Approved as to Form and Legality

# OAKLAND CITY COUNCIL

City Attorney

OFFICE OF THE CITY CLERK

2006 NOV 30 PM 5:28

**RESOLUTION NO. DRAFT C.M.S.**

Introduced by Councilmember _____

**A RESOLUTION ESTABLISHING A TRAFFIC IMPACT FEE (TIF) PURSUANT TO ADOTION AND IMPLEMENTATION OF THE TRAFFIC IMPACT PROGRAM (TIP) FOR THE SOUTHEASTERN PORTION OF THE CITY OF OAKLAND, INCLUDING THE ADOPTION AND IMPOSITION OF TRAFFIC IMPACT FEES (TIF) AND DESIGNATED PROJECTS FOR FY 2007-09**

**WHEREAS,** the purpose of this implementing resolution is to establish the amount of Traffic Impact Fee (TIF) to be imposed upon development projects within the city of Oakland, for the purpose of mitigating the impacts caused by development upon the City's traffic and transportation infrastructure and facilities; and

**WHEREAS,** the City is authorized to adopt and impose traffic impact fees upon development projects pursuant to article XI, section 7 of the California Constitutions; California Government Code sections 66000, *et seq* (hereinafter "Mitigation Fee Act"); and

**WHEREAS,** Oakland Municipal Code (OMC) Title X, Chapter 70, titled Traffic Impact Program has been adopted by the City to establish the procedures by which the City charges the traffic impact fee; and

**WHEREAS,** condition No. 26 and Settlement Agreement of the Leona Quarry development project, as outlined in Resolution No. 78358 C.M.S. (Resolution approving the application of the DeSilva Group to close the Leona Quarry, and reclaim it and redevelop the site for 477 residential units at 7100 Mountain Boulevard in compliance with Alameda Superior Court order [Action No. RG-03077607)] requires the establishment of a Traffic Impact Fee and Traffic Impact Fee; and

**WHEREAS**, pursuant to the California Environmental Quality Act (CEQA) on February 17, 2004, by Resolution 78359, the City certified an Environmental Impact Report (EIR) which adequately analyzed the impacts of the improvements contemplated by this Resolution, including the creation of fee programs to require new development in the Southeast area of Oakland to fund their proportional fair share of the cost of acquiring and improving public facilities, including traffic and transportation improvements; and

**WHEREAS,** Fehr & Peers Associates has prepared a transportation impact fee study dated September 2006 (Nexus Report), attached as Exhibit A, and hereby incorporated by reference, that provides the technical basis for implementation of a TIF and TIP in the Southeast Oakland area documenting the analytical approach for determining the nexus between the cost of improvements and the local traffic impact created by anticipated development in the Southeast Oakland area along with a traffic and fair-share cost analysis conducted to equitably distribute the costs of the necessary improvements to development that causes the impacts, per the provisions of the Mitigation Fee Act; and

**WHEREAS,** in accordance with Government Code section 66016, at least 14 days prior to the public hearing at which the City Council first considered the adoption of this Resolution, notice of time and place of the hearing was mailed to eligible interested parties; and

**WHEREAS,** in accordance with Government Code section 66016, the Nexus Report was available for public review and comment for 10 days prior to the public hearing at which the City Council first considered the adoption of the this Resolution; and

**WHEREAS,** ten (10) days advance notice of the public hearing at which the City Council first considered the adoption of this Resolution was given by publication in accordance with Section 6062(a) of the Government Code; and

**WHEREAS;** the record establishes and the City Council finds as follows:

1. That the purpose of the TIF set forth in this Resolution is to mitigate the traffic impacts of new development within the study area, by developing an overall transportation system that will accommodate the expected future traffic demand.

2. That the revenues from the Southeast Oakland TIF and TIP will be used to used to fund capital improvement projects necessary to accommodate future traffic demand in the study area. These projects include such improvements as the installation and coordination of traffic signals, the provision of additional turn lanes, and/or the reconfiguration of lane geometries at nine different intersections throughout the study area.

3. There is a reasonable relationship between the fee's use and the type of development generate traffic with different characteristics and the nexus analysis presented in the technical study accounts for the differential impact on the local street system caused by different development types.

4. That there is a reasonable relationship between the need for the facilities and the type of development on which the fee is imposed by determining that implementation of the improvements would return the traffic operations at the affected intersections to within the City's standards and that there are no existing deficiencies on any of the facilities to be included in this TIF program, indicating that the need for improvements at these locations is attributable to traffic generated by new development.

5. That there is a reasonable relationship between the amount of the fee and the cost of the public facility to ensure that all reasonably anticipated cost elements have been accounted for, thus ensuring that implementation of the improvements will be supported by the fee revenues received. The projected costs are then distributed among the different development types in proportion to their respective traffic generating characteristics, resulting in the proposed fee for each land use category. now, therefore be it

**RESOLVED:** that the city hereby finds that the facts set forth in recitals to this implementing resolution are true and correct, and establish the factual basis for the adoption of the Traffic Impact Fee (TIF); and be it

**FURTHER RESOLVED:** that the City Council hereby finds that the facts and analyses described in the report titled "Southeast Oakland Traffic Improvement Fee Study" (Exhibit A), including all technical reports incorporated by reference satisfy the requirements of the Mitigation Fee Act; and be it

**FURTHER RESOLVED:** that the City Council hereby adopts the Traffic Impact Fee for each identified land use category identified in Exhibit A as follows:

**TABLE 1**
**PRELIMINARY SOUTHEAST OAKLAND TIF AND TIP FEE CALCULATIONS**

| Land Use Category | Fee/Unit |
|---|---|
| Single-Family Residential | $3,160/Unit |
| Other Residential | $2,440/Unit |
| Retail | $5.89/Square Foot |
| Service | $3.12/Square Foot |
| Manufacturing | $1.44/Square Foot |

Source: Fehr & Peers, 2006.

; and be it

**FURTHER RESOLVED:** that the City Council hereby adopts the following Traffic Impact Fee project and cost estimates as follows:

**TABLE 2**
**COST ESTIMATES FOR SOUTHEAST OAKLAND TIF/TIP IMPROVEMENTS**

| Location | Cost Estimate |
|---|---|
| 1 and 2. I-580 WB On-Ramp/Edwards Avenue and I-580 EB Off-Ramp/Edwards Avenue | $961,300 |
| 4. Greenly Drive/Edwards Avenue | $107,800 |
| 6. MacArthur Boulevard/73rd Avenue | $622,300 |
| 7. Mountain Boulevard/Keller Avenue | $823,200 |
| 8. Mountain Boulevard/I-580 WB Off-Ramp/Shone Avenue | $409,100 |
| 9. I-580 EB Off-Ramp/Keller Avenue | $411,400 |
| 16. I-580 WB Off-Ramp/Seminary Avenue/Kuhnle Avenue | $757,000 |
| 18. I-580 EB Off-Ramp/Overdale Avenue/Seminary Avenue | $417,600 |
| A. Study of Edwards Avenue and Seminary Avenue operational improvements | $350,000 |
| **Total Cost of Improvements** | **$4,859,700** |

; and be it

**FURTHER RESOLVED:** that as funding is collected and/or allocated for each of the projects listed for the TIF, the Development Director will submit projects to the City Council for their approval through the Capital Improvement Program (CIP) budget process, under the heading of Traffic Impact Program projects; and be it

**FURTHER RESOLVED:** that the Development Director my move funds between individual TIF projects already approved by the City Council without the need for additional Council authorization to ensure the most effective and efficient implementation timeline for each of the traffic impact program projects; and be it

**FURTHER RESOLVED:** that any projects that has acquired or will acquire a vested right to develop under California law prior to the enactment of this resolution shall not be required to pay the TIF; and be it

**FURTHER RESOLVED:** that the fees established by this resolution shall become effective 60 days following its enactment contingent upon the adoption of the enabling ordinance Title 10 Vehicles And Traffic, Chapter 70 Southeast Oakland Area Traffic Impact Fee

IN COUNCIL, OAKLAND, CALIFORNIA, _____, 20_____

**PASSED BY THE FOLLOWING VOTE:**

AYES - BROOKS, BRUNNER, CHANG, KERNIGHAN, NADEL, QUAN, REID, and PRESIDENT DE LA FUENTE

NOES -

ABSENT -

ABSTENTION -

ATTEST: DRAFT
_____
LaTonda Simmons
City Clerk and Clerk of the Council
of the City of Oakland, California

FEHR & PEERS
TRANSPORTATION CONSULTANTS

*Final Draft Report*

# Southeast Oakland Traffic Improvement Fee Study

*September 2006*

***Prepared for:***
***City of Oakland***

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# 1. INTRODUCTION

## BACKGROUND

Pursuant to the *Mitigation Fee Act*, California Government Code Section 66000, et seq. (also known as AB 1600), a local agency is authorized to charge a fee to development applicants in connection with approval of a development project for the purpose of defraying all or a portion of the costs of public facilities related to the development project. The capital improvements funded through a fee program are typically those required to mitigate the traffic impacts of new development within the study area. *Specifically, the purpose of the fee is to maintain adequate level of service standards at intersections* throughout the study area. The fee is not imposed to improve or correct deficiencies in baseline service levels, or to mitigate the impacts of regional (through) traffic.

Transportation impact fees are commonly collected in many jurisdictions in the Bay Area and throughout California to aid in financing transportation infrastructure required by new development. Currently, the *City of Oakland does not collect transportation-related impact fees for new developments.* For comparison and reference purposes, Appendix A includes a summary of impact fee programs in a selection of northern California cities.

## PURPOSE

The purpose of this study is to provide the technical basis for implementation of a Traffic Improvement Fee (TIF) and Traffic Improvement Program (TIP) in the Southeast Oakland area. The TIF and TIP will constitute a funding mechanism for traffic improvements required to mitigate cumulative traffic impacts in the Southeast Oakland area, as documented in the Leona Quarry Environmental Impact Report. Development of a TIF and TIP is required as part of the Conditions of Approval (see Condition #26) for the Leona Quarry project, and is also addressed in the Leona Quarry Settlement Agreement executed in December 2003.

This report documents the analytical approach for determining the nexus between the cost of improvements and the local traffic impact created by anticipated development in the Southeast Oakland area. A traffic and fair-share cost analysis is conducted to equitably distribute the costs of the necessary improvements to development that causes the impacts, per the provisions of AB 1600.

## USE OF THE TRAFFIC MITIGATION FEE

AB 1600 requires that *mitigation fee programs comply with certain basic requirements, including:*

- Identifying the purpose of the fee
- Identifying how the fee will be used and the facilities to be funded through the fee
- Determining a reasonable relationship between the fee's use and the type of development on which the fee is imposed

- Determining a reasonable relationship between the need for the public facility and the type of development on which the fee is imposed

- Determining a reasonable relationship between the amount of the fee and the cost of the public facility (or portion of facility) attributable to new development

These items are addressed throughout this study and are summarized in the final chapter.

## STUDY AREA

The study area is located in Southeast Oakland and is shown on Figure 1. The area generally extends along both sides of the I-580 freeway corridor between the Seminary Avenue and the 98th Avenue interchanges. A more detailed map of the geographic area included in the Southeast Oakland TIF and TIP is provided in Appendix B. The goal of the study is to calculate a fee that would be collected on new development in the Southeast Oakland TIF and TIP area.

## STUDY PROCESS

This study was developed under the direction of City of Oakland staff. After review and public hearing, the City Council will consider approval of the study and adoption of an ordinance specifying a fee schedule.

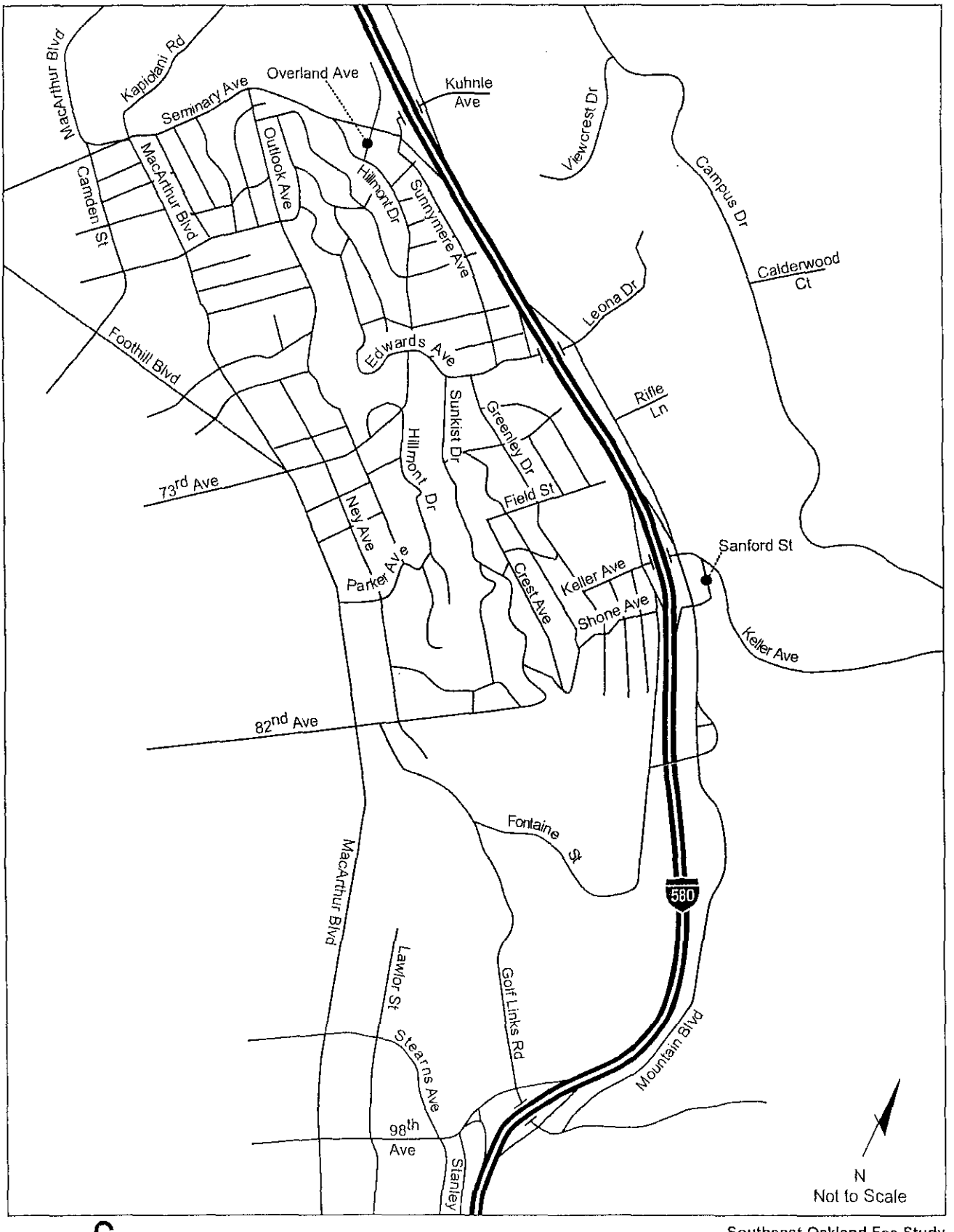
## ORGANIZATION OF THE REPORT

This report contains a total of four chapters including this introductory chapter.

*Chapter 2* – Fee Program Background provides an overview of fee programs and the factors considered in this analysis. A description of the projects proposed to be included in this TIF program is also included.

*Chapter 3* – Analysis Methods and Results describes the technical analysis conducted to establish the nexus between local development and the costs of improvements, and presents the results of the fee calculations.

*Chapter 4* – Findings reviews the study procedures and results in the context of the requirements of AB 1600.




Southeast Oakland Fee Study

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**STUDY AREA**

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Figure 1

# 2. THE PROPOSED FEE PROGRAM

This chapter describes the impetus behind this proposed fee program and identifies the project locations covered by the Southeast Oakland TIF and TIP.

The Southeast Oakland TIF and TIP developed here is intended to assess the cost-sharing responsibilities for capital roadway improvements identified in the Leona Quarry EIR and in the Conditions of Approval for the Leona Quarry project. As specified in these documents and in the Leona Quarry Settlement Agreement, the following improvements will be included in the Southeast Oakland TIF and TIP[1]:

1. I-580 Westbound On-Ramp/Edwards Avenue/Mountain Boulevard: Install traffic signal and associated geometric changes.

2. I-580 Eastbound Off-Ramp/Edwards Avenue: Install traffic signal and associated geometric changes (including improvements to the Burckhalter Park driveway).

