles east of the former Mokelumne City, is approximately 12.5 miles northwest of the project. It was established in 1849 by Edward Stokes and A.M. Woods. The ferry was purchased in 1850 by John A. Benson who laid out the principal wagon road between Sacramento and Stockton. After his murder in February 1859 by employee Green C. Palmer (and Palmer's suicide), Benson's son-in-law E.P. Gayetty ran the ferry. In addition to the ferry, clay was found nearby and used to make bricks for buildings in Mokelumne City. Benson's Ferry is on the *California Plan* and *California Inventory of Historic Places* under the theme of economic/industrial and is also California State Landmark (Thompson and West 1879:Map One; Hoover et al. 1966:374; CAL/OHP 1973:157, 1976:70, 260; 1990:209, #149).

Locke's Ford or **Lockeford** is yet another crossing and settlement along the Mokelumne River dating to the 1850s. This ford/town is located seven miles northeast of Lodi. Dr. Dean J. Locke and his brother George, joined brother Elmer H. at what was to become Locke's Ford and later, Lockeford settling on 360 acres of land purchased from D.J. Staples. They built their first cabin in 1851. Dr. Locke then built a ford and later laid out the town of Lockeford on his ranch in 1859. The Lockeford post office was established in June 1861. The town was hampered by the demise of the Mokelumne Steam Navigation Company within three or four years of its organization, a diminished demand for goods and services by miners after 1865, and the arrival of the railroad in 1869. Lockeford (Locke's Ford) is on the *California Plan* and *California Inventory of Historic Places* under the theme of exploration/settlement and is also California State Landmark (Hoover et al. 1966:374-375; Patera 1991:120, 139; CAL/OHP 1973:157, 1976:142, 260, 1990:210, #365).

Mokelumne City, a former city located northwest of Woodbridge and east of Benson's Ferry, was established by the Snap brothers who built a store at the junction of the Cosumnes and Mokelumne rivers in 1854 in hope of becoming a trading center for the southern mines. Unfortunately flooding in 1862 submerged and swept away up to 19 houses and Mokelumne City never recovered. As a result, the Mokelumne City post office, established June 28, 1861 was discontinued April 4, 1864 in favor of the existing post office at Woodbridge. The Site of Mokelumne City is on the *California Plan* and *California Inventory of Historic Places* under the theme of exploration/settlement and is also California State Landmark (Hoover et al. 1966:374; Patera 1991:120, 139; CAL/OHP 1973:157, 1976:144, 260, 1990:209, #162).

By 1853-1865, the "**Sacramento Road,**" the road to Sacramento, proceeded along the north/south mid-section line adjacent to the east side of the project. The Project was within a 160-acre parcel purchased for cash in June 1867. In 1879, the project area and near vicinity lacked any notable farmsteads or ranches although Kettleman Lane on the north side of the proposed Project was present as was Harney Lane along the southern boundary of Section 15. Roads in the general study area ran along section lines or crossed sections/quarter sections diagonally connecting various towns on the south side of the Mokelumne River (e.g., Lodi, Woodbridge, Mokelumne City, and Lockeford) and ferries and bridges crossing the river (e.g., Woodbridge, "Free Bridge" northeast of Lodi, Staples Ferry, and Benson's Ferry; US/BLM [GLO] 1853-1865, 1853-1988; USGS 1976 Lodi South, Calif.).

Lodi, southeast of Woodbridge and 14 rail miles north of Stockton came into existence about in 1869 as a result of the petition to the railroad by A.T. Ayres, John W. Magley and Ruben L. Wardrobe. The Central Pacific Railroad (CPR) Company of California had planned to bypass Woodbridge three miles to the east, but in return for 160 acres, the CPR[10] placed a station on high ground located about 0.5 mile south of the Mokelumne River southeast of Woodbridge. This station and nearby area were initially known as Mokelumne, but were renamed Lodi in 1874 to avoid confusion with the towns of "Mokelumne City" and "Mokelumne Hill." The town was laid out about 2.0 miles northeast of the proposed Project in the area from Washington to Church Street and Locust to Walnut Street. A number of wooden buildings were moved to the new town of Lodi from Woodbridge and other locations and the Lodi post office was established February 25, 1873. Lodi also depended on the San Joaquin and Sierra Nevada Railroad (SJ&SNR) for rail transportation. This railroad, incorporated in 1882, ran from Bracks Landing west to Woodbridge[11] and then to Lodi in 1882 and reached Valley Spring in 1885. In 1888 the SJ&SNR was consolidated into the Northern Railway Company and then was consolidated into the Southern Pacific in April 1898 [*sic*]. The Western Pacific Railroad

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10. Later subsumed under the Southern Pacific Transportation Company (SPT) line and now the Union Pacific.

11. The segment from Bracks Landing to Woodbridge was abandoned in 1897 (Robertson 1998:219).

Company (WP)[12] alignment from just south of Sacramento (Brighton) to Lodi was located about 2.75 miles west of the Project and opened August 1869. Yet another rail line, the Central California Traction Company (CCT), an electric interurban between Sacramento and Lodi was about 3.5 miles east of the Project. This interurban was in service from September 1907 and was completed in 1910 and later sold to SP, Santa Fe Railway and the WP on January 1, 1928. Service was discontinued February 1933 (Thompson and West 1879:115-116, Map One; Hillman and Covello 1985:31-41; Patera 1991:120; Hart 1987:282; Kyle 1990:355; Fickewirth 1992:27, 131; Walker 1994:Map CA-20; Gudde 1998:213; Robertson 1998:100-101, 219, 296).

Irrigation, the lifeblood of California agriculture, has been for responsible crop diversification and intensification in the state. The passage of the Wright Act[13] in 1887 facilitated the formation of irrigation districts to control and distribute water for agriculture. The study area is within the **Woodbridge Irrigation District**. The earliest irrigation company in the study area, the Mokelumne Ditch and Irrigation Company was established in 1875 and dissolved by October 1888. Its successor, the Woodbridge Canal and Irrigation Company, was formed in 1889 and by 1891 had built a 24-mile canal system with a dam near the North Lower Sacramento Road. The dam failed in 1895 and the company was foreclosed in 1897. Two years later, the Stockton Mokelumne Canal Company (SMCC) was incorporated and made various system improvements including replacing the failed dam in 1901. The Woodbridge Irrigation District (WID) was formed in 1924 and took over the SMCC in 1927. The WID provides both water storage and conveyance from the Mokelumne River to various users in the general study area from just north of Thornton south to the Calaveras River (Adams 1929:146; Bowen 2000a:3-4). The 1910 USGS Castle topographic map shows and labels a Woodbridge Irrigation canal. This canal appears on the 1976 USGS Lodi South, Calif. topographic map as the South Main Canal and is approximately 0.75 mile north and east of the Project. This 1976 USGS map also shows the Project as within an agricultural area southwest of urban City of Lodi with intermittent drainages/ditches through and adjacent to the proposed Project [Fig. 2].

ARCHAEOLOGICAL FIELD INVENTORY

A field inventory of the project was completed by Mr. Christopher Canzonieri (M.A.) on February 11, 2003 in accordance with standard archaeological practice for central California. The inventory used systematic north-south transects spaced no greater than 30 meters apart. Surface visibility was less than one-percent due to dense vegetation, including mustards, grasses, and clover. The exposed soils consist of a light tan silt-sand.

The north boundary of the proposed Project consists of a small unlined drainage ditch parallel to State Highway 12 (W. Kettleman Lane). Another irrigation ditch, approximately four feet

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12. A portion of the track alignment has been recorded as P-39-98, but not within the USGS Lodi South quadrangle map.

13. This act, sponsored by C.C. Wright, a state senator from Modesto, permitted riverland owners to unrestricted stream use with the right to create irrigation districts to divert river water to dry lands for flood control and water conservation (Hart 1987:566-567).

wide and two feet deep, runs north-south at the approximate mid-parcel line south from State Highway 12 to the NW 1/4 section line[14] (see Fig. 2). Three electric agricultural water pumps and associated concrete siphons are present on both the northern and southern boundaries.

A 3.65-acre storm water detention pond is to be excavated adjacent to the southwest corner of the 35-acre shopping center parcel and parallel to the southern boundary of the Project. The detention basin covers an area approximately 400 x 400 feet.

No evidence of either prehistoric or historic archaeological materials were observed during the surface survey of the proposed Project area or the offsite storm water detention area.

FINDINGS

The intent of this report is to identify historic properties which may be listed, determined or potentially eligible for inclusion on the California Register of Historical Resources (CRHR).

RECORDS SEARCH RESULTS

No prehistoric or historic archaeological sites or architectural features have been recorded, reported, or identified in or adjacent to the proposed Project (CHRIS/CCIC File No. No. 4852 L).

No historic properties listed, determined eligible, or pending on state and federal inventories and/or registers are located in or adjacent to the project area. A California Point of Historical Interest, the Beckman Ranch House located at 1150 W. Kettleman Lane, is located about 1.0 miles east of the project at Ham Lane (CAL/OHP 1992:59, #SJO-004).

Five cultural resources compliance reports on file at the CHRIS/CCIC include the parcel or adjacent areas (CHRIS/CCIC File No. 4852 L). Napton (1981) provides an *archaeological overview* of the county while the remainder of the reports involve negative records searches and negative field surveys (if conducted). A cultural resources inventory for four alternative power plant locations by Wohlgemuth (1990) included a proposed pipeline/transmission line along the northern edge of the Shopping Center just south of the south side of Kettleman Lane (Highway 12).

The *Lower Sacramento Road Widening Project* extended into the northeast corner of the proposed Project. The four reports completed for the widening project were negative (Bowen 1999, 2000a-b; Scott 2000).

The *Kettleman Lane Widening Project* also extended into the northeast corner of the proposed Project. The three reports completed for the widening project were negative (Jones & Stokes 2001; McGuirt 2001; Byrd 2001).

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14. Just south of the shopping center parcel, the ditch then turns and proceeds westward to terminate at the west boundary of the NW 1/4 section line.

NATIVE AMERICAN RESOURCES

The Native American Heritage Commission (NAHC) was contacted about the project (Busby 2003a) and responded that the Sacred Lands file record search failed to indicate the presence of Native American cultural resources in the immediate project area and that the ". . . absence of specific site information in the sacred land file does not indicate the absence of cultural resources" (Pilas-Treadway 2003). The 11 individuals recommended by the NAHC as possibly having further information about the Project area were contacted (Busby 2003b-l) and one response was received. The California Valley Miwok Tribe (Rashel Reznor, Secretary/Treasurer, 3/3/03) has no issues with the project area but requested that the group be kept apprised of any Miwok artifacts that might be found at the location.

No known ethnographic (e.g., villages or battle sites) or contemporary Native American resources, including villages, sacred places and traditional and/or contemporary use areas, have been identified in or adjacent to the proposed project.

HISTORIC PERIOD RESOURCES

No Hispanic dwellings or features appear to have been located within or near the proposed project. The Project was not within or near a pueblo, mission, or rancho.

No American Period dwellings or features such as ferries, towns, residences, etc. were located in or immediately adjacent to the project area. The project area and vicinity were part of an agricultural area southwest of the City of Lodi proper.

ARCHAEOLOGICAL SENSITIVITY

There appears to be minimal potential for buried prehistoric and/or historic archaeological resources in and adjacent to the proposed Project.

FIELD SURVEY

No prehistoric, historic archaeological or paleontological materials were observed during the field survey conducted for the project.

PALEONTOLOGICAL RESOURCES

Surficial sediments at the project site are mapped as Recent (Holocene) and Pleistocene alluvial fan deposits of unknown depth. No vertebrate fossil localities are recorded at the project site based on records at the University of California Museum of Paleontology (UCMP) at Berkeley. Given the scale of the project and the existence of post-Pleistocene sediments in the upper strata near the ground surface, it is unlikely that significant impacts to paleontologic resources will occur as a result of project construction.

MANAGEMENT RECOMMENDATIONS

It is the considered opinion of Basin Research Associates, based on a review of pertinent records, maps and other documents and a field inventory, that the proposed project can proceed as planned in regard to prehistoric and historic archaeological and paleontological resources.

Archaeological Resources

Subsurface testing for buried archaeological resources and archaeological monitoring during construction is not recommended. However, if any significant cultural materials[15] are exposed or discovered during either site clearing or during subsurface construction, operations should stop within 25 feet of the find and a qualified professional archaeologist contacted for further review and recommendations. Potential recommendations could include evaluation, collection, recordation and analysis of any significant cultural materials followed by a professional report.

Paleontological Resources

If vertebrate fossils are exposed during construction, work within 25 feet of the find should cease until a vertebrate paleontologist can examine the find and make appropriate recommendations. Potential recommendations could include evaluation, collection, recordation, and analysis of any significant paleontological materials followed by a professional report.

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15. Significant prehistoric materials may include:

- a. Human bone - either isolated or intact burials.
- b. Habitation (occupation or ceremonial structures as interpreted from rock rings/features, distinct ground depressions, differences in compaction (e.g., house floors).
- c. Artifacts including chipped stone objects such as projectile points and bifaces; groundstone artifacts such as manos, metates, mortars, pestles, grinding stones, pitted hammerstones; and, shell and bone artifacts including ornaments and beads.
- d. Various features and samples including hearths (fire-cracked rock; baked and vitrified clay), artifact caches, faunal and shellfish remains (which permit dietary reconstruction), distinctive changes in soil stratigraphy indicative of prehistoric activities.
- e. Isolated artifacts

Significant historic cultural materials may include finds from the late 19th through early 20th centuries. Objects and features associated with the Historic Period can include:

- a. Structural remains or portions of foundations (bricks, cobbles/boulders, stacked field stone, postholes, etc.).
- b. Trash pits, privies, wells and associated artifacts.
- c. Isolated artifacts or isolated clusters of manufactured artifacts (e.g., glass bottles, metal cans, manufactured wood items, etc.).
- d. Human remains.

In addition, cultural materials including both artifacts and structures that can be attributed to Hispanic, Asian and other ethnic or racial groups are potentially significant. Such features or clusters of artifacts and samples include remains of structures, trash pits, and privies.

If I can provide any additional information or be of further service please do not hesitate to contact me. Thank you for retaining our firm for the project.

Sincerely,
BASIN RESEARCH ASSOCIATES, INC.

Colin I. Busby, Ph.D., RPA
Principal

CIB/dmg
Enclosures

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Note: The abbreviated phrase "CHRIS/CCIC, CSU Stanislaus, Turlock" is used for material on file at the California Historical Resources Information System, Central California Information Center, CSU Stanislaus.

ATTACHMENTS

LIST OF FIGURES

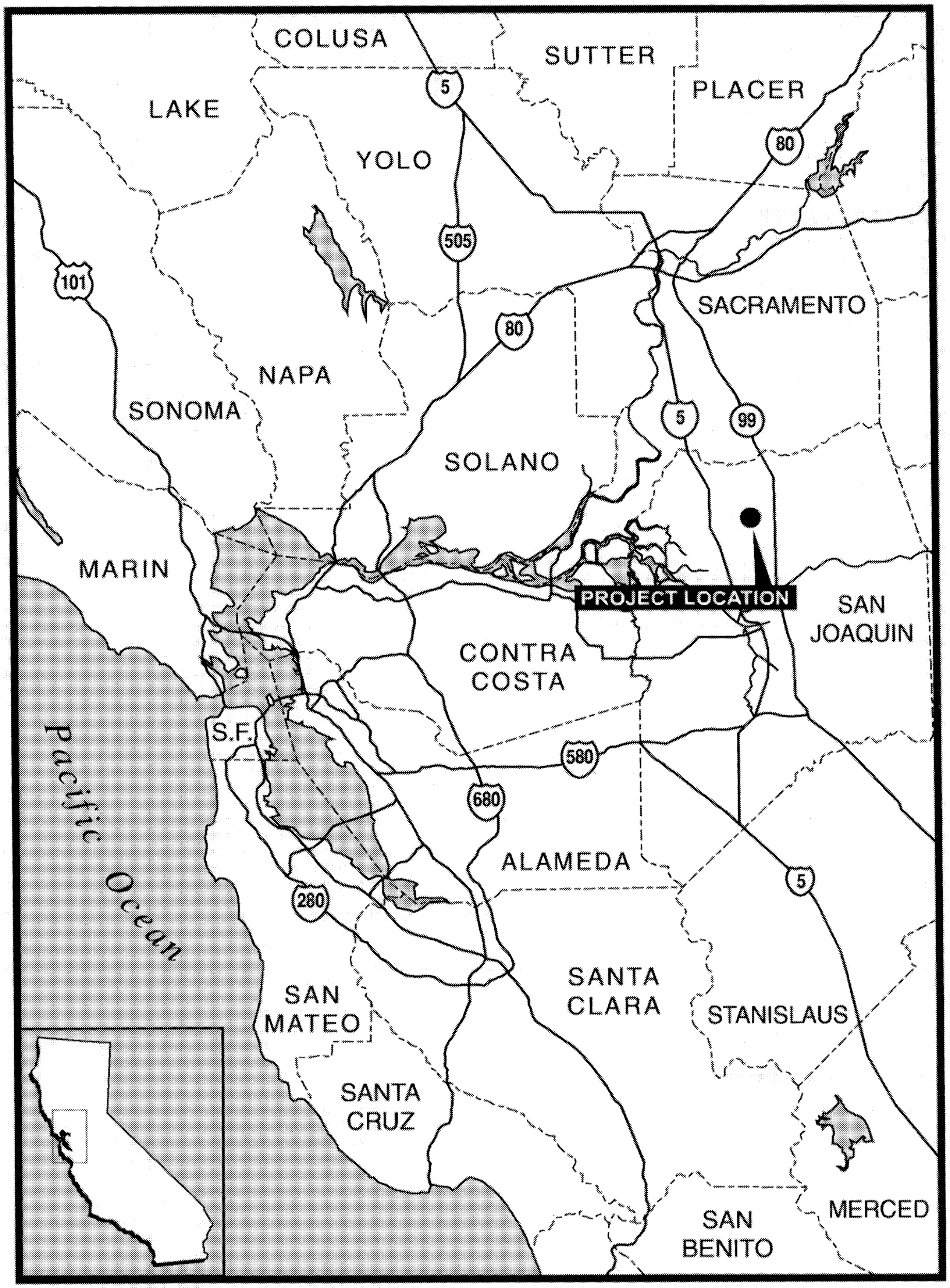


Figure 1: General Project Location

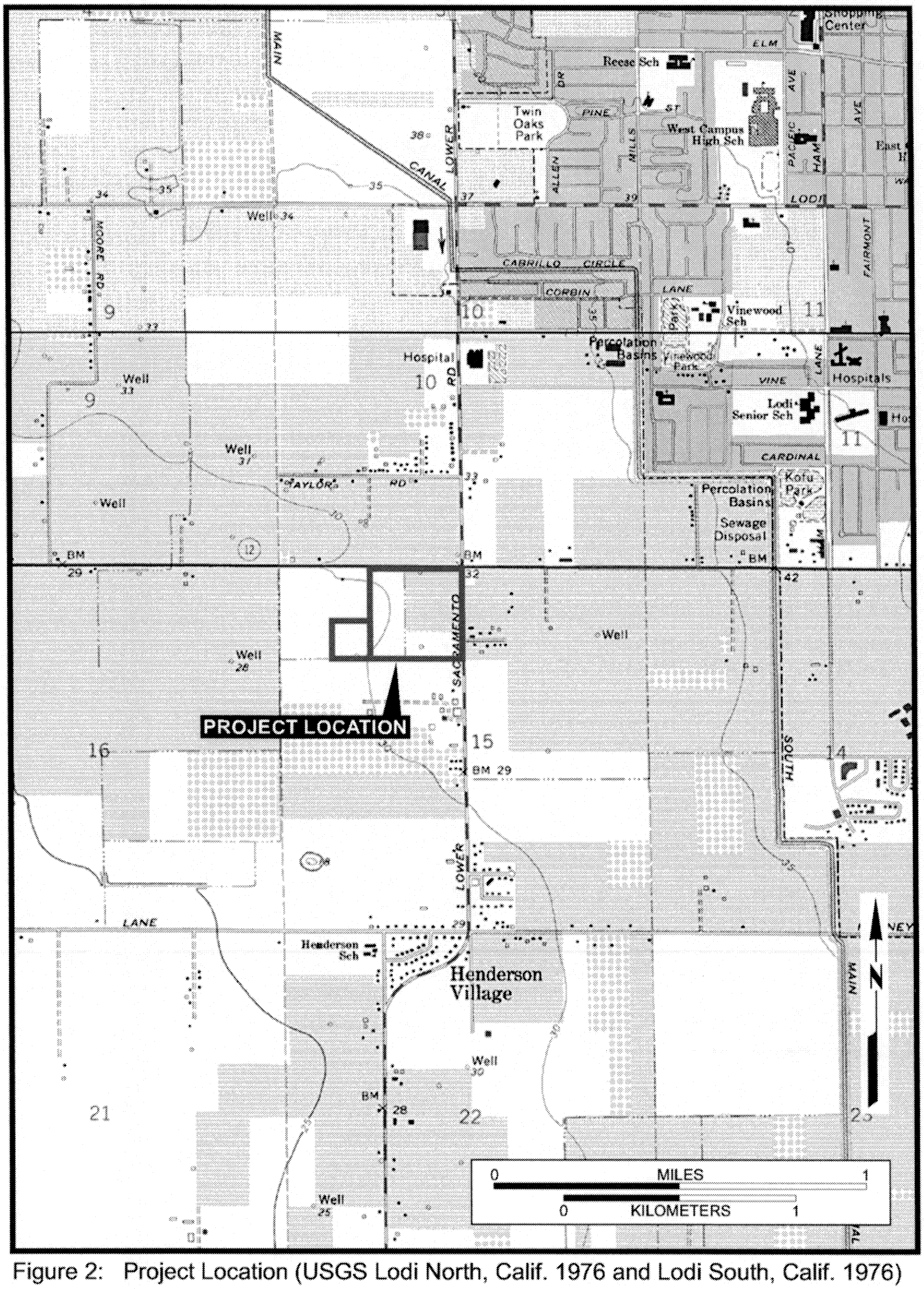


Figure 2: Project Location (USGS Lodi North, Calif. 1976 and Lodi South, Calif. 1976)

APPENDIX G

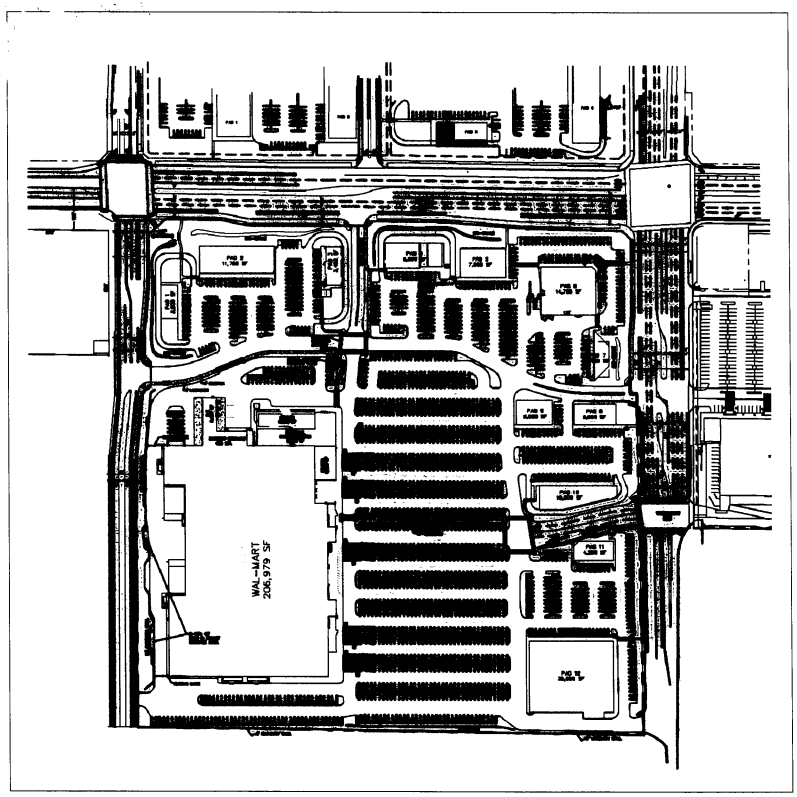
Traffic Report

Prepared by

Fehr & Peers Associates

July 2004

Final Report
Lodi Shopping Center Traffic Impact Study



Prepared for:

City of Lodi

Prepared by:

FEHR & PEERS
TRANSPORTATION CONSULTANTS

July, 2004
1045-660

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This Traffic Impact Study presents the potential transportation and circulation impacts associated with the development of the proposed Lodi Shopping Center Project. The analysis focuses on potential impacts to the roadway, transit, bicycle, and pedestrian systems in the vicinity of the project site.

This report includes three parts. The first two parts are the environmental and regulatory settings. The environmental setting describes the existing transportation system in the vicinity of the project site and the regulatory setting describes the policies and objectives of the City of Lodi and San Joaquin County that apply to the project. The third part describes the transportation impact analysis followed by the identification of significant project impacts and mitigation measures to reduce their significance.

ENVIRONMENTAL SETTING

The project site is located on the southwest corner of W. Kettleman Lane (State Route 12) and Lower Sacramento Road, in the City of Lodi, California. Access to the proposed project is provided via one right-turn in / right-turn out driveway on Kettleman Lane, two right-turn in / right-turn out driveways on Westgate Drive, and two right-turn in / right-turn out driveways and one full access signalized intersection on Lower Sacramento Road. The existing condition of the transportation system in the study area is described below.

EXISTING TRANSPORTATION SYSTEM

The existing transportation system in the vicinity of the project site consists primarily of two existing roadways located on the north (W. Kettleman Lane) and east (Lower Sacramento Road) frontages of the project site. A detailed description of the roadways in the study area is provided below and followed by discussions relative to other modes, including transit, bicycles, and pedestrians.

Roadway System

The following describes the major roadways in the study area:

Interstate 5 (I-5) is a north-south interstate freeway that extends from Southern California into Oregon and Washington. I-5 has six lanes in the immediate vicinity of the project site and four lanes north of State Route 12. Access to/from I-5 in the study area is provided by the State Route 12 interchange.

West Kettleman Lane / State Route 12 (SR 12) is a state highway located immediately north of the project site that extends west towards Interstate 5, Rio Vista, and Fairfield. SR 12 extends eastward to State Route 99 and downtown Lodi. SR 12 has one lane in each direction with turn pockets at major intersections between Thornton Road and Lower Sacramento Road. This segment has a posted speed limit of 55 miles per hour (mph) with standard lane and shoulder widths. East of Lower Sacramento Road, SR 12 is designated West Kettleman Lane and widens to provide two eastbound lanes and one westbound lane (and a two-way left-turn lane) as it extends past South Mills Avenue. SR 12 has two lanes in each direction from Thornton Road to west of I-5 and one lane in each direction further west. The I-5/SR 12 interchange consists of northbound and southbound diagonal ramps and a southbound loop on-ramp.

Lower Sacramento Road is a north-south roadway located immediately east of the project site. North of Kettleman Lane, Lower Sacramento Road contains four lanes (two lanes in each direction), a raised median, and left-turn lanes at major intersections. This roadway narrows to a two-lane undivided facility south of Kettleman Lane.

Tienda Drive is a roadway that extends northwards from Kettleman Lane and turns eastwards to South Mills Avenue. Tienda Drive contains two lanes and provides access to commercial-retail development. East of South Mills Avenue, Tienda Drive is a two-lane residential street.

Mills Avenue is a north-south roadway that extends from Turner Road to Harney Lane. North of Kettleman Lane, Mills Avenue is two lanes wide and provides access to residential neighborhoods. South of Kettleman Lane, Mills Avenue has a raised median and provides access to residential and commercial uses.

Harney Lane is an east-west roadway located south of the project site. Harney Lane extends east towards SR 99 and westward towards I-5. Harney Lane is a two-lane road in the vicinity of the project site.

West Century Boulevard is a two-lane east-west roadway that extends westward from South Church Street and terminates just west of Mills Avenue. West Century Boulevard is planned to be extended westward past Lower Sacramento Road and connect with Westgate Drive.

Westgate Drive is a planned two-lane north-south roadway that will extend from Harney Lane to the south to Lodi Avenue to the north. The section of Westgate Drive from W. Kettleman Lane to Taylor Road that forms the west frontage of the Vintner's Square Project is being contrasted as part of the Vintner's Square Project, with a signalized intersection at W. Kettleman Lane / Westgate Drive. The Proposed Project would construct the section of Westgate Drive south of W. Kettleman Lane that forms the west frontage of the Lodi Shopping Center Project and add the fourth leg to the signalized intersection that is currently under final design.

Intersection Level of Service Operations

The intersections of the study roadways are a key component of the roadway system. These are the "nodes" that connect each segment of the system. Intersections are usually the critical elements of the roadway system in assuring adequate capacity, minimizing delays, maximizing safety, and minimizing environmental impacts. Therefore, the analysis of project impacts on the roadway system focuses on intersection operations.

The operating condition of an intersection is typically described in terms of "Level of Service" (LOS). LOS is a quantitative measurement of the effect of various factors on traffic operating conditions, including travel speed, travel time, delay, freedom to maneuver, safety, driving comfort, and convenience. LOS is measured on a qualitative scale ranging from LOS A (the best) to LOS F (the worst). Empirical LOS criteria and methods of calculation have been developed by the Transportation Research Board (TRB) and are documented in the *2000 Highway Capacity Manual (HCM)*. These LOS definitions and calculation methods are the prevailing measurement standard used throughout the United States and are used in this study. The use of the 2000 HCM methodology is consistent with Caltrans guidelines.

The LOS at signalized and all-way stop-controlled intersections is based on the average control delay for all vehicles passing through the intersection. The 2000 HCM specifies that the LOS for minor-street stop-controlled intersections be based on the delay for vehicles on the minor-street approach only. Table 1 displays the average control delay range for each LOS category for signalized and unsignalized intersections.

Existing Conditions Data Collection

Vehicle turning movement counts were conducted during the a.m. (7:00 to 9:00 a.m.) and p.m. peak period (4:00 to 6:00 p.m.) on Wednesday, March 10, 2004 at the following six (6) study intersections in the vicinity of the project site. These intersections were selected for analysis based on the expected directionality of trips generated by the project and input received from the City of Lodi.

1) West Kettleman Lane (SR 12) / Lower Sacramento Road
2) West Kettleman Lane / Tienda Drive
3) West Kettleman Lane / Mills Avenue
4) Lower Sacramento Road / Safeway Driveway
5) Lower Sacramento Road / Middle Food 4 Less Driveway
6) Lower Sacramento Road / Harney Lane

Figure 1 presents locations of the study intersections and the project site. The existing peak hour turning volumes, lane configurations and traffic control devices at each intersection is shown on Figure 2.

The three West Kettleman Lane intersections and the Lower Sacramento Road / Safeway Driveway intersection are signalized. The Lower Sacramento Road / Food 4 Less Driveway intersection is stop controlled on the minor-street approach, and the intersection of Lower Sacramento Road and Harney Lane is all-way stop controlled.

Table 1

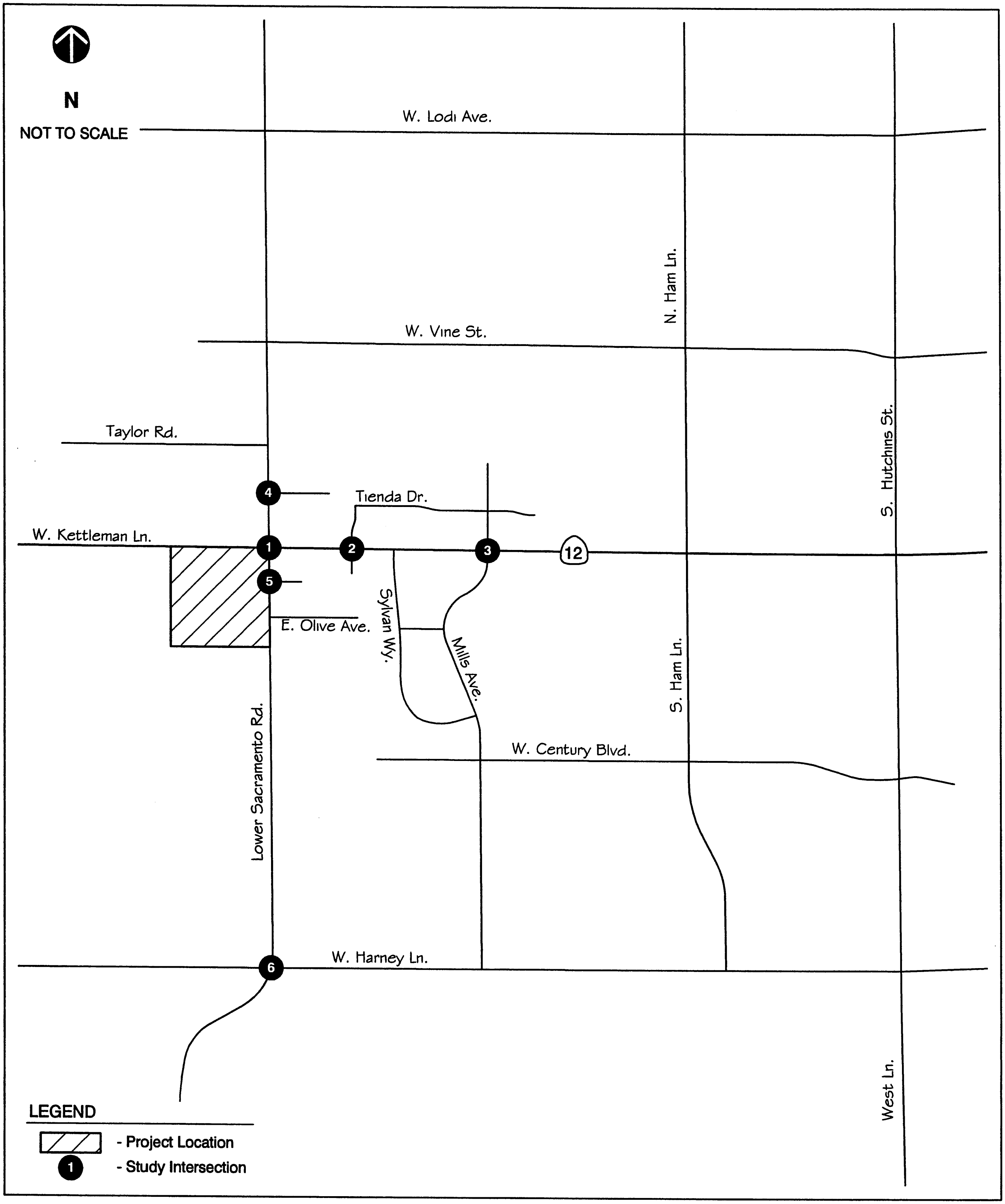
INTERSECTION LEVEL OF SERVICE DEFINITIONS

	Unsignalized Intersections		Signalized Intersections	
LOS	Description	Average Delay (sec/veh)	Description	Average Delay (sec/veh)
A	Little or no conflicting traffic for minor street approach.	≤ 10.0	Uncongested operations; all queues clear in a single cycle.	≤ 10.0
B	Minor street approach begins to notice presence of available gaps.	10.1 – 15.0	Very light congestion; an occasional phase is fully utilized.	10.1 – 20.0
C	Minor street approach begins experiencing delay while waiting for available gaps.	15.1 – 25.0	Light congestion; occasional queues on approaches.	20.1 – 35.0
D	Minor street approach experiences queuing due to a reduction in available gaps.	25.1 – 35.0	Significant congestion on critical approaches, but intersection is functional.	35.1 – 55.0
E	Extensive minor street queuing due to insufficient gaps.	35.1 – 50.0	Severe congestion with some longstanding queues on critical approaches.	55.1 - 80.0
F	Insufficient gaps of suitable size to allow minor street traffic to safely cross through major traffic stream.	> 50.0	Total breakdown, stop-and-go operation.	> 80.0

Source: *2000 Highway Capacity Manual* (Transportation Research Board)

Figure 2 also displays the a.m. and p.m. peak hour traffic volumes at each intersection. These volumes include both passenger vehicles and trucks. According to the *2002 Annual Average Daily Truck Traffic on California State Highway System* report (Caltrans, February 2004), approximately nine (9) percent of the vehicles on Kettleman Lane (SR 12) within the study area are classified as trucks (defined as large 2-axle delivery trucks and 3 or more axle trucks).

To identify the percentage of vehicles that are trucks (defined as large 2-axle delivery trucks and 3 or more axle trucks) within the study area, "truck-only" counts were performed at the West Kettleman Lane / Lower Sacramento Road intersection.



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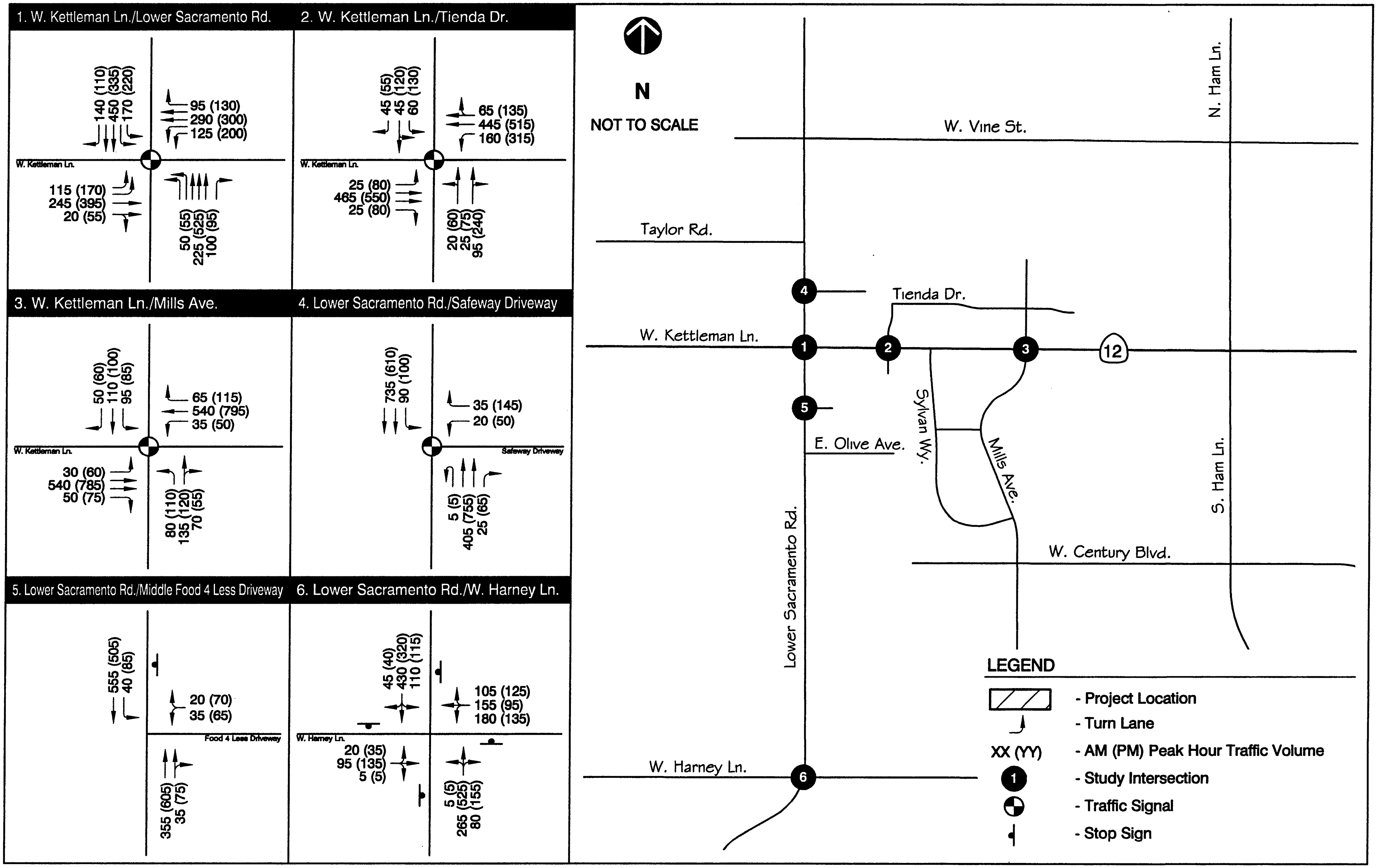
PROJECT LOCATION AND EXISTING STUDY INTERSECTIONS

FIGURE 1



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PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - EXISTING CONDITIONS

FIGURE 2

During the p.m. peak hour, truck traffic constitutes about eight (8) percent and four (4) percent of all traffic on the eastbound SR 12 and northbound Lower Sacramento Road approaches, respectively.

Due to the effect trucks have on intersection capacity, the intersection level of service computations explicitly considered the proportion of trucks on the study roadways. Therefore, for the purpose of this study, a conservative truck percentage factor of nine (9) percent was used for all approaches to all study intersections.

In addition, for the purpose of this study, a peak hour factor (PHF) of 0.92 was used as a conservative measure of intersection operations. The City of Lodi allows up to a PHF of 0.95 to be used for intersection calculations and was used by Fehr & Peers Associates for the City on the *Lower Sacramento Road Widening Project Traffic Impact Study* (Final Report September 2002). The 0.92 factor is also consistent with Vintner's Square Shopping Center EIR that was certified by the City of Lodi in May 2003.

Table 2 displays the existing a.m. and p.m. peak hour average delay and level of service at each study intersection, and the technical calculations are contained in Appendix A. The level of service for minor-street stop-controlled intersections is determined by the stop-controlled approach with greater delay (in cases where the intersection features two minor streets).

This table also displays the results of a traffic signal warrant analysis of each unsignalized study intersection. Beginning May 20, 2004, the MUTCD 2003 and the MUTCD 2003 California Supplement supersede and replace all the traffic control device topics (Chapters 4, 5, 6, 8, 10, 11, 12 and the traffic signals portion of chapter 9) in the 1996 Caltrans Traffic Manual, as amended and all previous editions thereof.

For each intersection, the eight (8) Signal Warrants identified in the MUTCD 2003 California Supplement were evaluated for the unsignalized intersections within the project study area. The Four-Hour Vehicular Volume Warrant is met where the volume of intersecting traffic exceed certain thresholds. The Peak Hour Volume Warrant is met at an intersection when certain predetermined traffic volume and delay thresholds are met.

Table 2 shows that the four signalized study intersection all operate at LOS C conditions or better during both a.m. and p.m. peak hour conditions. In addition, Table 2 also shows that the all-way STOP-controlled intersection of Lower Sacramento Road / Harney Lane operates at LOS F conditions and meets the Four Hour Volume and Peak Hour Volume warrants for both a.m. and p.m. peak hour conditions.

Table 2

EXISTING INTERSECTION LEVEL OF SERVICE (AM AND PM PEAK HOUR)

#	Intersection	Traffic Control	Peak Hour	Average Control Delay	Level of Service	Traffic Signal Warrants Met?
1	West Kettleman Lane (SR 12) / Lower Sacramento Road	Traffic Signal	AM PM	20.8 26.7	C C	Not Applicable
2	West Kettleman Lane / Tienda Drive	Traffic Signal	AM PM	20.0 29.9	B C	Not Applicable
3	West Kettleman Lane / Mills Avenue	Traffic Signal	AM PM	24.3 33.8	C C	Not Applicable
4	Lower Sacramento Road / Safeway Driveway	Traffic Signal	AM PM	10.2 11.6	B B	Not Applicable
5	Lower Sacramento Road / Middle Food 4 Less Driveway	Minor-Street Stop	AM PM	28.6 **> 50**	D **F**	No Signal Warrants Are Met
6	Lower Sacramento Road / Harney Lane	All-Way Stop	AM PM	**> 50** **> 50**	**F** **F**	Four-Hour Volume, Peak Hour Volume

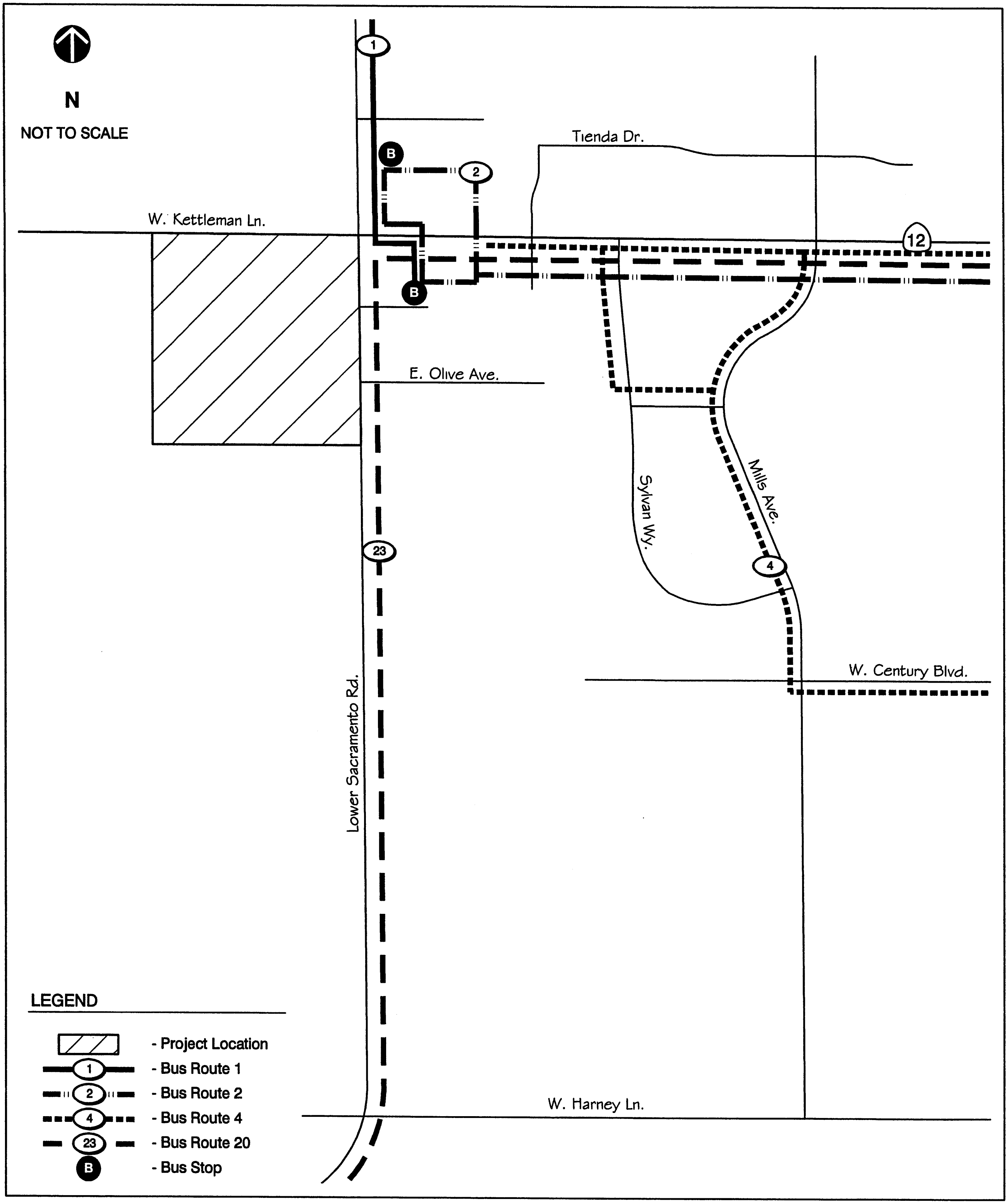
Notes: - For intersections with all-way stop-control or a traffic signal, average delay is for all vehicles entering the intersection.
- For intersections with minor-street stop-control, average delay is for vehicles on the minor-street approach only.

Source: Fehr & Peers Associates, 2004.

Transit System

The Lodi Grapeline provides transit service in the City of Lodi and the San Joaquin Regional Transit District provides transit service within the City of Stockton and unincorporated San Joaquin County. Both providers offer Fixed-Route and Dial-A-Ride services. Regional transit service between Lodi, Galt, and Sacramento is provided by South Sacramento County Transit (SCT Link). Figure 3 presents the Existing Transit Services in the project study area.

The Lodi Grapeline operates five local and three express bus routes within the City of Lodi. Grapeline Routes 1 and 2 provide service to the commercial developments on both sides of Kettleman Lane just east of Lower Sacramento Road. San Joaquin Bus Routes 23 and 93 provide service from Stockton to the Lodi Transportation Station and operate on Lower Sacramento Road and Kettleman Lane past the project site to the south and west, respectively.



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EXISTING TRANSIT SERVICES

FIGURE 3

Bicycle and Pedestrian System

Bicycle facilities comprise bike paths (Class I facilities), bike lanes (Class II facilities), and bike routes (Class III facilities). Bike paths are paved trails that are separated from the roadways. Bike lanes are lanes on roadways designated for use by bicycles by striping, pavement legends, and signs. Bike routes are roadways that are designated for bicycle use with signs but have no designated lanes. Figure 4 presents the Existing and Planned Bicycle Facilities in the project study area.

Bicycle lanes are provided on Lower Sacramento Road north of Kettleman Lane, Kettleman Lane east of Lower Sacramento Road, West Century Boulevard east of Sage Way, and Mills Avenue. According to the City of Lodi's website, bicycle lanes are proposed on Lower Sacramento Road from Kettleman Lane to Harney Lane and West Century Boulevard from Lower Sacramento Road to Sage Way

Pedestrian facilities comprise sidewalks, pedestrian paths, crosswalks, pedestrian signals, and other pedestrian amenities. There are no existing sidewalks on the segments of Kettleman Lane and Lower Sacramento Road along the frontage of the project site. Sidewalks are provided on both sides of Kettleman Lane between Lower Sacramento Road and Tienda Drive. East of Tienda Drive, discontinuous sidewalks are provided on the north side of Kettleman Lane. As part of the Kettleman Lane Gap Closure Project, continuous sidewalks will be constructed on the north side of Kettleman Lane between Tienda Lane and Ham Lane.

Sidewalks are provided on the east side of Lower Sacramento Road from Food 4 Less to north of its intersection with the Safeway driveway. Crosswalks and pedestrian signals with push buttons are provided at all signalized study intersections.

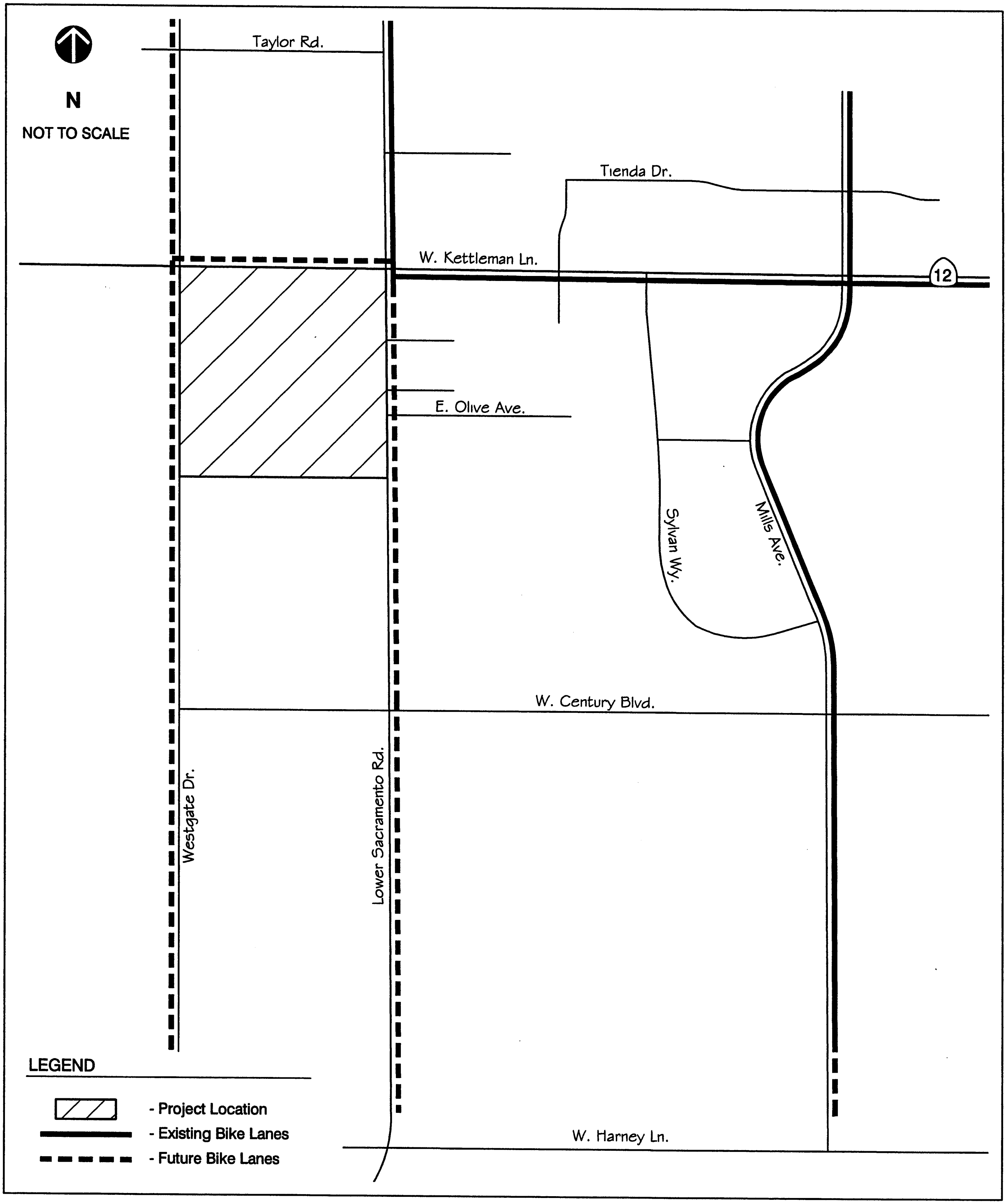
TRANSPORTATION AND CIRCULATION GOALS, POLICIES, AND OBJECTIVES

Numerous goals and policies from the *City of Lodi General Plan* (1991) apply to the transportation system within the study area. This document was reviewed as part of this study to assist in the development of impact significance criteria. A brief summary of the applicable regulatory guidelines is provided below. Since the project site is located within the City of Lodi, all of the objectives and policies listed below are from the *City of Lodi General Plan.*

Roadway System

<u>Objectives</u>

1) To provide for a circulation system that accommodates existing and proposed land uses and provides for the efficient movement of people, goods, and services.



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EXISTING AND PLANNED BICYCLE FACILITIES

FIGURE 4

2) To ensure the adequate provision of both on-street and off-street parking.

3) To encourage a reduction in regional vehicle miles traveled.

4) To achieve, through a cooperative effort with state, regional, and local jurisdictions, a high quality and diversified regional transportation system.

Policies

1) The City of Lodi shall strive to maintain Level of Service "C" on local streets and at intersections. The acceptable level of service goal will be consistent with the financial resources available and the limits of technical feasibility.

2) The City of Lodi shall review new developments for consistency with the General Plan Circulation Element and the capital improvements program.

3) The City of Lodi should upgrade existing substandard streets, as needed and when feasible, to accommodate traffic flow and minimize safety hazards.

4) The City of Lodi shall require new developments to provide an adequate number of off-street parking spaces in accordance with City parking standards.

5) The City of Lodi shall promote ridesharing to reduce peak-hour traffic congestion and help reduce regional vehicle miles traveled.

6) The City of Lodi shall strive for a cooperative relationship with San Joaquin County to successfully implement transportation improvements in the vicinity of Lodi.

7) The City of Lodi shall strive for a cooperative relationship with Caltrans to successfully implement transportation improvements in the vicinity of Lodi and to reduce traffic congestion on regional transportation facilities.

Transit System

Objectives

1) To encourage use of transit where feasible.

2) To develop a road and street system integrated with and complimentary to various transportation modes.

3) To provide a public mass transit system that satisfies the demonstrated needs in San Joaquin County for safe, efficient, convenient, economical and reliable transit service.

Policies

1) The City of Lodi shall continue to provide Dial-A-Ride services to local, transit dependent residents.

2) The City of Lodi shall provide information to local residents on transit services available for regional trips.

3) The City of Lodi shall consider expanding its transit service to include limited fixed-route services if sufficient demand exists and if the cost is economically feasible.

Bicycle and Pedestrian System

Objectives

1) To include plans for bikeway and pedestrian facilities in all road construction and improvement projects where it is appropriate and feasible.

2) To develop a road and street system integrated with and complimentary to various transportation modes.

3) To provide a countywide system of bicycle facilities for safe and convenient transportation and recreation.

Policies

1) The City of Lodi shall consider the need for bicycle facilities in new developments and when such facilities are required, specifications provided in Caltrans' Design Manual, or other appropriate standards shall be used.

2) The City of Lodi shall continue to require sidewalks for all developments in accordance with City design standards and encourage additional pedestrian access where applicable.

3) The City of Lodi shall consider the need for an interconnected system of bicycle and pedestrian paths linking major use areas in Lodi.

TRANSPORTATION IMPACT ANALYSIS

The transportation impact analysis identifies impacts of the project to the roadway, transit, bicycle, and pedestrian systems. This section begins by describing the thresholds for determining significant project impacts. The discussion of thresholds is followed by a description of the analysis methodology. The section concludes by identifying project impacts and mitigation measures.

SIGNIFICANCE CRITERIA

A significant environmental impact would occur if the proposed project would:

ROADWAY SYSTEM

According to the City of Lodi's General Plan Circulation Element, "the City shall strive to maintain LOS C on local streets and intersections. The acceptable LOS goal will be consistent with the financial resources available and the limits of technical feasibility." Based on discussions with City Engineering and Planning staff as part of the Vintner's Square Shopping Center EIR (Certified May 2003), West Kettleman Lane and Lower Sacramento Road would not be considered "local streets". Rather, they are major arterial / highways providing regional east-west and north-south access between the City of Lodi and San Joaquin County. [1]

According to Caltrans' guidelines: "Caltrans endeavors to maintain a target LOS at the transition between LOS C and LOS D on State Highway facilities; however, Caltrans acknowledges that this may not always be feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS."

Based on meeting with Caltrans and the City of Lodi as part of the part of the Vintner's Square Shopping Center EIR (Certified May 2003), a finding of LOS D along these major routes would not be considered significant given Cumulative Build-out of the City of Lodi General Plan and San Joaquin County General Plan. [2]

TRANSIT SYSTEM

1) create the demand for public transit service above that which is provided, or planned to be provided;

2) disrupt or interfere with existing or planned public transit services or facilities; or

---

1 Meeting with Sharon Welch (Senior Civil Engineer), Paula Fernandez (Senior Traffic Engineer), and J.D. Hightower (City Planner), City of Lodi, on October 15, 2002.

2 Caltrans, *Guide For The Preparation of Traffic Impact Studies*, January, 2001

3) create an inconsistency with policies concerning transit systems set forth in the General Plan for the City of Lodi

BICYCLE AND PEDESTRIAN SYSTEM

1) disrupt or interfere with existing or planned bicycle or pedestrian facilities;

2) create an unmet need for bicycle or pedestrian facilities; or

3) create an inconsistency with policies related to bicycle or pedestrian systems in the General Plan of the City of Lodi.

Near Term (Existing Plus Approved) Conditions

Near Term conditions represent traffic conditions prior to completion of the proposed development. Traffic volumes for Near Term Conditions comprise volumes from existing traffic counts plus traffic generated by approved, but not yet constructed, developments in the area. Table 3 contains the list of approved developments which were developed based on input from the City of Lodi. [3]

Approved Projects

The traffic associated with the approved developments was obtained from traffic reports prepared or estimated based on trip generation rates published in the Institute of Transportation Engineers *Trip Generation* (7^{th} edition). The trips associated with each development were then assigned to the roadway network based on the relative locations of complementary land uses and existing travel patterns through the project study area.

Figure 5 presents the following study intersections evaluated under Near Term Conditions:

1) West Kettleman Lane (SR 12) / Lower Sacramento Road
2) West Kettleman Lane (SR 12) / Tienda Drive
3) West Kettleman Lane (SR 12) / Mills Avenue
4) Lower Sacramento Road / Safeway Driveway
5) Lower Sacramento Road / Middle Food 4 Less Driveway
6) Lower Sacramento Road / Harney Lane
7) West Kettleman Lane (SR 12) / Westgate Drive

The projected a.m. and p.m. peak hour traffic volumes, intersection configurations and controls are presented on Figure 6.

---

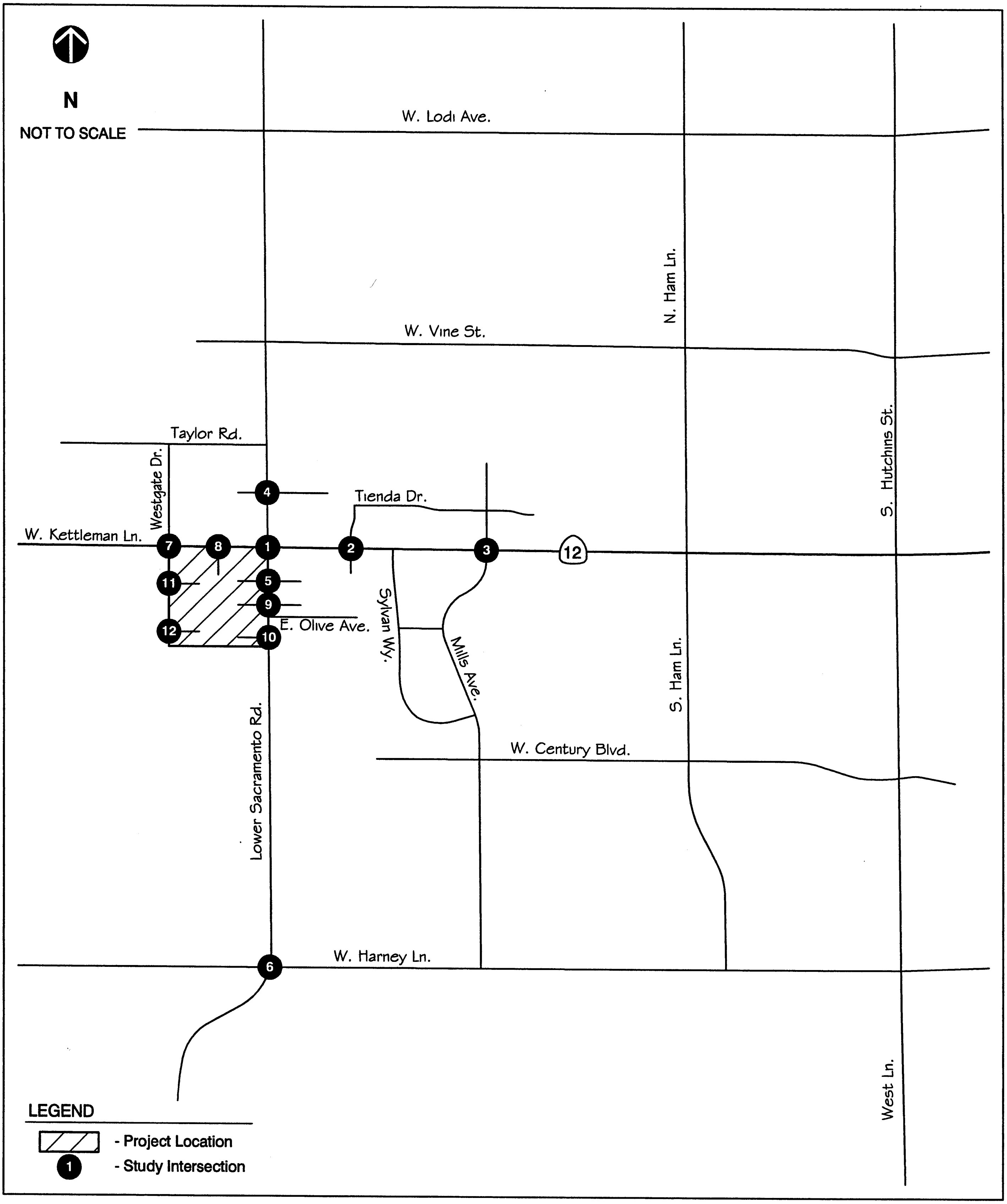
[3] E-Mail correspondence from Paula Fernandez, City of Lodi, Monday, May 10, 2004

Table 3
List of Approved Developments [1]

Project Name	Location	Size/Land Use
Lodi Storage	Lodi Avenue, west of Lower Sacramento Road	78,345 sf mini-storage units with resident manager
Mills Avenue Medical Offices	Mills Avenue, north of Kettleman Lane	45,000 sf medical office
Target Expansion	Kettleman Lane, east of Lower Sacramento Rd	2,741 sf shopping center
Tienda Public School	Tienda Drive, west of Mills Avenue	75 students
Sunwest Professional Center	Kettleman Lane, west of Mills Avenue	7,200 sf professional office
Westgate Plaza Expansion	Lower Sacramento Road, south of Lodi Avenue	27,200 shopping center
Bezug Lane Properties	Tienda Drive, west of Lakeshore Drive	7 residential units
Century Meadows One, Unit 2	Harney Lane, east of Mills Avenue	55 residential units
Century Meadows One, Unit 3	Harney Lane, east of Mills Avenue	74 residential units
Century Meadows Two, Unit 4	Harney Lane, east of Mills Avenue	60 residential units
Kirst Estates Unit No. 5	Harney Lane, west of Mills Avenue	6 residential units
Lalazar Estates	Lakeshore Drive, south of Kettleman Lane	9 residential units
Legacy Estates Subdivisions	Harney Lane, west of Mills Avenue	217 residential units
Mills Avenue Townhomes	Mills Avenue, south of Kettleman Lane	12 residential units
Millsbridge II	Tienda Drive, west of Lakeshore Drive	27 residential units
Sasaki Property	Tienda Drive, west of Lakeshore Drive	2 residential units (duplex)
Sunwest Cottages	Tienda Drive, west of Mills Avenue	9 apartment units (3 bedroom)
The Villas	Harney Lane, west of Highway 99 Frontage Road	80 residential units
Vintner's Square	Northwest corner of Lower Sacramento Road and Kettleman Lane	217,000 sf shopping center

Source: Fehr & Peers Associates, 2004.

[1] Based on input provided by City of Lodi Planning staff.



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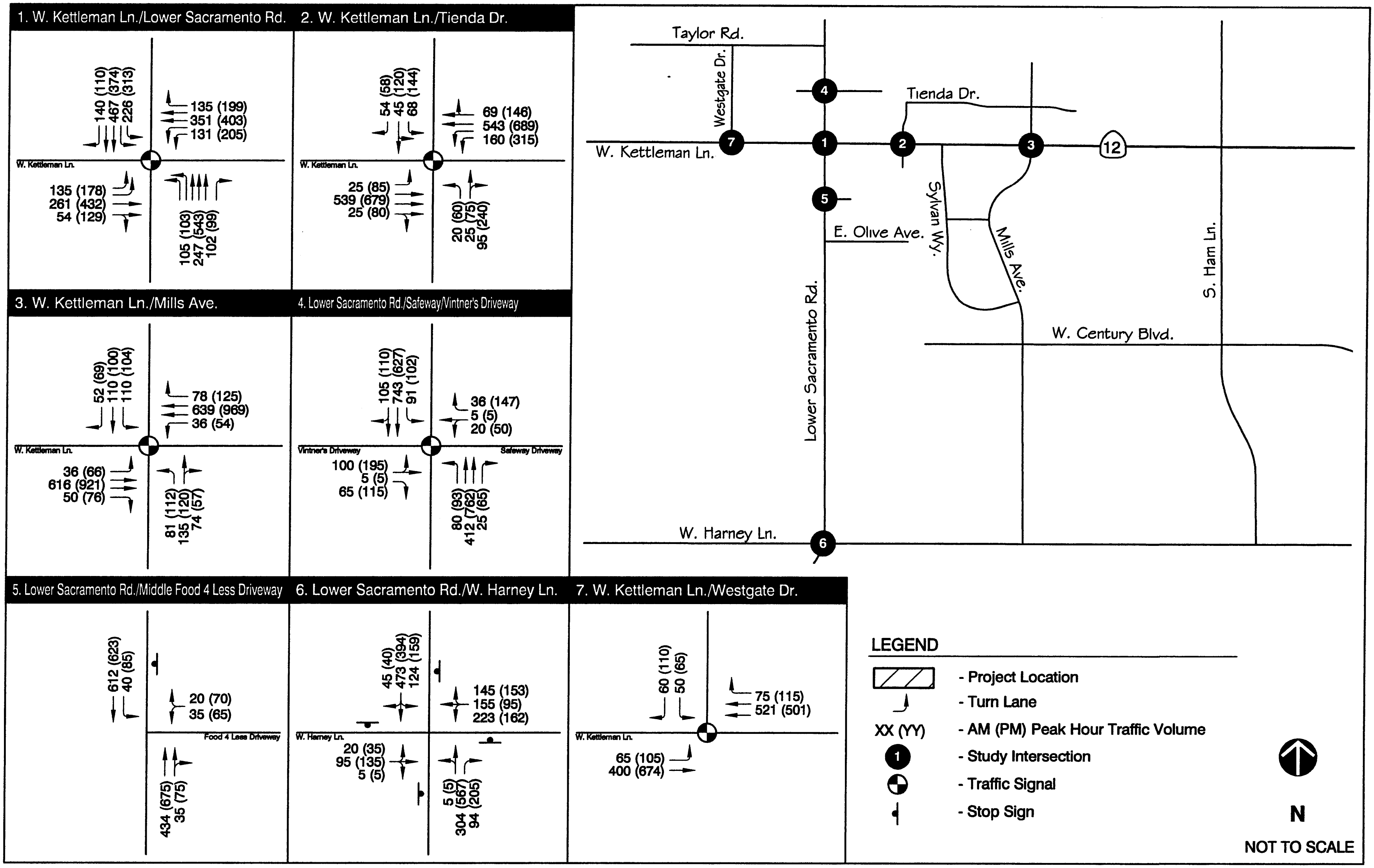
PROJECT LOCATION AND NEAR-TERM PLUS PROJECT STUDY INTERSECTIONS

FIGURE 5



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PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - NEAR-TERM BASE CONDITIONS

FIGURE 6

Near Term Circulation Improvements

Under Near Term Conditions, the following roadway improvement projects are assumed to be completed:

Kettleman Lane Gap Closure Project

The planned Kettleman Lane Gap Closure Project involves the widening of Kettleman Lane between Tienda Drive and Ham Lane to add an additional westbound through lane and a raised median island. This project is estimated to be completed by the end of 2004. This project would change the lane configurations at the following intersections:

West Kettleman Lane / Tienda Drive – A second westbound left-turn lane will be added. The eastbound right-turn pocket will be converted into a shared through/right-turn lane. The northbound Tienda drive lane configurations will consist of a shared left-turn/through lane and an exclusive right-turn lane.

West *Kettleman Lane / Mills Avenue* – A second westbound through lane will be added.

Vintner's Square Roadway Improvements

The following improvements will be constructed with development of the approved Vintner's Square Shopping Center located on the northwest corner of West Kettleman Lane / Lower Sacramento Road:

Lower Sacramento Road / Safeway / Vintner's Square Driveway – The eastbound leg of this intersection would be constructed to provide one shared left-turn/through lane and one right-turn lane. The southbound through lane would be converted into a shared through/right-turn lane. The westbound approach would be modified to provide a shared left-turn/through lane and one right-turn lane.

West Kettleman Lane / Lower Sacramento Road – A southbound right-turn pocket that extends back approximately 250 feet to the southernmost Vintner's Square driveway will be constructed.

West Kettleman Lane / Westgate Drive – Westgate Drive will be constructed as a two-lane roadway between Taylor Road and Kettleman Lane on Vintner's Square's west frontage site boundary. Westgate Drive will form a signalized T-intersection with West Kettleman Lane. One left-turn lane and two through lanes will be provided on eastbound West Kettleman Lane. One left-turn and one right-turn lane will be provided on the southbound approach.

Near Term Intersection Operations

Table 4 presents the intersection operations under Existing and Near Term Conditions, and the technical calculations are contained in Appendix B. The results of the analysis show that the addition of the 19 approved projects and the planned circulation improvements identified above will result in all four signalized study intersections to continue to operate at LOS C conditions or better during both a.m. and p.m. peak hours. The new signalized T-intersection of West Kettleman Lane / Westgate Drive is also projected to operate at LOS C conditions during both a.m. and p.m. peak hours.

Table 4

NEAR TERM INTERSECTION LEVEL OF SERVICE (AM AND PM PEAK HOUR)

				Existing Conditions		Near Term Conditions	
#	Intersection	Traffic Control	Peak Hour	Average Control Delay	LOS	Average Control Delay	LOS
1	SR 12/W.Kettleman Ln./ Lower Sacramento Rd	Traffic Signal	AM PM	20.8 26.7	C C	22.5 30.2	C C
2	W. Kettleman Ln./Tienda Dr.	Traffic Signal	AM PM	20.0 29.9	B C	17.4 26.0	B C
3	W. Kettleman Ln./Mills Ave.	Traffic Signal	AM PM	24.3 33.8	C C	22.6 26.6	C C
4	Lower Sacramento Rd./Safeway Dwy.	Traffic Signal	AM PM	10.2 11.6	B B	14.3 17.9	B B
5	Lower Sacramento Rd./Project Dwy. #1 (Middle Food 4 Less Dwy.)	Minor-Street Stop	AM PM	28.6 **> 50**	D **F**	40.7 **> 50**	E F
6	Lower Sacramento Rd./Harney Ln.	All-Way Stop	AM PM	**> 50** **> 50**	**F** **F**	**> 50** **> 50**	**F** **F**
7	W. Kettleman Ln./Westgate Ave.	Traffic Signal	AM PM	Not Applicable		21.6 24.7	C C

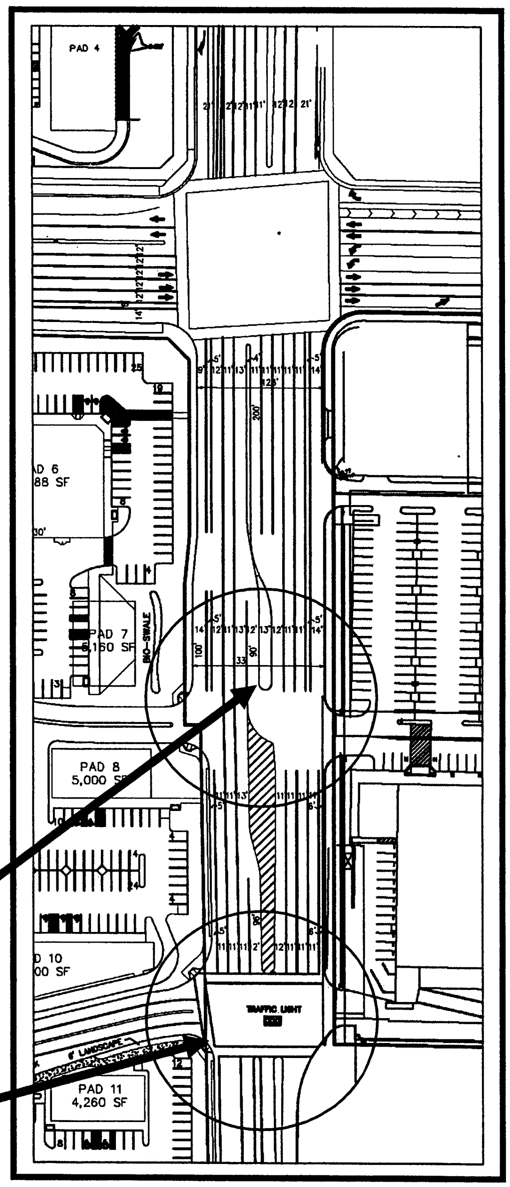
Notes: - LOS = Level of Service.
- For intersections with all-way stop-control or a traffic signal, average delay is for all vehicles entering the intersection.
- For intersections with minor-street stop-control, average delay is for vehicles on the minor-street approach only.

Source: Fehr & Peers Associates, 2004.

Table 4 shows that with the addition of approved projects, the all-way STOP-controlled intersection of Lower Sacramento Road / Harney Lane will continue to operate at LOS F conditions and meets the Four-Hour Vehicular Volume and Peak Hour Volume warrants for both a.m. and p.m. peak hour conditions. Approved projects are estimated to add 193 a.m. peak hour and 265 p.m. peak hour trips to the Lower Sacramento Road / Harney Lane intersection.