4. Greenly Drive/Edwards Avenue: Restripe Edwards Avenue to provide a separate westbound left-turn lane.

6. MacArthur Boulevard/Foothill Boulevard/73rd Avenue: Modify west leg to add a second eastbound left-turn lane.

7. Mountain Boulevard/Keller Avenue: Install traffic signal.

8. I-580 Westbound Off-Ramp/Mountain Boulevard/Shone Avenue: Install traffic signal.

9. I-580 Eastbound Off-Ramp/Keller Avenue: Install traffic signal.

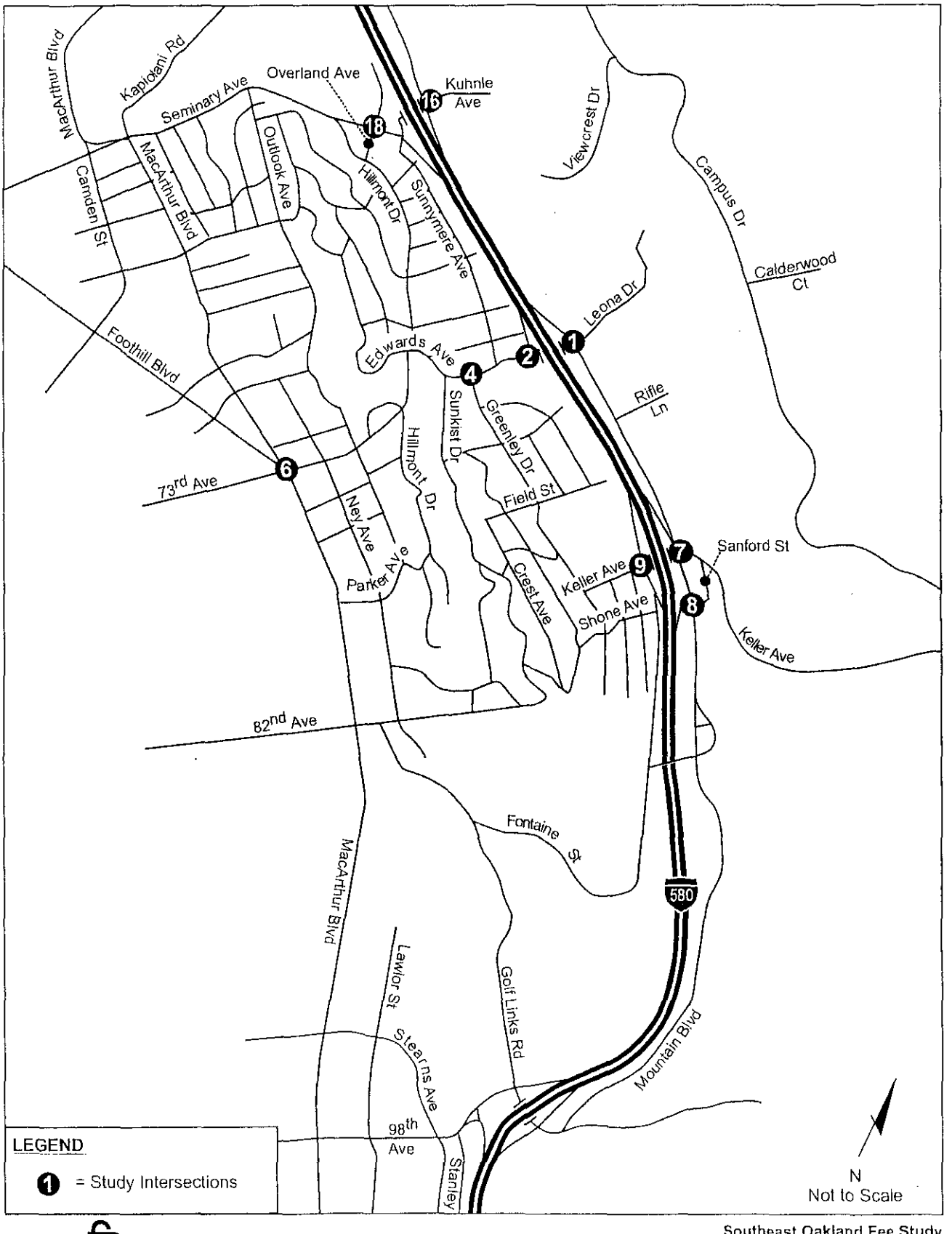
16. I-580 Westbound Off-Ramp/Seminary Avenue/Kuhnle Avenue: Install traffic signal and add second eastbound left-turn lane.

18. I-580 Eastbound Off-ramp/Seminary Avenue/Overdale Avenue: Install traffic signal.

In addition, Conditions of Approval #26g and #26h call for the TIF and TIP to include a study of other potential long-term operational improvements along the Edwards Avenue, 82nd Avenue, and Seminary Avenue routes, including any further intersection improvements in the Edwards Avenue corridor area beyond those identified in the Leona Quarry EIR. A more detailed description of this study is included in Appendix C.

The locations of these TIF and TIP projects are shown on Figure 2. The nexus analysis presented in the subsequent chapters calculates fees that can be collected to support improvements at these locations.

[1] Intersection numbering is consistent with that used in the Leona Quarry EIR.




Southeast Oakland Fee Study

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# SOUTHEAST OAKLAND TRAFFIC IMPROVEMENT FEE PROJECTS

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Figure 2

# 3. ANALYSIS METHODS AND RESULTS

The analysis methods used to determine the nexus between traffic impacts from new developments and the associated improvement measures are outlined in this chapter, along with the results of the fee calculations.

***Step 1 – Review and Update Prior Traffic Analysis***

The capital improvements to be included in this fee study were initially identified as mitigation measures in the Leona Quarry EIR. The analysis presented in the EIR was based on traffic forecasts derived from 2020 land use projections used in the Alameda County Congestion Management Agency (ACCMA) model. More recently, year 2025 ACCMA model land use projections have become available. For this study, an updated analysis using the most recent land use projections currently available was conducted to verify the applicability of the mitigation measures. The process of reviewing and updating the traffic analysis is described below. Appendix B provides further detail about the land use projections.

Existing Traffic Conditions

Existing peak hour operating conditions at the relevant study intersections from the Leona Quarry EIR are presented in Table 1. As shown in Table 1, the EIR analysis found that all intersections currently operate acceptably at LOS D or better during the morning and evening peak hours.

Future Traffic Conditions

As described above and in Appendix B, an updated future conditions analysis was conducted to ensure that the improvements called for in the Leona Quarry EIR would remain adequate to address future traffic demands. In this analysis, peak hour trips from new development in the study area were generated using rates from the Institute of Transportation Engineers (ITE) *Trip Generation*, 7th Edition and were added to the existing traffic volumes (a figure showing the resulting traffic volumes is included in Appendix D). The purpose of this analysis was to confirm that traffic from the new developments in the local study area would cause the need for improvements at the study intersections; to achieve this, no growth in traffic from outside the study area was assumed. In addition, we wanted to confirm that the mitigation measures proposed in the Leona Quarry EIR would be adequate to mitigate the projected deficiencies. A summary of these mitigation measures, which are the improvements included in this TIF and TIP, is provided in Table 2.

The resulting future peak hour traffic volumes were analyzed at each of the study locations, both with and without the specified mitigation measures, and the results are shown in Table 3. The results indicate that, with the addition of traffic from the new local developments ("Future Conditions"), all of the intersections would operate poorly, with levels of service at LOS E or F or with excessive queuing that would obstruct traffic flow. When the mitigation measures were applied ("Future With Mitigation"), all intersections would operate at LOS D or better, which is consistent with the City's standards. Thus, the capital improvements

identified for inclusion in the Southeast Oakland TIP/TIF will mitigate the traffic effects of new development in the area. Appendix D contains the detailed LOS analysis worksheets.

**TABLE 1**
**EXISTING CONDITIONS**
**PEAK HOUR INTERSECTION LEVELS OF SERVICE**

| Intersection | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|
| | Delay | LOS[1] | Delay | LOS[1] |
| **Side-Street Stop-Controlled** | | | | |
| 1. I-580 WB On-Ramp/Mountain Boulevard/Edwards Avenue | 9.1 | A | 5.7 | B |
| 2. I-580 EB Off-Ramp/Edwards Avenue | 3.9 | A | 3.6 | A |
| 8. Mountain Boulevard/I-580 WB Off-Ramp/Shone Avenue | 4.4 | A | 6.3 | B |
| 16. I-580 WB Off-Ramp/Seminary Avenue/Kuhnle Avenue | 8.6 | B | 8.2 | B |
| 18. I-580 EB Off-Ramp/Overdale Avenue/Seminary Avenue | 4.2 | A | 9.1 | B |
| **All-Way Stop-Controlled** | | | | |
| 7. Mountain Boulevard/Keller Avenue | 13.6 | C | 12.8 | C |
| 9. I-580 EB Off-Ramp/Keller Avenue | 7.9 | B | 14.7 | C |
| **Signalized** | | | | |
| 4. Greenly Drive/Edwards Avenue | 9.1 | B | 13.5 | B |
| 6. MacArthur Boulevard/73rd Avenue | 28.6 | D | 27.2 | D |

Notes: LOS = Level of Service; WB = westbound; EB = eastbound

1. Based on *Highway Capacity Manual* (HCM) 1994 method for unsignalized and signalized intersection service levels.

Source: *Revised Draft Traffic Study for the Proposed Residential Development at Leona Quarry Site in the City of Oakland*, TJKM Transportation Consultants, June 7, 2002.

**TABLE 2**
**SOUTHEAST OAKLAND TIF AND TIP PROJECT LIST**

| ID | Project | Description |
|---|---|---|
| 1 (MM K.2a) | I-580 WB On-Ramp/ Mountain Boulevard/ Edwards Avenue | • Signalize intersection and coordinate with I-580 EB Off-Ramp/Edwards Avenue |
| 2 (MM K.2b) | I-580 EB Off-Ramp/ Edwards Avenue | • Signalize intersection and coordinate with I-580 WB Off-Ramp/Edwards Avenue |
| 4 (MM K.2c) | Greenly Drive/ Edwards Avenue | • Add westbound left-turn lane |
| 6 (MM K.2d) | MacArthur Boulevard/ 73rd Avenue | • Add second eastbound left-turn lane |
| 7 (MM K.2e) | Mountain Boulevard/ Keller Avenue | • Signalize intersection and coordinate with I-580 EB Off-Ramp/Keller Avenue<br>• Re-stripe eastbound approach from one shared left/through/right lane to one shared left-turn/through lane and one shared through/right-turn lane<br>• Re-stripe west leg of Keller Avenue from two lanes to one lane |
| 8 (MM K.2f) | Mountain Boulevard/ I-580 WB Off-Ramp/ Shone Avenue | • Signalize intersection<br>• Re-stripe existing right-turn only lane on I-580 WB off-ramp to shared left-turn/right-turn lane |
| 9 (MM K.2g) | I-580 EB Off-Ramp/ Keller Avenue | • Signalize intersection and coordinate with Mountain Boulevard/Keller Avenue |
| 16 (MM K.2h) | I-580 WB Off-Ramp/ Seminary Avenue/ Kuhnle Avenue | • Signalize intersection and coordinate with I-580 EB Off-Ramp/Overdale Avenue/Seminary Avenue and I-580 EB On-Ramp/Seminary Avenue/Kuhnle Avenue<br>• Re-stripe eastbound Kuhnle Avenue to include two exclusive left-turn lanes and one through lane<br>• Widen the north leg of Mountain Boulevard to one southbound lane and two northbound lanes |
| 18 (MM K.2i) | I-580 EB Off-Ramp/ Overdale Avenue/ Seminary Avenue | • Signalize intersection and coordinate with I-580 WB Off-Ramp/Seminary Avenue/Kuhnle Avenue and I-580 EB On-Ramp/Seminary Avenue/Kuhnle Avenue |
| A (COA 26g/h) | Study of Edwards Avenue and Seminary Avenue operational improvements | • A study of other long-term operational traffic improvements along the Edwards Avenue, 82nd Avenue segment and Seminary Avenue routes, particularly the Foothill-82nd Avenue segment and the MacArthur-Seminary segment, including any further intersection improvements in the Edwards Avenue corridor area beyond those identified in the Leona Quarry EIR |

Source: Leona Quarry EIR and Conditions of Approval (including Mitigation Measure (MM) identification numbers).

**TABLE 3**
**FUTURE PEAK HOUR INTERSECTION LEVELS OF SERVICE**
**WITHOUT AND WITH MITIGATION**

| Intersection | Traffic Control[1] | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Future | | Future With Mitigation | | Future | | Future With Mitigation | |
| | | Delay | LOS | Delay | LOS | Delay | LOS | Delay | LOS |
| 1. I-580 WB On-Ramp/ Mountain Boulevard/ Edwards Avenue | Side Street Stop[2] (Signal[3]) | >50 (NB) | F | 15 | B | >50 (NB) | F | 11 | B |
| 2. I-580 EB Off-Ramp/ Edwards Avenue | Side Street Stop[2] (Signal[3]) | 41 (SB) | E | 20 | B | 47 (SB) | E | 19 | B |
| 4. Greenly Drive/ Edwards Avenue | Signal[3] | 10 | B | 11 | B | 9 | A[5] | 13 | B |
| 6. MacArthur Boulevard/ 73rd Avenue | Signal[3] | >80 | F | 49 | D | >80 | F | 55 | D |
| 7. Mountain Boulevard/ Keller Avenue | All-Way Stop[4] (Signal[3]) | >50 | F | 12 | B | >50 | F | 9 | A |
| 8. Mountain Boulevard/ I-580 WB Off-Ramp/ Shone Avenue | Side Street Stop[2] (Signal[3]) | 33 (EB) | D | 8 | A | >50 (EB) | F | 9 | A |
| 9. I-580 EB Off-Ramp/ Keller Avenue | All-Way Stop[4] (Signal[3]) | 20 | C | 18 | B | >50 | F | 20 | B |
| 16. I-580 WB Off-Ramp/ Seminary Avenue/ Kuhnle Avenue | Side Street Stop[2] (Signal[3])) | >50 (NB) | F | 20 | C | >50 (NB) | F | 19 | B |
| 18. I-580 EB Off-Ramp/ Overdale Avenue/ Seminary Avenue | Side Street Stop[2] (Signal[3]) | 27 (NB) | C | 7 | A | >50 (NB) | F | 11 | B |

Notes: LOS = Level of Service; NB = northbound; SB = southbound; WB = westbound; EB = eastbound.

1. *Traffic control with mitigation shown in parenthesis.*
2. Side-street stop-controlled intersection level of service based on worst approach delay per vehicle (in seconds), according to the *Highway Capacity Manual* (HCM) – *Special Report 209* (Transportation Research Board, 2000). The worst approach is indicated in parenthesis.
3. Signalized intersection level of service is based on average control delay per vehicle (in seconds), according to HCM 2000.
4. All-way stop-controlled intersection level of service is based on average delay per vehicle (in seconds), according to HCM 2000.
5. Westbound 95th percentile queue greater than 1,000 feet without mitigation.

Source: Fehr & Peers, 2006.

### *Step 2 – Summarize Capital Improvements and Estimate Costs*

During preparation of the EIR and the Conditions of Approval, cost estimates were developed for the improvements identified in Chapter 2. The cost estimates have been reviewed and updated for the purposes of this TIF and TIP study, and are based on actual construction and design engineering costs (where available), current City fees, and local construction cost trends. Table 4 lists the proposed TIF/TIP improvements and their associated costs. The detailed cost estimate worksheets for each project are included in Appendix E.

**TABLE 4**
**COST ESTIMATES FOR SOUTHEAST OAKLAND TIF/TIP IMPROVEMENTS**

| Location | Cost Estimate |
|---|---|
| 1 and 2. I-580 WB On-Ramp/Edwards Avenue and I-580 EB Off-Ramp/Edwards Avenue | $961,300 |
| 4. Greenly Drive/Edwards Avenue | $107,800 |
| 6. MacArthur Boulevard/73rd Avenue | $622,300 |
| 7. Mountain Boulevard/Keller Avenue | $823,200 |
| 8. Mountain Boulevard/I-580 WB Off-Ramp/Shone Avenue | $409,100 |
| 9. I-580 EB Off-Ramp/Keller Avenue | $411,400 |
| 16. I-580 WB Off-Ramp/Seminary Avenue/Kuhnle Avenue | $757,000 |
| 18. I-580 EB Off-Ramp/Overdale Avenue/Seminary Avenue | $417,600 |
| A. Study of Edwards Avenue and Seminary Avenue operational improvements | $350,000 |
| **Total Cost of Improvements** | **$4,859,700** |

Source: HQE, Incorporated, 2006; City of Oakland, 2006.

### *Step 3 – Summarize the Amount of New Development*

For purposes of a fee calculation, it is important to identify the amount of future growth expected in the fee program area, in order to produce a reasonably accurate estimate of the new development that will be subject to the fee. Existing and future land use projections from the ACCMA model were used to determine the amount of new development expected in the TIF and TIP area.

The most recent available set of Oakland land use data from the Alameda County CMA model was used to estimate the total amount of new development expected in the TIF and TIP area. The ACCMA model projections were provided in four basic land use categories: residential dwelling units, retail jobs, service jobs, and manufacturing jobs. Because there are different traffic-generating characteristics from different housing types, the City requested that the residential land use projections be broken down into two

categories: traditional single-family dwelling units and other residential types. Many of the residential development projects being proposed in this area of the City involve duet homes, townhomes, or other attached residential types that may have somewhat different traffic characteristics from traditional single-family development. For the Leona Quarry development, it is known that the project includes 404 townhomes and 19 single-family dwellings. For all other areas in the Southeast Oakland TIF/TIP area, it was assumed that the future residential development would be 40% single-family and 60% other types, which is generally consistent with the current development plans for the Oak Knoll site. The resulting development projections are shown in Table 5. The program area is expected to grow by approximately 1,400 residential units over the next 20 years; most of those new units are expected to be in the Leona Quarry and the Oak Knoll development areas. Employment is expected to grow by about 850 jobs, with most of the additional employment expected in the southernmost part of the TIF and TIP area, west of I-580 and south of 98th Avenue.

The concept of Dwelling Unit Equivalents (DUEs) is commonly used in fee studies to account for the fact that different development types generate traffic with different characteristics and with different levels of impact on the city's transportation system. DUE conversion factors typically account for differences in peak hour trip rates for each development type, as well as the effects of pass-by trips that are often associated with commercial uses. For example, retail uses tend to generate more trips per square foot than office uses, but those retail trips tend to be shorter in length because people often visit several retail establishments during the course of a single trip, or stop by a retail business on their way to their final destination. The DUE conversion process accounts for these differences in impact on the transportation system.

The DUE factors developed for the Southeast Oakland TIF/TIP are shown in Table 6, and reflect the PM peak hour trip rates published in the Institute of Transportation Engineer's (ITE's) *Trip Generation* Manual, 7th Edition and the percentage of new trips (i.e., excluding pass-by trips) published in the San Diego Association of Governments (SANDAG) *Brief Guide of Vehicular Traffic Generation Rates*, July 1998. The results were normalized to the single-family dwelling unit rate to produce a DUE per unit rate for each land use category.

The projected growth in each land use category shown in Table 5 was multiplied by the DUE conversion factors shown in Table 6, and the resulting total number of DUEs by category is shown in Table 7. Appendix B provides detailed land use and DUE results for each traffic analysis zone in the Southeast Oakland TIF/TIP area.

**TABLE 5**
**SOUTHEAST OAKLAND TIF AND TIP AREA HOUSING AND EMPLOYMENT PROJECTIONS**

| Land Use Category | Projected Growth |
|---|---|
| Single-Family Residential Units | 422 |
| Other Residential Units | 1,008 |
| Retail Jobs | 481 |
| Service Jobs | 387 |
| Manufacturing Jobs | 0 |

Source: Hausrath Economics Group, 2005.

**TABLE 6**
**DUE CONVERSION FACTORS**

| Land Use Category | Unit | PM Peak Hour Trip Rate[1] | % New Trips[2] | DUE per Unit |
|---|---|---|---|---|
| Single-Family Residences | Dwelling Unit | 1.01 | 100% | 1.00 |
| Other Residences | Dwelling Unit | 0.78 | 100% | 0.77 |
| Retail | Job | 1.13 | 50% | 0.56 |
| Service | Job | 0.46 | 65% | 0.30 |
| Manufacturing | Job | 0.42 | 80% | 0.33 |

Notes:

1. PM peak hour trip rates from ITE Trip Generation, 7th Edition, using the following categories:
   ITE #210: Single-Family Detached Housing used for Single-Family Residential category
   ITE #231: Low-Rise Residential Condo/Townhouse used for Other Residential category
   ITE #820: Shopping Center used for Retail Jobs category
   ITE #710: General Office Building used for Service Jobs category
   ITE #110: General Light Industrial used for Manufacturing Jobs category
2. SANDAG Brief Guide of Vehicular Traffic Generation Rates, July 1998.

Source: Fehr & Peers, 2006.

**TABLE 7**
**GROWTH CONVERTED TO DUES**

| Land Use Category | Total Growth | *DUE Per Unit* | Growth Converted to DUEs |
|---|---|---|---|
| Single-Family Residential Units | 422 | 1.00 | 422 |
| Other Residential Units | 1,008 | 0.77 | 777 |
| Retail Jobs | 481 | 0.56 | 270 |
| Service Jobs | 387 | 0.30 | 115 |
| Manufacturing Jobs | 0 | 0.33 | 0 |
| ***TOTAL DUEs*** | | | ***1,584*** |

Source: Fehr & Peers, 2006.

### *Step 4 – Determine Fee Amounts*

To determine the appropriate fee amounts assessed to individual developments, the total cost of the capital improvements (Step 2) was divided by the total number of new DUEs (Step 3). Table 8 displays the calculated impact fees by land use category. The total cost of the TIF and TIP improvement projects as shown in Table 4 ($4,859,700) was divided by the total number of DUEs expected in the program area as shown in Table 7 (1,584) to calculate the resulting fee per DUE ($3,068). An administration fee of 3% was added, to bring the final total fee to $3,160 per DUE. These figures do not reflect any reductions or subsidies that the City may choose to implement.

**TABLE 8**
**PRELIMINARY SOUTHEAST OAKLAND TIF AND TIP FEE CALCULATIONS**

| Land Use Category | Fee/Unit |
|---|---|
| Single-Family Residential | $3,160/Unit |
| Other Residential | $2,440/Unit |
| Retail | $5.89/Square Foot |
| Service | $3.12/Square Foot |
| Manufacturing | $1.44/Square Foot |

Source: Fehr & Peers, 2006.

# 4. FINDINGS

This report provides a detailed discussion of the elements of the proposed Southeast Oakland TIF and TIP and explains the analytical techniques used to develop this nexus study. The report addresses all the fee program elements required by AB 1600, as described below:

*Identifying the purpose of the fee*

The purpose of the Southeast Oakland TIF and TIP is to mitigate the traffic impacts of new development within the study area, by developing an overall transportation system that will accommodate the expected future traffic demand. Specifically, there are a number of intersections where traffic operations are expected to deteriorate with the addition of traffic from new development in the study area. Table 3 provides the traffic operations analysis results for these intersections and identifies the operations problems that are expected to occur if mitigation measures are not implemented. This TIF program is designed to fund the necessary mitigation measures and ensure that the traffic operations at the affected intersections remain within the City's standards.

*Identifying how the fee will be used and the facilities to be funded through the fee*

Revenues from the Southeast Oakland TIF and TIP will be used to fund capital improvement projects necessary to accommodate future traffic demand in the study area. These projects include such improvements as the installation and coordination of traffic signals, the provision of additional turn lanes, and/or the reconfiguration of lane geometries at nine different intersections throughout the study area. Table 2 describes all of the capital improvement projects to be funded through the fee program, and Table 4 summarizes the costs of those improvements. The TIF and TIP will be administered by the City of Oakland Public Works Agency.

*Determining a reasonable relationship between the fee's use and the type of development on which the fee is imposed*

Different types of development generate traffic with different characteristics and the nexus analysis presented in this report accounts for the differential impact on the local street system caused by different development types. Tables 5, 6 and 7 and the accompanying text describe the amount of new development of different types expected in the Southeast Oakland area over the next 20 years, including residential, retail, and professional/service types of uses. The traffic generated by these new uses will have effects on the nine intersections described above; the proposed fee levels are set such that each development type pays a fee that reflects its share of traffic contributions to the local transportation system.

*Determining a reasonable relationship between the need for the public facility and the type of development on which the fee is imposed*

The need for the capital improvements listed in Table 2 was established in the Leona Quarry EIR. This report confirms that the mitigation measures identified in that EIR would adequately address the expected traffic operations issues (through the analysis described in Chapter 3, Step 1) by determining that implementation of the improvements would return the traffic operations at the nine affected intersections to within the City's standards. Table 1 shows there are no existing deficiencies on any of the facilities to be included in this TIF program, indicating that the need for

improvements at these locations is attributable to traffic generated by new development. As described above, the proposed fee levels are set such that each development type pays a fee that reflects its share of traffic contributions to the local transportation system.

*Determining a reasonable relationship between the amount of the fee and the cost of the public facility (or portion of facility) attributable to new development*

The nine intersections included in this study currently operate within the City's standards, indicating that there are no existing deficiencies at the improvement locations included in the TIF program. Further, the analysis presented in Table 3 shows that traffic generated by the new development expected in the Southeast Oakland TIF program area will cause operational deficiencies at the study locations; those deficiencies are mitigated by the identified capital improvement projects. Thus, the TIF program is targeted toward the public improvements necessary to accommodate the traffic generated by new development within the program area.

The cost estimates for the capital improvement projects have been carefully developed and reviewed to ensure that all reasonably anticipated cost elements have been accounted for, thus ensuring that implementation of the improvements will be supported by the fee revenues received. The projected costs are then distributed among the different development types in proportion to their respective traffic generating characteristics, resulting in the proposed fee for each land use category.

# APPENDIX A:
# SUMMARY OF FEE PROGRAMS IN OTHER JURISDICTIONS

Appendix A

Currently, the City of Oakland does not collect transportation related impact fees for new development, although the city does charge fees for other purposes, such as affordable housing. For purposes of information and comparison, Tables A-1 and A-2 summarize citywide development fees and transportation related development fees in other Northern California jurisdictions.

**TABLE A-1**

**TOTAL IMPACT FEES[1]**

| City | Single Family Dwelling Unit | Multi-Family Dwelling Unit | General Office[2] (per ksf) | Restaurant[2] (per ksf) | Retail[2] (per ksf) |
|---|---|---|---|---|---|
| Alameda | $3,229 | $2,644 | $3,378 | $3,485 | $3,485 |
| Berkeley | $4,695 | $1,947 | $12,253 | $48,910 | $63,541 |
| Concord | $27,323 | $26,823 | $6,754 | $8,234 | $8,234 |
| Emeryville | $7,239 | $2,643 | $5,370 | $8,624 | $6,923 |
| Fremont | $25,049 | $16,938 | $5,975 | $7,732 | $5,903 |
| Sacramento | $6,505 | $4,934 | $3,148 | $1,033 | $1,033 |
| San Francisco | $23,270 | $23,270 | $22,000 | $10,000 | $12,000 |
| San Jose | $26,716 | $24,090 | $14,246 | $3,806 | $3,806 |
| Average | $15,503 | $12,911 | $9,140 | $11,478 | $13,116 |
| Minimum | $3,229 | $1,947 | $3,148 | $1,033 | $1,033 |
| Maximum | $27,323 | $26,823 | $22,000 | $48,910 | $63,541 |

Notes:

1. Total impact fee includes transportation impact fee and other development fees for parks, affordable housing, child care, sewer, drainage, fire, public facilities, etc. (building permit and plan check fees are excluded, as are fees collected by school districts or other outside agencies).
2. Calculation based on gross floor area.

Source: Fehr & Peers and HQE, Inc, March 2006.

TABLE A-2

TRANSPORTATION IMPACT FEES

| City | Single Family Dwelling Unit | Multi-Family Dwelling Unit | General Office[1] (per ksf) | Restaurant[1] (per ksf) | Retail[1] (per ksf) |
|---|---|---|---|---|---|
| Alameda[2] | $1,128 | $866 | $3,040 | $3,140 | $3,140 |
| Berkeley | $4,695 | $1,947 | $7,253 | $43,910 | $58,541 |
| Concord | $2,588 | $2,088 | $5,920 | $7,400 | $7,400 |
| Emeryville | $1,976 | $1,384 | $1,970 | $5,224 | $3,523 |
| Fremont | $2,513 | $1,949 | $5,000 | $6,360 | $5,000 |
| Sacramento | $380 | $316 | $318 | $600 | $600 |
| San Francisco | - | - | $10,000 | $10,000 | $10,000 |
| San Jose | $6,994 | $5,596 | $10,440 | - | - |
| Average | $2,534 | $1,768 | $5,493 | $9,579 | $11,026 |
| Minimum | $380 | $316 | $318 | $600 | $600 |
| Maximum | $6,994 | $5,596 | $10,440 | $43,910 | $58,541 |

Notes:

1. Calculation based on gross floor area.
2. City of Alameda Transportation Fee estimated based on discussion with city staff.

Source: Fehr & Peers and HQE, Inc, March 2006.

# APPENDIX B:
# TIF AND TIP AREA AND LAND USE PROJECTIONS

### TIF and TIP Area

Figure B-1 presents a detailed view of the TIF and TIP area, including the numbers of the TAZs from the Alameda County CMA model that are within the program area.

### Review of Land Use Projections

We compared the land use forecasts used in the Leona Quarry EIR with the most recent set available from the City's economic consultant (referred to as the Kaiser EIR dataset). The Leona Quarry EIR dataset projected to the year 2020, while the Kaiser EIR projected to 2025. Comparisons of household and employment totals for the study area from each dataset's respective horizon year showed very small differences of about 1% for households and 1.4% for employment. A summary of these comparisons is provided in Table B-1.

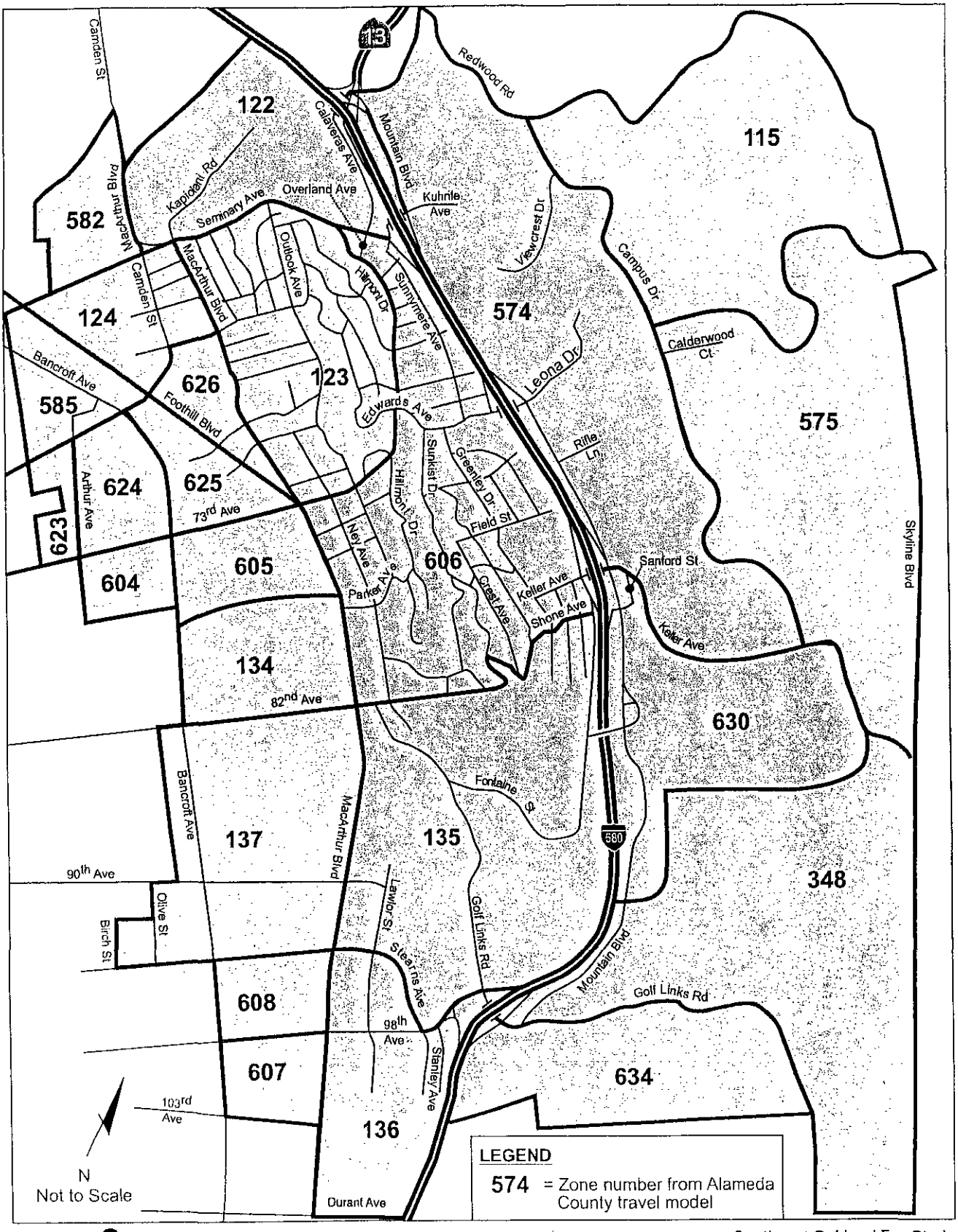
In a zone-by-zone comparison, the larger differences between the two datasets occur primarily in zones 135 and 136, which are in the far southern part of the study area and are unlikely to have much impact on travel through the intersections included in this traffic impact fee. Zone 123, located just south of Seminary Avenue near the Seminary interchange, also shows some increase in households, but that appears to be simply a recalibration of existing conditions; no growth in households is projected between the base year and the horizon year in either of the two datasets.

Based on this review, it was reasonable to conclude that the most recent set of land use projections are not substantially different from the projections used in the Leona Quarry EIR and thus would not substantially change the traffic forecasts in the study area.