Project Description

The proposed project totals 339,966 square feet (s.f.) of commercial-retail uses. The main tenant is a 226,868 square foot Wal-Mart SuperCenter of which 19,889 s.f. is for the Garden Center and associated fenced area, and 5,437 sf. is for the Tire & Lube Express. The remaining uses would consist of 75,960 s.f. of other retail-commercial development, 9,690 s.f. of fast-food, 7,500 square feet of sit-down restaurant uses, and 19,948 s.f. of pharmacy and bank uses. Figure 7 presents the proposed site plan.



Access Alternative A

Under this alternative, access to the proposed project is provided via the following access points:

1) One full access signalized intersection on Lower Sacramento Road (Study Intersection # 9);

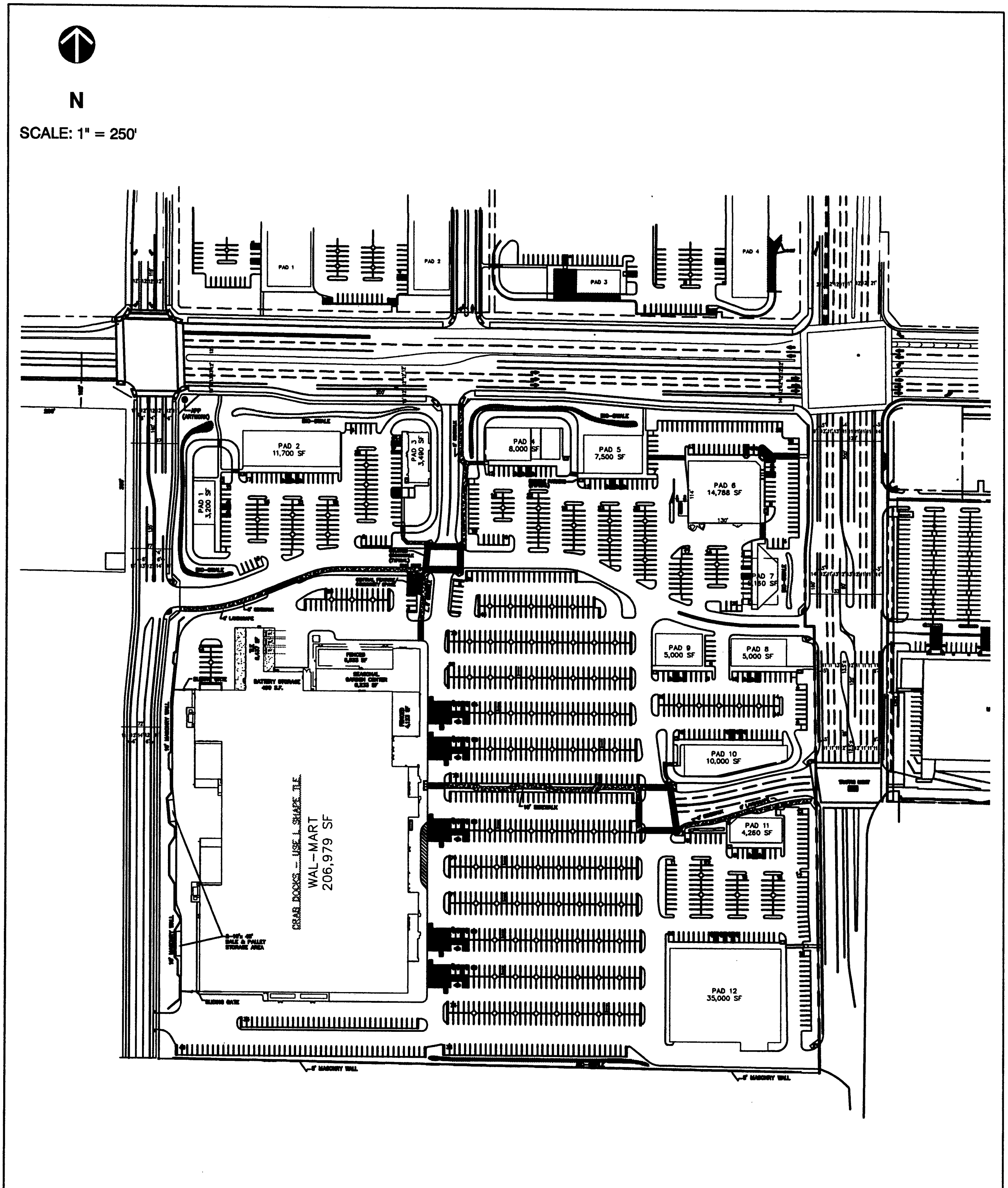
2) Two right-turn in / right-turn out driveways on Lower Sacramento Road (Study Intersections # 5 and # 10);

3) A right-turn in / right-turn out driveway on Kettleman Lane (Study Intersection # 8);

4) A full access driveway on Westgate Drive (Study Intersection # 11);

5) A right-turn in / right-turn out driveway on Westgate Drive (Study Intersection # 12);

Under this alternative, a 90-foot southbound left-turn pocket into the existing Food 4 Less site located on the east side of Lower Sacramento Road would be provided at both Project Driveway # 1 (signalized) and Project Driveway # 2 (unsignalized).



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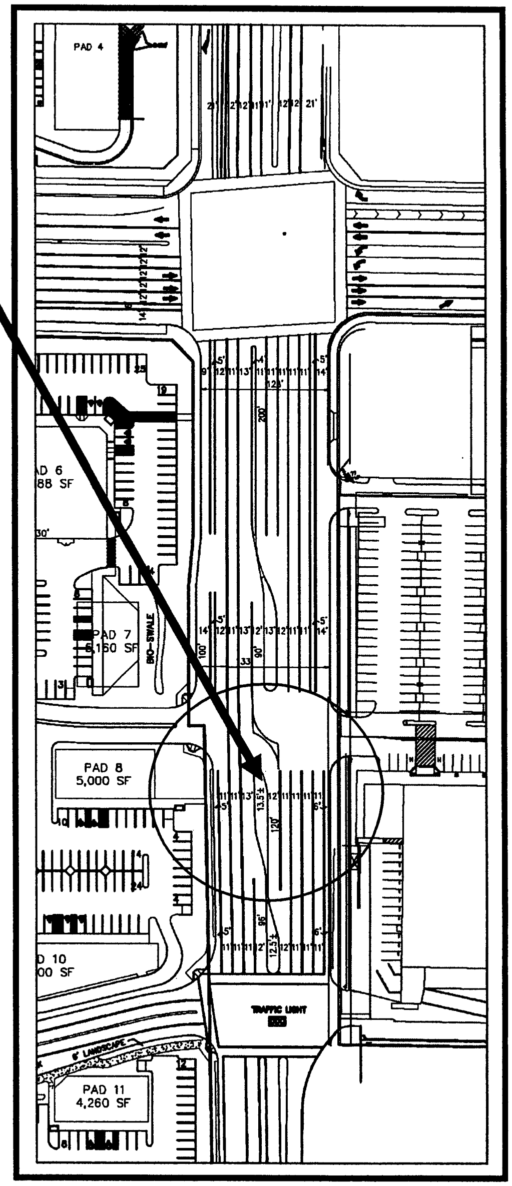
LODI SHOPPING CENTER
PROJECT SITE PLAN

FIGURE 7

Access Alternative B

The primary difference between Alternative A and B is that a 120-foot northbound left-turn lane at Project Driveway # 2 (unsignalized) would be provided. All other access points would remain the same.



Trip Generation

The amount of traffic generated by the proposed project was estimated using appropriate trip generation rates from *Trip Generation* (Institute of Transportation Engineers, 7th Edition, 2003) for the various land uses. Trip generation rates for "Free Standing Discount Store", "Shopping Center", "Fast Food Restaurant with Drive Through", "High Turnover Sit Down Restaurant", "Pharmacy with Drive Through", and "Walk In Bank" land uses were applied to the size of the appropriate parcels.

For the proposed Wal-Mart, Land Use Category 815 "Free Standing Discount Store" was used to estimate the trip generating characteristics for both a.m. and p.m. peak hour conditions. The discount stores that were surveyed across the United Stated are described as free-standing stores with off-street parking. They usually offer a variety of customer services, centralized cashiering and a wide range of products. They typically maintain long hours seven (7) days a week.

The trip generation estimates also accounted for pass-by trips. Pass-by trips are trips to the site made by vehicles already traveling by the site on the adjacent street (i.e., these vehicles make an interim stop between their primary origin and destination). Pass-by trips are included in the analysis of traffic that enters and exits the project site, but are not considered "new" trips added to the street system by the project. The following average pass-by percentages from the Institute of Transportation Engineers' *Trip Generation Handbooks* (1998 and 2001) were used:

1) Free Standing Discount Store – 17% PM

2) Shopping Center – 34% PM

3) Fast Food With Drive Through – 49% AM, 50% PM

4) High Turnover Restaurant – 43% PM

5) Pharmacy With Drive Through – 49% PM

6) Walk In Bank – 47% PM

Table 5 presents the trip generation estimates for the proposed project. The project is estimated to generate 23,843 net new daily trips, 682 net new AM peak-hour trips (394 inbound and 682 outbound), and 1,494 net new PM peak-hour trips (756 inbound and 738 outbound).

Table 5

TRIP GENERATION ESTIMATES– LODI SHOPPING CENTER

		Daily		A.M. Peak Hour				P.M. Peak Hour			
Land Use	Size (ksf)	Rate	Trips	Rate	In	Out	Total Trips	Rate	In	Out	Total Trips
Wal-Mart	226.868	56.02	12,709	0.84	130	61	191	5.06	574	574	1,148
Less Pass-by (17% PM)									(99)	(99)	(198)
Retail[1]	75.96	42.94	3,262	1.03	46	31	77	3.75	137	149	286
Less Pass-by (34% PM)									(53)	(53)	(106)
Fast Food Restaurant[2]	9.69	496.12	4,807	53.11	262	252	514	34.64	175	161	336
Less Pass-by (49%AM, 51% PM)					(123)	(123)	(246)		(85)	(85)	(170)
High Turnover Restaurant[3]	7.5	127.15	954	11.52	45	41	86	10.92	50	32	82
Less Pass-by (43% PM)									(18)	(18)	(36)
Pharmacy[4]	14.788	88.16	1,304	2.66	22	17	39	8.62	62	65	127
Less Pass-by (49% PM)									(32)	(32)	(64)
Bank[5]	5.16	156.48	807	4.07	12	9	21	33.15	86	85	171
Less Pass-by (47% PM)									(41)	(41)	(82)
Total Gross Trips			23,843		517	411	928		1,084	1,066	2,150
Total Pass-by Trips					(123)	(123)	(246)		(328)	(328)	(656)
Net New Trips			**23,843**		**394**	**288**	**682**		**756**	**738**	**1,494**

Notes: [1] Retail uses assumed for parcels 2, 4 (5,000 s.f.), 8, 9, 10, 11, and 12.

[2] Fast food restaurant use assumed for parcels 1, 3, and 4 (3,000 s.f.).

[3] High turnover restaurant use assumed for parcel 5.

[4] Pharmacy use assumed for parcel 6.

[5] Bank use assumed for parcel 7.

Source: Fehr & Peers Associates, 2004.

Trip Distribution

The expected distribution of project trips was based on San Joaquin Council of Governments (SJCOG) Existing Year 2000 Travel Demand Model and existing travel patterns through the study area. As illustrated on Figure 8, the project trips were distributed as follows:

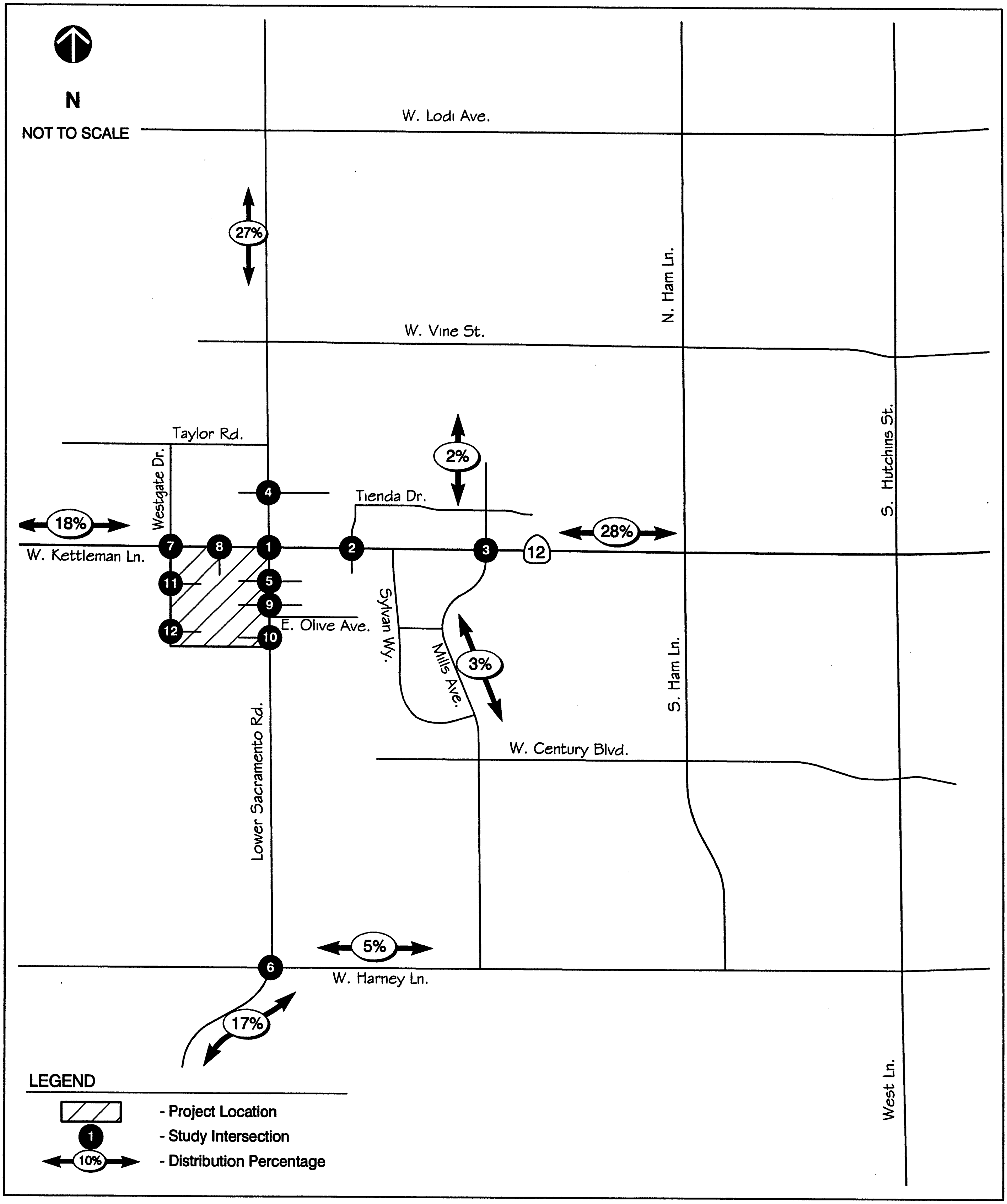
Kettleman Lane to/from west:	18%
Kettleman Lane to/from east:	28%
Lower Sacramento Road to/from north:	27%
Lower Sacramento Road south of Harney Lane:	17%
Harney Lane east of Lower Sacramento Road:	5%
Mills Avenue north of Kettleman:	2%
Mills Avenue south of Kettleman:	3%

Trip Assignment

The net new peak-hour trips generated by the proposed project were assigned to the roadway system based on the trip distribution pattern discussed above. The pass-by trips were assigned to the project driveways and the adjacent study intersections based on the existing a.m. and p.m. peak hour traffic volumes on West Kettleman Lane and Lower Sacramento Road.

Figure 9 presents the project trip assignment at the study intersections for Access Alternative A and Figure 10 presents the project trip assignment at the study intersections for Access Alternative B. A negative number for certain through movements at the project driveways indicate that these pass-by vehicles would turn into the project site, resulting in a net decrease in the volume of traffic for the corresponding through movement. The project trip assignment volumes were added to the Near Term volumes to obtain Near Term Plus Project volumes as indicated on Figure 11 for Alternative A and Figure 12 for Alternative B.

As noted in the previous section, the primary difference between Alternative A and B is that a 120-foot northbound left-turn lane at Project Driveway # 2 (unsignalized) would be provided. All other access points would remain the same.



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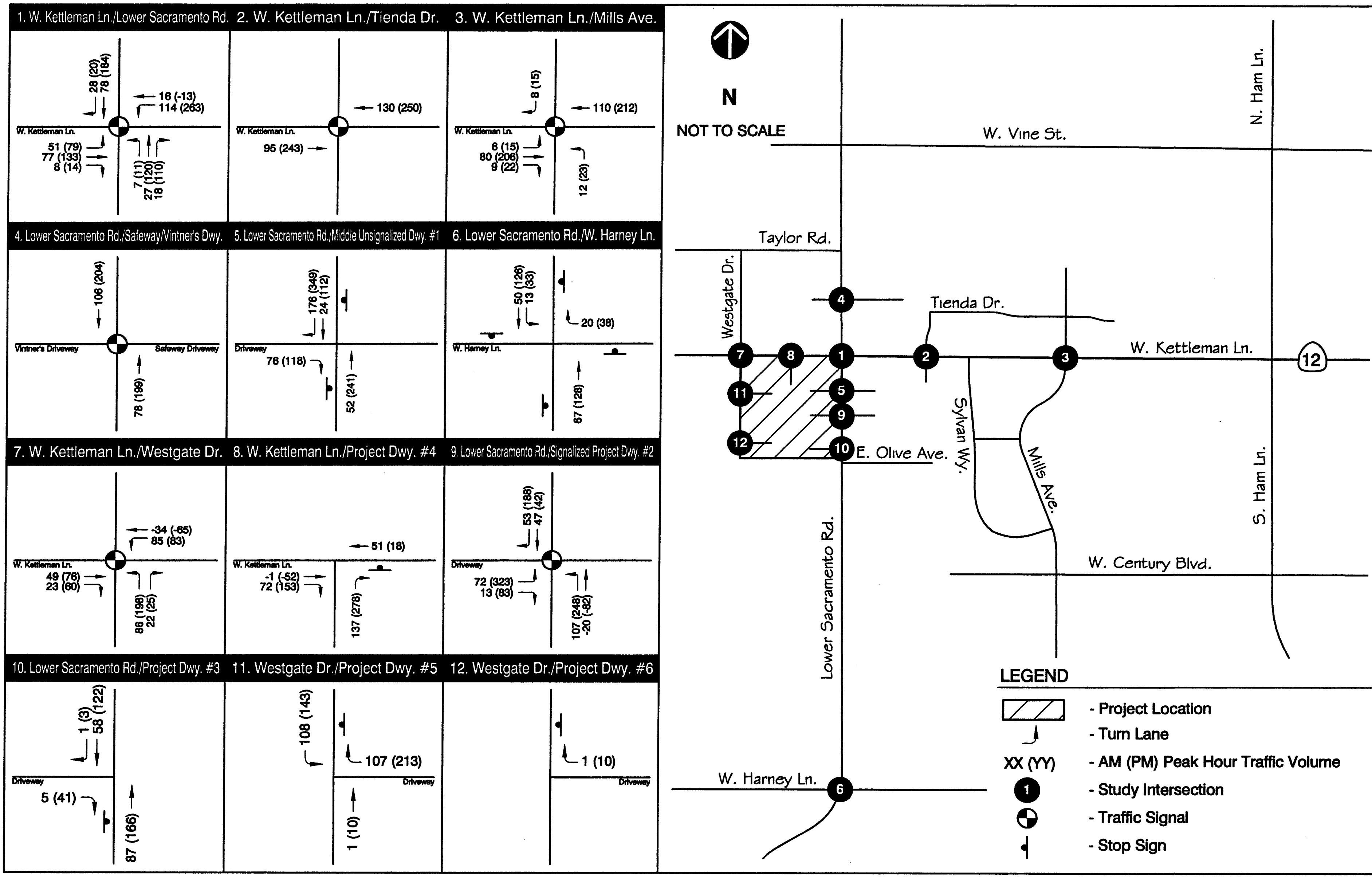
NEAR-TERM PLUS PROJECT TRIP DISTRIBUTION

FIGURE 8



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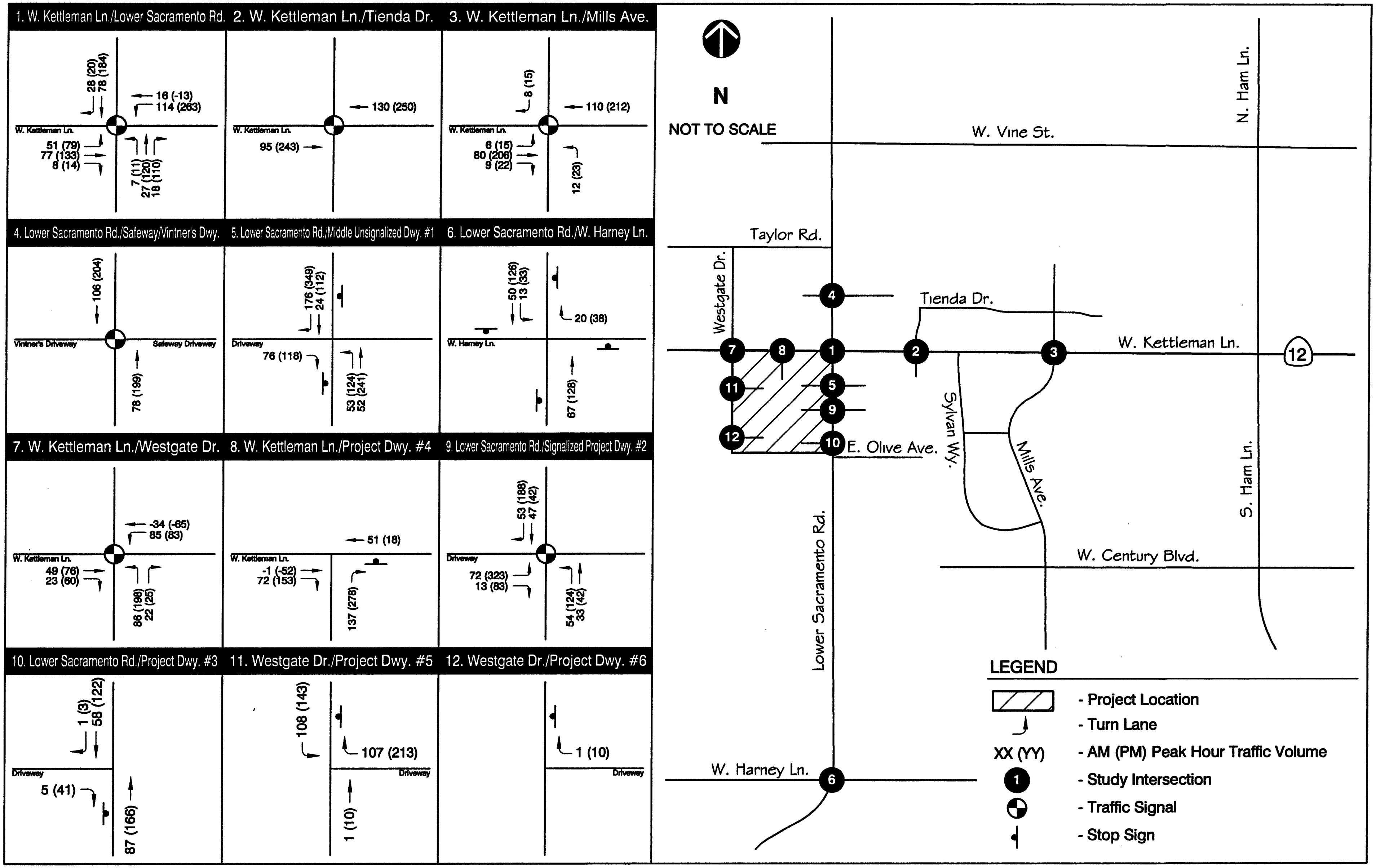
PROJECT TRIP ASSIGNMENT - ACCESS ALTERNATIVE A

FIGURE 9



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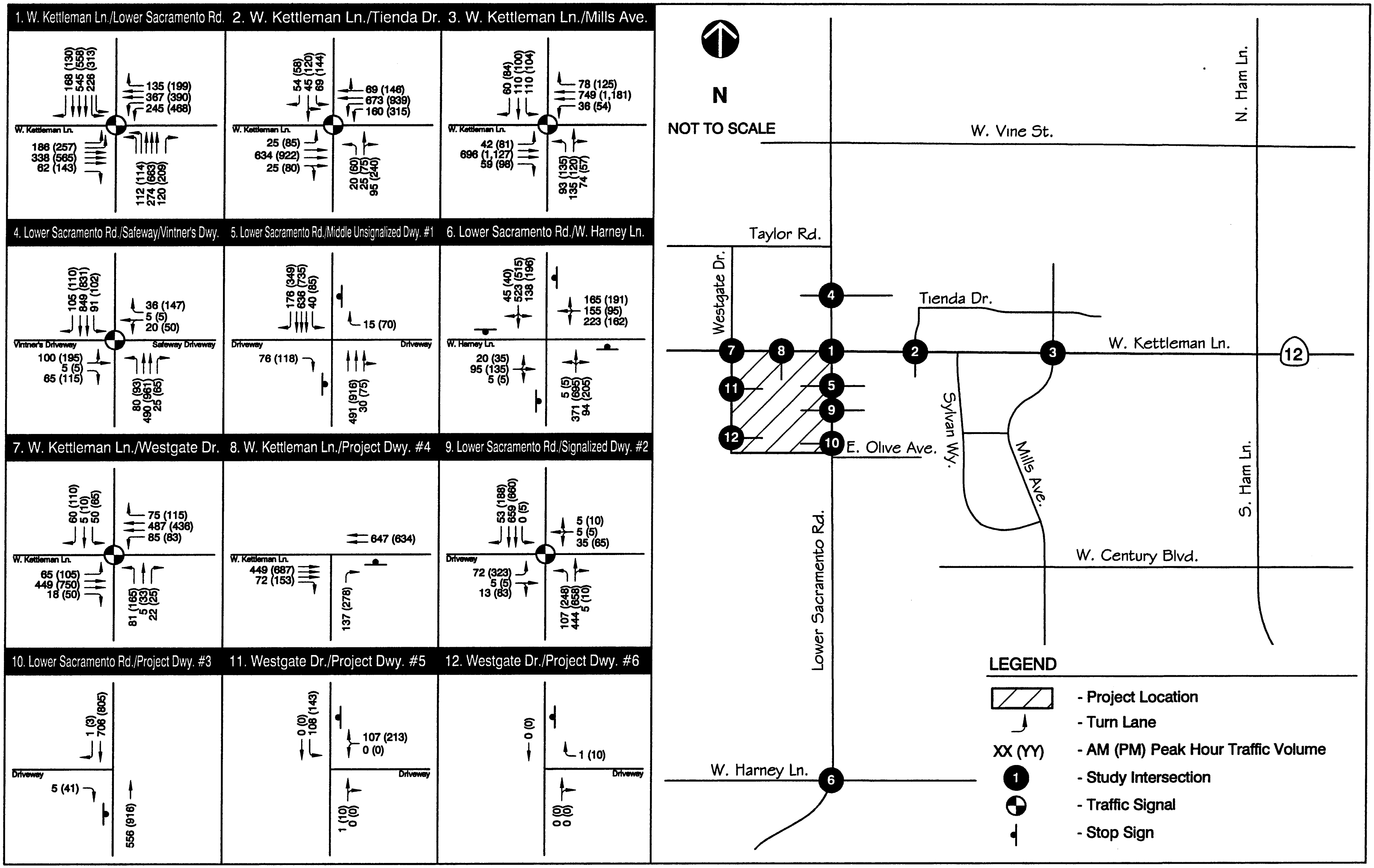
PROJECT TRIP ASSIGNMENT - ACCESS ALTERNATIVE B

FIGURE 10



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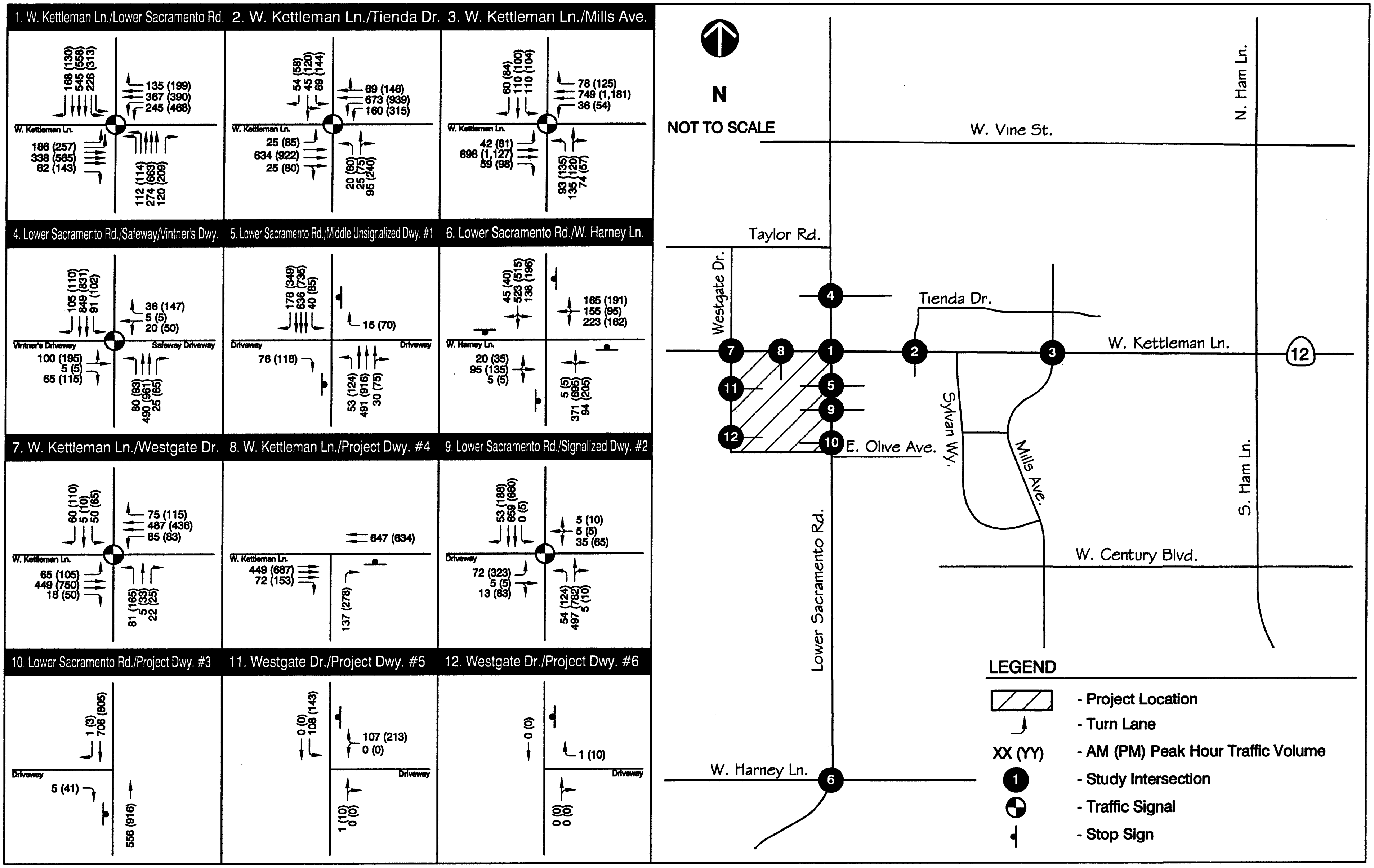
PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - NEAR-TERM PLUS PROJECT CONDITIONS - ACCESS ALTERNATIVE A

FIGURE 11



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PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - NEAR-TERM PLUS PROJECT CONDITIONS - ACCESS ALTERNATIVE B

FIGURE 12

Planned Near Term Plus Project Circulation Improvements

The proposed project will incorporate the following changes to the roadway system along the project's frontage:

West Kettleman Lane / Westgate Drive – Construct Westgate Drive as a two-lane roadway along the project's western boundary. This roadway would form the south leg of the West Kettleman Lane / Westgate Drive signalized intersection. The lane configuration at the Westgate Drive / Kettleman Lane intersection would consist of one left-turn lane, one through lane, and one right-turn lane on the northbound and southbound approaches. The eastbound approach would consist of one left-turn lane, one through lane, and one shared through-right-turn lane. The westbound approach would contain one left-turn lane, two through lanes, and one right-turn lane.

Westgate Drive Project Driveways - Add two project driveways on the extension of Westgate Drive. The northern Westgate Drive driveway would be located approximately 340 feet south of Kettleman Lane and provide full access (left and right-turns in and out) to the project site. The lane configuration for this intersection is one shared through/right-turn lane for the northbound approach, one left-turn lane and one through lane for the southbound approach, and one shared left and right-turn lane for the westbound approach. The southern Westgate Drive driveway is located 800 feet south of Kettleman Lane and will be limited to right-turns in and out only.

West Kettleman Lane Project Driveway - Add one project driveway on West Kettleman Lane located approximately 600 feet west of Lower Sacramento Road and provide right-turns in / right-turns out of the project site. Three eastbound through lanes and a 200 foot right-turn lane would be provided in the eastbound approach. A 285-foot right-turn lane will be provided in the northbound approach.

West Kettleman Lane / Lower Sacramento Road- West Kettleman Lane would be widened eastbound from Westgate Drive to Lower Sacramento Road to provide dual left-turn lanes, three through travel lanes and a 200-foot right turn lane.

Lower Sacramento Road- Lower Sacramento Road would be widened southbound from West Kettleman Lane to the signalized project driveway located approximately 650 feet south of West Kettleman Lane. At the middle (unsignalized) project driveway (study intersection # 5), two access alternatives were considered, as discussed above.

Access Alternative A would include a dedicated 100-foot southbound right turn lane and a 90-foot southbound left-turn lane. No northbound left-turn movements would be allowed into the project site and would be prevented by a raised center median.

Under Access Alternative B, In addition to the dedicated 100-foot southbound right turn lane and a 90-foot southbound left-turn lane, a 120-foot northbound left-turn lane would also be provided at this project driveway.

A 95-foot southbound left-turn lane and a 225-foot northbound left-turn lane would be provided at the signalized project driveway (study intersection # 9). The third southbound travel lane would become a trap right-turn lane at the signalized project driveway. South of the signalized intersection, two travel lanes would continue on Lower Sacramento Road and match the proposed design from the *Lower Sacramento Widening Project* that is currently under design by the City of Lodi.

Near Term Plus Project Intersection Operations – Access Alternative A

Table 6 presents the results of the Near Term Plus Project Conditions with the addition of project-generated traffic, and the technical calculations are contained in Appendix C. The results of the analysis show that the project will have a less than significant impact on intersection operations at the four existing signalized intersections during both a.m. and p.m. peak hour conditions. The proposed signalized intersection on Lower Sacramento Road will also operate at LOS C conditions during both peak hours.

Table 6 shows that with the addition of project-generated traffic, the all-way STOP-controlled intersection of Lower Sacramento Road / Harney Lane will continue to operate at LOS F conditions and meets the Peak Hour Volume and Peak Hour Delay signal warrants for both a.m. and p.m. peak hour conditions. A total of 151 a.m. peak hour and 324 p.m. peak hour vehicle trips are projected to travel through the Lower Sacramento Road / Harney Lane intersection.

The five side street stop-controlled driveway intersections will all operate with low to average delays for vehicles waiting to exit the project site.

Near Term Plus Project Intersection Operations – Access Alternative B

Figure 11 and Table 6 also shows that under Alternative B, the construction of the northbound left-turn lane at the northern Lower Sacramento Road driveway will result in traffic that would otherwise use the signalized project driveway under Access Alternative A to divert to the northern intersection. And with approximately 40 percent of the total project land use (and approximately 40 percent of trip generation) oriented toward West Kettleman, a conservative diversion factor of 50 percent was used to evaluate Access Alternative B Conditions at study intersections # 5 (unsignalized) and # 9 (signalized).

The results of the analysis for Access Alternative B indicate that the diversion of northbound left-turn vehicle trips into the project study area will result in:

1) A minor reduction in average vehicle delay at the signalized Lower Sacramento Road / Project Driveway. But the intersection will continue to operate at LOS B during a.m. and LOS C during p.m. peak hour conditions.

Table 6

NEAR TERM AND NEAR TERM PLUS PROJECT INTERSECTION LEVEL OF SERVICE (AM AND PM PEAK HOUR)

#	Intersection	Traffic Control	Peak Hour	Near Term Conditions		Near Term Plus Project Conditions	
				Average Control Delay	LOS	Average Control Delay	LOS
1	SR 12/W.Kettleman Ln./ Lower Sacramento Rd	Traffic Signal	AM PM	22.5 30.2	C C	25.0 35.9	C C
2	W. Kettleman Ln./Tienda Dr.	Traffic Signal	AM PM	17.4 26.0	B C	17.1 29.5	B C
3	W. Kettleman Ln./Mills Ave.	Traffic Signal	AM PM	22.6 26.6	C C	22.9 30.8	C C
4	Lower Sacramento Rd./Safeway Dwy.	Traffic Signal	AM PM	14.3 17.9	B B	14.0 19.1	B B
5	Lower Sacramento Rd./Project Dwy. #1 (Food 4 Less Dwy.)	Minor-Street Stop	AM PM	40.7 **> 50**	E **F**	8.3 (13.4 [1]) 12.7 (21.8 [1]) SBL (NBL[1])	A(B[1]) B(C[1])
6	Lower Sacramento Rd./Harney Ln.	All-Way Stop	AM PM	**> 50** **> 50**	**F** **F**	**> 50** **> 50**	**F** **F**
7	W. Kettleman Ln./Westgate Ave.	Traffic Signal	AM PM	21.6 24.7	C C	30.6 34.4	C C
8	W. Kettleman Ln./Project Dwy. #4	Minor-Street Stop	AM PM	Not Applicable		10.3 13.5	B B
9	Lower Sacramento Rd./Project Dwy. #2 (Food 4 Less Dwy.)	Traffic Signal	AM PM	Not Applicable		11.0 (10.4 [1]) 31.6 (29.5 [1])	B(B[1]) C(C[1])
10	Lower Sacramento Rd./ Project Dwy. #3	Minor-Street Stop	AM PM	Not Applicable		16.1 21.6	C C
11	Westgate Ave./Project Dwy. #5 (north)	Minor-Street Stop	AM PM	Not Applicable		8.8 9.5	A A
12	Westgate Ave./Project Dwy. #6 (south)	Minor-Street Stop	AM PM	Not Applicable		8.4 8.5	A A

Notes: - LOS = Level of Service.
- For intersections with all-way stop-control or a traffic signal, average delay is for all vehicles entering the intersection.
- For intersections with minor-street stop-control, average delay is for vehicles on the minor-street approach only.

1 Level of service operations under Alternative B Conditions

2) The northbound left-turn at the unsignalized driveway (study intersection # 5) would operate at LOS B during both a.m. and p.m. peak hour conditions. During the a.m. peak hour, approximately 175 southbound right-turn vehicles enter the project site from Lower Sacramento Road. Signal operations at the West Kettleman Lane / Lower Sacramento Road intersection and Near Term Plus Project traffic volumes on southbound Lower Sacramento Road provide sufficient gaps in traffic for northbound left-turning vehicles to safely cross three lanes of traffic during a.m. peak hour conditions.

   During the p.m. peak hour, it is projected that approximately 350 southbound right-turn vehicles enter the project site from Lower Sacramento Road. The northbound left-turn will operate at LOS C, but the number of available gaps to safely make the northbound left-turn is reduced when compared to .am. peak hour conditions described above.

Cumulative Conditions

The analysis of traffic operations under cumulative conditions is required under CEQA to determine if the addition of project traffic in combination with other traffic growth would result in cumulative adverse impacts. The following describes the travel forecasting methodology, planned roadway improvements, and the resulting traffic operations at the study intersections.

Travel Forecasting Methodology

Fehr & Peers Associates used the San Joaquin Council of Governments (SJCOG) travel demand model to develop cumulative (i.e., Year 2020) traffic forecasts. The SJCOG traffic model is a regional model that includes all areas that potentially attract trips from San Joaquin County, including Stanislaus County, Sacramento County, the San Francisco Bay Area, Sacramento, and other regions. As part of the Lower Sacramento Road Widening Study, Fehr & Peers Associates modified the land uses and roadway network assumptions within this area of the model in 2001. This version of the model was used to develop p.m. peak hour traffic forecasts at the study intersections.

Planned Cumulative Roadway Improvements

Consistent with previous studies, the following roadway improvements were assumed for cumulative analysis:

Lower Sacramento Road will be widened to provide additional travel lanes between Kettleman Lane and Harney Lane. Six through lanes are assumed on Lower Sacramento Road between Kettleman Lane and the signalized project driveway (southern Food 4 Less driveway). Four lanes are assumed on Lower Sacramento Road between the signalized project driveway (southern Food 4 Less driveway) and Harney Lane.

The City of Lodi is completing the Final Design of *Improvement Plans for the Lower Sacramento Road Widening from Harney Lane to Kettleman Road* (March 2004), and will begin construction by the end of 2004 and completed by 2006. The planned improvements to Lower Sacramento Road include two travel lanes in each direction from south of W. Kettleman Lane to just north of Harney Lane with the following design elements:

a) Dual 250-foot northbound left-turn pockets with a 120-foot taper at W. Kettleman Lane

b) A 110-foot southbound left-turn lane with a 100-foot taper at the southern Food 4 Less Driveway

c) Planted center median along the entire length of Lower Sacramento Road

d) No southbound left-turn at the middle Food 4 Less unsignalized driveway

Kettleman Lane would be widened to six travel lanes between Lower Sacramento Road and Mills Avenue. As part of the planned widening of Kettleman Lane, Caltrans plans to coordinate the traffic signals using Caltrans developed 2070 controller to provide for improved traffic flow in the eastbound / westbound directions. The City of Lodi uses NEMA controllers and would operate Lower Sacramento Road as a coordinated system between the Proposed project's Traffic Signal and Harney Lane to the south and the Safeway / Vintner's Square intersection and Vine Street to the north. But since the City does not control the Caltrans intersection of Lower Sacramento Road / W. Kettleman Lane, the coordinated system would create delays for the proposed Shopping Center traffic as well as traffic on northbound / southbound Lower Sacramento Road.

West Century Boulevard will be extended westward across Lower Sacramento Road to the Westgate Drive extension. The intersection of West Century Boulevard and Lower Sacramento Road will be signalized.

Westgate Drive will be extended southward to Harney Lane and intersect with the West Century Boulevard extension.

As a result of the roadway improvement projects listed above, the following lane configurations would change at the study intersections:

Kettleman Lane / Tienda Drive – The westbound right-turn lane will be converted into a shared through/right-turn lane.

Kettleman Lane/Mills Avenue - The eastbound and westbound right-turn lanes will be converted into a shared through/right-turn lane.

Lower Sacramento Road / West Century Boulevard – The intersection will be signalized and the following lane configuration is assumed: one left-turn lane and one shared through/right-turn lane on east and west approaches; and one left-turn lane, one through lane, and one shared through/right-turn lane on north and south approaches.

Lower Sacramento Road/Harney Lane – The intersection will be signalized and the following lane configuration is assumed:

Northbound: one left-turn lane, two through lanes, one right-turn lane

Southbound: one left-turn lane, one through lane, one shared through/right-turn lane

Eastbound: one left-turn lane, one shared through/right-turn lane

Westbound: one left-turn lane, one through lane, two right-turn lanes

Kettleman Lane / Westgate Drive – A third eastbound through lane will be added. The westbound right-turn lane will be converted into a shared through/right-turn lane.

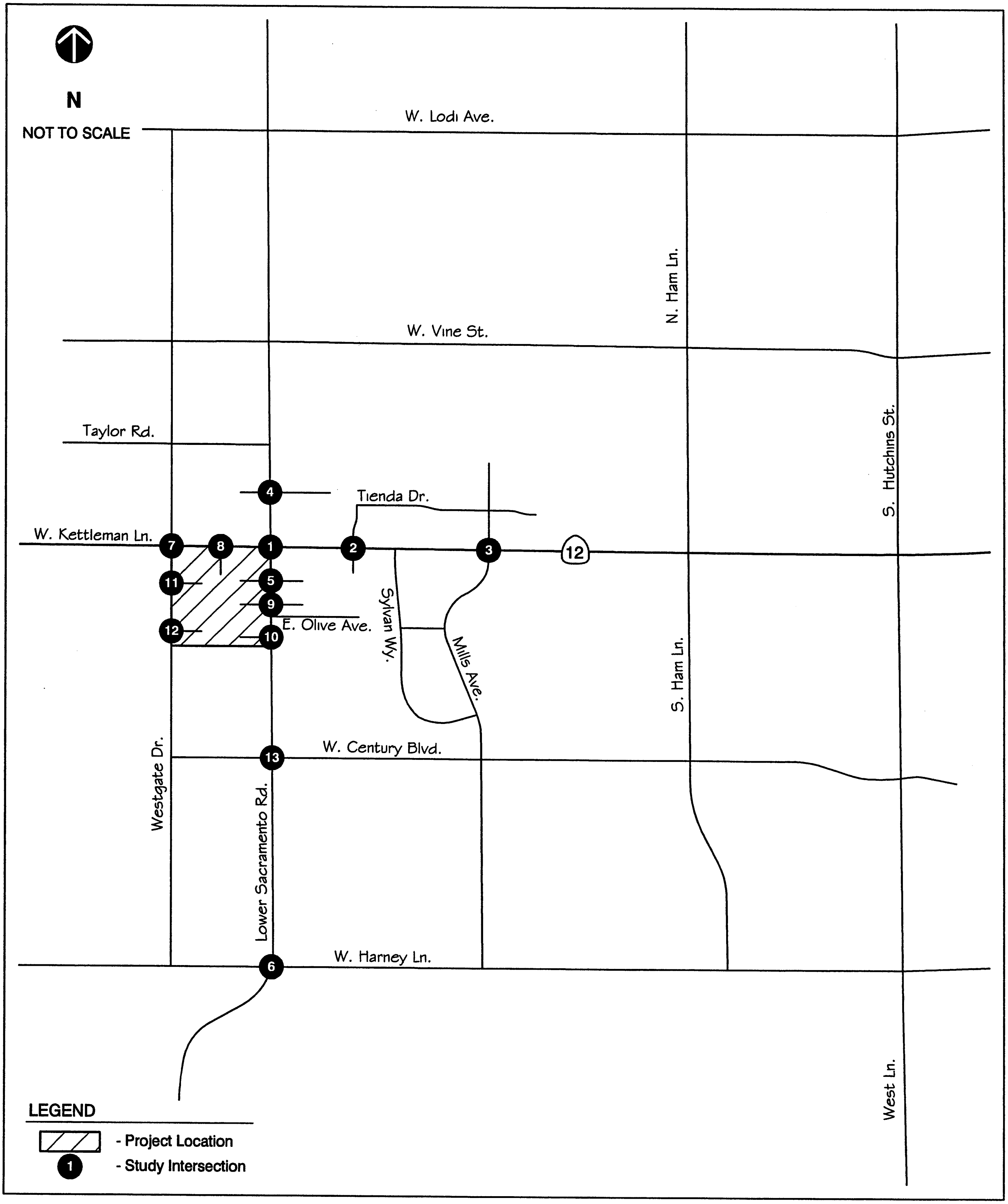
Cumulative No Project Traffic Forecasts

Figure 13 presents the cumulative study intersections and Figure 14 displays the cumulative no project p.m. peak hour traffic volumes at the study intersections. This figure also reflects the assumed roadway improvements to the roadway system.

Cumulative Project Trip Distribution

The expected distribution of project trips under Cumulative was based on San Joaquin Council of Governments Year 2020 model volumes from the City's of Lodi's travel demand forecasting model and future travel patterns in the study area. Under Cumulative Conditions, West Century Boulevard would be extended west past Lower Sacramento Road and intersection with Westgate Drive. As illustrated on Figure 15, the project trips would be distributed under Cumulative Conditions as follows:

Kettleman Lane to/from west:	17%
Kettleman Lane to/from east:	27%
Lower Sacramento Road to/from north:	25%
Lower Sacramento Road south of Harney Lane:	17%
Mills Avenue north of Kettleman Lane:	2%
Mills Avenue south of Kettleman Lane:	3%
Westgate Drive north of Kettleman Lane:	2%



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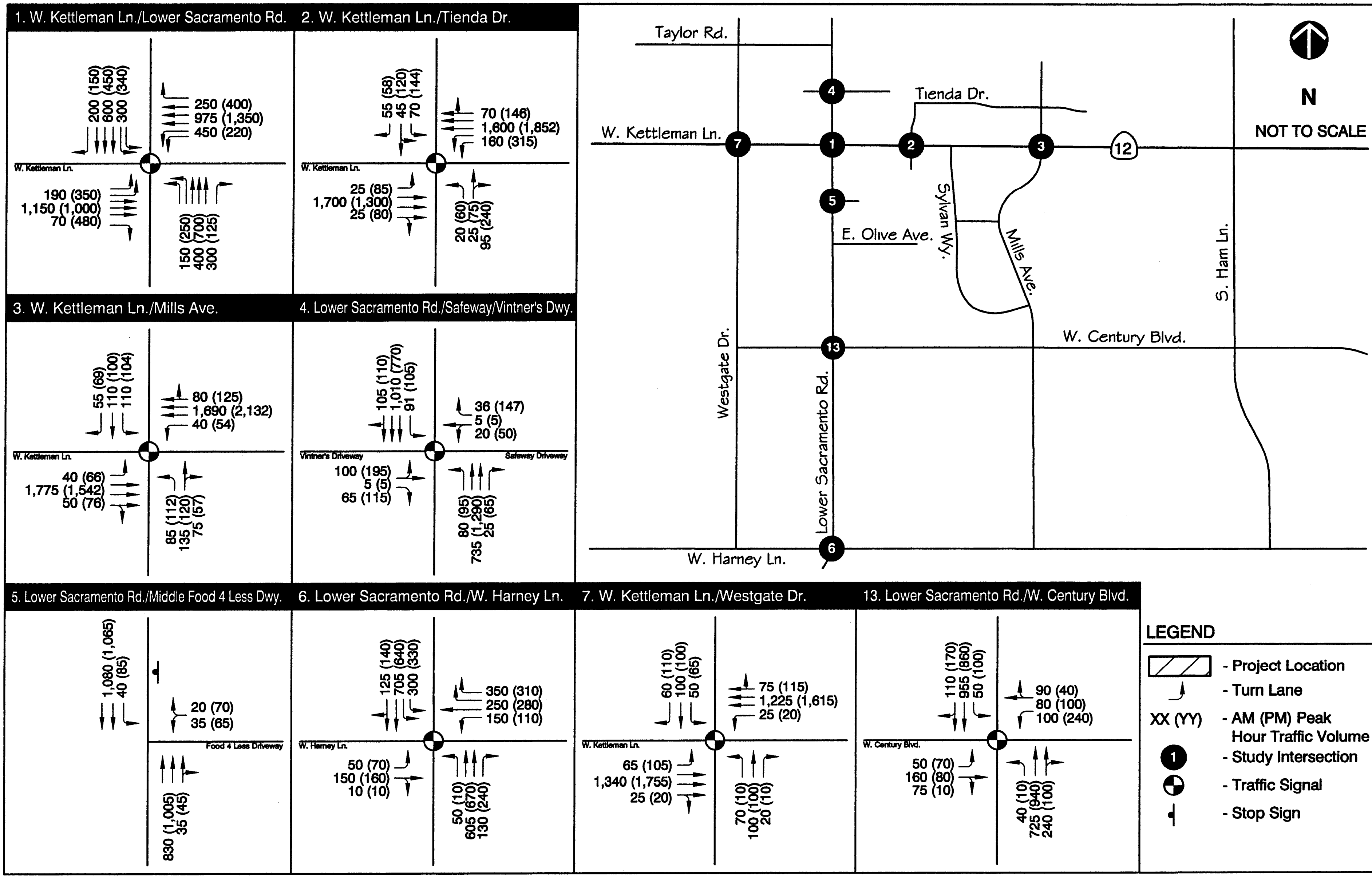
PROJECT LOCATION AND CUMULATIVE PLUS PROJECT STUDY INTERSECTIONS

FIGURE 13



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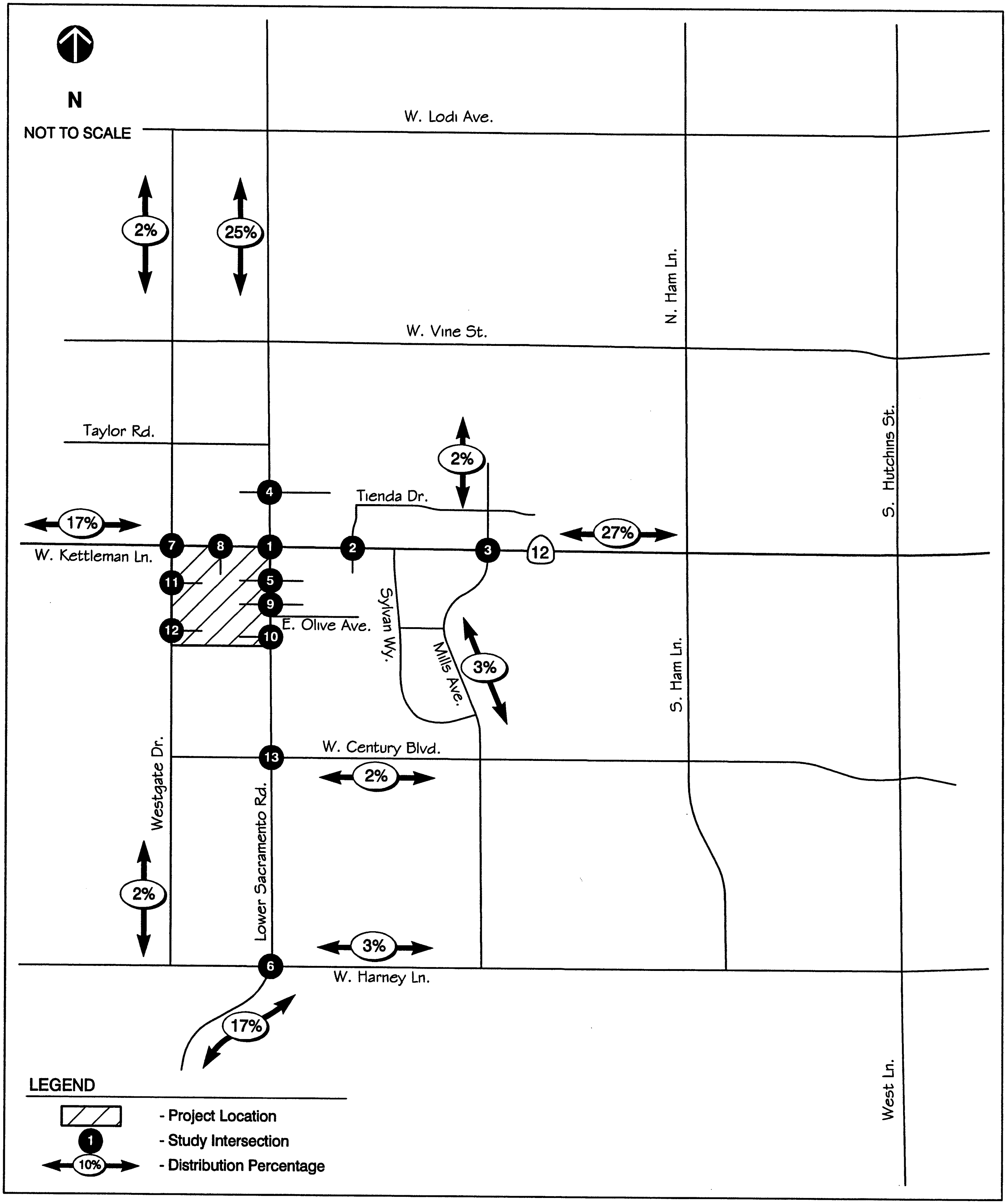
PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - CUMULATIVE NO PROJECT CONDITIONS

FIGURE 14



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CUMULATIVE TRIP DISTRIBUTION

FIGURE 15

West Century Boulevard:	2% (via Westgate)
Harney Lane east of Lower Sacramento Road:	3% (1% via Westgate)
Harney Lane west of Lower Sacramento Road:	2% (1% via Westgate)

Cumulative Trip Assignment

Using the cumulative trip distribution discussed above, the net new peak-hour trips generated by the proposed project were assigned to the roadway system. The pass-by trips were assigned to the project driveways and the adjacent study intersections based on the directional split of Cumulative No Project Volumes for Lower Sacramento Road and Kettleman Lane. Figure 16 presents the Cumulative Project Access Alternative A trip assignment and Figure 17 presents the Cumulative Project Access Alternative B trip assignment.

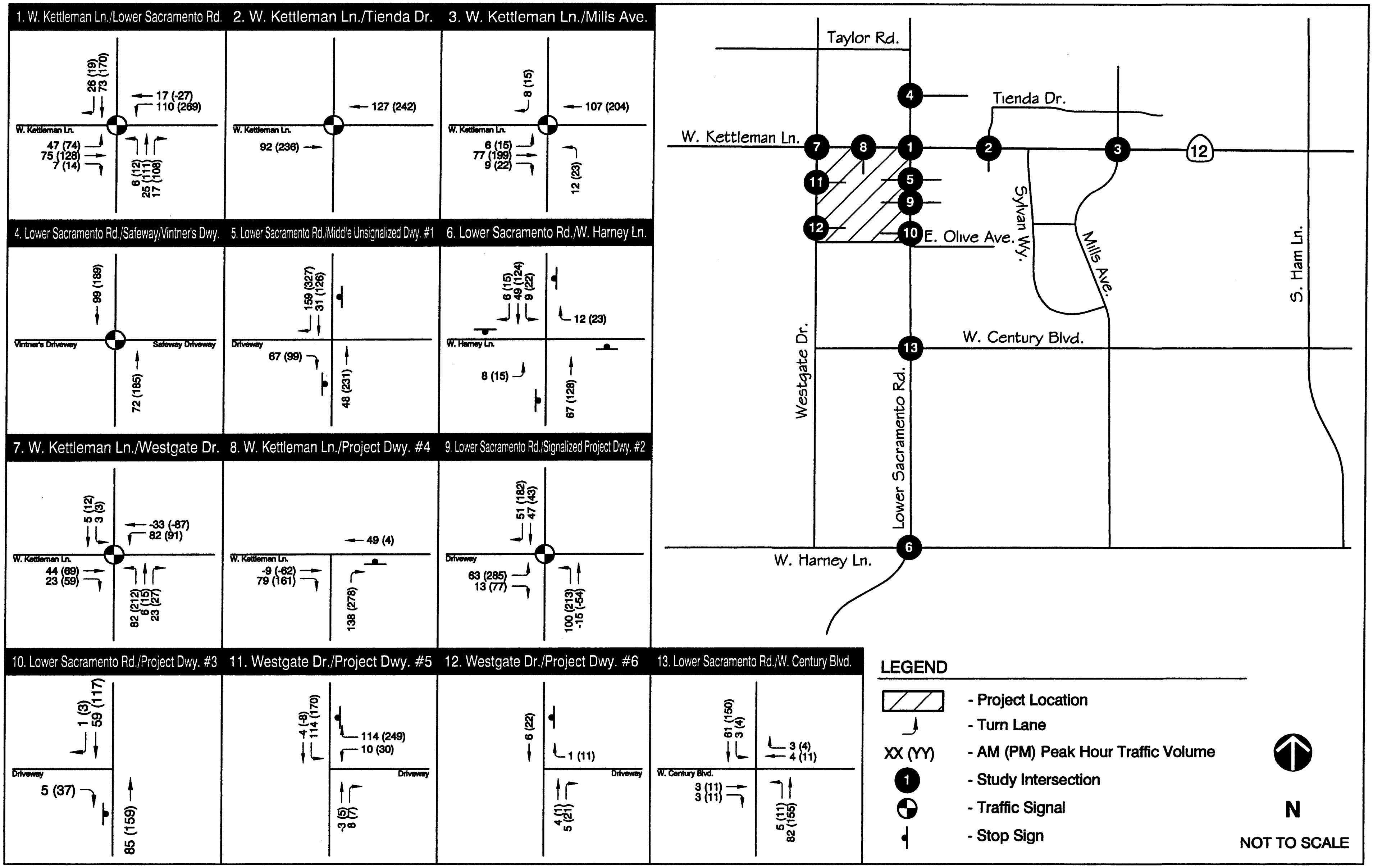
The project trip assignment volumes were added to the Cumulative No Project volumes to obtain Cumulative Plus Project volumes as indicated on Figure 18 for Alternative A and Figure 19 for Alternative B.

Cumulative No Project Intersection Operations

Table 7 presents the results of the Cumulative No Project Conditions operations analysis and the technical calculations are contained in Appendix D. The results of the analysis show that the projected Build-Out of the City of Lodi General Plan, San Joaquin County General Plan and regional traffic on West Kettleman Lane (SR 12) will result in the intersection of West Kettleman Lane / Lower Sacramento Road to operate at LOS D conditions during both a.m. and p.m. peak hour conditions. In addition, the intersection of West Kettleman Lane / Tienda drive is also projected to operate at LOS D Conditions during p.m. peak hour conditions.

The new signalized intersection of Lower Sacramento Road/ West Century Boulevard in projected to operate at LOS B conditions during both a.m. and p.m. peak hour conditions. The widened and signalized intersection of Lower Sacramento Road / Harney Lane is projected to operate at LOS C conditions during both a.m. and p.m. peak hour conditions.

The existing Food 4 Less driveway, located approximately 450 feet south of West Kettleman Lane is projected to operate at unacceptable LOS F conditions for the driveway stop-controlled intersection. But similar to existing conditions, the driveway would not meet any of Caltrans' signal warrants.



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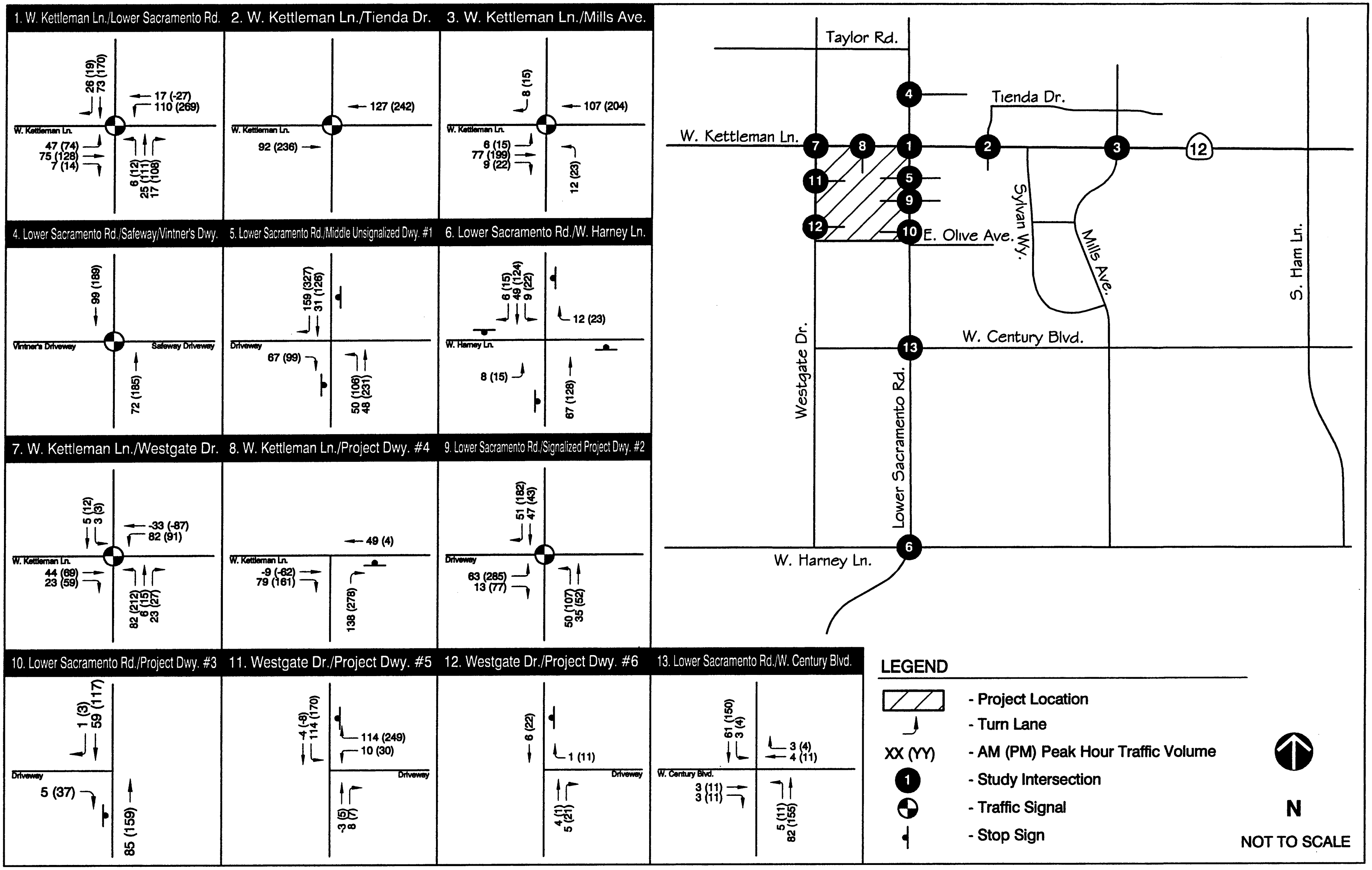
CUMULATIVE PROJECT TRIP ASSIGNMENT - ACCESS ALTERNATIVE A

FIGURE 16



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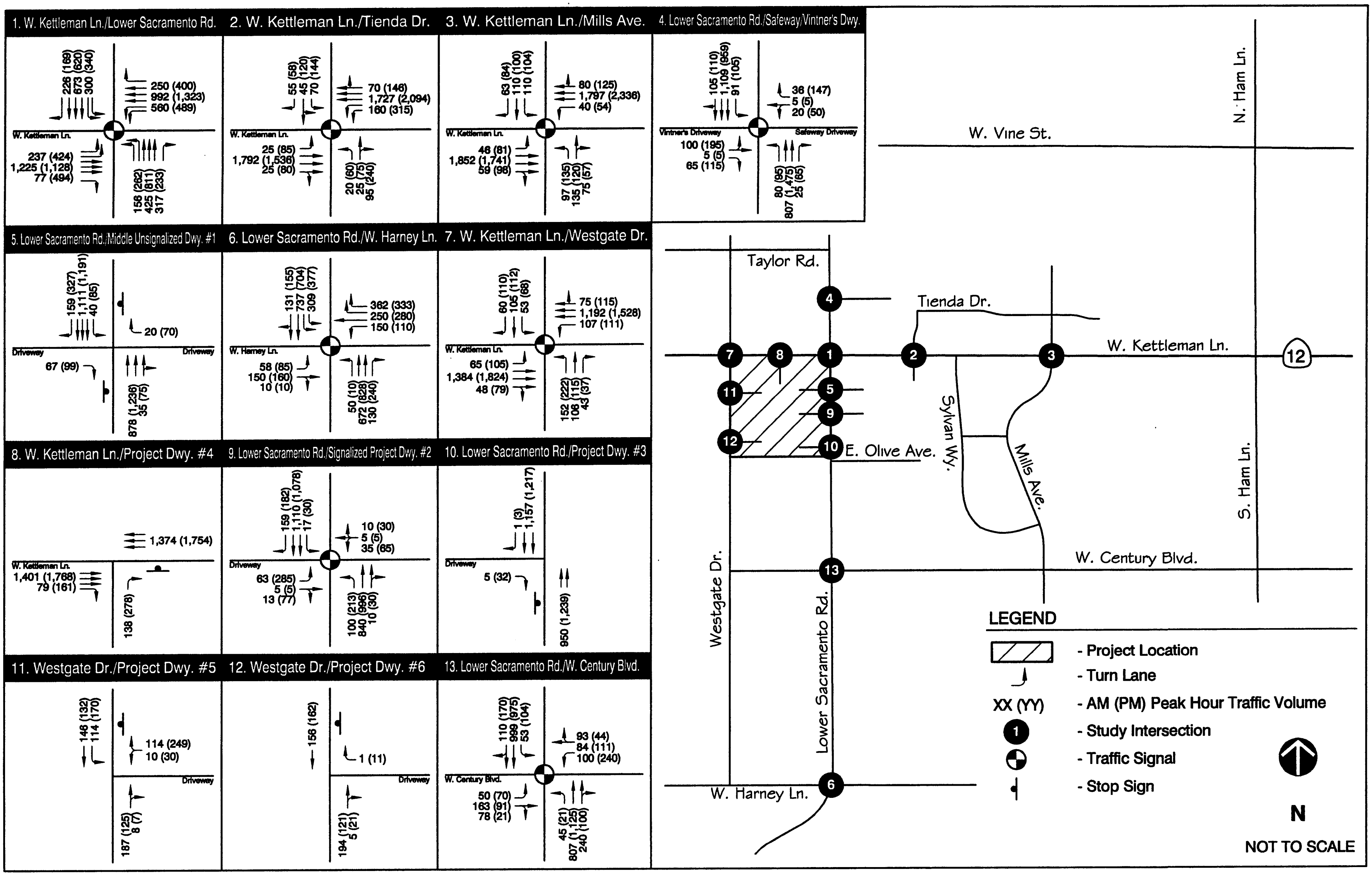
CUMULATIVE PROJECT TRIP ASSIGNMENT - ACCESS ALTERNATIVE B

FIGURE 17



PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - CUMULATIVE PLUS PROJECT CONDITIONS - ACCESS ALTERNATIVE A

FIGURE 18

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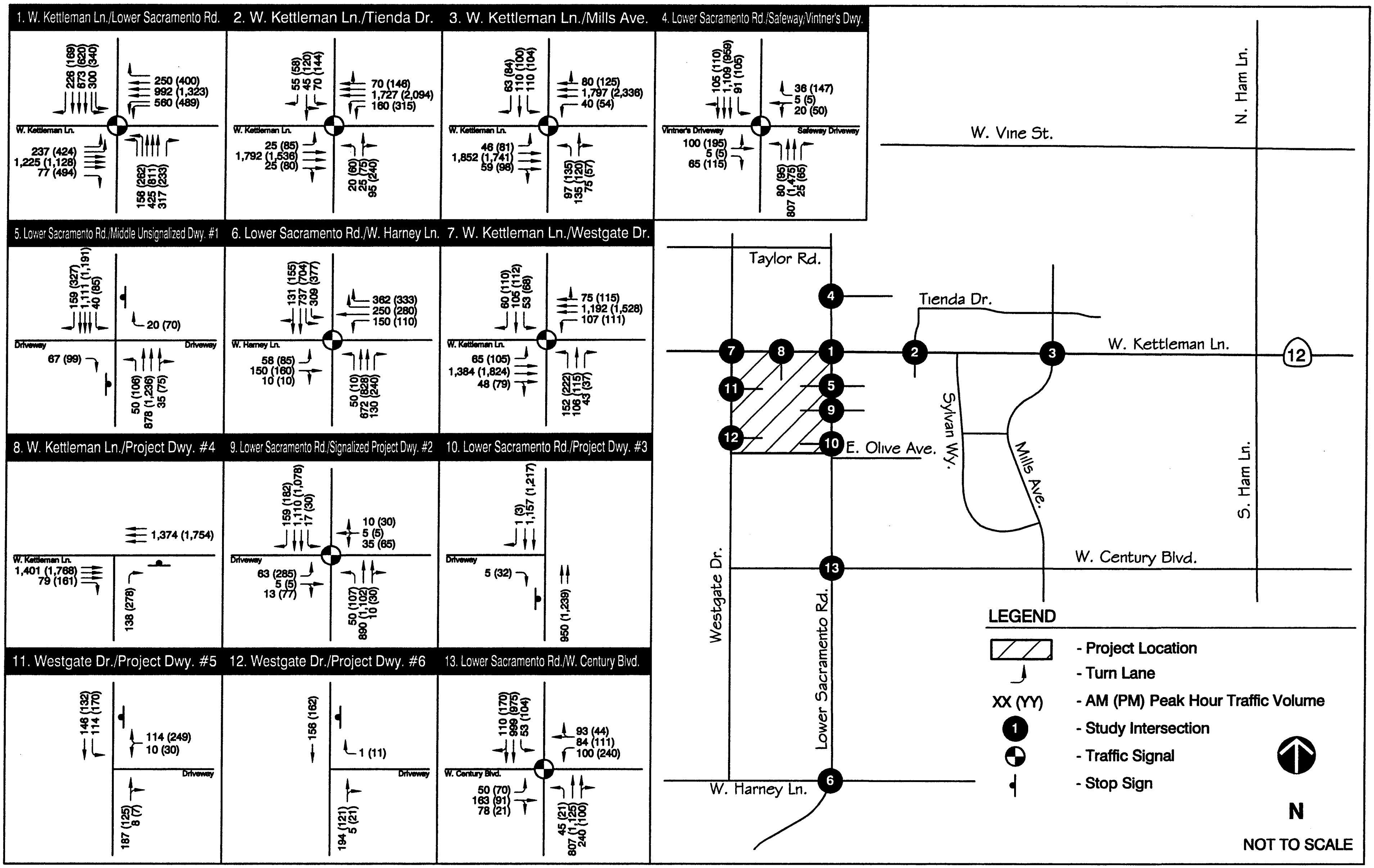

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PEAK HOUR TRAFFIC VOLUMES AND LANE CONFIGURATIONS - CUMULATIVE PLUS PROJECT CONDITIONS - ACCESS ALTERNATIVE B

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FIGURE 19

Cumulative Plus Project Intersection Operations – Access Alternative A

Table 7 also presents the results of the Cumulative Plus Project Alternative A operations analysis, and the technical calculations are contained in Appendix E. The results indicate that the seven signalized study intersection will all continue to operate at LOS D conditions or better during both a.m. and p.m. peak hour conditions.

During the a.m. peak hour, the addition of project-generated traffic will result in a 1 to 6 second increase in average vehicle delays at the seven signalized study intersections. During the p.m. peak hour, the addition of project-generated traffic will result in a 2 to 9 second increase in average vehicle delays at the seven signalized study intersections. The proposed signalized intersection on Lower Sacramento Road will operate at LOS C conditions during both peak hours.

The five side street stop-controlled driveway intersections will all operate with low to average delays for vehicles waiting to exit the project site during both a.m. and p.m. peak hours.

Cumulative Plus Project Intersection Operations – Access Alternative B

Figure 14 and Table 7 also shows that under Alternative B, the construction of the northbound left-turn lane at the northern Lower Sacramento Road driveway will result in traffic that would otherwise use the signalized project driveway under Access Alternative A to divert to the northern intersection. And with approximately 40 percent of the total project land use (and approximately 40 percent of trip generation) oriented towards West Kettleman, a conservative diversion factor of 50 percent was used to evaluate Alternative B Conditions at study intersections # 5 (unsignalized) and # 9 (signalized).

The results of the Alternative B analysis indicate that the diversion of northbound left-turn vehicle trips into the project study area will result in:

1) A minor reduction in average vehicle delay at the signalized Lower Sacramento Road / Project Driveway. But the intersection will continue to operate at LOS B during a.m. and LOS C during p.m. peak hour conditions.

2) With approximately 160 southbound right-turn vehicles entering the project site from Lower Sacramento Road and a southbound through volume in excess of 1,100 vehicles, the northbound left-turn at the unsignalized driveway (study intersection # 5) would operate at LOS B during a.m. peak hour conditions. Signal operations at the West Kettleman Lane / Lower Sacramento Road intersection and Cumulative Plus Project traffic volumes on southbound Lower Sacramento Road provide sufficient gaps in traffic for the estimated 50 northbound left-turning vehicles to safely cross three lanes of traffic during a.m. peak hour conditions.