### Estimate of New Development in TIF Program Area

Existing and future land use projections from the CMA model were used to determine the amount of new development expected in the TIF program area. For each of the traffic analysis zones (TAZs) in the study area, the change in land use from the 2005 to the 2025 CMA model represents the expected amount of new development. Non-residential conversions were made in accordance with the Memorandum on *Revisions to Estuary Plan for Traffic Modeling* from Barry Miller, March 15, 1999 which consolidated non-residential land use projections into the following categories: manufacturing jobs, retail jobs and service jobs. Table B-2 presents the change in land use projected for each TAZ in the TIF program area.

Table B-3 presents more specific land use category conversion factors based on the Barry Miller memorandum that may prove useful in applying the fee to specific development applications.




Southeast Oakland Fee Study

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TRANSPORTATION CONSULTANTS

# SOUTHEAST OAKLAND TIF PROGRAM AREA

September 2006
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Figure B-1

## TABLE B-1

## COMPARISON OF LEONA QUARRY EIR AND KAISER EIR LAND USE PROJECTIONS

| TAZ | Leona Quarry EIR | | | | Kaiser EIR | | | | Difference (Kaiser - Leona) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total Households | | Total Employment | | Total Households | | Total Employment | | Total Households | | Total Employment | |
| | 2005 | 2020 | 2005 | 2020 | 2005 | 2025 | 2005 | 2025 | 2005 | 2020 or 2025 | 2005 | 2020 or 2025 |
| 115 | 485 | 485 | 647 | 677 | 481 | 502 | 647 | 677 | -4 | 17 | 0 | 0 |
| 122 | 47 | 47 | 878 | 958 | 43 | 43 | 878 | 958 | -4 | -4 | 0 | 0 |
| 123 | 871 | 871 | 648 | 696 | 976 | 976 | 548 | 596 | 105 | 105 | -100 | -100 |
| 124 | 546 | 546 | 254 | 254 | 514 | 514 | 294 | 294 | -32 | -32 | 40 | 40 |
| 134 | 626 | 626 | 63 | 73 | 646 | 665 | 63 | 63 | 20 | 39 | 0 | -10 |
| 135 | 779 | 865 | 296 | 170 | 606 | 606 | 96 | 86 | -173 | -259 | -200 | -84 |
| 136 | 255 | 255 | 540 | 765 | 196 | 364 | 561 | 1,058 | -59 | 109 | 21 | 293 |
| 137 | 253 | 253 | 4 | 4 | 319 | 319 | 4 | 4 | 66 | 66 | 0 | 0 |
| 348 | 1,257 | 1,257 | 211 | 214 | 1,168 | 1,168 | 211 | 214 | -89 | -89 | 0 | 0 |
| 574 | 1,357 | 1,754 | 67 | 96 | 1,178 | 1,667 | 67 | 72 | -179 | -87 | 0 | -24 |
| 575 | 631 | 631 | 0 | 0 | 707 | 707 | 0 | 0 | 76 | 76 | 0 | 0 |
| 582 | 494 | 494 | 42 | 42 | 496 | 496 | 42 | 42 | 2 | 2 | 0 | 0 |
| 585 | 655 | 655 | 37 | 43 | 746 | 777 | 37 | 43 | 91 | 122 | 0 | 0 |
| 604 | 212 | 212 | 0 | 0 | 222 | 222 | 0 | 0 | 10 | 10 | 0 | 0 |
| 605 | 563 | 563 | 56 | 76 | 545 | 545 | 56 | 76 | -18 | -18 | 0 | 0 |
| 606 | 1,134 | 1,134 | 30 | 41 | 1,090 | 1,090 | 30 | 37 | -44 | -44 | 0 | -4 |
| 607 | 301 | 339 | 51 | 42 | 343 | 350 | 51 | 42 | 42 | 11 | 0 | 0 |
| 608 | 312 | 312 | 4 | 14 | 352 | 386 | 4 | 7 | 40 | 74 | 0 | -7 |
| 623 | 354 | 354 | 13 | 13 | 317 | 317 | 14 | 14 | -37 | -37 | 1 | 1 |
| 624 | 434 | 434 | 99 | 99 | 436 | 436 | 99 | 99 | 2 | 2 | 0 | 0 |
| 625 | 105 | 162 | 1,395 | 1,471 | 70 | 128 | 1,395 | 1,471 | -35 | -34 | 0 | 0 |
| 626 | 170 | 170 | 109 | 115 | 182 | 231 | 100 | 100 | 12 | 61 | -9 | -15 |
| 630 | 170 | 718 | 188 | 253 | 212 | 766 | 188 | 253 | 42 | 48 | 0 | 0 |
| 634 | 0 | 0 | 319 | 347 | 1 | 1 | 319 | 347 | 1 | 1 | 0 | 0 |
| **Total** | **12,011** | **13,137** | **5,951** | **6,463** | **11,846** | **13,276** | **5,704** | **6,553** | **-165** | **139** | **-247** | **90** |

Source: Hausrath Economics Group, 2005.

## TABLE B-2

## FORECASTED GROWTH IN STUDY AREA

| TAZ | Estimated Growth (2005-2025) [1] | | | | Estimated Growth in DUEs (2005-2025) [4] | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total Residential Units [2] | Employment [3] | | | Single-Family Residential | Other Residential | Employment | | Total |
| | | Manufacturing | Retail | Service | | | Retail | Service | |
| 115 | 21 | 0 | 0 | 30 | 8 | 10 | 0 | 9 | 27 |
| 122 | 0 | 0 | 0 | 80 | 0 | 0 | 0 | 24 | 24 |
| 123 | 0 | 0 | 5 | 43 | 0 | 0 | 3 | 13 | 16 |
| 124 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 134 | 19 | 0 | 0 | 0 | 8 | 8 | 0 | 0 | 16 |
| 135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 136 | 168 | 0 | 376 | 121 | 67 | 78 | 210 | 36 | 391 |
| 137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 348 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 1 |
| 574 | 489 | 0 | 0 | 5 | 45 | 343 | 0 | 1 | 389 |
| 575 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 582 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 585 | 31 | 0 | 0 | 6 | 12 | 15 | 0 | 2 | 29 |
| 604 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 605 | 0 | 0 | 10 | 10 | 0 | 0 | 6 | 3 | 9 |
| 606 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 2 | 2 |
| 607 | 7 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 6 |
| 608 | 34 | 0 | 0 | 3 | 14 | 15 | 0 | 1 | 30 |
| 623 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 624 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 625 | 58 | 0 | 48 | 28 | 23 | 27 | 27 | 8 | 85 |
| 626 | 49 | 0 | 0 | 0 | 20 | 22 | 0 | 0 | 42 |
| 630 | 554 | 0 | 30 | 35 | 222 | 256 | 17 | 10 | 505 |
| 634 | 0 | 0 | 12 | 16 | 0 | 0 | 7 | 5 | 12 |
| ***Grand Total*** | ***1,430*** | ***0*** | ***481*** | ***387*** | ***422*** | ***777*** | ***270*** | ***115*** | ***1,584*** |

*Notes:*

1. Growth calculated as the difference between year 2005 and 2025 land use projections from the Kaiser EIR, as shown in Table B-1.
2. Total Residential Units were divided into Single-Family and Other Residential as follows: For Leona Quarry development, assumed 19 single-family and 404 other. For all other development areas, assumed 40% single-family and 60% other.
3. The CMA model land use category "Other" was divided into the fee program Retail and Service land use categories (50% Retail and 50% Service).
4. Growth was converted to DUEs based on the factors provided in Table 6 of the report, then rounded to the nearest whole DUE.

Source: Fehr & Peers, 2006.

## TABLE B-3
## LAND USE CONVERSION FACTORS

| Land Use Category | Unit | Size/Employee | DUE Category Employment /Employee[1] | | |
|---|---|---|---|---|---|
| | | | Manufacturing | Retail | Service |
| Office | sf | 300 | 0.5 | 0.25 | 0.25 |
| Retail | sf | 300 | 0 | 0.5 | 0.5 |
| Dining | sf | 300 | 0 | 0.5 | 0.5 |
| Entertainment | sf | 300 | 0 | 0.5 | 0.5 |
| Wholesale | sf | 750 | 0 | 0.75 | 0.25 |
| Off-price Retail | sf | 750 | 0 | 0.75 | 0.25 |
| Warehousing | sf | 1500 | 0 | 0.5 | 0.5 |
| Light Industry | sf | 750 | 1 | 0 | 0 |
| Heavy Industry | sf | 1000 | 1 | 0 | 0 |
| Public Use | sf | 1000 | 0 | 0.5 | 0.5 |

Notes:

1. The consolidated CMA model land use category "Other" was divided into the fee program Retail and Service land use categories (50% Retail and 50% Service).

Source: Barry Miller, *Revisions to Estuary Plan for Traffic Modeling Memorandum*, March 15, 1999.

# APPENDIX C:
# DESCRIPTION OF EDWARDS/SEMINARY CORRIDOR STUDY

# DESCRIPTION OF EDWARDS/SEMINARY CORRIDOR STUDY

## Leona Quarry COA & MMRP 26g and 26h - Preliminary Study Scope

---

The Leona Quarry COA & MMRP 26g and 26h call for a study of other long-term operational improvements along the Edwards Avenue, 82nd Avenue segment and Seminary Avenue routes, particularly the Foothill Boulevard-82nd Avenue segment and the MacArthur Boulevard-Seminary Avenue segment and including any further intersections improvements in the Edwards Avenue corridor area beyond those identified in the Leona Quarry EIR. The preliminary scope is listed below. Note that a more detailed study scope will need to be developed in the future.

**Study Purpose**
The purpose of the study is to identify, package and prioritize traffic capacity, safety and calming improvements for the above-referenced roadways and potential cross-connectors under existing and 2025 conditions. The study is needed because several intersections and roadways, including arterial, collector and local streets, are projected to operate at unacceptable levels of service under 2025 conditions. The study must answer the concerns of the community regarding congestion and safety on the area roadways due to through traffic and traffic diversion onto local residential streets between I-580 and the Airport/Coliseum area as well as growth from nearby cumulative development. The recommended improvements will be presented to the City Council to request authorization to incorporate them into a previously approved Traffic Improvement Fee/Traffic Improvement Program, if any.

**Study Breadth/Influence Area**
The study area includes a local roadway network bounded by I-580 to the north, Foothill Boulevard and MacArthur Boulevard to the south, Seminary Avenue to the west and Golf Links Road/82nd Avenue to the east, and includes potential cross-connectors, such as Sunnymere Avenue, because these are routes that provide access between I-580 and the Coliseum/Airport Area, similar to Edwards Avenue. Study intersections and roadway segments include both signalized and unsignalized intersections as well as local, collector, and arterial roadways as follows:

Edwards Avenue at and between
Sunnymere Avenue
Greenly Drive
Sunkist Drive
Hillmont Drive
Outlook Avenue
Lacey/Ney Avenue

Seminary Avenue at and between
Outlook Avenue
MacArthur Boulevard
Camden Street
Foothill Boulevard

Golf Links Road/82nd Ave at and between
Fontaine Street
82nd Avenue
MacArthur Boulevard

Sunnymere Avenue at and between
Seminary Avenue and Edwards Avenue

Hillmont Drive at and between
Seminary Avenue and 75th Avenue

Outlook Avenue at and between
Seminary Avenue and Parker Avenue

Greenly Drive at and between
Edwards Avenue and Keller Avenue

Sunkist Drive at and between
Edwards Avenue and 82nd Avenue

Ney Avenue at and between
Edwards Avenue and 82nd Avenue

Keller Avenue at and between
Fontaine Street and Greenly Drive

Fontaine Street at and between
Keller Avenue
Crest Avenue
Golf Links Road

MacArthur Boulevard at and between
Seminary Avenue
64th Avenue
68th Avenue
73rd Avenue
75th Avenue
Parker Avenue
Ritchie Street
82nd Avenue

Foothill Boulevard at and between
Seminary Avenue
Camden Street
68th Avenue

Camden St at and between
Seminary Avenue
64th Avenue
Foothill Boulevard

68th Avenue at and between
Outlook Avenue
MacArthur Boulevard
Foothill Boulevard

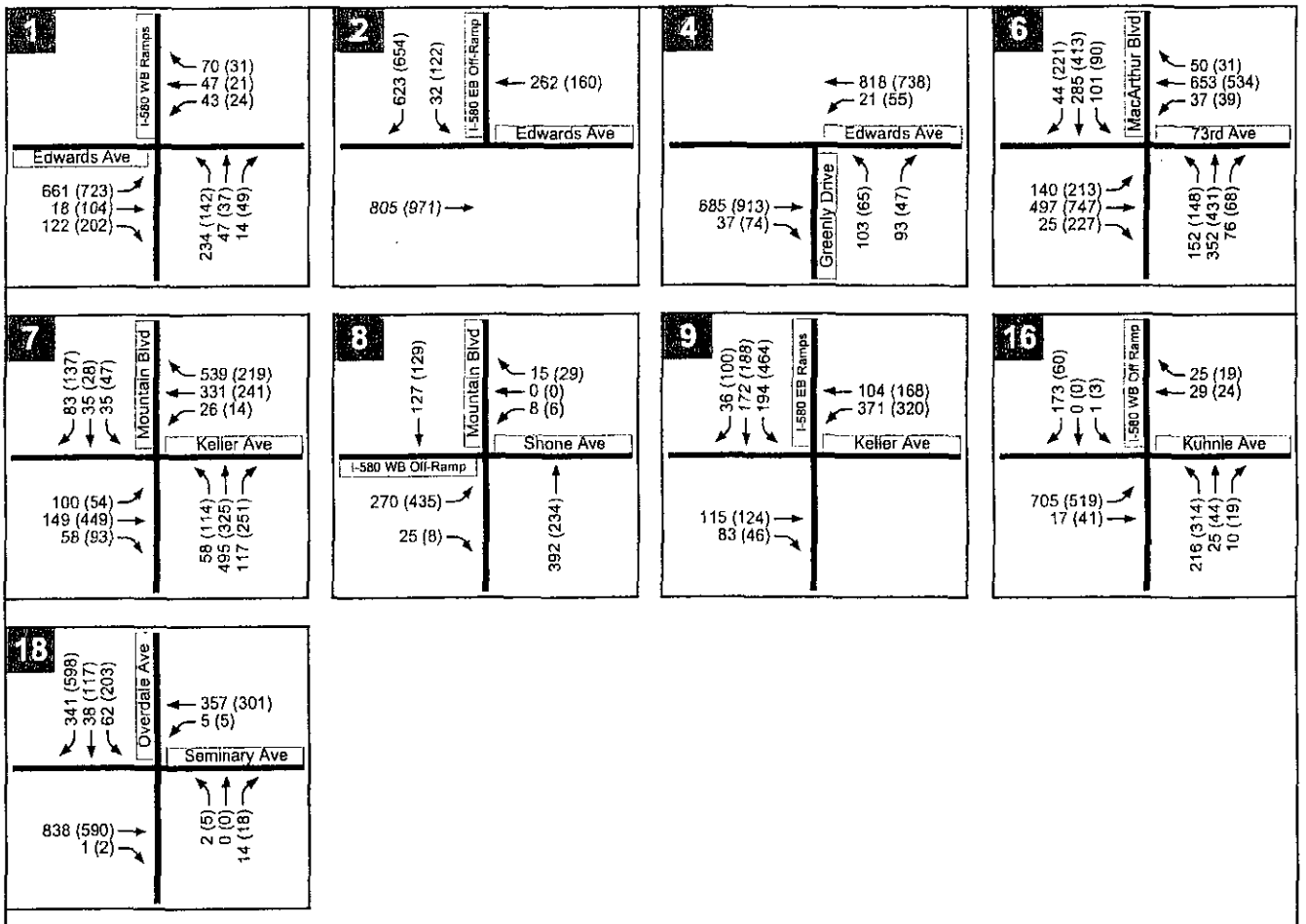
64th Avenue at and between
Outlook Avenue
MacArthur Boulevard
Camden Boulevard
Foothill Boulevard

The alternatives to be analyzed include existing and 2025 conditions with and without improvements, including two alternative improvement scenarios, during the a.m. and p.m. peak periods. The measures of effectiveness include level of service, speed, travel time, travel distance, traffic volumes, volume-to-capacity ratio, delay, queue lengths, number of stops, collisions, and benefit/cost ratio.

**Study Approach/Model**

The community is concerned about through traffic and traffic diversion to local residential streets between I-580 and the Airport/Coliseum area as well as growth from nearby cumulative development. A regional travel demand model would probably not be adequate to estimate traffic diversion on potential cut-through routes on a series of local residential streets because it would not be able to model the various types of traffic control and calming devices along these streets. Analytical Highway Capacity Manual (HCM) methods could estimate the capacity measures of effectiveness; however, they cannot estimate the effect queuing and traffic diversion. A study that uses both HCM analytical techniques and microsimulation techniques would probably best suit the needs of this study. The recommended software that incorporates both techniques is Synchro/SimTraffic.