Table 7
Cumulative and Cumulative Plus Project
Intersection Level of Service (AM and PM Peak Hour)

#	Intersection	Traffic Control	Peak Hour	Cumulative Conditions		Cumulative Plus Project Conditions	
				Average Control Delay	LOS	Average Control Delay	LOS
1	SR 12/W.Kettleman Ln./ Lower Sacramento Rd	Traffic Signal	AM PM	39.2 37.1	D D	44.0 40.9	D D
2	W. Kettleman Ln./Tienda Dr.	Traffic Signal	AM PM	27.5 45.2	C D	27.1 48.2	C D
3	W. Kettleman Ln./Mills Ave.	Traffic Signal	AM PM	30.1 32.6	C C	31.2 41.9	C D
4	Lower Sacramento Rd./Safeway Dwy.	Traffic Signal	AM PM	15.0 22.7	B C	15.0 25.8	B C
5	Lower Sacramento Rd./Project Dwy. #1 (Food 4 Less Dwy.)	Minor-Street Stop	AM PM	**> 50** **> 50**	**F** **F**	14.3 (13.4 [1]) 27.2 (**> 50** [1]) SBL (NBL[1])	B(B[1]) **D(F[1])**
6	Lower Sacramento Rd./Harney Ln.	Traffic Signal	AM PM	26.8 24.5	C C	27.5 28.4	C C
7	W. Kettleman Ln./Westgate Ave.	Traffic Signal	AM PM	27.2 29.4	C C	33.4 38.2	C D
8	W. Kettleman Ln./Project Dwy. #4	Minor-Street Stop	AM PM	Not Applicable		10.6 15.6	B C
9	Lower Sacramento Rd./Project Dwy. #2 (Food 4 Less Dwy.)	Traffic Signal	AM PM	Not Applicable		12.0 (10.1[1]) 28.7 (24.5[1])	B(B[1]) C(C[1])
10	Lower Sacramento Rd./ Project Dwy. #3	Minor-Street Stop	AM PM	Not Applicable		11.5 10.6	B B
11	Westgate Ave./Project Dwy. #5 (north)	Minor-Street Stop	AM PM	Not Applicable		10.9 12.8	B B
12	Westgate Ave./Project Dwy. #6 (south)	Minor-Street Stop	AM PM	Not Applicable		9.5 9.2	A A
13	Lower Sacramento Rd./W. Century Blvd.	Traffic Signal	AM PM	17.2 19.8	B B	18.1 22.5	B C

Notes: - LOS = Level of Service.
- For intersections with all-way stop-control or a traffic signal, average delay is for all vehicles entering the intersection.
- For intersections with minor-street stop-control, average delay is for vehicles on the minor-street approach only.

1 Level of service operations under Alternative B Conditions

3) With approximately 330 southbound right-turn vehicles enter the project site from Lower Sacramento Road and a southbound through volume in approaching 1,200 vehicles, the northbound left-turn at the unsignalized driveway (study intersection # 5) would operate at LOS F during p.m. peak hour conditions. Signal operations at the Lower Sacramento Road / Project Driveway # 2 / Southern Food 4 Less Driveway intersection would result in vehicle queues backing up into this unsignalized intersection. In order to provide sufficient green time for vehicles exiting the project site or pedestrians to cross the street, Lower Sacramento Road would be stopped for a maximum of 30 seconds. And with 285 left-turning vehicles exiting the project site, the southbound through movement would occasionally extend back 250 to 300 feet from the southbound stop bar and block the northbound left-turn movement from entering the project site. Based on this queuing problem, a sensitivity analysis was completed for the northbound left-turn movement to determine level of service operations and queuing for varying p.m. peak hour left-turn volumes.

The results of the sensitivity analysis are:

I) When an estimated 105 vehicles (50 percent of the 210 vehicles projected to enter the project site from northbound Lower Sacramento Road) the northbound left-turn would operate at LOS F conditions, with average delays greater than 50 seconds. The maximum queue would be 110 feet, or less than one vehicle under the 120-foot left-turn storage.

II) When an estimated 85 vehicles (40 percent of the 210 vehicles projected to enter the project site from northbound Lower Sacramento Road) the northbound left-turn would operate at LOS E conditions, with average delays of 30 seconds. The maximum queue would be 95 feet, or one vehicle length under the 120-foot left-turn storage.

III) When an estimated 65 vehicles (30 percent of the 210 vehicles projected to enter the project site from northbound Lower Sacramento Road) the northbound left-turn would operate at LOS D conditions. The maximum queue would be 50 feet, or three car lengths under the 120-foot left-turn storage.

IMPACTS AND MITIGATION MEASURES

The following describes the significant impacts of the project on the roadway, transit, and bicycle/pedestrian systems. Where appropriate, the impact statements are followed by mitigation measures intended to reduce the impacts to less-than-significant levels.

Roadway System Impacts

The following project-specific impacts on the roadway system were identified based on the established significance criteria.

Impact 1 **Near Term Plus Project Access Alternative A and Access Alternative B Signalized Intersection Operations** **With the addition of project-generated traffic, study intersection Level of Service would remain unchanged from Near Term No Project conditions. There would be minor increases in average vehicle delays, ranging from 1 to 9 seconds at certain study intersections, which is not considered a significant and adverse change.**

Analysis Result: Less Than Significant Near Term Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Impact 2 **Near Term Plus Project Access Alternative A and Access Alternative B Unsignalized Intersection Operations** **The addition of project-generated traffic would exacerbate LOS F operations at the intersection of Lower Sacramento Road / Harney Lane during both a.m. and p.m. peak hour conditions.**

Analysis Result: The all-way STOP-controlled intersection of Lower Sacramento Road / Harney Lane currently operates at LOS F conditions and meets the Four Hour Volume and Peak Hour Volume and Delay warrants for both a.m. and p.m. peak hour conditions. Under existing a.m. peak hour conditions, a total of 1,495 vehicles travel through the unsignalized intersection. Approved projects are estimated to add 193 a.m. peak hour vehicle trips and the proposed project would add a total of 151 a.m. peak hour trips.

Under existing p.m. peak hour conditions, a total of 1,690 vehicles travel through the unsignalized intersection. Approved projects are estimated to add 265 p.m. peak hour trips and the proposed project would add a total of 324 p.m. peak hour vehicle trips.

Mitigation *The Lower Sacramento Road Widening Project will provide two northbound and two southbound travel lanes on Lower Sacramento Road between the southern boundary of the project site and just north of Harney Lane. In addition, the southbound approach would be improved to provide a left-turn lane, a through lane, and a right-turn lane. But even with these improvements, the intersection will continue to operate at unacceptable LOS F conditions as either an unsignalized all-way STOP controlled intersection or with a temporary signal.*

Under Near Term Plus Project Conditions, the installation of a traffic signal and construction of left turn pockets on all four approaches would improve operations to LOS C conditions or better during a.m. and p.m. peak hours.

It should be noted that San Joaquin County is currently developing a Request for Proposals to develop improvements to the Lower Sacramento Road / Harney Lane intersection. Preliminary discussions with County staff indicate that improvements to the northbound, westbound and eastbound legs of the intersection would be completed by 2007, but no intersection designs have been developed to date.

Therefore, in order to mitigate unacceptable level of service conditions which the proposed project would exacerbate, the project applicant shall contribute its fair share cost for the installation of a temporary traffic signal with left-turn pockets on all four approaches to the Lower Sacramento Road / Harney Lane intersection.

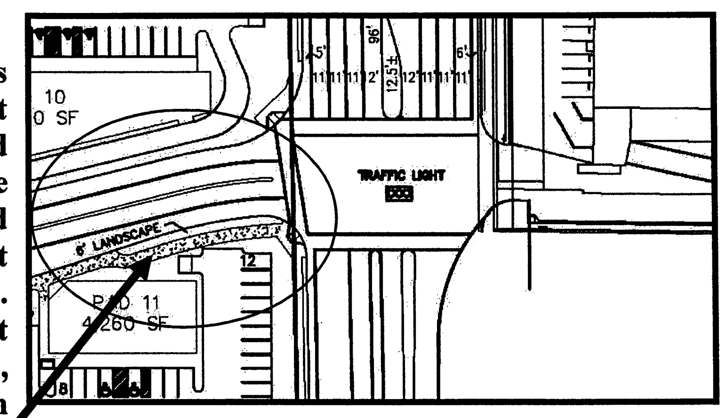
Implementation of this mitigation measure would reduce Impact 2 to less-than-significant.

Impact 3 **<u>Cumulative Plus Project Access Alternative A and Access Alternative B Signalized Intersection Operations</u> With the addition of project-generated traffic, all seven signalized study intersection would continue to operate at acceptable Level of Service Conditions. There would be minor increases in average vehicle delays, ranging from 2 to 9 seconds at certain study intersections, which is not considered a significant and adverse change.**

Analysis Result: Less Than Significant Cumulative Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Impact 4 **A signalized access driveway is proposed with the Project (Access Alternative A and Access Alternative B) along the Lower Sacramento Road frontage, approximately 625 feet south of West Kettleman Lane. For Cumulative Plus Project PM peak hour conditions, projected eastbound left-turn queue length of 250 feet (average queue) to 375 feet (95th Percentile queue) of exiting vehicles would extend back to the internal intersection located south of Pad 10.**



Analysis: Heavy eastbound left-turn traffic volumes exiting the project site, in excess of 275 vehicles during p.m. peak hour conditions, onto northbound Lower Sacramento Road would back up into the internal circulation intersection.

Signal operations at the Lower Sacramento Road / Project Driveway / Southern Food 4 Less intersection would provide up to 30 seconds of green time to serve the heavy-left-turning volume or for pedestrians to cross Lower Sacramento Road, but sufficient storage length is required to eliminate the potential for congestion on the internal circulation system and an adverse impact.

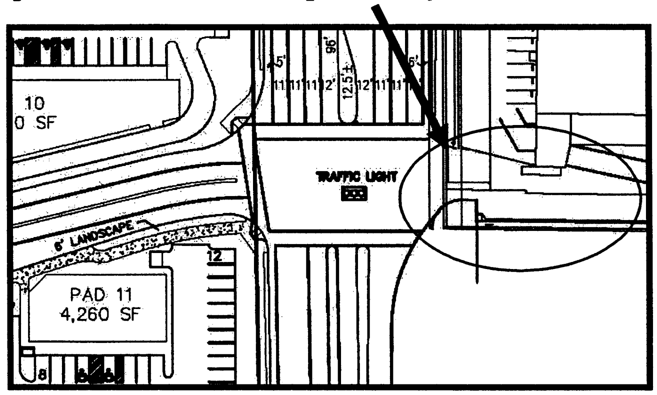
Mitigation

The project site plan shall be modified to provide dual eastbound left-turn movements out of the project site onto northbound Lower Sacramento Road, consisting of a 150-foot left-turn pocket and a full lane back to the internal project site intersection. In the westbound direction, a left-turn pocket and a full lane will provide adequate capacity for inbound traffic.

In addition, STOP signs shall be installed on all approaches at the on-site intersection adjacent to Pads 10 and 11, except the westbound approach to provide continuous traffic flow into the project site and eliminate the potential for an adverse impact onto Lower Sacramento Road.

On the Food 4 Less approach, a 100-foot left-turn pocket will be provided at the signalized intersection. With dual left-turn lanes in the eastbound directions, protected left-turn movements for eastbound (out of the proposed shopping center) and westbound (out of the Food 4 Less Driveway) approaches are required to eliminate the potential for accidents.

In addition, the site plan modification to the Food 4 Less property will be reviewed by the City of Lodi to ensure that vehicle and trucks entering the driveway do not result in vehicle queues backing up onto Lower Sacramento Road.

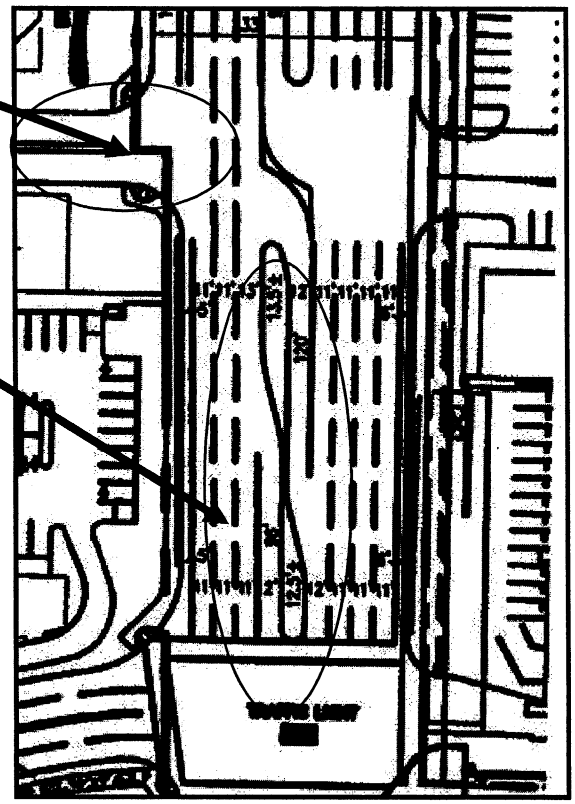


Under Cumulative + Project PM Peak Hour Conditions, the intersection would continue to operate at acceptable LOS C (average delay of 24.4. seconds) with a 90 second cycle length and at LOS C (average delay of 27.3 seconds) with a 150 second cycle length. The longer cycle length would provide improved coordination on Lower Sacramento Road, but would result in marginally longer delays for traffic exiting either the Proposed Project Driveway or Food 4 Less Driveway.

Implementation of this mitigation measure would reduce Impact 4 to less-than-significant.

Impact 5 **On Lower Sacramento Road, a non-City standard 60 foot back-to-back taper is provided between the 120-foot northbound left-turn lane (Alternative B) and the southbound left-turn lane at the signalized Food 4 Less Driveway / Project Driveway (located approximately 325 feet south of West Kettleman Lane). For Cumulative Plus Project PM peak hour conditions, signal operations at the proposed Lower Sacramento Road / Project Driveway / Food 4 Less intersection, located 625 feet south of West Kettleman Lane would block vehicles making the northbound left-turn movement into the project site or right-turn vehicles exiting the project site.**

Analysis: Based on the project site plan, the following geometric designs were identified:



a) A right-turn in / right-turn out driveway

b) Single 120-foot NB left-turn pockets;

c) A 60 foot back-to-back taper;

d) A 96-foot SB left-turn pocket.

e) Total distance of 276 feet; and

Heavy southbound traffic volumes on Lower Sacramento Road result in vehicles backing up in the two southbound travel lanes when the signal is red to serve vehicles exiting the project site and the Food 4 Less Driveway. The vehicle queue would block northbound left-turning vehicles from safely entering the project site between Pads 8 and 7 and result in LOS F conditions. In addition the southbound queue would also block exiting vehicles from making the eastbound right-turn movement onto southbound Lower Sacramento Road.

Based on the results of the Cumulative Plus Project PM Peak Hour analysis, the following maximum queue lengths and design standards would apply along this section of Lower Sacramento Road:

a) A maximum NB left-turn queue of 100 feet;
b) A maximum SB left-turn queue of 100 feet;
c) Lower Sacramento Road Widening Project Design of 50 feet deceleration lane for the SB left-turn lane into Food 4 Less;
d) City required 50 feet deceleration lane for the NB left-turn lane into the project site; and
b) A City required minimum turn pocket taper of 120 feet.
c) Total distance of 420 feet.

Mitigation The following site plan modifications will be made:

a) Extend the third southbound travel lane on Lower Sacramento Road from its current terminus at the signalized project driveway to the southern boundary of the project site;
b) Construct a 100-foot right turn lane at the signalized driveway;
c) Extend the southbound left-turn pocket to 100 feet;
d) Include 50 feet for deceleration (resulting in an effective pocket length of 150 feet);
e) Extend the taper from 60 feet to a City standard 120-foot taper; and
f) With the required SB left-turn pocket, deceleration and City standard 120-foot taper, <u>the northbound left-turn lane into the northern Project Driveway (Alternative B) would need to be eliminated</u>.

With the implementation of this mitigation measure, vehicles entering the project site at the signalized driveway will have a dedicated right-turn pocket and would not impact traffic flow on southbound Lower Sacramento Road. In addition, the extension of the third southbound travel lane will reduce southbound queuing at the signalized project driveway and improve egress from the northern right-turn out project driveway located 320 feet south of the W. Kettleman Lane / Lower Sacramento Road intersection.

It should be noted that the required pocket length of 150 feet and City standard taper of 120 feet is consistent with the *Improvement Plans for the Sacramento Road Widening Project*, which is under Final Design by the City of Lodi and Mark Thomas & Company

Implementation of this mitigation measure would reduce Impact 5 to less-than-significant.

Impact 6 **An unsignalized access drive is proposed with the Project (Access Alternative A and Access Alternative B) along the West Kettleman Lane frontage, approximately 525 feet west of Lower Sacramento Road. For Cumulative Plus Project PM peak hour conditions, projected queue length of 175 (average queue) to 250 feet (95^{th} Percentile queue) of exiting vehicles would extend south towards the internal intersection located between Pad 3 and Wal-Mart.**

Analysis: Heavy eastbound traffic volumes on West Kettleman Lane result in vehicles exiting the project site waiting for acceptable gaps in the traffic stream. Signal operations at the West Kettleman Lane / Westgate Drive intersection provide gaps during the westbound left-turn and northbound / southbound left-turn and through phases. But sufficient storage length is required to eliminate the potential for congestion on the internal circulation system and an adverse impact. The site plan shows 285 feet between the driveway on West Kettleman Lane and the internal project site intersection. Less Than Significant Cumulative Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Impact 7 **An unsignalized access drive is proposed with the Project (Access Alternative A and Access Alternative B) project along the Lower Sacramento Road frontage, approximately 325 feet south of West Kettleman Lane. For Cumulative Plus Project PM peak hour conditions, projected queue length of 50 (average queue) to 100 feet (95^{th} Percentile queue) of exiting vehicles would extend back toward the first drive aisle between Pads 8 and 9.**

Analysis: Heavy southbound traffic volumes on Lower Sacramento Road result in vehicles exiting the project site waiting for acceptable gaps in the traffic stream. Signal operations at the West Kettleman Lane / Lower Sacramento Road intersection provide gaps during the northbound left-turn and eastbound / westbound through phases. But sufficient storage length is required to eliminate the potential for congestion on the internal circulation system and an adverse impact. In addition, heavy southbound right-turn volumes in excess of 325 vehicles during p.m. peak hour conditions will use this driveway to enter the project site.

The project site plan shows a raised median to prevent inbound vehicles from making a left-turn into the drive aisle between Pads 8 and 9. The drive aisle would be limited to right-turn in / right turn out volume, eliminating the potential for vehicles to back up onto southbound Lower Sacramento Road.

Less Than Significant Cumulative Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Impact 8 **An unsignalized access drive is proposed with the project along the Westgate Drive frontage, approximately 340 feet south of West Kettleman Lane. For Cumulative Plus Project PM peak hour conditions, projected southbound queue length of 50 (average queue) to**

100 feet (95th Percentile queue) of entering vehicles would extend back toward the signalized intersection of West Kettleman Lane / Westgate Drive.

Analysis: Under Cumulative Plus Project p.m. peak hour conditions, 170 vehicles are projected to make the southbound left-turn movement from Westgate Drive into the project site. The project site plan shows a 136 foot left-turn pocket that will provide sufficient storage to serve the projected 95th percentile queue length and not impact operations at the signalized West Kettleman Lane / Westgate Drive intersection.

Less Than Significant Cumulative Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Impact 9 **On Westgate Drive, a non-City standard 64 foot back-to-back taper is provided between the northbound left-turn lane at W. Kettleman Lane and the southbound left-turn lane at the northern Project Driveway.**

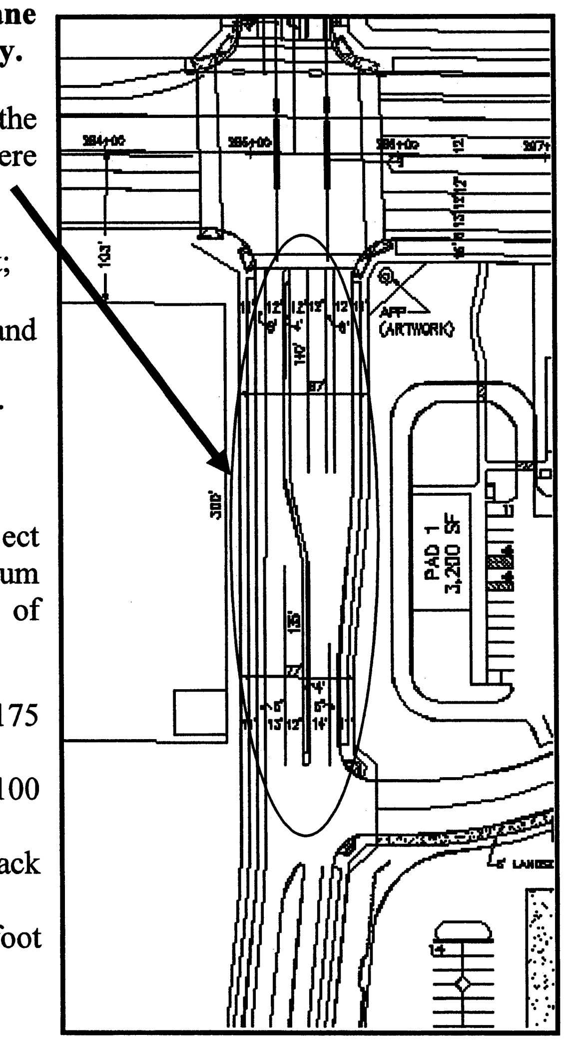
Analysis: Based on the project site plan, the following geometric designs were identified:

a) A 140-foot NB left-turn pocket;

b) A 64 foot back-to-back taper; and

c) A 136-foot SB left-turn pocket.

d) Total distance of 340 feet.



Based on the results of the Cumulative Plus Project PM Peak Hour analysis, the following maximum queue lengths would occur along this section of Westgate Drive:

a) A maximum NB left-turn queue of 175 feet;
b) A maximum SB left-turn queue of 100 feet; and
c) A City required minimum back-to-back taper of 90 feet.
d) Total distance of 365 feet with a 90-foot taper.

Mitigation The following site plan modification will be made:

a) Extend the northbound right-turn pocket to 180 feet with a 120 foot taper
b) Provide a 175-foot left-turn pocket
c) Provide a 90-foot back-to-back taper
d) Provide a 100-foot southbound left-turn pocket
e) Move the northern project driveway on Westgate Avenue 25 feet to the south to provide the required storage lengths and City standard 90-foot back-to-back taper.

The project site plan shows that there is approximately 47 to 60 feet between the back of the 8-foot sidewalk and the north wall of the Tire & Lube Express Building. With the 6-foot landscape, there is approximately 41 to 54 feet between the landscaping and the north wall of the Tire Lube Express area of the Wal-Mart building.

Therefore, the Westgate Drive North Project Driveway can be moved south 25 feet and still provide a minimum 16 foot drive aisle between the landscaped area and the north wall of the Tire & Lube Express area of the Wal-Mart building.

Implementation of this mitigation measure would reduce Impact 9 to less-than-significant.

Impact 10 **On Lower Sacramento Road, a non-City standard 70 foot back-to-back taper is provided between the dual northbound left-turn lanes at W. Kettleman Lane and the southbound left-turn lane at the middle Food 4 Less Driveway.**

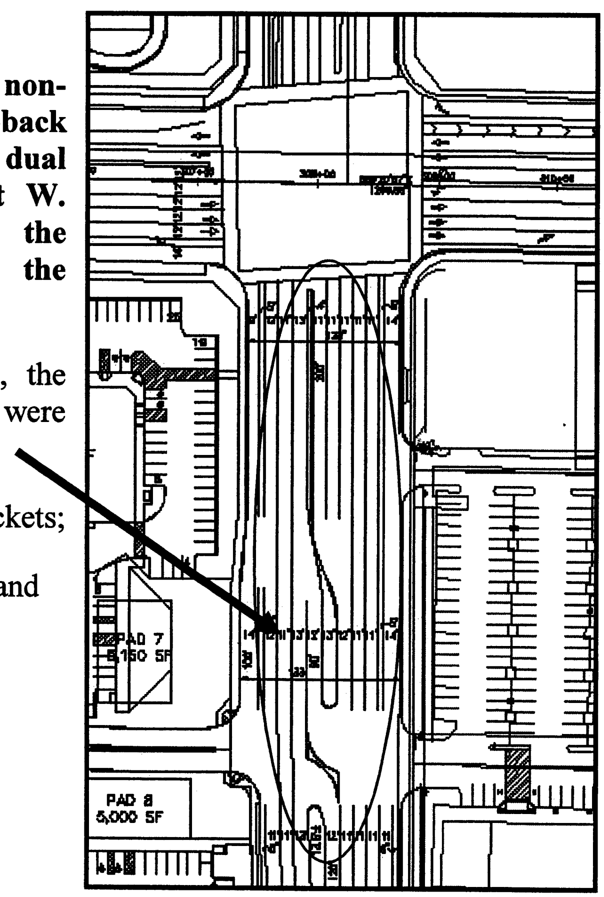
Analysis: Based on the project site plan, the following geometric designs were identified:

a) Dual 200-foot NB left-turn pockets;

b) A 70 foot back-to-back taper; and

c) A 90-foot SB left-turn pocket.

d) Total distance of 360 feet.



Based on the results of the Cumulative Plus Project PM Peak Hour analysis, the following maximum queue lengths would occur along this section of Lower Sacramento Road:

d) A maximum NB left-turn queue of 250 feet;
e) A maximum SB left-turn queue of 80 feet; and
f) A City required minimum back-to-back taper of 120 feet.
g) Total distance of 450 feet.

Mitigation The following site plan modification will be made:

a) Extend the northbound left-turn pocket to 250 feet;
b) Extend the taper from 70 feet to a City standard 120-foot taper; and
c) With the required NB left-turn pocket and City standard 120-foot taper, the southbound left-turn lane into the middle Food 4 Less Driveway would need to be eliminated.

It should be noted that the required pocket length of 250 feet and City standard taper of 120 feet is consistent with the *Improvement Plans for the Sacramento Road Widening Project*, which is under Final Design by the City of Lodi and Mark Thomas & Company

Implementation of this mitigation measure would reduce Impact 10 to less-than-significant.

Transit System Impacts

The following project-specific impacts on the transit system were identified based on the established significance criteria.

Impact 11 **Development of the project would create a demand for increased public transit service above that which is currently provided or planned.**

Analysis: Typical weekday activities within the site would attract residents from Lodi and San Joaquin County, some of whom would use public transit, if available, to access the site. Since the existing transit service may not be sufficient to serve existing land uses, approved land uses in the area, and the proposed project, this is considered a significant impact.

Based on a transit ridership analysis completed by the City of Lodi, the addition of the Wal-Mart SuperCenter along with the other stores in the proposed shopping center would result in a 20% increase in demand on transit. This would exceed the capacity of the existing transit system and would require the purchase of an additional transit vehicle.

Based on information provided by the City of Lodi, The additional vehicle should be based off of a purchase price of $80,000 and the annual operating cost would be roughly $60,000.00

Mitigation *The project applicant shall work with and provide fair share funding to the City of Lodi Grapeline Service and the San Joaquin Regional Transit District to expand transit service to the project site.*

Implementation of this mitigation measure would reduce Impact 11 to less-than-significant.

Impact 12 **Development of the project would create an unmet demand for public transit service and warrant the installation of additional transit facilities within the project site.**

Analysis: Typical weekday activities within the site would create the demand for public transit service to the project site. To accommodate transit vehicles, an on-site transit stop would be needed.

Mitigation *A transit stop is shown on the south-west corner of the internal site intersection (between Wal-Mart and Pad 3). The transit stop shall be modified to provide a bus bay to eliminate the potential for a transit vehicle blocking the internal intersection while dropping off or picking up passengers. In addition, a sheltered transit stop should be provided for inclement weather or high temperatures.*

But based on the size of the project, a second transit stop located within the project site and near Lower Sacramento Road is required. The second transit stop shall be located next to Pad 10 and would require elimination of eight parking spaces to provide a bus bay and sheltered transit stop

Implementation of this mitigation measure would reduce Impact 12 to less-than-significant.

Bicycle and Pedestrian System Impacts

The following project-specific impact on the bicycle and pedestrian systems was identified based on the established significance criteria.

Impact 13 **Development of the project would create a demand for bicycle facilities along West Kettleman Lane, Lower Sacramento Road, and Westgate Drive.**

Analysis: Typical weekday activities within the site would create a demand for bicycle facilities along West Kettleman Lane and Lower Sacramento Road. Bicycle lanes are provided on Lower Sacramento Road north of Kettleman

Lane, Kettleman Lane east of Lower Sacramento Road, and West Century Boulevard east of Sage Way.. According to the City of Lodi's website, bicycle lanes are proposed on Lower Sacramento Road from Kettleman Lane to Harney Lane and West Century Boulevard from Lower Sacramento Road to Sage Way.

The project applicant will provide bicycle racks in front of all 13 retail buildings in order to meet Standard 17.58.142 (F) of the City of Lodi Ordinance No. 1746

The project site plan shows that the applicant shall construct a Class II on-street bicycle lane on eastbound West Kettleman Lane, southbound Lower Sacramento Road and northbound / southbound Westgate Drive along the project's frontage.

Less Than Significant Cumulative Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Impact 14 **Development of the project would create an unmet demand for pedestrian facilities along West Kettleman Lane, Lower Sacramento Road, Westgate Drive, and internally between the different areas of the project site.**

Analysis: The project site plan shows sidewalks being provided on the segments of Kettleman Lane and Lower Sacramento Road along the frontage of the project site. In addition, the proposed project would provide sidewalks on the east side of Westgate Drive as part of the roadway extension along the west project frontage. In addition, pedestrian walkways and crosswalks are proposed between Wal-Mart and the majority of pads within the project site. However, gaps in the internal pedestrian circulation system serving Pads 8, 9, and 12 were identified on the project site plan.

Mitigation Pedestrian walkways and crosswalks should be provided to serve Pads 8, 9, and 12 in order to complete the internal pedestrian circulation system.

Implementation of this mitigation measure would reduce Impact 15 to less-than-significant.

Parking

Impact 15 **Development of the project would create a demand for off-street parking spaces**

Analysis: The City of Lodi General Plan requires new developments to provide an adequate number of off-street parking spaces in accordance with City parking standards. As specified City's *Design Standards for Large Retail Establishments* (adopted April 7, 2004), the minimum number of off-street parking spaces to be provided by a large-scale retail operation shall be 2 spaces for every 1,000 square feet of building space. The maximum number of off-street parking spaces shall not exceed five (5) spaces for every 1,000 square feet of building space.

The proposed site plan provides 1,641 off-street parking spaces for 339,966 square feet of building space. This corresponds to 4.83 spaces per 1,000 square feet of building space, which falls over the minimum and under the maximum permitted by the design standards.

Less Than Significant Cumulative Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Impact 16 Development of the project would create a demand for on-site truck circulation and site access from W. Kettleman Lane, Lower Sacramento Road, and Westgate Drive.

Analysis: The City of Lodi General Plan requires new developments to provide adequate width of on-site travel lanes and curb radii for on-site truck circulation. In addition, adequate access and egress from the surrounding roadway system must be provided for truck traffic without impacting traffic flow on W. Kettleman Lane, Lower Sacramento Road, and Westgate Drive.

The proposed site plan was reviewed for both on-site truck circulation and site access from the surrounding roadway system. It was determined that adequate width was provided for on-site travel lanes to serve both single unit (WB-20) and tractor-trailer unit (WB-40) trucks. In addition, it was determined that the project driveways (i.e., two on Westgate Drive, one on W. Kettleman Lane and three on Lower Sacramento Road) all provide sufficient curb radii to serve project generated truck traffic entering and exiting the project site.

As discussed above under Impacts 4, 5, 9, 10, 11, 12, and 14, modifications to the site plan are required to mitigate identified traffic and circulation impacts to the roadway network adjacent to the project site. For purposes of this analysis, it is reasonable to expect that the City of Lodi will ensure that the required project design changes do not result in deficiencies with regard to adequate lane widths and turn radii for truck access and internal circulation. As such, the project is not expected to result in a significant impact in terms of truck access and circulation.

Analysis Result: Less Than Significant Cumulative Plus Project Impact

Mitigation A less than significant impact was identified. Therefore, no mitigation is required.

Table 8 summarizes the significant transportation impacts and mitigation measures associated with the proposed project.

Table 8

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES – TRANSPORTATION AND CIRCULATION

#	Impact	Level of Significance	Mitigation Measure
1	Near Term Plus Project Access Alternative A and Access Alternative B Signalized Intersection Operations	❍	A less than significant impact was identified. Therefore, no mitigation is required
2	Near Term Plus Project Access Alternative A and Access Alternative B Unsignalized Intersection Operations	⊙	The project applicant shall contribute its fair share cost for the installation of a traffic signal at the intersection of Lower Sacramento Road / Harney Lane
3	Cumulative Plus Project Access Alternative A and Access Alternative B Signalized Intersection Operations	❍	A less than significant impact was identified. Therefore, no mitigation is required
4	Eastbound queue length at the signalized access driveway on Lower Sacramento Road	⊙	Provide dual eastbound left-turn movements out of the project site onto northbound Lower Sacramento Road. In addition, STOP signs will be installed on all on-site approaches except the westbound approach
5	Non-standard 60 foot back-to-back taper on Lower Sacramento Road and queuing impact from signalized project driveway.	⊙	Extend the third southbound travel lane from its current terminus at the signalized project driveway to the southern boundary of the project site and construction of a 100-foot right-turn lane at the signalized project driveway. Extend the southbound left-turn pocket to the required 150 feet; provide a City standard 60-foot taper. Eliminate the northbound left-turn lane into the northern Project Driveway (Alternative B).
6	Northbound queue length at unsignalized access driveway on West Kettleman Lane	❍	A less than significant impact was identified. Therefore, no mitigation is required
7	Eastbound queue length at the unsignalized access driveway on Lower Sacramento Road	❍	A less than significant impact was identified. Therefore, no mitigation is required

Notes:
- ❍ Less Than Significant Impact
- ● Significant impact before and after mitigation
- ⊙ Significant impact before mitigation; less than significant impact after mitigation

Source: Fehr & Peers Associates, 2004.

Table 8 (Cont.)

SUMMARY OF SIGNIFICANT IMPACTS AND MITIGATION MEASURES – TRANSPORTATION AND CIRCULATION

#	Impact	Level of Significance	Mitigation Measure
8	Southbound queue length at the unsignalized access driveway on Westgate Drive	❍	A less than significant impact was identified. Therefore, no mitigation is required
9	Non-standard 64 foot back-to-back taper on Westgate Drive	⊙	Move the northern project driveway on Westgate Drive 25 feet to the south to provide the required storage lengths and City standard 90-foot back-to-back taper
10	Non-standard 70 foot back-to-back taper on Lower Sacramento Road	⊙	Extend the northbound left-turn pocket to the required 250 feet, provide a City standard 120-foot taper. Eliminate the southbound left-turn lane into the middle Food 4 Less Driveway.
11	Unmet transit demand	⊙	Work with Lodi Grapeline Service and the San Joaquin Regional Transit District to expand transit service
12	Insufficient transit facilities on-site	⊙	Provide a second transit stop located within the project site near Lower Sacramento Road.
13	Unmet demand for bicycle facilities	❍	A less than significant impact was identified. Therefore, no mitigation is required
14	Unmet demand for pedestrian facilities	⊙	A less than significant impact was identified. Therefore, no mitigation is required
15	Unmet demand for off-site parking spaces	❍	A less than significant impact was identified. Therefore, no mitigation is required
16	Unmet demand for on-site truck circulation and project site access and egress for truck traffic	⊙	Project applicant shall provide a site plan showing electronic truck routes and turning templates into and out of the project site

Notes:
- ❍ Less Than Significant Impact
- ● Significant impact before and after mitigation
- ⊙ Significant impact before mitigation; less than significant impact after mitigation

Source: Fehr & Peers Associates, 2004.

Appendix A

Existing Conditions
AM and PM Peak Hour
Intersection Level of Service Analysis

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↱		↰↰	↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	3271		3213	3312	1462	3213	4759	1462	3213	3312	1462
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	3271		3213	3312	1462	3213	4759	1462	3213	3312	1462
Volume (vph)	115	245	20	125	290	95	50	225	100	170	450	140
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	266	22	136	315	103	54	245	109	185	489	152
RTOR Reduction (vph)	0	5	0	0	0	78	0	0	77	0	0	37
Lane Group Flow (vph)	125	283	0	136	315	25	54	245	32	185	489	115
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	6.6	13.5		6.8	13.7	13.7	3.7	16.8	16.8	7.5	20.6	20.6
Effective Green, g (s)	7.1	16.0		7.3	16.2	16.2	4.2	19.3	19.3	8.0	23.1	23.1
Actuated g/C Ratio	0.11	0.24		0.11	0.24	0.24	0.06	0.29	0.29	0.12	0.35	0.35
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5		3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	343	786		352	806	356	203	1379	424	386	1149	507
v/s Ratio Prot	0.04	0.09		c0.04	c0.10		0.02	0.05		c0.06	c0.15	
v/s Ratio Perm						0.02			0.02			0.08
v/c Ratio	0.36	0.36		0.39	0.39	0.07	0.27	0.18	0.07	0.48	0.43	0.23
Uniform Delay, d1	27.7	21.0		27.6	21.1	19.4	29.7	17.7	17.2	27.4	16.7	15.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1		0.7	0.1	0.0	0.7	0.0	0.1	0.9	0.2	0.2
Delay (s)	28.3	21.1		28.3	21.2	19.4	30.4	17.8	17.2	28.3	16.9	15.6
Level of Service	C	C		C	C	B	C	B	B	C	B	B
Approach Delay (s)		23.3			22.6			19.3			19.2	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	66.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	125	288	136	315	103	54	245	109	185	489	152
v/c Ratio	0.28	0.35	0.30	0.38	0.23	0.15	0.18	0.22	0.38	0.42	0.27
Control Delay	35.9	24.5	35.6	24.8	6.6	39.1	22.2	6.3	34.4	19.9	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.9	24.5	35.6	24.8	6.6	39.1	22.2	6.3	34.4	19.9	14.7
Queue Length 50th (ft)	22	50	24	55	0	9	26	0	32	78	27
Queue Length 95th (ft)	84	132	89	144	41	44	77	42	114	208	108
Internal Link Dist (ft)		3890		920			405			630	
Turn Bay Length (ft)	200		225		180	145		200	200		50
Base Capacity (vph)	922	1844	997	1899	881	740	2346	775	785	1741	794
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.16	0.14	0.17	0.12	0.07	0.10	0.14	0.24	0.28	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑↱			↰↑↱		↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			0.95		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			0.99		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.99		0.95	0.99	1.00
Satd. Flow (prot)	1656	3312	1446	1656	3243			2927		1573	1642	1461
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.99		0.95	0.99	1.00
Satd. Flow (perm)	1656	3312	1446	1656	3243			2927		1573	1642	1461
Volume (vph)	25	465	25	160	445	65	20	25	95	60	45	45
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	505	27	174	484	71	22	27	103	65	49	49
RTOR Reduction (vph)	0	0	15	0	5	0	0	92	0	0	0	43
Lane Group Flow (vph)	27	505	12	174	550	0	0	60	0	55	59	6
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot			Split			Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2									4
Actuated Green, G (s)	2.7	34.0	34.0	12.3	43.6			8.1		8.9	8.9	8.9
Effective Green, g (s)	2.7	35.3	35.3	12.3	44.9			8.3		9.1	9.1	9.1
Actuated g/C Ratio	0.03	0.44	0.44	0.15	0.55			0.10		0.11	0.11	0.11
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3			4.2		4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8	2.8	2.5	2.5			2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	55	1443	630	251	1798			300		177	184	164
v/s Ratio Prot	0.02	c0.15		c0.11	0.17			c0.02		0.03	c0.04	
v/s Ratio Perm			0.01									0.00
v/c Ratio	0.49	0.35	0.02	0.69	0.31			0.20		0.31	0.32	0.03
Uniform Delay, d1	38.5	15.2	13.0	32.6	9.7			33.3		33.1	33.1	32.0
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2	2.5	0.1	0.0	7.4	0.1			0.1		0.4	0.4	0.0
Delay (s)	41.0	15.3	13.0	40.0	9.8			33.4		33.4	33.5	32.1
Level of Service	D	B	B	D	A			C		C	C	C
Approach Delay (s)		16.5			17.0			33.4			33.0	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	81.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	27	505	27	174	555	152	55	59	49
v/c Ratio	0.22	0.36	0.04	0.64	0.30	0.36	0.28	0.29	0.22
Control Delay	41.6	22.4	11.7	30.1	14.0	12.9	31.9	31.7	11.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.6	22.4	11.7	30.1	14.0	12.9	31.9	31.7	11.6
Queue Length 50th (ft)	8	70	0	50	42	7	16	17	0
Queue Length 95th (ft)	56	266	25	219	240	48	83	88	35
Internal Link Dist (ft)		920			1520	470		475	
Turn Bay Length (ft)	360		185	240			150		150
Base Capacity (vph)	367	1960	863	610	2279	990	499	521	496
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.26	0.03	0.29	0.24	0.15	0.11	0.11	0.10

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑	↱	↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1447	1656	1743	1448	1656	1646		1656	1743	1462
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1447	1656	1743	1448	1656	1646		1656	1743	1462
Volume (vph)	30	540	50	35	540	65	80	135	70	95	110	50
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	587	54	38	587	71	87	147	76	103	120	54
RTOR Reduction (vph)	0	0	17	0	0	17	0	10	0	0	0	43
Lane Group Flow (vph)	33	587	37	38	587	54	87	213	0	103	120	11
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	3.7	40.9	40.9	3.9	41.1	41.1	7.8	17.0		8.5	17.7	17.7
Effective Green, g (s)	3.7	42.6	42.6	3.9	42.8	42.8	7.8	17.6		8.5	18.3	18.3
Actuated g/C Ratio	0.04	0.48	0.48	0.04	0.48	0.48	0.09	0.20		0.10	0.21	0.21
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5	5.5	2.0	5.5	5.5	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	69	1592	696	73	842	699	146	327		159	360	302
v/s Ratio Prot	0.02	0.18		c0.02	c0.34		0.05	c0.13		c0.06	0.07	
v/s Ratio Perm			0.03			0.04						0.01
v/c Ratio	0.48	0.37	0.05	0.52	0.70	0.08	0.60	0.65		0.65	0.33	0.04
Uniform Delay, d1	41.5	14.5	12.3	41.4	17.8	12.3	38.9	32.7		38.6	30.0	28.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	0.4	0.1	3.1	3.5	0.1	4.3	3.5		6.6	0.2	0.0
Delay (s)	43.4	14.9	12.3	44.5	21.3	12.4	43.2	36.2		45.2	30.2	28.1
Level of Service	D	B	B	D	C	B	D	D		D	C	C
Approach Delay (s)		16.1			21.7			38.1			35.4	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM Average Control Delay	24.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	88.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	33	587	54	38	587	71	87	223	103	120	54
v/c Ratio	0.22	0.37	0.08	0.27	0.70	0.10	0.48	0.67	0.52	0.34	0.16
Control Delay	57.9	17.7	9.8	57.5	23.7	11.1	53.2	41.8	51.9	41.0	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.9	17.7	9.8	57.5	23.7	11.1	53.2	41.8	51.9	41.0	12.4
Queue Length 50th (ft)	18	112	6	21	263	12	48	115	57	60	0
Queue Length 95th (ft)	74	251	37	82	620	51	153	305	174	173	39
Internal Link Dist (ft)		1520			2225			975		905	
Turn Bay Length (ft)	100		100	165		165	200		120		140
Base Capacity (vph)	430	2222	978	369	1150	963	387	631	455	712	628
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.26	0.06	0.10	0.51	0.07	0.22	0.35	0.23	0.17	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations				↰		↱		↰	↑↑	↱	↰	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor				1.00		1.00		1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes				1.00		0.99		1.00	1.00	0.98	1.00	1.00
Flpb, ped/bikes				1.00		1.00		1.00	1.00	1.00	1.00	1.00
Frt				1.00		0.85		1.00	1.00	0.85	1.00	1.00
Flt Protected				0.95		1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)				1656		1460		1656	3312	1445	1656	3312
Flt Permitted				0.95		1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)				1656		1460		1656	3312	1445	1656	3312
Volume (vph)	0	0	0	20	0	35	5	0	405	25	90	735
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	22	0	38	5	0	440	27	98	799
RTOR Reduction (vph)	0	0	0	0	0	29	0	0	0	16	0	0
Lane Group Flow (vph)	0	0	0	22	0	9	0	5	440	11	98	799
Confl. Peds. (#/hr)						2				2		
Turn Type				Prot		custom	Prot	Prot		Perm	Prot	
Protected Phases				3			5	5	2		1	6
Permitted Phases						8				2		
Actuated Green, G (s)				10.6		10.6		1.5	18.0	18.0	5.4	21.2
Effective Green, g (s)				10.7		10.7		2.0	19.4	19.4	5.5	22.9
Actuated g/C Ratio				0.22		0.22		0.04	0.41	0.41	0.12	0.48
Clearance Time (s)				4.1		4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)				3.0		3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)				372		328		70	1350	589	191	1593
v/s Ratio Prot				c0.01				0.00	0.13		c0.06	c0.24
v/s Ratio Perm						0.01				0.01		
v/c Ratio				0.06		0.03		0.07	0.33	0.02	0.51	0.50
Uniform Delay, d1				14.5		14.4		21.9	9.6	8.4	19.8	8.4
Progression Factor				1.00		1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2				0.1		0.0		0.4	0.2	0.0	2.3	0.2
Delay (s)				14.6		14.4		22.3	9.8	8.4	22.1	8.7
Level of Service				B		B		C	A	A	C	A
Approach Delay (s)		0.0			14.5				9.9			10.2
Approach LOS		A			B				A			B

Intersection Summary			
HCM Average Control Delay	10.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	47.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	22	38	5	440	27	98	799
v/c Ratio	0.06	0.10	0.02	0.33	0.05	0.28	0.47
Control Delay	18.6	8.6	21.0	11.1	5.1	19.9	8.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.6	8.6	21.0	11.1	5.1	19.9	8.2
Queue Length 50th (ft)	15	0	1	48	0	28	46
Queue Length 95th (ft)	23	21	9	81	12	64	149
Internal Link Dist (ft)				630			1447
Turn Bay Length (ft)	100		150			180	
Base Capacity (vph)	456	429	364	1588	706	390	1873
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.09	0.01	0.28	0.04	0.25	0.43

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	35	20	355	35	40	555
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	22	386	38	43	603
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						485
pX, platoon unblocked	0.83					
vC, conflicting volume	1100	217			429	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1121	217			429	
tC, single (s)	7.0	7.1			4.3	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	75	97			96	
cM capacity (veh/h)	150	763			1074	
Direction, Lane #	**WB 1**	**NB 1**	**NB 2**	**SB 1**	**SB 2**	
Volume Total	60	257	167	43	603	
Volume Left	38	0	0	43	0	
Volume Right	22	0	38	0	0	
cSH	211	1700	1700	1074	1700	
Volume to Capacity	0.28	0.15	0.10	0.04	0.35	
Queue Length 95th (ft)	28	0	0	3	0	
Control Delay (s)	28.6	0.0	0.0	8.5	0.0	
Lane LOS	D			A		
Approach Delay (s)	28.6	0.0		0.6		
Approach LOS	D					
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization			39.2%	ICU Level of Service		A
Analysis Period (min)			15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	95	5	180	155	105	5	265	80	110	430	45
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	103	5	196	168	114	5	288	87	120	467	49

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total (vph)	130	478	293	87	636
Volume Left (vph)	22	196	5	0	120
Volume Right (vph)	5	114	0	87	49
Hadj (s)	0.16	-0.09	0.16	-0.55	-0.14
Departure Headway (s)	9.0	7.4	8.4	7.7	7.8
Degree Utilization, x	0.33	0.99	0.69	0.19	1.37
Capacity (veh/h)	386	480	418	458	469
Control Delay (s)	16.3	65.8	26.7	11.3	203.8
Approach Delay (s)	16.3	65.8	23.1		203.8
Approach LOS	C	F	C		F

Intersection Summary			
Delay	105.8		
HCM Level of Service	F		
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

1: W. Kettleman Lane & Lower Sacramento Road

HCM Signalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↱		↰↰	↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	3246		3213	3312	1462	3213	4759	1462	3213	3312	1462
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	3246		3213	3312	1462	3213	4759	1462	3213	3312	1462
Volume (vph)	170	395	55	200	300	130	55	525	95	220	335	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	185	429	60	217	326	141	60	571	103	239	364	120
RTOR Reduction (vph)	0	8	0	0	0	101	0	0	74	0	0	38
Lane Group Flow (vph)	185	481	0	217	326	40	60	571	29	239	364	82
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	8.4	18.7		11.1	21.4	21.4	4.1	20.8	20.8	11.1	27.8	27.8
Effective Green, g (s)	8.9	21.2		11.6	23.9	23.9	4.6	23.3	23.3	11.6	30.3	30.3
Actuated g/C Ratio	0.11	0.25		0.14	0.29	0.29	0.05	0.28	0.28	0.14	0.36	0.36
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5		3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	342	822		445	946	417	177	1325	407	445	1199	529
v/s Ratio Prot	0.06	c0.15		c0.07	c0.10		0.02	c0.12		c0.07	0.11	
v/s Ratio Perm						0.03			0.02			0.06
v/c Ratio	0.54	0.58		0.49	0.34	0.10	0.34	0.43	0.07	0.54	0.30	0.16
Uniform Delay, d1	35.5	27.4		33.3	23.7	22.0	38.1	24.8	22.2	33.6	19.1	18.1
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	0.7		0.8	0.1	0.0	1.1	0.2	0.1	1.3	0.1	0.1
Delay (s)	37.2	28.1		34.1	23.8	22.0	39.2	24.9	22.3	34.8	19.2	18.2
Level of Service	D	C		C	C	C	D	C	C	C	B	B
Approach Delay (s)		30.6			26.7			25.7			24.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	26.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	83.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	185	489	217	326	141	60	571	103	239	364	120
v/c Ratio	0.45	0.61	0.47	0.33	0.27	0.21	0.47	0.23	0.52	0.30	0.21
Control Delay	39.1	28.8	38.1	26.5	6.0	44.0	27.3	7.0	39.4	22.1	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.1	28.8	38.1	26.5	6.0	44.0	27.3	7.0	39.4	22.1	14.3
Queue Length 50th (ft)	40	104	47	66	0	13	81	0	52	67	20
Queue Length 95th (ft)	117	233	133	154	48	49	180	42	148	162	83
Internal Link Dist (ft)		3390		920			405			630	
Turn Bay Length (ft)	200		225		180	145		200	200		50
Base Capacity (vph)	752	1628	855	1746	836	589	2000	673	656	1553	716
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.30	0.25	0.19	0.17	0.10	0.29	0.15	0.36	0.23	0.17

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↱			↰↑↱		↰	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			0.95		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			0.99		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97			0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.99		0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1445	1656	3199			2944		1573	1651	1461
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.99		0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1445	1656	3199			2944		1573	1651	1461
Volume (vph)	80	550	80	315	515	135	60	75	240	130	120	55
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	598	87	342	560	147	65	82	261	141	130	60
RTOR Reduction (vph)	0	0	54	0	13	0	0	223	0	0	0	53
Lane Group Flow (vph)	87	598	33	342	694	0	0	185	0	132	139	7
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot			Split			Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases			2									4
Actuated Green, G (s)	7.8	25.7	25.7	25.5	43.4			11.7		10.9	10.9	10.9
Effective Green, g (s)	7.8	27.0	27.0	25.5	44.7			11.9		11.1	11.1	11.1
Actuated g/C Ratio	0.09	0.30	0.30	0.28	0.49			0.13		0.12	0.12	0.12
Clearance Time (s)	4.0	5.3	5.3	4.0	5.3			4.2		4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8	2.8	2.5	2.5			2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	141	977	426	462	1563			383		191	200	177
v/s Ratio Prot	0.05	c0.18		c0.21	0.22			c0.06		0.08	c0.08	
v/s Ratio Perm			0.02									0.00
v/c Ratio	0.62	0.61	0.08	0.74	0.44			0.48		0.69	0.69	0.04
Uniform Delay, d1	40.4	27.7	23.3	30.0	15.3			36.9		38.6	38.6	35.5
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2	5.5	1.1	0.1	6.0	0.1			0.4		8.4	8.2	0.0
Delay (s)	45.9	28.8	23.3	35.9	15.4			37.3		46.9	46.7	35.5
Level of Service	D	C	C	D	B			D		D	D	D
Approach Delay (s)		30.1			22.1			37.3			44.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	29.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	91.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	87	598	87	342	707	408	132	139	60
v/c Ratio	0.51	0.65	0.19	0.75	0.45	0.67	0.60	0.60	0.24
Control Delay	51.3	34.1	11.2	40.0	20.6	18.4	46.3	45.9	12.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.3	34.1	11.2	40.0	20.6	18.4	46.3	45.9	12.8
Queue Length 50th (ft)	46	154	4	167	180	42	73	77	0
Queue Length 95th (ft)	143	344	52	#521	339	126	200	207	42
Internal Link Dist (ft)		920			1520	470		475	
Turn Bay Length (ft)	360		185	240			150		150
Base Capacity (vph)	353	1451	674	621	1880	1051	453	476	463
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.41	0.13	0.55	0.38	0.39	0.29	0.29	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑	↱	↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1444	1656	1743	1445	1656	1653		1656	1743	1460
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1444	1656	1743	1445	1656	1653		1656	1743	1460
Volume (vph)	60	785	75	50	795	115	110	120	55	82	100	60
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	65	853	82	54	864	125	120	130	60	89	109	65
RTOR Reduction (vph)	0	0	14	0	0	16	0	9	0	0	0	56
Lane Group Flow (vph)	65	853	68	54	864	109	120	181	0	89	109	9
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	8.5	82.6	82.6	7.7	81.8	81.8	13.6	22.0		10.2	18.6	18.6
Effective Green, g (s)	8.5	84.3	84.3	7.7	83.5	83.5	13.6	22.6		10.2	19.2	19.2
Actuated g/C Ratio	0.06	0.60	0.60	0.05	0.59	0.59	0.10	0.16		0.07	0.14	0.14
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5	5.5	2.0	5.5	5.5	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	100	1983	865	91	1034	857	160	265		120	238	199
v/s Ratio Prot	c0.04	0.26		0.03	c0.50		c0.07	c0.11		0.05	0.06	
v/s Ratio Perm			0.05			0.08						0.01
v/c Ratio	0.65	0.43	0.08	0.59	0.84	0.13	0.75	0.68		0.74	0.46	0.04
Uniform Delay, d1	64.7	15.3	11.9	65.0	23.1	12.6	61.9	55.7		64.0	56.0	52.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.9	0.4	0.1	6.7	6.8	0.2	16.0	5.7		19.2	0.5	0.0
Delay (s)	75.6	15.6	12.0	71.8	29.9	12.8	77.9	61.4		83.2	56.5	52.9
Level of Service	E	B	B	E	C	B	E	E		F	E	D
Approach Delay (s)		19.2			30.0			67.8			64.7	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM Average Control Delay	33.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	65	853	82	54	864	125	120	190	89	109	65
v/c Ratio	0.55	0.42	0.09	0.52	0.83	0.14	0.74	0.68	0.65	0.48	0.26
Control Delay	69.2	18.6	11.0	70.8	34.5	12.5	72.4	57.9	68.7	58.5	12.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	69.2	18.6	11.0	70.8	34.5	12.5	72.4	57.9	68.7	58.5	12.9
Queue Length 50th (ft)	58	218	18	48	615	33	107	159	79	94	0
Queue Length 95th (ft)	124	399	61	109	#1279	96	205	267	159	166	44
Internal Link Dist (ft)		1520			2225			975		905	
Turn Bay Length (ft)	100		100	165		165	200		120		140
Base Capacity (vph)	268	2046	904	220	1047	882	231	402	270	442	419
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.42	0.09	0.25	0.83	0.14	0.52	0.47	0.33	0.25	0.16

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations				↰		↱		↰	↑↑	↱	↰	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0		4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor				1.00		1.00		1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes				1.00		0.99		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes				1.00		1.00		1.00	1.00	1.00	1.00	1.00
Frt				1.00		0.85		1.00	1.00	0.85	1.00	1.00
Flt Protected				0.95		1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)				1656		1459		1656	3312	1444	1656	3312
Flt Permitted				0.95		1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)				1656		1459		1656	3312	1444	1656	3312
Volume (vph)	0	0	0	50	0	145	5	0	755	65	100	610
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	54	0	158	5	0	821	71	109	663
RTOR Reduction (vph)	0	0	0	0	0	127	0	0	0	40	0	0
Lane Group Flow (vph)	0	0	0	54	0	31	0	5	821	31	109	663
Confl. Peds. (#/hr)						2				2		
Turn Type				Prot		custom	Prot	Prot		Perm	Prot	
Protected Phases				3			5	5	2		1	6
Permitted Phases						8				2		
Actuated Green, G (s)				10.7		10.7		1.8	22.9	22.9	7.7	28.1
Effective Green, g (s)				10.8		10.8		2.3	24.3	24.3	7.8	29.8
Actuated g/C Ratio				0.20		0.20		0.04	0.44	0.44	0.14	0.54
Clearance Time (s)				4.1		4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)				3.0		3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)				326		287		69	1466	639	235	1798
v/s Ratio Prot				c0.03				0.00	c0.25		c0.07	0.20
v/s Ratio Perm						0.02				0.02		
v/c Ratio				0.17		0.11		0.07	0.56	0.05	0.46	0.37
Uniform Delay, d1				18.3		18.1		25.3	11.8	8.7	21.6	7.2
Progression Factor				1.00		1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2				0.2		0.2		0.4	0.6	0.0	1.4	0.1
Delay (s)				18.5		18.3		25.7	11.9	8.8	23.1	7.3
Level of Service				B		B		C	B	A	C	A
Approach Delay (s)		0.0			18.3				11.8			9.5
Approach LOS		A			B				B			A

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	54.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	54	158	5	821	71	109	663
v/c Ratio	0.16	0.37	0.02	0.59	0.11	0.34	0.35
Control Delay	21.0	6.9	22.4	14.0	3.8	22.8	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.0	6.9	22.4	14.0	3.8	22.8	7.0
Queue Length 50th (ft)	15	0	1	104	0	32	36
Queue Length 95th (ft)	42	42	9	167	20	71	122
Internal Link Dist (ft)				630			1447
Turn Bay Length (ft)	100		150			180	
Base Capacity (vph)	393	467	326	1488	687	359	2006
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.34	0.02	0.55	0.10	0.30	0.33

Intersection Summary

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↱		↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	65	70	605	75	85	505
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	76	658	82	92	549
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						485
pX, platoon unblocked	0.89					
vC, conflicting volume	1437	375			744	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1490	375			744	
tC, single (s)	7.0	7.1			4.3	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	16	87			89	
cM capacity (veh/h)	84	601			811	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	147	438	301	92	549
Volume Left	71	0	0	92	0
Volume Right	76	0	82	0	0
cSH	152	1700	1700	811	1700
Volume to Capacity	0.97	0.26	0.18	0.11	0.32
Queue Length 95th (ft)	177	0	0	10	0
Control Delay (s)	122.7	0.0	0.0	10.0	0.0
Lane LOS	F			B	
Approach Delay (s)	122.7	0.0		1.4	
Approach LOS	F				

Intersection Summary			
Average Delay	12.4		
Intersection Capacity Utilization	41.8%	ICU Level of Service	A
Analysis Period (min)	15		
c			

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			↰	↱		✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	35	135	5	135	95	125	5	525	155	115	320	40
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	147	5	147	103	136	5	571	168	125	348	43

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total (vph)	190	386	576	168	516
Volume Left (vph)	38	147	5	0	125
Volume Right (vph)	5	136	0	168	43
Hadj (s)	0.18	0.02	0.16	0.55	0.15
Departure Headway (s)	9.4	8.3	8.5	7.8	8.3
Degree Utilization, x	0.50	0.89	1.37	0.37	1.19
Capacity (veh/h)	362	386	432	455	441
Control Delay (s)	21.4	48.3	202.1	14.1	131.6
Approach Delay (s)	21.4	48.3	159.6		131.6
Approach LOS	C	E	F		F

Intersection Summary			
Delay	114.0		
HCM Level of Service	F		
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		

Appendix B

Near Term Conditions
AM and PM Peak Hour
Intersection Level of Service Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↱		↰↰	↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	3219		3213	3312	1462	3213	4759	1462	3213	3312	1462
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	3219		3213	3312	1462	3213	4759	1462	3213	3312	1462
Volume (vph)	135	261	54	131	351	135	105	247	102	226	467	140
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	284	59	142	382	147	114	268	111	246	508	152
RTOR Reduction (vph)	0	12	0	0	0	110	0	0	80	0	0	105
Lane Group Flow (vph)	147	331	0	142	382	37	114	268	31	246	508	47
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	6.9	14.8		6.7	14.6	14.6	6.2	16.4	16.4	8.6	18.8	18.8
Effective Green, g (s)	7.4	17.3		7.2	17.1	17.1	6.7	18.9	18.9	9.1	21.3	21.3
Actuated g/C Ratio	0.11	0.25		0.11	0.25	0.25	0.10	0.28	0.28	0.13	0.31	0.31
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5		3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	347	813		338	827	365	314	1313	403	427	1030	455
v/s Ratio Prot	c0.05	0.10		0.04	c0.12		0.04	0.06		c0.08	c0.15	
v/s Ratio Perm						0.03			0.02			0.03
v/c Ratio	0.42	0.41		0.42	0.46	0.10	0.36	0.20	0.08	0.58	0.49	0.10
Uniform Delay, d1	28.6	21.3		28.7	21.8	19.8	28.9	19.0	18.3	27.9	19.2	16.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.1		0.8	0.1	0.0	0.7	0.1	0.1	1.9	0.3	0.1
Delay (s)	29.4	21.4		29.5	21.9	19.8	29.6	19.1	18.4	29.8	19.5	16.9
Level of Service	C	C		C	C	B	C	B	B	C	B	B
Approach Delay (s)		23.8			23.1			21.4			21.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	68.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	147	343	142	382	147	114	268	111	246	508	152
v/c Ratio	0.33	0.41	0.33	0.45	0.30	0.28	0.20	0.23	0.47	0.49	0.27
Control Delay	35.7	24.6	35.7	25.9	6.0	36.6	23.8	6.8	32.7	22.8	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.7	24.6	35.7	25.9	6.0	36.6	23.8	6.8	32.7	22.8	5.3
Queue Length 50th (ft)	28	62	27	73	0	22	31	0	47	90	0
Queue Length 95th (ft)	87	143	85	165	47	72	82	43	130	213	47
Internal Link Dist (ft)		1220		920			405			630	
Turn Bay Length (ft)	500		425		350	200			350		300
Base Capacity (vph)	982	1481	1229	1698	820	848	2079	700	1028	1599	783
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.23	0.12	0.22	0.18	0.13	0.13	0.16	0.24	0.32	0.19

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰↰	↑↱			↰↑	↱	↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.95			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.98			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4724		3213	3247			1705	1462	1573	1638	1462
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4724		3213	3247			1705	1462	1573	1638	1462
Volume (vph)	25	539	25	160	543	69	20	25	95	68	45	54
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	586	27	174	590	75	22	27	103	74	49	59
RTOR Reduction (vph)	0	3	0	0	6	0	0	0	91	0	0	52
Lane Group Flow (vph)	27	610	0	174	659	0	0	49	12	60	63	7
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	2.3	30.1		7.9	35.7			8.1	8.1	8.4	8.4	8.4
Effective Green, g (s)	2.3	31.4		7.9	37.0			8.3	8.3	8.6	8.6	8.6
Actuated g/C Ratio	0.03	0.43		0.11	0.51			0.11	0.11	0.12	0.12	0.12
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	53	2054		352	1664			196	168	187	195	174
v/s Ratio Prot	0.02	0.13		c0.05	c0.20			c0.03		0.04	c0.04	
v/s Ratio Perm									0.01			0.00
v/c Ratio	0.51	0.30		0.49	0.40			0.25	0.07	0.32	0.32	0.04
Uniform Delay, d1	34.4	13.2		30.3	10.8			29.1	28.5	29.1	29.1	28.1
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.8	0.1		0.8	0.1			0.2	0.1	0.4	0.4	0.0
Delay (s)	37.2	13.3		31.1	10.9			29.4	28.6	29.5	29.5	28.2
Level of Service	D	B		C	B			C	C	C	C	C
Approach Delay (s)		14.3			15.1			28.8			29.1	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	72.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	27	613	174	665	49	103	60	63	59
v/c Ratio	0.21	0.30	0.43	0.38	0.22	0.37	0.28	0.29	0.24
Control Delay	40.3	19.3	29.6	15.9	28.1	7.9	28.1	28.0	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.3	19.3	29.6	15.9	28.1	7.9	28.1	28.0	9.7
Queue Length 50th (ft)	7	52	24	54	13	0	16	17	0
Queue Length 95th (ft)	52	187	102	291	63	45	78	81	34
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	165	3078	749	2343	578	563	536	558	536
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.20	0.23	0.28	0.08	0.18	0.11	0.11	0.11

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1448	1656	3312	1448	1656	1643		1656	1743	1462
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1448	1656	3312	1448	1656	1643		1656	1743	1462
Volume (vph)	36	616	50	36	639	78	81	135	74	110	110	52
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	670	54	39	695	85	88	147	80	120	120	57
RTOR Reduction (vph)	0	0	31	0	0	36	0	11	0	0	0	42
Lane Group Flow (vph)	39	670	23	39	695	49	88	216	0	120	120	15
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	3.8	31.2	31.2	3.8	31.2	31.2	5.4	16.9		8.5	20.0	20.0
Effective Green, g (s)	3.8	32.9	32.9	3.8	32.9	32.9	5.4	17.5		8.5	20.6	20.6
Actuated g/C Ratio	0.05	0.42	0.42	0.05	0.42	0.42	0.07	0.22		0.11	0.26	0.26
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5	5.5	2.0	5.5	5.5	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	80	1385	605	80	1385	605	114	365		179	456	383
v/s Ratio Prot	c0.02	0.20		0.02	c0.21		0.05	c0.13		c0.07	c0.07	
v/s Ratio Perm			0.02			0.03						0.01
v/c Ratio	0.49	0.48	0.04	0.49	0.50	0.08	0.77	0.59		0.67	0.26	0.04
Uniform Delay, d1	36.5	16.7	13.5	36.5	16.9	13.8	36.0	27.4		33.8	23.0	21.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.7	0.7	0.1	1.7	0.7	0.1	24.9	1.7		7.5	0.1	0.0
Delay (s)	38.2	17.4	13.6	38.2	17.6	13.9	61.0	29.1		41.3	23.1	21.7
Level of Service	D	B	B	D	B	B	E	C		D	C	C
Approach Delay (s)		18.2			18.2			38.0			30.2	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM Average Control Delay	22.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	78.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	39	670	54	39	695	85	88	227	120	120	57
v/c Ratio	0.23	0.47	0.08	0.26	0.49	0.13	0.47	0.64	0.54	0.26	0.13
Control Delay	48.4	20.2	6.5	48.3	20.4	9.0	44.7	33.9	42.6	31.1	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.4	20.2	6.5	48.3	20.4	9.0	44.7	33.9	42.6	31.1	9.8
Queue Length 50th (ft)	19	127	0	19	133	7	42	99	56	50	0
Queue Length 95th (ft)	73	295	28	73	308	48	133	256	170	141	35
Internal Link Dist (ft)		1520			2225			975		905	
Turn Bay Length (ft)	100			165		165	150		120		140
Base Capacity (vph)	383	2140	951	413	2158	962	560	675	582	747	658
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.31	0.06	0.09	0.32	0.09	0.16	0.34	0.21	0.16	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↱		↰	↱		↶	↑↑	↱	↰	↑↑↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.98	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	0.98
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1664	1462		1675	1461		1656	3312	1445	1656	3241
Flt Permitted		0.72	1.00		0.79	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1247	1462		1379	1461		1656	3312	1445	1656	3241
Volume (vph)	100	5	65	20	5	36	5	75	412	25	91	743
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	5	71	22	5	39	5	82	448	27	99	808
RTOR Reduction (vph)	0	0	55	0	0	30	0	0	0	14	0	11
Lane Group Flow (vph)	0	114	16	0	27	9	0	87	448	13	99	911
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		11.6	11.6		13.2	13.2		4.9	27.9	27.9	5.3	27.6
Effective Green, g (s)		13.3	13.3		13.3	13.3		5.4	29.3	29.3	5.4	29.3
Actuated g/C Ratio		0.22	0.22		0.22	0.22		0.09	0.49	0.49	0.09	0.49
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		276	324		306	324		149	1617	706	149	1583
v/s Ratio Prot								0.05	0.14		c0.06	c0.28
v/s Ratio Perm		c0.09	0.01		0.02	0.01				0.01		
v/c Ratio		0.41	0.05		0.09	0.03		0.58	0.28	0.02	0.66	0.58
Uniform Delay, d1		20.0	18.4		18.5	18.3		26.2	9.1	7.9	26.4	10.9
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.0	0.1		0.1	0.0		5.7	0.1	0.0	10.6	0.5
Delay (s)		21.0	18.4		18.7	18.3		31.9	9.2	7.9	37.1	11.4
Level of Service		C	B		B	B		C	A	A	D	B
Approach Delay (s)		20.0			18.5				12.7			13.9
Approach LOS		C			B				B			B

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT
	→	↘	←	↖	↖	↑	↗	↘	↓
Lane Group Flow (vph)	114	71	27	39	87	448	27	99	922
v/c Ratio	0.41	0.19	0.09	0.11	0.36	0.29	0.04	0.48	0.57
Control Delay	25.7	7.3	23.6	8.9	32.6	10.7	4.6	42.9	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.7	7.3	23.6	8.9	32.6	10.7	4.6	42.9	13.7
Queue Length 50th (ft)	40	0	9	0	32	48	0	38	126
Queue Length 95th (ft)	96	30	31	23	92	106	13	#142	274
Internal Link Dist (ft)	570		705			630			1447
Turn Bay Length (ft)		400		400	150			180	
Base Capacity (vph)	472	589	554	594	328	1999	881	211	1890
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.12	0.05	0.07	0.27	0.22	0.03	0.47	0.49

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	35	20	434	35	40	612
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	22	472	38	43	665
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						485
pX, platoon unblocked	0.81					
vC, conflicting volume	1248	260			515	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1306	260			515	
tC, single (s)	7.0	7.1			4.3	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	65	97			96	
cM capacity (veh/h)	110	715			995	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	60	314	195	43	665
Volume Left	38	0	0	43	0
Volume Right	22	0	38	0	0
cSH	159	1700	1700	995	1700
Volume to Capacity	0.38	0.18	0.11	0.04	0.39
Queue Length 95th (ft)	40	0	0	3	0
Control Delay (s)	40.7	0.0	0.0	8.8	0.0
Lane LOS	E			A	
Approach Delay (s)	40.7	0.0		0.5	
Approach LOS	E				

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	42.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	95	5	223	155	145	5	304	94	124	473	45
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	103	5	242	168	158	5	330	102	135	514	49

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	130	568	438	698
Volume Left (vph)	22	242	5	135
Volume Right (vph)	5	158	102	49
Hadj (s)	0.16	0.07	0.02	0.15
Departure Headway (s)	9.6	7.9	7.9	8.0
Degree Utilization, x	0.35	1.25	0.96	1.54
Capacity (veh/h)	367	451	451	456
Control Delay (s)	17.7	152.8	61.2	276.9
Approach Delay (s)	17.7	152.8	61.2	276.9
Approach LOS	C	F	F	F

Intersection Summary			
Delay	168.5		
HCM Level of Service	F		
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	0.98	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1656	1743	3312	1445	1656	1461
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1656	1743	3312	1445	1656	1461
Volume (vph)	65	400	521	75	50	60
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	435	566	82	54	65
RTOR Reduction (vph)	0	0	0	60	0	35
Lane Group Flow (vph)	71	435	566	22	54	30
Confl. Peds. (#/hr)				2		2
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	7.1	31.0	19.4	19.4	34.4	34.4
Effective Green, g (s)	7.6	31.5	19.9	19.9	34.9	34.9
Actuated g/C Ratio	0.10	0.42	0.27	0.27	0.47	0.47
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	169	738	886	386	777	685
v/s Ratio Prot	0.04	c0.25	0.17		c0.03	
v/s Ratio Perm				0.02		0.02
v/c Ratio	0.42	0.59	0.64	0.06	0.07	0.04
Uniform Delay, d1	31.3	16.5	24.1	20.3	10.8	10.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7	1.2	1.5	0.1	0.2	0.1
Delay (s)	33.0	17.7	25.6	20.3	11.0	10.8
Level of Service	C	B	C	C	B	B
Approach Delay (s)		19.8	24.9		10.9	
Approach LOS		B	C		B	

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	74.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	71	435	566	82	54	65
v/c Ratio	0.36	0.60	0.63	0.18	0.07	0.09
Control Delay	33.6	17.2	25.0	5.9	14.9	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.6	17.2	25.0	5.9	14.9	5.0
Queue Length 50th (ft)	31	145	122	0	14	0
Queue Length 95th (ft)	76	223	183	30	43	25
Internal Link Dist (ft)		2059	1220		581	
Turn Bay Length (ft)	325			325		140
Base Capacity (vph)	373	1011	1315	622	786	727
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.43	0.43	0.13	0.07	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↱		↰↰	↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95		0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	3188		3213	3312	1461	3213	4759	1461	3213	3312	1461
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	3188		3213	3312	1461	3213	4759	1461	3213	3312	1461
Volume (vph)	178	432	129	205	403	199	103	543	99	313	374	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	193	470	140	223	438	216	112	590	108	340	407	120
RTOR Reduction (vph)	0	19	0	0	0	158	0	0	81	0	0	79
Lane Group Flow (vph)	193	591	0	223	438	58	112	590	27	340	407	41
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6			8			4
Actuated Green, G (s)	11.0	20.8		11.8	21.6	21.6	6.9	20.1	20.1	15.3	28.5	28.5
Effective Green, g (s)	11.5	23.3		12.3	24.1	24.1	7.4	22.6	22.6	15.8	31.0	31.0
Actuated g/C Ratio	0.13	0.26		0.14	0.27	0.27	0.08	0.25	0.25	0.18	0.34	0.34
Clearance Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5		3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	411	825		439	887	391	264	1195	367	564	1141	503
v/s Ratio Prot	0.06	c0.19		c0.07	0.13		0.03	c0.12		c0.11	0.12	
v/s Ratio Perm						0.04			0.02			0.03
v/c Ratio	0.47	0.72		0.51	0.49	0.15	0.42	0.49	0.07	0.60	0.36	0.08
Uniform Delay, d1	36.4	30.3		36.0	27.8	25.1	39.3	28.8	25.7	34.2	22.0	19.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	2.5		0.9	0.2	0.1	1.1	0.2	0.1	1.8	0.1	0.1
Delay (s)	37.3	32.8		37.0	28.0	25.2	40.4	29.0	25.8	36.0	22.2	20.0
Level of Service	D	C		D	C	C	D	C	C	D	C	B
Approach Delay (s)		33.9			29.6			30.2			27.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	30.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	193	610	223	438	216	112	590	108	340	407	120
v/c Ratio	0.47	0.72	0.51	0.49	0.39	0.35	0.53	0.25	0.61	0.36	0.21
Control Delay	42.7	32.4	41.6	30.2	5.5	45.6	32.7	8.2	39.2	25.8	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.7	32.4	41.6	30.2	5.5	45.6	32.7	8.2	39.2	25.8	6.0
Queue Length 50th (ft)	53	157	61	108	0	30	105	0	91	92	0
Queue Length 95th (ft)	121	300	136	212	59	78	201	47	190	183	43
Internal Link Dist (ft)		1220		920			405			630	
Turn Bay Length (ft)	500		425		350	200			350		300
Base Capacity (vph)	801	1229	1036	1457	763	649	1646	576	858	1399	686
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.50	0.22	0.30	0.28	0.17	0.36	0.19	0.40	0.29	0.17

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰↰	↑↱			↰↑	↱	↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.95			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.98		1.00	0.97			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4676		3213	3212			1705	1461	1573	1646	1461
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4676		3213	3212			1705	1461	1573	1646	1461
Volume (vph)	85	679	80	315	689	146	60	75	240	144	120	58
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	738	87	342	749	159	65	82	261	157	130	63
RTOR Reduction (vph)	0	11	0	0	13	0	0	0	210	0	0	54
Lane Group Flow (vph)	92	814	0	342	895	0	0	147	51	140	147	9
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	9.0	25.4		15.6	32.0			10.6	10.6	10.7	10.7	10.7
Effective Green, g (s)	9.0	26.7		15.6	33.3			10.8	10.8	10.9	10.9	10.9
Actuated g/C Ratio	0.11	0.33		0.19	0.42			0.14	0.14	0.14	0.14	0.14
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	186	1561		627	1337			230	197	214	224	199
v/s Ratio Prot	0.06	0.17		c0.11	c0.28			c0.09		0.09	c0.09	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.49	0.52		0.55	0.67			0.64	0.26	0.65	0.66	0.04
Uniform Delay, d1	33.4	21.5		29.0	18.9			32.8	31.0	32.8	32.8	30.0
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	0.3		0.8	1.2			4.2	0.3	5.4	5.2	0.0
Delay (s)	34.1	21.8		29.8	20.1			37.0	31.3	38.1	38.0	30.1
Level of Service	C	C		C	C			D	C	D	D	C
Approach Delay (s)		23.0			22.7			33.3			36.6	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	92	825	342	908	147	261	140	147	63
v/c Ratio	0.50	0.52	0.55	0.67	0.55	0.60	0.56	0.56	0.22
Control Delay	55.6	25.3	38.8	22.7	39.0	9.3	39.2	39.1	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.6	25.3	38.8	22.7	39.0	9.3	39.2	39.1	11.1
Queue Length 50th (ft)	44	122	78	185	67	8	67	70	0
Queue Length 95th (ft)	#211	257	#238	417	183	94	187	193	40
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	184	2555	775	1972	545	632	504	527	510
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.32	0.44	0.46	0.27	0.41	0.28	0.28	0.12

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1446	1656	3312	1447	1656	1651		1656	1743	1461
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1446	1656	3312	1447	1656	1651		1656	1743	1461
Volume (vph)	66	921	76	54	969	125	112	120	57	104	100	69
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	1001	83	59	1053	136	122	130	62	113	109	75
RTOR Reduction (vph)	0	0	28	0	0	31	0	10	0	0	0	63
Lane Group Flow (vph)	72	1001	55	59	1053	105	122	182	0	113	109	12
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	7.6	56.4	56.4	6.9	55.7	55.7	10.4	17.9		9.9	17.4	17.4
Effective Green, g (s)	7.6	58.1	58.1	6.9	57.4	57.4	10.4	18.5		9.9	18.0	18.0
Actuated g/C Ratio	0.07	0.53	0.53	0.06	0.52	0.52	0.10	0.17		0.09	0.16	0.16
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5	5.5	2.0	5.5	5.5	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	115	1759	768	104	1738	759	157	279		150	287	240
v/s Ratio Prot	c0.04	0.30		0.04	c0.32		c0.07	c0.11		0.07	0.06	
v/s Ratio Perm			0.04			0.07						0.01
v/c Ratio	0.63	0.57	0.07	0.57	0.61	0.14	0.78	0.65		0.75	0.38	0.05
Uniform Delay, d1	49.5	17.2	12.5	49.8	18.1	13.3	48.4	42.4		48.6	40.7	38.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.4	0.8	0.1	4.2	1.0	0.2	19.4	4.1		17.1	0.3	0.0
Delay (s)	56.9	18.0	12.6	54.0	19.1	13.5	67.8	46.6		65.7	41.0	38.5
Level of Service	E	B	B	D	B	B	E	D		E	D	D
Approach Delay (s)		20.1			20.1			54.8			49.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	26.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	109.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	72	1001	83	59	1053	136	122	192	113	109	75
v/c Ratio	0.45	0.57	0.11	0.43	0.61	0.17	0.64	0.67	0.62	0.38	0.25
Control Delay	63.9	22.3	8.3	64.4	23.7	11.9	60.3	51.1	60.7	52.3	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.9	22.3	8.3	64.4	23.7	11.9	60.3	51.1	60.7	52.3	12.2
Queue Length 50th (ft)	54	256	8	44	281	26	91	134	85	77	0
Queue Length 95th (ft)	135	516	48	115	565	92	202	265	191	165	48
Internal Link Dist (ft)		1520			2225			975		905	
Turn Bay Length (ft)	100			165		165	150		120		140
Base Capacity (vph)	302	2028	906	325	2021	906	455	532	453	550	511
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.49	0.09	0.18	0.52	0.15	0.27	0.36	0.25	0.20	0.15

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	0.98
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1662	1461		1667	1461		1656	3312	1444	1656	3225
Flt Permitted		0.69	1.00		0.67	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1199	1461		1173	1461		1656	3312	1444	1656	3225
Volume (vph)	195	5	115	50	5	147	5	88	762	65	102	627
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	5	125	54	5	160	5	96	828	71	111	682
RTOR Reduction (vph)	0	0	94	0	0	120	0	0	0	38	0	15
Lane Group Flow (vph)	0	217	31	0	59	40	0	101	828	33	111	787
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		16.0	16.0		17.6	17.6		7.4	31.5	31.5	7.6	31.0
Effective Green, g (s)		17.7	17.7		17.7	17.7		7.9	32.9	32.9	7.7	32.7
Actuated g/C Ratio		0.25	0.25		0.25	0.25		0.11	0.47	0.47	0.11	0.47
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		302	368		295	368		186	1550	676	181	1500
v/s Ratio Prot								0.06	c0.25		c0.07	0.24
v/s Ratio Perm		c0.18	0.02		0.05	0.03				0.02		
v/c Ratio		0.72	0.09		0.20	0.11		0.54	0.53	0.05	0.61	0.52
Uniform Delay, d1		24.0	20.1		20.7	20.2		29.5	13.3	10.2	29.9	13.3
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		7.9	0.1		0.3	0.1		3.2	0.5	0.0	6.0	0.3
Delay (s)		32.0	20.2		21.1	20.4		32.7	13.7	10.2	35.9	13.6
Level of Service		C	C		C	C		C	B	B	D	B
Approach Delay (s)		27.7			20.6				15.4			16.3
Approach LOS		C			C				B			B

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	70.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	217	125	59	160	101	828	71	111	802
v/c Ratio	0.70	0.27	0.20	0.33	0.45	0.55	0.10	0.61	0.52
Control Delay	31.0	6.0	23.3	5.7	36.6	15.3	3.6	54.3	16.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	6.0	23.3	5.7	36.6	15.3	3.6	54.3	16.7
Queue Length 50th (ft)	85	0	20	0	42	135	0	50	138
Queue Length 95th (ft)	184	39	56	44	103	212	21	#161	227
Internal Link Dist (ft)	570		705			630			1447
Turn Bay Length (ft)		400		400	150			180	
Base Capacity (vph)	406	577	415	615	287	1807	819	182	1699
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.22	0.14	0.26	0.35	0.46	0.09	0.61	0.47

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↑>		↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	65	70	675	75	85	623
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	76	734	82	92	677
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						485
pX, platoon unblocked	0.87					
vC, conflicting volume	1641	413			820	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1736	413			820	
tC, single (s)	7.0	7.1			4.3	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	0	87			88	
cM capacity (veh/h)	56	567			758	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	147	489	326	92	677
Volume Left	71	0	0	92	0
Volume Right	76	0	82	0	0
cSH	104	1700	1700	758	1700
Volume to Capacity	1.41	0.29	0.19	0.12	0.40
Queue Length 95th (ft)	263	0	0	10	0
Control Delay (s)	304.7	0.0	0.0	10.4	0.0
Lane LOS	F			B	
Approach Delay (s)	304.7	0.0		1.2	
Approach LOS	F				

Intersection Summary				
Average Delay		26.4		
Intersection Capacity Utilization		47.4%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	35	135	5	162	95	153	5	567	205	159	394	40
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	147	5	176	103	166	5	616	223	173	428	43
Direction, Lane #	**EB 1**	**WB 1**	**NB 1**	**SB 1**								
Volume Total (vph)	190	446	845	645								
Volume Left (vph)	38	176	5	173								
Volume Right (vph)	5	166	223	43								
Hadj (s)	0.18	0.01	0.00	0.17								
Departure Headway (s)	9.7	8.3	8.3	8.5								
Degree Utilization, x	0.51	1.03	1.95	1.52								
Capacity (veh/h)	358	425	440	428								
Control Delay (s)	22.6	80.4	454.5	266.9								
Approach Delay (s)	22.6	80.4	454.5	266.9								
Approach LOS	C	F	F	F								
Intersection Summary												
Delay			280.5									
HCM Level of Service			F									
Intersection Capacity Utilization			121.0%		ICU Level of Service				H			
Analysis Period (min)			15									

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↰	↑	↑↑	↱	↰	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	0.97	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1656	1743	3312	1444	1656	1461
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1656	1743	3312	1444	1656	1461
Volume (vph)	105	674	501	115	65	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	733	545	125	71	120
RTOR Reduction (vph)	0	0	0	84	0	71
Lane Group Flow (vph)	114	733	545	41	71	49
Confl. Peds. (#/hr)				2		2
Turn Type	Prot			Perm		Perm
Protected Phases	5	2	6		4	
Permitted Phases				6		4
Actuated Green, G (s)	9.4	41.2	27.3	27.3	34.2	34.2
Effective Green, g (s)	9.9	41.7	27.8	27.8	34.7	34.7
Actuated g/C Ratio	0.12	0.49	0.33	0.33	0.41	0.41
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	194	861	1091	476	681	601
v/s Ratio Prot	0.07	c0.42	0.16		c0.04	
v/s Ratio Perm				0.03		0.03
v/c Ratio	0.59	0.85	0.50	0.09	0.10	0.08
Uniform Delay, d1	35.3	18.6	22.7	19.5	15.3	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.5	8.1	0.4	0.1	0.3	0.3
Delay (s)	39.8	26.8	23.1	19.6	15.6	15.4
Level of Service	D	C	C	B	B	B
Approach Delay (s)		28.5	22.4		15.5	
Approach LOS		C	C		B	

Intersection Summary			
HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	84.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	114	733	545	125	71	120
v/c Ratio	0.52	0.87	0.49	0.22	0.10	0.18
Control Delay	38.3	23.0	24.1	5.0	19.7	5.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.3	23.0	24.1	5.0	19.7	5.1
Queue Length 50th (ft)	56	316	122	0	22	0
Queue Length 95th (ft)	119	466	184	37	63	38
Internal Link Dist (ft)		2059	1220		581	
Turn Bay Length (ft)	325			325		140
Base Capacity (vph)	343	1011	1293	639	689	678
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.73	0.42	0.20	0.10	0.18

Intersection Summary

Appendix C

Near Term Plus Project Conditions
AM and PM Peak Hour
Intersection Level of Service Analysis

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑	↱	↰↰	↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	4759	1462	3213	3312	1462	3213	4759	1462	3213	4759	1462
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	4759	1462	3213	3312	1462	3213	4759	1462	3213	4759	1462
Volume (vph)	186	338	62	245	367	135	112	274	120	226	545	168
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	202	367	67	266	399	147	122	298	130	246	592	183
RTOR Reduction (vph)	0	0	52	0	0	107	0	0	97	0	0	126
Lane Group Flow (vph)	202	367	15	266	399	40	122	298	33	246	592	57
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	8.4	14.9	14.9	11.8	18.3	18.3	6.8	16.9	16.9	11.4	21.5	21.5
Effective Green, g (s)	8.9	17.4	17.4	12.3	20.8	20.8	7.3	19.4	19.4	11.9	24.0	24.0
Actuated g/C Ratio	0.12	0.23	0.23	0.16	0.27	0.27	0.09	0.25	0.25	0.15	0.31	0.31
Clearance Time (s)	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	371	1075	330	513	895	395	305	1199	368	497	1483	456
v/s Ratio Prot	0.06	0.08		c0.08	c0.12		0.04	0.06		c0.08	c0.12	
v/s Ratio Perm			0.01			0.03			0.02			0.04
v/c Ratio	0.54	0.34	0.05	0.52	0.45	0.10	0.40	0.25	0.09	0.49	0.40	0.13
Uniform Delay, d1	32.1	25.0	23.3	29.6	23.3	21.1	32.8	23.0	22.0	29.8	20.8	19.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1	0.0	0.9	0.1	0.0	0.9	0.1	0.1	0.8	0.1	0.1
Delay (s)	33.8	25.1	23.3	30.5	23.4	21.1	33.7	23.1	22.1	30.6	21.0	19.1
Level of Service	C	C	C	C	C	C	C	C	C	C	C	B
Approach Delay (s)		27.6			25.3			25.2			22.9	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	77.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	202	367	67	266	399	147	122	298	130	246	592	183
v/c Ratio	0.46	0.36	0.19	0.51	0.44	0.29	0.33	0.26	0.29	0.49	0.39	0.31
Control Delay	35.7	27.4	8.5	33.9	26.7	5.9	38.0	26.1	7.1	34.4	23.4	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.7	27.4	8.5	33.9	26.7	5.9	38.0	26.1	7.1	34.4	23.4	5.4
Queue Length 50th (ft)	40	50	0	53	80	0	24	36	0	50	74	0
Queue Length 95th (ft)	118	113	35	147	180	48	79	98	49	138	174	53
Internal Link Dist (ft)		655			920			405			630	
Turn Bay Length (ft)	500		275	425		350	200			350		300
Base Capacity (vph)	891	1941	635	1186	1613	786	754	1844	645	960	2139	757
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.19	0.11	0.22	0.25	0.19	0.16	0.16	0.20	0.26	0.28	0.24

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰↰	↑↱			↰↑	↱	↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.95			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4729		3213	3259			1705	1462	1573	1638	1462
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4729		3213	3259			1705	1462	1573	1638	1462
Volume (vph)	25	634	25	160	673	69	20	25	95	68	45	54
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	689	27	174	732	75	22	27	103	74	49	59
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	92	0	0	52
Lane Group Flow (vph)	27	713	0	174	803	0	0	49	11	60	63	7
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	2.2	33.3		8.0	39.1			7.9	7.9	8.3	8.3	8.3
Effective Green, g (s)	2.2	34.6		8.0	40.4			8.1	8.1	8.5	8.5	8.5
Actuated g/C Ratio	0.03	0.46		0.11	0.54			0.11	0.11	0.11	0.11	0.11
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	48	2176		342	1751			184	157	178	185	165
v/s Ratio Prot	0.02	0.15		c0.05	c0.25			c0.03		0.04	c0.04	
v/s Ratio Perm									0.01			0.00
v/c Ratio	0.56	0.33		0.51	0.46			0.27	0.07	0.34	0.34	0.04
Uniform Delay, d1	36.0	12.9		31.7	10.7			30.8	30.2	30.8	30.8	29.7
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.7	0.1		0.9	0.1			0.3	0.1	0.4	0.4	0.0
Delay (s)	44.7	13.0		32.6	10.8			31.1	30.2	31.2	31.2	29.8
Level of Service	D	B		C	B			C	C	C	C	C
Approach Delay (s)		14.1			14.7			30.5			30.7	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	17.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	75.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	27	716	174	807	49	103	60	63	59
v/c Ratio	0.22	0.33	0.44	0.43	0.23	0.38	0.30	0.30	0.25
Control Delay	43.7	18.7	32.1	15.7	31.1	8.6	31.1	31.0	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.7	18.7	32.1	15.7	31.1	8.6	31.1	31.0	10.6
Queue Length 50th (ft)	8	64	25	70	14	0	18	18	0
Queue Length 95th (ft)	55	220	109	364	69	48	85	88	37
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	159	3072	724	2347	561	549	520	541	522
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.23	0.24	0.34	0.09	0.19	0.12	0.12	0.11

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1447	1656	3312	1448	1656	1643		1656	1743	1462
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1447	1656	3312	1448	1656	1643		1656	1743	1462
Volume (vph)	42	696	59	36	749	78	93	135	74	110	110	60
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	757	64	39	814	85	101	147	80	120	120	65
RTOR Reduction (vph)	0	0	32	0	0	28	0	11	0	0	0	51
Lane Group Flow (vph)	46	757	32	39	814	57	101	216	0	120	120	14
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	4.2	39.0	39.0	3.9	38.7	38.7	8.3	16.7		9.1	17.5	17.5
Effective Green, g (s)	4.2	40.7	40.7	3.9	40.4	40.4	8.3	17.3		9.1	18.1	18.1
Actuated g/C Ratio	0.05	0.47	0.47	0.04	0.46	0.46	0.10	0.20		0.10	0.21	0.21
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5	5.5	2.0	5.5	5.5	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	80	1549	677	74	1538	672	158	327		173	363	304
v/s Ratio Prot	c0.03	0.23		0.02	c0.25		0.06	c0.13		c0.07	0.07	
v/s Ratio Perm			0.02			0.04						0.01
v/c Ratio	0.57	0.49	0.05	0.53	0.53	0.08	0.64	0.66		0.69	0.33	0.04
Uniform Delay, d1	40.5	16.0	12.6	40.6	16.5	13.0	37.9	32.1		37.6	29.3	27.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.1	0.6	0.1	3.1	0.7	0.1	6.1	3.7		9.3	0.2	0.0
Delay (s)	46.6	16.6	12.7	43.7	17.3	13.1	44.0	35.8		46.9	29.5	27.6
Level of Service	D	B	B	D	B	B	D	D		D	C	C
Approach Delay (s)		17.9			18.0			38.3			35.9	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	46	757	64	39	814	85	101	227	120	120	65
v/c Ratio	0.29	0.49	0.09	0.28	0.53	0.12	0.52	0.67	0.57	0.33	0.18
Control Delay	54.4	19.9	6.1	55.0	20.8	10.0	49.7	39.8	48.7	38.8	11.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.4	19.9	6.1	55.0	20.8	10.0	49.7	39.8	48.7	38.8	11.0
Queue Length 50th (ft)	25	157	1	22	174	10	55	115	66	59	0
Queue Length 95th (ft)	90	345	30	80	382	53	163	292	186	162	41
Internal Link Dist (ft)		1520			2225			975		905	
Turn Bay Length (ft)	100			165		165	150		120		140
Base Capacity (vph)	356	2112	942	383	2125	945	540	631	543	669	600
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.36	0.07	0.10	0.38	0.09	0.19	0.36	0.22	0.18	0.11

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↱		↰	↱		↶	↑↑	↱	↰	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.98	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	1.00
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1664	1462		1675	1461		1656	3312	1445	1656	3312
Flt Permitted		0.72	1.00		0.79	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1247	1462		1379	1461		1656	3312	1445	1656	3312
Volume (vph)	100	5	65	20	5	36	5	75	490	25	91	849
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	5	71	22	5	39	5	82	533	27	99	923
RTOR Reduction (vph)	0	0	55	0	0	30	0	0	0	14	0	0
Lane Group Flow (vph)	0	114	16	0	27	9	0	87	533	13	99	923
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		11.8	11.8		13.4	13.4		4.9	29.3	29.3	5.2	28.9
Effective Green, g (s)		13.5	13.5		13.5	13.5		5.4	30.7	30.7	5.3	30.6
Actuated g/C Ratio		0.22	0.22		0.22	0.22		0.09	0.50	0.50	0.09	0.50
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		274	321		303	321		145	1653	721	143	1648
v/s Ratio Prot								0.05	0.16		c0.06	c0.28
v/s Ratio Perm		c0.09	0.01		0.02	0.01				0.01		
v/c Ratio		0.42	0.05		0.09	0.03		0.60	0.32	0.02	0.69	0.56
Uniform Delay, d1		20.6	18.9		19.1	18.8		27.0	9.2	7.8	27.3	10.8
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		1.0	0.1		0.1	0.0		6.5	0.2	0.0	13.5	0.4
Delay (s)		21.6	19.0		19.2	18.9		33.6	9.3	7.8	40.8	11.2
Level of Service		C	B		B	B		C	A	A	D	B
Approach Delay (s)		20.6			19.0				12.5			13.5
Approach LOS		C			B				B			B

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	61.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	114	71	27	39	87	533	27	99	923	114
v/c Ratio	0.41	0.19	0.09	0.11	0.37	0.33	0.04	0.49	0.55	0.15
Control Delay	26.3	7.3	24.0	8.9	33.3	10.8	4.6	44.1	13.8	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.3	7.3	24.0	8.9	33.3	10.8	4.6	44.1	13.8	3.6
Queue Length 50th (ft)	43	0	9	0	34	60	0	40	132	0
Queue Length 95th (ft)	96	30	31	23	92	127	13	#142	277	30
Internal Link Dist (ft)	570		705			630			1447	
Turn Bay Length (ft)		400		400	150			180		175
Base Capacity (vph)	463	579	545	585	322	1996	879	205	1920	884
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.12	0.05	0.07	0.27	0.27	0.03	0.48	0.48	0.13

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	95	5	223	155	165	5	371	94	138	523	45
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	103	5	242	168	179	5	403	102	150	568	49

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	130	590	511	767
Volume Left (vph)	22	242	5	150
Volume Right (vph)	5	179	102	49
Hadj (s)	0.16	0.05	0.04	0.15
Departure Headway (s)	9.7	7.9	7.9	8.0
Degree Utilization, x	0.35	1.30	1.13	1.72
Capacity (veh/h)	366	448	458	452
Control Delay (s)	17.9	175.6	108.5	351.3
Approach Delay (s)	17.9	175.6	108.5	351.3
Approach LOS	C	F	F	F

Intersection Summary			
Delay	215.6		
HCM Level of Service	F		
Intersection Capacity Utilization	110.8%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.97	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1445	1656	3312	1445	1656	1743	1461	1656	1743	1461
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1445	1656	3312	1445	1656	1743	1461	1656	1743	1461
Volume (vph)	65	449	18	85	487	75	81	5	22	50	5	60
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	488	20	92	529	82	88	5	24	54	5	65
RTOR Reduction (vph)	0	0	15	0	0	62	0	0	14	0	0	41
Lane Group Flow (vph)	71	488	5	92	529	20	88	5	10	54	5	24
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	6.9	19.8	19.8	6.2	19.1	19.1	7.8	33.1	33.1	4.8	30.1	30.1
Effective Green, g (s)	7.4	20.3	20.3	6.7	19.6	19.6	8.3	33.6	33.6	5.3	30.6	30.6
Actuated g/C Ratio	0.09	0.25	0.25	0.08	0.24	0.24	0.10	0.41	0.41	0.06	0.37	0.37
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	150	821	358	135	793	346	168	715	599	107	651	546
v/s Ratio Prot	0.04	0.15		c0.06	c0.16		c0.05	0.00		0.03	0.00	
v/s Ratio Perm			0.00			0.01			c0.01			c0.02
v/c Ratio	0.47	0.59	0.01	0.68	0.67	0.06	0.52	0.01	0.02	0.50	0.01	0.04
Uniform Delay, d1	35.4	27.2	23.2	36.6	28.2	24.0	34.9	14.3	14.3	37.0	16.1	16.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.3	1.2	0.0	13.3	2.1	0.1	2.9	0.0	0.1	3.7	0.0	0.2
Delay (s)	37.7	28.3	23.3	49.8	30.3	24.1	37.9	14.3	14.4	40.7	16.1	16.5
Level of Service	D	C	C	D	C	C	D	B	B	D	B	B
Approach Delay (s)		29.3			32.2			32.0			27.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	81.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	71	488	20	92	529	82	88	5	24	54	5	65
v/c Ratio	0.38	0.57	0.05	0.53	0.65	0.20	0.43	0.01	0.04	0.32	0.01	0.11
Control Delay	40.7	27.2	10.1	49.1	29.0	7.0	38.7	22.4	9.7	41.5	24.6	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.7	27.2	10.1	49.1	29.0	7.0	38.7	22.4	9.7	41.5	24.6	7.7
Queue Length 50th (ft)	36	120	0	47	133	0	44	2	0	27	2	0
Queue Length 95th (ft)	86	173	16	#121	197	34	97	11	19	69	11	32
Internal Link Dist (ft)		2059			485			355			581	
Turn Bay Length (ft)	325			325		325	140		140	140		140
Base Capacity (vph)	243	1242	554	188	1162	559	311	740	634	218	653	587
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.39	0.04	0.49	0.46	0.15	0.28	0.01	0.04	0.25	0.01	0.11

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
	→	↘	↙	←	↖	↗
Lane Configurations	↑↑↑	↱		↑↑		↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	449	72	0	647	0	137
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	488	78	0	703	0	149
Pedestrians					5	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	565			735		
pX, platoon unblocked					0.93	
vC, conflicting volume			571		845	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			571		756	168
tC, single (s)			4.3		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			100		100	82
cM capacity (veh/h)			947		805	822

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	NB 1
Volume Total	163	163	163	78	352	352	149
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	78	0	0	149
cSH	1700	1700	1700	1700	1700	1700	822
Volume to Capacity	0.10	0.10	0.10	0.05	0.21	0.21	0.18
Queue Length 95th (ft)	0	0	0	0	0	0	16
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	10.3
Lane LOS							B
Approach Delay (s)	0.0				0.0		10.3
Approach LOS							B

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	24.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			✥		↰	↱		↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0			4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00			0.95	1.00
Frpb, ped/bikes	1.00	0.99			1.00		1.00	1.00			1.00	0.97
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00			1.00	1.00
Frt	1.00	0.89			0.99		1.00	1.00			1.00	0.85
Flt Protected	0.95	1.00			0.96		0.95	1.00			1.00	1.00
Satd. Flow (prot)	1656	1534			1651		1656	1740			3312	1444
Flt Permitted	0.82	1.00			0.76		0.95	1.00			1.00	1.00
Satd. Flow (perm)	1437	1534			1312		1656	1740			3312	1444
Volume (vph)	72	5	13	35	5	5	107	444	5	0	659	53
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	5	14	38	5	5	116	483	5	0	716	58
RTOR Reduction (vph)	0	12	0	0	4	0	0	0	0	0	0	25
Lane Group Flow (vph)	78	7	0	0	44	0	116	488	0	0	716	33
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								6
Actuated Green, G (s)	8.9	8.9			8.9		9.6	56.5			42.4	42.4
Effective Green, g (s)	9.4	9.4			9.4		10.1	57.0			42.9	42.9
Actuated g/C Ratio	0.13	0.13			0.13		0.14	0.77			0.58	0.58
Clearance Time (s)	4.5	4.5			4.5		4.5	4.5			4.5	4.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	182	194			166		225	1333			1910	833
v/s Ratio Prot		0.00					c0.07	c0.28			0.22	
v/s Ratio Perm	c0.05				0.03							0.02
v/c Ratio	0.43	0.03			0.26		0.52	0.37			0.37	0.04
Uniform Delay, d1	30.0	28.5			29.4		29.9	2.8			8.5	6.8
Progression Factor	1.00	1.00			1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2	1.6	0.1			0.8		2.0	0.8			0.6	0.1
Delay (s)	31.6	28.6			30.2		31.9	3.6			9.1	6.9
Level of Service	C	C			C		C	A			A	A
Approach Delay (s)		31.0			30.2			9.0			8.9	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	74.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	78	19	48	116	488	716	58
v/c Ratio	0.38	0.07	0.21	0.47	0.35	0.36	0.07
Control Delay	24.5	13.3	21.1	26.9	5.4	12.2	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	13.3	21.1	26.9	5.4	12.2	5.0
Queue Length 50th (ft)	27	2	14	39	54	84	0
Queue Length 95th (ft)	64	17	41	102	200	215	24
Internal Link Dist (ft)		428	547		425	225	
Turn Bay Length (ft)				200			
Base Capacity (vph)	388	479	437	433	1398	1981	886
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.04	0.11	0.27	0.35	0.36	0.07

Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑	↑	↱
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	5	0	556	706	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	0	604	767	1
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					505	
pX, platoon unblocked	0.78	0.78	0.78			
vC, conflicting volume	1377	772	773			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1481	709	711			
tC, single (s)	6.5	6.8	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	100	98	100			
cM capacity (veh/h)	104	329	668			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	5	604	767	1
Volume Left	0	0	0	0
Volume Right	5	0	0	1
cSH	329	1700	1700	1700
Volume to Capacity	0.02	0.36	0.45	0.00
Queue Length 95th (ft)	1	0	0	0
Control Delay (s)	16.1	0.0	0.0	0.0
Lane LOS	C			
Approach Delay (s)	16.1	0.0	0.0	
Approach LOS	C			

Intersection Summary

Average Delay	0.1		
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↑↱		↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	107	1	0	108	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	116	1	0	117	0
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						435
pX, platoon unblocked						
vC, conflicting volume	241	6			6	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	241	6			6	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	100	89			92	
cM capacity (veh/h)	675	1052			1564	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	116	1	117	0
Volume Left	0	0	117	0
Volume Right	116	0	0	0
cSH	1052	1700	1564	1700
Volume to Capacity	0.11	0.00	0.08	0.00
Queue Length 95th (ft)	9	0	6	0
Control Delay (s)	8.8	0.0	7.5	0.0
Lane LOS	A		A	
Approach Delay (s)	8.8	0.0	7.5	
Approach LOS	A			

Intersection Summary			
Average Delay	8.1		
Intersection Capacity Utilization	25.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	1	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	0	0	0	0
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1235
pX, platoon unblocked						
vC, conflicting volume	5	5			5	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	5	5			5	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	100	100			100	
cM capacity (veh/h)	995	1054			1565	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	1	0	0
Volume Left	0	0	0
Volume Right	1	0	0
cSH	1054	1700	1700
Volume to Capacity	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	8.4	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.4	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	8.4		
Intersection Capacity Utilization	8.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑	↱	↰↰	↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	4759	1461	3213	3312	1461	3213	4759	1461	3213	4759	1461
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	4759	1461	3213	3312	1461	3213	4759	1461	3213	4759	1461
Volume (vph)	257	565	143	468	390	199	114	663	209	313	558	130
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	279	614	155	509	424	216	124	721	227	340	607	141
RTOR Reduction (vph)	0	0	123	0	0	156	0	0	166	0	0	91
Lane Group Flow (vph)	279	614	32	509	424	60	124	721	61	340	607	50
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	14.7	19.5	19.5	22.7	27.5	27.5	7.7	26.4	26.4	16.8	35.5	35.5
Effective Green, g (s)	15.2	22.0	22.0	23.2	30.0	30.0	8.2	28.9	28.9	17.3	38.0	38.0
Actuated g/C Ratio	0.14	0.20	0.20	0.22	0.28	0.28	0.08	0.27	0.27	0.16	0.35	0.35
Clearance Time (s)	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	455	975	299	694	925	408	245	1281	393	518	1684	517
v/s Ratio Prot	0.09	c0.13		c0.16	0.13		0.04	c0.15		c0.11	0.13	
v/s Ratio Perm			0.02			0.04			0.04			0.03
v/c Ratio	0.61	0.63	0.11	0.73	0.46	0.15	0.51	0.56	0.16	0.66	0.36	0.10
Uniform Delay, d1	43.3	39.0	34.7	39.2	32.0	29.1	47.7	33.8	29.9	42.3	25.7	23.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.4	0.9	0.1	4.0	0.1	0.1	1.6	0.5	0.1	3.0	0.1	0.1
Delay (s)	45.8	39.9	34.8	43.2	32.1	29.2	49.3	34.3	30.1	45.3	25.8	23.3
Level of Service	D	D	C	D	C	C	D	C	C	D	C	C
Approach Delay (s)		40.7			36.5			35.1			31.6	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM Average Control Delay	35.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	107.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	279	614	155	509	424	216	124	721	227	340	607	141
v/c Ratio	0.61	0.63	0.37	0.74	0.46	0.38	0.42	0.59	0.42	0.66	0.36	0.23
Control Delay	49.4	41.7	7.9	43.9	34.2	5.7	54.0	38.9	7.3	48.2	29.8	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.4	41.7	7.9	43.9	34.2	5.7	54.0	38.9	7.3	48.2	29.8	6.4
Queue Length 50th (ft)	98	149	0	176	132	0	44	161	0	119	117	0
Queue Length 95th (ft)	178	231	58	294	216	59	93	279	70	212	209	51
Internal Link Dist (ft)		655			920			405			630	
Turn Bay Length (ft)	500		275	425		350	200			350		300
Base Capacity (vph)	707	1546	579	978	1328	715	559	1489	613	742	1849	653
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.40	0.27	0.52	0.32	0.30	0.22	0.48	0.37	0.46	0.33	0.22

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰↰	↑↱			↰↑	↱	↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.95			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.98			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4696		3213	3234			1705	1461	1573	1646	1461
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4696		3213	3234			1705	1461	1573	1646	1461
Volume (vph)	85	922	80	315	939	146	60	75	240	144	120	58
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	1002	87	342	1021	159	65	82	261	157	130	63
RTOR Reduction (vph)	0	7	0	0	8	0	0	0	207	0	0	55
Lane Group Flow (vph)	92	1082	0	342	1172	0	0	147	54	140	147	8
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	8.2	35.8		15.9	43.5			13.7	13.7	11.7	11.7	11.7
Effective Green, g (s)	8.2	37.1		15.9	44.8			13.9	13.9	11.9	11.9	11.9
Actuated g/C Ratio	0.09	0.39		0.17	0.47			0.15	0.15	0.13	0.13	0.13
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	143	1838		539	1528			250	214	197	207	183
v/s Ratio Prot	0.06	0.23		c0.11	c0.36			c0.09		0.09	c0.09	
v/s Ratio Perm									0.04			0.01
v/c Ratio	0.64	0.59		0.63	0.77			0.59	0.25	0.71	0.71	0.04
Uniform Delay, d1	41.9	22.8		36.7	20.7			37.8	35.8	39.8	39.8	36.4
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.2	0.5		2.1	2.3			2.3	0.2	9.6	9.2	0.0
Delay (s)	49.1	23.3		38.9	22.9			40.0	36.1	49.4	49.0	36.5
Level of Service	D	C		D	C			D	D	D	D	D
Approach Delay (s)		25.3			26.5			37.5			46.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	94.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	92	1089	342	1180	147	261	140	147	63
v/c Ratio	0.65	0.60	0.64	0.78	0.59	0.62	0.62	0.63	0.24
Control Delay	74.0	25.9	47.5	24.9	46.4	10.6	46.8	46.6	12.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.0	25.9	47.5	24.9	46.4	10.6	46.8	46.6	12.4
Queue Length 50th (ft)	55	191	97	295	83	9	83	87	0
Queue Length 95th (ft)	#230	354	#271	600	202	101	205	214	42
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	142	2429	627	1905	483	587	430	450	445
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.65	0.45	0.55	0.62	0.30	0.44	0.33	0.33	0.14

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.98	1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1445	1656	3312	1446	1656	1651		1656	1743	1461
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1445	1656	3312	1446	1656	1651		1656	1743	1461
Volume (vph)	81	1127	98	54	1181	125	135	120	57	104	100	84
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	1225	107	59	1284	136	147	130	62	113	109	91
RTOR Reduction (vph)	0	0	27	0	0	23	0	10	0	0	0	78
Lane Group Flow (vph)	88	1225	80	59	1284	113	147	182	0	113	109	13
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6						4
Actuated Green, G (s)	9.3	72.0	72.0	7.4	70.1	70.1	13.1	19.4		10.9	17.2	17.2
Effective Green, g (s)	9.3	73.7	73.7	7.4	71.8	71.8	13.1	20.0		10.9	17.8	17.8
Actuated g/C Ratio	0.07	0.58	0.58	0.06	0.56	0.56	0.10	0.16		0.09	0.14	0.14
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5	5.5	2.0	5.5	5.5	2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	120	1907	832	96	1858	811	169	258		141	242	203
v/s Ratio Prot	c0.05	0.37		0.04	c0.39		c0.09	c0.11		0.07	0.06	
v/s Ratio Perm			0.06			0.08						0.01
v/c Ratio	0.73	0.64	0.10	0.61	0.69	0.14	0.87	0.70		0.80	0.45	0.06
Uniform Delay, d1	58.1	18.3	12.2	58.9	20.1	13.4	56.6	51.2		57.5	50.6	47.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	17.9	1.1	0.1	7.9	1.6	0.2	33.8	7.0		25.6	0.5	0.0
Delay (s)	76.1	19.4	12.3	66.9	21.7	13.6	90.4	58.2		83.1	51.1	47.9
Level of Service	E	B	B	E	C	B	F	E		F	D	D
Approach Delay (s)		22.4			22.8			72.1			61.7	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	30.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	128.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	88	1225	107	59	1284	136	147	192	113	109	91
v/c Ratio	0.58	0.64	0.12	0.49	0.69	0.16	0.74	0.71	0.68	0.44	0.32
Control Delay	70.5	25.2	10.0	70.4	28.1	14.1	64.6	56.1	66.6	59.6	12.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.5	25.2	10.0	70.4	28.1	14.1	64.6	56.1	66.6	59.6	12.0
Queue Length 50th (ft)	78	376	17	52	424	34	130	159	100	93	0
Queue Length 95th (ft)	161	721	68	118	810	107	242	270	196	172	53
Internal Link Dist (ft)		1520			2225			975		905	
Turn Bay Length (ft)	100			165		165	150		120		140
Base Capacity (vph)	252	2001	896	271	1958	875	393	462	388	466	457
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.61	0.12	0.22	0.66	0.16	0.37	0.42	0.29	0.23	0.20

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰↑	↱		↰↑	↱		↶↰	↑↑	↱	↰	↑↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.95
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	1.00
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1662	1461		1667	1461		1656	3312	1443	1656	3312
Flt Permitted		0.69	1.00		0.66	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1199	1461		1147	1461		1656	3312	1443	1656	3312
Volume (vph)	195	5	115	50	5	147	5	88	961	65	102	831
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	5	125	54	5	160	5	96	1045	71	111	903
RTOR Reduction (vph)	0	0	94	0	0	120	0	0	0	35	0	0
Lane Group Flow (vph)	0	217	31	0	59	40	0	101	1045	36	111	903
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		18.1	18.1		19.7	19.7		7.8	38.1	38.1	7.2	36.8
Effective Green, g (s)		19.8	19.8		19.8	19.8		8.3	39.5	39.5	7.3	38.5
Actuated g/C Ratio		0.25	0.25		0.25	0.25		0.11	0.50	0.50	0.09	0.49
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		302	368		289	368		175	1664	725	154	1622
v/s Ratio Prot								0.06	c0.32		c0.07	0.27
v/s Ratio Perm		c0.18	0.02		0.05	0.03				0.02		
v/c Ratio		0.72	0.09		0.20	0.11		0.58	0.63	0.05	0.72	0.56
Uniform Delay, d1		26.9	22.5		23.2	22.6		33.5	14.2	10.0	34.7	14.1
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		7.9	0.1		0.4	0.1		4.6	0.9	0.0	15.3	0.4
Delay (s)		34.8	22.6		23.5	22.8		38.0	15.1	10.0	49.9	14.5
Level of Service		C	C		C	C		D	B	B	D	B
Approach Delay (s)		30.3			23.0				16.7			17.6
Approach LOS		C			C				B			B

Intersection Summary			
HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	78.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	217	125	59	160	101	1045	71	111	903	120
v/c Ratio	0.71	0.27	0.20	0.33	0.49	0.64	0.10	0.71	0.55	0.15
Control Delay	34.0	6.1	25.1	5.7	40.0	16.9	3.5	66.4	17.9	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.0	6.1	25.1	5.7	40.0	16.9	3.5	66.4	17.9	3.8
Queue Length 50th (ft)	105	0	26	0	52	200	0	60	180	0
Queue Length 95th (ft)	184	39	56	44	103	288	21	#161	270	31
Internal Link Dist (ft)	570		705			630			1447	
Turn Bay Length (ft)		400		400	150			180		175
Base Capacity (vph)	385	554	381	578	255	1764	802	156	1678	790
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.23	0.15	0.28	0.40	0.59	0.09	0.71	0.54	0.15

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	35	135	5	162	95	191	5	695	205	196	515	40
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	147	5	176	103	208	5	755	223	213	560	43

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	190	487	984	816
Volume Left (vph)	38	176	5	213
Volume Right (vph)	5	208	223	43
Hadj (s)	0.18	-0.03	0.02	0.17
Departure Headway (s)	9.7	8.3	8.3	8.5
Degree Utilization, x	0.51	1.12	2.28	1.92
Capacity (veh/h)	358	429	441	430
Control Delay (s)	22.6	108.5	600.3	444.4
Approach Delay (s)	22.6	108.5	600.3	444.4
Approach LOS	C	F	F	F

Intersection Summary			
Delay	407.9		
HCM Level of Service	F		
Intersection Capacity Utilization	138.4%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱	↰	↑	↱	↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.97	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1656	3312	1444	1656	3312	1444	1656	1743	1461	1656	1743	1461
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1656	3312	1444	1656	3312	1444	1656	1743	1461	1656	1743	1461
Volume (vph)	105	750	50	83	436	115	165	33	25	65	10	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	815	54	90	474	125	179	36	27	71	11	120
RTOR Reduction (vph)	0	0	37	0	0	89	0	0	17	0	0	85
Lane Group Flow (vph)	114	815	17	90	474	36	179	36	10	71	11	35
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	8.2	27.9	27.9	6.3	26.0	26.0	13.1	32.8	32.8	7.0	26.7	26.7
Effective Green, g (s)	8.7	28.4	28.4	6.8	26.5	26.5	13.6	33.3	33.3	7.5	27.2	27.2
Actuated g/C Ratio	0.09	0.31	0.31	0.07	0.29	0.29	0.15	0.36	0.36	0.08	0.30	0.30
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	157	1022	446	122	954	416	245	631	529	135	515	432
v/s Ratio Prot	c0.07	c0.25		0.05	0.14		c0.11	0.02		0.04	0.01	
v/s Ratio Perm			0.01			0.02			0.01			c0.02
v/c Ratio	0.73	0.80	0.04	0.74	0.50	0.09	0.73	0.06	0.02	0.53	0.02	0.08
Uniform Delay, d1	40.5	29.2	22.2	41.7	27.2	23.9	37.4	19.1	18.9	40.5	23.0	23.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	15.4	4.4	0.0	20.6	0.4	0.1	10.7	0.2	0.1	3.7	0.1	0.4
Delay (s)	55.8	33.6	22.3	62.3	27.6	24.0	48.1	19.3	18.9	44.2	23.0	23.8
Level of Service	E	C	C	E	C	C	D	B	B	D	C	C
Approach Delay (s)		35.5			31.5			40.6			30.9	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	34.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	92.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	114	815	54	90	474	125	179	36	27	71	11	120
v/c Ratio	0.61	0.78	0.11	0.60	0.49	0.24	0.71	0.06	0.05	0.44	0.02	0.24
Control Delay	50.7	31.8	7.0	56.9	28.3	6.0	48.5	24.9	9.7	47.0	28.5	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.7	31.8	7.0	56.9	28.3	6.0	48.5	24.9	9.7	47.0	28.5	7.2
Queue Length 50th (ft)	68	237	0	55	127	0	107	16	0	43	5	0
Queue Length 95th (ft)	127	308	26	#122	175	41	#197	40	20	88	20	43
Internal Link Dist (ft)		2059			485			355			581	
Turn Bay Length (ft)	325			325		325	140		140	140		140
Base Capacity (vph)	215	1193	564	163	1102	564	293	646	558	196	502	506
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.68	0.10	0.55	0.43	0.22	0.61	0.06	0.05	0.36	0.02	0.24

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↱		↑↑		↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	687	153	0	634	0	278
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	747	166	0	689	0	302
Pedestrians					5	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	565			735		
pX, platoon unblocked					0.91	
vC, conflicting volume			918		1096	254
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			918		1007	254
tC, single (s)			4.3		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			100		100	58
cM capacity (veh/h)			694		204	722

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	NB 1
Volume Total	249	249	249	166	345	345	302
Volume Left	0	0	0	0	0	0	0
Volume Right	0	0	0	166	0	0	302
cSH	1700	1700	1700	1700	1700	1700	722
Volume to Capacity	0.15	0.15	0.15	0.10	0.20	0.20	0.42
Queue Length 95th (ft)	0	0	0	0	0	0	52
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	13.5
Lane LOS							B
Approach Delay (s)	0.0				0.0		13.5
Approach LOS							B

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	1.00		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.99			1.00		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.86			0.98		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.96		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	1474			1643		1656	1738		1656	3312	1442
Flt Permitted	0.72	1.00			0.74		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1261	1474			1267		1656	1738		1656	3312	1442
Volume (vph)	323	5	83	65	5	10	248	658	10	5	660	188
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	351	5	90	71	5	11	270	715	11	5	717	204
RTOR Reduction (vph)	0	64	0	0	6	0	0	0	0	0	0	127
Lane Group Flow (vph)	351	31	0	0	81	0	270	726	0	5	717	77
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								6
Actuated Green, G (s)	25.3	25.3			25.3		17.4	49.5		1.2	33.3	33.3
Effective Green, g (s)	25.8	25.8			25.8		17.9	50.0		1.7	33.8	33.8
Actuated g/C Ratio	0.29	0.29			0.29		0.20	0.56		0.02	0.38	0.38
Clearance Time (s)	4.5	4.5			4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	364	425			365		331	971		31	1251	545
v/s Ratio Prot		0.02					c0.16	c0.42		0.00	0.22	
v/s Ratio Perm	c0.28				0.06							0.05
v/c Ratio	0.96	0.07			0.22		0.82	0.75		0.16	0.57	0.14
Uniform Delay, d1	31.4	23.2			24.2		34.2	15.0		43.2	22.1	18.3
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	37.5	0.1			0.3		14.3	5.2		2.4	1.9	0.5
Delay (s)	68.9	23.2			24.5		48.5	20.2		45.6	24.0	18.9
Level of Service	E	C			C		D	C		D	C	B
Approach Delay (s)		59.2			24.5			27.9			23.0	
Approach LOS		E			C			C			C	

Intersection Summary			
HCM Average Control Delay	31.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	351	95	87	270	726	5	717	204
v/c Ratio	0.93	0.19	0.26	0.78	0.72	0.05	0.62	0.32
Control Delay	57.8	7.0	23.1	42.5	19.6	41.4	26.8	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.8	7.0	23.1	42.5	19.6	41.4	26.8	4.8
Queue Length 50th (ft)	190	2	33	141	251	3	177	0
Queue Length 95th (ft)	#361	36	72	#244	#574	14	242	46
Internal Link Dist (ft)		428	547		425		225	
Turn Bay Length (ft)				200		90		
Base Capacity (vph)	391	520	379	392	1012	185	1162	639
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.90	0.18	0.23	0.69	0.72	0.03	0.62	0.32

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑	↑	↱
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	41	0	916	805	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	45	0	996	875	3
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)					505	
pX, platoon unblocked	0.74	0.74	0.74			
vC, conflicting volume	1876	880	883			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2189	837	841			
tC, single (s)	6.5	6.3	4.2			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	100	83	100			
cM capacity (veh/h)	35	261	561			

Direction, Lane #	EB 1	NB 1	SB 1	SB 2
Volume Total	45	996	875	3
Volume Left	0	0	0	0
Volume Right	45	0	0	3
cSH	261	1700	1700	1700
Volume to Capacity	0.17	0.59	0.51	0.00
Queue Length 95th (ft)	15	0	0	0
Control Delay (s)	21.6	0.0	0.0	0.0
Lane LOS	C			
Approach Delay (s)	21.6	0.0	0.0	
Approach LOS	C			

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		Tr		↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	213	10	0	143	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	232	11	0	155	0
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						435
pX, platoon unblocked						
vC, conflicting volume	327	16			16	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	327	16			16	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	100	78			90	
cM capacity (veh/h)	585	1039			1551	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	232	11	155	0
Volume Left	0	0	155	0
Volume Right	232	0	0	0
cSH	1039	1700	1551	1700
Volume to Capacity	0.22	0.01	0.10	0.00
Queue Length 95th (ft)	21	0	8	0
Control Delay (s)	9.5	0.0	7.6	0.0
Lane LOS	A		A	
Approach Delay (s)	9.5	0.0	7.6	
Approach LOS	A			

Intersection Summary			
Average Delay	8.5		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑↱			↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	10	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	11	0	0	0	0
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1235
pX, platoon unblocked						
vC, conflicting volume	5	5			5	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	5	5			5	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	100	99			100	
cM capacity (veh/h)	995	1054			1565	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	11	0	0
Volume Left	0	0	0
Volume Right	11	0	0
cSH	1054	1700	1700
Volume to Capacity	0.01	0.00	0.00
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.5	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.5	0.0	0.0
Approach LOS	A		

Intersection Summary

- Average Delay: 8.5
- Intersection Capacity Utilization: 8.2% — ICU Level of Service: A
- Analysis Period (min): 15

Appendix D

Cumulative No Project Conditions
AM and PM Peak Hour
Intersection Level of Service Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	4759	1460	3213	4759	1465	3213	4759	1460	3213	4759	1460
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	4759	1460	3213	4759	1465	3213	4759	1460	3213	4759	1460
Volume (vph)	190	1150	70	450	975	250	150	400	300	300	600	200
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	207	1250	76	489	1060	272	163	435	326	326	652	217
RTOR Reduction (vph)	0	0	42	0	0	48	0	0	269	0	0	170
Lane Group Flow (vph)	207	1250	34	489	1060	224	163	435	57	326	652	47
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		pm+ov	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6	7	3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	36.0	58.6	58.6	27.4	50.0	68.5	11.9	23.5	23.5	18.5	30.1	30.1
Effective Green, g (s)	36.5	61.1	61.1	27.9	52.5	71.5	12.4	26.0	26.0	19.0	32.6	32.6
Actuated g/C Ratio	0.24	0.41	0.41	0.19	0.35	0.48	0.08	0.17	0.17	0.13	0.22	0.22
Clearance Time (s)	4.5	6.5	6.5	4.5	6.5	4.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5	1.5	3.0	1.5	3.0	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	782	1938	595	598	1666	698	266	825	253	407	1034	317
v/s Ratio Prot	0.06	c0.26		c0.15	c0.22	0.04	0.05	0.09		c0.10	c0.14	
v/s Ratio Perm			0.02			0.11			0.04			0.03
v/c Ratio	0.26	0.64	0.06	0.82	0.64	0.32	0.61	0.53	0.22	0.80	0.63	0.15
Uniform Delay, d1	45.9	35.7	27.0	58.6	40.8	24.2	66.5	56.4	53.3	63.7	53.2	47.5
Progression Factor	0.52	0.44	0.08	0.82	0.71	0.72	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	1.4	0.2	7.4	1.6	0.2	4.1	0.5	0.3	10.8	1.1	0.2
Delay (s)	24.0	17.1	2.4	55.4	30.4	17.8	70.6	56.9	53.6	74.5	54.3	47.6
Level of Service	C	B	A	E	C	B	E	E	D	E	D	D
Approach Delay (s)		17.3			35.2			58.2			58.6	
Approach LOS		B			D			E			E	

Intersection Summary			
HCM Average Control Delay	39.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	207	1250	76	489	1060	272	163	435	326	326	652	217
v/c Ratio	0.26	0.64	0.12	0.82	0.64	0.36	0.62	0.53	0.62	0.80	0.63	0.45
Control Delay	25.1	18.0	1.0	51.8	30.2	7.3	74.0	57.0	9.0	77.4	54.6	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	18.0	1.0	51.8	30.2	7.3	74.0	57.0	9.0	77.4	54.6	7.8
Queue Length 50th (ft)	60	68	0	239	331	65	80	142	0	162	214	0
Queue Length 95th (ft)	117	421	m6	227	210	121	120	173	89	#231	249	68
Internal Link Dist (ft)		1220			920			405			630	
Turn Bay Length (ft)	500		275	425		350	200			350		300
Base Capacity (vph)	782	1941	638	728	2015	751	291	1031	572	416	1202	531
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.64	0.12	0.67	0.53	0.36	0.56	0.42	0.57	0.78	0.54	0.41

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰↰	↑↑↑↱			↰↑	↱	↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4747		3213	4724			1705	1459	1573	1637	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4747		3213	4724			1705	1459	1573	1637	1459
Volume (vph)	25	1700	25	160	1600	70	20	25	95	70	45	55
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	1848	27	174	1739	76	22	27	103	76	49	60
RTOR Reduction (vph)	0	1	0	0	2	0	0	0	95	0	0	55
Lane Group Flow (vph)	27	1874	0	174	1813	0	0	49	8	61	64	5
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	4.4	95.2		12.8	103.6			11.6	11.6	12.7	12.7	12.7
Effective Green, g (s)	4.4	96.5		12.8	104.9			11.8	11.8	12.9	12.9	12.9
Actuated g/C Ratio	0.03	0.64		0.09	0.70			0.08	0.08	0.09	0.09	0.09
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	49	3054		274	3304			134	115	135	141	125
v/s Ratio Prot	0.02	c0.39		c0.05	0.38			c0.03		0.04	c0.04	
v/s Ratio Perm									0.01			0.00
v/c Ratio	0.55	0.61		0.64	0.55			0.37	0.07	0.45	0.45	0.04
Uniform Delay, d1	71.8	15.8		66.3	11.0			65.5	64.0	65.2	65.2	62.9
Progression Factor	0.79	1.97		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.6	0.7		4.2	0.7			0.6	0.1	0.9	0.8	0.0
Delay (s)	62.7	31.7		70.5	11.7			66.2	64.1	66.1	66.0	62.9
Level of Service	E	C		E	B			E	E	E	E	E
Approach Delay (s)		32.2			16.8			64.8			65.0	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	27	1875	174	1815	49	103	61	64	60
v/c Ratio	0.38	0.61	0.63	0.54	0.36	0.49	0.45	0.45	0.33
Control Delay	64.1	37.2	70.3	15.1	63.1	11.6	63.8	63.8	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	64.1	37.2	70.3	15.1	63.1	11.6	63.8	63.8	13.7
Queue Length 50th (ft)	23	671	86	262	47	0	62	65	0
Queue Length 95th (ft)	m40	#812	124	630	80	53	101	104	41
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	79	3054	364	3356	332	367	306	318	332
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.61	0.48	0.54	0.15	0.28	0.20	0.20	0.18

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	4736		1656	4721		1656	1641		1656	1743	1460
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	4736		1656	4721		1656	1641		1656	1743	1460
Volume (vph)	40	1775	50	40	1690	80	85	135	75	110	110	55
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	1929	54	43	1837	87	92	147	82	120	120	60
RTOR Reduction (vph)	0	1	0	0	2	0	0	12	0	0	0	49
Lane Group Flow (vph)	43	1982	0	43	1922	0	92	217	0	120	120	11
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	7.0	82.8		7.0	82.8		12.1	22.8		14.6	25.3	25.3
Effective Green, g (s)	7.0	84.5		7.0	84.5		12.1	23.4		14.6	25.9	25.9
Actuated g/C Ratio	0.05	0.58		0.05	0.58		0.08	0.16		0.10	0.18	0.18
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5		2.0	5.5		2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	80	2750		80	2742		138	264		166	310	260
v/s Ratio Prot	c0.03	c0.42		0.03	0.41		0.06	c0.13		c0.07	0.07	
v/s Ratio Perm												0.01
v/c Ratio	0.54	0.72		0.54	0.70		0.67	0.82		0.72	0.39	0.04
Uniform Delay, d1	67.7	22.0		67.7	21.6		64.7	59.0		63.5	52.8	49.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.4	1.3		3.4	1.1		9.1	17.6		12.4	0.3	0.0
Delay (s)	71.1	23.2		71.1	22.7		73.8	76.6		75.8	53.1	49.5
Level of Service	E	C		E	C		E	E		E	D	D
Approach Delay (s)		24.3			23.8			75.8			61.5	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	145.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	43	1983	43	1924	92	229	120	120	60
v/c Ratio	0.45	0.72	0.46	0.70	0.66	0.83	0.72	0.39	0.19
Control Delay	73.8	27.0	73.4	26.3	70.6	62.7	70.3	55.2	12.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.8	27.0	73.4	26.3	70.6	62.7	70.3	55.2	12.6
Queue Length 50th (ft)	40	494	40	470	86	201	113	102	0
Queue Length 95th (ft)	93	772	93	736	165	325	202	178	42
Internal Link Dist (ft)		1520		2225		976		905	
Turn Bay Length (ft)	100		165		150		120		140
Base Capacity (vph)	202	2765	220	2756	278	386	282	411	390
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.21	0.72	0.20	0.70	0.33	0.59	0.43	0.29	0.15

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↱		↰	↱		↰	↑↑	↱	↰	↑↑↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.91
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	0.99
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1664	1461		1675	1460		1656	3312	1442	1656	4680
Flt Permitted		0.72	1.00		0.78	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1247	1461		1355	1460		1656	3312	1442	1656	4680
Volume (vph)	100	5	65	20	5	36	5	75	735	25	91	1010
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	5	71	22	5	39	5	82	799	27	99	1098
RTOR Reduction (vph)	0	0	59	0	0	33	0	0	0	11	0	10
Lane Group Flow (vph)	0	114	12	0	27	7	0	87	799	16	99	1202
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		13.3	13.3		14.9	14.9		8.3	51.6	51.6	9.9	52.5
Effective Green, g (s)		15.0	15.0		15.0	15.0		8.8	53.0	53.0	10.0	54.2
Actuated g/C Ratio		0.17	0.17		0.17	0.17		0.10	0.59	0.59	0.11	0.60
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		208	244		226	243		162	1950	849	184	2818
v/s Ratio Prot								0.05	0.24		c0.06	c0.26
v/s Ratio Perm		c0.09	0.01		0.02	0.00				0.01		
v/c Ratio		0.55	0.05		0.12	0.03		0.54	0.41	0.02	0.54	0.43
Uniform Delay, d1		34.4	31.5		31.9	31.4		38.7	10.0	7.7	37.8	9.6
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.9	0.1		0.2	0.0		3.4	0.6	0.0	3.0	0.5
Delay (s)		37.3	31.6		32.1	31.4		42.1	10.7	7.7	40.8	10.1
Level of Service		D	C		C	C		D	B	A	D	B
Approach Delay (s)		35.1			31.7				13.6			12.4
Approach LOS		D			C				B			B

Intersection Summary			
HCM Average Control Delay	15.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	114	71	27	39	87	799	27	99	1212
v/c Ratio	0.52	0.23	0.11	0.14	0.48	0.41	0.03	0.54	0.42
Control Delay	34.0	7.5	28.2	9.1	41.7	12.2	4.6	50.8	11.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.0	7.5	28.2	9.1	41.7	12.2	4.6	50.8	11.9
Queue Length 50th (ft)	61	0	13	0	47	124	0	53	124
Queue Length 95th (ft)	96	30	31	23	92	203	13	#142	229
Internal Link Dist (ft)	570		705			630			1447
Turn Bay Length (ft)		400		400	150			180	
Base Capacity (vph)	376	483	421	461	230	1950	860	184	2873
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.15	0.06	0.08	0.38	0.41	0.03	0.54	0.42

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	35	20	830	35	40	1080
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	22	902	38	43	1174
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						485
pX, platoon unblocked	0.86					
vC, conflicting volume	1600	325			945	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1536	325			945	
tC, single (s)	7.0	7.1			4.3	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	53	97			94	
cM capacity (veh/h)	80	648			677	

Direction, Lane #	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	60	361	361	218	43	587	587
Volume Left	38	0	0	0	43	0	0
Volume Right	22	0	0	38	0	0	0
cSH	118	1700	1700	1700	677	1700	1700
Volume to Capacity	0.51	0.21	0.21	0.13	0.06	0.35	0.35
Queue Length 95th (ft)	59	0	0	0	5	0	0
Control Delay (s)	63.7	0.0	0.0	0.0	10.7	0.0	0.0
Lane LOS	F				B		
Approach Delay (s)	63.7	0.0			0.4		
Approach LOS	F						

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	39.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	0.88	1.00	0.95	1.00	0.97	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1656	1725		1656	1743	2575	1656	3312	1466	3213	3224	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1656	1725		1656	1743	2575	1656	3312	1466	3213	3224	
Volume (vph)	50	150	10	150	250	350	50	605	130	300	705	125
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	163	11	163	272	380	54	658	141	326	766	136
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	54	174	0	163	272	380	54	658	141	326	902	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		pm+ov	Prot		pm+ov	Prot		
Protected Phases	7	4		3	8	1	5	2	3	1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	4.2	12.2		7.3	15.3	28.3	2.3	25.4	32.7	13.0	36.1	
Effective Green, g (s)	4.7	12.7		7.8	15.8	29.3	2.8	25.9	33.7	13.5	36.6	
Actuated g/C Ratio	0.06	0.17		0.10	0.21	0.39	0.04	0.34	0.44	0.18	0.48	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	103	289		170	363	1130	61	1130	728	571	1555	
v/s Ratio Prot	0.03	0.10		c0.10	c0.16	0.06	c0.03	0.20	0.02	c0.10	c0.28	
v/s Ratio Perm						0.09			0.08			
v/c Ratio	0.52	0.60		0.96	0.75	0.34	0.89	0.58	0.19	0.57	0.58	
Uniform Delay, d1	34.5	29.8		33.9	28.2	16.4	36.4	20.6	12.8	28.5	14.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.7	3.5		56.2	8.2	0.2	75.0	0.8	0.1	1.4	0.6	
Delay (s)	39.3	32.8		90.1	36.4	16.6	111.4	21.3	13.0	29.9	14.7	
Level of Service	D	C		F	D	B	F	C	B	C	B	
Approach Delay (s)		34.3			37.9			25.6			18.7	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM Average Control Delay	26.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	75.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	54	174	163	272	380	54	658	141	326	902
v/c Ratio	0.29	0.51	0.67	0.60	0.36	0.41	0.63	0.22	0.53	0.51
Control Delay	39.5	31.2	47.5	30.1	14.2	50.6	25.9	14.3	33.5	18.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.5	31.2	47.5	30.1	14.2	50.6	25.9	14.3	33.5	18.9
Queue Length 50th (ft)	26	80	81	128	69	27	152	39	79	191
Queue Length 95th (ft)	65	143	#197	215	108	#83	234	84	135	294
Internal Link Dist (ft)		1115		1425			1445			2415
Turn Bay Length (ft)	100		140		300	200		150	275	
Base Capacity (vph)	223	504	268	567	1142	131	1253	659	747	1772
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.35	0.61	0.48	0.33	0.41	0.53	0.21	0.45	0.51

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↑	↱	↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1656	4743		1656	4709		1656	1743	1459	1656	1743	1459
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1656	4743		1656	4709		1656	1743	1459	1656	1743	1459
Volume (vph)	65	1340	25	25	1225	75	70	100	20	50	100	60
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	1457	27	27	1332	82	76	109	22	54	109	65
RTOR Reduction (vph)	0	1	0	0	4	0	0	0	16	0	0	48
Lane Group Flow (vph)	71	1483	0	27	1410	0	76	109	6	54	109	17
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases									8			4
Actuated Green, G (s)	11.2	76.5		5.6	70.9		11.9	41.2	41.2	8.7	38.0	38.0
Effective Green, g (s)	11.7	77.0		6.1	71.4		12.4	41.7	41.7	9.2	38.5	38.5
Actuated g/C Ratio	0.08	0.51		0.04	0.48		0.08	0.28	0.28	0.06	0.26	0.26
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	129	2435		67	2241		137	485	406	102	447	374
v/s Ratio Prot	c0.04	c0.31		0.02	0.30		c0.05	c0.06		0.03	c0.06	
v/s Ratio Perm									0.00			0.01
v/c Ratio	0.55	0.61		0.40	0.63		0.55	0.22	0.02	0.53	0.24	0.04
Uniform Delay, d1	66.6	25.8		70.2	29.4		66.1	41.7	39.3	68.3	44.2	41.9
Progression Factor	1.00	1.00		1.39	0.51		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	1.1		3.4	1.2		4.8	1.1	0.1	4.9	1.3	0.2
Delay (s)	71.6	27.0		101.0	16.3		70.9	42.8	39.3	73.2	45.5	42.1
Level of Service	E	C		F	B		E	D	D	E	D	D
Approach Delay (s)		29.0			17.9			52.7			51.1	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	27.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	71	1484	27	1414	76	109	22	54	109	65
v/c Ratio	0.55	0.59	0.29	0.62	0.55	0.22	0.05	0.47	0.25	0.16
Control Delay	75.3	26.0	95.9	16.1	67.9	45.2	15.4	73.1	48.0	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.3	26.0	95.9	16.1	67.9	45.2	15.4	73.1	48.0	11.1
Queue Length 50th (ft)	68	375	28	467	73	84	0	52	86	0
Queue Length 95th (ft)	122	443	m53	127	125	144	24	98	149	42
Internal Link Dist (ft)		2059		1220		1035			581	
Turn Bay Length (ft)	325		325		140		140	140		140
Base Capacity (vph)	157	2522	144	2275	276	485	422	150	437	415
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.59	0.19	0.62	0.28	0.22	0.05	0.36	0.25	0.16

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.92		1.00	0.96		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1656	1652		1656	1593		1656	3168		1656	3252	
Flt Permitted	0.52	1.00		0.36	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	914	1652		632	1593		1656	3168		1656	3252	
Volume (vph)	50	160	75	100	80	90	40	725	240	50	955	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	174	82	109	87	98	43	788	261	54	1038	120
RTOR Reduction (vph)	0	22	0	0	52	0	0	29	0	0	8	0
Lane Group Flow (vph)	54	234	0	109	133	0	43	1020	0	54	1150	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	13.0	13.0		13.0	13.0		4.2	39.0		4.4	39.2	
Effective Green, g (s)	13.5	13.5		13.5	13.5		4.7	39.5		4.9	39.7	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.07	0.57		0.07	0.57	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	177	319		122	308		111	1790		116	1847	
v/s Ratio Prot		0.14			0.08		0.03	0.32		c0.03	c0.35	
v/s Ratio Perm	0.06			c0.17								
v/c Ratio	0.31	0.73		0.89	0.43		0.39	0.57		0.47	0.62	
Uniform Delay, d1	24.2	26.5		27.5	24.8		31.2	9.8		31.2	10.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	8.5		49.9	1.0		2.2	0.4		2.9	0.7	
Delay (s)	25.2	35.0		77.4	25.8		33.5	10.2		34.2	10.8	
Level of Service	C	C		E	C		C	B		C	B	
Approach Delay (s)		33.3			44.9			11.1			11.8	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	69.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	54	256	109	185	43	1049	54	1158
v/c Ratio	0.25	0.65	0.63	0.46	0.23	0.54	0.28	0.58
Control Delay	25.6	24.9	31.7	17.9	35.8	13.6	35.9	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.6	24.9	31.7	17.9	35.8	13.6	35.9	14.7
Queue Length 50th (ft)	22	101	48	50	20	167	25	200
Queue Length 95th (ft)	53	183	105	110	54	305	64	363
Internal Link Dist (ft)		927		1155		2415		1840
Turn Bay Length (ft)	150		250		100		200	
Base Capacity (vph)	332	579	266	584	256	2026	257	2068
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.44	0.41	0.32	0.17	0.52	0.21	0.56

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	4759	1460	3213	4759	1460	3213	4759	1460	3213	4759	1460
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	4759	1460	3213	4759	1460	3213	4759	1460	3213	4759	1460
Volume (vph)	350	1000	480	220	1350	400	250	700	125	340	450	150
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	380	1087	522	239	1467	435	272	761	136	370	489	163
RTOR Reduction (vph)	0	0	224	0	0	204	0	0	105	0	0	123
Lane Group Flow (vph)	380	1087	298	239	1467	231	272	761	31	370	489	40
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	22.6	60.4	60.4	15.8	53.6	53.6	17.7	32.0	32.0	19.8	34.1	34.1
Effective Green, g (s)	23.1	62.9	62.9	16.3	56.1	56.1	18.2	34.5	34.5	20.3	36.6	36.6
Actuated g/C Ratio	0.15	0.42	0.42	0.11	0.37	0.37	0.12	0.23	0.23	0.14	0.24	0.24
Clearance Time (s)	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	495	1996	612	349	1780	546	390	1095	336	435	1161	356
v/s Ratio Prot	c0.12	0.23		0.07	c0.31		0.08	c0.16		c0.12	0.10	
v/s Ratio Perm			0.20			0.16			0.02			0.03
v/c Ratio	0.77	0.54	0.49	0.68	0.82	0.42	0.70	0.69	0.09	0.85	0.42	0.11
Uniform Delay, d1	60.9	32.8	31.8	64.4	42.5	34.9	63.3	52.9	45.4	63.4	47.8	44.1
Progression Factor	0.58	0.34	0.30	0.69	0.63	1.28	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	0.7	1.8	3.1	2.5	1.3	5.4	1.8	0.1	14.7	0.2	0.1
Delay (s)	40.0	11.8	11.3	47.5	29.5	46.1	68.6	54.7	45.5	78.1	48.0	44.2
Level of Service	D	B	B	D	C	D	E	D	D	E	D	D
Approach Delay (s)		17.0			34.9			56.9			58.3	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM Average Control Delay	37.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	380	1087	522	239	1467	435	272	761	136	370	489	163
v/c Ratio	0.77	0.64	0.62	0.68	0.82	0.58	0.70	0.70	0.31	0.85	0.42	0.34
Control Delay	40.4	12.2	5.1	45.1	30.6	14.7	65.8	55.3	8.2	79.0	49.0	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	12.2	5.1	45.1	30.6	14.7	65.8	55.3	8.2	79.0	49.0	8.3
Queue Length 50th (ft)	184	97	6	105	658	288	134	247	0	184	144	0
Queue Length 95th (ft)	215	176	108	m115	606	m427	177	294	55	#260	190	61
Internal Link Dist (ft)		1220			920			405			680	
Turn Bay Length (ft)	500		275	425		350	200			350		300
Base Capacity (vph)	536	1999	837	621	1783	751	557	1193	468	449	1162	480
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.54	0.62	0.38	0.82	0.58	0.49	0.64	0.29	0.82	0.42	0.34

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰↰	↑↑↑↱			↰↑	↱	↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4713		3213	4697			1705	1459	1573	1646	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4713		3213	4697			1705	1459	1573	1646	1459
Volume (vph)	85	1300	80	315	1852	146	60	75	240	144	120	58
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	1413	87	342	2013	159	65	82	261	157	130	63
RTOR Reduction (vph)	0	3	0	0	5	0	0	0	213	0	0	55
Lane Group Flow (vph)	92	1497	0	342	2167	0	0	147	48	140	147	8
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	15.3	74.8		20.8	80.3			18.3	18.3	18.4	18.4	18.4
Effective Green, g (s)	15.3	76.1		20.8	81.6			18.5	18.5	18.6	18.6	18.6
Actuated g/C Ratio	0.10	0.51		0.14	0.54			0.12	0.12	0.12	0.12	0.12
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	169	2391		446	2555			210	180	195	204	181
v/s Ratio Prot	0.06	0.32		c0.11	c0.46			c0.09		0.09	c0.09	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.54	0.63		0.77	0.85			0.70	0.27	0.72	0.72	0.04
Uniform Delay, d1	64.0	26.7		62.3	29.0			63.1	59.6	63.2	63.2	57.9
Progression Factor	0.82	1.69		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	1.0		7.4	3.7			8.0	0.3	10.0	10.1	0.0
Delay (s)	54.4	46.1		69.7	32.7			71.1	59.9	73.2	73.3	57.9
Level of Service	D	D		E	C			E	E	E	E	E
Approach Delay (s)		46.6			37.7			63.9			70.5	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	45.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	92	1500	342	2172	147	261	140	147	63
v/c Ratio	0.55	0.63	0.77	0.85	0.70	0.66	0.72	0.72	0.27
Control Delay	63.9	50.2	73.8	34.1	65.9	12.8	66.6	66.5	12.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.9	50.2	73.8	34.1	65.9	12.8	66.6	66.5	12.8
Queue Length 50th (ft)	84	560	165	639	141	16	141	148	0
Queue Length 95th (ft)	m#216	617	#271	#902	202	101	205	214	42
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	168	2394	445	2560	332	480	306	320	335
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.63	0.77	0.85	0.44	0.54	0.46	0.46	0.19

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱		↰	↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	4719		1656	4713		1656	1651		1656	1743	1460
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	4719		1656	4713		1656	1651		1656	1743	1460
Volume (vph)	66	1542	76	54	2132	125	112	120	57	104	100	69
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	1676	83	59	2317	136	122	130	62	113	109	75
RTOR Reduction (vph)	0	2	0	0	3	0	0	10	0	0	0	65
Lane Group Flow (vph)	72	1757	0	59	2450	0	122	182	0	113	109	10
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	9.2	84.1		8.2	83.1		14.7	20.4		13.9	19.6	19.6
Effective Green, g (s)	9.2	85.8		8.2	84.8		14.7	21.0		13.9	20.2	20.2
Actuated g/C Ratio	0.06	0.59		0.06	0.59		0.10	0.14		0.10	0.14	0.14
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5		2.0	5.5		2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	105	2794		94	2758		168	239		159	243	204
v/s Ratio Prot	c0.04	0.37		0.04	c0.52		c0.07	c0.11		0.07	0.06	
v/s Ratio Perm												0.01
v/c Ratio	0.69	0.63		0.63	0.89		0.73	0.76		0.71	0.45	0.05
Uniform Delay, d1	66.4	19.2		66.9	26.0		63.1	59.5		63.5	57.2	54.0
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.8	0.7		9.1	4.3		12.4	12.0		11.7	0.5	0.0
Delay (s)	80.2	19.9		75.9	30.2		75.5	71.6		75.3	57.7	54.1
Level of Service	F	B		E	C		E	E		E	E	D
Approach Delay (s)		22.3			31.3			73.1			63.5	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	32.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	144.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	72	1759	59	2453	122	192	113	109	75
v/c Ratio	0.59	0.63	0.55	0.88	0.73	0.76	0.71	0.44	0.28
Control Delay	73.9	23.7	73.2	33.5	70.3	61.2	70.4	60.1	12.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.9	23.7	73.2	33.5	70.3	61.2	70.4	60.1	12.5
Queue Length 50th (ft)	67	385	55	719	113	166	105	96	0
Queue Length 95th (ft)	140	663	119	#1245	210	279	197	173	49
Internal Link Dist (ft)		1520		2225		975		905	
Turn Bay Length (ft)	100		165		150		120		140
Base Capacity (vph)	206	2809	223	2776	284	385	283	393	387
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.63	0.26	0.88	0.43	0.50	0.40	0.28	0.19

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.91
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	0.98
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1662	1461		1667	1460		1656	3312	1442	1656	4654
Flt Permitted		0.69	1.00		0.62	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1199	1461		1084	1460		1656	3312	1442	1656	4654
Volume (vph)	195	5	115	50	5	147	5	90	1290	65	105	770
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	5	125	54	5	160	5	98	1402	71	114	837
RTOR Reduction (vph)	0	0	95	0	0	121	0	0	0	34	0	18
Lane Group Flow (vph)	0	217	30	0	59	39	0	103	1402	37	114	939
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		20.1	20.1		21.7	21.7		8.7	45.7	45.7	9.0	45.3
Effective Green, g (s)		21.8	21.8		21.8	21.8		9.2	47.1	47.1	9.1	47.0
Actuated g/C Ratio		0.24	0.24		0.24	0.24		0.10	0.52	0.52	0.10	0.52
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		290	354		263	354		169	1733	755	167	2430
v/s Ratio Prot								0.06	c0.42		c0.07	0.20
v/s Ratio Perm		c0.18	0.02		0.05	0.03				0.03		
v/c Ratio		0.75	0.09		0.22	0.11		0.61	0.81	0.05	0.68	0.39
Uniform Delay, d1		31.6	26.4		27.3	26.5		38.7	17.7	10.5	39.1	12.9
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		10.1	0.1		0.4	0.1		6.1	4.2	0.1	10.9	0.5
Delay (s)		41.7	26.5		27.8	26.7		44.8	21.9	10.6	50.0	13.3
Level of Service		D	C		C	C		D	C	B	D	B
Approach Delay (s)		36.1			27.0				22.9			17.2
Approach LOS		D			C				C			B

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	217	125	59	160	103	1402	71	114	957
v/c Ratio	0.75	0.28	0.21	0.34	0.54	0.81	0.09	0.68	0.38
Control Delay	38.5	5.9	26.3	5.7	43.3	23.4	3.5	62.5	14.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.5	5.9	26.3	5.7	43.3	23.4	3.5	62.5	14.4
Queue Length 50th (ft)	112	0	26	0	56	353	0	62	117
Queue Length 95th (ft)	184	39	56	44	105	456	21	#166	169
Internal Link Dist (ft)	570		705			630			1447
Turn Bay Length (ft)		400		400	150			180	
Base Capacity (vph)	356	521	352	546	230	1733	789	168	2494
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.24	0.17	0.29	0.45	0.81	0.09	0.68	0.38

Intersection Summary
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	65	70	1005	45	85	1065
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	71	76	1092	49	92	1158
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						485
pX, platoon unblocked	0.91					
vC, conflicting volume	1885	576			1146	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1873	576			1146	
tC, single (s)	7.0	7.1			4.3	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	0	83			84	
cM capacity (veh/h)	44	442			564	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	147	728	413	92	579	579
Volume Left	71	0	0	92	0	0
Volume Right	76	0	49	0	0	0
cSH	83	1700	1700	564	1700	1700
Volume to Capacity	1.77	0.43	0.24	0.16	0.34	0.34
Queue Length 95th (ft)	310	0	0	15	0	0
Control Delay (s)	476.3	0.0	0.0	12.6	0.0	0.0
Lane LOS	F			B		
Approach Delay (s)	476.3	0.0		0.9		
Approach LOS	F					