# APPENDIX D:
# DETAILED TRAFFIC LEVEL OF SERVICE ANALYSIS WORKSHEETS




**KEY:**

XX (YY) = AM (PM) *Peak Hour* Traffic Volumes

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Southeast Oakland Fee Study

## FUTURE PEAK HOUR TRAFFIC VOLUMES AT STUDY INTERSECTIONS

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2176-D1

Figure D-1

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 661 | 18 | 122 | 43 | 47 | 70 | 234 | 47 | 14 | 0 | 0 | 0 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 734 | 20 | 136 | 48 | 52 | 78 | 260 | 52 | 16 | 0 | 0 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | 1252 | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 130 | | | 156 | | | 1704 | 1782 | 88 | 1678 | 1772 | 52 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 130 | | | 156 | | | 1704 | 1782 | 88 | 1678 | 1772 | 52 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 50 | | | 97 | | | 0 | 0 | 98 | 0 | 100 | 100 |
| cM capacity (veh/h) | 1455 | | | 1425 | | | 43 | 39 | 971 | 0 | 40 | 1015 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 734 | 156 | 100 | 78 | 260 | 68 |
| Volume Left | 734 | 0 | 48 | 0 | 260 | 0 |
| Volume Right | 0 | 136 | 0 | 78 | 0 | 16 |
| cSH | 1455 | 1700 | 1425 | 1700 | 43 | 50 |
| Volume to Capacity | 0.50 | 0.09 | 0.03 | 0.05 | 6.12 | 1.35 |
| Queue Length 95th (ft) | 74 | 0 | 3 | 0 | Err | 156 |
| Control Delay (s) | 10.0 | 0.0 | 3.8 | 0.0 | Err | 377.8 |
| Lane LOS | A | | A | | F | F |
| Approach Delay (s) | 8.2 | | 2.1 | | 8009.5 | |
| Approach LOS | | | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1886.7 | | |
| Intersection Capacity Utilization | 62.9% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑ | ↑ | | ↖ | ↱ |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 0 | 805 | 262 | 0 | 32 | 623 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0 | 894 | 291 | 0 | 36 | 692 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | 936 | | | | |
| pX, platoon unblocked | | | | | 0.75 | |
| vC, conflicting volume | 291 | | | | 1186 | 291 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 291 | | | | 1247 | 291 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 75 | 7 |
| cM capacity (veh/h) | 1271 | | | | 144 | 748 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 | SB 2 |
|---|---|---|---|---|
| Volume Total | 894 | 291 | 36 | 692 |
| Volume Left | 0 | 0 | 36 | 0 |
| Volume Right | 0 | 0 | 0 | 692 |
| cSH | 1700 | 1700 | 144 | 748 |
| Volume to Capacity | 0.53 | 0.17 | 0.25 | 0.93 |
| Queue Length 95th (ft) | 0 | 0 | 23 | 325 |
| Control Delay (s) | 0.0 | 0.0 | 38.1 | 40.8 |
| Lane LOS | | | E | E |
| Approach Delay (s) | 0.0 | 0.0 | 40.7 | |
| Approach LOS | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 15.5 | | |
| Intersection Capacity Utilization | 59.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | | | 1.00 | 1.00 | |
| Frt | 0.99 | | | 1.00 | 0.94 | |
| Flt Protected | 1.00 | | | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1850 | | | 1860 | 1699 | |
| Flt Permitted | 1.00 | | | 0.98 | 0.97 | |
| Satd. Flow (perm) | 1850 | | | 1818 | 1699 | |
| Volume (vph) | 685 | 37 | 21 | 818 | 103 | 93 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 761 | 41 | 23 | 909 | 114 | 103 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 49 | 0 |
| Lane Group Flow (vph) | 800 | 0 | 0 | 932 | 168 | 0 |
| Turn Type | | | pm+pt | | | |
| Protected Phases | 4 | | 3 | 8 | 2 | |
| Permitted Phases | | | 8 | | | |
| Actuated Green, G (s) | 45.1 | | | 45.1 | 11.0 | |
| Effective Green, g (s) | 46.1 | | | 46.1 | 12.0 | |
| Actuated g/C Ratio | 0.70 | | | 0.70 | 0.18 | |
| Clearance Time (s) | 5.0 | | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 3.0 | | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 1290 | | | 1268 | 308 | |
| v/s Ratio Prot | 0.43 | | | | c0.10 | |
| v/s Ratio Perm | | | | c0.51 | | |
| v/c Ratio | 0.62 | | | 0.74 | 0.55 | |
| Uniform Delay, d1 | 5.3 | | | 6.2 | 24.6 | |
| Progression Factor | 1.00 | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.2 | | | 2.2 | 2.0 | |
| Delay (s) | 7.6 | | | 8.5 | 26.5 | |
| Level of Service | A | | | A | C | |
| Approach Delay (s) | 7.6 | | | 8.5 | 26.5 | |
| Approach LOS | A | | | A | C | |

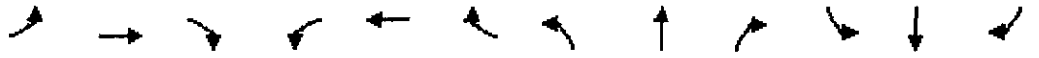
| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.1 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 66.1 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 78.0% | ICU Level of Service | D |
| Analysis 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 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.95 | | | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 0.98 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | | 0.99 | 1.00 |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1843 | | | 3425 | | | 3494 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | | 0.99 | 1.00 |
| Satd. Flow (perm) | 1770 | 1863 | 1583 | 1770 | 1843 | | | 3425 | | | 3494 | 1583 |
| Volume (vph) | 140 | 497 | 25 | 37 | 653 | 50 | 152 | 352 | 76 | 101 | 285 | 44 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 156 | 552 | 28 | 41 | 726 | 56 | 169 | 391 | 84 | 112 | 317 | 49 |
| RTOR Reduction (vph) | 0 | 0 | 18 | 0 | 2 | 0 | 0 | 9 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 156 | 552 | 10 | 41 | 780 | 0 | 0 | 635 | 0 | 0 | 429 | 49 |
| Turn Type | Prot | | Perm | Prot | | | Split | | | Split | | Free |
| Protected Phases | 7 | 4 | | 3 | 8 | | 2 | 2 | | 6 | 6 | |
| Permitted Phases | | | 4 | | | | | | | | | Free |
| Actuated Green, G (s) | 5.0 | 45.5 | 45.5 | 32.5 | 73.0 | | | 18.0 | | | 15.0 | 131.0 |
| Effective Green, g (s) | 6.0 | 46.5 | 46.5 | 33.5 | 74.0 | | | 19.0 | | | 16.0 | 131.0 |
| Actuated g/C Ratio | 0.05 | 0.35 | 0.35 | 0.26 | 0.56 | | | 0.15 | | | 0.12 | 1.00 |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 81 | 661 | 562 | 453 | 1041 | | | 497 | | | 427 | 1583 |
| v/s Ratio Prot | c0.09 | c0.30 | | 0.02 | c0.42 | | | c0.19 | | | c0.12 | |
| v/s Ratio Perm | | | 0.01 | | | | | | | | | 0.03 |
| v/c Ratio | 1.93 | 0.84 | 0.02 | 0.09 | 0.75 | | | 1.28 | | | 1.00 | 0.03 |
| Uniform Delay, d1 | 62.5 | 38.7 | 27.4 | 37.1 | 21.5 | | | 56.0 | | | 57.5 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 458.7 | 9.0 | 0.0 | 0.1 | 4.9 | | | 139.5 | | | 44.7 | 0.0 |
| Delay (s) | 521.2 | 47.7 | 27.4 | 37.2 | 26.4 | | | 195.5 | | | 102.2 | 0.0 |
| Level of Service | F | D | C | D | C | | | F | | | F | A |
| Approach Delay (s) | | 147.3 | | | 27.0 | | | 195.5 | | | 91.7 | |
| Approach LOS | | F | | | C | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 112.0 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.94 | | |
| Actuated Cycle Length (s) | 131.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 87.6% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Stop | | | Stop | |
| Volume (vph) | 100 | 149 | 58 | 26 | 331 | 539 | 58 | 495 | 117 | 35 | 35 | 83 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 111 | 166 | 64 | 29 | 368 | 599 | 64 | 550 | 130 | 39 | 39 | 92 |

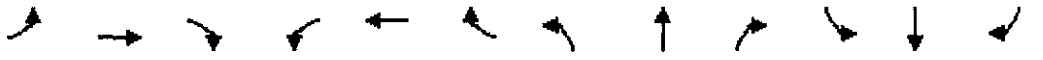
| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|
| Volume Total (vph) | 341 | 397 | 599 | 339 | 405 | 78 | 92 |
| Volume Left (vph) | 111 | 29 | 0 | 64 | 0 | 39 | 0 |
| Volume Right (vph) | 64 | 0 | 599 | 0 | 130 | 0 | 92 |
| Hadj (s) | -0.01 | 0.07 | -0.67 | 0.13 | -0.19 | 0.28 | -0.67 |
| Departure Headway (s) | 8.2 | 8.2 | 7.5 | 8.3 | 8.0 | 9.7 | 8.7 |
| Degree Utilization, x | 0.78 | 0.91 | 1.25 | 0.78 | 0.90 | 0.21 | 0.22 |
| Capacity (veh/h) | 430 | 431 | 487 | 428 | 439 | 352 | 388 |
| Control Delay (s) | 34.9 | 51.0 | 150.0 | 33.9 | 47.8 | 14.0 | 13.1 |
| Approach Delay (s) | 34.9 | 110.6 | | 41.5 | | 13.5 | |
| Approach LOS | D | F | | E | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 68.9 | | |
| HCM Level of Service | F | | |
| Intersection Capacity Utilization | 79.4% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 270 | 0 | 25 | 8 | 0 | 15 | 0 | 392 | 0 | 0 | 127 | 0 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 300 | 0 | 28 | 9 | 0 | 17 | 0 | 436 | 0 | 0 | 141 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 593 | 577 | 141 | 604 | 577 | 436 | 141 | | | 436 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 593 | 577 | 141 | 604 | 577 | 436 | 141 | | | 436 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 | 2.2 | | | 2.2 | | |
| p0 queue free % | 26 | 100 | 97 | 98 | 100 | 97 | 100 | | | 100 | | |
| cM capacity (veh/h) | 406 | 428 | 907 | 397 | 428 | 621 | 1442 | | | 1124 | | |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|---|
| Volume Total | 300 | 28 | 26 | 436 | 141 |
| Volume Left | 300 | 0 | 9 | 0 | 0 |
| Volume Right | 0 | 28 | 17 | 0 | 0 |
| cSH | 406 | 907 | 519 | 1700 | 1700 |
| Volume to Capacity | 0.74 | 0.03 | 0.05 | 0.26 | 0.08 |
| Queue Length 95th (ft) | 147 | 2 | 4 | 0 | 0 |
| Control Delay (s) | 35.1 | 9.1 | 12.3 | 0.0 | 0.0 |
| Lane LOS | E | A | B | | |
| Approach Delay (s) | 32.9 | | 12.3 | 0.0 | 0.0 |
| Approach LOS | D | | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 11.9 | | |
| Intersection Capacity Utilization | 48.9% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Stop | | | Stop | |
| Volume (vph) | 0 | 115 | 83 | 371 | 104 | 0 | 0 | 0 | 0 | 194 | 172 | 36 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0 | 128 | 92 | 412 | 116 | 0 | 0 | 0 | 0 | 216 | 191 | 40 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|
| Volume Total (vph) | 220 | 412 | 116 | 311 | 136 |
| Volume Left (vph) | 0 | 412 | 0 | 216 | 0 |
| Volume Right (vph) | 92 | 0 | 0 | 0 | 40 |
| Hadj (s) | -0.22 | 0.53 | 0.03 | 0.38 | -0.17 |
| Departure Headway (s) | 6.6 | 6.9 | 6.4 | 7.1 | 6.5 |
| Degree Utilization, x | 0.40 | 0.79 | 0.21 | 0.61 | 0.25 |
| Capacity (veh/h) | 521 | 513 | 544 | 486 | 527 |
| Control Delay (s) | 13.9 | 30.0 | 9.8 | 19.5 | 10.5 |
| Approach Delay (s) | 13.9 | 25.6 | | 16.7 | |
| Approach LOS | B | D | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 20.1 | | |
| HCM Level of Service | C | | |
| Intersection Capacity Utilization | 53.2% | 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 | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 705 | 17 | 0 | 0 | 29 | 25 | 216 | 25 | 10 | 1 | 0 | 173 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 783 | 19 | 0 | 0 | 32 | 28 | 240 | 28 | 11 | 1 | 0 | 192 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 60 | | | 19 | | | 1824 | 1646 | 19 | 1657 | 1632 | 46 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 60 | | | 19 | | | 1824 | 1646 | 19 | 1657 | 1632 | 46 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 49 | | | 100 | | | 0 | 43 | 99 | 96 | 100 | 81 |
| cM capacity (veh/h) | 1544 | | | 1598 | | | 29 | 49 | 1059 | 27 | 50 | 1023 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | NB 1 | NB 2 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 783 | 19 | 60 | 240 | 39 | 193 |
| Volume Left | 783 | 0 | 0 | 240 | 0 | 1 |
| Volume Right | 0 | 0 | 28 | 0 | 11 | 192 |
| cSH | 1544 | 1700 | 1700 | 29 | 67 | 844 |
| Volume to Capacity | 0.51 | 0.01 | 0.04 | 8.28 | 0.58 | 0.23 |
| Queue Length 95th (ft) | 75 | 0 | 0 | Err | 61 | 22 |
| Control Delay (s) | 9.7 | 0.0 | 0.0 | Err | 115.0 | 10.5 |
| Lane LOS | A | | | F | F | B |
| Approach Delay (s) | 9.5 | | 0.0 | 8620.7 | | 10.5 |
| Approach LOS | | | | F | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1808.9 | | |
| Intersection Capacity Utilization | 78.5% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↕ | | | ↕ | | | ↕ | | | ↕ | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 0 | 838 | 1 | 5 | 357 | 0 | 2 | 0 | 14 | 62 | 38 | 341 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0 | 931 | 1 | 6 | 397 | 0 | 2 | 0 | 16 | 69 | 42 | 379 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 397 | | | 932 | | | 1541 | 1339 | 466 | 889 | 1340 | 198 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 397 | | | 932 | | | 1541 | 1339 | 466 | 889 | 1340 | 198 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 99 | | | 93 | 100 | 97 | 70 | 72 | 53 |
| cM capacity (veh/h) | 1158 | | | 730 | | | 33 | 150 | 543 | 230 | 150 | 810 |