Intersection Summary			
Average Delay	28.0		
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱↱	↰	↑↑	↱	↰↰	↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	0.88	1.00	0.95	1.00	0.97	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1656	1726		1656	1743	2572	1656	3312	1466	3213	3208	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1656	1726		1656	1743	2572	1656	3312	1466	3213	3208	
Volume (vph)	70	160	10	110	280	310	10	670	240	330	640	140
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	174	11	120	304	337	11	728	261	359	696	152
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	76	185	0	120	304	337	11	728	261	359	848	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		pm+ov	Prot		pm+ov	Prot		
Protected Phases	7	4		3	8	1	5	2	3	1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	5.2	13.7		9.0	17.5	29.9	1.3	27.5	36.5	12.4	38.6	
Effective Green, g (s)	5.7	14.2		9.5	18.0	30.9	1.8	28.0	37.5	12.9	39.1	
Actuated g/C Ratio	0.07	0.18		0.12	0.22	0.38	0.02	0.35	0.47	0.16	0.49	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	117	304		195	389	1114	37	1151	755	514	1556	
v/s Ratio Prot	0.05	0.11		c0.07	c0.17	0.05	0.01	c0.22	0.04	c0.11	0.26	
v/s Ratio Perm						0.08			0.14			
v/c Ratio	0.65	0.61		0.62	0.78	0.30	0.30	0.63	0.35	0.70	0.54	
Uniform Delay, d1	36.5	30.6		33.8	29.4	17.3	38.8	22.0	13.7	32.0	14.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.8	3.4		5.7	9.8	0.2	4.5	1.1	0.3	4.1	0.4	
Delay (s)	48.3	34.1		39.5	39.3	17.5	43.2	23.1	14.0	36.1	14.9	
Level of Service	D	C		D	D	B	D	C	B	D	B	
Approach Delay (s)		38.2			29.7			21.0			21.2	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	76	185	120	304	337	11	728	261	359	848
v/c Ratio	0.47	0.51	0.58	0.74	0.32	0.08	0.71	0.41	0.66	0.52
Control Delay	47.2	31.4	50.2	34.4	15.4	41.2	27.3	17.2	37.6	16.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.2	31.4	50.2	34.4	15.4	41.2	27.3	17.2	37.6	16.3
Queue Length 50th (ft)	40	88	64	153	64	6	178	86	96	144
Queue Length 95th (ft)	#94	151	#153	244	97	22	254	154	#148	276
Internal Link Dist (ft)		1115		1425			1445			2415
Turn Bay Length (ft)	100		140		300	200		150	275	
Base Capacity (vph)	172	469	214	524	1087	217	1202	643	619	1689
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.39	0.56	0.58	0.31	0.05	0.61	0.41	0.58	0.50

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↑	↱	↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1656	4749		1656	4702		1656	1743	1459	1656	1743	1459
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1656	4749		1656	4702		1656	1743	1459	1656	1743	1459
Volume (vph)	105	1755	20	20	1615	115	10	100	10	65	100	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1908	22	22	1755	125	11	109	11	71	109	120
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	8	0	0	81
Lane Group Flow (vph)	114	1930	0	22	1875	0	11	109	3	71	109	39
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases									8			4
Actuated Green, G (s)	13.0	75.1		5.2	67.3		3.0	40.8	40.8	10.9	48.7	48.7
Effective Green, g (s)	13.5	75.6		5.7	67.8		3.5	41.3	41.3	11.4	49.2	49.2
Actuated g/C Ratio	0.09	0.50		0.04	0.45		0.02	0.28	0.28	0.08	0.33	0.33
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	149	2393		63	2125		39	480	402	126	572	479
v/s Ratio Prot	c0.07	0.41		0.01	c0.40		0.01	c0.06		c0.04	0.06	
v/s Ratio Perm									0.00			0.03
v/c Ratio	0.77	0.81		0.35	0.88		0.28	0.23	0.01	0.56	0.19	0.08
Uniform Delay, d1	66.7	31.1		70.3	37.5		72.0	42.0	39.5	66.9	36.1	34.8
Progression Factor	1.00	1.00		1.15	0.35		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.6	3.0		2.2	3.9		3.9	1.1	0.0	5.7	0.7	0.3
Delay (s)	87.3	34.1		83.2	16.9		76.0	43.1	39.5	72.6	36.9	35.1
Level of Service	F	C		F	B		E	D	D	E	D	D
Approach Delay (s)		37.1			17.7			45.6			44.6	
Approach LOS		D			B			D			D	

Intersection Summary			
HCM Average Control Delay	29.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	114	1930	22	1880	11	109	11	71	109	120
v/c Ratio	0.77	0.76	0.25	0.85	0.14	0.24	0.03	0.56	0.19	0.21
Control Delay	91.7	30.9	79.2	15.2	68.6	46.7	20.2	76.9	39.0	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	91.7	30.9	79.2	15.2	68.6	46.7	20.2	76.9	39.0	7.5
Queue Length 50th (ft)	110	561	23	135	11	86	0	68	73	0
Queue Length 95th (ft)	#206	650	m32	163	33	144	18	122	138	50
Internal Link Dist (ft)		2059		1220		1035			581	
Turn Bay Length (ft)	325		325		140		140	140		140
Base Capacity (vph)	157	2537	144	2216	276	449	384	150	571	559
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.76	0.15	0.85	0.04	0.24	0.03	0.47	0.19	0.21

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.96		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1656	1711		1656	1662		1656	3256		1656	3216	
Flt Permitted	0.61	1.00		0.69	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1059	1711		1209	1662		1656	3256		1656	3216	
Volume (vph)	70	80	10	240	100	40	10	940	100	100	860	170
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	87	11	261	109	43	11	1022	109	109	935	185
RTOR Reduction (vph)	0	5	0	0	16	0	0	8	0	0	14	0
Lane Group Flow (vph)	76	93	0	261	136	0	11	1123	0	109	1106	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	20.4	20.4		20.4	20.4		1.3	41.3		7.3	47.3	
Effective Green, g (s)	20.9	20.9		20.9	20.9		1.8	41.8		7.8	47.8	
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.02	0.51		0.09	0.58	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	268	433		306	421		36	1650		157	1863	
v/s Ratio Prot		0.05			0.08		0.01	c0.34		c0.07	0.34	
v/s Ratio Perm	0.07			c0.22								
v/c Ratio	0.28	0.21		0.85	0.32		0.31	0.68		0.69	0.59	
Uniform Delay, d1	24.8	24.3		29.3	25.0		39.7	15.8		36.2	11.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	0.2		19.9	0.4		4.8	1.2		12.5	0.5	
Delay (s)	25.4	24.6		49.3	25.5		44.5	16.5		48.7	11.6	
Level of Service	C	C		D	C		D	B		D	B	
Approach Delay (s)		24.9			40.5			16.8			14.9	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	82.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	76	98	261	152	11	1131	109	1120
v/c Ratio	0.29	0.23	0.82	0.33	0.09	0.70	0.56	0.57
Control Delay	26.7	23.6	38.7	22.8	41.6	20.3	44.6	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.7	23.6	38.7	22.8	41.6	20.3	44.6	12.2
Queue Length 50th (ft)	33	39	134	57	6	270	59	170
Queue Length 95th (ft)	70	78	#251	108	22	351	113	317
Internal Link Dist (ft)		927		1155		2415		1840
Turn Bay Length (ft)	150		250		100		200	
Base Capacity (vph)	324	525	383	542	205	1677	224	1989
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.19	0.68	0.28	0.05	0.67	0.49	0.56

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix E

Cumulative Plus Project Conditions AM and PM Peak Hour Intersection Level of Service Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	ᵞᵞ	↑↑↑	↱	ᵞᵞ	↑↑↑	↱	ᵞᵞ	↑↑↑	↱	ᵞᵞ	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	4759	1460	3213	4759	1460	3213	4759	1460	3213	4759	1460
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	4759	1460	3213	4759	1460	3213	4759	1460	3213	4759	1460
Volume (vph)	237	1225	77	560	992	250	156	425	317	300	673	226
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	258	1332	84	609	1078	272	170	462	345	326	732	246
RTOR Reduction (vph)	0	0	46	0	0	182	0	0	279	0	0	189
Lane Group Flow (vph)	258	1332	38	609	1078	90	170	462	66	326	732	57
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	36.8	52.0	52.0	31.9	47.1	47.1	12.0	26.2	26.2	17.9	32.1	32.1
Effective Green, g (s)	37.3	54.5	54.5	32.4	49.6	49.6	12.5	28.7	28.7	18.4	34.6	34.6
Actuated g/C Ratio	0.25	0.36	0.36	0.22	0.33	0.33	0.08	0.19	0.19	0.12	0.23	0.23
Clearance Time (s)	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	799	1729	530	694	1574	483	268	911	279	394	1098	337
v/s Ratio Prot	0.08	c0.28		c0.19	0.23		0.05	0.10		c0.10	c0.15	
v/s Ratio Perm			0.03			0.06			0.05			0.04
v/c Ratio	0.32	0.77	0.07	0.88	0.68	0.19	0.63	0.51	0.24	0.83	0.67	0.17
Uniform Delay, d1	46.0	42.2	31.2	56.9	43.4	35.8	66.5	54.3	51.4	64.2	52.5	46.2
Progression Factor	0.50	0.47	0.09	0.83	0.72	2.22	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	2.7	0.2	10.3	2.0	0.7	4.8	0.3	0.3	13.3	1.4	0.2
Delay (s)	23.4	22.5	3.0	57.3	33.2	80.1	71.4	54.6	51.7	77.6	53.8	46.4
Level of Service	C	C	A	E	C	F	E	D	D	E	D	D
Approach Delay (s)		21.7			47.2			56.5			58.4	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	44.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	258	1332	84	609	1078	272	170	462	345	326	732	246
v/c Ratio	0.32	0.77	0.15	0.88	0.69	0.41	0.63	0.51	0.62	0.83	0.67	0.47
Control Delay	25.0	23.4	1.3	56.0	32.3	8.8	74.8	55.2	9.1	79.4	54.5	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	23.4	1.3	56.0	32.3	8.8	74.8	55.2	9.1	79.4	54.5	7.7
Queue Length 50th (ft)	61	441	1	292	359	76	84	146	0	162	236	0
Queue Length 95th (ft)	148	424	m3	326	193	65	125	184	92	#231	281	72
Internal Link Dist (ft)		655			920			405			680	
Turn Bay Length (ft)	500		275	425		350	200			350		300
Base Capacity (vph)	800	1729	577	734	2015	775	291	1031	587	407	1202	553
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.77	0.15	0.83	0.53	0.35	0.58	0.45	0.59	0.80	0.61	0.44

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰↰	↑↑↑↱			↰↑	↱	↰	↰↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4748		3213	4726			1705	1459	1573	1637	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4748		3213	4726			1705	1459	1573	1637	1459
Volume (vph)	25	1792	25	160	1727	70	20	25	95	70	45	55
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	1948	27	174	1877	76	22	27	103	76	49	60
RTOR Reduction (vph)	0	1	0	0	2	0	0	0	95	0	0	55
Lane Group Flow (vph)	27	1974	0	174	1951	0	0	49	8	61	64	5
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	4.4	95.2		12.8	103.6			11.6	11.6	12.7	12.7	12.7
Effective Green, g (s)	4.4	96.5		12.8	104.9			11.8	11.8	12.9	12.9	12.9
Actuated g/C Ratio	0.03	0.64		0.09	0.70			0.08	0.08	0.09	0.09	0.09
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	49	3055		274	3305			134	115	135	141	125
v/s Ratio Prot	0.02	c0.42		c0.05	0.41			c0.03		0.04	c0.04	
v/s Ratio Perm									0.01			0.00
v/c Ratio	0.55	0.65		0.64	0.59			0.37	0.07	0.45	0.45	0.04
Uniform Delay, d1	71.8	16.3		66.3	11.5			65.5	64.0	65.2	65.2	62.9
Progression Factor	0.91	1.84		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.9	0.7		4.2	0.8			0.6	0.1	0.9	0.8	0.0
Delay (s)	70.0	30.8		70.5	12.3			66.2	64.1	66.1	66.0	62.9
Level of Service	E	C		E	B			E	E	E	E	E
Approach Delay (s)		31.3			17.1			64.8			65.0	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	27	1975	174	1953	49	103	61	64	60
v/c Ratio	0.39	0.65	0.63	0.58	0.36	0.49	0.45	0.45	0.33
Control Delay	70.8	35.3	70.3	15.8	63.1	11.6	63.8	63.8	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.8	35.3	70.3	15.8	63.1	11.6	63.8	63.8	13.7
Queue Length 50th (ft)	23	710	86	296	47	0	62	65	0
Queue Length 95th (ft)	m35	#887	124	709	80	53	101	104	41
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	79	3054	364	3356	332	367	306	318	332
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.65	0.48	0.58	0.15	0.28	0.20	0.20	0.18

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	4733		1656	4723		1656	1641		1656	1743	1460
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	4733		1656	4723		1656	1641		1656	1743	1460
Volume (vph)	46	1852	59	40	1797	80	97	135	75	110	110	63
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	2013	64	43	1953	87	105	147	82	120	120	68
RTOR Reduction (vph)	0	1	0	0	2	0	0	12	0	0	0	56
Lane Group Flow (vph)	50	2076	0	43	2038	0	105	217	0	120	120	12
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	7.6	83.4		7.0	82.8		13.3	22.9		14.6	24.2	24.2
Effective Green, g (s)	7.6	85.1		7.0	84.5		13.3	23.5		14.6	24.8	24.8
Actuated g/C Ratio	0.05	0.58		0.05	0.58		0.09	0.16		0.10	0.17	0.17
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5		2.0	5.5		2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	86	2755		79	2730		151	264		165	296	248
v/s Ratio Prot	c0.03	c0.44		0.03	0.43		0.06	c0.13		c0.07	0.07	
v/s Ratio Perm												0.01
v/c Ratio	0.58	0.75		0.54	0.75		0.70	0.82		0.73	0.41	0.05
Uniform Delay, d1	67.7	22.7		68.0	22.9		64.5	59.3		63.9	54.1	50.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.3	1.5		4.1	1.5		10.7	17.6		12.7	0.3	0.0
Delay (s)	74.0	24.3		72.1	24.4		75.1	76.9		76.5	54.5	50.8
Level of Service	E	C		E	C		E	E		E	D	D
Approach Delay (s)		25.4			25.3			76.3			62.3	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	31.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	146.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	50	2077	43	2040	105	229	120	120	68
v/c Ratio	0.49	0.75	0.47	0.74	0.69	0.83	0.72	0.40	0.22
Control Delay	74.2	28.1	73.9	28.2	70.8	63.2	70.7	56.9	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	74.2	28.1	73.9	28.2	70.8	63.2	70.7	56.9	12.2
Queue Length 50th (ft)	47	539	41	527	99	202	113	103	0
Queue Length 95th (ft)	104	836	93	821	182	327	204	182	45
Internal Link Dist (ft)		1520		2225		975		905	
Turn Bay Length (ft)	100		165		150		120		140
Base Capacity (vph)	202	2768	219	2748	279	385	281	404	390
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.75	0.20	0.74	0.38	0.59	0.43	0.30	0.17

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations		↰	↱		↰	↱		↰	↑↑	↱	↰	↑↑↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.91
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	0.99
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1664	1461		1675	1460		1656	3312	1442	1656	4686
Flt Permitted		0.72	1.00		0.78	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1247	1461		1355	1460		1656	3312	1442	1656	4686
Volume (vph)	100	5	65	20	5	36	5	75	807	25	91	1109
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	5	71	22	5	39	5	82	877	27	99	1205
RTOR Reduction (vph)	0	0	59	0	0	33	0	0	0	11	0	9
Lane Group Flow (vph)	0	114	12	0	27	7	0	87	877	16	99	1310
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		13.3	13.3		14.9	14.9		8.3	51.6	51.6	9.9	52.5
Effective Green, g (s)		15.0	15.0		15.0	15.0		8.8	53.0	53.0	10.0	54.2
Actuated g/C Ratio		0.17	0.17		0.17	0.17		0.10	0.59	0.59	0.11	0.60
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		208	244		226	243		162	1950	849	184	2822
v/s Ratio Prot								0.05	0.26		c0.06	c0.28
v/s Ratio Perm		c0.09	0.01		0.02	0.00				0.01		
v/c Ratio		0.55	0.05		0.12	0.03		0.54	0.45	0.02	0.54	0.46
Uniform Delay, d1		34.4	31.5		31.9	31.4		38.7	10.3	7.7	37.8	9.9
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.9	0.1		0.2	0.0		3.4	0.8	0.0	3.0	0.6
Delay (s)		37.3	31.6		32.1	31.4		42.1	11.1	7.7	40.8	10.4
Level of Service		D	C		C	C		D	B	A	D	B
Approach Delay (s)		35.1			31.7				13.7			12.6
Approach LOS		D			C				B			B

Intersection Summary			
HCM Average Control Delay	15.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	114	71	27	39	87	877	27	99	1319
v/c Ratio	0.52	0.23	0.11	0.14	0.48	0.45	0.03	0.54	0.46
Control Delay	34.0	7.5	28.2	9.1	41.7	12.6	4.6	50.8	12.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.0	7.5	28.2	9.1	41.7	12.6	4.6	50.8	12.3
Queue Length 50th (ft)	61	0	13	0	47	140	0	53	139
Queue Length 95th (ft)	96	30	31	23	92	228	13	#142	256
Internal Link Dist (ft)	570		705			630			1447
Turn Bay Length (ft)		400		400	150			180	
Base Capacity (vph)	376	488	421	461	230	1950	860	184	2876
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.15	0.06	0.08	0.38	0.45	0.03	0.54	0.46

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱↱	↰	↑↑	↱	↰↰	↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	0.88	1.00	0.95	1.00	0.97	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1656	1725		1656	1743	2573	1656	3312	1466	3213	3225	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1656	1725		1656	1743	2573	1656	3312	1466	3213	3225	
Volume (vph)	58	150	10	150	250	362	50	672	180	309	737	131
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	63	163	11	163	272	393	54	730	141	336	801	142
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	63	174	0	163	272	393	54	730	141	336	943	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		pm+ov	Prot		pm+ov	Prot		
Protected Phases	7	4		3	8	1	5	2	3	1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	5.8	14.7		7.5	16.4	28.7	2.4	24.7	32.2	12.3	34.6	
Effective Green, g (s)	6.3	15.2		8.0	16.9	29.7	2.9	25.2	33.2	12.8	35.1	
Actuated g/C Ratio	0.08	0.20		0.10	0.22	0.38	0.04	0.33	0.43	0.17	0.45	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	135	340		172	382	1123	62	1081	706	533	1466	
v/s Ratio Prot	0.04	0.10		c0.10	c0.16	0.06	0.03	0.22	0.02	c0.10	c0.29	
v/s Ratio Perm						0.09			0.08			
v/c Ratio	0.47	0.51		0.95	0.71	0.35	0.87	0.68	0.20	0.63	0.64	
Uniform Delay, d1	33.8	27.7		34.4	27.9	16.9	37.0	22.5	13.7	30.0	16.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.5	1.3		52.8	6.2	0.2	70.2	1.7	0.1	2.4	1.0	
Delay (s)	36.4	29.0		87.2	34.1	17.1	107.2	24.1	13.9	32.4	17.2	
Level of Service	D	C		F	C	B	F	C	B	C	B	
Approach Delay (s)		31.0			36.5			27.4			21.2	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	77.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	63	174	163	272	393	54	730	141	336	943
v/c Ratio	0.35	0.53	0.73	0.69	0.38	0.46	0.73	0.23	0.61	0.62
Control Delay	40.6	31.8	51.5	32.6	15.8	54.3	28.0	14.3	35.7	20.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.6	31.8	51.5	32.6	15.8	54.3	28.0	14.3	35.7	20.3
Queue Length 50th (ft)	31	83	84	133	75	28	176	40	86	208
Queue Length 95th (ft)	74	143	#197	215	111	#83	263	84	139	312
Internal Link Dist (ft)		1115		1425			1445			2415
Turn Bay Length (ft)	100		140		300	200		150	275	
Base Capacity (vph)	207	471	244	537	1074	117	1160	635	633	1585
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.37	0.67	0.51	0.37	0.46	0.63	0.22	0.53	0.59

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱		↰	↑	↱	↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1656	4730		1656	4708		1656	1743	1459	1656	1743	1459
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1656	4730		1656	4708		1656	1743	1459	1656	1743	1459
Volume (vph)	65	1384	48	107	1192	75	152	106	43	53	105	60
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	1504	52	116	1296	82	165	115	47	58	114	65
RTOR Reduction (vph)	0	3	0	0	5	0	0	0	34	0	0	52
Lane Group Flow (vph)	71	1553	0	116	1373	0	165	115	13	58	114	13
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases									8			4
Actuated Green, G (s)	11.2	70.0		12.1	70.9		19.3	41.0	41.0	8.9	30.6	30.6
Effective Green, g (s)	11.7	70.5		12.6	71.4		19.8	41.5	41.5	9.4	31.1	31.1
Actuated g/C Ratio	0.08	0.47		0.08	0.48		0.13	0.28	0.28	0.06	0.21	0.21
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	129	2223		139	2241		219	482	404	104	361	302
v/s Ratio Prot	0.04	c0.33		c0.07	0.29		c0.10	0.07		0.04	c0.07	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.55	0.70		0.83	0.61		0.75	0.24	0.03	0.56	0.32	0.04
Uniform Delay, d1	66.6	31.4		67.7	29.1		62.7	42.0	39.6	68.3	50.4	47.6
Progression Factor	1.00	1.00		1.40	0.43		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	1.9		29.4	1.1		13.6	1.2	0.1	6.3	2.3	0.3
Delay (s)	71.6	33.2		124.4	13.6		76.4	43.2	39.7	74.6	52.7	47.8
Level of Service	E	C		F	B		E	D	D	E	D	D
Approach Delay (s)		34.9			22.2			59.4			56.7	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	33.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	64.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	71	1556	116	1378	165	115	47	58	114	65
v/c Ratio	0.55	0.69	0.83	0.61	0.76	0.24	0.11	0.50	0.32	0.19
Control Delay	75.3	32.7	125.1	13.4	71.4	45.6	11.9	73.9	55.8	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.3	32.7	125.1	13.4	71.4	45.6	11.9	73.9	55.8	13.0
Queue Length 50th (ft)	68	429	119	104	157	90	0	56	97	0
Queue Length 95th (ft)	122	485	#230	129	234	151	35	104	166	45
Internal Link Dist (ft)		2059		485		355			581	
Turn Bay Length (ft)	325		325		140		140	140		140
Base Capacity (vph)	157	2254	144	2275	276	482	438	150	351	346
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.69	0.81	0.61	0.60	0.24	0.11	0.39	0.32	0.19

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↱		↑↑↑		↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1401	79	0	1374	0	138
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1523	86	0	1493	0	150
Pedestrians					5	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	565			735		
pX, platoon unblocked			0.75		0.85	0.75
vC, conflicting volume			1614		2026	513
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1159		857	0
tC, single (s)			4.3		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			100		100	81
cM capacity (veh/h)			420		238	796

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	508	508	508	86	498	498	498	150
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	86	0	0	0	150
cSH	1700	1700	1700	1700	1700	1700	1700	796
Volume to Capacity	0.30	0.30	0.30	0.05	0.29	0.29	0.29	0.19
Queue Length 95th (ft)	0	0	0	0	0	0	0	17
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.6
Lane LOS								B
Approach Delay (s)	0.0				0.0			10.6
Approach LOS								B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	42.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	68	19	54	109	924	18	1207	55
v/c Ratio	0.38	0.09	0.28	0.52	0.37	0.15	0.55	0.06
Control Delay	33.7	16.2	27.0	39.9	7.4	41.1	14.5	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.7	16.2	27.0	39.9	7.4	41.1	14.5	4.4
Queue Length 50th (ft)	37	3	23	59	55	10	188	0
Queue Length 95th (ft)	63	18	47	105	241	31	#467	22
Internal Link Dist (ft)		428	547		425		225	
Turn Bay Length (ft)				200		90		
Base Capacity (vph)	398	470	434	280	2494	127	2183	969
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.04	0.12	0.39	0.37	0.14	0.55	0.06

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			✥		↰	↑↑↱		↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.99			1.00		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.89			0.97		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	1534			1633		1656	3305		1656	3312	1442
Flt Permitted	0.79	1.00			0.79		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1369	1534			1337		1656	3305		1656	3312	1442
Volume (vph)	63	5	13	35	5	10	100	840	10	17	1110	51
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	68	5	14	38	5	11	109	913	11	18	1207	55
RTOR Reduction (vph)	0	12	0	0	10	0	0	1	0	0	0	20
Lane Group Flow (vph)	68	7	0	0	44	0	109	923	0	18	1207	35
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								6
Actuated Green, G (s)	10.6	10.6			10.6		9.7	63.0		2.9	56.2	56.2
Effective Green, g (s)	11.1	11.1			11.1		10.2	63.5		3.4	56.7	56.7
Actuated g/C Ratio	0.12	0.12			0.12		0.11	0.71		0.04	0.63	0.63
Clearance Time (s)	4.5	4.5			4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	169	189			165		188	2332		63	2087	908
v/s Ratio Prot		0.00					c0.07	0.28		0.01	c0.36	
v/s Ratio Perm	c0.05				0.03							0.02
v/c Ratio	0.40	0.04			0.27		0.58	0.40		0.29	0.58	0.04
Uniform Delay, d1	36.4	34.7			35.8		37.9	5.4		42.1	9.7	6.3
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1			0.9		4.3	0.5		2.5	1.2	0.1
Delay (s)	38.0	34.8			36.7		42.2	5.9		44.6	10.9	6.4
Level of Service	D	C			D		D	A		D	B	A
Approach Delay (s)		37.3			36.7			9.7			11.1	
Approach LOS		D			D			A			B	

Intersection Summary			
HCM Average Control Delay	12.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	5	0	950	1157	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	0	1033	1258	1
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)				1110	505	
pX, platoon unblocked	0.81	0.79	0.79			
vC, conflicting volume	1779	634	1264			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1584	263	1064			
tC, single (s)	7.0	7.1	4.3			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	100	99	100			
cM capacity (veh/h)	74	560	478			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	5	516	516	629	629	1
Volume Left	0	0	0	0	0	0
Volume Right	5	0	0	0	0	1
cSH	560	1700	1700	1700	1700	1700
Volume to Capacity	0.01	0.30	0.30	0.37	0.37	0.00
Queue Length 95th (ft)	1	0	0	0	0	0
Control Delay (s)	11.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	11.5	0.0		0.0		
Approach LOS	B					

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	42.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	10	114	187	8	114	146
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	124	203	9	124	159
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						435
pX, platoon unblocked						
vC, conflicting volume	619	213			217	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	619	213			217	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	97	85			91	
cM capacity (veh/h)	398	807			1307	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	135	212	124	159
Volume Left	11	0	124	0
Volume Right	124	9	0	0
cSH	745	1700	1307	1700
Volume to Capacity	0.18	0.12	0.09	0.09
Queue Length 95th (ft)	16	0	8	0
Control Delay (s)	10.9	0.0	8.0	0.0
Lane LOS	B		A	
Approach Delay (s)	10.9	0.0	3.5	
Approach LOS	B			

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	34.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations		↱	↑↱			↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	1	194	5	0	156
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1	211	5	0	170
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1235
pX, platoon unblocked						
vC, conflicting volume	388	219			221	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	388	219			221	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	100	100			100	
cM capacity (veh/h)	599	801			1302	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	1	216	170
Volume Left	0	0	0
Volume Right	1	5	0
cSH	801	1700	1700
Volume to Capacity	0.00	0.13	0.10
Queue Length 95th (ft)	0	0	0
Control Delay (s)	9.5	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.5	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	21.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	0.99		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.92		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1656	1651		1656	1594		1656	3179		1656	3254	
Flt Permitted	0.50	1.00		0.35	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	879	1651		602	1594		1656	3179		1656	3254	
Volume (vph)	50	163	78	100	84	93	45	807	240	53	999	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	177	85	109	91	101	49	877	261	58	1086	120
RTOR Reduction (vph)	0	22	0	0	51	0	0	25	0	0	7	0
Lane Group Flow (vph)	54	240	0	109	141	0	49	1113	0	58	1199	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	13.1	13.1		13.1	13.1		4.3	39.7		4.5	39.9	
Effective Green, g (s)	13.6	13.6		13.6	13.6		4.8	40.2		5.0	40.4	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.07	0.57		0.07	0.57	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	169	317		116	306		112	1805		117	1857	
v/s Ratio Prot		0.15			0.09		0.03	0.35		c0.04	c0.37	
v/s Ratio Perm	0.06			c0.18								
v/c Ratio	0.32	0.76		0.94	0.46		0.44	0.62		0.50	0.65	
Uniform Delay, d1	24.6	27.0		28.2	25.4		31.7	10.2		31.7	10.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.1	9.9		64.0	1.1		2.7	0.6		3.3	0.8	
Delay (s)	25.7	37.0		92.1	26.5		34.4	10.8		35.0	11.1	
Level of Service	C	D		F	C		C	B		C	B	
Approach Delay (s)		35.0			50.2			11.8			12.2	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	70.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	54	262	109	192	49	1138	58	1206
v/c Ratio	0.25	0.67	0.64	0.48	0.26	0.58	0.30	0.60
Control Delay	25.7	25.5	32.5	18.5	36.1	14.6	36.4	15.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.7	25.5	32.5	18.5	36.1	14.6	36.4	15.4
Queue Length 50th (ft)	22	106	49	54	23	196	27	218
Queue Length 95th (ft)	54	187	106	115	60	348	67	387
Internal Link Dist (ft)		927		1155		2415		1030
Turn Bay Length (ft)	150		250		100		200	
Base Capacity (vph)	321	572	258	577	253	2021	253	2060
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.46	0.42	0.33	0.19	0.56	0.23	0.59

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱	↰↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3213	4759	1460	3213	4759	1460	3213	4759	1460	3213	4759	1460
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3213	4759	1460	3213	4759	1460	3213	4759	1460	3213	4759	1460
Volume (vph)	424	1128	494	489	1323	400	262	811	233	340	620	169
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	461	1226	537	532	1438	435	285	882	253	370	674	184
RTOR Reduction (vph)	0	0	204	0	0	208	0	0	191	0	0	137
Lane Group Flow (vph)	461	1226	333	532	1438	227	285	882	62	370	674	47
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	25.7	46.5	46.5	27.4	48.2	48.2	18.3	34.4	34.4	19.7	35.8	35.8
Effective Green, g (s)	26.2	49.0	49.0	27.9	50.7	50.7	18.8	36.9	36.9	20.2	38.3	38.3
Actuated g/C Ratio	0.17	0.33	0.33	0.19	0.34	0.34	0.13	0.25	0.25	0.13	0.26	0.26
Clearance Time (s)	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5	4.5	6.5	6.5
Vehicle Extension (s)	3.0	1.5	1.5	3.0	1.5	1.5	3.0	2.5	2.5	3.0	2.5	2.5
Lane Grp Cap (vph)	561	1555	477	598	1609	493	403	1171	359	433	1215	373
v/s Ratio Prot	0.14	c0.26		0.17	c0.30		0.09	c0.19		c0.12	0.14	
v/s Ratio Perm			0.23			0.16			0.04			0.03
v/c Ratio	0.82	0.79	0.70	0.89	0.89	0.46	0.71	0.75	0.17	0.85	0.55	0.13
Uniform Delay, d1	59.6	45.8	44.0	59.5	47.1	38.9	63.0	52.3	44.5	63.5	48.5	43.0
Progression Factor	0.59	0.48	0.29	0.58	0.62	1.20	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.0	2.6	5.2	6.6	3.3	1.2	5.6	2.7	0.2	15.1	0.4	0.1
Delay (s)	41.0	24.7	17.7	40.9	32.6	47.9	68.5	55.0	44.7	78.5	48.9	43.1
Level of Service	D	C	B	D	C	D	E	D	D	E	D	D
Approach Delay (s)		26.4			37.2			55.9			57.0	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	40.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 1: W. Kettleman Lane & Lower Sacramento Road

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	WB
Directions Served	L	L	T	T	T	R	L	L	T	T	T	R
Maximum Queue (ft)	235	225	420	533	550	302	276	281	516	483	488	386
Average Queue (ft)	151	155	276	282	268	132	201	193	326	330	297	113
95th Queue (ft)	213	222	408	423	421	238	266	255	503	501	477	247
Link Distance (ft)			719	719	719				1224	1224	1224	
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	500	500				275	425	425				350
Storage Blk Time (%)					0.04	0.00			0.03		0.02	0.00
Queuing Penalty (veh)					21	0			14		10	0

Intersection: 1: W. Kettleman Lane & Lower Sacramento Road

Movement	NB	NB	NB	NB	NB	NB	SB	SB	SB	SB	SB	SB
Directions Served	L	L	T	T	T	R	L	L	T	T	T	R
Maximum Queue (ft)	239	255	398	413	362	271	342	365	308	279	261	160
Average Queue (ft)	143	191	279	261	236	82	198	204	205	188	179	65
95th Queue (ft)	241	293	408	367	339	183	323	317	280	262	242	132
Link Distance (ft)			381	381	381	381			1009	1009	1009	
Upstream Blk Time (%)			0.05	0.00	0.00							
Queuing Penalty (veh)			16	1	0							
Storage Bay Dist (ft)	200	200					350	350				300
Storage Blk Time (%)	0.06	0.09	0.16				0.00	0.00				
Queuing Penalty (veh)	17	26	44				0	0				

Intersection: 5: Unsignalized Food 4 Less / Project Dwy # 1 & Lower Sacramento Road

Movement	EB	WB	NB	NB	NB	SB	SB	SB	SB	SB
Directions Served	R	R	T	T	TR	L	T	T	T	R
Maximum Queue (ft)	130	79	217	224	218	121	390	324	213	227
Average Queue (ft)	63	38	24	14	9	63	70	71	43	20
95th Queue (ft)	115	68	119	96	76	119	218	205	145	118
Link Distance (ft)	398	552	242	242	242		381	381	381	381
Upstream Blk Time (%)				0.00			0.00			
Queuing Penalty (veh)				0			1			
Storage Bay Dist (ft)						90				
Storage Blk Time (%)						0.08	0.02			
Queuing Penalty (veh)						32	2			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰↰	↑↑↑↱			↰↑	↱	↰	↰↓	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00	0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99			1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (prot)	1656	4719		3213	4704			1705	1459	1573	1646	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.98	1.00	0.95	0.99	1.00
Satd. Flow (perm)	1656	4719		3213	4704			1705	1459	1573	1646	1459
Volume (vph)	85	1536	80	315	2094	146	60	75	240	144	120	58
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	1670	87	342	2276	159	65	82	261	157	130	63
RTOR Reduction (vph)	0	3	0	0	5	0	0	0	213	0	0	55
Lane Group Flow (vph)	92	1754	0	342	2430	0	0	147	48	140	147	8
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Split		Perm	Split		Perm
Protected Phases	5	2		1	6		3	3		4	4	
Permitted Phases									3			4
Actuated Green, G (s)	15.6	74.8		20.8	80.0			18.3	18.3	18.4	18.4	18.4
Effective Green, g (s)	15.6	76.1		20.8	81.3			18.5	18.5	18.6	18.6	18.6
Actuated g/C Ratio	0.10	0.51		0.14	0.54			0.12	0.12	0.12	0.12	0.12
Clearance Time (s)	4.0	5.3		4.0	5.3			4.2	4.2	4.2	4.2	4.2
Vehicle Extension (s)	2.0	2.8		2.5	2.5			2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	172	2394		446	2550			210	180	195	204	181
v/s Ratio Prot	0.06	0.37		c0.11	c0.52			c0.09		0.09	c0.09	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.53	0.73		0.77	0.95			0.70	0.27	0.72	0.72	0.04
Uniform Delay, d1	63.8	29.0		62.3	32.5			63.1	59.6	63.2	63.2	57.9
Progression Factor	0.74	1.48		1.00	1.00			1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	1.3		7.4	9.8			8.0	0.3	10.0	10.1	0.0
Delay (s)	48.1	44.2		69.7	42.3			71.1	59.9	73.2	73.3	57.9
Level of Service	D	D		E	D			E	E	E	E	E
Approach Delay (s)		44.4			45.7			63.9			70.5	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	48.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	92	1757	342	2435	147	261	140	147	63
v/c Ratio	0.53	0.73	0.77	0.95	0.70	0.66	0.72	0.72	0.27
Control Delay	56.6	47.0	73.8	42.8	65.9	12.8	66.6	66.5	12.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.6	47.0	73.8	42.8	65.9	12.8	66.6	66.5	12.8
Queue Length 50th (ft)	74	652	165	805	141	16	141	148	0
Queue Length 95th (ft)	m#168	#730	#271	#1095	202	101	205	214	42
Internal Link Dist (ft)		920		1520	470			475	
Turn Bay Length (ft)	360		240			90	150		150
Base Capacity (vph)	172	2399	445	2553	332	480	306	320	335
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.73	0.77	0.95	0.44	0.54	0.46	0.46	0.19

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↑↱		↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	4714		1656	4716		1656	1651		1656	1743	1460
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1656	4714		1656	4716		1656	1651		1656	1743	1460
Volume (vph)	81	1741	98	54	2336	125	135	120	57	104	100	84
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	88	1892	107	59	2539	136	147	130	62	113	109	91
RTOR Reduction (vph)	0	2	0	0	3	0	0	10	0	0	0	79
Lane Group Flow (vph)	88	1997	0	59	2672	0	147	182	0	113	109	12
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	12.0	87.2		8.4	83.6		17.0	21.4		14.1	18.5	18.5
Effective Green, g (s)	12.0	88.9		8.4	85.3		17.0	22.0		14.1	19.1	19.1
Actuated g/C Ratio	0.08	0.60		0.06	0.57		0.11	0.15		0.09	0.13	0.13
Clearance Time (s)	4.0	5.7		4.0	5.7		4.0	4.6		4.0	4.6	4.6
Vehicle Extension (s)	2.0	5.5		2.0	5.5		2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	133	2805		93	2693		188	243		156	223	187
v/s Ratio Prot	c0.05	c0.42		0.04	c0.57		c0.09	c0.11		0.07	0.06	
v/s Ratio Perm												0.01
v/c Ratio	0.66	0.71		0.63	0.99		0.78	0.75		0.72	0.49	0.06
Uniform Delay, d1	66.7	21.3		69.0	31.7		64.4	61.0		65.8	60.6	57.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.2	1.2		9.9	15.6		17.5	10.5		13.2	0.6	0.1
Delay (s)	75.9	22.4		78.9	47.3		81.9	71.5		78.9	61.2	57.3
Level of Service	E	C		E	D		F	E		E	E	E
Approach Delay (s)		24.7			48.0			76.0			66.5	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	149.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	88	1999	59	2675	147	192	113	109	91
v/c Ratio	0.66	0.71	0.56	1.00	0.78	0.76	0.72	0.49	0.34
Control Delay	76.0	26.5	74.9	49.9	73.0	62.3	72.3	63.1	12.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.0	26.5	74.9	49.9	73.0	62.3	72.3	63.1	12.1
Queue Length 50th (ft)	83	481	56	899	138	168	106	99	0
Queue Length 95th (ft)	166	834	122	#1492	249	281	202	178	54
Internal Link Dist (ft)		1520		2225		975		905	
Turn Bay Length (ft)	100		165		150		120		140
Base Capacity (vph)	205	2824	217	2677	279	380	274	379	388
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.71	0.27	1.00	0.53	0.51	0.41	0.29	0.23

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00	0.95	1.00	1.00	0.91
Frpb, ped/bikes		1.00	0.99		1.00	0.99		1.00	1.00	0.97	1.00	1.00
Flpb, ped/bikes		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt		1.00	0.85		1.00	0.85		1.00	1.00	0.85	1.00	0.98
Flt Protected		0.95	1.00		0.96	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1662	1461		1667	1460		1656	3312	1442	1656	4672
Flt Permitted		0.69	1.00		0.62	1.00		0.95	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1199	1461		1080	1460		1656	3312	1442	1656	4672
Volume (vph)	195	5	115	50	5	147	5	90	1475	65	105	959
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	5	125	54	5	160	5	98	1603	71	114	1042
RTOR Reduction (vph)	0	0	95	0	0	121	0	0	0	34	0	13
Lane Group Flow (vph)	0	217	30	0	59	39	0	103	1603	37	114	1149
Confl. Peds. (#/hr)			2			2				2		
Turn Type	Perm		Perm	Perm		Perm	Prot	Prot		Perm	Prot	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4		4	8		8				2		
Actuated Green, G (s)		20.0	20.0		21.6	21.6		8.7	45.8	45.8	9.0	45.4
Effective Green, g (s)		21.7	21.7		21.7	21.7		9.2	47.2	47.2	9.1	47.1
Actuated g/C Ratio		0.24	0.24		0.24	0.24		0.10	0.52	0.52	0.10	0.52
Clearance Time (s)		5.7	5.7		4.1	4.1		4.5	5.4	5.4	4.1	5.7
Vehicle Extension (s)		3.0	3.0		3.0	3.0		3.0	4.0	4.0	3.0	3.0
Lane Grp Cap (vph)		289	352		260	352		169	1737	756	167	2445
v/s Ratio Prot								0.06	c0.48		c0.07	0.25
v/s Ratio Perm		c0.18	0.02		0.05	0.03				0.03		
v/c Ratio		0.75	0.09		0.23	0.11		0.61	0.92	0.05	0.68	0.47
Uniform Delay, d1		31.6	26.5		27.4	26.6		38.7	19.7	10.4	39.1	13.6
Progression Factor		1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		10.5	0.1		0.4	0.1		6.1	9.7	0.1	10.9	0.7
Delay (s)		42.1	26.6		27.9	26.8		44.8	29.4	10.6	50.0	14.2
Level of Service		D	C		C	C		D	C	B	D	B
Approach Delay (s)		36.4			27.1				29.6			17.4
Approach LOS		D			C				C			B

Intersection Summary			
HCM Average Control Delay	25.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SBR
Lane Configurations	
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frpb, ped/bikes	
Flpb, ped/bikes	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Volume (vph)	110
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	120
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Confl. Peds. (#/hr)	2
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	

Intersection Summary

	→	↘	←	↖	↖	↑	↗	↘	↓
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	217	125	59	160	103	1603	71	114	1162
v/c Ratio	0.75	0.28	0.21	0.34	0.54	0.92	0.09	0.68	0.46
Control Delay	38.5	5.9	26.3	5.7	43.3	31.7	3.5	62.4	15.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.5	5.9	26.3	5.7	43.3	31.7	3.5	62.4	15.5
Queue Length 50th (ft)	113	0	26	0	56	461	0	62	153
Queue Length 95th (ft)	184	39	56	44	105	#631	21	#166	216
Internal Link Dist (ft)	570		705			630			1447
Turn Bay Length (ft)		400		400	150			180	
Base Capacity (vph)	356	521	352	546	230	1735	789	168	2504
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.24	0.17	0.29	0.45	0.92	0.09	0.68	0.46

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

5: Unsignalized Food 4 Less / Project Dwy # 1 & Lower Sacramento Road Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	11.7	8.1	27.3	1.9	0.9	21.9	2.8	3.2	4.3

Intersection: 5: Unsignalized Food 4 Less / Project Dwy # 1 & Lower Sacramento Road

Movement	EB	WB	NB	NB	NB	SB	SB	SB	SB	SB
Directions Served	R	R	L	T	TR	L	T	T	T	R
Maximum Queue (ft)	41	34	65	33	3	61	6	19	11	14

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱↱	↰	↑↑	↱	↰↰	↑↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	0.88	1.00	0.95	1.00	0.97	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.99	1.00	1.00	0.99	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1656	1726		1656	1743	2570	1656	3312	1465	3213	3207	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1656	1726		1656	1743	2570	1656	3312	1465	3213	3207	
Volume (vph)	85	160	10	110	280	333	10	828	240	377	704	155
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	92	174	11	120	304	362	11	900	261	410	765	168
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	92	185	0	120	304	362	11	900	261	410	933	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot		pm+ov	Prot		pm+ov	Prot		
Protected Phases	7	4		3	8	1	5	2	3	1	6	
Permitted Phases						8			2			
Actuated Green, G (s)	5.5	17.8		8.1	20.4	33.4	1.4	30.1	38.2	13.0	41.7	
Effective Green, g (s)	6.0	18.3		8.6	20.9	34.4	1.9	30.6	39.2	13.5	42.2	
Actuated g/C Ratio	0.07	0.21		0.10	0.24	0.40	0.02	0.35	0.45	0.16	0.49	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	114	363		164	419	1134	36	1165	727	499	1556	
v/s Ratio Prot	0.06	0.11		c0.07	c0.17	0.05	0.01	c0.27	0.04	c0.13	0.29	
v/s Ratio Perm						0.09			0.14			
v/c Ratio	0.81	0.51		0.73	0.73	0.32	0.31	0.77	0.36	0.82	0.60	
Uniform Delay, d1	39.9	30.4		38.1	30.4	18.2	41.9	25.1	15.7	35.6	16.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	32.6	1.1		15.4	6.1	0.2	4.8	3.2	0.3	10.5	0.6	
Delay (s)	72.6	31.5		53.5	36.6	18.4	46.7	28.3	16.0	46.1	16.9	
Level of Service	E	C		D	D	B	D	C	B	D	B	
Approach Delay (s)		45.1			30.8			25.8			25.8	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	87.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	92	185	120	304	362	11	900	261	410	933
v/c Ratio	0.63	0.52	0.69	0.69	0.34	0.09	0.84	0.41	0.78	0.57
Control Delay	56.6	32.3	56.8	35.8	15.9	41.4	33.1	17.3	44.2	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.6	32.3	56.8	35.8	15.9	41.4	33.1	17.3	44.2	17.4
Queue Length 50th (ft)	49	89	64	154	70	6	236	86	112	165
Queue Length 95th (ft)	#121	151	#153	244	104	22	#356	154	#190	313
Internal Link Dist (ft)		1116		1425			1445			2415
Turn Bay Length (ft)	100		140		300	200		150	275	
Base Capacity (vph)	154	447	184	491	1087	194	1132	635	552	1644
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.41	0.65	0.62	0.33	0.06	0.80	0.41	0.74	0.57

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↑	↱	↰	↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.98	1.00	1.00	0.98
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1656	4723		1656	4699		1656	1743	1459	1656	1743	1459
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1656	4723		1656	4699		1656	1743	1459	1656	1743	1459
Volume (vph)	105	1824	79	111	1528	115	222	115	37	68	112	110
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1983	86	121	1661	125	241	125	40	74	122	120
RTOR Reduction (vph)	0	3	0	0	6	0	0	0	30	0	0	99
Lane Group Flow (vph)	114	2066	0	121	1780	0	241	125	10	74	122	21
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases									8			4
Actuated Green, G (s)	13.0	70.7		12.3	70.0		23.6	38.0	38.0	11.0	25.4	25.4
Effective Green, g (s)	13.5	71.2		12.8	70.5		24.1	38.5	38.5	11.5	25.9	25.9
Actuated g/C Ratio	0.09	0.47		0.09	0.47		0.16	0.26	0.26	0.08	0.17	0.17
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	149	2242		141	2209		266	447	374	127	301	252
v/s Ratio Prot	0.07	c0.44		c0.07	0.38		c0.15	0.07		0.04	c0.07	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.77	0.92		0.86	0.81		0.91	0.28	0.03	0.58	0.41	0.08
Uniform Delay, d1	66.7	36.8		67.7	33.9		61.8	44.6	41.7	66.9	55.2	52.1
Progression Factor	1.00	1.00		1.21	0.27		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	20.6	7.7		25.2	2.0		31.4	1.6	0.1	6.7	4.0	0.6
Delay (s)	87.3	44.5		107.0	11.2		93.3	46.2	41.9	73.6	59.2	52.7
Level of Service	F	D		F	B		F	D	D	E	E	D
Approach Delay (s)		46.7			17.2			73.7			60.1	
Approach LOS		D			B			E			E	

Intersection Summary			
HCM Average Control Delay	38.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Intersection: 7: W. Kettleman Lane & Westgate Avenue

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB
Directions Served	L	T	T	TR	L	T	T	TR	L	T	R	L
Maximum Queue (ft)	369	947	814	692	352	554	491	418	168	371	58	167
Average Queue (ft)	138	503	445	392	131	374	347	305	147	264	22	90
95th Queue (ft)	286	749	677	580	274	501	461	406	198	449	49	167
Link Distance (ft)		2093	2093	2093		1904	1904	1904		354		
Upstream Blk Time (%)										0.10		
Queuing Penalty (veh)										37		
Storage Bay Dist (ft)	325				325				140		140	140
Storage Blk Time (%)		0.19				0.12			0.32	0.04		0.03
Queuing Penalty (veh)		20				13			51	9		6

Intersection: 7: W. Kettleman Lane & Westgate Avenue

Movement	SB	SB
Directions Served	T	R
Maximum Queue (ft)	337	168
Average Queue (ft)	137	61
95th Queue (ft)	257	137
Link Distance (ft)	603	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		140
Storage Blk Time (%)	0.09	
Queuing Penalty (veh)	17	

Intersection: 11: Project Dwy # 4 & Westgate Avenue

Movement	WB	NB	SB
Directions Served	LR	TR	L
Maximum Queue (ft)	273	104	80
Average Queue (ft)	89	16	26
95th Queue (ft)	179	71	69
Link Distance (ft)	421	738	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			135
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 12: Project Dwy # 5 & Westgate Avenue

Movement	WB
Directions Served	R
Maximum Queue (ft)	31
Average Queue (ft)	9
95th Queue (ft)	31
Link Distance (ft)	536
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Nework Summary

Network wide Queuing Penalty: 153

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↑	↱		↑↑↑		↱
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	1768	161	0	1754	0	278
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1922	175	0	1907	0	302
Pedestrians					5	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (ft)	565			735		
pX, platoon unblocked			0.60		0.74	0.60
vC, conflicting volume			2102		2562	646
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1513		719	0
tC, single (s)			4.3		7.0	7.1
tC, 2 stage (s)						
tF (s)			2.3		3.6	3.4
p0 queue free %			100		100	53
cM capacity (veh/h)			244		258	639

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	641	641	641	175	636	636	636	302
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	175	0	0	0	302
cSH	1700	1700	1700	1700	1700	1700	1700	639
Volume to Capacity	0.38	0.38	0.38	0.10	0.37	0.37	0.37	0.47
Queue Length 95th (ft)	0	0	0	0	0	0	0	63
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.6
Lane LOS								C
Approach Delay (s)	0.0				0.0			15.6
Approach LOS								C

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	58.0%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBT	NBL	NBT	SBL	SBT	SBR
Lane Group Flow (vph)	310	89	109	116	1231	33	1172	198
v/c Ratio	0.90	0.19	0.31	0.55	0.67	0.29	0.74	0.25
Control Delay	53.1	7.1	20.5	40.9	17.6	46.4	24.7	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.1	7.1	20.5	40.9	17.6	46.4	24.7	3.6
Queue Length 50th (ft)	165	2	36	63	281	18	296	0
Queue Length 95th (ft)	#312	35	79	112	364	48	#448	40
Internal Link Dist (ft)		428	547		1975		225	
Turn Bay Length (ft)				200		90		
Base Capacity (vph)	366	501	409	276	1848	116	1594	797
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.18	0.27	0.42	0.67	0.28	0.74	0.25

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

48 ft = 2 vehicles

1 WB-60 Truck = 65
1 Passenger Car = 25
90 ft ⇒ use 100 ft

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			✥		↰	↑↱		↰	↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	0.99			1.00		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.86			0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1656	1475			1612		1656	3294		1656	3312	1442
Flt Permitted	0.70	1.00			0.78		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1218	1475			1302		1656	3294		1656	3312	1442
Volume (vph)	285	5	77	65	5	30	213	996	30	30	1078	182
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	310	5	84	71	5	33	232	1083	33	33	1172	198
RTOR Reduction (vph)	0	60	0	0	18	0	0	2	0	0	0	115
Lane Group Flow (vph)	310	29	0	0	91	0	232	1114	0	33	1172	83
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								6
Actuated Green, G (s)	24.9	24.9			24.9		14.2	48.1		3.5	37.4	37.4
Effective Green, g (s)	25.4	25.4			25.4		14.7	48.6		4.0	37.9	37.9
Actuated g/C Ratio	0.28	0.28			0.28		0.16	0.54		0.04	0.42	0.42
Clearance Time (s)	4.5	4.5			4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	344	416			367		270	1779		74	1395	607
v/s Ratio Prot		0.02					c0.14	0.34		0.02	c0.35	
v/s Ratio Perm	c0.25				0.07							0.06
v/c Ratio	0.90	0.07			0.25		0.86	0.63		0.45	0.84	0.14
Uniform Delay, d1	31.1	23.6			24.9		36.6	14.4		41.9	23.3	16.0
Progression Factor	1.00	1.00			1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	25.5	0.1			0.4		22.8	1.7		4.2	6.2	0.5
Delay (s)	56.6	23.7			25.3		59.4	16.1		46.2	29.6	16.5
Level of Service	E	C			C		E	B		D	C	B
Approach Delay (s)		49.2			25.3			23.5			28.1	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations		↱		↑↑	↑↑	↱
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	0	32	0	1239	1217	3
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	35	0	1347	1323	3
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)				1110	505	
pX, platoon unblocked	0.84	0.68	0.68			
vC, conflicting volume	2001	666	1381			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	905	46	1020			
tC, single (s)	7.0	7.1	4.3			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.3			
p0 queue free %	100	95	100			
cM capacity (veh/h)	219	674	432			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	35	673	673	661	661	3
Volume Left	0	0	0	0	0	0
Volume Right	35	0	0	0	0	3
cSH	674	1700	1700	1700	1700	1700
Volume to Capacity	0.05	0.40	0.40	0.39	0.39	0.00
Queue Length 95th (ft)	4	0	0	0	0	0
Control Delay (s)	10.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	B					
Approach Delay (s)	10.6	0.0		0.0		
Approach LOS	B					

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	Y		↱		↰	↑
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	30	249	125	7	170	132
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	271	136	8	185	143
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						435
pX, platoon unblocked						
vC, conflicting volume	658	145			148	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	658	145			148	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	91	69			87	
cM capacity (veh/h)	361	881			1385	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	303	143	185	143
Volume Left	33	0	185	0
Volume Right	271	8	0	0
cSH	763	1700	1385	1700
Volume to Capacity	0.40	0.08	0.13	0.08
Queue Length 95th (ft)	48	0	12	0
Control Delay (s)	12.8	0.0	8.0	0.0
Lane LOS	B		A	
Approach Delay (s)	12.8	0.0	4.5	
Approach LOS	B			

Intersection Summary			
Average Delay	6.9		
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	11	121	21	0	162
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	12	132	23	0	176
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						1235
pX, platoon unblocked						
vC, conflicting volume	324	148			159	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	324	148			159	
tC, single (s)	6.5	6.3			4.2	
tC, 2 stage (s)						
tF (s)	3.6	3.4			2.3	
p0 queue free %	100	99			100	
cM capacity (veh/h)	653	877			1373	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	12	154	176
Volume Left	0	0	0
Volume Right	12	23	0
cSH	877	1700	1700
Volume to Capacity	0.01	0.09	0.10
Queue Length 95th (ft)	1	0	0
Control Delay (s)	9.2	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.2	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	18.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1656	1689		1656	1662		1656	3264		1656	3225	
Flt Permitted	0.58	1.00		0.66	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1005	1689		1154	1662		1656	3264		1656	3225	
Volume (vph)	70	91	21	240	111	44	21	1125	100	104	975	170
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	99	23	261	121	48	23	1223	109	113	1060	185
RTOR Reduction (vph)	0	10	0	0	16	0	0	6	0	0	13	0
Lane Group Flow (vph)	76	112	0	261	153	0	23	1326	0	113	1232	0
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8								
Actuated Green, G (s)	21.1	21.1		21.1	21.1		2.9	41.8		7.5	46.4	
Effective Green, g (s)	21.6	21.6		21.6	21.6		3.4	42.3		8.0	46.9	
Actuated g/C Ratio	0.26	0.26		0.26	0.26		0.04	0.50		0.10	0.56	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	259	435		297	428		67	1646		158	1803	
v/s Ratio Prot		0.07			0.09		0.01	c0.41		c0.07	0.38	
v/s Ratio Perm	0.08			c0.23								
v/c Ratio	0.29	0.26		0.88	0.36		0.34	0.81		0.72	0.68	
Uniform Delay, d1	25.0	24.8		29.9	25.5		39.2	17.4		36.8	13.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	0.3		24.1	0.5		3.1	3.0		14.3	1.1	
Delay (s)	25.7	25.1		54.0	26.0		42.2	20.3		51.1	14.3	
Level of Service	C	C		D	C		D	C		D	B	
Approach Delay (s)		25.3			43.0			20.7			17.4	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	83.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	76	122	261	169	23	1332	113	1245
v/c Ratio	0.30	0.29	0.85	0.37	0.17	0.81	0.59	0.67
Control Delay	27.3	23.2	42.7	23.6	40.5	24.7	46.2	16.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.3	23.2	42.7	23.6	40.5	24.7	46.2	16.0
Queue Length 50th (ft)	33	47	136	65	13	351	62	203
Queue Length 95th (ft)	71	91	#261	120	36	#500	117	388
Internal Link Dist (ft)		927		1165		2415		1030
Turn Bay Length (ft)	150		250		100		200	
Base Capacity (vph)	303	512	358	531	204	1661	218	1896
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.24	0.73	0.32	0.11	0.80	0.52	0.66

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Appendix F

Mitigated Lower Sacramento Road / Signalized Project Driveway Cumulative Plus Project Conditions AM and PM Peak Hour Intersection Level of Service Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↱		↰	↱		↰	↑↱		↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.95		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.86		1.00	0.87		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3213	1476		1656	1497		1656	3294		1656	4759	1442
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3213	1476		1656	1497		1656	3294		1656	4759	1442
Volume (vph)	285	5	77	65	5	30	213	996	30	30	1078	182
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	310	5	84	71	5	33	232	1083	33	33	1172	198
RTOR Reduction (vph)	0	73	0	0	30	0	0	2	0	0	0	120
Lane Group Flow (vph)	310	16	0	71	8	0	232	1114	0	33	1172	78
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	12.0	11.4		8.0	7.4		17.8	48.7		3.9	34.8	34.8
Effective Green, g (s)	12.5	11.9		8.5	7.9		18.3	49.2		4.4	35.3	35.3
Actuated g/C Ratio	0.14	0.13		0.09	0.09		0.20	0.55		0.05	0.39	0.39
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	446	195		156	131		337	1801		81	1867	566
v/s Ratio Prot	c0.10	c0.01		0.04	0.01		c0.14	c0.34		0.02	0.25	
v/s Ratio Perm												0.05
v/c Ratio	0.70	0.08		0.46	0.06		0.69	0.62		0.41	0.63	0.14
Uniform Delay, d1	36.9	34.3		38.6	37.6		33.2	14.0		41.5	22.1	17.6
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.7	0.2		2.1	0.2		5.8	1.6		3.3	1.6	0.5
Delay (s)	41.6	34.4		40.7	37.8		39.0	15.6		44.9	23.7	18.1
Level of Service	D	C		D	D		D	B		D	C	B
Approach Delay (s)		40.0			39.7			19.6			23.4	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	24.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰↰	↱		↰	↱		↰	↑↱		↰	↑↑↑	↱
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.97	1.00		1.00	1.00		1.00	0.95		1.00	0.91	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	0.97
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.86		1.00	0.87		1.00	1.00		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3213	1474		1656	1495		1656	3294		1656	4759	1435
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3213	1474		1656	1495		1656	3294		1656	4759	1435
Volume (vph)	285	5	77	65	5	30	213	996	30	30	1078	182
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	310	5	84	71	5	33	232	1083	33	33	1172	198
RTOR Reduction (vph)	0	74	0	0	31	0	0	1	0	0	0	86
Lane Group Flow (vph)	310	15	0	71	7	0	232	1115	0	33	1172	112
Confl. Peds. (#/hr)			2			2			2			2
Turn Type	Prot			Prot			Prot			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												6
Actuated Green, G (s)	20.5	17.0		11.9	8.4		25.5	95.9		7.2	77.6	77.6
Effective Green, g (s)	21.0	17.5		12.4	8.9		26.0	96.4		7.7	78.1	78.1
Actuated g/C Ratio	0.14	0.12		0.08	0.06		0.17	0.64		0.05	0.52	0.52
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	4.5
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	450	172		137	89		287	2117		85	2478	747
v/s Ratio Prot	c0.10	c0.01		0.04	0.00		c0.14	c0.34		0.02	0.25	
v/s Ratio Perm												0.08
v/c Ratio	0.69	0.09		0.52	0.08		0.81	0.53		0.39	0.47	0.15
Uniform Delay, d1	61.4	59.1		65.9	66.7		59.6	14.5		68.9	22.9	18.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.12	0.64	0.19
Incremental Delay, d2	4.4	0.2		3.3	0.4		15.3	0.9		2.2	0.5	0.3
Delay (s)	65.8	59.3		69.2	67.1		74.9	15.4		79.6	15.2	3.8
Level of Service	E	E		E	E		E	B		E	B	A
Approach Delay (s)		64.3			68.5			25.7			15.1	
Approach LOS		E			E			C			B	

Intersection Summary			
HCM Average Control Delay	27.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Appendix G

Manual on Uniform Traffic Control Devices (MUTCD)
Chapter 4C
Traffic Control Signal Needs Studies

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

TABLE OF CONTENTS

CHAPTER 4C. TRAFFIC CONTROL SIGNAL NEEDS STUDIES

Section 4C.01 Studies and Factors for Justifying Traffic Control Signals

Standard:

An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location.

The investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the following traffic signal warrants and other factors related to existing operation and safety at the study location:

Warrant 1, Eight-Hour Vehicular Volume.
Warrant 2, Four-Hour Vehicular Volume.
Warrant 3, Peak Hour.
Warrant 4, Pedestrian Volume.
Warrant 5, School Crossing.
Warrant 6, Coordinated Signal System.
Warrant 7, Crash Experience.
Warrant 8, Roadway Network.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

Support:

Sections 8D.07 and 10D.05 contain information regarding the use of traffic control signals instead of gates and/or flashing light signals at highway-railroad grade crossings and highway-LRT grade crossings, respectively.

Guidance:

A traffic control signal should not be installed unless one or more of the factors described in this section are met.

A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.

A traffic control signal should not be installed if it will seriously disrupt progressive traffic flow.

The study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the above signal warrants.

Engineering judgment should also be used in applying various traffic signal warrants to cases where approaches consist of one lane plus one left-turn or right-turn lane. The site-specific traffic characteristics dictate whether an approach should be considered as one lane or two lanes. For example, for an approach with one lane for through and right-turning traffic plus a left-turn lane, engineering judgment could indicate that it should be considered a one-lane approach if the traffic using the left-turn lane is minor. In such a case, the total traffic volume approaching the intersection should be applied against the signal warrants as a one-lane approach. The approach should be considered two lanes if approximately half of the traffic on the approach turns left and the left-turn lane is of sufficient length to accommodate all left-turn vehicles.

Similar engineering judgment and rationale should be applied to a street approach with one lane plus a right-turn lane. In this case, the degree of conflict of minor-street right-turn traffic with traffic on the major street should be considered. Thus, right-turn traffic should not be included in the minor-street volume if the movement enters the major street with minimal conflict. The approach should be evaluated as a one-lane approach with only the traffic volume in the through/left-turn lane considered.

At a location that is under development or construction and where it is not possible to obtain a traffic count that would represent future traffic conditions, hourly volumes should be estimated as part of an engineering study for comparison with traffic signal warrants.

For signal warrant analysis, a location with a wide median should be considered as one intersection.

Option:

Engineering study data may include the following:

A. The number of vehicles entering the intersection in each hour from each approach during 12 hours of an average day. It is desirable that the hours selected contain the greatest percentage of the 24-hour traffic volume.

B. Vehicular volumes for each traffic movement from each approach, classified by vehicle type (heavy trucks, passenger cars and light trucks, public-transit vehicles, and, in some locations, bicycles), during each 15-minute period of the 2 hours in the morning and 2 hours in the afternoon during which total traffic entering the intersection is greatest.

C. Pedestrian volume counts on each crosswalk during the same periods as the vehicular counts in Paragraph B above and during hours of highest pedestrian volume. Where young, elderly, and/or persons with physical or visual disabilities need special consideration, the pedestrians and their crossing times may be classified by general observation.

D. Information about nearby facilities and activity centers that serve the young, elderly, and/or persons with disabilities, including requests from persons with disabilities for accessible crossing improvements at the location under study. These persons may not be adequately reflected in the pedestrian volume count if the absence of a signal restrains their mobility.

E. The posted or statutory speed limit or the 85th-percentile speed on the uncontrolled approaches to the location.

F. A condition diagram showing details of the physical layout, including such features as intersection geometrics, channelization, grades, sight-distance restrictions, transit stops and routes, parking conditions, pavement markings, roadway lighting, driveways, nearby railroad crossings, distance to nearest traffic control signals, utility poles and fixtures, and adjacent land use.

G. A collision diagram showing crash experience by type, location, direction of movement, severity, weather, time of day, date, and day of week for at least 1 year.

The following data, which are desirable for a more precise understanding of the operation of the intersection, may be obtained during the periods specified in Paragraph B above:

A. Vehicle-hours of stopped time delay determined separately for each approach to be consistent with the Peak Hour Warrant.

B. The number and distribution of acceptable gaps in vehicular traffic on the major street for entrance from the minor street.

C. The posted or statutory speed limit or the 85th-percentile speed on controlled approaches at a point near to the intersection but unaffected by the control.

D. Pedestrian delay time for at least two 30-minute peak pedestrian delay periods of an average weekday or like periods of a Saturday or Sunday.

E. Queue length on stop-controlled approaches.

Section 4C.02 Warrant 1, Eight-Hour Vehicular Volume

Support:

The Minimum Vehicular Volume, Condition A, is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

The Interruption of Continuous Traffic, Condition B, is intended for application where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Standard:

The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:

A. The vehicles per hour given in both of the 100% columns of Condition A in Table 4C-1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection, or

B. The vehicles per hour given in both of the 100% columns of Condition B in Table 4C-1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection.

In applying each condition the major street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h (40 mph), or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70% columns in Table 4C-1 may be used in place of the 100% columns.

Standard:

The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:

A. The vehicles per hour given in both of the 80% columns of Condition A in Table 4C-1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection, and

B. The vehicles per hour given in both of the 80% columns of Condition B in Table 4C-1 exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection.

These major street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street the higher volume shall not be required to be on the same approach during each of the 8 hours.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A - Minimum Vehicular Volume							
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor-street approach (one direction only)		
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	100%[a]	80%[b]	70%[c]
1................	1................	500	400	350	150	120	105
2 or more...	1................	600	480	420	150	120	105
2 or more...	2 or more...	600	480	420	200	160	140
1................	2 or more....	500	400	350	200	160	140

Condition B - Interruption of Continuous Traffic							
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)			Vehicles per hour on higher-volume minor-street approach (one direction only)		
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	100%[a]	80%[b]	70%[c]
1................	1................	750	600	525	75	60	53
2 or more...	1................	900	720	630	75	60	53
2 or more...	2 or more...	900	720	630	100	80	70
1................	2 or more....	750	600	525	100	80	70

[a] Basic minimum hourly volume.
[b] Used for combination of Conditions A and B after adequate trial of other remedial measures.
[c] May be used when the major street speed exceeds 70 km/h (40 mph) or in an isolated community with a population of less than 10,000.

Guidance:

The combination of Conditions A and B should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Section 4C.03 Warrant 2, Four-Hour Vehicular Volume

Support:

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

The need for a traffic control signal shall be considered if an engineering study finds that for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.

Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h (40 mph), or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

Section 4C.04 Warrant 3, Peak Hour

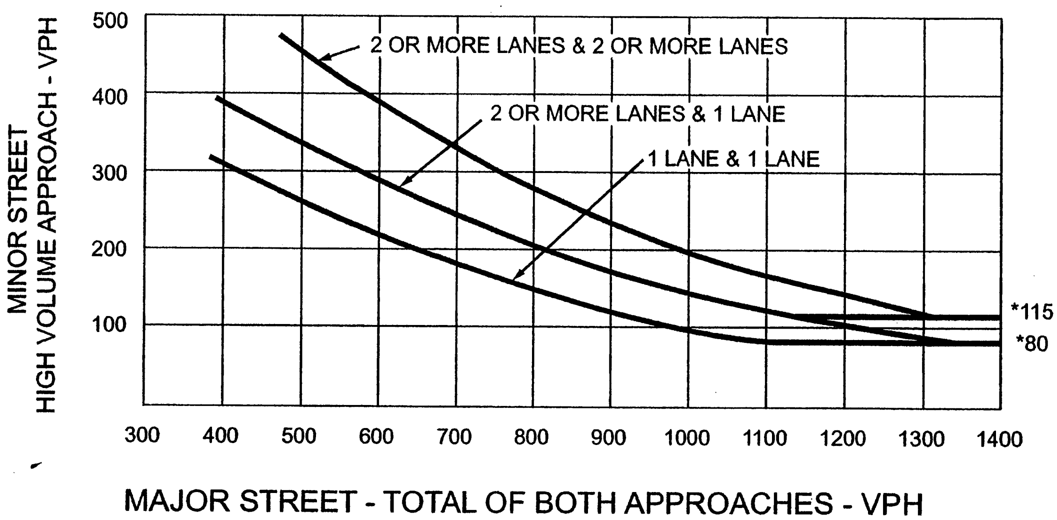
Support:

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

This signal warrant shall be applied only in unusual cases. Such cases include, but are not limited to, office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

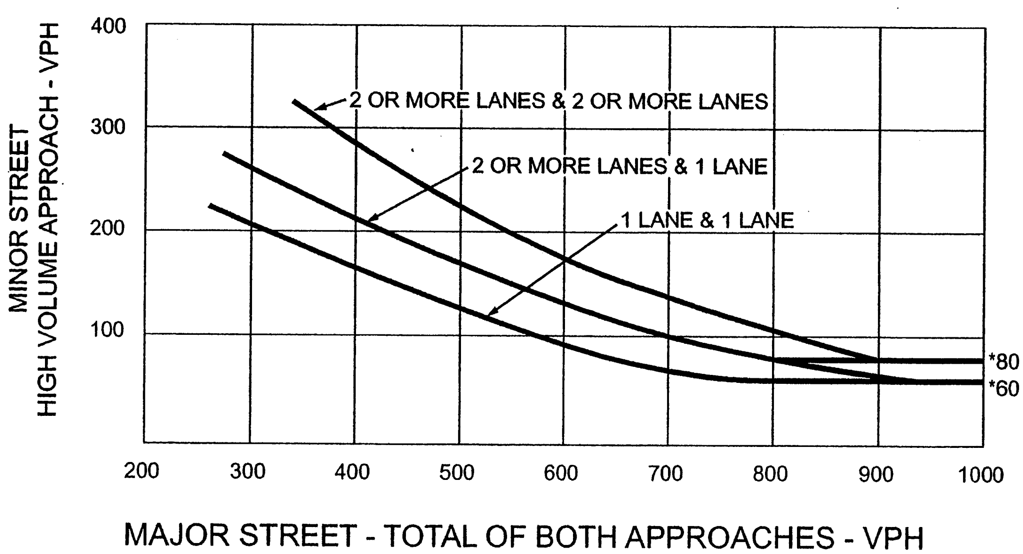
Figure 4C-1. Warrant 2 - Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor street approach with one lane.

Figure 4C-2. Warrant 2 - Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor street approach with one lane.

The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach; or 5 vehicle-hours for a two-lane approach, and

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and

3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Option:

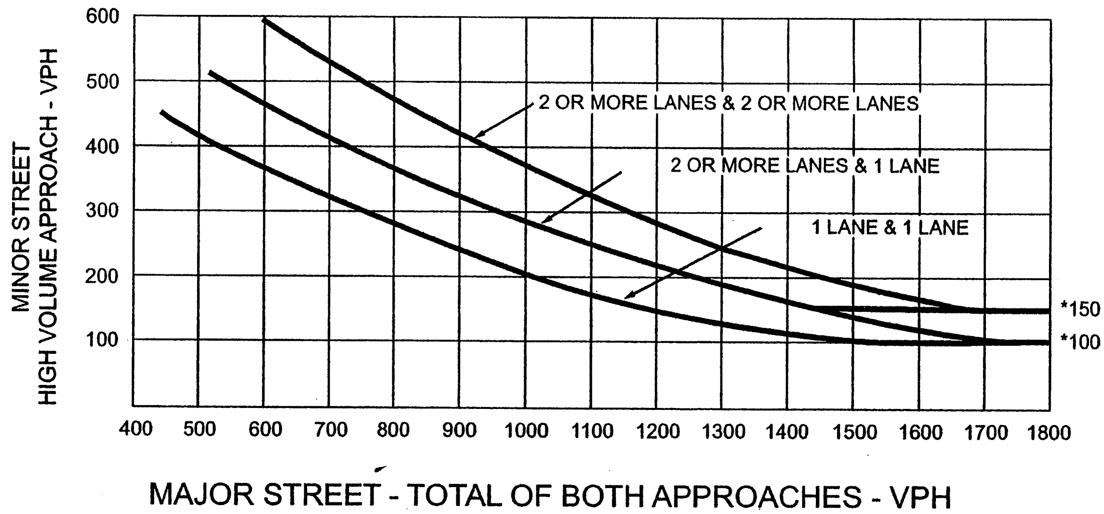
If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h (40 mph), or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to satisfy the criteria in the second category of the Standard.

4C.05 Warrant 4, Pedestrian Volume

Support:

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

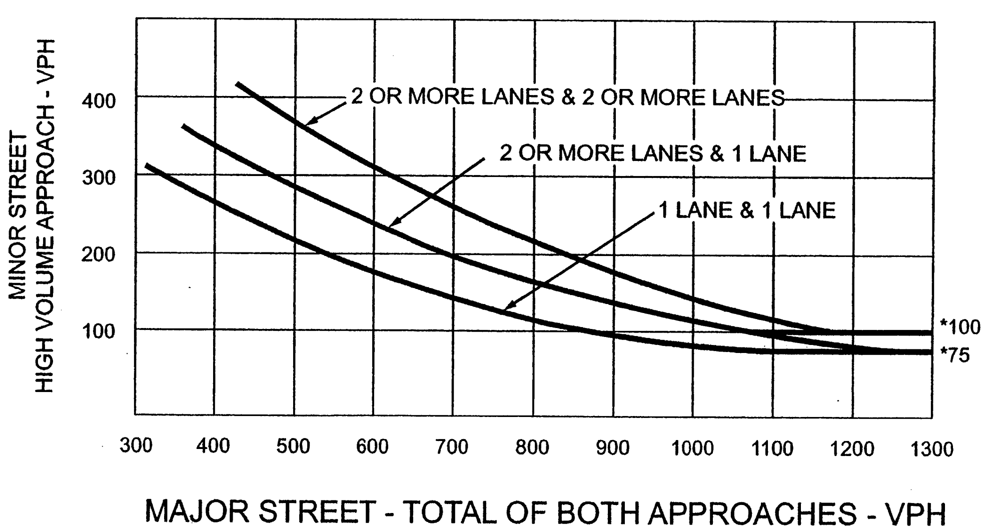
Figure 4C-3. Warrant 3 - Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor street approach with one lane.

Figure 4C-4. Warrant 3 - Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor street approach with one lane.

Standard:

The need for a traffic control signal at an intersection or mid-block crossing shall be considered if an engineering study finds that both of the following criteria are met:

A. The pedestrian volume crossing the major street at an intersection or mid-block location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour, and

B. There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.

The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

If a traffic control signal is justified by both this signal warrant and a traffic engineering study, the traffic control signal shall be equipped with pedestrian signal heads conforming to requirements set forth in Chapter 4E.

Guidance:

If a traffic control signal is justified by both this signal warrant and a traffic engineering study:

A. If installed within a signal system, the traffic control signal should be coordinated.

B. At an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors. As a minimum, it should have semi-actuated operation, but full-actuated operation with detectors on all approaches might also be appropriate.

C. At non-intersection crossings, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.

Option:

The criterion for the pedestrian volume crossing the major roadway may be reduced as much as 50 percent if the average crossing speed of pedestrians is less than 1.2 m/sec (4 ft/sec).

A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street, even if the rate of gap occurrence is less than one per minute.

Section 4C.06 Warrant 5, School Crossing

Support:

The School Crossing signal warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal.

Standard:

The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 students during the highest crossing hour.

Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.

The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

Guidance:

If a traffic control signal is justified by both this signal warrant and an engineering study:

A. If installed within a signal system, the traffic control signal should be coordinated.

B. At an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors. As a minimum, it should have semi-actuated operation, but full-actuated operation with detectors on all approaches might also be appropriate.

C. At non-intersection crossings, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.

Section 4C.07 Warrant 6, Coordinated Signal System

Support:

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

Standard:

The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:

A. On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

B. On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

Guidance:

The Coordinated Signal System signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 300 m (1,000 ft).

Section 4C.08 Warrant 7, Crash Experience

Support:

The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Standard:

The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency, and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash, and

C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80% columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80% columns of Condition B in Table 4C-1 exists on the major street and on the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Section 4C.09 Warrant 8, Roadway Network

Support:

Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Standard:

The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:

A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday, or

B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).

A major route as used in this signal warrant shall have one or more of the following characteristics:

A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow, or

B. It includes rural or suburban highways outside, entering, or traversing a city, or

C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.

APPENDIX H

Noise Assessment

Prepared by

Illingworth & Rodkin

July 2004

Lodi Shopping Center Environmental Noise Study

Lodi, California

July 9, 2004

◆ ◆ ◆

Prepared for:

Pacific Municipal Consultants
10461 Old Placerville Road, Suite 110
Sacramento, CA 95827

Prepared by:

Paul R. Donavan, Sc.D.

ILLINGWORTH & RODKIN, INC.
Acoustics · Air Quality
505 Petaluma Boulevard South
Petaluma, CA 94952
(707) 766-7700

Job No.: 03-012

INTRODUCTION

This study evaluates the potential environmental noise impacts resulting from the proposed development of a commercial retail shopping center at the southwest corner of the intersection of Lower Sacramento Road and Highway 12 in Lodi, California. This report is divided into three major sections: Environmental Setting, Potential Noise Impacts, and Mitigation Measures. In the Environmental Setting Section, background information on noise is provided along with a discussion of the applicable noise regulations and existing noise environment. In the second section, criteria for impact assessment are discussed, estimated noise levels from the project are determined for comparison to the criteria, and potentially significant impacts identified. In the final section, mitigation measures for each significant impact are presented.

ENVIRONMENTAL SETTING

Background Information on Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its loudness. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales, which are used to describe noise in a particular location. *A decibel (dB)* is a unit of measurement, which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level or dBA.* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

TABLE 1: Definition of Acoustical Terms

TERM	DEFINITIONS
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
Frequency, HZ	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dB	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Day/Night Noise Level, L_{dn}	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

TABLE 2: Typical Sound Levels Measured in the Environment and Industry

At a Given Distance From Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100')	130		
Jet Takeoff (200')	120		Pain Threshold
	110	Rock Music Concert	
Diesel Pile Driver (100')	100		Very Loud
	90	Boiler Room	
Freight Cars (50')		Printing Press Plant	
Pneumatic Drill (50')	80		
Freeway (100')		In Kitchen With Garbage	
Vacuum Cleaner (10')	70	Disposal Running	Moderately Loud
	60	Data Processing Center	
Light Traffic (100')	50	Department Store	
Large Transformer (200')			
	40	Private Business Office	Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		
	0		Threshold of Hearing

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The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level, CNEL*, is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level,* L_{dn}, is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Effects of Noise

Hearing Loss

While physical damage to the ear from an intense noise impulse is rare, a degradation of auditory acuity can occur even within a community noise environment. Hearing loss occurs mainly due to chronic exposure to excessive noise, but may be due to a single event such as an explosion. Natural hearing loss associated with aging may also be accelerated from chronic exposure to loud noise.

The Occupational Safety and Health Administration (OSHA) has a noise exposure standard which is set at the noise threshold where hearing loss may occur from long-term exposures. The maximum allowable level is 90 dBA averaged over eight hours. If the noise is above 90 dBA, the allowable exposure time is correspondingly shorter.

Sleep and Speech Interference

The thresholds of interference for relaxed speech indoors are about 45 dBA if the noise is steady and above 55 dBA if the noise is fluctuating. Outdoors, for normal voice, the thresholds are about 15 dBA higher. Steady noises of sufficient intensity (above 35 dBA) and fluctuating noise levels above about 45 dBA have been shown to affect sleep. Interior residential standards for multi-family dwellings are set by the State of California at 45 dBA L_{dn}. Typically, the highest steady traffic noise level during the daytime is about equal to the L_{dn} and nighttime levels are 10 dBA lower. The standard is designed for sleep and speech protection and most jurisdictions apply the same criterion for all residential uses. Typical structural attenuation is 12-17 dBA with open windows. With closed windows in good condition, the noise attenuation factor is around 20 dBA for an older structure and 25 dBA for a newer dwelling. Sleep and speech interference is therefore possible when exterior noise levels are about 57-62 dBA L_{dn} with open windows and 65-70 dBA L_{dn} if the windows are closed. Levels of 55-60 dBA are common along collector streets and secondary arterials, while 65-70 dBA is a typical value for a primary/major arterial. Levels of 75-80 dBA are normal noise levels at the first row of development outside a freeway right-of-way. In order to achieve an acceptable interior noise environment, bedrooms facing secondary roadways need to be able to have their windows closed, and those facing major roadways and freeways typically need special glass windows.

Annoyance

Attitude surveys are used for measuring the annoyance felt in a community for noises intruding into homes or affecting outdoor activity areas. In these surveys, it was determined that the causes for annoyance include interference with speech, radio and television, house vibrations, and interference with sleep and rest. The L_{dn} as a measure of noise has been found to provide a valid correlation of noise level and the percentage of people annoyed. People have been asked to judge the annoyance caused by aircraft noise and ground transportation noise. There continues to be disagreement about the relative annoyance of these different sources. When measuring the percentage of the population highly annoyed, the threshold for ground vehicle noise is about 55 dBA L_{dn}. At an L_{dn} of about 60 dBA, approximately 2 percent of the population is highly annoyed. When the L_{dn} increases to 70 dBA, the percentage of the population highly annoyed increases to about 12 percent of the population. There is, therefore, an increase of about 1 percent per dBA between an L_{dn} of 60-70 dBA. Between an L_{dn} of 70-80 dBA, each decibel increase increases by about 2 percent the percentage of the population highly annoyed. People appear to respond more adversely to aircraft noise. When the L_{dn} is 60 dBA, approximately 10 percent of the population is believed to be highly annoyed. Each decibel increase to 70 dBA adds about 2 percentage points to the number of people highly annoyed. Above 70 dBA, each decibel increase results in about a 3 percent increase in the percentage of the population highly annoyed.

Regulatory Setting

The State of California and the City of Lodi have established guidelines and policies which are applicable to the proposed project. The State of California has established the California Environmental Quality Act (CEQA) to assess the potential for significant noise impacts as a result of a project. Local guidelines and policies to "ensure the City residents are protected from excessive noise" have been established in the City of Lodi General Plan, June 12, 1991, and are also addressed in the City of Lodi Municipal Code as noise regulations. The guidelines and policies from these documents are applicable to the proposed project.

State of California CEQA Guidelines

The California Environmental Quality Act (CEQA) asks the following questions regarding potential noise effects from a project. Would the project result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b) Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels?

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

For purposes of the second question, CEQA does not define what noise level increase would be considered "substantial". However, in CEQA noise analysis it is common to define a noise impact as significant if the pre-existing noise environment is greater than L_{dn}[1] = 55, and the project would increase noise levels by more than 3 dBA at noise-sensitive receptors. Where the existing noise level is lower than L_{dn} = 55, a somewhat higher increase, up to 5 dB, is generally tolerated before a finding of significance is made.

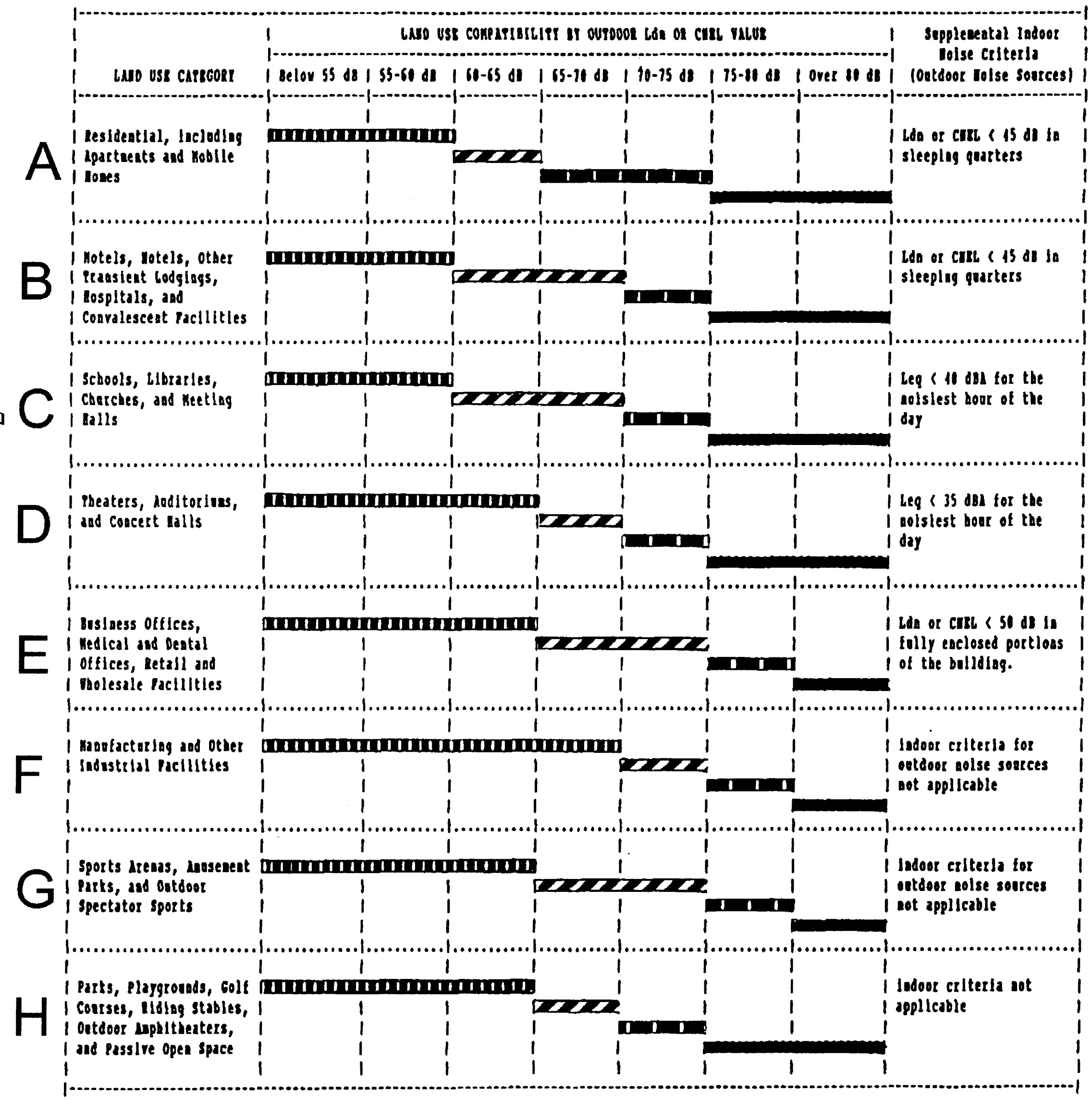
Noise Element of the City of Lodi General Plan

In order to protect its residents from excessive noise, the City Lodi uses outdoor CNEL as the primary criteria for assessing land use compatibility as shown in Table 3. However, it is also noted that intermittent or discontinuous noises are not adequately measured by CNEL and therefore cases with these types of noise source require case-by-case consideration. The City requires noise impact analysis for development projects proposed for sites that are currently noise impacted or projected to be in the future. Noise impacted sites are those where compatibility criteria are anything but "presumed to be acceptable". The City also requires impact analysis for projects that might cause or contribute to adjacent properties to become noise impacted. The City recognizes residential uses, motels, hotels, other transient lodgings, hospitals, convalescent facilities, and schools as "noise-sensitive". With a few exceptions, the City is also charged with denying development projects that would be classified as "normally unacceptable" or "presumed to be unacceptable" particularly for noise sensitive uses.

Table 3: Land Use Compatibility Chart for the Noise Element of the City of Lodi General Plan

FIGURE 6-4. LAND USE COMPATIBILITY CHART FOR THE NOISE ELEMENT OF THE CITY OF LODI GENERAL PLAN

Category



COMPATIBILITY CATEGORY DEFINITIONS

= Presumed To Be Acceptable; no special noise mitigation required.

= Conditionally Acceptable; acceptability depends on specific property uses and the extent of noise mitigation provided.

= Normally Unacceptable; acceptability requires specific findings outlined in Policy A-8 of the Noise Element text.

= Presumed To Be Unacceptable; adequate mitigation measures unlikely to be available.

Notes:

CNEL criteria apply to outdoor noise from sources that operate continuously or that operate frequently throughout most of a 24-hour period.

CNEL criteria should be applied to noise conditions that are typical for the noise source, not to conditions reflecting temporary peak activity periods.

Land use compatibility classifications for areas affected primarily by intermittent or discontinuous noise sources must be made on a case-by-case basis, reflecting the magnitude, duration, and temporal pattern of ambient noise.

Supplemental indoor noise criteria apply to the noise increment contributed by outdoor noise sources.

Supplemental indoor noise criteria represent minimum performance standards to be met through building design and acoustic insulation.

City of Lodi Noise Regulations

The Noise Regulations of the City of Lodi covers three classifications of noise. These include "public nuisance", "excessive, offensive or disturbing", and "animal" noises. In general, the regulations do not cite levels and are very much open to interpretation as to their application to any noises arising from Lodi development projects. Under item 9.24.030 on excessive, offensive, or disturbing noise, the regulation states that it is not permitted to raise the ambient level noise by more that 5 dB between 10:00 pm and 7:00 am at the property line of any residential property. This regulation explicitly applies to sound equipment, horns and warning devices; however, the list is not deemed exclusive by the City of Lodi which applies this section of the Noise Regulations to any activity which causes excessive nighttime noise. Therefore an excessive, offensive, or disturbing noise from the proposed development would be subject to this noise restriction.

Existing Noise Environment

The proposed Lodi Shopping Center project site is bounded along its north by State Highway 12 and by Lower Sacramento Road to east side. In the vicinity of the site, both roadways produce CNEL values of 65 dB or greater at 100 feet as noted in the Noise Element of the Lodi General Plan. To the south and west, the site is bounded by agricultural land uses, which are designated for residential use in the City of Lodi General Plan. The closest existing residences are across Highway 12 to the northwest of site and across Lower Sacramento Road to the east of the site (Figure 1). Noise sensitive receptors are also present at greater distances from the site along the major arterial streets. Throughout the site itself and the surrounding area, the dominant contributor to the existing noise is traffic noise from the two arterial streets.

To quantify the existing noise levels, noise measurements were made at the project site and immediate surrounding area. These consisted of three long-term measurements and two short-term measurements, as described in the following paragraphs.

At the location of each long-term noise measurement, hourly noise metrics were measured continuously from the afternoon of Wednesday, September 17th to earlier afternoon of September 19th, 2003. The measurement locations used for this monitoring are indicated in Figure 1. The first site, LT1, was chosen to characterize noise experienced by residences to the north of Highway 12. It was set back from the road by 250 feet in an area free of obstacles which might obscure the traffic. The dominant source of noise at this location was the traffic on Highway 12. The second site, LT2, was set back into the residential area to the east of Lower Sacramento Road, 250 feet from the edge of the roadway and was selected to represent the noise exposure for these receptors. At this location, the noise sources were a primarily traffic on Lower Sacramento Road and, to a lesser extent, noise from local activities. The final site, located on the southern project boundary, was chosen to measure noise levels farther away from either of the arterial roadways to represent what the existing levels might be if the area of land to the south of the site were used for residential purposes. This site is close to what would be the southeast corner of the proposed Wal-Mart. This site was located about 1300 feet south of Highway 12 and 1200 feet west of Lower Sacramento Road. At each site, noise levels were monitored with precision Type 1 sound level meters, either Larson-Davis Type 812 or 820 fitted with a ½-inch pre-polarized condenser microphone and windscreens. The meters were calibrated before and after the surveys with a 114 dB, 1000 hertz Larson Davis acoustical calibrator. The meters were secured in trees or on poles at a height of about 3 to 5 meters above the ground.

A continuous representation of the hourly L_1, L_{10}, L_{50}, L_{90}, and L_{eq} data obtained from these measurements are presented in Figures 2, 3, and 4 for LT1, LT2, and LT3 respectively. For sites LT1 and LT2, the noise data appears to be dominated by traffic noise. Typical of traffic noise, the levels are reduced somewhat in the nighttime hours. However, at both locations, the hourly L_{eq} only drops below 50 dBA around 2 to 3 a.m. Also at both sites, there is a broad peak in noise levels centered around 6 to 8 a.m. Throughout the remainder of the daytime hours, the levels are relatively constant and average about 57 dBA and 55 dBA in hourly L_{eq} for sites LT1 and LT2 respectively. The 24-hour metrics for these two sites were CNEL 64 dB at LT1 with an L_{dn} also of 64 dB, and a CNEL of 61 dB at LT2 with an L_{dn} of 60 dB. For purposes of assessing potential noise impact, these levels are taken to be typical of the residences in each of the areas represented by the sites. It should be noted that the areas represented by LT1 and LT2 would be considered as noise impacted for residential use under the City of Lodi Noise Element. However, both are within the bounds that would be considered conditionally acceptable for this usage.

For site LT3, measured levels do not appear to follow the same trends as LT1 and LT2. The levels at LT3 behaved quite erratically during the period from the evening of September 17th to the afternoon of September 18th. In particular, high levels occurred in and around the hours of 6 a.m. and 3 p.m. on the 18th. In both of these cases, the levels were higher than at other two long-term sites. At midnight, the levels were also higher at LT3 than the other sites. Based on the traffic noise measured at LT1 & LT2, it is expected that the noise level due to traffic at this location would have daytime hourly L_{eq} levels between about 48 and 51 dBA. For portions of September 18th, these levels are confirmed. Further, the hour-to-hour variation for September 19th follows that of LT1 and LT2. It appears that for portions of the time during which these measurements were taken, other local sources existed creating the higher than expected levels. This location is on the boundary of an active vineyard and operations on this property may have influenced the measurements. However, for portions of the measurement period, levels were consistent with what would be expected for the distant traffic noise from Highway 12 and Lower Sacramento Road. Based on this comparison, it is expected that typical daytime hourly Leq values at this location would range between 48 and 51 dBA in the absence of any local noise intrusions. Further, discounting the large "spike" in noise at 3 p.m. on September 18th, CNEL and L_{dn} values of about 56 dBA are expected for this location. Assuming that this CNEL is representative of the levels at this location without extraneous noises, the location would not be considered noise impacted for residential use.

Short-term measurements were also made of traffic noise at two locations along both Highway 12 and Lower Sacramento Road. The first site, ST1, was in the vicinity of LT1 and was located about 75 feet north of Highway 12 in line with the LT1 at 250 feet north of SR 12. The second site, ST2, was in the vicinity of LT2 and located about 50 feet east of Lower Sacramento Road in the direction of LT2, at approximately the front setback of the nearest dwelling along the east side of the road. Noise levels at both sites were measured in four, 5-minute intervals and traffic was counted during the noise measurements. From the traffic counts, the mix of vehicles was determined and the data was used to calculate the predicted noise using the L_{eq}V2 Traffic Noise Model. The measured and predicted noise levels are given in Table 4. At ST1 on Highway 12, the traffic mix was 90% light vehicles, 9% heavy trucks, and less than 1% medium trucks, buses and motorcycles. At ST2 on Lower Sacramento Road, the mix was 98% light vehicles, 1% trucks, and less than 1% buses. The predicted results correspond reasonably well with the measured sound levels assuming 35 mph for ST1 and 40 mph for ST2.

Table 4: Short Term Traffic Noise Measurements along Highway 12 (ST1) and Lower Sacramento Road (ST2)

Site	L_{eq}	L_1	L_{10}	L_{50}	L_{90}	Calc L_{eq}	Dist (ft)
ST1	65	74	69	62	51	65	75
ST2	68	75	70	65	56	67	50

POTENTIAL NOISE IMPACTS

Significance Criteria

For the proposed Lodi Shopping Center Project, two of the six questions on noise in the CEQA Guidelines are relevant. As a result, the project would be considered to have a significant noise impact if it would result in:

- Creating substantial, permanent increase in the ambient noise levels in the areas adjoining the project area; and
- Generating substantial temporary or periodic increases in ambient noise levels in the areas adjoining the project.

In regard to land use compatibility, ranges from Table 3 are applicable to this project both in terms of the nearby sensitive receptors and the use of the project site for retail facilities. For residences surrounding the site, they would be considered "noise impacted" if the project increased the CNEL above 60 dB. In cases where the CNEL is above 60, if the CNEL increased more than 3 dB (CEQA criteria) or exceeded 65 dB, a significant noise impact would occur. For the current agricultural land to the south and west of the project site, which are designated for residential purposes in the Lodi General Plan, these same criteria are used to assess project compatibility. For the retail use of this site, the CNEL should be 65 dB or less to be considered acceptable and not noise impacted. Above this limit, the site would be considered noise impacted; however, noise levels would be considered to be conditionally acceptable up to a CNEL of 75 dB. For intermittent or discontinuous noise, the Noise Element does not state specific standards, but Policy 2 states that these noises need to be estimated and considered on a case-by-case basis for the existing and future planned residential uses.

In regard to the City Noise Regulations, any project-generated noise exceeding the ambient noise at the property line of any residential property by 5 dB between 10:00 pm and 7:00 am would be interpreted as a violation of this ordinance. In general, such exceedances are difficult to predict. Based on the long-term data, specific operations on the site can be compared to this requirement.

In regard to the two remaining CEQA criteria, a 3 dB permanent increase in noise level is considered substantial for areas subject to existing noise levels of 55 dBA or greater. For areas under 55 dB, and a permanent increase of up to 5 dB can be tolerated before the increase would be considered substantial. This is applied to the noise generated on-site by the project and noise generated by increased traffic due to the project. It is typically evaluated on a time-averaged basis either by CNEL or hourly L_{eq} depending on the nature of the noise. For intermittent noise sources that operate for only part of the day, the City of Lodi recognizes that disturbance may result and considers these on a case-by-case basis.

Compatibility of the Proposed Project with the Onsite Noise Environment

The source of noise affecting the project site is traffic on Highway 12 and Lower Sacramento Road. Using the data from the long term measurements, the majority of the site would not be considered noise impacted for retail use as the measured CNEL's were 64 dB or lower. For those retail facilities located within 200 ft of Highway 12, the CNEL values would likely exceed 65 dB; however, they would remain within the range of being considered conditionally acceptable (65 to 75 dB). Since the land uses proposed would consist of relatively noise insensitive commercial/retail, no noise attenuation measures would be required in the higher noise areas along the arterial roads.

Offsite Noise Impacts – Project and Cumulative Traffic

Increases in noise levels due to project-generated traffic increases along Highway 12 and Lower Sacramento Road were calculated based on the traffic volume data supplied by Fehr & Peers Transportation Consultants. For this analysis, traffic noise for the baseline condition, baseline plus the Lodi Shopping Center project, the Lodi General Plan for 2020, and the General Plan plus the project were all considered. The changes in noise level were calculated for Highway 12 west of Lower Sacramento Road where residential receptors are located, and east of Lower Sacramento Road beyond the existing shopping centers near other noise sensitive residential receptors. Changes were evaluated near noise sensitive residential receptors to the east of the project site on Lower Sacramento Road, and to the north of Highway 12 just beyond the Vintner's Square Shopping Center site. To determine the increase in level due the increased traffic, the L_{eq}V2 Traffic Noise Model was used to first calculate the change in a.m. and p.m. peak hour noise levels. The changes in the morning and afternoon hours were then applied to the corresponding hourly Leq's so that changes in the daily CNEL could be determined using the appropriate long-term data. In this manner, the increases in CNEL are given in Table 5.

Table 5: Increases in Traffic Noise CNEL Levels with Increased Traffic Volumes Relative t Baseline Traffic Conditions, dB

Location	Project	General Plan	Project + General Plan
Highwy 12 West	0	2	2
Highwy 12 East	0	2	2
Lower Sacramento Road South	0	1	1
Lower Sacramento Road North	0	1	1

Considering the results of Table 5, it is seen that proposed Lodi Shopping Center project would increase the CNEL over the baseline case by less than 3 dB for all affected road segments. Therefore, the project-generated traffic increases would not result in a significant noise impact to sensitive residential receptors in the area.

With the projected increases in the General Plan, the levels would increase 1 to 2 dB depending on location. Considering the project and General Plan levels cumulatively, the increase is still 1 to 2 dB depending on location. Although these increases are less than what would be considered significant under CEQA criteria, it should be noted that under the General Plan and cumulative scenarios for residences on Highway 12 in locations similar to LT1, the CNEL would increase from 64 to 66 dB thereby raising it to a category of normally unacceptable. However, this level is consistent with the Noise Element of the City of Lodi General Plan projections and as a result is not considered to be in conflict with it. As noted, the increased traffic noise under General Plan and cumulative conditions would be less than significant as they would be less than 3 dB.

Project Operational Noise Impacts on Nearby Residential Areas

Onsite noise sources associated with the Lodi Shopping Center will include (1) parking lot activity, (2) delivery truck activity, (3) loading dock activity, (4) trash compactors, (5) mechanical equipment, (6) automotive service activities, and (7) parking lot cleaning activities. Noise levels associated with some of these activities were measured near a major retail store in the City of Fairfield, CA (Figure 5). The configuration of this particular store is virtually identical to that of the proposed Wal-Mart of the Lodi Shopping Center (Figure 6). The measurements were made at a location 200 feet from the outside wall of the vehicle service garage which provides oil and tire changing. The measured location was 300 feet from the loading dock area, and parking lot activities occurred at distances from 60 to 200 feet from the measurement location.

Using the data cited above and other information from similar projects, estimated noise generated by each of the onsite project activities, and associated environmental impacts, are described below:

(1) Parking Lot Activity. Major noise sources in the parking lot include, in order of magnitude, the starting of engines, car horns, door slams, low speed moving vehicles, and human voices. The proposed parking areas nearest to the existing residential neighbors to the east would be located about 160 feet away from the nearest dwellings with Lower Sacramento Road in between. The majority of these dwellings are located at least 200 feet from the nearest planned parking stalls. The center region of the major parking area would be more than 500 feet away and with Lower Sacramento Road or retail buildings in between. The nearest existing dwellings to the northwest would be at least 500 feet from the nearest parking and with Highway 12 in between. Along the southern boundary, the nearest parking spaces would be within 15 feet of future residential property lines; however, the planned residential uses to south of the site will be screened from the major parking area by an 8-foot masonry sound wall.

For the parking lot noises, all noises are of short to very short duration. The sound of starting vehicle tends to last a few seconds and produces levels of the order of 55 dBA at 200 feet. Impulsive horn sounds occur mostly due to remote door locking systems that give a short "beep" to signify the doors are locked. These very short beeps can produce maximum levels of 50 dBA as measured on Slow meter response at distances of 200 feet. More intentional horn usage can produce levels on the order of 55 dBA at 200 feet. Low speed, light vehicle movements typically produce levels of about 44 dBA at 200 feet. Door slams create very short-term duration noise which can produce maximum levels of as much as 44 dBA. The hourly average noise level L_{eq} resulting from all of these noise-generating activities in a busy shopping center parking lot could range from 35 to 40 dBA 200 feet from the path of the vehicles. Sounds might be heard occasionally outside of the nearest residences due to parking lot activity during project operational hours, but noise levels would not measurably alter the existing traffic-dominated noise levels for these existing residences. For these residences, the noise impact associated with parking lot activity would be less than significant.

Residential development is also planned between the detention basin and the electrical substation on the west side of the shopping center. The proposed new Westgate Drive (a 72-foot wide roadway) would be located between this residential development and the shopping center. Noise levels within this future residential area would be dominated by traffic on this new street. According to the Community Development Department, this future residential development would consist of multi-family units facing Westgate Drive. Since the outdoor activity areas would be to the rear of the units, the buildings themselves would provide shielding from street noise and would also serve to reduce noise emanating from proposed shopping center. Since the speed of the cars on the street would be much greater than the speed of the cars in the parking lot and the distance between the new homes and any parking spaces would be over 150 feet, it is not likely that the noise levels from the parking lot would be noticeable at these new residences. In any case, they would not add to the noise level generated by traffic on the new street.

(2) Delivery Truck Movements. Loading docks are proposed for the Wal-Mart and the retail store on Pad 12 in the southeast corner of the site. The loading dock for the Wal-Mart would be on the west side of the building facing the future Westgate Drive. The proposed residential development on the south would be screened from activity and noise from this area by the Wal-Mart building itself and the proposed masonry walls along the south and west sides of the shopping center. The proposed loading dock of the store on Pad 12 would be located near the south property line adjacent to the proposed future residential development. Noise generated by delivery trucks at this location would depend on the type of truck and frequency of deliveries.

The loading dock proposed for the Wal-Mart would be located on the west side of the proposed building. This area would be screened from the proposed future residential development to the west by a 10-foot masonry wall to be constructed along the west side of the Wal-Mart building.

Anticipated Delivery Activities. The store on Pad 12 is expected to receive about seven deliveries per day. These would be by either medium or large trucks between 7:00 AM and noon, approximately one delivery per hour. (Note: Per the City's Noise Regulations, delivery activity would commence no sooner than 7:00 AM.)

Wal-Mart will receive two to three large truck deliveries per day for general merchandise, and two to three large refrigerated trucks per day for the grocery component. It will also receive 8 to 10 deliveries per day by medium-sized vendor owned trucks.

All deliveries would occur between the hours of 7:00 AM and 10:00 PM, per the City of Lodi Noise Regulations.

Typical Truck Noise. From the noise measurements at the Fairfield facility, as well as other locations, a typical average level for low speed heavy truck movement onsite into and out of loading dock areas is 66 dBA at 150 feet. For medium-size delivery trucks, the typical noise level is about 63 dBA at 150 feet. Truck refrigeration equipment generates a maximum noise level of 67 to 70 dBA at a distance of 150 feet.

Given the low volume of truck traffic that would likely be generated by the store on Pad 12, and the proximity of the loading dock area to Lower Sacramento Road, intermittent noise from truck operations are calculated to not increase the CNEL outside of the nearest existing dwellings across Lower Sacramento Road to the east or the closest proposed homes along the south property line. Since no truck movements are anticipated for this loading dock area at night, no sleep disturbance would be projected and no violations of the City of Lodi Noise Regulations would be expected to occur. The presence of the 8-foot masonry wall at this location would further reduce noise from the loading dock area to a level that would be indistinguishable from traffic noise on Lower Sacramento Road.

Future development located to the west of the shopping center would be screened from the loading dock area of the Wal-Mart by a 10-foot masonry sound wall. Additionally, this residential area would be separated from the proposed shopping center by the presence of future Westgate Drive. The 10-foot high masonry sound wall would reduce noise generated by activity in the loading dock area of Wal-Mart to a level at or below that generated by traffic on Westgate Drive. This activity would not be a significant noise source to the future residential development.

Since the project site plan shows a continuous drive aisle along the southern site boundary, this would allow delivery trucks bound for Wal-Mart to enter at the southern entrance driveway on Lower Sacramento Road and travel westward along the southern site boundary to the Wal-Mart loading docks. Since the exhaust pipes on large delivery trucks are typically 11 feet above the ground, the 8-foot high masonry wall planned along the southern site boundary would not provide attenuation of exhaust noise for the future residential units whose rear yards would abut this wall. For any large delivery trucks that may travel along the southern boundary outside of the City authorized hours of 7:00 AM to 10:00 PM, their exhaust noise would violate the City's Noise Ordinance and result in a significant noise impact to the future adjacent residents to the south.

(3) Loading Dock/Material Movement Activity. In addition to the truck movements to and from the project loading docks, there is concern that loading activities at the docks themselves would also generate adverse noise impacts. At the Fairfield facility (Figure 7), noise from unloading of the both large and medium delivery trucks did not produce any audible or measurable noise. Common to other "big-box" retail centers in the Northern California area, these docks are designed so that larger delivery trucks must back up to a rubber gasket against the opening of the building, with all unloading done directly into the building. The rubber gasket type of loading dock provides a tight connection between the truck and the building specifically

for noise abatement purposes. Field visits to this and similar facilities have indicated that little loading noise escapes into the community from this loading dock type.

In addition to strictly unloading operations, other activities are expected on the west side of the Wal-Mart building that may generate noise. Some forklift operations are expected for movement of pallets (Figure 7). For typical propane fueled fork lifts, levels for these types of operations are expected to generate maximum noise levels at 150 feet of about 56 dBA. Given the location of these activities, noise levels at the closest existing residences east of Lower Sacramento Road and north of Highway 12 will be inaudible. For these existing residences there would not be a significant noise impact resulting from these activities.

Activity on the west side of Wal-Mart would be conducted behind a 10-foot high sound wall. At the closest point, this activity would be about 100 feet from the nearest proposed residences to the south and the west. Maximum noise level at these locations would be expected to be less than 60 dBA and typically less than 50 dBA. Since this activity would be confined to the daytime and maximum noise levels would be typical of existing maximum noise levels in the area, no noise impacts would be expected on future residential development. Other activities at the loading dock of the store on Pad 12 would be much less intense. Noise sources associated with this activity would be banging and clanging of metal occasionally (closing rollup doors, rolling carts, etc.), and loud voices. An 8-foot masonry wall would be interposed between this loading dock and the future residential development to the south. Maximum noise levels would be expected to be kept below 70 dBA, which would be typical of maximum noise levels generated by traffic emanating from Lower Sacramento Road in this area. In addition, the noise from the activity at this loading dock would not be expected to be audible outside of the existing homes on the other side of Lower Sacramento Road due to the distance from the loading dock and the noise generated by traffic on Lower Sacramento Road.

(4) Trash Compactors. Trash compactors generate maximum noise levels of 40 to 50 dBA at 150 feet, depending on the power rating and enclosure characteristics. Based on the project site plan, trash compactors would be located on the site on the north and south sides of the Wal-Mart loading dock areas. At these locations, future residential property lines could be located as close as about 100 feet to the west and 270 feet to the south producing noise levels from 30 to 40 dBA with the intervening masonry walls. As a result, this is a less-than-significant impact.

(5) Mechanical Equipment. Mechanical equipment typically includes heating, ventilating, air conditioning, and refrigeration equipment. Noise typically generated by rooftop mounted mechanical equipment varies significantly depending upon the equipment type and size. Project mechanical equipment specifics have not been determined at this preliminary development plan phase. The precise noise impacts of project mechanical equipment cannot be determined without detailed system design specifications regarding location, type, size, capacity, enclosure design, etc. -- details which are typically provided during later phases of the project design and development review process (final subdivision map, building permit, etc.) along with other more detailed project engineering specifications. However, based on measurements made at other similar commercial centers and large supermarkets in the region, noise levels of 60 to 70 dBA at 15 feet from external mechanical systems can be anticipated from the project. Noise levels would be somewhat reduced due to shielding from the roofs and distance. In addition, the applicant has indicated that parapet walls are planned for Wal-Mart and the other retail buildings,

including the store on Pad 12. The heights of the parapets would range from about six to eight feet and would not exceed 10 feet. The intent is to design the parapets to break the line of sight between the rooftop mechanical equipment and the nearest existing and future residences. For any instances where the parapet walls are not sufficiently high to break the line of sight, individual screen walls would be installed around each mechanical unit. The potential noise impacts associated with the mechanical equipment, assuming installation of solid parapets and/or screen walls, upon the nearest existing and future residents is evaluated below.

The nearest existing residences on the east side of Lower Sacramento Road would be at least 300 feet from the mechanical equipment on the roof of the building on Pad 12. Equipment noise levels are expected to be reduced to less than 45 dBA at the nearest existing residences due to the intervening distance and shielding provided by the building and parapets.

For planned future residences to the south of the project, the nearest property lines could be as close as 130 feet from the rooftop mechanical equipment on the Wal-Mart building, and as close as 60 feet from the rooftop equipment on the building on Pad 12. The planned masonry wall between the shopping center and potential future residences would likely be too low to provide any attenuation from the rooftop to the yards of the residences. However, the solid parapet walls planned for Wal-Mart store and the building on Pad 12 would provide sufficient screening to reduce average daily noise levels to less than 60 dB CNEL in both cases. Assuming the parapet walls and/or screen walls are effective in reducing mechanical noise, the impact to the nearest future residences to the south should be less than significant.

The future residential development to the west of the project would be at least 200 feet from the nearest rooftop mechanical equipment on the Wal-Mart store. Noise levels would be reduced to well under 60 dB CNEL at these future residences by the distance separation, the screening effect of the parapet walls, and due to the fact that the outdoor use areas for the nearest units would be to the west of the dwellings and screened by the residential buildings themselves. Therefore, for the planned residential development to the west of the project, rooftop mechanical equipment would represent a less-than-significant noise impact.

Based on the above analysis, the noise impact to the nearest existing and future residences would be less than significant if all rooftop mechanical equipment is fully screened as indicated by the applicant. However, building plans showing these parapets and screen walls have not been completed and therefore were not available for review in this analysis. Until such plans are submitted and reviewed for adequacy of noise mitigation, it must be concluded that the mechanical equipment may result in a potentially significant impact to some nearby residences, particularly the future dwellings planned along the south project boundary.

In addition to the rooftop mechanical equipment, the Wal-Mart store will include two condenser units for refrigeration equipment to serve the grocery sales area in the southern portion of the store. The units will be located along the south wall of the store and will be enclosed by 16-foot high CMU walls which will extend at least two feet above the condenser units. The south-facing doors of the enclosure will also be composed of solid material. Ventilation louvers will likely be included on the east and west facing walls of the enclosure, and will include sound insulating material as needed. Refrigeration condenser units typically produce maximum noise levels of 65 dBA at 25 feet. The only potentially affected residential areas would be the planned future residential adjacent to the south where the rear yards of the nearest dwellings would be as close as 110 feet to the condenser units. The noise levels in these rear yards would be reduced somewhat by this distance separation, and substantial noise attenuation would be provided by the solid enclosures surrounding the condenser units and the 8-foot high masonry wall along the southern project boundary. The resulting average daily noise levels from the condenser units in the nearest rear yards is projected to be 35 dB CNEL. This would be well under the City's 60 dB CNEL threshold for residential outdoor use areas, and therefore would represent a less-than-significant impact.

(6) Automotive Service Bays. The proposed Wal-Mart would include an auto service shop in its northwest corner. Noise generated by activities at the auto maintenance shop typically include the use of power tools, air compressors, slamming of doors and hoods, engine startups, and people's voices. The operation at the Fairfield facility is virtually identical to the proposed Wal-Mart in terms of layout and operation (Figure 9). At a distance of 200 feet from the outside of that facility, pneumatic tool usage was the only activity that was faintly audible. The level of these noises could not be measured above the ambient of 45 dBA. For the Lodi Shopping Center, all existing residences are over 800 feet away from the planned activities with intervening arterial streets. Future residential property lines to the south would be over 600 feet from this facility, and would also receive sound blocking from the Wal-Mart store itself and the 8-foot masonry wall along the south project boundary. At this distance, the noise reaching this area is expected to be inaudible. Future residential development to the west would be at least 200 feet away, with an intervening 10-foot masonry wall along the west side of the Wal-Mart site. With the attenuating effects of the distance separation and intervening sound wall, and the presence of ambient traffic noise along Westgate Drive, the noise reaching this area from the auto service shop is also expected to be inaudible. Noise generated by activities at the auto service shop is not expected to result in a significant adverse noise impact.

(7) Parking Lot Cleaning. Typically, the parking area surface at such shopping centers is periodically cleaned using small mechanical parking lot sweepers and hand-held, back-mounted leaf blowers. The noise from this type of equipment was measured by Illingworth & Rodkin, Inc. in a previous noise study conducted for the City of Pleasanton in response to complaints from nearby neighbors of a similar community shopping center. It was determined that at a distance of 150 feet, the noise of the mechanical parking lot sweeper was not significant. However, the noise of the back-mounted leaf blowers was found to be significant. Leaf blower noise from four different tested types ranged from 60 to 70 dBA at a distance of 150 feet. Such equipment could probably be operated throughout the project site without resulting in noise impacts, with the possible exception of the parking spaces along the perimeter of the southeast corner of the site where the nearest existing dwellings are 160 feet away. While the average daily noise levels due to leaf blowing activity are unlikely to exceed the 60 dB CNEL threshold, the maximum noise levels would violate the City's Noise Regulations if leaf blowing is conducted in southeast corner of the project site between the hours of 10 p.m. and 7 a.m. Therefore, for the nearest dwellings on the east side of Lower Sacramento Road, any leaf blowing activity near the southeast corner of the project site would result in a potentially significant noise impact.

Storm Water Basin Pump Noise

As part of the proposed project, a temporary storm water basin is planned to be located to the west of the shopping center along the southern property line (Figure 6). This basin will include a 5 to 10 hp pump that would occasionally run. The location of this pump has not been determined. If the pump is located on the south, west, or north side of the basin, it could be within 50 feet of future residential property. Expected noise levels from pumps range from 68 to 80 dBA at 50 feet. Given the size of the pump, and even assuming it would produce only 68 dBA at 50 feet, this would result in a significant noise impact relative to future residential land uses adjacent to the basin. If the pump is located on the east side of the basin, adjacent to Westgate Drive, midway between the future residential areas to the north and south, these levels would be reduced by about 12 dBA resulting in noise levels of up to 56 dBA outside the nearest proposed homes. These levels may create a significant noise impact based on operating cycle and frequency of operation, although the overall effect during daytime hours would be masked by traffic noise along Westgate Drive. Since ambient nighttime noise levels in these residential areas is expected to be 40 to 41 dBA, the resulting noise levels would be up to 16 dBA over ambient at the nearest future dwellings. For nighttime operation, this level of noise would exceed the noise restrictions of the City Noise Regulations, which only allow an increase of up to 5 dBA over ambient at night (Figure 4). As such, noise from this pump is a potentially significant noise impact for future residential land uses adjacent to the basin site. The pump would not be audible from the nearest existing residences in the vicinity, which would be at least 800 feet to the north and 1400 feet east of the basin.

Construction Noise Impacts

Each phase of project construction would involve several noise-generating activities. The first construction phase would typically involve ground clearing, site grading, development of infrastructure, and paving. Subsequent phases would include site improvements and the erection of the various shopping center buildings. The typical range of hourly average noise levels (L_{eq}) during various phases of construction measured at 50 feet from the primary construction activity is shown in Table 6. Average noise levels above 60 dBA begin interfering with speech communication.

For existing residences along Highway 12 to the northwest of the site, construction activities would range in distance from 800 to 2200 feet. At these distances, the highest levels of construction noise (88 dBA at 50 ft) would range from 55 to 64 dBA on an average hourly basis. Depending on location, the construction activities could exceed the current noise levels by up 7 dB and create periods of speech inference. For the existing residences to the east of the site across Lower Sacramento Road, distance from construction activity would range between 160 and 1200 feet creating a range in level from 60 to 78 dBA. These levels would exceed the current average noise hourly levels by up to 15 dB. Depending on the phase of construction, associated noise intrusion into residential areas adjacent to the project site would intermittently interfere with typical residential activities. These intrusions would result in short-term significant adverse impacts.

Table 6: Overall Average Construction Noise Levels by Phase

Construction Phase	Hourly Average Noise Level, L_{eq} (dBA)
Ground Clearing	83
Excavation	88
Foundations	81
Erection	81
Finishing	88
Source: U.S. EPA 1971	

MITIGATION MEASURES

a. Compatibility of the Proposed Development with the Onsite Noise Environment

The proposed shopping center land uses would be compatible with the existing and projected future onsite noise environment. No mitigation is required.

b. Offsite Noise Impacts - Cumulative Traffic

No significant offsite noise impacts related to project-generated or cumulative traffic have been identified. No mitigation measures are necessary.

c. Project Operational Noise Impacts on Adjacent Residential Areas

No significant noise impacts were found for all existing residences surrounding the project site. For future residential land use development to the south and west of the project site, potentially significant impacts were found, as follows:

1) Parking Lot Activity. Anticipated normal parking lot vehicular and pedestrian activity would not be expected to have a significant adverse impact on adjacent, future residential areas to the south when the planned masonry wall is constructed along the southern property line

2) Delivery Truck Movements. The proposed 8-foot masonry wall will reduce noise from the loading dock of the store on Pad 12 to an insignificant level. In order to avoid noise impacts resulting from the movement of large delivery trucks along the southern site boundary, no delivery trucks (except those bound for Pad 12) will be permitted to enter or exit the site from the southern project entrance on Lower Sacramento Road. This restriction will be implemented by signage and/or design features incorporated into the southern drive aisle that will discourage through truck movements. The specific measures used to enforce this prohibition will be determined by the City at the project design review stage.

3) Loading Dock/Material Movement Activity. Loading dock and material movement activity noise impacts will be reduced to a less than significant level with the incorporation of the masonry walls planned along the southern and western project boundaries.

4) Trash Compactors. No significant noise impact identified, no mitigation required.

5) Mechanical Equipment. To ensure that the potential noise impact of mechanical equipment is reduced to less than significant levels, prior to issuance of related building permits, require applicant submittal of engineering and acoustical specifications for project mechanical equipment demonstrating that the equipment design (types, location, enclosure specifications), combined with any parapets and/or screen walls, will not result in noise levels exceeding 45 dBA ($L_{eq\text{-}hour}$) for any residential yards.

6) Automotive Service Bay. No significant noise impacts related to onsite automotive service were identified. No mitigation measures are necessary.

7) Parking Lot Cleaning. Along the southern property line to the east, average daily noise levels associated with parking lot cleaning activity will be reduced to a less than significant level with the 8-foot masonry wall proposed along the southern project boundary. To assure compliance with the City of Lodi Noise Regulations regarding occasional excessive noise, leaf blowers and other loud cleaning equipment such as vacuum trucks shall be limited to operating during the hours of 7:00 a.m. to 10:00 p.m.

d. Site Support Operational Noise Impacts

To reduce the potential noise impact of storm water basin pump noise to less than significant levels, the pump should located as far as is feasible from planned future residential property lines. The pump facility should be designed so that noise levels do not exceed 45 dBA at the nearest residential property lines. The pump may need to be enclosed to meet this level. Meeting the 45 dBA limit would reduce this impact to less than significant.

In order to avoid creating a noise nuisance during nighttime hours, pump operations shall be restricted to the hours of 7 a.m. to 10 p.m., except under emergency conditions (e.g., when the basin needs to be emptied immediately to accommodate flows from another imminent storm).

e. Construction Noise Impacts

For the construction phase of this project, it is assumed that it will completed prior to the development of land to south and to the west for residential use. If the land to the south is developed prior to the proposed project, the wall along the south property should be constructed as a first priority, before general site development. To reduce project construction period noise impacts on existing nearby residents to a less than significant level, incorporate the following conditions in project construction contract agreements:

1) Construction Scheduling. The applicant/contractor shall limit noise-generating construction activities to daytime, weekday, non-holiday hours (7:00 AM to 6:00 PM).

2) Construction Equipment Mufflers and Maintenance. The applicant/contractor shall properly muffle and maintain all construction equipment powered by internal combustion engines.

3) Equipment Location and Shielding. The applicant/contractor shall locate all stationary noise-generating construction equipment, such as air compressors, as far as practical from existing nearby residences and other noise-sensitive land uses. Acoustically shield such equipment as required to achieve continuous noise levels at the property line of 55 dBA or lower.

4) Quiet Equipment Selection. The applicant/contractor shall select quiet construction equipment, particularly air compressors, whenever possible. Fit motorized equipment with proper mufflers in good working order.

5) Notification. The applicant/contractor shall notify neighbors located adjacent to, and across major roadways from, the construction site of the construction schedule in writing.

6) Noise Disturbance Coordinator. The applicant/contractor shall designate a "noise disturbance coordinator" who would be responsible for responding to any local complaints about construction noise. The disturbance coordinator would notify the City, determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and would require that reasonable measures warranted to correct the problem be implemented. Conspicuously post a telephone number for the disturbance coordinator at the construction site and include it in the notice sent to neighbors regarding the construction schedule. (The applicant should be responsible for designating a noise disturbance coordinator, for posting the phone number, and for providing construction schedule notices). All complaints and remedial actions shall be reported to the City of Lodi.

APPENDIX I

Air Quality Report

Prepared by

Donald Ballanti

July 2004

AIR QUALITY IMPACT ANALYSIS FOR THE LODI SHOPPING CENTER PROJECT
CITY OF LODI

Prepared for:

Pacific Municipal Consultants
10461 Old Placerville Road, Suite 110
Sacramento, CA. 95827

July 2004

Donald Ballanti *Certified Consulting Meteorologist*

1424 Scott Street / El Cerrito, California 94530 / (510) 234-6087 / Fax: (510) 232-7752

INTRODUCTION

This report describes the impacts of the proposed project on local and regional air quality. The section was prepared using thresholds of significance recommended by the San Joaquin Valley Air Pollution Control District. This report describes existing air quality; construction-related impacts; direct and indirect emissions associated with the project; the impacts of these emissions on both the local and regional scale; and mitigation measures warranted to reduce or eliminate any identified significant impacts.

EXISTING CONDITIONS

Air Pollution Climatology

The project is located in the San Joaquin Valley air basin, which is defined by the Sierra Nevada in the east, the Coast Ranges in the west, and the Tehachapi mountains in the south. The surrounding topographic features restrict air movement through and out of the basin and, as a result, impede the dispersion of pollutants from the basin. Inversion layers are formed in the San Joaquin Valley air basin throughout the year. (An inversion layer is created when a mass of warm dry air sits over cooler air near the ground, preventing vertical dispersion of pollutants from the air mass below). During the summer, the San Joaquin Valley experiences daytime temperature inversions at elevations from 2,000 to 2,500 feet above the valley floor. During the winter months, inversions occur from 500 to 1,000 feet above the valley floor (SJVAPCD, 2002).

The climate of the project area is typical of inland valleys in California, with hot dry summers and cool, mild winters. Daytime temperatures in the summer often exceed 100 degrees, with lows in the 60's. In winter daytime temperatures are usually in the 50's, with lows around 35 degrees. Radiation fog is common in the winter, and may persist for days. In the northern portions of the San Joaquin Valley winds are predominantly westerly in all seasons, but more so in the summer and spring months. Winds in the fall and winter are generally lighter and more variable in direction (CARB, 1974).

The pollution potential of the San Joaquin Valley is very high. Surrounding elevated terrain in conjunction with temperature inversions frequently restrict lateral and vertical dilution of pollutants. Abundant sunshine and warm temperatures in summer are ideal conditions for the formation of photochemical oxidant, and the Valley is a frequent scene of photochemical pollution.

Ambient Air Quality Standards

The federal and California state ambient air quality standards are summarized in Table 1 for important pollutants. The federal and state ambient standards were developed independently with differing purposes and methods, although both processes attempted to avoid health-related effects. As a result, the federal and state standards differ in

Table 1
Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	Federal Primary Standard	State Standard
Ozone	1-Hour 8-Hour	0.12 ppm 0.08 ppm	0.09 ppm --
Carbon Monoxide	8-Hour 1-Hour	9.0 ppm 35.0 ppm	9.0 ppm 20.0 ppm
Nitrogen Dioxide	Annual 1-Hour	0.05 ppm --	-- 0.25 ppm
Sulfur Dioxide	Annual 24-Hour 1-Hour	0.03 ppm 0.14 ppm --	-- 0.05 ppm 0.5 ppm
PM_{10}	Annual 24-Hour	50 ug/m^3 150 ug/m^3	20 ug/m^3 50 ug/m^3
$PM_{2.5}$	Annual 24-Hour	15 ug/m^3 65 ug/m^3	12 ug/m^3 --
Lead	30-Day Avg. Month Avg.	-- 1.5 ug/m^3	1.5 ug/m^3 --

ppm = parts per pillion
ug/m^3 = Micrograms per Cubic Meter

Source: CARB, 2003

some cases. In general, the California state standards are more stringent. This is particularly true for ozone and PM_{10}.

The U.S. Environmental Protection Agency established new national air quality standards for ground-level ozone and for fine particulate matter in 1997. Implementation of these standards was delayed by litigation, but they were determined to be valid and enforceable by the U. S. Supreme Court in a decision issued in February of 2001.

The State of California regularly reviews scientific literature regarding the health effects and exposure to PM and other pollutants. On May 3, 2002, the California Air Resources Board (CARB) staff recommended lowering the level of the annual standard for PM_{10} and establishing a new annual standard for $PM_{2.5}$ (particulate matter 2.5 micrometers in diameter and smaller). The new standards became effective on July 5, 2003.

In addition to the criteria pollutants discussed above, Toxic Air Contaminants (TACs) are another group of pollutants of concern. Toxic Air Contaminants (TACs) are injurious in small quantities and are regulated despite the absence of criteria documents. The identification, regulation and monitoring of TACs is relatively recent compared to that for criteria pollutants.

Health Effects of Pollutants

The primary air quality problems in the San Joaquin Valley Air Basin are ozone and particulate matter. Carbon monoxide has been a problem in the past within the San Joaquin Valley Air Basin in larger cities such as Fresno, Bakersfield, Modesto and Stockton. The following is a discussion of the health effects of these important pollutants.

<u>Ozone</u>

Ozone is produced by chemical reactions, involving nitrogen oxides (NOx) and reactive organic gases (ROG) that are triggered by sunlight. Nitrogen oxides are created during combustion of fuels, while reactive organic gases are emitted during combustion and evaporation of organic solvents. Since ozone is not directly emitted to the atmosphere, but is formed as a result of photochemical reactions, it is considered a secondary pollutant. In the San Joaquin Valley Air Basin ozone is a seasonal problem, occurring roughly from April through October.

Ozone is a strong irritant that attacks the respiratory system, leading to the damage of lung tissue. Asthma, bronchitis and other respiratory ailments as well as cardiovascular diseases are aggravated by exposure to ozone. A healthy person exposed to high concentrations may become nauseated or dizzy, may develop headache or cough, or may experience a burning sensation in the chest.

Research has shown that exposure to ozone damages the alveoli (the individual air sacs in the lung where the exchange of oxygen and carbon dioxide between the air and blood takes place). Research has shown that ozone also damages vegetation.

Suspended Particulate

Particulate matter (PM) is a complex mixture of tiny particles that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. Exposure to PM aggravates a number of respiratory illnesses and may even cause early death in people with existing heart and lung disease.

"Inhalable" PM consists of particles less than 10 microns in aerodynamic diameter, and is defined as "suspended particulate matter" or "PM_{10}". PM_{10} includes the subgroup of finer particles with aerodynamic diameter of 2.5 microns and smaller ($PM_{2.5}$). These finer particles pose an increased health risk because they can deposit deep in the lung and contain substances that are particularly harmful to human health.

PM is a mixture of substances that include elements such as carbon and metals; compounds such as nitrates, organic compounds, and sulfates; and complex mixtures such as diesel exhaust and soil. Some particles are emitted directly into the atmosphere. Others, referred to as secondary particles, result from gases that are transformed into particles through physical and chemical processes in the atmosphere.

Carbon Monoxide

Carbon monoxide is a local pollutant in that high concentrations occur only very near the source. The major source of carbon monoxide, a colorless, odorless, poisonous gas, is automobile traffic. Elevated concentrations, therefore, are usually only found near areas of high traffic volumes.

Carbon monoxide's health effects are related to its affinity for hemoglobin in the blood. At high concentrations, carbon monoxide reduces the amount of oxygen in the blood, causing heart difficulties in people with chronic diseases, reduced lung capacity and impaired mental abilities.

Carbon monoxide concentrations are highly seasonal, with the highest concentrations occurring in the winter. This is partly due to the fact that automobiles create more carbon monoxide in colder weather and partly due to the very stable atmospheric conditions that exist on cold winter evenings when winds are calm. Concentrations typically are highest during stagnant air periods within the period November through January.

Regional Air Quality Planning

Federal and state air quality laws require identification of areas not meeting the ambient air quality standards. These areas must develop regional air quality plans to eventually attain the standards. Under both the federal and state Clean Air Acts, the San Joaquin Valley Air Basin is a non-attainment area (standards have not been attained) for ozone and PM_{10}. The air basin is either attainment or unclassified for other ambient standards.

To meet federal Clean Air Act requirements, the SJVAPCD has adopted an Ozone Attainment Demonstration Plan and in June 2003 adopted the "2003 PM_{10} Plan". The most recent federal ozone plan (*Amended 2002 and 2005 Rate of Progress Plan for San Joaquin Valley Ozone*, December 2002) determined that it could not be demonstrated that the federal ozone standards could be met by the required date of November 15, 2005. In December 2003 the San Joaquin Valley Air Pollution Control District requested that the U.S.E.P.A. downgrade the Valley's ozone status from "severe" to "extreme" non-attainment. The downgrade would extend the deadline for meeting attainment while avoiding automatic sanctions, but requires implementation of stricter controls on existing and future air pollutant sources.

The air basin is designated as a "serious" non-attainment area for federal PM_{10} ambient air quality standards. Under this designation, the air district is required to meet the 24-hour and annual PM_{10} standards by December 31, 2006. Failure to meet the attainment deadline could result in increased offset requirements for new industrial sources and potential sanctions including withholding of federal grants for capacity-expanding transportation projects, new transportation planning requirements and can ultimately stop all federally funded transportation projects in the District (except safety projects).

The U.S. Environmental Protection Agency has designed the San Joaquin Valley Air Basin as a non-attainment area for the federal 8-hour ozone standard. The California Air Resources Board and U.S. Environmental Protection Agency are both recommending that the San Joaquin Valley Air Basin be classified non-attainment for the federal $PM_{2.5}$ standard. Final designations for the $PM_{2.5}$ standard are expected by December 15, 2004.

To meet California Clean Air Act requirements, the District is currently drafting the 2003 Triennial Plan updating the Air Quality Attainment Plan (AQAP) addressing the California ozone standard. The California Legislature, when it passed the California Clean Air Act in 1988, excluded PM_{10} from the basic planning requirements of the Act. The Act did require the CARB to prepare a report to the Legislature regarding the prospect of achieving the State ambient air quality standard for PM_{10}. This report did not recommend imposing a planning process similar to that for ozone or other pollutants for achievement of the standard within a certain period of time.

Current Air Quality

The San Joaquin Valley Air Pollution Control District and California Air Resources Board (CARB) operate air monitoring sites throughout the San Joaquin Valley Air Basin. The closest to the project site are located in Stockton about 15 miles south of the project site. There are two monitoring sites in Stockton. The East Mariposa monitoring

Table 2
Ambient Air Quality at Stockton Monitoring Sites

Pollutant/Standard		Days Exceeding Standard in: 2001	2002	2003
East Mariposa Monitoring Site				
Ozone	1-Hour State	5	5	-
	1-Hour Federal	0	0	-
	8-Hour Federal	1	1	-
Hazelton Street Monitoring Site				
Ozone	1-Hour State	5	5	3
	1-Hour Federal	0	0	0
	8-Hour Federal	1	0	1
Carbon Monoxide	8-Hour State/Fed.	0	0	0
	1-Hour State	0	0	0
Nitrogen Dioxide	1-Hour State	0	0	0
PM_{10}	24-Hour State	11	10	3
	24-Hour Federal	0	0	0
$PM_{2.5}$	24-Hour Federal	2	0	0

Source: Air Resources Board Aerometric Data Analysis and Management System (ADAM), 2003 site measures only ozone. The Hazelton Street monitoring site monitors ozone, particulate matter, carbon monoxide and nitrogen dioxide. Table 2 summarizes recorded exceedances of State and Federal standards at these monitoring sites for the period 2001-2003. Table 2 shows that the federal/state standards for ozone and particulate matter are frequently exceeded in the project area.

Sensitive Receptors

The SJVAPCD defines a sensitive receptor as a location where human populations, especially children, seniors, and sick persons are present and where there is a reasonable expectation of continuous human exposure to pollutants. Examples of sensitive receptors include residences, hospitals and schools. The closest sensitive receptors to the site are residences across Lower Sacramento Road from the project site. Residences are also located just west of the site on the north side of Highway 12. Other surrounding land uses are commercial or agricultural.

General Plan Policies

The *City of Lodi General Plan Policy Document* contains numerous air quality policies under the goal "to promote and, insofar as possible, improve air quality in Lodi and the region". Air quality policies are:

1. The City shall promote travel by bicycle and foot within Lodi.

2. The City shall promote transit for trips within Lodi and for regional trips.

3. The City shall promote ridesharing for Lodi residents commuting to employment centers outside of Lodi.

4. The City shall promote the development of Caltrans park-and-ride lots to serve Lodi residents working in destinations outside of Lodi.

5 The City shall promote employment opportunities within Lodi to reduce commuting to areas outside of Lodi.

6. The City shall cooperate with the City of Stockton and San Joaquin County on the development of an area-wide air quality mitigation program.

IMPACTS

Significance Criteria

The San Joaquin Valley Air Pollution Control District (SJVAPCD) has established the following standards of significance (SJVAPCD, 2002):

- A project results in estimated carbon monoxide concentrations exceeding the California Ambient Air Quality Standard of 9 parts per million averaged over 8 hours and 20 ppm for 1-hour.

- A project results in new direct or indirect emissions of ozone precursors (ROG or NO_x) in excess of 10 tons per year.

- Any project with the potential to frequently expose members of the public to objectionable odors will be deemed to have a significant impact.

- Any project with the potential to expose sensitive receptors (including residential areas) or the general public to substantial levels of toxic air contaminants would be deemed to have a potentially significant impact.

While San Joaquin Valley Air Pollution Control District CEQA guidance recognizes that PM_{10} is a major air quality issue in the basin, it has to date not established numerical thresholds for significance for PM_{10}. For the purposes of this analysis, a PM_{10} emission of 15 tons per year was used as a significance threshold. This emission is the SJVAPCD threshold level at which new stationary sources requiring permits from the District must provide emissions "offsets". This threshold of significance for PM_{10} is consistent with the District's ROG and NO_x thresholds of ten tons per year, which are also the offset thresholds established in SJVAPCD Rule 2201 New and Modified Stationary Source Review Rule.

Despite the establishment of both federal and state standards for $PM_{2.5}$ (particulate matter, 2.5 microns), the SJVAPCD has not developed a threshold of significance for this pollutant. For this analysis, $PM_{2.5}$ impacts would be considered significant if project emissions of PM_{10} exceed 15 tons per year.

SJVAPCD CEQA guidance does not recommend quantitative analysis of construction emissions. The SJVAPCD significance threshold for construction dust impacts is based on the appropriateness of construction dust controls. The SJVAPCD guidelines provide feasible control measures for construction emission of PM_{10} beyond that required by district regulations. If the appropriate construction controls are to be implemented, then air pollutant emissions for construction activities would be considered less than significant.

Construction Impacts

Construction within the project site area would result in numerous activities that would generate dust. The fine, silty soils in the project area and often strong afternoon winds exacerbate the potential for dust, particularly in the summer months. Grading, earthmoving and excavation are the activities that generate the most PM emissions. Impacts would be localized and variable. Construction impacts would last for a period of months for any given parcel. Construction dust impacts are considered to be potentially significant on a localized basis, and could result in nuisance complaints at the residences located downwind of the project site on the east side of Lower Sacramento Road.

Construction equipment and vehicles would also generate exhaust emissions during active construction. Although operated temporarily at construction sites, construction equipment is a substantial source category within the San Joaquin Valley Air Basin, generating ozone precursors as well as PM_{10}. Since construction equipment is normally considered part of the existing inventory of sources quantification of this emission is not recommended by the SJVAPCD except for very large projects.

The San Joaquin Valley Air Pollution Control District regulates construction emissions through its Regulation VIII. The provisions of Regulation VIII pertaining to construction activities require:

- Effective dust suppression for land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill and demolition activities.

- Effective stabilization of all disturbed areas of a construction site, including storage piles, not used for seven or more days.

- Control of fugitive dust from on-site unpaved roads and off-site unpaved access roads.

- Removal of accumulations of mud or dirt at the end of the work day or once every 24 hours from public paved roads, shoulders and access ways adjacent to the site.

Regulation VIII requires that a formal dust control plan be submitted to the SJVAPCD and violations of the requirements of Regulation VIII are subject to enforcement action. Violations are indicated by the generation of visible dust clouds and/or generation of complaints.

During construction various diesel-powered vehicles and equipment would be in use on the site. In 1998 the California Air Resources Board identified particulate matter from diesel-fueled engines as a toxic air contaminant (TAC). CARB has completed a risk management process that identified potential cancer risks for a range of activities using diesel-fueled engines (CARB, 2000). High volume freeways, stationary diesel engines and facilities attracting heavy and constant diesel vehicle traffic (distribution centers, truck stops, etc) were identified as having the highest associated risk.

Health risks from Toxic Air Contaminants are function of both concentration and duration of exposure. Unlike the above types of sources, construction diesel emissions are temporary, affecting an area for a period of days or perhaps weeks. Additionally, construction related sources are mobile and transient in nature, and the bulk of the emission occurs within the project site at a substantial distance from nearby receptors. Because of its short duration, health risks from construction emissions of diesel particulate would be less-than-significant impact.

During construction various diesel-powered vehicles and equipment in use on the site would create odors. These odors would be temporary and unlikely to be noticeable beyond the project boundaries.

Permanent Local Impacts

On the local scale the pollutant of greatest interest is carbon monoxide. Concentrations of this pollutant are related to the levels of traffic and congestion along streets and at intersections.

The SJVAPCD's *Guide for Assessing and Mitigation Air Quality Impacts* provides screening criteria to identify situations where modeling is warranted. If neither of the following criteria is met at intersections affected by the project, the project is concluded to have no potential to create a violation of the carbon monoxide standards:

- The Level of Service (LOS) on one or more streets or at one or more signalized intersections in the project vicinity will be reduced to LOS E or F, or

- The project will substantially worsen an already existing LOS F on one or more streets or at one or more signalized intersections in the project vicinity.

The transportation impact analysis conducted for the proposed project found no roads or signalized intersections forecast to operate at LOS E or F in the project vicinity for existing, project or cumulative conditions. Based on the SJVAPCD criteria and the forecasted Level of Service conditions on roads and intersections affected by project and cumulative traffic, the project would have no potential to create a violation of the carbon monoxide standards. Any carbon monoxide concentration increases resulting from the proposed project would be less than significant.

Permanent Regional Impacts

Project traffic emissions would have an effect on air quality outside the project vicinity. Trips to and from the project would result in air pollutant emissions within the air basin. To evaluate emissions associated with the project, the URBEMIS-2002 computer program was employed (Jones and Stokes, 2003). The URBEMIS-2002 output is included in as an Appendix.

The annual increase in regional emissions from auto travel and area sources (landscaping activities, water and space heating, etc.) is shown in Table 3 for the two precursors of ozone (reactive organic gases and oxides of nitrogen) and particulate matter (PM_{10} and $PM_{2.5}$). Project emissions of all three pollutants are well above the thresholds of significance, so project impacts on regional air quality would be significant.

Odors

Proposed uses within the project include restaurants, which are a potential source of odors. Reaction to cooking odors varies widely with individuals. Some people find them objectionable, while others find them pleasant. Restaurant cooking odors have, in some instances, been the subject of complaints.

Since the nature of any restaurants is currently unknown, prediction of whether odors would cause problems or not is difficult. A potential for odor nuisance would exist during light wind conditions. This is considered a potentially significant impact which is normally mitigatible.

Toxic Air Contaminant Emissions

The project would generate new diesel truck trips, increasing exposure to diesel particulate. The California Air Resources Board has identified particulate emissions from diesel-fueled engines as a Toxic Air Contaminant (TAC).

The identification of particulate from diesel engines as a TAC required the California Air Resource Board to determine if there is a need for further control. CARB has recently completed a risk management process that identifies cost effective measures available to reduce public exposure. A ban on diesel-fueled engines is not being considered. The risk management program proposes the three following components:

- New regulatory standards for all new on-road diesel vehicles that will result in a 90 percent reduction in particulate emissions from diesel engines.

- New retrofit requirements for existing on-road vehicles where determined to be technically feasible and cost-effective; and

- New diesel fuel regulations to reduce the sulfur content as needed by advanced diesel emission controls.

The projected emission benefits are reductions in diesel exhaust particulate of 75 percent by 2010 and 85 percent by 2020 (CARB, 2000).

Table 3
Project Auto and Area-source Emissions (Tons Per Year)

	ROG	NOx	PM_{10}
Auto Emissions	37.12	44.33	28.03
Area Source Emissions	0.08	0.55	0.00
Total	37.20	44.88	28.03
Significance Threshold	10.00	10.00	15.00

The majority of large truck trips generated by the project would go to the loading docks located on the west side of the major anchor store at the southwest corner of the site. A lesser number of truck trips would be generated by a small loading dock at the southeast corner of the project site. The major anchor loading dock is no less than 1000 feet from the closest existing residential property. Existing residences east of the project site would be closer to the small loading dock at the southeast corner of the site, but truck traffic generated by this loading dock would be limited.

Future residential development is expected to occur west and south of the project site. Future residential development would not be downwind of either loading dock under prevalent westerly winds. For the above reasons, the release of diesel particulate into the atmosphere from trucks using project loading docks would have a less-than-significant impact on the health risks to nearby existing or future residents.

Cumulative Air Quality Impacts

SJVAPCD guidance provides that a project that would individually have a significant air quality impact is also considered to have a significant cumulative air quality impact. Regional emissions from the proposed project would exceed the significance thresholds for ozone precursors and particulate matter (PM_{10} and $PM_{2.5}$) by a substantial amount, so the project is considered to have a significant cumulative impact on regional air quality.

MITIGATION MEASURES

Construction Impacts

The project developer should prepare and submit a dust control plan to the SJVAPCD that incorporates all provisions of Regulation VIII and the following additional measures

- Limit traffic speeds on unpaved roads to 15 mph.
- Install wheel washers for all exiting trucks, or wash off all trucks and equipment leaving the site.
- Suspend excavation and grading activities when winds exceed 20 mph.
- Limit size of area subject to excavation, grading or other construction activity at any one time to avoid excessive dust.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with a slope greater than one percent.
- Expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours when operations are occurring.

The following are appropriate mitigation measures that would reduce exhaust emissions during construction:

- Equipment not in use for more than ten minutes should be turned off.
- Limit the hours of operation of heavy duty equipment and/or the amount of equipment in use.
- Whenever feasible and cost effective, use electrically driven equipment (provided they are not run via a portable generator set).

With implementation of Regulation VIII controls and the above additional measures construction impacts would be reduced to a less-than-significant level.

Regional and Cumulative Impacts

The final design of the project shall:

- Use energy efficient design including automated control system for heating/air conditioning and energy efficiency, utilize lighting controls and energy-efficient lighting in buildings and use light colored roof materials to reflect heat.
- Provide deciduous trees on the south and westerly facing sides of buildings.

- Provide low nitrogen oxide (NO_x) emitting and/or high efficiency water heaters.

- Reserve appropriate easements to provide for future improvements such as bus turnouts, loading areas, and shelters.

The project shall be subject to a Transportation Demand Management plan to reduce single occupant vehicle commute trips by employees and promote non-auto travel by both employees and patrons. The plan shall include the following components:

- Designate an on-site TSM coordinator.

- Implement carpool/vanpool program, e.g., carpool ride-matching for employees, assistance with vanpool formation, provision of vanpool vehicles, etc.

- Provide lockers for employees bicycling or walking to work.

The suburban location and character of the proposed project limits the potential for further reducing regional air quality impacts. Available air quality mitigation strategies for commercial development are most effective on employee work trips, which comprise a very small fraction of total project trips. Parking restrictions or fees as a means of reducing vehicle trips are impractical unless imposed regionally.

Information on the effectiveness of various air quality mitigation measures on actual emissions is not readily available. Where estimates have been made, a wide range is generally provided, indicating that local conditions will have a profound influence on the effectiveness of a given measure (BAAMQD, 1999). Another factor is that the actual number of persons willing to modify their driving behavior may be limited, and adoption of several mitigation strategies may be hardly more effective than adoption of a single strategy as each strategy is competing for the same participants. The upper limit of trip reduction through TSM measures, under ideal conditions, is about 20%. For the project, where TSM effectiveness is limited by several factors, effectiveness of the above air quality mitigation measures in reducing daily trips is estimated at 5%. This would not reduce project and cumulative regional air quality impacts to a level that is less than significant. Project regional and cumulative air quality impacts would be significant and unavoidable.

Odor Impacts

Odors from restaurants within the project have been identified as having a potentially significant impact. This impact can be reduced to a level that is less than significant by requiring all restaurant uses within the project site to install exhaust vents in accordance with accepted engineering practice and install exhaust filtration systems or other accepted methods of odor reduction. The combination of dilution and odor removal through filtration will effectively reduce odor strength to undetectable levels.

References

Bay Area Air Quality Management District. 1999. *BAAQMD CEQA Guidelines.*

California Air Resources Board (CARB). 1974. *Climate of the San Joaquin Valley Air Basin*.

California Air Resources Board (CARB). 2000. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles.*

California Air Resources Board (CARB). 2003. Ambient Air Quality Standards. http://www.arb.ca.gov/aqs/aaqs2.pdf

Jones and Stokes Associates. May 2003. *Software User's Guide: URBEMIS-2002 For Windows with Enhanced Construction Module.* Version 7.4.

San Joaquin Valley Air Pollution Control District (SJVAPCD). 2002. *Guidance for Assessing and Mitigating Air Quality Impacts*.

APPENDIX: URBEMIS-2002 OUTPUT

URBEMIS 2002 For Windows 7.4.2

File Name: C:\Program Files\URBEMIS 2002 For Windows\Projects2k2\lodi.urb
Project Name: Lodi Shopping Center
Project Location: San Joaquin Valley
On-Road Motor Vehicle Emissions Based on EMFAC2002 version 2.2

SUMMARY REPORT
(Tons/Year)

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10
TOTALS (tpy, unmitigated)	0.08	0.55	0.54	0.00	0.00

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10
TOTALS (tpy, unmitigated)	37.12	44.33	404.49	0.28	28.03
TOTALS (tpy, mitigated)	37.12	44.33	404.49	0.28	28.03

SUM OF AREA AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10
TOTALS (tpy, unmitigated)	37.21	44.89	405.02	0.28	28.03

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

URBEMIS 2002 For Windows 7.4.2

File Name: C:\Program Files\URBEMIS 2002 For Windows\Projects2k2\lodi.urb
Project Name: Lodi Shopping Center
Project Location: San Joaquin Valley
On-Road Motor Vehicle Emissions Based on EMFAC2002 version 2.2

DETAIL REPORT
(Tons/Year)

AREA SOURCE EMISSION ESTIMATES

Source	ROG	NOx	CO	SO2	PM10
Natural Gas	0.04	0.55	0.22	-	0.00
Wood Stoves	0.00	0.00	0.00	0.00	0.00
Fireplaces	0.00	0.00	0.00	0.00	0.00
Landscaping	0.04	0.00	0.32	0.00	0.00
Consumer Prdcts	0.00	-	-	-	-
TOTALS (tpy, unmitigated)	0.08	0.55	0.54	0.00	0.00

UNMITIGATED OPERATIONAL EMISSIONS

	ROG	NOx	CO	SO2	PM10
High turnover (sit-down)	1.41	1.36	13.00	0.01	0.80
Fast food rest. w/ drive	7.73	9.21	84.45	0.06	5.80
Free-standing discount su	20.80	25.36	230.25	0.16	16.15
Shopping Center	5.28	6.35	57.72	0.04	4.03
Bank (with drive-through)	1.23	1.28	11.98	0.01	0.77
Pharmacy/drugstore with d	0.68	0.77	7.09	0.00	0.48
TOTAL EMISSIONS (tons/yr)	37.12	44.33	404.49	0.28	28.03

Includes correction for passby trips.
Includes the following double counting adjustment for internal trips:
Residential trips: 0.00 % reduction. Nonresidential trips: 0.00 % reduction.