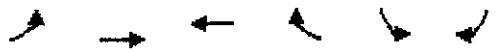
| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|
| Volume Total | 466 | 467 | 204 | 198 | 18 | 111 | 379 |
| Volume Left | 0 | 0 | 6 | 0 | 2 | 69 | 0 |
| Volume Right | 0 | 1 | 0 | 0 | 16 | 0 | 379 |
| cSH | 1158 | 1700 | 730 | 1700 | 183 | 191 | 810 |
| Volume to Capacity | 0.00 | 0.27 | 0.01 | 0.12 | 0.10 | 0.58 | 0.47 |
| Queue Length 95th (ft) | 0 | 0 | 1 | 0 | 8 | 79 | 63 |
| Control Delay (s) | 0.0 | 0.0 | 0.4 | 0.0 | 26.7 | 47.1 | 13.3 |
| Lane LOS | | | A | | D | E | B |
| Approach Delay (s) | 0.0 | | 0.2 | | 26.7 | 21.0 | |
| Approach LOS | | | | | D | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 5.9 | | |
| Intersection Capacity Utilization | 44.5% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 723 | 104 | 202 | 24 | 21 | 31 | 142 | 37 | 49 | 0 | 0 | 0 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 803 | 116 | 224 | 27 | 23 | 34 | 158 | 41 | 54 | 0 | 0 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | 1252 | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 58 | | | 340 | | | 1911 | 1946 | 228 | 1874 | 2023 | 23 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 58 | | | 340 | | | 1911 | 1946 | 228 | 1874 | 2023 | 23 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 48 | | | 98 | | | 0 | 0 | 93 | 0 | 100 | 100 |
| cM capacity (veh/h) | 1546 | | | 1219 | | | 30 | 30 | 812 | 0 | 27 | 1053 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | NB 2 |
|---|---|---|---|---|---|---|
| Volume Total | 803 | 340 | 50 | 34 | 158 | 96 |
| Volume Left | 803 | 0 | 27 | 0 | 158 | 0 |
| Volume Right | 0 | 224 | 0 | 34 | 0 | 54 |
| cSH | 1546 | 1700 | 1219 | 1700 | 30 | 67 |
| Volume to Capacity | 0.52 | 0.20 | 0.02 | 0.02 | 5.26 | 1.42 |
| Queue Length 95th (ft) | 78 | 0 | 2 | 0 | Err | 200 |
| Control Delay (s) | 9.8 | 0.0 | 4.4 | 0.0 | Err | 359.5 |
| Lane LOS | A | | A | | F | F |
| Approach Delay (s) | 6.9 | | 2.6 | | 6363.1 | |
| Approach LOS | | | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1093.8 | | |
| Intersection Capacity Utilization | 61.3% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | ↑ | ↑ | | ↰ | ↱ |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Volume (veh/h) | 0 | 971 | 160 | 0 | 122 | 654 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0 | 1079 | 178 | 0 | 136 | 727 |
| Pedestrians | | | | | | |
| Lane Width (ft) | | | | | | |
| Walking Speed (ft/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | | | None | |
| Median storage veh) | | | | | | |
| Upstream signal (ft) | | 936 | | | | |
| pX, platoon unblocked | | | | | 0.77 | |
| vC, conflicting volume | 178 | | | | 1257 | 178 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 178 | | | | 1335 | 178 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 0 | 16 |
| cM capacity (veh/h) | 1398 | | | | 130 | 865 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 | SB 2 |
|---|---|---|---|---|
| Volume Total | 1079 | 178 | 136 | 727 |
| Volume Left | 0 | 0 | 136 | 0 |
| Volume Right | 0 | 0 | 0 | 727 |
| cSH | 1700 | 1700 | 130 | 865 |
| Volume to Capacity | 0.63 | 0.10 | 1.05 | 0.84 |
| Queue Length 95th (ft) | 0 | 0 | 188 | 250 |
| Control Delay (s) | 0.0 | 0.0 | 157.8 | 26.7 |
| Lane LOS | | | F | D |
| Approach Delay (s) | 0.0 | 0.0 | 47.3 | |
| Approach LOS | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 19.3 | | |
| Intersection Capacity Utilization | 64.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | | | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | | | 1.00 | 1.00 | |
| Frt | 0.99 | | | 1.00 | 0.94 | |
| Flt Protected | 1.00 | | | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1844 | | | 1856 | 1708 | |
| Flt Permitted | 1.00 | | | 0.80 | 0.97 | |
| Satd. Flow (perm) | 1844 | | | 1496 | 1708 | |
| Volume (vph) | 913 | 74 | 55 | 738 | 65 | 47 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 1014 | 82 | 61 | 820 | 72 | 52 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 22 | 0 |
| Lane Group Flow (vph) | 1094 | 0 | 0 | 881 | 102 | 0 |
| Turn Type | | | pm+pt | | | |
| Protected Phases | 4 | | 3 | 8 | 2 | |
| Permitted Phases | | | 8 | | | |
| Actuated Green, G (s) | 94.1 | | | 94.1 | 11.7 | |
| Effective Green, g (s) | 95.1 | | | 95.1 | 12.7 | |
| Actuated g/C Ratio | 0.82 | | | 0.82 | 0.11 | |
| Clearance Time (s) | 5.0 | | | 5.0 | 5.0 | |
| Vehicle Extension (s) | 3.0 | | | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 1514 | | | 1229 | 187 | |
| v/s Ratio Prot | c0.59 | | | | c0.06 | |
| v/s Ratio Perm | | | | 0.59 | | |
| v/c Ratio | 0.72 | | | 0.72 | 0.54 | |
| Uniform Delay, d1 | 4.6 | | | 4.5 | 48.8 | |
| Progression Factor | 1.00 | | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.7 | | | 2.0 | 3.2 | |
| Delay (s) | 6.3 | | | 6.5 | 52.0 | |
| Level of Service | A | | | A | D | |
| Approach Delay (s) | 6.3 | | | 6.5 | 52.0 | |
| Approach LOS | A | | | A | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 115.8 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 97.3% | ICU Level of Service | F |
| 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 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.95 | | | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 0.98 | | | 1.00 | 0.85 |
| *Flt Protected* | *0.95* | *1.00* | *1.00* | *0.95* | *1.00* | | | *0.99* | | | *0.99* | *1.00* |
| Satd. Flow (prot) | 1770 | 1863 | 1583 | 1770 | 1848 | | | 3444 | | | 3508 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | | 0.99 | 1.00 |
| Satd. Flow (perm) | 1770 | 1863 | 1583 | 1770 | 1848 | | | 3444 | | | 3508 | 1583 |
| *Volume (vph)* | *213* | *747* | *227* | *39* | *534* | *31* | *148* | *431* | *68* | *90* | *413* | *221* |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 237 | 830 | 252 | 43 | 593 | 34 | 164 | 479 | 76 | 100 | 459 | 246 |
| RTOR Reduction (vph) | 0 | 0 | 89 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 237 | 830 | 163 | 43 | 625 | 0 | 0 | 713 | 0 | 0 | 559 | 246 |
| Turn Type | Prot | | Perm | Prot | | | Split | | | Split | | Free |
| Protected Phases | 7 | 4 | | 3 | 8 | | 2 | 2 | | 6 | 6 | |
| Permitted Phases | | | 4 | | | | | | | | | Free |
| Actuated Green, G (s) | 14.0 | 69.7 | 69.7 | 7.3 | 63.0 | | | 26.0 | | | 18.0 | 141.0 |
| *Effective Green, g (s)* | 15.0 | 70.7 | 70.7 | 8.3 | 64.0 | | | 27.0 | | | 19.0 | 141.0 |
| Actuated g/C Ratio | 0.11 | 0.50 | 0.50 | 0.06 | 0.45 | | | 0.19 | | | 0.13 | 1.00 |
| Clearance Time (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | | | 5.0 | | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 188 | 934 | 794 | 104 | 839 | | | 659 | | | 473 | 1583 |
| v/s Ratio Prot | c0.13 | c0.45 | | 0.02 | c0.34 | | | c0.21 | | | c0.16 | |
| v/s Ratio Perm | | | 0.10 | | | | | | | | | 0.16 |
| v/c Ratio | 1.26 | 0.89 | 0.20 | 0.41 | 0.75 | | | 1.08 | | | 1.18 | 0.16 |
| Uniform Delay, d1 | 63.0 | 31.6 | 19.5 | 64.0 | 31.8 | | | 57.0 | | | 61.0 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 152.8 | 10.3 | 0.1 | 2.7 | 6.0 | | | 59.1 | | | 101.7 | 0.2 |
| Delay (s) | 215.8 | 41.9 | 19.7 | 66.7 | 37.7 | | | 116.1 | | | 162.7 | 0.2 |
| Level of Service | F | D | B | E | D | | | F | | | F | A |
| Approach Delay (s) | | 68.9 | | | 39.6 | | | 116.1 | | | 113.1 | |
| *Approach LOS* | | E | | | D | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 83.1 | HCM Level of Service | F |
| HCM Volume to Capacity ratio | 0.98 | | |
| Actuated Cycle Length (s) | 141.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 88.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Stop | | | Stop | |
| Volume (vph) | 54 | 449 | 93 | 14 | 241 | 219 | 114 | 325 | 251 | 47 | 28 | 137 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 60 | 499 | 103 | 16 | 268 | 243 | 127 | 361 | 279 | 52 | 31 | 152 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | NB 1 | NB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|
| Volume Total (vph) | 662 | 283 | 243 | 307 | 459 | 83 | 152 |
| Volume Left (vph) | 60 | 16 | 0 | 127 | 0 | 52 | 0 |
| Volume Right (vph) | 103 | 0 | 243 | 0 | 279 | 0 | 152 |
| Hadj (s) | -0.04 | 0.06 | -0.67 | 0.24 | -0.39 | 0.35 | -0.67 |
| Departure Headway (s) | 8.2 | 8.7 | 8.0 | 8.5 | 7.9 | 9.6 | 8.7 |
| Degree Utilization, x | 1.51 | 0.68 | 0.54 | 0.73 | 1.01 | 0.22 | 0.37 |
| Capacity (veh/h) | 441 | 405 | 437 | 415 | 459 | 365 | 407 |
| Control Delay (s) | 264.8 | 27.3 | 18.7 | 29.9 | 71.6 | 14.2 | 15.4 |
| Approach Delay (s) | 264.8 | 23.3 | | 54.9 | | 14.9 | |
| Approach LOS | F | C | | F | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 106.4 | | |
| HCM Level of Service | F | | |
| Intersection Capacity Utilization | 83.5% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Stop | | | Stop | | | Free | | | Free | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 435 | 0 | 8 | 6 | 0 | 29 | 0 | 234 | 0 | 0 | 129 | 0 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| *Hourly flow rate (vph)* | 483 | 0 | 9 | 7 | 0 | 32 | 0 | 260 | 0 | 0 | 143 | 0 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| *Upstream signal (ft)* | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 436 | 403 | 143 | 412 | 403 | 260 | 143 | | | 260 | | |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 436 | 403 | 143 | 412 | 403 | 260 | 143 | | | 260 | | |
| tC, single (s) | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 | 4.1 | | | 4.1 | | |
| tC, 2 stage (s) | | | | | | | | | | | | |
| *tF (s)* | *3.5* | *4.0* | *3.3* | *3.5* | *4.0* | *3.3* | *2.2* | | | *2.2* | | |
| p0 queue free % | 5 | 100 | 99 | 99 | 100 | 96 | 100 | | | 100 | | |
| cM capacity (veh/h) | 509 | 536 | 904 | 545 | 536 | 779 | 1439 | | | 1304 | | |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|---|
| Volume Total | 483 | 9 | 39 | 260 | 143 |
| Volume Left | 483 | 0 | 7 | 0 | 0 |
| Volume Right | 0 | 9 | 32 | 0 | 0 |
| cSH | 509 | 904 | 725 | 1700 | 1700 |
| Volume to Capacity | 0.95 | 0.01 | 0.05 | 0.15 | 0.08 |
| Queue Length 95th (ft) | 299 | 1 | 4 | 0 | 0 |
| *Control Delay (s)* | *56.9* | *9.0* | *10.2* | *0.0* | *0.0* |
| Lane LOS | F | A | B | | |
| Approach Delay (s) | 56.0 | | 10.2 | 0.0 | 0.0 |
| Approach LOS | F | | B | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 29.9 | | |
| Intersection Capacity Utilization | 49.7% | 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) | 0 | 124 | 46 | 320 | 168 | 0 | 0 | 0 | 0 | 464 | 188 | 100 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0 | 138 | 51 | 356 | 187 | 0 | 0 | 0 | 0 | 516 | 209 | 111 |

| Direction, Lane # | EB 1 | WB 1 | WB 2 | SB 1 | SB 2 |
|---|---|---|---|---|---|
| Volume Total (vph) | 189 | 356 | 187 | 620 | 216 |
| Volume Left (vph) | 0 | 356 | 0 | 516 | 0 |
| Volume Right (vph) | 51 | 0 | 0 | 0 | 111 |
| Hadj (s) | -0.13 | 0.53 | 0.03 | 0.45 | -0.33 |
| Departure Headway (s) | 7.2 | 7.6 | 7.1 | 7.2 | 6.4 |
| Degree Utilization, x | 0.38 | 0.75 | 0.37 | 1.24 | 0.39 |
| Capacity (veh/h) | 492 | 472 | 503 | 507 | 550 |
| Control Delay (s) | 14.5 | 28.4 | 12.9 | 147.3 | 12.2 |
| Approach Delay (s) | 14.5 | 23.1 | | 112.4 | |
| Approach LOS | B | C | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 69.7 | | |
| HCM Level of Service | F | | |
| Intersection Capacity Utilization | 62.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 519 | 41 | 0 | 0 | 24 | 19 | 314 | 44 | 19 | 3 | 0 | 60 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 577 | 46 | 0 | 0 | 27 | 21 | 349 | 49 | 21 | 3 | 0 | 67 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 48 | | | 46 | | | 1303 | 1247 | 46 | 1282 | 1236 | 37 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 48 | | | 46 | | | 1303 | 1247 | 46 | 1282 | 1236 | 37 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 63 | | | 100 | | | 0 | 55 | 98 | 95 | 100 | 94 |
| cM capacity (veh/h) | 1559 | | | 1562 | | | 92 | 109 | 1024 | 66 | 111 | 1035 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | NB 1 | NB 2 | SB 1 |
|---|---|---|---|---|---|---|
| Volume Total | 577 | 46 | 48 | 349 | 70 | 70 |
| Volume Left | 577 | 0 | 0 | 349 | 0 | 3 |
| Volume Right | 0 | 0 | 21 | 0 | 21 | 67 |
| cSH | 1559 | 1700 | 1700 | 92 | 150 | 611 |
| Volume to Capacity | 0.37 | 0.03 | 0.03 | 3.81 | 0.47 | 0.11 |
| Queue Length 95th (ft) | 43 | 0 | 0 | Err | 54 | 10 |
| Control Delay (s) | 8.7 | 0.0 | 0.0 | Err | 48.6 | 11.7 |
| Lane LOS | A | | | F | E | B |
| Approach Delay (s) | 8.0 | | 0.0 | 8336.2 | | 11.7 |
| Approach LOS | | | | F | | B |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3018.2 | | |
| Intersection Capacity Utilization | 66.1% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ↰↑↑↱ | | | ↰↑↑↱ | | | ↰↱ | | | ↰ | ↱ |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Volume (veh/h) | 0 | 590 | 2 | 5 | 301 | 0 | 5 | 0 | 18 | 203 | 117 | 598 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Hourly flow rate (vph) | 0 | 656 | 2 | 6 | 334 | 0 | 6 | 0 | 20 | 226 | 130 | 664 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (ft) | | | | | | | | | | | | |
| Walking Speed (ft/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | | | | | | | None | | | None | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (ft) | | | | | | | | | | | | |
| *pX, platoon unblocked* | | | | | | | | | | | | |
| vC, conflicting volume | 334 | | | 658 | | | 1564 | 1002 | 329 | 693 | 1003 | 167 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 334 | | | 658 | | | 1564 | 1002 | 329 | 693 | 1003 | 167 |
| tC, single (s) | 4.1 | | | 4.1 | | | 7.5 | 6.5 | 6.9 | 7.5 | 6.5 | 6.9 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.2 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 100 | | | 99 | | | 40 | 100 | 97 | 29 | 46 | 22 |
| cM capacity (veh/h) | 1222 | | | 926 | | | 9 | 240 | 667 | 318 | 239 | 848 |

| Direction, Lane # | EB 1 | EB 2 | WB 1 | WB 2 | NB 1 | SB 1 | SB 2 |
|---|---|---|---|---|---|---|---|
| Volume Total | 328 | 330 | 173 | 167 | 26 | 356 | 664 |
| Volume Left | 0 | 0 | 6 | 0 | 6 | 226 | 0 |
| Volume Right | 0 | 2 | 0 | 0 | 20 | 0 | 664 |
| cSH | 1222 | 1700 | 926 | 1700 | 41 | 284 | 848 |
| Volume to Capacity | 0.00 | 0.19 | 0.01 | 0.10 | 0.63 | 1.25 | 0.78 |
| Queue Length 95th (ft) | 0 | 0 | 0 | 0 | 57 | 422 | 201 |
| Control Delay (s) | 0.0 | 0.0 | 0.3 | 0.0 | 189.9 | 176.3 | 22.8 |
| Lane LOS | | | A | | F | F | C |
| Approach Delay (s) | 0.0 | | 0.2 | | 189.9 | 76.3 | |
| Approach LOS | | | | | F | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 40.5 | | |
| Intersection Capacity Utilization | 58.8% | ICU Level of Service | B |
| 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 | 0.97 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Frt | 1.00 | 0.87 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| Flt Protected | 0.95 | 1.00 | | | 0.98 | 1.00 | 0.95 | 1.00 | 1.00 | | | |
| Satd. Flow (prot) | 3433 | 1619 | | | 1819 | 1583 | 1770 | 1863 | 1583 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 0.98 | 1.00 | 0.95 | 1.00 | 1.00 | | | |
| Satd. Flow (perm) | 3433 | 1619 | | | 1819 | 1583 | 1770 | 1863 | 1583 | | | |
| Volume (vph) | 661 | 18 | 122 | 43 | 47 | 70 | 234 | 47 | 14 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 734 | 20 | 136 | 48 | 52 | 78 | 260 | 52 | 16 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 62 | 0 | 0 | 0 | 70 | 0 | 0 | 13 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 734 | 94 | 0 | 0 | 100 | 8 | 260 | 52 | 3 | 0 | 0 | 0 |
| Turn Type | Split | | | Split | | Perm | Split | | Perm | | | |
| Protected Phases | 2 | 2 | | 6 | 6 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 42.5 | 42.5 | | | 8.3 | 8.3 | 16.2 | 16.2 | 16.2 | | | |
| Effective Green, g (s) | 43.5 | 43.5 | | | 8.3 | 8.3 | 16.2 | 16.2 | 16.2 | | | |
| Actuated g/C Ratio | 0.54 | 0.54 | | | 0.10 | 0.10 | 0.20 | 0.20 | 0.20 | | | |
| Clearance Time (s) | 5.0 | 5.0 | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | |
| Lane Grp Cap (vph) | 1867 | 880 | | | 189 | 164 | 358 | 377 | 321 | | | |
| v/s Ratio Prot | c0.21 | 0.06 | | | c0.05 | | c0.15 | 0.03 | | | | |
| v/s Ratio Perm | | | | | | 0.01 | | | 0.00 | | | |
| v/c Ratio | 0.39 | 0.11 | | | 0.53 | 0.05 | 0.73 | 0.14 | 0.01 | | | |
| Uniform Delay, d1 | 10.6 | 8.8 | | | 34.0 | 32.3 | 29.8 | 26.2 | 25.5 | | | |
| Progression Factor | 0.39 | 0.37 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Incremental Delay, d2 | 0.5 | 0.2 | | | 2.7 | 0.1 | 7.2 | 0.2 | 0.0 | | | |
| Delay (s) | 4.6 | 3.4 | | | 36.7 | 32.4 | 37.0 | 26.3 | 25.5 | | | |
| Level of Service | A | A | | | D | C | D | C | C | | | |
| Approach Delay (s) | | 4.4 | | | 34.8 | | | 34.7 | | | 0.0 | |
| Approach LOS | | A | | | C | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 15.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.49 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 46.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| 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 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 1863 | 1863 | | 1770 | 1583 |
| Flt Permitted | | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 1863 | 1863 | | 1770 | 1583 |
| Volume (vph) | 0 | 805 | 262 | 0 | 32 | 623 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 894 | 291 | 0 | 36 | 692 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 457 |
| Lane Group Flow (vph) | 0 | 894 | 291 | 0 | 36 | 235 |
| Turn Type | | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | | 56.2 | 56.2 | | 15.8 | 15.8 |
| Effective Green, g (s) | | 56.2 | 56.2 | | 15.8 | 15.8 |
| Actuated g/C Ratio | | 0.70 | 0.70 | | 0.20 | 0.20 |
| Clearance Time (s) | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1309 | 1309 | | 350 | 313 |
| v/s Ratio Prot | | c0.48 | 0.16 | | 0.02 | |
| v/s Ratio Perm | | | | | | c0.15 |
| v/c Ratio | | 0.68 | 0.22 | | 0.10 | 0.75 |
| Uniform Delay, d1 | | 6.8 | 4.2 | | 26.3 | 30.2 |
| Progression Factor | | 1.00 | 0.26 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 2.9 | 0.3 | | 0.1 | 9.5 |
| Delay (s) | | 9.7 | 1.4 | | 26.4 | 39.7 |
| Level of Service | | A | A | | C | D |
| Approach Delay (s) | | 9.7 | 1.4 | | 39.0 | |
| Approach LOS | | A | A | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 19.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 59.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

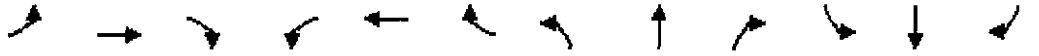
| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | |
| Frt | 0.99 | | 1.00 | 1.00 | 0.94 | |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1850 | | 1770 | 1863 | 1699 | |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 1850 | | 1770 | 1863 | 1699 | |
| Volume (vph) | 685 | 37 | 21 | 818 | 103 | 93 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 761 | 41 | 23 | 909 | 114 | 103 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 49 | 0 |
| Lane Group Flow (vph) | 800 | 0 | 23 | 909 | 168 | 0 |
| Turn Type | | | Prot | | | |
| Protected Phases | 4 | | 3 | 8 | 2 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 34.6 | | 2.0 | 40.6 | 10.4 | |
| Effective Green, g (s) | 34.6 | | 2.0 | 40.6 | 10.4 | |
| Actuated g/C Ratio | 0.59 | | 0.03 | 0.69 | 0.18 | |
| Clearance Time (s) | 4.0 | | 4.0 | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 1085 | | 60 | 1282 | 299 | |
| v/s Ratio Prot | 0.43 | | 0.01 | c0.49 | c0.10 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.74 | | 0.38 | 0.71 | 0.56 | |
| Uniform Delay, d1 | 8.9 | | 27.9 | 5.6 | 22.2 | |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 2.6 | | 4.0 | 1.8 | 2.4 | |
| Delay (s) | 11.5 | | 31.9 | 7.4 | 24.6 | |
| Level of Service | B | | C | A | C | |
| Approach Delay (s) | 11.5 | | | 8.0 | 24.6 | |
| Approach LOS | B | | | A | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 11.3 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 59.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 61.1% | 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 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.95 | | | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 0.98 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | | 0.99 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 1843 | | | 3425 | | | 3494 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | | 0.99 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 1843 | | | 3425 | | | 3494 | 1583 |
| Volume (vph) | 140 | 497 | 25 | 37 | 653 | 50 | 152 | 352 | 76 | 101 | 285 | 44 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 156 | 552 | 28 | 41 | 726 | 56 | 169 | 391 | 84 | 112 | 317 | 49 |
| RTOR Reduction (vph) | 0 | 0 | 15 | 0 | 2 | 0 | 0 | 11 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 156 | 552 | 13 | 41 | 780 | 0 | 0 | 633 | 0 | 0 | 429 | 49 |
| Turn Type | Prot | | Perm | Prot | | | Split | | | Split | | Free |
| Protected Phases | 7 | 4 | | 3 | 8 | | 2 | 2 | | 6 | 6 | |
| Permitted Phases | | | 4 | | | | | | | | | Free |
| Actuated Green, G (s) | 7.9 | 52.9 | 52.9 | 3.6 | 48.6 | | | 21.6 | | | 14.8 | 110.9 |
| Effective Green, g (s) | 7.9 | 52.9 | 52.9 | 3.6 | 48.6 | | | 22.6 | | | 15.8 | 110.9 |
| Actuated g/C Ratio | 0.07 | 0.48 | 0.48 | 0.03 | 0.44 | | | 0.20 | | | 0.14 | 1.00 |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 5.0 | | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 245 | 889 | 755 | 57 | 808 | | | 698 | | | 498 | 1583 |
| v/s Ratio Prot | c0.05 | 0.30 | | 0.02 | c0.42 | | | c0.18 | | | c0.12 | |
| v/s Ratio Perm | | | 0.01 | | | | | | | | | 0.03 |
| v/c Ratio | 0.64 | 0.62 | 0.02 | 0.72 | 0.97 | | | 0.91 | | | 0.86 | 0.03 |
| Uniform Delay, d1 | 50.1 | 21.5 | 15.3 | 53.1 | 30.3 | | | 43.1 | | | 46.5 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.3 | 1.4 | 0.0 | 35.1 | 23.2 | | | 15.4 | | | 14.2 | 0.0 |
| Delay (s) | 55.4 | 22.9 | 15.3 | 88.2 | 53.6 | | | 58.5 | | | 60.7 | 0.0 |
| Level of Service | E | C | B | F | D | | | E | | | E | A |
| Approach Delay (s) | | 29.5 | | | 55.3 | | | 58.5 | | | 54.5 | |
| Approach LOS | | C | | | E | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 48.8 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.91 | | |
| Actuated Cycle Length (s) | 110.9 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 82.1% | ICU Level of Service | E |
| 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 |
| Lane Util. Factor | | 0.95 | | | 1.00 | 1.00 | | 0.95 | | | 1.00 | 1.00 |
| Frt | | 0.97 | | | 1.00 | 0.85 | | 0.97 | | | 1.00 | 0.85 |
| Flt Protected | | 0.98 | | | 1.00 | 1.00 | | 1.00 | | | 0.98 | 1.00 |
| Satd. Flow (prot) | | 3384 | | | 1856 | 1583 | | 3432 | | | 1817 | 1583 |
| *Flt Permitted* | | *0.75* | | | *0.96* | *1.00* | | *0.92* | | | *0.67* | *1.00* |
| Satd. Flow (perm) | | 2594 | | | 1792 | 1583 | | 3187 | | | 1243 | 1583 |
| Volume (vph) | 100 | 149 | 58 | 26 | 331 | 539 | 58 | 495 | 117 | 35 | 35 | 83 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 111 | 166 | 64 | 29 | 368 | 599 | 64 | 550 | 130 | 39 | 39 | 92 |
| RTOR Reduction (vph) | 0 | 27 | 0 | 0 | 0 | 72 | 0 | 19 | 0 | 0 | 0 | 58 |
| Lane Group Flow (vph) | 0 | 314 | 0 | 0 | 397 | 527 | 0 | 725 | 0 | 0 | 78 | 34 |
| Turn Type | Perm | | | Perm | | Perm | Perm | | | Perm | | Perm |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| *Permitted Phases* | 4 | | | 8 | | 8 | 2 | | | 6 | | 6 |
| Actuated Green, G (s) | | 21.8 | | | 21.8 | 21.8 | | 17.5 | | | 17.5 | 17.5 |
| Effective Green, g (s) | | 21.8 | | | 21.8 | 21.8 | | 17.5 | | | 17.5 | 17.5 |
| Actuated g/C Ratio | | 0.46 | | | 0.46 | 0.46 | | 0.37 | | | 0.37 | 0.37 |
| Clearance Time (s) | | 4.0 | | | 4.0 | 4.0 | | 4.0 | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1196 | | | 826 | 730 | | 1179 | | | 460 | 586 |
| v/s Ratio Prot | | | | | | | | | | | | |
| v/s Ratio Perm | | 0.12 | | | 0.22 | c0.33 | | c0.23 | | | 0.06 | 0.02 |
| v/c Ratio | | 0.26 | | | 0.48 | 0.72 | | 0.62 | | | 0.17 | 0.06 |
| Uniform Delay, d1 | | 7.8 | | | 8.8 | 10.3 | | 12.2 | | | 10.0 | 9.6 |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.1 | | | 0.4 | 3.5 | | 1.0 | | | 0.2 | 0.0 |
| Delay (s) | | 7.9 | | | 9.3 | 13.8 | | 13.1 | | | 10.2 | 9.6 |
| Level of Service | | A | | | A | B | | B | | | B | A |
| Approach Delay (s) | | 7.9 | | | 12.0 | | | 13.1 | | | 9.9 | |
| Approach LOS | | A | | | B | | | B | | | A | |