OPERATIONAL (Vehicle) EMISSION ESTIMATES

Analysis Year: 2004 Temperature (F): 85 Season: Annual

EMFAC Version: EMFAC2002 (9/2002)

Summary of Land Uses:

Unit Type	Trip Rate	Size	Total Trips
High turnover (sit-down)	127.20 trips / 1000 sq. ft.	7.50	954.00
Fast food rest. w/ drive	496.12 trips / 1000 sq. ft	9.40	4,663.53
Free-standing discount su	56.00 trips / 1000 sq. ft.	216.21	12,107.87
Shopping Center	42.94 trips / 1000 sq. ft.	71.70	3,078.80
Bank (with drive-through)	156.40 trips / 1000 sq. ft.	5.16	807.02
Pharmacy/drugstore with d	88.16 trips / 1000 sq. ft.	4.79	422.11

Vehicle Assumptions:

Fleet Mix:

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	56.10	2.70	96.80	0.50
Light Truck < 3,750 lbs	15.10	4.60	92.70	2.70
Light Truck 3,751- 5,750	15.60	2.60	96.20	1.20
Med Truck 5,751- 8,500	6.90	2.90	94.20	2.90
Lite-Heavy 8,501-10,000	1.00	0.00	80.00	20.00
Lite-Heavy 10,001-14,000	0.30	0.00	66.70	33.30
Med-Heavy 14,001-33,000	1.00	10.00	20.00	70.00
Heavy-Heavy 33,001-60,000	0.80	0.00	12.50	87.50
Line Haul > 60,000 lbs	0.00	0.00	0.00	100.00
Urban Bus	0.10	0.00	0.00	100.00
Motorcycle	1.60	87.50	12.50	0.00
School Bus	0.20	0.00	0.00	100.00
Motor Home	1.30	15.40	76.90	7.70

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip Speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
High turnover (sit-down) rest.				5.0	2.5	92.5
Fast food rest. w/ drive thru				5.0	2.5	92.5
Free-standing discount superstore				2.0	1.0	97.0
Shopping Center				2.0	1.0	97.0
Bank (with drive-through)				2.0	1.0	97.0
Pharmacy/drugstore with drive through				2.0	1.0	97.0

Changes made to the default values for Land Use Trip Percentages

Changes made to the default values for Area

The wood stove option switch changed from on to off.
The fireplcase option switch changed from on to off.
The consumer products option switch changed from on to off.

Changes made to the default values for Operations

The pass by trips option switch changed from off to on.
The operational winter selection item changed from 2 to 1.
The operational summer selection item changed from 7 to 6.
The travel mode environment settings changed from both to: none

APPENDIX J

Environmental Site Assessment

Prepared by

Twining Laboratories

December 2003

DRAFT

PHASE I ENVIRONMENTAL SITE ASSESSMENT

SOUTHWEST CORNER OF THE INTERSECTION OF

HIGHWAY 12 & LOWER SACRAMENTO ROAD

LODI, CALIFORNIA

Prepared For:

Browman Development, LLP
100 Swan Way, Suite 206
Oakland, California 94621-1459

Prepared By:

The Twining Laboratories, Inc.
2527 Fresno Street
Fresno, California 93721

A07242.01

December 10, 2003

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TABLES

APPENDICES

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ACRONYMS

AST(s)	Aboveground Storage Tank(s)
AWP	Annual Workplan
CAL-EPA	State of California, Environmental Protection Agency
CERCLIS	Comprehensive Environmental Responsibility, Compensation, and Liability Information System
CIWMB	California Integrated Waste Management Board
CRWQCB-CVR	California Regional Water Quality Control Board, Central Valley Region
DTSC	Department of Toxic Substances Control
ERNS	Emergency Response and Notification System
SJCAO	San Joaquin County Assessor's Office
SJCBD	San Joaquin County Building Department
SJCEHD	San Joaquin County Environmental Health Department
SJCRO	San Joaquin County Recorder's Office
LUST	Leaking Underground Storage Tank
NPL	National Priority List
RCRA	Resource Conservation and Recovery Act
SWIS	Solid Waste Information System
SWRCB	State Water Resource Control Board
TSD	Hazardous Waste Transport, Storage, or Disposal Facilities
US EPA	United States Environmental Protection Agency
UST(s)	Underground Storage Tanks(s)

1.0 INTRODUCTION

This report summarizes the findings of a Phase I Environmental Site Assessment (Phase I) conducted for an approximately 35-acre property located at the southwest corner of Highway 12 and Lower Sacramento Road in the city of Lodi, San Joaquin County, California (Site). A Site Location Map is presented as Drawing 1 in Appendix A.

This Phase I was authorized by Mr. Jerry Neighbors of Browman Development Company, Inc. in Oakland, California by written agreement dated August 21, 2003. The Phase I was performed by the Environmental Services Division of The Twining Laboratories, Inc. (Twining), in Fresno, California, consistent with American Society for Testing and Materials (ASTM) "Standard Practice for Environmental Site Assessments" E-1527-00 (ASTM, 2000), and in accordance with Wal★Mart specifications as outlined in "Phase I Environmental Site Assessment Guidelines and Report Requirements," revised January 2001, and with guidelines set forth by Comerica Bank.

2.0 PURPOSE AND SCOPE

The purpose of the Phase I was to:

- Assess the environmental condition of the Site based on past and current existence (or absence) of impairments and the past existence of activities, practices, and materials which are subject to environmental regulation governing contamination of soil and/or groundwater; and,
- Assess reported soil and groundwater contamination incidents in the surrounding area, up to a one mile radius of the Site, which could pose an environmental concern or impairment to the Site.

The scope of work is summarized as follows:

- Conducted a reconnaissance of the Site and a reconnaissance of accessible areas within one-quarter mile of the Site;
- Reviewed available historic resources to assess the history and past use of the Site;
- Reviewed available regulatory agency files regarding known releases of hazardous materials to the environment, up to one mile of the Site. Facilities known to operate and/or maintain underground storage tanks (USTs) within a half mile of the Site were identified;
- Conducted interviews with individuals who may have knowledge of the Site;
- Reviewed an Environmental Questionnaire and Disclosure Statements completed by the current Site owners;
- Reviewed data to assess potential environmental concerns or impairments as a result of the past and present activities at the Site, existing Site conditions, and conditions at off-Site properties;
- Consideration and/or identification of business environmental risk issues; and
- Prepared this report to present the assessment procedures, findings, evaluations, conclusions, and recommendations.

3.0 SITE INFORMATION

The Site is rectangular and currently vacant. A Site Map, presented as Drawing 2 in Appendix A, depicts the Site, observed on-Site features, and adjoining property uses. General information concerning the Site is presented in Tables 1, 2, 3, and 4.

TABLE 1
SUMMARY OF SITE INFORMATION

Addresses	not assigned Lodi, California
Location	Within the northwest quarter of Section 15, Township 3 North, Range 6 East, Mount Diablo Baseline and Meridian. Southwest corner at the Intersection of Highway 12 & Lower Sacramento Road.
Assessor's Parcel Numbers	058-030-02 (approximately 21 acres) and the eastern portion of 058-030-01 (approximately 14 acres)
Approximate Site Acreage	35-acres
Existing Use	vacant
Intended Use	Community Shopping Center

TABLE 2
REGIONAL GEOLOGIC AND HYDROLOGIC CHARACTERISTICS

Geomorphic province and subprovince	Great Valley, San Joaquin Valley
Regional geology	Sedimentary basin filled with a sequence of marine and continental sedimentary rocks. Surficial Quaternary deposits are alluvium derived from the Sierra Nevada, consisting of silty sand, sandy silt, and sandy clay (United States Department of the Interior, 1959).
Surface soil types	Acampo sandy loam & Tokay fine sandy loam (United States Department of Agriculture, 1992).
Approximate depth to groundwater	Groundwater was encountered at an average depth of 47 feet below ground surface, approximately 240 feet northeast of the Site at Sunset Liquors (Foothill Engineering, 2003).
Approximate direction of groundwater flow	The direction of groundwater at the Site has not been assessed. However, according to environmental reports reviewed for nearby facilities, groundwater flow in the area trends southeasterly (Foothill Engineering, 2003).

TABLE 3 ADJOINING STREETS AND PROPERTY USE		
DIRECTION	**ADJOINING STREET**	**ADJOINING PROPERTY USE**
north	Highway 12	Agricultural (vineyard) beyond Highway 12
east	Lower Sacramento Road	commercial/residential use
south	none	agricultural/residential use
west	none	agricultural use

TABLE 4 SUMMARY OF SITE UTILITIES	
UTILITY	**PROVIDER**
Electricity	PG & E
Natural Gas	none
Emergency Power	none
Stormwater Drainage	City of Lodi
Solid Waste Disposal	California Waste Removal Systems
Sanitary Sewer	City of Lodi
Drinking Water	City of Lodi

4.0 ASSESSMENT PROCEDURES

This Phase I consisted of gathering basic information concerning the Site and properties in the vicinity of the Site. Tasks performed to complete the Phase I are summarized in the following subsections.

4.1 Aerial Photograph Review

Aerial photographs of the Site were reviewed at the United States Department of Agriculture (U.S.D.A.) Soil Conservation office, and the Berkeley Public Library for information concerning past development and use. The findings of the aerial photograph review are summarized in Subsection 5.1.

4.2 Sanborn Fire Insurance Map Review

Twining reviewed Sanborn Fire Insurance Maps online at http://sanborn.umi.com, sponsored by Bell & Howell UMI. Sanborn Maps can provide historical information regarding a Site. A summary of the results of the Sanborn Fire Insurance map search is presented in Subsection 5.2.

4.3 Historical City Directory Review

Historical city directories published by Haines Directories were reviewed at the Cesar Chavez Central Library, in Stockton, California. These directories were reviewed for information regarding former Site use. Information obtained through a review of the Haines Directories is summarized in Subsection 5.3.

4.4 Agricultural Chemical Use Review

Twining reviewed agricultural chemical use permits issued by the San Joaquin County Agricultural Commissioner's office in Stockton, California. These permits were reviewed for information regarding agricultural chemical use at the Site. A summary of the results of the review is presented in Subsection 5.4.

4.5 Previous Investigation

Twining was not supplied with previous environmental investigations pertaining to the Site. However, a Limited Soils Investigation was performed concurrently with the Phase I. A summary of the results of the investigation is presented in Subsection 5.5.

4.6 Business Risk Considerations

Consideration and identification of additional factors that could pose a business environmental risk, in accordance with Wal★Mart specifications, are discussed in Subsection 5.6.

4.7 Review of Site Use

Data concerning past and current ownership and uses of the Site were assembled from a variety of sources including a review of records at the local building department, a review of historical aerial photographs, a review of agricultural chemical use, and interviews with individuals having knowledge of the Site. In addition, Environmental Questionnaire and Disclosure Statements were completed by the current Site owners. Copies of the completed questionnaires are presented in Appendix B. The findings of this review of ownership and historical use are summarized in Subsection 5.7.

4.8 Site Reconnaissance

A reconnaissance of the Site and a reconnaissance of adjoining properties was performed by Mr. Timothy Thomas of Twining on September 23, 2003 and on November 18, 2003. Project Team Resumes are presented in Appendix C. The findings of the Site reconnaissance are summarized in Subsection 5.8. A Site Map depicting the observed on-Site features is presented as Drawing 2 in Appendix A. Photographs of the Site are presented in Appendix D.

4.9 List, Record, Permit Review, and Interviews

Federal, state, and local government regulatory agency lists, records, and permits were researched by Track Info Services, Inc. (TIS) for information regarding potential impacts to the Site by off-Site and on-Site sources. The lists, records, and permits reviewed, and their respective search parameters for each are summarized in Subsection 5.9. Findings of the list, record, and permit review are also summarized in Subsection 5.9. In addition, government agency personnel and others with knowledge of the Site were interviewed. The individuals and agencies contacted are summarized in Table 5. Information obtained through interviews with these individuals is presented throughout Section 5. The TIS report is presented in Appendix E.

TABLE 5 SUMMARY OF RESOURCES
Carolyn Reichmuth (Site owner since 1974) Lodi, California
Lodi Southwest Associates (Site owner since 1992) Lodi, California
Local Office of Real Property Records San Joaquin County Assessor's Office (SJCAO)/San Joaquin County Recorder's Office (SJCRO) Stockton, California
Local UST Regulatory Agency San Joaquin Environmental Health Department (SJCEHD) Stockton, California
United States Geological Survey, Topographic Map, 7.5 Minute Series: Lodi South, California Quadrangle, 1981

5.0 FINDINGS

The findings of the Phase I are presented in the following subsections.

5.1 Aerial Photograph Review

The findings of the aerial photograph review are summarized in Table 6.

TABLE 6
SUMMARY OF AERIAL PHOTOGRAPH REVIEW

YEAR	OBSERVED FEATURES
1953	The Site appears to be in agricultural use. The surrounding area is also in agricultural use.
1968	The Site appears to be in agricultural use. The surrounding area is also in agricultural use.
1988	The Site appears to be in agricultural use. The surrounding area is also in agricultural use.
1993	The Site appears to be in agricultural use. The surrounding area is also in agricultural use.
1995	The Site appears to be in agricultural use. The surrounding area is also in agricultural use.

5.2 Sanborn Fire Insurance Map Review

Sanborn Fire Insurance Maps drawn for the city of Lodi do not include the Site or surrounding property.

5.3 Historical City Directory Review

Historical Haines directories covering the area of the Site were reviewed. The Site was previously located in the county, and therefore was not listed in the city directories.

5.4 Agricultural Chemical Use Review

Twining reviewed agricultural chemical use permits issued by the San Joaquin County Agricultural Commissioner's (SJCAC) office in Stockton, California. These permits were reviewed for information regarding agricultural chemical use at the Site. The following is a list of permitted agricultural chemicals on file at the SJCAC office for the Site:

- MCPA. Dimethylamine 2003. 2002, 2001
- Paraquat 2000. 1999
- Sevin 1999. 1998
- Methomyl 1999, 1998

Additionally, Mr. John Batch who has leased the Site for farming since 1996 was contacted regarding agricultural chemical use at the Site. According to Mr. Batch, the Site has not been farmed since 1999. Mr. Batch, further indicated that although the SJCAC has permitted several pesticides and herbicides for use at the Site, only herbicides for weed control have been used since 1996. Mr. Batch stated that the herbicides were applied by helicopter.

5.5 Previous Investigation

A Phase II Site Assessment (Phase II) was performed at the Site concurrently with the Phase I. The purpose of the Phase II was to determine if environmentally persistent agricultural chemicals were present in Site soils. The environmentally persistent agricultural chemicals selected for analyses included organophosphate and organochloine pesticides, chlorophenoxyacid herbicide and paraquat. The laboratory results indicated that the soil samples submitted for analyses were reported as none detected (ND) for the chemicals selected for analysis. A copy of the Phase II is presented in Appendix F.

5.6 Business Risk Considerations

Consideration and identification of additional factors that could pose a business environmental risk, in accordance with Wal★Mart specifications, are discussed below.

Radon

A survey of California residential indoor and outdoor radon concentrations was conducted by the California Air Resource Board. The results of this survey are presented in the U.S. Environmental Protection Agency (EPA) Map of Radon Zones Report, dated September 1993. The EPA's map report identifies, on a county-by county basis, areas of highest potential for elevated indoor radon levels (greater than 4 pico curies per liter). A review of the results indicates that the annual geometric mean radon concentration for the State of California is approximately 0.9 pico curies per liter (pCi/L). The report also concluded that regions of higher radon concentrations could be found in portions of Ventura County and counties along the Sierra Nevada foothills. The Site lies within San Joaquin County, and not along the Sierra Nevada Foothills. The EPA's report indicates that the San Joaquin County average for radon is 2.5 pCi/l and is ranked low (US EPA, 1993).

Lead in Drinking Water

It is Twining's understanding that drinking water for the Site will be provided by the City of Lodi. The City of Lodi was contacted to determine potential for lead in drinking water for the area of the Site. According to the City of Lodi, drinking water for the area of the Site has met California State regulations as outlined in Title 26 of the California Code of Regulations including lead.

High Voltage Power Lines

Currently, no high voltage power lines are present on, or adjacent to, the Site.

Asbestos Containing Materials

Asbestos Containing Materials are evaluated only when buildings are present. There are no buildings on the Site.

Lead-Based Paint

Lead-Based Paint is evaluated only when buildings are present. There are no buildings present on Site.

Regulatory Compliance, Industrial Hygiene, Health and Safety, and Indoor Air Quality

No regulatory compliance, industrial hygiene, health and safety, or indoor air quality issues are associated with the Site.

Biological Evaluation

A Biological Evaluation was conducted by Live Oak Associates, Inc. (LOA) for the Site to assess biotic resources with respect to federal, state, and local laws. The study included California state databases, reference books, and the *San Joaquin County Multi-Species Habitat Conservation and Open Space Plan*. A field survey of the Site and surrounding environment was conducted on February 19, 2003 by Ms. Melissa Denena of LOA. The complete Biological Evaluation Report is presented in Appendix G. Below is a summary of the LOA report.

The Site consists of relatively flat, 0 to 2 percent slope, agricultural land that had been disced at the time of the field study. A drainage ditch runs north-south across the site. The entire site's habitat can be classified as ruderal. Ruderal habitat consists of species that are associated with land that has been disturbed by human activity. The ditch had no noticeable difference in vegetation from the surrounding land and was included in the ruderal habitat. It was determined that the ditch is unlikely to be a wetland feature. Further, because the ditch lacks wet indicators and is a man made feature it is the opinion of LOA that the Army Corp of Engineers and the California Department of Fish and Game will not have an interest in this feature.

In general, because of the disturbed nature of ruderal habitat, it is poor habitat for terrestrial vertebrates. In fact no vertebrates were seen using the Site during the field visit. However, the Site is likely used by a number of bird species common to the area as a forage location. Ruderal habitat is also often used by small fossorial mammals as habitat, and as forage and corridor habitat for larger mammals, some of which hunt the smaller mammals. No known corridor crosses or involves the Site.

A search of the databases for the site and surrounding area for special status species, revealed a number of species that occur in the region where the Site occurs. The Site and adjacent land was evaluated for their ability to offer habitat to these species. The Site offered no potential habitat for any of the special status plant species that occurred in the databases. The Site was assessed not to have any habitat potential for any special status animal species, other than avian species and bats. Most of the airborne species that have a possibility of occurring on the Site, are believed to only use it as a possible forage site.

There were three avian species that were determined to be of a higher level of concern; the Swainson's hawk (*Buteo swainsoni*), the burrowing owl (*Athene cunicularia*), and the California horned lark (*Eremophila alpestris actia*). While no evidence was found on Site that these species used the Site, there is suitable nesting habitat for the burrowing owl and the horned lark on Site, and for the Swainson's hawk adjacent to the Site only. All three of these species could use the Site habitat as forage.

The Site's ability to act as habitat for these three species requires evaluation and possible mitigation under five laws and policies. All three of these species require consideration under the California Endangered Species law, the California Environmental Quality Act and the *San Joaquin County Multi-Species Habitat Conservation and Open Space Plan*. The burrowing owl and Swainson's hawk as birds of prey are protected under California's State Fish and Game Code. In addition, Swainson's hawk is protected under the federal Migratory Bird Treaty Act.

A pre-construction survey is strongly recommended for the burrowing owl year round. If owls were found on Site during the non-nesting season the required mitigation would be to have a qualified ornithologist set up exclusion measures to force the owls to relocate. The Swainson's hawk and the horned lark would require a preconstruction survey only if the work were to commence during their nesting season. The mitigation for a nesting bird is the same for all three species; a 250 foot exclusion buffer would need to be erected around the nest until the chicks were fledged. The combined nesting season for all three birds is from February 1st to August 31st. In addition, the *San Joaquin County Multi-Species Habitat Conservation and Open Space Plan* will require notifying the City of Lodi and the Plan's Joint Powers Authority that the appropriate fees have been paid, a total of $2,535.00 for both parcels.

The report identified a further environmental concern with respect to the possibility of degradation of water quality. These concerns are under the authority of the State Water Quality Control Board. The standard mitigation of using Best Management Practices and preparing a Storm Water Pollution Prevention Plan should reduce these impacts to less than significant levels.

Cultural and Historic Resources, Archaeological Resources, and Ecological Resources

An Archaeological/Paleontological Resources Assessment report was prepared for the Site during November 2003, by Conlin I. Busby, Ph. D. of Basin Research Associates, Inc. The following is a summary of the report. The complete report is included in Appendix H.

A prehistoric and historic Site record and literature search was conducted by the Central California Information Center (CCIC), California State University, Stanislaus, Turlock (CCIC File No. 4852 L dated February 11, 2003). In addition, reference material from the CCIC and material on file at Basin Research Associates, San Leandro was also reviewed.

The Native American Heritage Commission (NAHC) was contacted for a search of the *Sacred Lands Inventory* and individual Native Americans recommended by the NAHC were contacted (Busby 2003a-l). The California Valley Miwok Tribe (Rashel Reznor, Secretary/Treasurer, 3/3/03) has no issues with the project area but requested that the group be kept apprised of any Miwok artifacts that might be found at the location.

Archaeological Field Inventory

A field inventory of the project was completed by Mr. Christopher Canzonieri on February 11, 2003 in accordance with standard archaeological practice for central California. The inventory used systematic north-south transects spaced no greater than 30 meters apart. Surface visibility was less than one-percent due to dense vegetation, including mustards, grasses, and clover. The exposed soils consist of a light tan silt-sand.

No evidence of either prehistoric or historic archaeological materials were observed during the surface survey of the proposed project area or the off-Site storm water detention area.

No prehistoric or historic archaeological sites or architectural features have been recorded, reported, or identified in or adjacent to the proposed Project (CHRIS/CCIC File No. No. 4852 L). No historic properties listed, determined eligible, or pending on state and federal inventories and/or registers are located in or adjacent to the project area.

Five cultural resources compliance reports on file at the CHRIS/CCIC include the parcel or adjacent areas (CHRIS/CCIC File No. 4852 L). Napton (1981) provides an *archaeological overview* of the county while the remainder of the reports involve negative records searches and negative field surveys (if conducted).

Archaeological Sensitivity

There appears to be minimal potential for buried prehistoric and/or historic archaeological resources in and adjacent to the proposed Project.

Field Survey

No prehistoric, historic archaeological or paleontological materials were observed during the field survey conducted for the project.

Recommendations

It is the considered opinion of Basin Research Associates, based on a review of pertinent records, maps and other documents and a field inventory, that the proposed project can proceed as planned in regard to prehistoric and historic archaeological and paleontological resources.

Archaeological Resources

Subsurface testing for buried archaeological resources and archaeological monitoring during construction is not recommended. However, if any significant cultural materials are exposed or discovered during either Site clearing or during subsurface construction, operations should stop within 25 feet of the find and a qualified professional archaeologist contacted for further review and recommendations. Potential recommendations could include evaluation, collection, recordation and analysis of any significant cultural materials followed by a professional report.

Paleontological Resources

If vertebrate fossils are exposed during construction, work within 25 feet of the find should cease until a vertebrate paleontologist can examine the find and make appropriate recommendations. Potential recommendations could include evaluation, collection, recordation, and analysis of any significant paleontological materials followed by a professional report.

5.7 Review of Site Use

According to aerial photographs, the Site appears to have been in agricultural use from at least 1953 to 1999. Currently, both parcels that comprise the Site are vacant. According to Environmental Questionnaire and Disclosure Statements completed by Ms. Carolyn Reichmuth, owner of the western parcel, and Ms. Lori McIntosh, president of LWM Southwest, Inc., owner of the eastern parcel, both parcels have been in agricultural use for the past 94 years. Both Ms. Reichmuth and Ms. McIntosh reported that they had no knowledge of chemicals that had been used on-Site, nor did either know of current or former ASTs, USTs, or disposal areas on-Site. Additionally, no areas were identified during the Site reconnaissance where agricultural chemicals may have been stored or formulated. Also, neither Ms. Reichmuth or Ms. McIntosh had information regarding releases, or spills of hazardous materials at the Site as a result of illegal dumping or traffic accidents along the adjoining roadways.

5.8 Site Reconnaissance

During the reconnaissance, the Site was observed for specific indicators of possible environmental concern. Reconnaissance observations are summarized in Table 7.

TABLE 7
SUMMARY OF SITE RECONNAISSANCE OBSERVATIONS

FEATURE	OBSERVED	NOT OBSERVED
ASTs (other than propane and/or water ASTs)		X
Chemical/pesticide/hazardous material storage area		X
Debris		X
Discolored or stained soil or water		X
Drainage ditch	X	
Drums		X
Irrigation Wells	X	
Farm Equipment		X
Pipes of unknown use		X
Ponding basins		X
Storage drums		X
Storm drains		X
Stressed vegetation (not apparently due to seasonal factors)		X
Structures (existing or evidence of former)		X
USTs or evidence of USTs		X
Waste or wastewater discharge to surface or surface waters of Site (not storm water)		X
Potential Polychlorinated biphenyl (PCB)-Containing Equipment	X	
Waste oil storage		X
Domestic Water wells		X

Irrigation Well(s):

There are two electrically powered irrigation water wells located on the Site. One well is located near the southwestern corner of the Site, and the other at the northeastern corner of the Site. While water wells are not an environmental concern themselves, they can provide a conduit for contaminants to enter the groundwater beneath a site. Twining recommends that if the wells are not to be used, then they should be destroyed in accordance with state and county regulations.

Potential Polychlorinated biphenyl (PCB)-Containing Equipment:

Twining observed two pole mounted transformers at the southern portion of the Site that are owned and operated by Pacific Gas and Electric (PG & E). The transformers appeared to be old. However, there were no leaks or stains observed in connection with the transformers during the Site reconnaissance. According to representatives with P G & E, most transformers owned by the utility company that contained high concentrations of PCB have been serviced by P G & E to reduce PCB concentrations. Additionally, according to the Environmental Services Division of P G & E, any impact to a site caused by leaking or damaged transformers is the responsibility of the owner of the transformers. No transformers other than those owned and operated by a Pacific Gas and Electric were observed at the Site.

Drainage Ditch

Twining observed a drainage ditch located along Highway 12 at the northern portion of the Site.

5.9 List, Record, and Permit Review

Information regarding the list, record, and permit review findings is summarized in Tables 8 and 9.

TABLE 8
SUMMARY OF REGULATORY LISTS AND RECORDS REVIEWED

SOURCE	DATE	SEARCH RADIUS (Mile)	PROXIMITY TO SITE (miles)			
			SITE	WITHIN ¼	¼-½	½-1
US EPA, CERCLIS List	6/03	½	NONE	NONE	NONE	NA
US EPA, NPL List	6/03	1	NONE	NONE	NONE	NONE
US EPA, ERNS List	12/02	SITE	NONE	NA	NA	NA
US EPA, RCRA Hazardous Waste Generators	12/02	SITE/adjoining	NONE	NONE	NA	NA
US EPA, RCRA TSD Facilities	12/02	½	NONE	NONE	NONE	NA
US EPA, RCRA CORRACTS	12/02	1	NONE	NONE	NONE	NONE
CAL-EPA, DTSC AWP	10/00	1	NONE	NONE	NONE	NONE
CAL-EPA, IWMB SWIS	6/03	½	NONE	NONE	NONE	NA
CAL-EPA, RWQCB Leaking USTs	12/02	½	NONE	2	NONE	NONE
CAL-EPA, SWRCB USTs	6/03	SITE/adjoining	NONE	1	NA	NA
SJCFD Hazardous Material Permits		SITE	NONE	NA	NA	NA
SCJFD, Hazardous Material Incidents		SITE	NONE	NA	NA	NA
Oil/Gas Wells, Munger Map Book	12/94	SITE	NONE	NA	NA	NA

NA = Not Applicable

TABLE 9
SUMMARY OF FACILITIES IDENTIFIED ON THE LIST AND RECORD REVIEW

FACILITY AND ADDRESS	APPROXIMATE DISTANCE AND DIRECTION	LIST EACH FACILITY WAS IDENTIFIED ON
Ultramar Beacon #696 2448 West Kettleman Lane (Highway 12)	Beyond Lower Sacramento Road, approx. 100 feet east of the Site	**CAL-EPA,** RWQCB List of Leaking USTs
Sunwest Liquors 2449 West Kettleman Lane (Highway 12)	240 feet northeast beyond West Kettleman Lane (Highway 12)	**CAL-EPA,** RWQCB List of Leaking USTs

Files regarding the facilities identified in the list and record review were reviewed at the San Joaquin County Environmental Health Department (SJCEHD) in Stockton, California on September 23, 2003, to assess the environmental concern posed to soil and/or groundwater at the Site.

The Ultramar Beacon Service Station #696, located at 2448 West Kettleman Lane, approximately 100 feet east of the Site. Prior to 1988, this service station was owned and operated by Conoco. Impacted soil and groundwater were discovered at the service station property in 1987 during the removal and replacement of fuel storage USTs. Since 1988, assessment and remediation efforts, including groundwater monitoring, extraction and treatment, and soil vapor extraction, were ongoing at this facility and the adjoining property to the southeast. Monitoring wells installed on the property southeast of the service station were destroyed under oversight by the SJCEHD in May 1994. After the destruction of the monitoring wells, three approximately 60-foot deep soil borings were drilled on the property southeast of the service station. Soil samples were collected at five foot intervals in these borings. Selected soil samples were analyzed for total petroleum hydrocarbons-gasoline range (TPH-G), benzene, toluene, ethylbenzene, and xylenes (BTEX). Additionally, groundwater samples were analyzed for TPH-G, BTEX, and methyl tert-butyl ether (MTBE). Concentrations of xylenes were detected in one of the groundwater samples at a concentration of 0.61 micrograms per liter. No detectable concentrations of BTEX, or TPH-G were reported in the soil samples or groundwater samples from the other two borings. A California Regional Water Quality Control Board (CRWQCB) letter dated August 28, 1997, stated that no further action is required at this facility. No information was found indicating that soil between the service station facility and the Site has been impacted, or that impacted groundwater from beneath the service station facility has migrated to or toward the Site. Groundwater flow at this facility is reported to trend southeasterly, away from the Site.

Sunwest Liquors located at 2449 West Kettleman Lane is approximately 240 feet northeast of the Site. In July 1998, three 10,000-gallon gasoline USTs were removed from the facility. Soil samples collected during the removal of the USTs indicated elevated concentrations of petroleum hydrocarbons present in the soils beneath one of the USTs, and low concentrations of TPH-G, BTEX, MTBE and Tert-Butyl alcohol (TBA) were detected in the soils beneath the fuel product piping. The SJCEHD requested that the vertical and horizontal extent of the impacts be determined. In August 1998, five soil borings were advanced, and soil samples were collected from 8 to 37 feet below ground surface (fbg) and analyzed. Groundwater was not encountered in these borings. Laboratory analysis did not detect petroleum hydrocarbons in the soil samples submitted for analysis. The soil in the area of the former UST was then over excavated on August 21, 1998, removing approximately 60 cubic yards of soil. The CRWQCB, in concurrence with the SJCEHD, determined the highest concentration of impacted soil had been removed during the over excavation, and the remaining soil was unlikely to pose a threat to groundwater. The CRWQCB did not require any additional investigation and issued a closure letter dated November 2, 1998. Groundwater flow at this facility is reported to trend southeasterly, away from the Site.

In April 1999, a second case for the Sunwest Liquors facility was opened with the CRWQCB when groundwater contamination was discovered during activities on the property. Three soil borings were advanced to a maximum depth of 45 feet, and four monitoring wells were installed to a maximum depth of 50 feet at the western portion of the facility. Laboratory analysis of the soil samples collected from the borings did not indicate a presence of petroleum hydrocarbons, with the exception of low concentrations in one boring located in the center of the former location of the USTs. One water sample collected from monitoring well (GMX-1) located approximately 33 feet south of the former UST location indicated concentrations for TPH-G at 35 milligrams per liter (mg/L), BTEX at 150; 2,700; 1,300; and 8,100 (micrograms per liter) µg/L, respectively, and MTBE at 120 µg/L. Groundwater monitoring has continued on a quarterly basis at this facility since April 1999. A review of the analytical results from the quarterly groundwater monitoring indicates the constituents of concern have generally decreased over time. The most recent groundwater monitoring event in August 2003 reported concentrations of TPH-G at 8.4 mg/L, BTEX at 25; 618; 369; and 1,114 µg/L, respectively. The August 15, 2003 groundwater monitoring report indicates that on average, groundwater flow trends southeasterly, away from the subject Site; thus, posing a low risk of contamination to groundwater at the Site. No information was found indicating that soil between the service station facility and the Site has been impacted, or that impacted groundwater from beneath the service station facility has migrated to or toward the Site.

6.0 EVALUATION

An evaluation of the Phase I findings is summarized in the following subsections.

6.1 On-Site

The Site appears to have been in agricultural use for approximately 90 years prior to 1999, and since 1999, the Site has not been farmed. Reportedly, only herbicides for weed control have been applied at the Site since 1996. No areas were identified during the Site reconnaissance where agricultural chemicals may have been stored or formulated. A Phase II was performed at the Site concurrently with the Phase I. The purpose of the Phase II was to determine if environmentally persistent agricultural chemicals were present in Site soils. The environmentally persistent agricultural chemicals selected for analyses included organophosphate and organochloine pesticides, chlorophenoxyacid herbicide, and paraquat. The laboratory results for the soil samples submitted were reported as none detected for the chemicals selected for analysis.

There are two electrically powered irrigation water wells located on the Site. While water wells are not an environmental concern themselves, they can provide a conduit to groundwater. Provided water wells are destroyed consistent with applicable regulations, the presence of water wells on the Site would typically present a low environmental concern.

With respect to biological resources, there were three avian species that were determined to be of a concern for the Site; the Swainson's hawk, the burrowing owl, and the California horned lark. While no evidence was found on Site that these species used the Site, there is suitable nesting habitat for the burrowing owl and the horned lark on Site, and for the Swainson's hawk adjacent to the Site only. All three of these species could use the Site habitat as forage.

The Site's ability to act as habitat for these three species requires evaluation and possible mitigation under five laws and policies. All three of these species require consideration under the California Endangered Species law, the California Environmental Quality Act and the *San Joaquin County Multi-Species Habitat Conservation and Open Space Plan*. The burrowing owl and Swainson's hawk as birds of prey are protected under California's State Fish and Game Code. In addition, Swainson's hawk is protected under the federal Migratory Bird Treaty Act.

6.2 Off-Site

Although two facilities within one-half mile of the Site were identified to have impacted soil and possibly groundwater beneath them, no information was found indicating that these impacts have migrated toward or to the Site. The environmental concern posed to the Site by off-Site sources appears low.

7.0 CONCLUSIONS AND RECOMMENDATIONS

This Phase I was conducted in conformance with the generally accepted guidelines for ASTM Phase I Environmental Site Assessments to evaluate the Site for the presence of hazardous substances as defined within ASTM E 1527-00, as well as guidelines set forth by Wal★Mart, and Comerica Bank. In the professional opinion of Twining, an appropriate level of inquiry has been made into the previous ownership and uses of the property consistent with good commercial and customary practice in an effort to minimize liability. This assessment has revealed no evidence of recognized environmental conditions in connection with the Site. However, the following areas of concern are noted:

- Two electrically powered irrigation wells are located on the Site. These water wells could provide a conduit for contaminants to enter the groundwater beneath the Site. Twining recommends that if the wells are not to be used, they should be destroyed in accordance with state and county regulations.

- With respect to biological resources, there were three avian species that were determined to be of a concern for the Site; the Swainson's hawk, the burrowing owl, and the California horned lark. While no evidence was found on Site that these species used the Site, there is suitable nesting habitat for the burrowing owl and the horned lark on Site, and for the Swainson's hawk adjacent to the Site only. All three of these species could use the Site habitat as forage. The Site's ability to act as habitat for these three species requires evaluation and possible mitigation. Therefore, a pre-construction survey is strongly recommended.

The material content of this report is intended to be consistent with a standard of practice as defined by ASTM practice E 1527-00, guidelines set forth by Wal★Mart, and Comerica Bank. Any exceptions to or deletions from this practice are described in the following paragraph.

The report format differs in style, arrangement, and presentation of material facts from the format described by ASTM. Additionally, business risk issues regarding historic cultural, archeological and biological resources were not evaluated in the report, but are presented in an EIR prepared for the Site.

8.0 LIMITATIONS

The purpose of an environmental assessment is to reasonably assess the potential for, or actual impact of, past practices on a given property which may pose an environmental impairment to it. No assessment is thorough enough to identify all potential environmental impairments at a given property. If environmental impairments have not been identified during the assessment, such a finding should not, therefore, be construed as a guarantee of the absence of such conditions on the Site, but rather the result of the services performed within the scope, limitations, and cost of the work performed. It should be noted that the collection of soil and groundwater samples for chemical analyses was not within our authorized work scope. Information obtained from the aerial photographs is an interpretation of features observed in the photographs. Actual conditions at the Site may be different from those interpreted. There were no significant limitations encountered during the performance of the Phase I with the exception of the aerial photographic review of the Site; a 20 year gap exists between 1968 to 1988.

The conclusions presented in this report are solely professional opinions based on information provided regarding the Site and the findings of the reconnaissance and records search. Conclusions presented are based on conditions as they existed at the time the work was performed. Changes in existing conditions of the Site due to time lapse, natural causes, or operations adjacent to the Site may deem conclusions presented invalid, unless the changes are reviewed and the conclusions reevaluated. Such conditions may require additional field and laboratory investigations to assess if the conclusions are applicable considering the changed conditions.

This work was performed for the sole use of our client, Browman Development Company, Inc., Wal★Mart Stores, Inc., and Comerica Bank. Any reliance on this report by a third party is at such party's sole risk. Others who seek to rely on the findings have a duty to determine the adequacy of this report for their intended use, time, and location. Twining does not warrant the accuracy of information supplied by others. No other warranty, either express or implied, is made.

Twining warrants that the services, findings, and/or recommendations provided to Comerica Incorporated, its affiliates and subsidiaries, and their respective successors and assigns (individually and collectively "Comerica"), have been prepared, performed and rendered in accordance with procedures, practices and standards generally accepted and customary in the consultant's profession for use in similar assignments. Twining shall indemnify, save and hold harmless Comerica from and against any and all losses, costs, expenses and liabilities, including without limit reasonable attorneys fees, which are attributable to the breach of the above warranty, up to an aggregate amount of $1,000,000.00 (One Million Dollars), notwithstanding any limitation (expressed or implied) contained in any other agreement or document relating to the services, findings and/or recommendations provided by Twining.

The standard of practice is time-dependent. Services provided were performed consistent with generally-accepted professional consulting principles and practices for environmental assessors in San Joaquin County at the time the work was performed. The findings and conclusions presented in this report are solely professional opinions derived in accordance with current standards of professional practice.

9.0 CLOSING

We appreciate the opportunity to be of service to you on this project. If you have questions regarding this report, please feel free to contact us at our Fresno office.

Sincerely,

THE TWINING LABORATORIES, INC.
Environmental Services Division

Timothy W. Thomas
Environmental Assessor

William R. Cooper
Senior Environmental Assessor

Chris Skelton
Quality Control Reviewer

10. REFERENCES

American Society for Testing and Materials, 2000, *ASTM Standards on Environmental Site Assessments for Commercial Real Estate*, 1st ed., E 1527-00, Philadelphia, Pennsylvania.

Munger, Averill H., Ed. 1994. *Munger Map Book, California-Alaska Oil and Gas Fields.* Munger: Los Angeles, California.

United States Environmental Protection Agency, Radon Division, Office Of Radiation and Indoor Air. *EPA's Map Of Radon Zones, California:* U.S. EPA, September 1993.

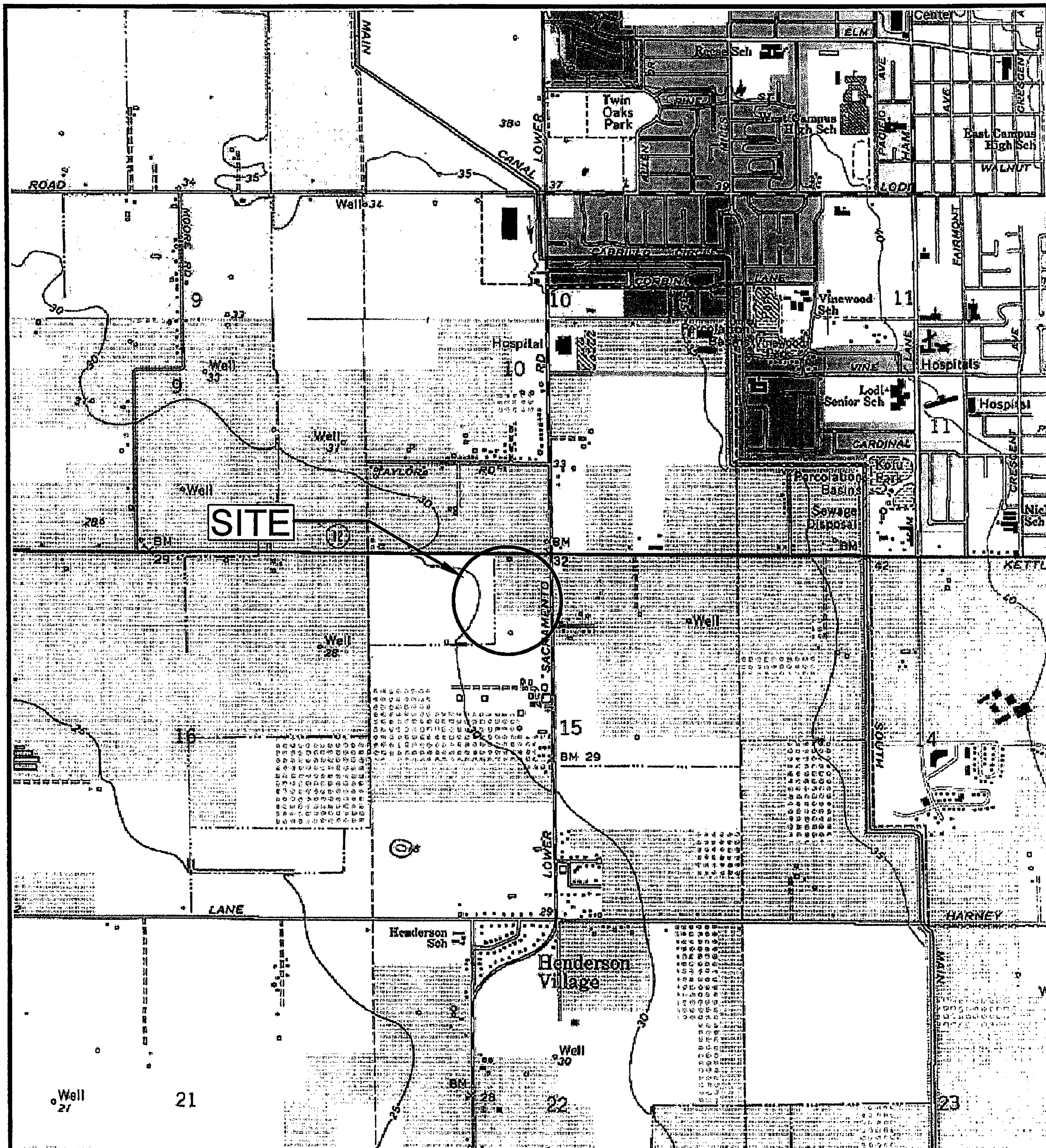
United States Department of Agriculture. 1990. United States Department of Agriculture, Soil Conservation Service. *Soil Survey of San Joaquin County, California.* Government Printing Office, Washington D.C.

United States Geological Survey, Topographic Map, 7.5 Minute Series. *South Lodi, California Quadrangle, 1981.* United States Geological Survey.

Wal★Mart *"Phase I Environmental Site Assessment Guidelines and Report Requirements,"* revised January 2, 2001.

APPENDIX A

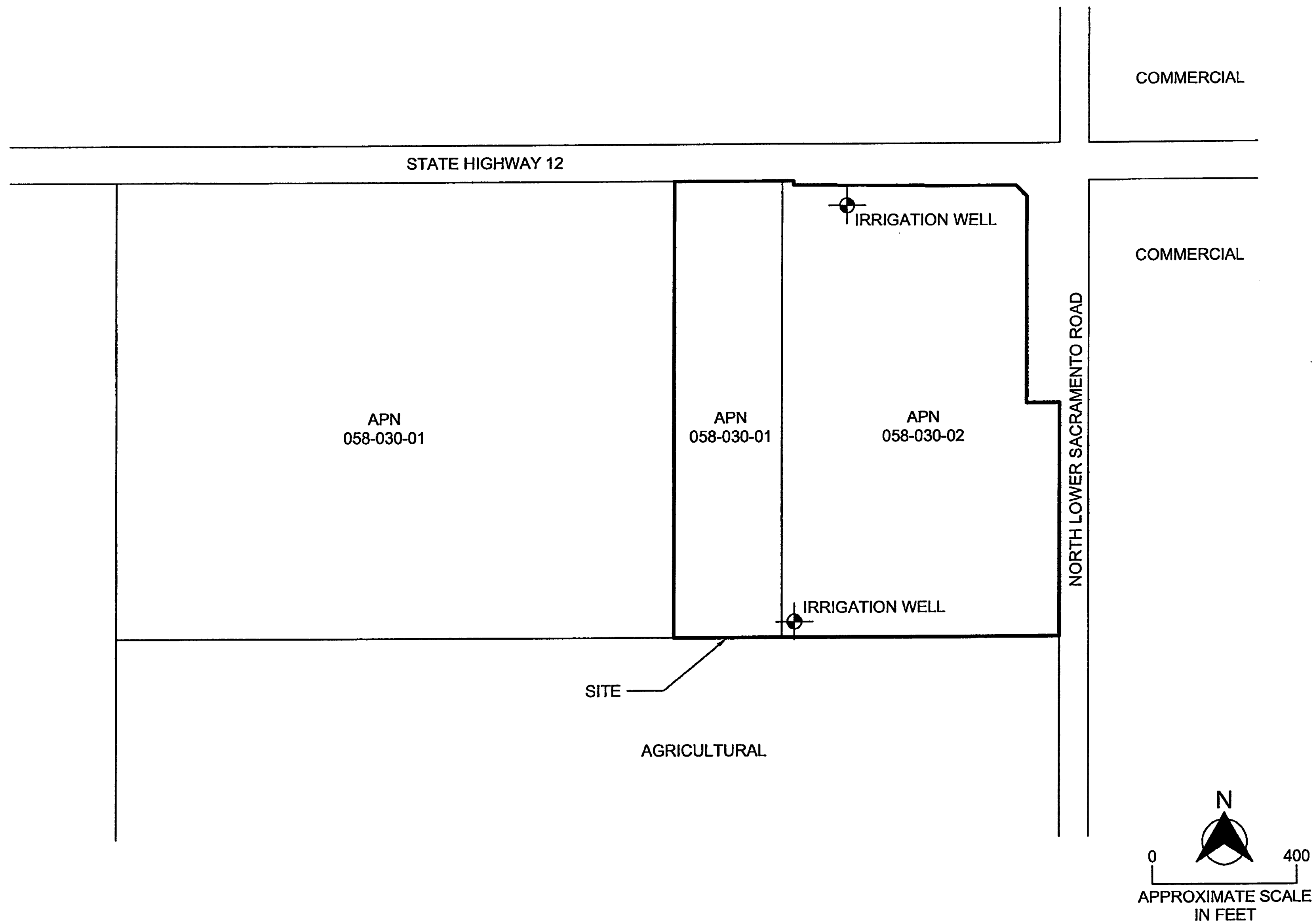
DRAWINGS



SOURCE: U.S.G.S. TOPOGRAPHIC MAP, 7 ½ MINUTE SERIES
LODI SOUTH, CALIFORNIA QUADRANGLE, PHOTOREVISED 1976

0 2000
APPROXIMATE SCALE
IN FEET

SITE LOCATION MAP BROWMAN DEVELOPMENT SEC OF STATE HWY. 12 AND N. LOWER SACRAMENTO RD. LODI, CALIFORNIA	FILE NO.: 07242-01	DATE: 09/30/03	THE TWINING LABORATORIES, INC. EST.1898 FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY
	DRAWN BY: WME	APPROVED BY:	
	PROJECT NO. A07242.01	DRAWING NO. 1	



SITE PLAN
BROWMAN DEVELOPMENT
SEC OF STATE HIGHWAY 12 AND NORTH LOWER SACRAMENTO ROAD
LODI, CALIFORNIA

FILE NO. 07242-01	DATE DRAWN: 09/30/03
DRAWN BY: WME	APPROVED BY:
PROJECT NO. A07242.01	DRAWING NO. 2

THE TWINING LABORATORIES, INC.
EST. 1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY

APPENDIX B

ENVIRONMENTAL QUESTIONNAIRE AND DISCLOSURE STATEMENTS

THE TWINING LABORATORIES, INC.
EST. 1898
ANALYTICAL CHEMISTRY • ENVIRONMENTAL SERVICES
GEOTECHNICAL ENGINEERING • SAMPLING SERVICES
CONSTRUCTION INSPECTION & MATERIALS TESTING

ENVIRONMENTAL QUESTIONNAIRE AND DISCLOSURE STATEMENT

GENERAL INSTRUCTIONS: Please fill-in the blanks to the best of your ability. If you do not know the answer, please check the "DON'T KNOW" box. If you answer "YES" or the answer requires explanation please use additional pages and reference the table. Thank you, for your time and cooperation.

SITE INFORMATION	
Current Site Address	302 E Hwy 12, Lodi, CA 95240
Current Site Use	Agriculture
Current Site Zoning	Commercial
Current Assessor's Parcel Number	058-030-02
Addresses Formerly Assigned to Site (if any)	A portion of 058-030-01

SITE OWNERSHIP AND PAST USE		
OWNER NAME, ADDRESS & PHONE #	**PERIOD OF OWNERSHIP/USE**	**TYPE OF USE**
CURRENT LODI SOUTHWEST ASSOC. 301 S. HAM LN., SUITE A, LODI CA 95242	9 yrs.	Agriculture
FORMER CAROLYN REICHMUTH	unk.	↓
FORMER 1358 MIDVALE LODI, CA 95240		↓

ADJACENT PROPERTY USE		
DIRECTION	**TYPE OF USE**	**LENGTH OF USE**
North	Agriculture	unk.
East	Commercial Shopping Center	↓
South	Winery, Res.	↓
West	Agriculture	↓

EXISTING SITE STRUCTURES			
STRUCTURE DESCRIPTION	LOCATION	USE	DATE OF CONSTRUCTION
None			

FORMER SITE STRUCTURES			
STRUCTURE DESCRIPTION	FORMER LOCATION	USE	DATE OF DEMOLITION
None Known			

SITE LESSEES		
NAME, ADDRESS & PHONE #	LENGTH/YEARS OF LEASE	TYPE OF USE
PRESENT: John Batch	9 yrs.	Agriculture
FORMER: 11174 Golfview Rd. Lodi, CA 95240		
FORMER: unk.		

SITE UTILITIES	
UTILITY	PROVIDER
Electricity	
Natural Gas	
Drinking Water	
Storm water Drainage	
Solid Waste Disposal	
Sanitary Sewer	
Emergency Power Source	

************* PLEASE PROVIDE DETAILS FOR ALL YES ANSWERS *************

#	SPECIFIC USES OF SITE OR ADJACENT PROPERTY*	SITE			ADJACENT		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	Agricultural chemical formulation, distribution, or application			X			X
2	Airport and/or airplane maintenance		X			X	
3	Automotive wrecking yard		X			X	
4	Bulk chemical or fuel storage		X			X	
5	Commercial printing		X			X	
6	Dry cleaning		X			X	
7	Landfill		X			X	
8	Metal plating or finishing		X			X	
9	Mining or minerals processing		X			X	
10	Motor vehicle or equipment repair and/or maintenance		X			X	
11	Photographic laboratory		X			X	
12	Service station		X			X	
13	Skeet shooting or gun club		X			X	
14	Waste treatment, storage, disposal, processing or recycling, other than a landfill		X			X	

* "Adjacent Property" includes those properties that border the immediate site and properties located across the street from the site.

********** *PLEASE PROVIDE DETAILS FOR ALL YES ANSWERS* **********

#	ON-SITE HAZARDOUS MATERIALS USE, STORAGE AND DISPOSAL	YES	NO	DON'T KNOW
1	Are asbestos-containing materials present in on-site structures?		X/NA	
2	Has an asbestos survey been conducted for on-site structures?		X/NA	
3	Are any electrical transformers or capacitors on-site?		X	
4	Are any electrical transformers or capacitors on-site **not** owned by an electrical utility?		X	
5	Has an Environmental Audit or Assessment been conducted for the site?	X		
6	Do you know of any current or former aboveground storage tanks?		X	
7	Do you know of any current or former underground storage tanks (not septic)?		X	
8	Do you know of any fill dirt having been imported to the site?		X	
9	Do you know of any current or former wells on site, including, domestic drinking water, irrigation water, disposal, oil and/or abandoned wells?	X		
10	Do you know of any pesticides/herbicides permits for the site?		X	
11	Do you know of any pesticides/herbicides stored or used on-site?		X	
12	Are solvents, petroleum products, or paint products stored on-site?		X	
13	Are you aware of any permits having been issued for the site by the local fire, environmental health, or air pollution control agencies?		X	

********** *PLEASE PROVIDE DETAILS FOR ALL YES ANSWERS* **********

#	SITE WASTE GENERATION, STORAGE AND DISPOSAL	YES	NO	DON'T KNOW
1	Is liquid waste disposed of to a septic tank on-site?		X	
2	Is liquid waste disposed of elsewhere on-site?		X	
3	Are any ponds, sumps, basins, lagoons, or clarifiers used on-site to collect, treat, or dispose of liquid?	X		
4	If liquid waste is disposed of on-site, is a waste discharge permit required?			X
5	Is liquid waste disposed of to an off-site treatment works?		X	
6	Is solid waste disposed of on-site (burned or buried)?		X	
7	Does any solid or liquid off-site waste disposal require a waste manifest or disposal permit?		X	
8	Is any hazardous waste generated, stored, or treated on-site?		X	
9	Are any spills or releases of hazardous materials known or suspected to have occurred at the site?		X	
10	Is there another individual who may have additional or more complete information regarding the former use and activities at the site?	X		

THIS ENVIRONMENTAL QUESTIONNAIRE AND DISCLOSURE STATEMENT WAS PREPARED BY:

NAME LORI MCINTOSH TITLE PRESIDENT

FIRM LWM SOUTHWEST, INC. RELATIONSHIP TO SITE GENERAL PARTNER

ADDRESS 301 S. HAM LN., SUITE A

LODI, CA 95242

TELEPHONE NUMBER 209·333·0900 DATE 10·10·01

PREPARER REPRESENTS THAT TO THE BEST OF THE PREPARER'S KNOWLEDGE THE ABOVE STATEMENTS AND FACTS ARE TRUE AND CORRECT AND THAT TO THE BEST OF THE PREPARER'S KNOWLEDGE NO MATERIAL FACTS HAVE BEEN SUPPRESSED OR MISSTATED.

[signature] 10·10·01

Signed Date

THE **TWINING** LABORATORIES, INC.

EST. 1898

ANALYTICAL CHEMISTRY • ENVIRONMENTAL SERVICES
GEOTECHNICAL ENGINEERING • SAMPLING SERVICES
CONSTRUCTION INSPECTION & MATERIALS TESTING

ENVIRONMENTAL QUESTIONNAIRE AND DISCLOSURE STATEMENT

GENERAL INSTRUCTIONS: Please fill-in the blanks to the best of your ability. If you do not know the answer, please check the "DON'T KNOW" box. If you answer "YES" or the answer requires explanation please use additional pages and reference the table. Thank you, for your time and cooperation.

SITE INFORMATION	
Current Site Address	302 E. State Route 12 HY
Current Site Use	farming
Current Site Zoning	commerical
Current Assessor's Parcel Number	058-030-01
Addresses Formerly Assigned to Site (if any)	

SITE OWNERSHIP AND PAST USE		
OWNER NAME, ADDRESS & PHONE #	PERIOD OF OWNERSHIP/USE	TYPE OF USE
CURRENT Carolyn Hines Reichmath	27 yrs.	farming
FORMER Lloyd B. Hines	17 yrs	farming
FORMER Henrietta Hines	50 yrs	farming

ADJACENT PROPERTY USE		
DIRECTION	TYPE OF USE	LENGTH OF USE
North	vacant	?
East	commericial	12 yrs.
South	farming	?
West	farming	?

CORPORATE OFFICE
2527 Fresno Street
Fresno, CA 93721-1804
(559) 268-7021 • Fax 268-7126

MODESTO
4230 Kiernan Ave., #105
Modesto, CA 95256-9322
(209) 545-1050 • Fax 545-1147

VISALIA
130 North Kelsey St., #H6
Visalia, CA 93291-9000
(559) 651-8280 • Fax 651-8288

BAKERSFIELD
3701 Pegasus Drive, #124
Bakersfield, CA 93308-6843
(661) 393-5088 • Fax 393-4643

MONTEREY
10 Harris Ct., Ste. B4
Monterey, CA 93940-5773
(831) 333-1180 • Fax 333-1182

EXISTING SITE STRUCTURES			
STRUCTURE DESCRIPTION	LOCATION	USE	DATE OF CONSTRUCTION

FORMER SITE STRUCTURES			
STRUCTURE DESCRIPTION	FORMER LOCATION	USE	DATE OF DEMOLITION

SITE LESSEES		
NAME, ADDRESS & PHONE #	LENGTH/YEARS OF LEASE	TYPE OF USE
PRESENT: John Batch	8 yrs	farming
FORMER: Delmar Batch	15 yrs	farming
FORMER:		

SITE UTILITIES	
UTILITY	PROVIDER
Electricity	PG&E
Natural Gas	—
Drinking Water	—
Storm water Drainage	—
Solid Waste Disposal	—
Sanitary Sewer	—
Emergency Power Source	—

************* PLEASE PROVIDE DETAILS FOR ALL YES ANSWERS *************

#	SPECIFIC USES OF SITE OR ADJACENT PROPERTY*	SITE			ADJACENT		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	Agricultural chemical formulation, distribution, or application		✓			✓	
2	Airport and/or airplane maintenance		✓			✓	
3	Automotive wrecking yard		✓			✓	
4	Bulk chemical or fuel storage		✓			✓	
5	Commercial printing		✓			✓	
6	Dry cleaning		✓			✓	
7	Landfill		✓			✓	
8	Metal plating or finishing		✓			✓	
9	Mining or minerals processing		✓			✓	
10	Motor vehicle or equipment repair and/or maintenance		✓			✓	
11	Photographic laboratory		✓			✓	
12	Service station		✓			✓	
13	Skeet shooting or gun club		✓			✓	
14	Waste treatment, storage, disposal, processing or recycling, other than a landfill		✓			✓	

* "Adjacent Property" includes those properties that border the immediate site and properties located across the street from the site.

********** *PLEASE PROVIDE DETAILS FOR ALL YES ANSWERS* **********

#	**ON-SITE HAZARDOUS MATERIALS USE, STORAGE AND DISPOSAL**	**YES**	**NO**	**DON'T KNOW**
1	Are asbestos-containing materials present in on-site structures?		✓	
2	Has an asbestos survey been conducted for on-site structures?		✓	
3	Are any electrical transformers or capacitors on-site?		✓	
4	Are any electrical transformers or capacitors on-site **not** owned by an electrical utility?		✓	
5	Has an Environmental Audit or Assessment been conducted for the site?		✓	
6	Do you know of any current or former aboveground storage tanks?		✓	
7	Do you know of any current or former underground storage tanks (not septic)?		✓	
8	Do you know of any fill dirt having been imported to the site?		✓	
9	Do you know of any current or former wells on site, including, domestic drinking water, irrigation water, disposal, oil and/or abandoned wells?		✓	
10	Do you know of any pesticides/herbicides permits for the site?			✓
11	Do you know of any pesticides/herbicides stored or used on-site?			✓
12	Are solvents, petroleum products, or paint products stored on-site?		✓	
13	Are you aware of any permits having been issued for the site by the local fire, environmental health, or air pollution control agencies?		✓	

********** *PLEASE PROVIDE DETAILS FOR ALL YES ANSWERS* **********

#	SITE WASTE GENERATION, STORAGE AND DISPOSAL	YES	NO	DON'T KNOW
1	Is liquid waste disposed of to a septic tank on-site?		✓	
2	Is liquid waste disposed of elsewhere on-site?		✓	
3	Are any ponds, sumps, basins, lagoons, or clarifiers used on-site to collect, treat, or dispose of liquid?		✓	
4	If liquid waste is disposed of on-site, is a waste discharge permit required?		✓	
5	Is liquid waste disposed of to an off-site treatment works?		✓	
6	Is solid waste disposed of on-site (burned or buried)?		✓	
7	Does any solid or liquid off-site waste disposal require a waste manifest or disposal permit?		✓	
8	Is any hazardous waste generated, stored, or treated on-site?		✓	
9	Are any spills or releases of hazardous materials known or suspected to have occurred at the site?		✓	
10	Is there another individual who may have additional or more complete information regarding the former use and activities at the site?		✓	

THIS ENVIRONMENTAL QUESTIONNAIRE AND DISCLOSURE STATEMENT WAS PREPARED BY:

NAME Carolyn Reichmuth TITLE ____________

FIRM ____________ RELATIONSHIP TO SITE Owner

ADDRESS 1358 Midvale Rd.
Lodi, CA 95240

TELEPHONE NUMBER 209 368-0132 DATE 09/26/01

PREPARER REPRESENTS THAT TO THE BEST OF THE PREPARER'S KNOWLEDGE THE ABOVE STATEMENTS AND FACTS ARE TRUE AND CORRECT AND THAT TO THE BEST OF THE PREPARER'S KNOWLEDGE NO MATERIAL FACTS HAVE BEEN SUPPRESSED OR MISSTATED.

Carolyn Reichmuth 09/26/01
Signed Date

APPENDIX C

PROJECT TEAM RESUMES

Timothy W. Thomas
Environmental Assessor

Mr. Thomas joined Twining's Environmental Division in May of 2002. Since joining Twining, Mr. Thomas has attended training courses for conducting Phase I environmental site assessments, and asbestos surveys. Mr. Thomas has successfully completed these courses and has received a site surveillance technician certification for conducting asbestos surveys. Mr. Thomas has performed over fifty Phase I Environmental Site Assessments, Updates, and Real Estate Transaction Screens since May of 2002.

William R. Cooper
Senior Environmental Assessor

Mr. Cooper received a Bachelor of Arts degree in Geology from California State University Fresno in 1979, and is a State of California Registered Geologist, # 7427. He was professionally engaged in the petroleum industry in various capacities from 1980 through 1994. Mr. Cooper joined the environmental industry in 1994, and has been engaged as a project geologist and environmental assessor for several environmental services companies specializing in Preliminary Site Assessments, UST programs, soil and groundwater assessment, and cleanup programs. Mr. Cooper has performed numerous Phase I Environmental Site Assessments. Since joining Twining in 2001, he has participated in over two-hundred Environmental Site Assessments on diverse properties throughout California and Washington.

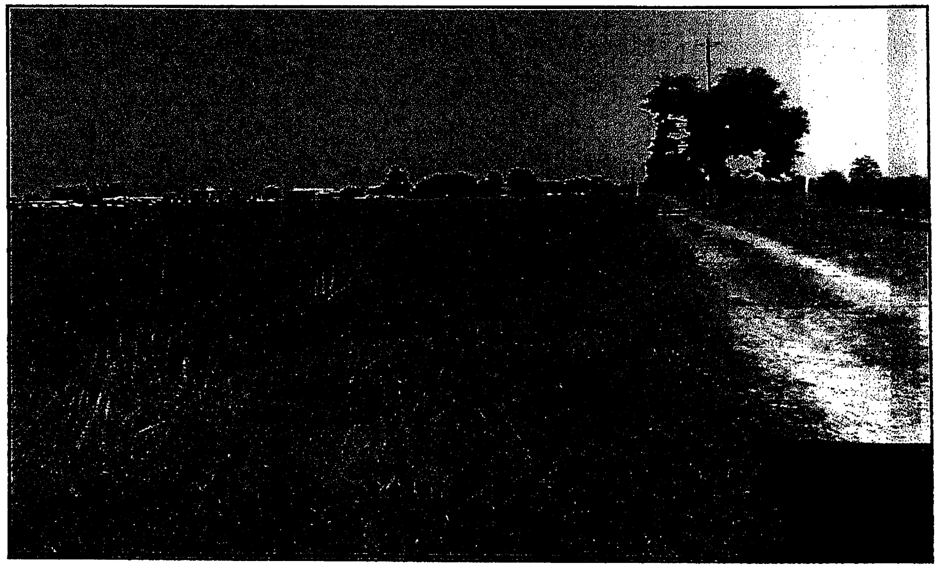
Christopher Skelton
Quality Control Reviewer

Mr. Skelton received a Bachelor of Science degree in Geology from California State University Fresno in 1995, and is a State of California Registered Geologist, # 7414. Mr. Skelton brings more than seven years of Environmental and Hydrogeolic Assessments, Engineering Geology, Natural Attenuation Assessments, Bioremediation and Groundwater Modeling experience to The Twining Laboratories, Inc. In addition to field experience and exploration, Mr. Skelton manages an integrated team of geologists, biologist, certified asbestos consultants, environmental assessors and technicians, providing a wide variety of environmental services. Mr. Skelton has conducted direct subsurface investigations at former underground storage tank sites, dry cleaning facilities, bulk petroleum storage sites, landfills and oil refinery sites. Mr. Skelton has conducted numerous Phase I and II site assessment, feasibility studies, risk assessment and corrective planning. He has extensive experience preparing boring logs and field reports for soil, vapor and groundwater samples.

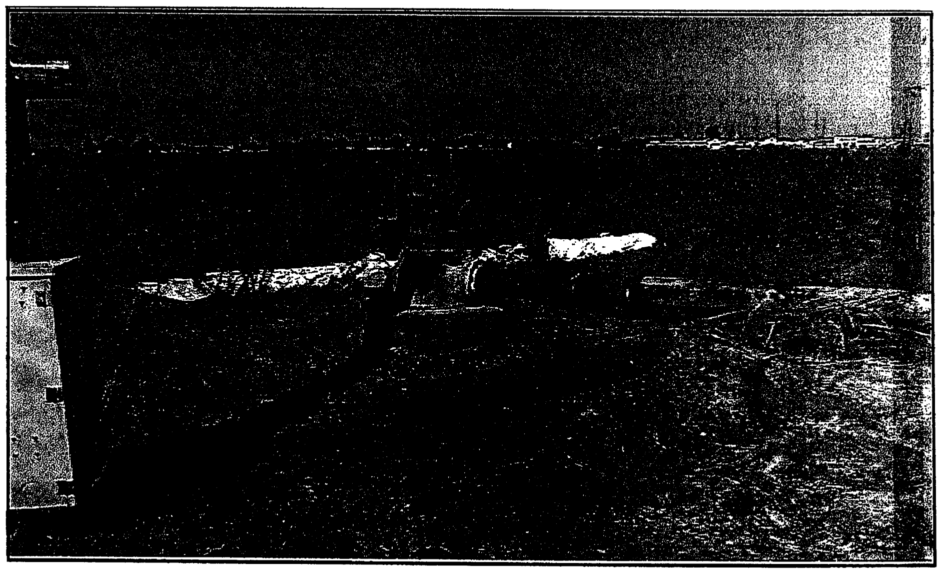
APPENDIX D

SITE PHOTOGRAPHS

PHOTOGRAPH 1
View of the Site looking east along the southern portion of the Site.



PHOTOGRAPH 2
View of a irrigation well located at the southern portion of the Site.



PHOTOGRAPH 3
View of a irrigation well located at he northern portion of the Site.

The Twining Laboratories, Inc.
Fresno, California

APPENDIX E

TIS REPORT

TRACK ➤ INFO SERVICES, LLC

Environmental FirstSearch™ Report

TARGET PROPERTY:

LOWER SACARMENTO ROAD

LODI CA 95242

Job Number: A07242.01

PREPARED FOR:

The Twining Laboratories, Inc.

2527 Fresno Street

Fresno, CA 92716

09-10-03

Environmental FIRSTSEARCH

Tel: (323) 664-9981 *Fax: (323) 664-9982*

Environmental FirstSearch
Search Summary Report

Target Site: LOWER SACARMENTO ROAD
LODI CA 95242

FirstSearch Summary

Database	Sel	Updated	Radius	Site	1/8	1/4	1/2	1/2>	ZIP	TOTALS
NPL	Y	07-09-03	1.00	0	0	0	0	0	0	0
CERCLIS	Y	06-09-03	0.50	0	0	0	0	-	0	0
NFRAP	Y	06-09-03	0.12	0	0	-	-	-	0	0
RCRA TSD	Y	12-09-02	0.50	0	0	0	0	-	0	0
RCRA COR	Y	12-09-02	1.00	0	0	0	0	0	0	0
RCRA GEN	Y	12-09-02	0.25	0	0	1	-	-	0	1
RCRA NLR	Y	12-09-02	0.12	0	0	-	-	-	0	0
ERNS	Y	12-31-02	0.12	0	0	-	-	-	0	0
State Sites	Y	04-30-03	1.00	0	0	0	0	0	1	1
Spills-1990	Y	07-01-03	0.12	0	0	-	-	-	0	0
SWL	Y	08-14-03	0.50	0	0	0	0	-	0	0
Permits	Y	06-03-03	0.12	0	0	-	-	-	0	0
Other	Y	04-30-03	0.12	0	0	-	-	-	0	0
REG UST/AST	Y	06-25-03	0.25	0	0	2	-	-	0	2
Leaking UST	Y	12-11-02	0.50	0	0	1	2	-	0	3
- TOTALS -				0	0	4	2	0	1	7

Notice of Disclaimer

Due to the limitations, constraints, inaccuracies and incompleteness of government information and computer mapping data currently available to TRACK Info Services, certain conventions have been utilized in preparing the locations of all federal, state and local agency sites residing in TRACK Info Services's databases. All EPA NPL and state landfill sites are depicted by a rectangle approximating their location and size. The boundaries of the rectangles represent the eastern and western most longitudes; the northern and southern most latitudes. As such, the mapped areas may exceed the actual areas and do not represent the actual boundaries of these properties. All other sites are depicted by a point representing their approximate address location and make no attempt to represent the actual areas of the associated property. Actual boundaries and locations of individual properties can be found in the files residing at the agency responsible for such information.

Waiver of Liability

Although TRACK Info Services uses its best efforts to research the actual location of each site, TRACK Info Services does not and can not warrant the accuracy of these sites with regard to exact location and size. All authorized users of TRACK Info Services's services proceeding are signifying an understanding of TRACK Info Services's searching and mapping conventions, and agree to waive any and all liability claims associated with search and map results showing incomplete and or inaccurate site locations.

Environmental FirstSearch
Site Information Report

Request Date:	09-10-03	**Search Type:**	COORD
Requestor Name:	Tim Thomas	**Job Number:**	A07242.01
Standard:	ASTM		**Filtered Report**

TARGET ADDRESS: LOWER SACARMENTO ROAD
LODI CA 95242

Demographics

Sites: 7 **Non-Geocoded:** 1 **Population:** NA

Radon: NA

Site Location

	Degrees (Decimal)	Degrees (Min/Sec)		UTMs
Longitude:	-121.307965	-121:18:29	**Easting:**	648336.225
Latitude:	38.113292	38:6:48	**Northing:**	4219531.295
			Zone:	10

Comment

Comment: AUGUST RERUN

Additional Requests/Services

Adjacent ZIP Codes: 0 Mile(s)

ZIP Code	City Name	ST	Dist/Dir	Sel

Services:

	Requested?	Date
Sanborns	No	
Aerial Photographs	No	
Topographical Maps	No	
City Directories	No	
Title Search	No	
Municipal Reports	No	
Online Topos	No	

Environmental FirstSearch
Sites Summary Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

TOTAL: 7 **GEOCODED:** 6 **NON GEOCODED:** 1 **SELECTED:** 7

ID	DB Type	Site Name/ID/Status	Address	Dist/Dir	Map ID
2	UST	BEACON #696 TISID-STATE42591/ACTIVE	800 12 LODI CA 95242	0.19 NE	1
4	LUST	BEACON #696 CASE #1 T0607700464/CASE CLOSED	2448 KETTLEMAN LN W LODI CA 95242	0.19 NE	1
3	UST	ULTRAMAR BEACON #696 SANJOAQUIN003855	2448 W KETTLEMAN LODI CA 95240	0.19 NE	1
1	RCRAGN	USA GASOLINE CORPORATION FACILITY 3 CAR000142166/SGN	2448 W KETTLEMAN LN LODI CA 95242	0.19 NE	1
5	LUST	SUNWEST LIQUORS CASE #1 T0607700834/CASE CLOSED	2449 KETTLEMAN LN W LODI CA 95242	0.26 NE	2
6	LUST	SUNWEST LIQUORS CASE #2 T0607700875/LEAK BEING CONFIRMED	2449 KETTLEMAN LN W LODI CA 95242	0.26 NE	2

Environmental FirstSearch
Sites Summary Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

TOTAL: 7 **GEOCODED:** 6 **NON GEOCODED:** 1 **SELECTED:** 7

ID	DB Type	Site Name/ID/Status	Address	Dist/Dir	Map ID
7	STATE	KETTLEMAN LANE COMMUNITY SCHOOL CAL39010017/NO FURTHER ACTION FO	2241/2247 WEST KETTLEMAN LANE LODI CA 95242	NON GC	

Environmental FirstSearch
Site Detail Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

REGISTERED UNDERGROUND STORAGE TANKS

SEARCH ID: 2 **DIST/DIR:** 0.19 NE **MAP ID:** 1

NAME:	BEACON #696	**REV:**	01/01/94
ADDRESS:	800 12	**ID1:**	TISID-STATE42591
	LODI CA	**ID2:**	
		STATUS:	ACTIVE
CONTACT:		**PHONE:**	

UST HISTORICAL DATA

This site was listed in the FIDS Zip Code List as a UST site. The Office of Hazardous Data Management produced the FIDS list. The FIDS list is an index of names & locations of sites recorded in various California State environmental agency databases. It is sorted by zip code and as an index, details regarding the sites were never included.

The UST information included in FIDS as provided by the Office of Hazardous Data Management was originally collected from the SWEEPS database. The SWEEPS database recorded Underground Storage Tanks and was maintained by the State Water Resources Control Board (SWRCB). That agency no longer maintains the SWEEPS database and last updated it in 1994. The last release of that 1994 database was in 1997.

Oversight of Underground Storage Tanks within California is now conducted by Certified Unified Program Agencies referred to as CUPA s. There are approximately 102 CUPA s and Local Oversight Programs (LOP s) in the State of California. Most are city or county government agencies. As of 1998, all sites or facilities with underground storage tanks were required by Federal mandate to obtain certification by designated UST oversight agencies (in this case, CUPA s) that the UST/s at their location were upgraded or removed in adherence with the 1998 RCRA standards.

Information from the FIDS/SWEEPS lists were included in this report search to help identify where underground storage tanks may have existed that were not recorded in CUPA databases or lists collected by Track Info Services. This may occur if a tank was removed prior to development of recent CUPA UST lists or never registered with a CUPA.

Environmental FirstSearch
Site Detail Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

LEAKING UNDERGROUND STORAGE TANKS

SEARCH ID: 4 **DIST/DIR:** 0.19 NE **MAP ID:** 1

NAME: BEACON #696 CASE #1
ADDRESS: 2448 KETTLEMAN LN W
LODI CA 95240
CONTACT:

REV: 12/11/02
ID1: T0607700464
ID2:
STATUS: CASE CLOSED
PHONE:

RELEASE DATA FROM THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD LUSTIS DATABASE
Please note that some data previously provided by the State Water Resources Control Board in the LUSTIS database is not currently being provided by the agency in the most recent edition. Incidents that occurred dating after the year 2000 may not have much information. Field headers with blank information following after should be interpreted as unreported by the agency.

LEAD AGENCY: *LOCAL AGENCY*
REGIONAL BOARD: *5S*
LOCAL CASE NUMBER: *1948*
RESPONSIBLE PARTY: *ULTRAMAR*
ADDRESS OF RESPONSIBLE PARTY: *525 THIRD ST W, HANFORD, CA 93232-0466*
SITE OPERATOR:
WATER SYSTEM:

CASE NUMBER: *390588*
CASE TYPE: *AQUIFER AFFECTED*
SUBSTANCE LEAKED: *GASOLINE*
SUBSTANCE QUANTITY:
LEAK CAUSE:
LEAK SOURCE:
HOW LEAK WAS DISCOVERED: *OTHER MEANS*
DATE DISCOVERED (blank if not reported):
HOW LEAK WAS STOPPED:
STOP DATE (blank if not reported):
STATUS: *CASE CLOSED*
ABATEMENT METHOD (please note that not all code translations have been provided by the reporting agency): *PUMP AND TREAT GROUND WATER- GENERALLY EMPLOYED TO REMOVE DISSOLVED CONTAMINANTS*
ENFORCEMENT TYPE (please note that not all code translations have been provided by the reporting agency): *NONE TAKEN*
DATE OF ENFORCEMENT (blank if not reported): *1/1/1965*

ENTER DATE (blank if not reported): *4/22/1991*
REVIEW DATE (blank if not reported): *11/2/1998*
DATE OF LEAK CONFIRMATION (blank if not reported):
DATE PRELIMINARY SITE ASSESSMENT PLAN WAS SUBMITTED (blank if not reported):
DATE PRELIMINARY SITE ASSESSMENT PLAN BEGAN (blank if not reported):
DATE POLLUTION CHARACTERIZATION PLAN BEGAN (blank if not reported):
DATE REMEDIATION PLAN WAS SUBMITTED (blank if not reported):
DATE REMEDIAL ACTION UNDERWAY (blank if not reported):
DATE POST REMEDIAL ACTION MONITORING BEGAN (blank if not reported):
DATE CLOSURE LETTER ISSUED (SITE CLOSED) (blank if not reported): *8/28/1997*
REPORT DATE (blank if not reported):

MTBE DATA FROM THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD LUSTIS DATABASE
MTBE DATE(Date of historical maximum MTBE concentration):
MTBE GROUNDWATER CONCENTRATION:
MTBE SOIL CONCENTRATION:
MTBE CNTS: *0*
MTBE FUEL: *1*
MTBE TESTED: *SITE NOT TESTED FOR MTBE. INCLUDES UNKNOWN AND NOT ANALYZED*
MTBE CLASS: *

Environmental FirstSearch
Site Detail Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

REGISTERED UNDERGROUND STORAGE TANKS

SEARCH ID: 3 **DIST/DIR:** 0.19 NE **MAP ID:** 1

NAME: ULTRAMAR BEACON #696
ADDRESS: 2448 W KETTLEMAN
LODI CA 95240
CONTACT:

REV: 08/27/99
ID1: SANJOAQUIN003855
ID2:
STATUS:
PHONE:

COUNTY OF SAN JOAQUIN UNDERGROUND TANKS LIST INFORMATION FOR TANK ID *TA194804*

Tank ID Number:	*TA194804*
Compliant (if blank undefined by agency):	*YES*
Tank Capacity:	*10000*
Tank Contents:	*001 UNLEADED*
Tank Billing Status:	*01*

COUNTY OF SAN JOAQUIN UNDERGROUND TANKS LIST INFORMATION FOR TANK ID *TA194805*

Tank ID Number:	*TA194805*
Compliant (if blank undefined by agency):	*YES*
Tank Capacity:	*10000*
Tank Contents:	*001 UNLEADED*
Tank Billing Status:	*01*

COUNTY OF SAN JOAQUIN UNDERGROUND TANKS LIST INFORMATION FOR TANK ID *TA194806*

Tank ID Number:	*TA194806*
Compliant (if blank undefined by agency):	*YES*
Tank Capacity:	*10000*
Tank Contents:	*002 LEADED*
Tank Billing Status:	*01*

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

RCRA GENERATOR SITE

SEARCH ID: 1 **DIST/DIR:** 0.19 NE **MAP ID:** 1

NAME:	USA GASOLINE CORPORATION FACILITY 3696	**REV:**	7/8/03
ADDRESS:	2448 W KETTLEMAN LN	**ID1:**	CAR000142166
	LODI CA 95242	**ID2:**	
		STATUS:	SGN
CONTACT:	CHUCK MILLER	**PHONE:**	818-865-9200

DETAILS NOT AVAILABLE

Environmental FirstSearch
Site Detail Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

LEAKING UNDERGROUND STORAGE TANKS

SEARCH ID: 5 **DIST/DIR:** 0.26 NE **MAP ID:** 2

NAME: SUNWEST LIQUORS CASE #1
ADDRESS: 2449 KETTLEMAN LN W
LODI CA 95242
CONTACT:

REV: 12/11/02
ID1: T0607700834
ID2:
STATUS: CASE CLOSED
PHONE:

RELEASE DATA FROM THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD LUSTIS DATABASE

Please note that some data previously provided by the State Water Resources Control Board in the LUSTIS database is not currently being provided by the agency in the most recent edition. Incidents that occurred dating after the year 2000 may not have much information. Field headers with blank information following after should be interpreted as unreported by the agency.

LEAD AGENCY: *LOCAL AGENCY*
REGIONAL BOARD: *5S*
LOCAL CASE NUMBER: *503357*
RESPONSIBLE PARTY: *ALAGNOS, JIN*
ADDRESS OF RESPONSIBLE PARTY: *2449 KETTLEMAN LN W, LODI, CA 95242*
SITE OPERATOR:
WATER SYSTEM:

CASE NUMBER: *391014*
CASE TYPE: *AQUIFER AFFECTED*
SUBSTANCE LEAKED: *GASOLINE*
SUBSTANCE QUANTITY:
LEAK CAUSE:
LEAK SOURCE:
HOW LEAK WAS DISCOVERED: *TANK CLOSURE*
DATE DISCOVERED (blank if not reported):
HOW LEAK WAS STOPPED:
STOP DATE (blank if not reported):
STATUS: *CASE CLOSED*
ABATEMENT METHOD (please note that not all code translations have been provided by the reporting agency):
ENFORCEMENT TYPE (please note that not all code translations have been provided by the reporting agency): *NONE TAKEN*
DATE OF ENFORCEMENT (blank if not reported): *1/1/1965*

ENTER DATE (blank if not reported): *8/4/1998*
REVIEW DATE (blank if not reported): *7/31/2002*
DATE OF LEAK CONFIRMATION (blank if not reported): *7/20/1998*
DATE PRELIMINARY SITE ASSESSMENT PLAN WAS SUBMITTED (blank if not reported):
DATE PRELIMINARY SITE ASSESSMENT PLAN BEGAN (blank if not reported):
DATE POLLUTION CHARACTERIZATION PLAN BEGAN (blank if not reported):
DATE REMEDIATION PLAN WAS SUBMITTED (blank if not reported):
DATE REMEDIAL ACTION UNDERWAY (blank if not reported):
DATE POST REMEDIAL ACTION MONITORING BEGAN (blank if not reported):
DATE CLOSURE LETTER ISSUED (SITE CLOSED) (blank if not reported): *11/2/1998*
REPORT DATE (blank if not reported):

MTBE DATA FROM THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD LUSTIS DATABASE

MTBE DATE(Date of historical maximum MTBE concentration): *8/27/1998*
MTBE GROUNDWATER CONCENTRATION: *120*
MTBE SOIL CONCENTRATION: *EQUAL TO 10*
MTBE CNTS: *2*
MTBE FUEL: *1*
MTBE TESTED: *YES*
MTBE CLASS:

Environmental FirstSearch
Site Detail Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

LEAKING UNDERGROUND STORAGE TANKS

SEARCH ID: 6 **DIST/DIR:** 0.26 NE **MAP ID:** 2

NAME: SUNWEST LIQUORS CASE #2
ADDRESS: 2449 KETTLEMAN LN W
LODI CA 95242
CONTACT:

REV: 12/11/02
ID1: T0607700875
ID2:
STATUS: LEAK BEING CONFIRMED
PHONE:

RELEASE DATA FROM THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD LUSTIS DATABASE
Please note that some data previously provided by the State Water Resources Control Board in the LUSTIS database is not currently being provided by the agency in the most recent edition. Incidents that occurred dating after the year 2000 may not have much information. Field headers with blank information following after should be interpreted as unreported by the agency.

LEAD AGENCY: *LOCAL AGENCY*
REGIONAL BOARD: *5S*
LOCAL CASE NUMBER: *5033571*
RESPONSIBLE PARTY: *SUNWEST LIQUORS*
ADDRESS OF RESPONSIBLE PARTY: *2449 KETTLEMAN LN W, LODI, CA 95242*
SITE OPERATOR:
WATER SYSTEM:

CASE NUMBER: *391059*
CASE TYPE: *AQUIFER AFFECTED*
SUBSTANCE LEAKED: *GASOLINE*
SUBSTANCE QUANTITY:
LEAK CAUSE:
LEAK SOURCE:
HOW LEAK WAS DISCOVERED: *SUBSURFACE MONITORING*
DATE DISCOVERED (blank if not reported):
HOW LEAK WAS STOPPED:
STOP DATE (blank if not reported):
STATUS: *LEAK BEING CONFIRMED*
ABATEMENT METHOD (please note that not all code translations have been provided by the reporting agency):
ENFORCEMENT TYPE (please note that not all code translations have been provided by the reporting agency): *NONE TAKEN*
DATE OF ENFORCEMENT (blank if not reported): *1/1/1965*

ENTER DATE (blank if not reported): *5/17/1999*
REVIEW DATE (blank if not reported):
DATE OF LEAK CONFIRMATION (blank if not reported): *4/27/1999*
DATE PRELIMINARY SITE ASSESSMENT PLAN WAS SUBMITTED (blank if not reported):
DATE PRELIMINARY SITE ASSESSMENT PLAN BEGAN (blank if not reported):
DATE POLLUTION CHARACTERIZATION PLAN BEGAN (blank if not reported):
DATE REMEDIATION PLAN WAS SUBMITTED (blank if not reported):
DATE REMEDIAL ACTION UNDERWAY (blank if not reported):
DATE POST REMEDIAL ACTION MONITORING BEGAN (blank if not reported):
DATE CLOSURE LETTER ISSUED (SITE CLOSED) (blank if not reported):
REPORT DATE (blank if not reported):

MTBE DATA FROM THE CALIFORNIA STATE WATER RESOURCES CONTROL BOARD LUSTIS DATABASE
MTBE DATE(Date of historical maximum MTBE concentration): *4/28/1999*
MTBE GROUNDWATER CONCENTRATION: *EQUAL TO 120*
MTBE SOIL CONCENTRATION: *EQUAL TO 10*
MTBE CNTS: *2*
MTBE FUEL: *1*
MTBE TESTED: *YES*
MTBE CLASS: *C*

Environmental FirstSearch
Site Detail Report

TARGET SITE: LOWER SACARMENTO ROAD
LODI CA 95242

JOB: A07242.01
AUGUST RERUN

STATE SITE

SEARCH ID: 7 **DIST/DIR:** NON GC **MAP ID:**

NAME: KETTLEMAN LANE COMMUNITY SCHOOL
ADDRESS: 2241/2247 WEST KETTLEMAN LANE
LODI CA 95242
SAN JOAQUIN
CONTACT:

REV: 04/30/03
ID1: CAL39010017
ID2:
STATUS: NO FURTHER ACTION FOR DTSC
PHONE:

OTHER SITE NAMES (blank below = not reported by agency)
SAN JOAQUIN COUNTY OFFICE OF EDUCATION

KETTLEMAN LANE COMMUNITY SCHOOL

GENERAL SITE INFORMATION
File Name (if different than site name): *KETTLEMAN LANE COMMUNITY SCHOOL*

Status: *NO FURTHER ACTION FOR DTSC*
AWP Site Type: *PROPOSED SCHOOL SITE PROPERTY*
NPL Site:
Fund:
Status Date: *10052001*
Lead: *DEPT OF TOXIC SUBSTANCES CONTROL*
Staff: *FLOPEZ2*
DTSC Region & RWQCB #: *SACRAMENTO*
Branch: *SCHOOL EVALUATION*
RWQCB:
Site Access:
Groundwater Contamination:
Number of Sources Contributing to Contamination at the Site: *0*

OTHER AGENCY ID NUMBERS (blank below = not reported by agency)
ID SOURCE NAME, & VALUE: *CALSTARS CODE 104152-11*

BACKGROUND INFORMATION (blank below = not reported by agency)
The 2.15-acre site is currently occupied by a vineyard and residence. The site has been used as agriculture farmland since at least 1939.

INFORMATION ON SPECIAL PROGRAMS THE SITE IS ASSOCIATED WITH (blank below = not reported by agency)

PROJECTED ACTIVITIES (blank below = not reported by agency)
Activity: *I/SE, IORSE, FFA, FFSRA, VCA, EA*
Activity Status: *NO FURTHER ACTION FOR DTSC*
Completion Due Date:
Revised Completion Due Date:
Date Activity Actually Completed: *12222000*
Yards of Solids Removed: *0*
Yards of Solids Treated: *0*
Gallons of Liquid Removed: *0*
Gallons of Liquid Treated: *0*

Activity: *PRELIMINARY ENDANGERMENT ASSESSMENT*

- Continued on next page -

STATE SITE

SEARCH ID: 7 **DIST/DIR:** NON GC **MAP ID:**

NAME:	KETTLEMAN LANE COMMUNITY SCHOOL	**REV:**	04/30/03
ADDRESS:	2241/2247 WEST KETTLEMAN LANE	**ID1:**	CAL39010017
	LODI CA 95242	**ID2:**	
	SAN JOAQUIN	**STATUS:**	NO FURTHER ACTION FOR DTSC
CONTACT:		**PHONE:**	

Activity Status:	*NO FURTHER ACTION FOR DTSC*
Completion Due Date:	
Revised Completion Due Date:	
Date Activity Actually Completed:	*10052001*
Yards of Solids Removed:	*0*
Yards of Solids Treated:	*0*
Gallons of Liquid Removed:	*0*
Gallons of Liquid Treated:	*0*

DTSC COMMENTS REGARDING THIS SITE (blank below = not reported by agency)

Comments Date: ***10052001***

: *DTSC approved the Preliminary Endangerment Assessment (PEA). Based on the information presented in the PEA, neither an actual a potential release of hazardous material, nor the presence of naturally occurring hazardous material indicated at the site pose a threat to human health or the environment under any land use. Therefore, DTSC concurred that no further environmental investigation or cleanup was required at this site, and approved the PEA. DTSC entered into an Environmental Oversight Agreement (Docket No. HSA-A 00/01-139) with San Joaquin County Office of Education to provide oversight for a Preliminary Endangerment Assessment for the proposed Kettleman Lane Community School Site.*

Environmental FirstSearch
Federal Databases and Sources

ASTM Databases:

CERCLIS: ***Comprehensive Environmental Response Compensation and Liability Information System.*** The EPA's database of current and potential Superfund sites currently or previously under investigation. Source: Environmental Protection Agency.

Updated quarterly.

CERCLIS-NFRAP (Archive): ***Comprehensive Environmental Response Compensation and Liability Information System Archived Sites.*** The Archive designation means that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL). This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Updated quarterly.

ERNS: ***Emergency Response Notification System.*** The EPA's database of emergency response actions. Source: Environmental Protection Agency. Data since January, 2001, has been received from the National Response Center as the EPA no longer maintains this data.

Updated quarterly.

FINDS: ***The Facility Index System.*** The EPA's Index of identification numbers associated with a property or facility which the EPA has investigated or has been made aware of in conjunction with various regulatory programs. Each record indicates the EPA office that may have files on the site or facility. Source: Environmental Protection Agency.

Updated semi-annually.

NPL: ***National Priority List.*** The EPA's list of confirmed or proposed Superfund sites. Source: Environmental Protection Agency.

Updated quarterly.

RCRIS: ***Resource Conservation and Recovery Information System.*** The EPA's database of registered hazardous waste generators and treatment, storage and disposal facilities. Included are RAATS (RCRA Administrative Action Tracking System) and CMEL (Compliance Monitoring & Enforcement List). Source: Environmental Protection Agency.

RCRA TSD: ***Resource Conservation and Recovery Information System Treatment, Storage, and Disposal Facilities.*** The EPA's database of RCRIS sites which treat, store, dispose, or incinerate hazardous waste. This information is also reported in the standard RCRIS detailed data.

ASTM Databases (continued):

RCRA COR: ***Resource Conservation and Recovery Information System Corrective Action Sites.*** The EPA's database of RCRIS sites with reported corrective action. This information is also reported in the standard RCRIS detailed data.

RCRA GEN: ***Resource Conservation and Recovery Information System Large and Small Quantity Generators.*** The EPA's database of RCRIS sites that create more than 100kg of hazardous waste per month or meet other RCRA requirements. Included are RAATS (RCRA Administrative Action Tracking System) and CMEL (Compliance Monitoring & Enforcement List).

RCRA NLR: ***Resource Conservation and Recovery Information System sites No Longer Regulated.*** The EPA's database of RCRIS sites that create less than 100kg of hazardous waste per month or do not meet other RCRA requirements.

All RCRA databases are Updated quarterly

Environmental FirstSearch
Federal Databases and Sources

Non-ASTM Databases:

HMIRS: ***Hazardous Materials Incident Response System.*** This database contains information from the US Department of Transportation regarding materials, packaging, and a description of events for tracked incidents.

Updated quarterly.

NCDB: ***National Compliance Database.*** The National Compliance Data Base System (NCDB) tracks regional compliance and enforcement activity and manages the Pesticides and Toxic Substances Compliance and Enforcement program at a national level. The system tracks all compliance monitoring and enforcement activities from the time an inspector conducts and inspection until the time the inspector closes or the case settles the enforcement action. NCDB is the national repository of the 10 regional and Headquarters FIFRA/TSCA Tracking System (FTTS). Data collected in the regional FTTS is transferred to NCDB to support the need for monitoring national performance of regional programs.

Updated quarterly

NPDES: ***National Pollution Discharge Elimination System.*** The EPA's database of all permitted facilities receiving and discharging effluents. Source: Environmental Protection Agency.

Updated semi-annually.

NRDB: ***National Radon Database.*** The NRDB was created by the EPA to distribute information regarding the EPA/State Residential Radon Surveys and the National Residential Radon Survey. The data is presented by zipcode in Environmental FirstSearch Reports. Source: National Technical Information Service (NTIS)

Updated Periodically

Nuclear: The Nuclear Regulatory Commission's (NRC) list of permitted nuclear facilities.

Updated Periodically

PADS: PCB Activity Database System
The EPA's database PCB handlers (generators, transporters, storers and/or disposers) that are required to notify the EPA, the rules being similar to RCRA. This database indicates the type of handler and registration number. Also included is the PCB Transformer Registration Database.

Updated semi-annually.

Receptors: 1995 TIGER census listing of schools and hospitals that may house individuals deemed sensitive to environmental discharges due to their fragile immune systems.

Updated Periodically

APPENDIX F

LIMITED SOILS INVESTIGATION

THE TWINING LABORATORIES, INC.
EST. 1898
ANALYTICAL CHEMISTRY • ENVIRONMENTAL SERVICES
GEOTECHNICAL ENGINEERING • SAMPLING SERVICES
CONSTRUCTION INSPECTION & MATERIALS TESTING

December 11, 2003 A07242.02

Mr. Jerry Neighbors
Browman Development Co.
100 Swan Way, Suite 206
Oakland, California 94621

Subject: **Limited Phase II Environmental Site Assessment**

Project: **Proposed Shopping Center**
Southwest Corner, Highway 12 and Lower Sacramento Road
Lodi, California

Dear Mr. Neighbors:

This letter has been prepared to document the results of the Limited Phase II Environmental Site Assessment (Phase II) conducted by The Twining Laboratories, Inc. (Twining) at the proposed shopping Center located at the southwest corner of Highway 12 and Sacramento Road in Lodi, California (site). The site location is indicated on Drawing 1. This letter includes a brief project background, purpose and scope, analytical results, evaluation, conclusions and recommendations.

Twining understands that the Browman Development Company (Browman) intends to develop the site as a shopping center. Information identified during the Phase I indicates that former uses of the site included farming. Twining subsequently obtained agricultural chemical use reports from the San Joaquin County Agricultural Commissioner's Office. Agricultural chemicals permitted for use on the site included MCPA, Dimethylamine, and Paraquat. Mr. John Batch, who leased the site for farming, indicated that only herbicides have been used at the site since 1996.

Based on the former agricultural use of the site, Browman has requested that Twining conduct a limited assessment to evaluate the presence of environmentally persistent agricultural chemicals including organochlorine pesticides, organophosphate pesticides, chlorophenoxyacid herbicides and paraquat in soil at the site.

SCOPE OF WORK

The purpose of this Phase II was to assess site soil for the presence of environmentally persistent agricultural chemicals.

On November 18, 2003, Twining advanced four hand-auger soil borings at the site to a depth of two feet for soil sample collection. The soil boring locations were located at roughly equal distances across the site. Soil samples were collected from each boring from a depth of six inches below site grade (bsg) and two feet bsg. Soil sampling locations are indicated on Drawing 2.

Soil samples collected from each of the soil borings were field screened consistent with Twining's Standard Operating Procedures (SOPs) attached to this report. Field screening procedures included observation of the soil for lithologic description, odor, and unusual stains.

The ends of the sample sleeves were covered with teflon tape and plastic end caps. The samples were then placed in an ice chest for transportation to Twining's state certified analytical laboratory under chain-of-custody documentation. The work was performed under the direction of a licensed California-registered geologist.

ANALYTICAL PROCEDURES

Four soil samples (the six-inch sample from each of borings B1 through B4) were analyzed in Twining's state certified analytical laboratory for organochlorine pesticides, organophosphate pesticides, and chlorophenoxyacid herbicides. A composite of these four samples were composited in the laboratory and subsequently analyzed for paraquat.

ANALYTICAL RESULTS

Analytical results for soil samples collected from borings B1, B2, B3 and B4 were reported as non-detect above the reporting limit for the analytes reported. Analytical results for samples collected from the site are summarized in Table 1 attached to this report.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of this investigation, Twining presents the following conclusions and recommendations.

- Analytical results indicated no detectable concentrations of constituents of concern for soil samples collected in agricultural areas of the site.

- No further assessment for agricultural chemicals in site soil is recommended.

LIMITATIONS

Twining's services are based on the assumption that Site conditions do not deviate from those reported to Twining. If variations are found, or undesirable conditions exist, Twining should be notified so that supplemental consideration may be provided.

Work performed by Twining will be for the sole use of the client. Any reliance on Twining's work by a third party is at such party's sole risk.

Geologic and hydrologic conditions may exist at the Site that cannot be identified solely by visual observation. Where subsurface assessment is performed, professional opinions are based on interpretation of data at discrete sampling locations which may not represent conditions at unsampled locations.

Twining is unable to predict events that may change the Site conditions after its professional services are performed. Therefore, Twining assumes no responsibility for conditions it was not authorized to evaluate, or conditions not generally recognized as predictable when services were performed.

Professional services performed by Twining were in accordance with generally-accepted engineering principles and practices in San Joaquin County at the time the services were performed. This warranty is in lieu of all other warranties, either expressed or implied.

CLOSING

Twining appreciates the opportunity to assist you on this project. If you have questions regarding this report, please contact Twining at (559) 268-7021.

Sincerely,

THE TWINING LABORATORIES, INC.
Environmental and Geological Services Division

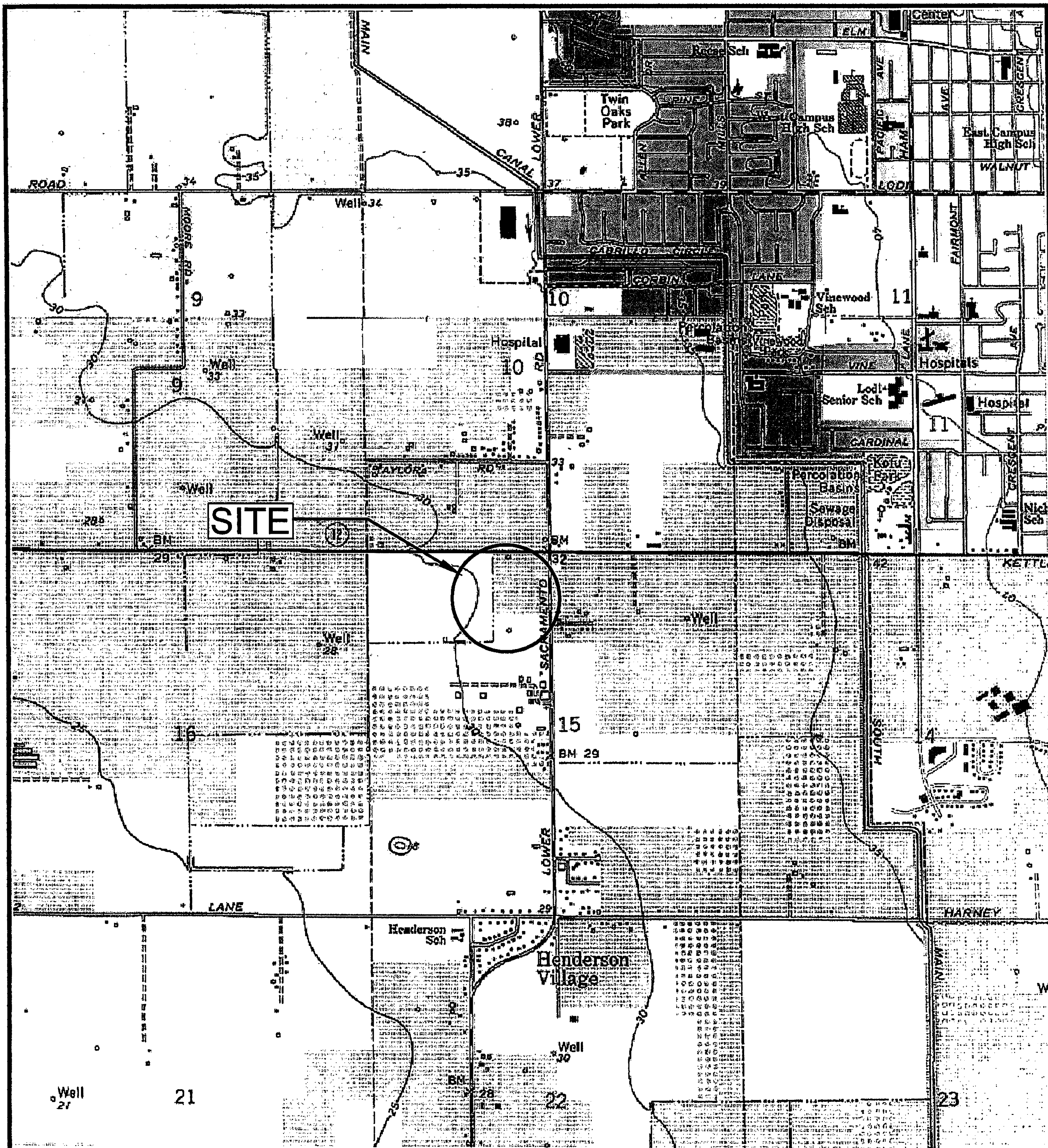
Jason R. Paul, RG 7557
Phase II Department Manager

Attachments: Table 1
Drawing 1
Drawing 2
SOPs
Chain-of-Custody Documentation, Laboratory Report of Analyses

Table 1
Summary of Soil Sample Analytical Results
Proposed Shopping Center - Southwest Corner Highway 12 and Lower Sacramento Road
Lodi, California

Sample ID	Date	Organochlorine Pesticides (mg/kg)	Organophosphate Pesticides (mg/kg)	Chlorophenoxy-acid Herbicides (mg/kg)	Paraquat (mg/kg)
B1 @ 6"	11/18/2003	<DL	<DL	<DL	NA
B2 @ 6"	11/18/2003	<DL	<DL	<DL	NA
B3 @ 6"	11/18/2003	<DL	<DL	<DL	NA
B4 @ 6"	11/18/2003	<DL	<DL	<DL	NA
CompB1,B2, B3,B4	11/18/2003	NA	NA	NA	<1.0*

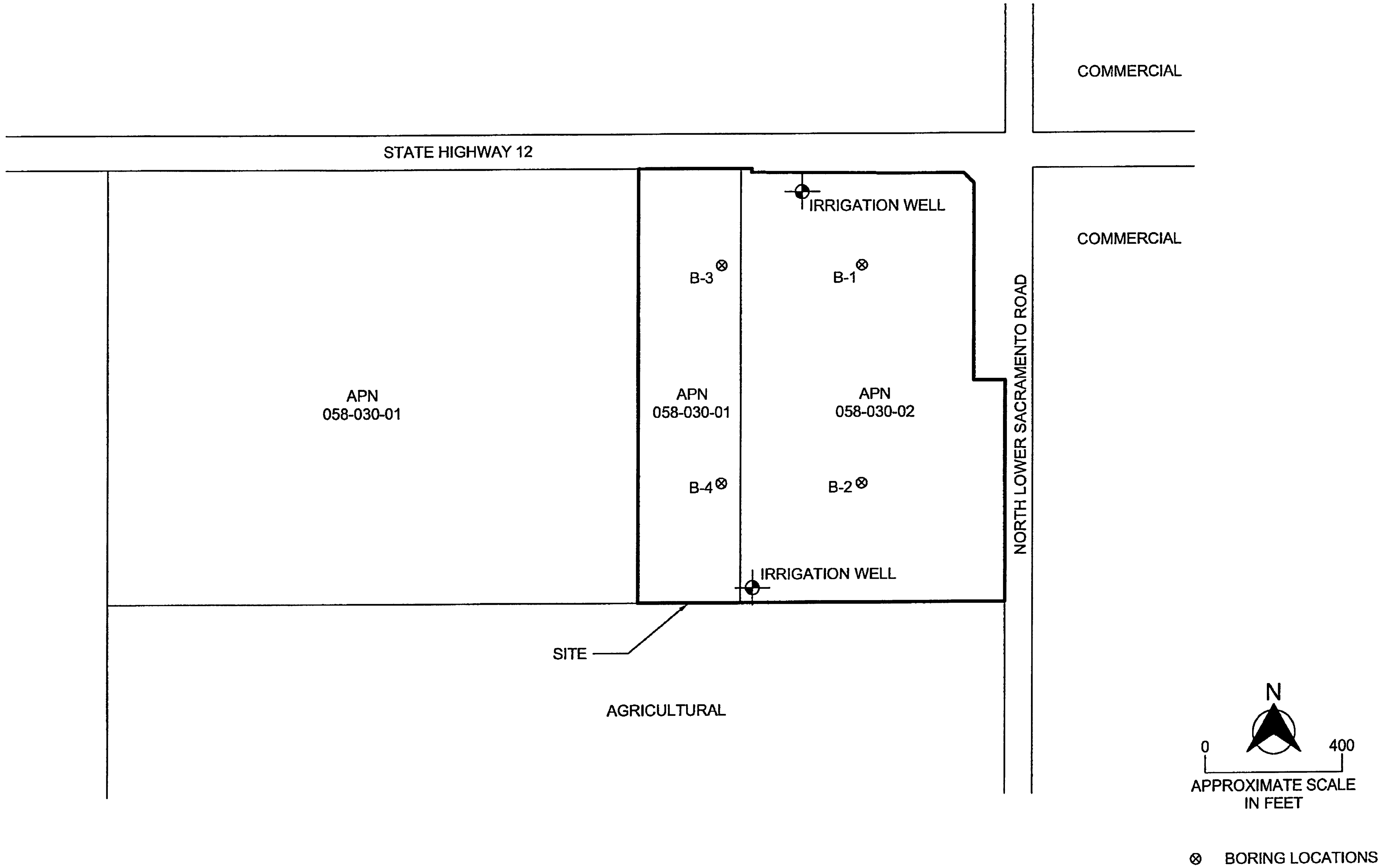
Notes:
< DL -- all results for this suite of analyses are less than the detection limits for reporting purposes for each analyte. Detection limits for individual analytes are listed in attached laboratory analytical reports.
< 1.0 -- results of analyses are less than the reporting limits for this analyte.
mg/kg -- milligrams per kilogram.
* -- Sample was received and analyzed 1 day past the observed hold time.



SOURCE: U.S.G.S. TOPOGRAPHIC MAP, 7 ½ MINUTE SERIES
LODI SOUTH, CALIFORNIA QUADRANGLE, PHOTOREVISED 1976

0 2000
APPROXIMATE SCALE IN FEET

SITE LOCATION MAP BROWMAN DEVELOPMENT SEC OF STATE HWY. 12 AND N. LOWER SACRAMENTO RD. LODI, CALIFORNIA	FILE NO.: 07242-01	DATE: 09/30/03	THE TWINING LABORATORIES, INC. EST. 1898 FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY
	DRAWN BY: WME	APPROVED BY:	
	PROJECT NO. A07242.01	DRAWING NO. 1	



SITE PLAN
BROWMAN DEVELOPMENT
SEC OF STATE HIGHWAY 12 AND NORTH LOWER SACRAMENTO ROAD
LODI, CALIFORNIA

FILE NO. 07242-01	DATE DRAWN: 09/30/03
DRAWN BY: WME	APPROVED BY:
PROJECT NO. A07242.02	DRAWING NO. 2

THE TWINING LABORATORIES, INC. EST. 1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/MONTEREY

THE TWINING LABORATORIES, INC.

STANDARD OPERATING PROCEDURES

This appendix contains the standard operating procedures used by The Twining Laboratories, Inc. (Twining) in performing investigations. Twining observes these procedures in order to obtain consistent, reliable data. The procedures used for this investigation included the following.

- Drilling and Soil Sampling
- Equipment Decontamination
- Sample Handling and Chain-of-Custody
- Laboratory Quality Assurance/Quality Control (QA/QC)

A-1 Standard Operating Procedures for Drilling and Soil Sampling: Subsurface assessment and/or well construction permits are filed with the appropriate government agency before conducting field operations. Underground Service Alert is notified at least 48 hours prior to initiation of field activities. Field activities are performed under the direction of a California registered geologist or certified professional engineer.

Soil borings are drilled using an appropriate method. The method selected will depend upon project objectives and subsurface conditions. Typically soil borings are drilled using a Central Mine Equipment Company model 75 (CME-75) truck-mounted drill rig equipped with 6-5/8-inch outside diameter, continuous-flight, hollow-stem augers. Twining is a licensed drilling contractor under C-57 classification (Contractor's License No. 506159). Soil borings may also be completed using hand auger equipment. The soil borings are drilled under the direction of a Twining geologist.

Drilling and sampling equipment are thoroughly cleaned before, during and after each use. Cleaning procedures are described in in a subsequent paragraph.

Soil samples are collected using a continuous-coring device, by driving a split-spoon sampler, or by grabbing samples from the drilling cutting returns. The sampler or coring device is lined with brass, stainless steel, or acrylic tubes, in which samples may be retained for subsequent chemical analyses. To collect samples using the split-spoon sampler, the sampler is initially lowered to the bottom of the soil boring and driven 6 inches into undisturbed soil. It is then driven 12 inches deeper by repeatedly dropping a 140-pound weight from a height of 30 inches. The number of blows required to advance the sampler 12 inches is recorded on the boring logs as "blows per foot". This information is used in estimating soil density. Soil samples are collected from hand-auger soil borings using a slide hammer and sampler lined with one brass or stainless-steel tube.

Soil samples are examined for the purpose of preparing lithologic logs Soils are logged consistent with the Unified Soil Classification System (USCS). The soil boring logs note soil types encountered at depth including consistency, soil moisture, particle size, color, and other distinguishing features.

The soil samples are field screened for evidence of contaminants. The field screening consists of visual observation for straining or free fluids, and unusual odor.

Generally, soil samples selected for analyses typically represent those which the field screening indicated will be most likely to contain the contaminant of concern. In most instances the deepest two samples and/or and sample collected from just above groundwater are selected for analyses. Samples intended for chemical analyses are sealed with Teflon tape and plastic end caps, labeled, placed on ice, and delivered to a laboratory, along with chain-of-custody documentation.

The soil borings may be completed as groundwater monitoring wells, or abandoned by grouting with a 6-sack cement slurry. Abandonment procedures depend upon the boring depth, depth to groundwater, project objectives, and regulatory requirements. For borings greater than 15 feet deep, grout is emplaced through the hollow augers or a tremie pipe which will extend to within 15 feet of the bottom of the boring. The slurry is pumped through the annulus in the hollow-stem augers or the tremie pipe. Backfill is placed in one continuous operation from the bottom to the top of the borehole. When the annulus/borehole fills with the slurry, auger flights or tremie pipe sections are removed (no more than 10 feet at a time) from the borehole, allowing the slurry to uniformly fill the borehole to the surface.

A-2 Standard Operating Procedures for Equipment Decontamination: Proper decontamination procedures reduce the potential for: cross-contamination among sample locations; and introduction of contamination from outside sources.

Before, during, and following drilling operations, drilling equipment is thoroughly cleaned using a high pressure hot water (steam) washer. Well casing, screen, end caps, and centralizers will also be cleaned using the steam washer.

Steam cleaning condensate will be containerized for later disposal. Generally, disposal will be the client's responsibility.

Sampling equipment and any tools, measuring devices, or other equipment which will contact soil, groundwater, or any media being assessed will be washed in a low-phosphate soap and water solution, and rinsed in clean water before each use. The type of soap used will depend upon project requirements.

A-3 Standard Operating Procedures for Sample Handling and Chain-of-Custody: Records are developed for samples which include: sampling date, sample type, location, job number, name of sampling personnel, and method of preservation. Each sample container is labeled immediately following collection. Sample containers are transported under custody seal. Chain-of-custody protocol, as described in United States Environmental Protection Agency, 1986, Test Methods for Evaluating Solid Waste, SW-846, Third Edition, is followed. Samples will be maintained at approximately 4°C. Upon arrival at the laboratory, the samples will be preserved for analysis as appropriate. Sample containers will be sealed with a custody seal during transport.

Samples may be delivered to Twining's chemistry laboratory in Fresno, California. The Twining representative in charge of the field work transport or direct the transportation of the samples and custody forms to the laboratory, where the samples are transferred to the sample control department. A receiving clerk, or an authorized analyst, signs the custody forms, present a duplicate copy to the Twining representative, and transfers the samples to a laboratory analyst. The condition of the custody seal will be annotated on the custody form in the "remarks" section. The laboratory manager retains possession of the custody forms during analyses of the samples.

The laboratory manager's responsibilities include monitoring the sample integrity within the laboratory. This involves assigning each sample a laboratory number and maintaining cross-reference between the sample's field and laboratory identifications. The analysts' responsibilities include maintaining accurate records of the samples analyzed along with the analytical data produced. This involves labeling chromatograms and maintaining the laboratory numbers on subsamples taken from the submitted samples, labeling glassware used in the analyses, and properly labeling sample extract containers with each sample's laboratory number.

Following analyses, the samples are transferred to a limited-access storage room. Chain-of-custody forms, chromatograms, and other pertinent information are filed for future reference. Splits of samples analyzed are kept for 30 days. Samples containing hazardous concentrations will be returned to the client for disposal.

A-4 Standard Operating Procedures for Laboratory Quality Assurance/Quality Control: These laboratory QA/QC procedures were developed to reduce outside interferences during analyses of samples. The laboratory director is responsible for creating and maintaining the program. General QA/QC procedures follow:

- Analytical instruments are serviced on a regular basis to assure accurate calibration;
- Organic-free water is monitored daily for quality;
- Gas chromatographs are calibrated daily;
- Method blanks are run to check whether the glassware and reagents are free of interference from chemicals that would invalidate the analyses;
- Standards are prepared using the applicable reference materials;
- Matrix spikes are analyzed in duplicate to validate the accuracy and precision of the method; and
- During groundwater sampling, a travel blank sample consisting of organic-free water is prepared and containerized in the laboratory, transported to the site, and handled and transported in the same manner as the groundwater samples.

THE TWINING LABORATORIES, INC.
EST. 1898
ANALYTICAL CHEMISTRY • ENVIRONMENTAL SERVICES
GEOTECHNICAL SERVICES • SAMPLING SERVICES
CONSTRUCTION INSPECTION & MATERIALS TESTING

ANALYTICAL CHEMISTRY DIVISION
PROJECT COVER SHEET

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.1-8

INVOICE # 70306237
PROJECT MANAGER: Mr. C. Skelton

ATTENTION : Mr. C. Skelton
CLIENT The Twining Laboratories, Inc.
2527 Fresno Street
Fresno, CA 93721

PROJECT INFO : Browman SWC Highway 12 and Lower Sacramento Road
PROJECT # : A07260.01

Please find enclosed the analytical results of your samples. In accordance with your instructions, the samples were analyzed for the components specified.

The Twining Laboratories is accredited by the State of California Department of Health Services for the analysis of Drinking Water, Wastewater and Hazardous Waste under Certificate No. 1371.

Please feel free to contact us if you have any questions or comments regarding the analyses or results. Thank you for allowing us to serve your analytical needs.

elw

Ronald J. Boquist
Director of Analytical Chemistry

Rev. 4 06/03 jau (COVER)

CORPORATE
2527 Fresno Street
Fresno, CA 93721-1804
(559) 268-7021
Fax 268-0740

MODESTO
5253 Jerusalem Court, Suite E
Modesto, CA 95356-9322
(209) 342-2061
Fax 579-1480

VISALIA
130 North Kelsey Street, #H6
Visalia, CA 93291-9000
(559) 651-8280
Fax 651-8288

BAKERSFIELD
3651 Pegasus Drive, #117
Bakersfield, CA 93308-6843
(661) 393-5088
Fax 393-4643

MONTEREY
501 Ortiz Avenue
Sand City, CA 93955-3553
(831) 392-1056
Fax 268-7126

SACRAMENTO
5675 Power Inn Road, Suite C
Sacramento, CA 95824-2313
(916) 381-9477
Fax 381-9478

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.1

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1057 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
DATE PREPARED : 11/19/03

REVIEWED BY: J. Ureno
DATE ANALYZED: 11/19/03
SAMPLE TYPE : Soil

CLIENT SAMPLE ID : B1 @6"

ORGANOPHOSPHATE PESTICIDES **METHOD: 8141** **UNIT:mg/kg**

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Thionazin (Zinophos)	ND	1.0	Fenchlorophos (Ronnel)	ND	0.50
Phosdrin (Mevinphos)	ND	0.50	Malathion	ND	0.25
Prophos (Ethoprop)	ND	0.10	Fenthion	ND	0.25
Dibrom (Naled)	ND	5.0	Parathion-Ethyl	ND	0.25
Phorate (Thimet)	ND	0.10	Chlorpyrifos (Dursban)	ND	0.25
Dimethoate	ND	0.25	Trichloronate	ND	0.25
Demeton-O	ND	0.25	Tetrachlorvinphos (Stirofos)	ND	1.0
Demeton-S	ND	0.25	Fensulfothion	ND	0.50
Disulfoton (Disyston)	ND	0.10	Sulprophos (Bolstar)	ND	0.25
Diazinon	ND	0.25	Guthion (Azinophos, Methyl)	ND	5.0
Parathion-Methyl	ND	0.50	Coumaphos (Co-Ral)	ND	1.0

Triphenylphosphate Surrogate	93 %	70-130 %

CALIFORNIA DEPARTMENT OF HEALTH SERVICES CERTIFICATE NO. 1371
ND: None Detected
DLR: Detection Limit for Reporting purposes
mg/kg: milligrams per kilogram, parts per million (ppm) concentration units

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.2

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1212 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
DATE PREPARED : 11/19/03

REVIEWED BY: J. Ureno
DATE ANALYZED: 11/19/03
SAMPLE TYPE : Soil

CLIENT SAMPLE ID : B2 @6"

ORGANOPHOSPHATE PESTICIDES **METHOD: 8141** **UNIT:mg/kg**

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Thionazin (Zinophos)	ND	1.0	Fenchlorophos (Ronnel)	ND	0.50
Phosdrin (Mevinphos)	ND	0.50	Malathion	ND	0.25
Prophos (Ethoprop)	ND	0.10	Fenthion	ND	0.25
Dibrom (Naled)	ND	5.0	Parathion-Ethyl	ND	0.25
Phorate (Thimet)	ND	0.10	Chlorpyrifos (Dursban)	ND	0.25
Dimethoate	ND	0.25	Trichloronate	ND	0.25
Demeton-O	ND	0.25	Tetrachlorvinphos (Stirofos)	ND	1.0
Demeton-S	ND	0.25	Fensulfothion	ND	0.50
Disulfoton (Disyston)	ND	0.10	Sulprophos (Bolstar)	ND	0.25
Diazinon	ND	0.25	Guthion (Azinophos, Methyl)	ND	5.0
Parathion-Methyl	ND	0.50	Coumaphos (Co-Ral)	ND	1.0

Triphenylphosphate Surrogate	103 %	70-130 %

CALIFORNIA DEPARTMENT OF HEALTH SERVICES CERTIFICATE NO. 1371
ND: None Detected
DLR: Detection Limit for Reporting purposes
mg/kg: milligrams per kilogram, parts per million (ppm) concentration units

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.3

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1244 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
DATE PREPARED : 11/19/03

REVIEWED BY: J. Ureno
DATE ANALYZED: 11/19/03
SAMPLE TYPE : Soil

CLIENT SAMPLE ID : B3 @6"

ORGANOPHOSPHATE PESTICIDES **METHOD: 8141** **UNIT:mg/kg**

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Thionazin (Zinophos)	ND	1.0	Fenchlorophos (Ronnel)	ND	0.50
Phosdrin (Mevinphos)	ND	0.50	Malathion	ND	0.25
Prophos (Ethoprop)	ND	0.10	Fenthion	ND	0.25
Dibrom (Naled)	ND	5.0	Parathion-Ethyl	ND	0.25
Phorate (Thimet)	ND	0.10	Chlorpyrifos (Dursban)	ND	0.25
Dimethoate	ND	0.25	Trichloronate	ND	0.25
Demeton-O	ND	0.25	Tetrachlorvinphos (Stirofos)	ND	1.0
Demeton-S	ND	0.25	Fensulfothion	ND	0.50
Disulfoton (Disyston)	ND	0.10	Sulprophos (Bolstar)	ND	0.25
Diazinon	ND	0.25	Guthion (Azinophos, Methyl)	ND	5.0
Parathion-Methyl	ND	0.50	Coumaphos (Co-Ral)	ND	1.0

Triphenylphosphate Surrogate	76 %	70-130 %

CALIFORNIA DEPARTMENT OF HEALTH SERVICES CERTIFICATE NO. 1371
ND: None Detected
DLR: Detection Limit for Reporting purposes
mg/kg: milligrams per kilogram, parts per million (ppm) concentration units

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.4

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1302 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
DATE PREPARED : 11/19/03

REVIEWED BY: J. Ureno
DATE ANALYZED: 11/19/03
SAMPLE TYPE : Soil

CLIENT SAMPLE ID : B4 @6"

ORGANOPHOSPHATE PESTICIDES **METHOD: 8141** **UNIT:mg/kg**

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Thionazin (Zinophos)	ND	1.0	Fenchlorophos (Ronnel)	ND	0.50
Phosdrin (Mevinphos)	ND	0.50	Malathion	ND	0.25
Prophos (Ethoprop)	ND	0.10	Fenthion	ND	0.25
Dibrom (Naled)	ND	5.0	Parathion-Ethyl	ND	0.25
Phorate (Thimet)	ND	0.10	Chlorpyrifos (Dursban)	ND	0.25
Dimethoate	ND	0.25	Trichloronate	ND	0.25
Demeton-O	ND	0.25	Tetrachlorvinphos (Stirofos)	ND	1.0
Demeton-S	ND	0.25	Fensulfothion	ND	0.50
Disulfoton (Disyston)	ND	0.10	Sulprophos (Bolstar)	ND	0.25
Diazinon	ND	0.25	Guthion (Azinophos, Methyl)	ND	5.0
Parathion-Methyl	ND	0.50	Coumaphos (Co-Ral)	ND	1.0

Triphenylphosphate Surrogate	109 %	70-130 %

CALIFORNIA DEPARTMENT OF HEALTH SERVICES CERTIFICATE NO. 1371
ND: None Detected
DLR: Detection Limit for Reporting purposes
mg/kg: milligrams per kilogram, parts per million (ppm) concentration units

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.1

DATE SAMPLED : 11/18/03 at 1057 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
REVIEWED BY : J. Ureno

DATE PREPARED : 11/19/03
DATE ANALYZED : 11/19/03

SAMPLE TYPE :Soil

CLIENT SAMPLE ID : B1@ 6"

ORGANOCHLORINE PESTICIDES

METHOD: EPA 8081

UNIT: mg/kg

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Aldrin	ND	0.05	Endrin	ND	0.05
alpha BHC	ND	0.05	Endrin Aldehyde	ND	0.05
beta BHC	ND	0.05	Endosulfan I	ND	0.05
delta BHC	ND	0.05	Endosulfan II	ND	0.05
gamma BHC (Lindane)	ND	0.05	Endosulfan Sulfate	ND	0.05
Chlordane	ND	0.05	Heptachlor	ND	0.05
p,p-DDD	ND	0.05	Heptachlor Epoxide	ND	0.05
p,p-DDE	ND	0.05	Methoxychlor	ND	0.05
p,p-DDT	ND	0.05	Toxaphene	ND	0.5
Dieldrin	ND	0.05			

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.2

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1212 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
REVIEWED BY : J. Ureno

DATE PREPARED : 11/19/03
DATE ANALYZED : 11/19/03

SAMPLE TYPE :Soil

CLIENT SAMPLE ID : B2 @6"

ORGANOCHLORINE PESTICIDES

METHOD: EPA 8081 **UNIT: mg/kg**

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Aldrin	ND	0.05	Endrin	ND	0.05
alpha BHC	ND	0.05	Endrin Aldehyde	ND	0.05
beta BHC	ND	0.05	Endosulfan I	ND	0.05
delta BHC	ND	0.05	Endosulfan II	ND	0.05
gamma BHC (Lindane)	ND	0.05	Endosulfan Sulfate	ND	0.05
Chlordane	ND	0.05	Heptachlor	ND	0.05
p,p-DDD	ND	0.05	Heptachlor Epoxide	ND	0.05
p,p-DDE	ND	0.05	Methoxychlor	ND	0.05
p,p-DDT	ND	0.05	Toxaphene	ND	0.5
Dieldrin	ND	0.05			

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.3

DATE SAMPLED : 11/18/03 at 1244 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
REVIEWED BY : J. Ureno

DATE PREPARED : 11/19/03
DATE ANALYZED : 11/19/03

SAMPLE TYPE :Soil

CLIENT SAMPLE ID : B3 @6"

ORGANOCHLORINE PESTICIDES

METHOD: EPA 8081 **UNIT: mg/kg**

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Aldrin	ND	0.05	Endrin	ND	0.05
alpha BHC	ND	0.05	Endrin Aldehyde	ND	0.05
beta BHC	ND	0.05	Endosulfan I	ND	0.05
delta BHC	ND	0.05	Endosulfan II	ND	0.05
gamma BHC (Lindane)	ND	0.05	Endosulfan Sulfate	ND	0.05
Chlordane	ND	0.05	Heptachlor	ND	0.05
p,p-DDD	ND	0.05	Heptachlor Epoxide	ND	0.05
p,p-DDE	ND	0.05	Methoxychlor	ND	0.05
p,p-DDT	ND	0.05	Toxaphene	ND	0.5
Dieldrin	ND	0.05			

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.4

DATE SAMPLED : 11/18/03 at 1302 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha
REVIEWED BY : J. Ureno

DATE PREPARED : 11/19/03
DATE ANALYZED : 11/19/03

SAMPLE TYPE :Soil

CLIENT SAMPLE ID : B4 @6"

ORGANOCHLORINE PESTICIDES

METHOD: EPA 8081

UNIT: mg/kg

CONSTITUENT	RESULT	DLR	CONSTITUENT	RESULT	DLR
Aldrin	ND	0.05	Endrin	ND	0.05
alpha BHC	ND	0.05	Endrin Aldehyde	ND	0.05
beta BHC	ND	0.05	Endosulfan I	ND	0.05
delta BHC	ND	0.05	Endosulfan II	ND	0.05
gamma BHC (Lindane)	ND	0.05	Endosulfan Sulfate	ND	0.05
Chlordane	ND	0.05	Heptachlor	ND	0.05
p,p-DDD	ND	0.05	Heptachlor Epoxide	ND	0.05
p,p-DDE	ND	0.05	Methoxychlor	ND	0.05
p,p-DDT	ND	0.05	Toxaphene	ND	0.5
Dieldrin	ND	0.05			

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.1

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1057 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha

REVIEWED BY: J. Ureno

DATE PREPARED : 11/21/03
DATE ANALYZED : 11/21/03

SAMPLE TYPE : Soil

CLIENT SAMPLE ID : B1 @6"

CHLOROPHENOXYACID HERBICIDE METHOD: 8151 UNITS: mg/kg

CONSTITUENT	RESULTS mg/kg	DLR mg/kg
2,4,5-T	ND	0.025
2,4-D	ND	0.25
2,4-DB	ND	0.25
Dalapon	ND	1.0
Dicamba	ND	0.025
Dichloroprop	ND	0.25
Dinoseb	ND	0.25
MCPA	ND	25
MCPP	ND	25
Silvex	ND	0.025
SURROGATE	% RECOVERY	ACCEPTABLE RECOVERY LIMITS
DCAA	67%*	70-130%

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes
*Low recovery due to matrix interference

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.2

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1212 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha

REVIEWED BY: J. Ureno

DATE PREPARED : 11/21/03
DATE ANALYZED : 11/21/03

SAMPLE TYPE : Soil

CLIENT SAMPLE ID : B2 @6"

CHLOROPHENOXYACID HERBICIDE METHOD: 8151 UNITS: mg/kg

CONSTITUENT	RESULTS mg/kg	DLR mg/kg
2,4,5-T	ND	0.025
2,4-D	ND	0.25
2,4-DB	ND	0.25
Dalapon	ND	1.0
Dicamba	ND	0.025
Dichloroprop	ND	0.25
Dinoseb	ND	0.25
MCPA	ND	25
MCPP	ND	25
Silvex	ND	0.025
SURROGATE	% RECOVERY	ACCEPTABLE RECOVERY LIMITS
DCAA	51%*	70-130%

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes
*Low recovery due to matrix interference

REPORT DATE : November 24, 2003
LABORATORY ID : 703-6237.3

THE TWINING LABORATORIES, INC.

DATE SAMPLED : 11/18/03 at 1244 by Tim Thomas
DATE RECEIVED : 11/18/03 at 1626 from Tim Thomas

CLIENT : TL / Environmental

ANALYZED BY : D. Vongkhampha

REVIEWED BY: J. Ureno

DATE PREPARED : 11/21/03
DATE ANALYZED : 11/21/03

SAMPLE TYPE : Soil

CLIENT SAMPLE ID : B3 @6"

CHLOROPHENOXYACID HERBICIDE METHOD: 8151 UNITS: mg/kg

CONSTITUENT	RESULTS mg/kg	DLR mg/kg
2,4,5-T	ND	0.025
2,4-D	ND	0.25
2,4-DB	ND	0.25
Dalapon	ND	1.0
Dicamba	ND	0.025
Dichloroprop	ND	0.25
Dinoseb	ND	0.25
MCPA	ND	25
MCPP	ND	25
Silvex	ND	0.025
SURROGATE	% RECOVERY	ACCEPTABLE RECOVERY LIMITS
DCAA	64%*	70-130%

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes
*Low recovery due to matrix interference

REPORT DATE	: November 24, 2003
LABORATORY ID	: 703-6237.4

THE TWINING LABORATORIES, INC.

DATE SAMPLED	: 11/18/03 at 1302 by Tim Thomas
DATE RECEIVED	: 11/18/03 at 1626 from Tim Thomas
CLIENT	: TL / Environmental
ANALYZED BY	: D. Vongkhampha
DATE PREPARED	: 11/21/03
DATE ANALYZED	: 11/21/03
CLIENT SAMPLE ID	: B4 @6"

REVIEWED BY: J. Ureno

SAMPLE TYPE : Soil

CHLOROPHENOXYACID HERBICIDE METHOD: 8151 UNITS: mg/kg

CONSTITUENT	RESULTS mg/kg	DLR mg/kg
2,4,5-T	ND	0.025
2,4-D	ND	0.25
2,4-DB	ND	0.25
Dalapon	ND	1.0
Dicamba	ND	0.025
Dichloroprop	ND	0.25
Dinoseb	ND	0.25
MCPA	ND	25
MCPP	ND	25
Silvex	ND	0.025
SURROGATE	% RECOVERY	ACCEPTABLE RECOVERY LIMITS
DCAA	69%*	70-130%

mg/kg: milligrams per kilogram (parts per million)
ND: None Detected DLR: Detection Limit for Reporting purposes
*Low recovery due to matrix interference

THE TWINING LABORATORIES, INC.
EST. 1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/SALINAS

ORGANOCHLORINE PESTICIDES
EPA METHOD 8151
MATRIX SPIKE
QUALITY CONTROL REPORT

Analyzed By: Dara P. Vongkhampha/Fernando Baguinguito | **Reviewed By: Joseph A. Ureno**

Date of Extraction: 11/21/2003 | **Date of Analysis: 11/21/2003**

Twining Laboratories, Inc. Run ID Number: TL04112103 | **Sample Matrix: SOIL** **Sample: 70306237.4**

Spike ID: WS 1938 | **COC Number: 70306237.1-4**

Constituent	Matrix Sample Concentration (mg/kg)	Matrix Spike Concentration Level (mg/kg)	Matrix Spike Recovery (mg/kg)	Matrix Spike Duplicate Recovery (mg/kg)	Acceptable Percent Recovery Range (%)		Matrix Spike Percent Recovery (%)	Matrix Spike Duplicate Percent Recovery (%)	Relative Percent Difference (%)
2,4 Dichlorophenoxyacetic acid (2,4 D)	0.003	0.07	0.04	0.04	32	102	50.0	51.5	2.7
2-(2,4,5-Trichlorophenoxy)propionic acid (Silvex)	0.001	0.07	0.02	0.02	26	74	28.8	31.8	9.5
2-(sec-butyl)-4,6--Dinitrophenol (Dinoseb)	0.000	0.07	0.02	0.02	10	74	31.8	33.3	4.7

EXPLANATIONS:

ND	Non-Detectable; the target analyte was not found above the detectable limit for reporting purposes (DLR).
mg/kg	micrograms per kilograms, parts per million (ppm) concentration units.
Matrix Sample:	The matrix sample is the sample chosen for use in the matrix spike analyses.
Matrix Spike:	A matrix spike is generated by adding the target analyte(s) into the sample noted above. The matrix spike sample is analyzed exactly like a regular sample, and its purpose is to determine whether the sample matrix has a measurable effect on precise and accurate analyte detection and quantification.

THE TWINING LABORATORIES, INC. EST. 1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/SALINAS

ORGANOCHLORINE PESTICIDES
EPA METHOD 8081
LABORATORY CONTROL SPIKE
QUALITY CONTROL REPORT

Analyzed By: Dara P. Vongkhampha/Fernando Baguinguito
Reviewed By: Joseph A. Ureno
Date of Extraction: 11/19/2003
Date of Analysis: 11/19/2003
Twining Laboratories, Inc. Run ID Number: TL04111903
Sample Matrix: Soil
Spike ID: WS 1919
COC Number: 70306237.1-4

Constituent	Method Blank Concentration (mg/kg)	Laboratory Control Spike Concentration Level (mg/kg)	Laboratory Control Spike Recovery (mg/kg)	Laboratory Control Spike Duplicate Recovery (mg/kg)	Acceptable Percent Recovery Range (%) Low	High	Laboratory Control Spike Percent Recovery (%)	Laboratory Control Spike Duplicate Percent Recovery (%)	Relative Percent Difference (%)
Lindane (Gamma-BHC)	0.001	0.042	0.047	0.045	64	126	112	107	4.3
Heptachlor	0.000	0.042	0.056	0.054	47	157	133	129	3.6
Dieldrin	0.000	0.042	0.045	0.043	62	124	107	102	4.5
Endrin	0.000	0.042	0.056	0.056	58	164	133	133	0.0

EXPLANATIONS

ND	Non-Detectable; the target analyte was not found above the detectable limit for reporting purposes (DLR).
mg/kg	milligrams per kilogram, parts per million (ppm) concentration units.
Method Blank:	The method blank is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents or equipment.
Laboratory Control Spike:	A laboratory control spike is generated by adding the target analyte(s) into a relatively inert matrix (sodium sulfate or distilled water). The laboratory control sample is analyzed exactly like a sample, and its purpose is to determine whether the methodology is controlled and the laboratory is capable of making precise and accurate measurements.

THE TWINING LABORATORIES, INC.
FRESNO/MODESTO/VISALIA/BAKERSFIELD/SALINAS
EST. 1898

ORGANOCHLORINE PESTICIDES
EPA METHOD 8081
MATRIX SPIKE
QUALITY CONTROL REPORT

Analyzed By: Dara P. Vongkhampha/Fernando Baguinguito
Reviewed By: Joseph A. Ureno
Date of Extraction: 11/19/2003
Date of Analysis: 11/19/2003
Twining Laboratories, Inc. Run ID Number: TL04111903
Sample Matrix: Soil **Sample: Sand**
Spike ID: WS 1919
COC Number: 70306237.1-4

Constituent	Matrix Sample Concentration (mg/kg)	Matrix Spike Concentration Level (mg/kg)	Matrix Spike Recovery (mg/kg)	Matrix Spike Duplicate Recovery (mg/kg)	Acceptable Percent Recovery Range (%) Low	High	Matrix Spike Percent Recovery (%)	Matrix Spike Duplicate Percent Recovery (%)	Relative Percent Difference (%)
Lindane (Gamma-BHC)	0.001	0.042	0.048	0.048	64	126	112	112	0.0
Heptachlor	0.000	0.042	0.054	0.055	47	157	129	131	1.8
Dieldrin	0.000	0.042	0.042	0.042	62	124	100	100	0.0
Endrin	0.000	0.042	0.052	0.052	58	164	124	124	0.0

EXPLANATIONS:

ND	Non-Detectable; the target analyte was not found above the detectable limit for reporting purposes (DLR).
mg/kg	milligrams per kilogram, parts per million (ppm) concentration units.
Matrix Sample:	The matrix sample is the sample chosen for use in the matrix spike analyses.
Matrix Spike:	A matrix spike is generated by adding the target analyte(s) into the sample noted above. The matrix spike sample is analyzed exactly like a regular sample, and its purpose is to determine whether the sample matrix has a measurable effec on precise and accurate analyte detection and quantification.

THE TWINING LABORATORIES, INC.
EST. 1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/SALINAS

ORGANOPHOSPHORUS PESTICIDES
EPA METHOD 8141 / 614
MATRIX SPIKE
QUALITY CONTROL REPORT

Analyzed By: Dara P. Vongkhampha/Fernando Baguinguito — **Reviewed By: Joseph A. Ureno**

Date of Extraction: 11/19/2003 — **Date of Analysis:11/19/2003**

Twining Laboratories, Inc. Run ID Number: TL02111903 — **Sample Matrix: 70306237.4** — **Sample: Sand**

Spike ID: WS 1943 — **COC Number: 70306237.1-4**

Constituent	Matrix Sample Concentration (mg/kg)	Matrix Spike Concentration Level (mg/kg)	Matrix Spike Recovery (mg/kg)	Matrix Spike Duplicate Recovery (mg/kg)	Acceptable Percent Recovery Range (%) Low	High	Matrix Spike Percent Recovery (%)	Matrix Spike Duplicate Percent Recovery (%)	Relative Percent Difference (%)
THIONAZIN	0.000	0.067	0.061	0.062	70%	130%	91.6%	93.1%	1.6%
DIMETHOATE	0.000	0.067	0.075	0.077	70%	130%	113%	116%	2.6%
DIAZINON	0.000	0.067	0.049	0.047	70%	130%	73.6%	70.6%	4.2%
DISULFOTON	0.000	0.067	0.056	0.058	70%	130%	84.1%	87.1%	3.5%
M-PARATHION	0.000	0.067	0.064	0.065	70%	130%	96.1%	97.6%	1.6%

EXPLANATIONS:

ND	Non-Detectable; the target analyte was not found above the detectable limit for reporting purposes (DLR).
mg/kg	milligrams per kilogram, parts per billion (ppm) concentration units.
Matrix Sample:	The matrix sample is the sample chosen for use in the matrix spike analyses.
Matrix Spike:	A matrix spike is generated by adding the target analyte(s) into the sample noted above. The matrix spike sample is analyzed exactly like a regular sample, and its purpose is to determine whether the sample matrix has a measurable effect on precise and accurate analyte detection and quantification.

THE TWINING LABORATORIES, INC.
EST. 1898
FRESNO/MODESTO/VISALIA/BAKERSFIELD/SALINAS

ORGANOPHOSPHORUS PESTICIDES
EPA METHOD 8141 / 614
LABORATORY CONTROL SPIKE
QUALITY CONTROL REPORT

Analyzed By: Dara P. Vongkhampha/Fernando Baguinguito
Date of Extraction: 11/19/2003
Twining Laboratories, Inc. Run ID Number: TL02111903
Spike ID: WS 1943

Reviewed By: Joseph A. Ureno
Date of Analysis:11/19/2003
Sample Matrix: 70306237.4
COC Number: 70306237.1-4

Constituent	Method Blank Concentration (mg/kg)	Laboratory Control Spike Concentration Level (mg/kg)	Laboratory Control Spike Recovery (mg/kg)	Laboratory Control Spike Duplicate Recovery (mg/kg)	Acceptable Percent Recovery Range (%) Low	High	Laboratory Control Spike Percent Recovery (%)	Laboratory Control Spike Duplicate Percent Recovery (%)	Relative Percent Difference (%)
THIONAZIN	0.00	0.07	0.06	0.06	70%	130%	96.1%	88.6%	8.1%
DIMETHOATE	0.00	0.07	0.06	0.06	70%	130%	96.1%	93.1%	3.2%
DIAZINON	0.00	0.07	0.06	0.05	70%	130%	84.1%	76.6%	9.3%
DISULFOTON	0.00	0.07	0.06	0.06	70%	130%	93.1%	90.1%	3.3%
M-PARATHION	0.00	0.07	0.07	0.07	70%	130%	104%	97.6%	6.0%

EXPLANATIONS:

ND	Non-Detectable; the target analyte was not found above the detectable limit for reporting purposes (DLR).
mg/kg	milligrams per kilogram, parts per billion (ppm) concentration units.
Method Blank:	The method blank is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents or equipment.
Laboratory Control Spike:	A laboratory control spike is generated by adding the target analyte(s) into a relatively inert matrix (sodium sulfate or distilled water). The laboratory control sample is analyzed exactly like a sample, and its purpose is to determine whether the methodology is controlled and the laboratory is capable of making precise and accurate measurements.

THE TWINING LABORATORIES, INC.

CHAIN OF CUSTODY/ANALYSIS REQUEST

COC # 7030 6237.1-8

2527 FRESNO STREET • FRESNO, CA 93721 • (559) 268-7021 FAX: (559) 268-0740

SUBMITTER INFORMATION:

REPORT TO: TL	SEND INVOICE TO: TL Env.	RESULTS RELEASED TO:
ADDRESS:	ADDRESS:	ADDRESS:
ATTENTION:	ATTENTION:	ATTENTION:
PH ( )	PH ( )	PH ( )
FAX ( )	FAX ( )	FAX ( )
	CONTRACT # OR P.O.:	

BACTERIOLOGICAL SAMPLE SOURCE
- ☐ PUBLIC SYSTEM
- ☐ PRIVATE WELL
- ☐ SURFACE WATER
- ☐ CONSTRUCTION ☐ OTHER

SAMPLE STATUS
- ☐ ROUTINE
- ☐ REPEAT
- ☐ OTHER

REPORTS FOR:
COUNTY: ☐ FRESNO ☐ KINGS ☐ MADERA ☐ MERCED ☐ TULARE
☐ STATE DEPT. OF HEALTH SERVICES ☐ OTHER:

SAMPLE INFORMATION:
SAMPLE BY (PRINT NAME): Tim Thomas
SIGNATURE: [signature]
☐ ROUTINE ANALYSIS
☒ RUSH ANALYSIS, RESULTS NEEDED BY: 48 hr – 5 day

PROJECT:
SITE: Brouwer SWC Highway 12 and Lower Sacramento Road
PROJECT #: A07260.01
PROJECT MANAGER: Chris Skelton

KEY FOR CHEMICAL ANALYSIS SAMPLE TYPE
BS - Biosolids
DW - Drinking Water
GW - Ground Water
SF - Surface Water
SL - Soil/Solid
ST - Storm Water
WW - Waste Water

ANALYSIS REQUESTED

LAB USE	SAMPLE ID	DATE	TIME	TYPE	EPA 8081	EPA 8141 Phosphate	Hold	EPA 8151 Added 11/20/03						(LAB USE - BOTTLES)
1	B1@6"	11/18/03	10:57	SS	X	X		X		(1-4) SL ∅ ORI				
5	B1@2'		11:07				X							
2	B2@6"		12:12		X	X		X						
6	B2@2'		12:17				X							
3	B3@6"		12:44		X	X		X		(5-8) SL ∅ HOLD				
7	B3@2'		12:53				X							
4	B4@6"		13:02		X	X		X						
8	B4@2'		13:07				X							

COMMENTS:

RELINQUISHED BY	COMPANY	DATE	TIME	RECEIVED BY	COMPANY
Timothy Thomas	TL	11/18/03	4:26	[signature]	TL

THE TWINING LABORATORIES, INC.
ANALYTICAL CHEMISTRY • ENVIRONMENTAL SERVICES
GEOTECHNICAL SERVICES • SAMPLING SERVICES
CONSTRUCTION INSPECTION & MATERIALS TESTING
EST. 1898

ANALYTICAL CHEMISTRY DIVISION
PROJECT COVER SHEET

REPORT DATE : December 10, 2003 INVOICE # 70306451
LABORATORY ID : 703-6451.1 **PROJECT MANAGER: CHRIS SKELTON**

ATTENTION : Mr. Chris Skelton
CLIENT The Twining Laboratories, Inc.
2527 Fresno Street
Fresno, CA 93721

PROJECT INFO : BROWMAN SWC HWY 12 + LOWER SAC
PROJECT # : A07260.01

Please find enclosed the analytical results of your samples. In accordance with your instructions, the samples were analyzed for the components specified.

The Twining Laboratories is accredited by the State of California Department of Health Services for the analysis of Drinking Water, Wastewater and Hazardous Waste under Certificate No. 1371.

We are in receipt of a faxed copy of the Paraquat analysis report from the subcontractor laboratory. We will send the final report to you via mail upon receipt to our laboratory.

Please feel free to contact us if you have any questions or comments regarding the analyses or results. Thank you for allowing us to serve your analytical needs.

ljt

THE TWINING LABORATORIES, INC.

Ronald J. Boquist
Director of Analytical Chemistry

Rev. 4 06/03 jau (COVER)

CORPORATE 2527 Fresno Street, Fresno, CA 93721-1804, (559) 268-7021, Fax 268-0740
MODESTO 5253 Jerusalem Court, Suite E, Modesto, CA 95356-9322, (209) 342-2061, Fax 579-1480
VISALIA 130 North Kelsey Street, #H6, Visalia, CA 93291-9000, (559) 651-8280, Fax 651-8288
BAKERSFIELD 3651 Pegasus Drive, #117, Bakersfield, CA 93308-6843, (661) 393-5088, Fax 393-4643
MONTEREY 501 Ortiz Avenue, Sand City, CA 93955-3553, (831) 392-1056, Fax 268-7126
SACRAMENTO 5675 Power Inn Road, Suite C, Sacramento, CA 95824-2313, (916) 381-9477, Fax 381-9478

NORTH COAST LABORATORIES LTD

December 08, 2003

The Twining Lab, Inc.
2527 Fresno St
Fresno, CA 93721

Attn: Client Services

RE:

Order No.: 0312088
Invoice No.: 38512
PO No.:
ELAP No. 1247-Expires July 2004

SAMPLE IDENTIFICATION

Fraction	Client Sample Description
01A	COMP B1,B2,B3,B4 @ 6" (70306451)

ND = Not Detected at the Reporting Limit
Limit = Reporting Limit
All solid results are expressed on a wet-weight basis unless otherwise noted.

REPORT CERTIFIED BY

Laboratory Supervisor(s)

QA Unit

Jesse G. Chaney, Jr.
Laboratory Director

North Coast Laboratories, Ltd. **Date:** *08-Dec-03*

CLIENT:	The Twining Lab, Inc.
Project:	
Lab Order:	0312088

CASE NARRATIVE

Paraquat:
Although there is no official holding time for paraquat in soil, NCL observes a 14 day holding time to keep within guidelines established by EPA SW-846. The sample was received and analyzed 1 day past the observed holding time.

NORTH COAST LABORATORIES
5680 West End Road • Arcata, California 95521-9202 • 707-822-4649 • FAX 707-822-6831

Date: 08-Dec-03
WorkOrder: 0312088

ANALYTICAL REPORT

Client Sample ID: COMP B1,B2,B3,B4 @ 6" (70306451) **Received:** 12/3/03 **Collected:** 11/18/03 0:00
Lab ID: 0312088-01A

Test Name: Paraquat **Reference:** Chevron RM8-10

Parameter	Result	Limit	Units	DF	Extracted	Analyzed
Paraquat	ND	1.0	µg/g	1.0	12/3/03	12/6/03

NORTH COAST LABORATORIES
5680 West End Road • Arcata, California 95521-9202 • 707-822-4649 • FAX 707-822-6831

North Coast Laboratories, Ltd.

Date: 08-Dec-03

CLIENT: The Twining Lab, Inc.
Work Order: 0312088
Project:

QC SUMMARY REPORT

Method Blank

Sample ID **MB-10407** Batch ID: **10407** Test Code: **PARAQS** Units: **µg/g** Analysis Date **12/5/03** Prep Date **12/3/03**

Client ID: Run ID: **OLSPEC_031205A** SeqNo: **388014**

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Paraquat	ND	1.0									

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank

North Coast Laboratories, Ltd.

Date: 08-Dec-03

CLIENT: The Twining Lab, Inc.
Work Order: 0312088
Project:

QC SUMMARY REPORT

Laboratory Control Spike

Sample ID LCS-10407 | Batch ID: 10407 | Test Code: PARAQS | Units: µg/g | Analysis Date 12/5/03 | Prep Date 12/3/03
Client ID: | Run ID: OLSPEC_031205A | SeqNo: 388015

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Paraquat	4.212	1.0	5.00	0	84.2%	56	103	0			

Sample ID LCSD-10407 | Batch ID: 10407 | Test Code: PARAQS | Units: µg/g | Analysis Date 12/5/03 | Prep Date 12/3/03
Client ID: | Run ID: OLSPEC_031205A | SeqNo: 388016

Analyte	Result	Limit	SPK value	SPK Ref Val	% Rec	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Paraquat	4.184	1.0	5.00	0	83.7%	56	103	4.21	0.669%	20	

Qualifiers: ND - Not Detected at the Reporting Limit; J - Analyte detected below quantitation limits; S - Spike Recovery outside accepted recovery limits; R - RPD outside accepted recovery limits; B - Analyte detected in the associated Method Blank

THE TWINING LABORATORIES, INC.

CHAIN OF CUSTODY/ANALYSIS REQUEST

COC # 70306451

2527 FRESNO STREET • FRESNO, CA 93721 • (559) 268-7021 FAX: (559) 268-0740

SUBMITTER INFORMATION:		
REPORT TO: Env	SEND INVOICE TO:	RESULTS RELEASED TO:
ADDRESS:	ADDRESS:	ADDRESS:
ATTENTION:	ATTENTION:	ATTENTION:
PH ( )	PH ( )	PH ( )
FAX ( )	FAX ( )	FAX ( )
	CONTRACT # OR P.O.	

BACTERIOLOGICAL SAMPLE SOURCE

- ☐ PUBLIC SYSTEM
- ☐ PRIVATE WELL
- ☐ SURFACE WATER
- ☐ CONSTRUCTION ☐ OTHER

SAMPLE STATUS

- ☐ ROUTINE
- ☐ REPEAT
- ☐ OTHER

REPORTS FOR:

COUNTY: ☐ FRESNO ☐ KINGS ☐ MADERA ☐ MERCED ☐ TULARE

☐ STATE DEPT. OF HEALTH SERVICES ☐ OTHER:

SAMPLE INFORMATION:

SAMPLE BY (PRINT NAME): Tim Thomas

SIGNATURE:

☐ ROUTINE ANALYSIS

☒ RUSH ANALYSIS, RESULTS NEEDED BY: 12/10/03

PROJECT:

SITE: Browman SWC Hwy12 + Lower Sac

PROJECT #: A07260.01

PROJECT MANAGER: Chris Skelton

KEY FOR CHEMICAL ANALYSIS SAMPLE TYPE

BS - Biosolids | GW - Ground Water | SL - Soil/Solid | DW - Drinking Water | SF - Surface Water | ST - Storm Water | WW - Waste Water

ANALYSIS REQUESTED

LAB USE	SAMPLE ID	SAMPLE DATE	SAMPLE TIME	SAMPLE TYPE	Paraquot										(LAB USE - BOTTLES)
	Comp B1, B2, B3, B4 @ 6"	11/18		SL	X										

COMMENTS: Sample four part comp, B1@6" B2@6" B3@6" B4@6"
Comp in Lab 12/2/03
From COC # ~~62~~ 70306237

RELINQUISHED BY	COMPANY	DATE	TIME	RECEIVED BY	COMPANY
		12/2/03		[signature]	TL

Note: The biological and cultural resources reports are not reproduced here since they are contained in Appendix E and F of this volume.