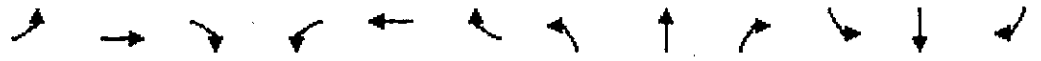
| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 11.6 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 47.3 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 71.4% | ICU Level of Service | C |
| Analysis 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 | |
| Lane Util. Factor | 0.95 | 0.95 | | | 1.00 | | | 1.00 | | | 1.00 | |
| Frt | 1.00 | 0.98 | | | 0.91 | | | 1.00 | | | 1.00 | |
| Flt Protected | 0.95 | 0.96 | | | 0.98 | | | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | 1681 | 1658 | | | 1669 | | | 1863 | | | 1863 | |
| Flt Permitted | 0.74 | 0.74 | | | 0.89 | | | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | 1310 | 1281 | | | 1508 | | | 1863 | | | 1863 | |
| Volume (vph) | 270 | 0 | 25 | 8 | 0 | 15 | 0 | 392 | 0 | 0 | 127 | 0 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 300 | 0 | 28 | 9 | 0 | 17 | 0 | 436 | 0 | 0 | 141 | 0 |
| RTOR Reduction (vph) | 0 | 15 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 151 | 162 | 0 | 0 | 13 | 0 | 0 | 436 | 0 | 0 | 141 | 0 |
| Turn Type | Perm | | | Perm | | | | | | | | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | | | | | | |
| Actuated Green, G (s) | 9.7 | 9.7 | | | 9.7 | | | 21.0 | | | 21.0 | |
| Effective Green, g (s) | 9.7 | 9.7 | | | 9.7 | | | 21.0 | | | 21.0 | |
| Actuated g/C Ratio | 0.25 | 0.25 | | | 0.25 | | | 0.54 | | | 0.54 | |
| Clearance Time (s) | 4.0 | 4.0 | | | 4.0 | | | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | | | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 328 | 321 | | | 378 | | | 1011 | | | 1011 | |
| v/s Ratio Prot | | | | | | | | c0.23 | | | 0.08 | |
| v/s Ratio Perm | 0.12 | c0.13 | | | 0.01 | | | | | | | |
| v/c Ratio | 0.46 | 0.50 | | | 0.04 | | | 0.43 | | | 0.14 | |
| Uniform Delay, d1 | 12.3 | 12.4 | | | 11.0 | | | 5.3 | | | 4.4 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 1.0 | 1.3 | | | 0.0 | | | 0.3 | | | 0.1 | |
| Delay (s) | 13.3 | 13.7 | | | 11.0 | | | 5.6 | | | 4.4 | |
| Level of Service | B | B | | | B | | | A | | | A | |
| Approach Delay (s) | | 13.5 | | | 11.0 | | | 5.6 | | | 4.4 | |
| Approach LOS | | B | | | B | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 8.4 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 38.7 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 42.2% | ICU Level of Service | A |
| 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 | |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | | | | | | 0.95 | |
| Frt | | 0.94 | | 1.00 | 1.00 | | | | | | 0.99 | |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | | | | | | 0.98 | |
| Satd. Flow (prot) | | 1758 | | 1770 | 1863 | | | | | | 3409 | |
| Flt Permitted | | 1.00 | | 0.95 | 1.00 | | | | | | 0.98 | |
| Satd. Flow (perm) | | 1758 | | 1770 | 1863 | | | | | | 3409 | |
| Volume (vph) | 0 | 115 | 83 | 371 | 104 | 0 | 0 | 0 | 0 | 194 | 172 | 36 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 128 | 92 | 412 | 116 | 0 | 0 | 0 | 0 | 216 | 191 | 40 |
| RTOR Reduction (vph) | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| Lane Group Flow (vph) | 0 | 187 | 0 | 412 | 116 | 0 | 0 | 0 | 0 | 0 | 438 | 0 |
| Turn Type | | | | Prot | | | | | | Split | | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 11.2 | | 17.3 | 32.5 | | | | | | 12.2 | |
| Effective Green, g (s) | | 11.2 | | 17.3 | 32.5 | | | | | | 12.2 | |
| Actuated g/C Ratio | | 0.21 | | 0.33 | 0.62 | | | | | | 0.23 | |
| Clearance Time (s) | | 4.0 | | 4.0 | 4.0 | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 374 | | 581 | 1149 | | | | | | 789 | |
| v/s Ratio Prot | | c0.11 | | c0.23 | 0.06 | | | | | | c0.13 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.50 | | 0.71 | 0.10 | | | | | | 0.55 | |
| Uniform Delay, d1 | | 18.3 | | 15.5 | 4.1 | | | | | | 17.9 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | | | | | | 1.00 | |
| Incremental Delay, d2 | | 1.1 | | 4.0 | 0.0 | | | | | | 0.8 | |
| Delay (s) | | 19.3 | | 19.5 | 4.2 | | | | | | 18.7 | |
| Level of Service | | B | | B | A | | | | | | B | |
| *Approach Delay (s)* | | *19.3* | | | *16.1* | | | *0.0* | | | *18.7* | |
| Approach LOS | | B | | | B | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 17.7 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 52.7 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 53.2% | ICU Level of Service | A |
| 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 | |
| Lane Util. Factor | 0.97 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | | | 0.94 | | 1.00 | 0.96 | | | 0.87 | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | 3433 | 1863 | | | 1745 | | 1770 | 1784 | | | 1612 | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | | 0.59 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | 3433 | 1863 | | | 1745 | | 1108 | 1784 | | | 1611 | |
| Volume (vph) | 705 | 17 | 0 | 0 | 29 | 25 | 216 | 25 | 10 | 1 | 0 | 173 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 783 | 19 | 0 | 0 | 32 | 28 | 240 | 28 | 11 | 1 | 0 | 192 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 8 | 0 | 0 | 142 | 0 |
| Lane Group Flow (vph) | 783 | 19 | 0 | 0 | 37 | 0 | 240 | 31 | 0 | 0 | 51 | 0 |
| Turn Type | Prot | | | | | | Perm | | | Perm | | |
| Protected Phases | 5 | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | | 4 | | |
| Actuated Green, G (s) | 18.3 | 32.0 | | | 9.7 | | 14.2 | 14.2 | | | 14.2 | |
| Effective Green, g (s) | 18.3 | 32.0 | | | 9.7 | | 14.2 | 14.2 | | | 14.2 | |
| Actuated g/C Ratio | 0.34 | 0.59 | | | 0.18 | | 0.26 | 0.26 | | | 0.26 | |
| Clearance Time (s) | 4.0 | 4.0 | | | 4.0 | | 4.0 | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 1159 | 1100 | | | 312 | | 290 | 467 | | | 422 | |
| v/s Ratio Prot | c0.23 | 0.01 | | | c0.02 | | | 0.02 | | | | |
| v/s Ratio Perm | | | | | | | c0.22 | | | | 0.03 | |
| v/c Ratio | 0.68 | 0.02 | | | 0.12 | | 0.83 | 0.07 | | | 0.12 | |
| Uniform Delay, d1 | 15.4 | 4.6 | | | 18.7 | | 18.8 | 15.0 | | | 15.2 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 1.6 | 0.0 | | | 0.2 | | 17.3 | 0.1 | | | 0.1 | |
| Delay (s) | 17.0 | 4.6 | | | 18.8 | | 36.2 | 15.1 | | | 15.4 | |
| Level of Service | B | A | | | B | | D | B | | | B | |
| Approach Delay (s) | | 16.7 | | | 18.8 | | | 33.2 | | | 15.4 | |
| Approach LOS | | B | | | B | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 20.1 | HCM Level of Service | C |
| HCM Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 54.2 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 59.5% | 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 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | | 1.00 | | | 1.00 | 1.00 |
| Frt | | 1.00 | | | 1.00 | | | 0.88 | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 1.00 | | | 0.99 | | | 0.97 | 1.00 |
| Satd. Flow (prot) | | 3539 | | | 3537 | | | 1630 | | | 1807 | 1583 |
| Flt Permitted | | 1.00 | | | 0.94 | | | 0.97 | | | 0.82 | 1.00 |
| Satd. Flow (perm) | | 3539 | | | 3336 | | | 1592 | | | 1521 | 1583 |
| Volume (vph) | 0 | 838 | 1 | 5 | 357 | 0 | 2 | 0 | 14 | 62 | 38 | 341 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 931 | 1 | 6 | 397 | 0 | 2 | 0 | 16 | 69 | 42 | 379 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 244 |
| Lane Group Flow (vph) | 0 | 932 | 0 | 0 | 403 | 0 | 0 | 6 | 0 | 0 | 111 | 135 |
| Turn Type | | | | Perm | | | Perm | | | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | 6 | | | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | | 17.1 | | | 17.1 | | | 9.2 | | | 9.2 | 9.2 |
| Effective Green, g (s) | | 17.1 | | | 17.1 | | | 9.2 | | | 9.2 | 9.2 |
| Actuated g/C Ratio | | 0.50 | | | 0.50 | | | 0.27 | | | 0.27 | 0.27 |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | 4.0 | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1764 | | | 1663 | | | 427 | | | 408 | 425 |
| v/s Ratio Prot | | c0.26 | | | | | | | | | | |
| v/s Ratio Perm | | | | | 0.12 | | | 0.00 | | | 0.07 | c0.09 |
| v/c Ratio | | 0.53 | | | 0.24 | | | 0.01 | | | 0.27 | 0.32 |
| Uniform Delay, d1 | | 5.9 | | | 4.9 | | | 9.2 | | | 9.9 | 10.0 |
| Progression Factor | | 1.00 | | | 1.00 | | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.3 | | | 0.1 | | | 0.0 | | | 0.4 | 0.4 |
| Delay (s) | | 6.1 | | | 5.0 | | | 9.2 | | | 10.3 | 10.5 |
| Level of Service | | A | | | A | | | A | | | B | B |
| Approach Delay (s) | | 6.1 | | | 5.0 | | | 9.2 | | | 10.4 | |
| Approach LOS | | A | | | A | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 7.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 34.3 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 44.5% | ICU Level of Service | A |
| 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 | | | |
| Lane Util. Factor | 0.97 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| Frt | 1.00 | 0.90 | | | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | | | |
| *Flt Protected* | *0.95* | *1.00* | | | *0.97* | *1.00* | *0.95* | *1.00* | *1.00* | | | |
| Satd. Flow (prot) | 3433 | 1679 | | | 1814 | 1583 | 1770 | 1863 | 1583 | | | |
| Flt Permitted | 0.95 | 1.00 | | | 0.97 | 1.00 | 0.95 | 1.00 | 1.00 | | | |
| *Satd. Flow (perm)* | 3433 | 1679 | | | 1814 | 1583 | 1770 | 1863 | 1583 | | | |
| Volume (vph) | 723 | 104 | 202 | 24 | 21 | 31 | 142 | 37 | 49 | 0 | 0 | 0 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 803 | 116 | 224 | 27 | 23 | 34 | 158 | 41 | 54 | 0 | 0 | 0 |
| RTOR Reduction (vph) | 0 | 55 | 0 | 0 | 0 | 31 | 0 | 0 | 45 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 803 | 285 | 0 | 0 | 50 | 3 | 158 | 41 | 9 | 0 | 0 | 0 |
| Turn Type | Split | | | Split | | Perm | Split | | Perm | | | |
| Protected Phases | 2 | 2 | | 6 | 6 | | 4 | 4 | | | | |
| Permitted Phases | | | | | | 6 | | | 4 | | | |
| Actuated Green, G (s) | 47.8 | 47.8 | | | 6.5 | 6.5 | 12.7 | 12.7 | 12.7 | | | |
| Effective Green, g (s) | 48.8 | 48.8 | | | 6.5 | 6.5 | 12.7 | 12.7 | 12.7 | | | |
| Actuated g/C Ratio | 0.61 | 0.61 | | | 0.08 | 0.08 | 0.16 | 0.16 | 0.16 | | | |
| Clearance Time (s) | 5.0 | 5.0 | | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | |
| Lane Grp Cap (vph) | 2094 | 1024 | | | 147 | 129 | 281 | 296 | 251 | | | |
| v/s Ratio Prot | c0.23 | 0.17 | | | c0.03 | | c0.09 | 0.02 | | | | |
| v/s Ratio Perm | | | | | | 0.00 | | | 0.01 | | | |
| v/c Ratio | 0.38 | 0.28 | | | 0.34 | 0.02 | 0.56 | 0.14 | 0.03 | | | |
| Uniform Delay, d1 | 7.9 | 7.3 | | | 34.7 | 33.8 | 31.1 | 28.9 | 28.5 | | | |
| *Progression Factor* | *0.56* | *0.40* | | | *1.00* | *1.00* | *1.00* | *1.00* | *1.00* | | | |
| Incremental Delay, d2 | 0.3 | 0.4 | | | 1.4 | 0.1 | 2.6 | 0.2 | 0.1 | | | |
| Delay (s) | 4.8 | 3.4 | | | 36.1 | 33.9 | 33.6 | 29.2 | 28.5 | | | |
| Level of Service | A | A | | | D | C | C | C | C | | | |
| Approach Delay (s) | | 4.4 | | | 35.2 | | | 31.8 | | | 0.0 | |
| Approach LOS | | A | | | D | | | C | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.8 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.41 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 41.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| 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 |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Frt | | 1.00 | 1.00 | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (prot) | | 1863 | 1863 | | 1770 | 1583 |
| Flt Permitted | | 1.00 | 1.00 | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 1863 | 1863 | | 1770 | 1583 |
| Volume (vph) | 0 | 971 | 160 | 0 | 122 | 654 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 1079 | 178 | 0 | 136 | 727 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 0 | 605 |
| Lane Group Flow (vph) | 0 | 1079 | 178 | 0 | 136 | 122 |
| Turn Type | | | | | | Perm |
| Protected Phases | | 2 | 6 | | 4 | |
| Permitted Phases | | | | | | 4 |
| Actuated Green, G (s) | | 58.6 | 58.6 | | 13.4 | 13.4 |
| Effective Green, g (s) | | 58.6 | 58.6 | | 13.4 | 13.4 |
| Actuated g/C Ratio | | 0.73 | 0.73 | | 0.17 | 0.17 |
| Clearance Time (s) | | 4.0 | 4.0 | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1365 | 1365 | | 296 | 265 |
| v/s Ratio Prot | | c0.58 | 0.10 | | 0.08 | |
| v/s Ratio Perm | | | | | | c0.08 |
| v/c Ratio | | 0.79 | 0.13 | | 0.46 | 0.46 |
| Uniform Delay, d1 | | 6.8 | 3.2 | | 30.0 | 30.0 |
| Progression Factor | | 1.00 | 0.14 | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 4.7 | 0.2 | | 1.1 | 1.3 |
| Delay (s) | | 11.5 | 0.6 | | 31.2 | 31.3 |
| Level of Service | | B | A | | C | C |
| Approach Delay (s) | | 11.5 | 0.6 | | 31.3 | |
| Approach LOS | | B | A | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 18.7 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.73 | | |
| Actuated Cycle Length (s) | 80.0 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 64.5% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 4.0 | | 4.0 | 4.0 | 4.0 | |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | |
| Frt | 0.99 | | 1.00 | 1.00 | 0.94 | |
| Flt Protected | 1.00 | | 0.95 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1844 | | 1770 | 1863 | 1708 | |
| Flt Permitted | 1.00 | | 0.95 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 1844 | | 1770 | 1863 | 1708 | |
| Volume (vph) | 913 | 74 | 55 | 738 | 65 | 47 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 1014 | 82 | 61 | 820 | 72 | 52 |
| RTOR Reduction (vph) | 2 | 0 | 0 | 0 | 25 | 0 |
| Lane Group Flow (vph) | 1094 | 0 | 61 | 820 | 99 | 0 |
| Turn Type | | | Prot | | | |
| Protected Phases | 4 | | 3 | 8 | 2 | |
| Permitted Phases | | | | | | |
| Actuated Green, G (s) | 69.7 | | 5.5 | 79.2 | 10.9 | |
| Effective Green, g (s) | 69.7 | | 5.5 | 79.2 | 10.9 | |
| Actuated g/C Ratio | 0.71 | | 0.06 | 0.81 | 0.11 | |
| Clearance Time (s) | 4.0 | | 4.0 | 4.0 | 4.0 | |
| Vehicle Extension (s) | 3.0 | | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 1310 | | 99 | 1504 | 190 | |
| v/s Ratio Prot | c0.59 | | 0.03 | c0.44 | c0.06 | |
| v/s Ratio Perm | | | | | | |
| v/c Ratio | 0.84 | | 0.62 | 0.55 | 0.52 | |
| Uniform Delay, d1 | 10.1 | | 45.3 | 3.3 | 41.1 | |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 4.8 | | 10.9 | 0.4 | 2.6 | |
| Delay (s) | 14.9 | | 56.1 | 3.7 | 43.7 | |
| Level of Service | B | | E | A | D | |
| Approach Delay (s) | 14.9 | | | 7.3 | 43.7 | |
| Approach LOS | B | | | A | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 13.4 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.79 | | |
| Actuated Cycle Length (s) | 98.1 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 65.7% | ICU Level of Service | C |
| 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 |
| Lane Util. Factor | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.95 | | | 0.95 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | | 0.98 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | | 0.99 | 1.00 |
| Satd. Flow (prot) | 3433 | 1863 | 1583 | 1770 | 1848 | | | 3444 | | | 3508 | 1583 |
| Flt Permitted | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 0.99 | | | 0.99 | 1.00 |
| Satd. Flow (perm) | 3433 | 1863 | 1583 | 1770 | 1848 | | | 3444 | | | 3508 | 1583 |
| Volume (vph) | 213 | 747 | 227 | 39 | 534 | 31 | 148 | 431 | 68 | 90 | 413 | 221 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 237 | 830 | 252 | 43 | 593 | 34 | 164 | 479 | 76 | 100 | 459 | 246 |
| RTOR Reduction (vph) | 0 | 0 | 101 | 0 | 2 | 0 | 0 | 8 | 0 | 0 | 0 | 0 |
| *Lane Group Flow (vph)* | *237* | *830* | *151* | *43* | *625* | *0* | *0* | *711* | *0* | *0* | *559* | *246* |
| Turn Type | Prot | | Perm | Prot | | | Split | | | Split | | Free |
| Protected Phases | 7 | 4 | | 3 | 8 | | 2 | 2 | | 6 | 6 | |
| Permitted Phases | | | 4 | | | | | | | | | Free |
| Actuated Green, G (s) | 10.6 | 53.1 | 53.1 | 3.1 | 45.6 | | | 24.1 | | | 19.1 | 117.4 |
| Effective Green, g (s) | 10.6 | 53.1 | 53.1 | 3.1 | 45.6 | | | 25.1 | | | 20.1 | 117.4 |
| Actuated g/C Ratio | 0.09 | 0.45 | 0.45 | 0.03 | 0.39 | | | 0.21 | | | 0.17 | 1.00 |
| Clearance Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | | 5.0 | | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 310 | 843 | 716 | 47 | 718 | | | 736 | | | 601 | 1583 |
| v/s Ratio Prot | c0.07 | c0.45 | | 0.02 | 0.34 | | | c0.21 | | | c0.16 | |
| v/s Ratio Perm | | | 0.10 | | | | | | | | | 0.16 |
| v/c Ratio | 0.76 | 0.98 | 0.21 | 0.91 | 0.87 | | | 0.97 | | | 0.93 | 0.16 |
| Uniform Delay, d1 | 52.2 | 31.7 | 19.5 | 57.0 | 33.2 | | | 45.7 | | | 48.0 | 0.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 10.7 | 27.0 | 0.1 | 98.6 | 11.2 | | | 24.9 | | | 21.2 | 0.2 |
| Delay (s) | 62.9 | 58.7 | 19.6 | 155.6 | 44.4 | | | 70.6 | | | 69.1 | 0.2 |
| Level of Service | E | E | B | F | D | | | E | | | E | A |
| Approach Delay (s) | | 52.0 | | | 51.5 | | | 70.6 | | | 48.1 | |
| Approach LOS | | D | | | D | | | E | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 54.8 | HCM Level of Service | D |
| HCM Volume to Capacity ratio | 0.97 | | |
| Actuated Cycle Length (s) | 117.4 | Sum of lost time (s) | 16.0 |
| Intersection Capacity Utilization | 88.4% | ICU Level of Service | E |
| 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 |
| Lane Util. Factor | | 0.95 | | | 1.00 | 1.00 | | 0.95 | | | 1.00 | 1.00 |
| Frt | | 0.98 | | | 1.00 | 0.85 | | 0.95 | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 1.00 | 1.00 | | 0.99 | | | 0.97 | 1.00 |
| Satd. Flow (prot) | | 3441 | | | 1858 | 1583 | | 3319 | | | 1806 | 1583 |
| Flt Permitted | | 0.90 | | | 0.95 | 1.00 | | 0.89 | | | 0.58 | 1.00 |
| Satd. Flow (perm) | | 3115 | | | 1766 | 1583 | | 2966 | | | 1080 | 1583 |
| Volume (vph) | 54 | 449 | 93 | 14 | 241 | 219 | 114 | 325 | 251 | 47 | 28 | 137 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 60 | 499 | 103 | 16 | 268 | 243 | 127 | 361 | 279 | 52 | 31 | 152 |
| RTOR Reduction (vph) | 0 | 19 | 0 | 0 | 0 | 149 | 0 | 97 | 0 | 0 | 0 | 90 |
| Lane Group Flow (vph) | 0 | 643 | 0 | 0 | 284 | 94 | 0 | 670 | 0 | 0 | 83 | 62 |
| *Turn Type* | Perm | | | Perm | | Perm | Perm | | | Perm | | Perm |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | 6 |
| Actuated Green, G (s) | | 13.8 | | | 13.8 | 13.8 | | 14.6 | | | 14.6 | 14.6 |
| *Effective Green, g (s)* | | 14.8 | | | 14.8 | 14.8 | | 15.6 | | | 15.6 | 15.6 |
| Actuated g/C Ratio | | 0.39 | | | 0.39 | 0.39 | | 0.41 | | | 0.41 | 0.41 |
| Clearance Time (s) | | 5.0 | | | 5.0 | 5.0 | | 5.0 | | | 5.0 | 5.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | 3.0 | | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1201 | | | 681 | 610 | | 1205 | | | 439 | 643 |
| v/s Ratio Prot | | | | | | | | | | | | |
| v/s Ratio Perm | | c0.21 | | | 0.16 | 0.06 | | c0.23 | | | 0.08 | 0.04 |
| v/c Ratio | | 0.54 | | | 0.42 | 0.15 | | 0.56 | | | 0.19 | 0.10 |
| *Uniform Delay, d1* | | 9.1 | | | 8.6 | 7.7 | | 8.7 | | | 7.3 | 7.0 |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.5 | | | 0.4 | 0.1 | | 0.6 | | | 0.2 | 0.1 |
| Delay (s) | | 9.6 | | | 9.1 | 7.8 | | 9.3 | | | 7.5 | 7.1 |
| Level of Service | | A | | | A | A | | A | | | A | A |
| Approach Delay (s) | | 9.6 | | | 8.5 | | | 9.3 | | | 7.3 | |
| *Approach LOS* | | A | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.0 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.55 | | |
| Actuated Cycle Length (s) | 38.4 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 68.2% | ICU Level of Service | C |
| 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 | |
| Lane Util. Factor | 0.95 | 0.95 | | | 1.00 | | | 1.00 | | | 1.00 | |
| Frt | 1.00 | 0.99 | | | 0.89 | | | 1.00 | | | 1.00 | |
| Flt Protected | 0.95 | 0.95 | | | 0.99 | | | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | 1681 | 1679 | | | 1642 | | | 1863 | | | 1863 | |
| Flt Permitted | 0.73 | 0.71 | | | 0.93 | | | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | 1295 | 1241 | | | 1544 | | | 1863 | | | 1863 | |
| Volume (vph) | 435 | 0 | 8 | 6 | 0 | 29 | 0 | 234 | 0 | 0 | 129 | 0 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 483 | 0 | 9 | 7 | 0 | 32 | 0 | 260 | 0 | 0 | 143 | 0 |
| RTOR Reduction (vph) | 0 | 3 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lane Group Flow (vph) | 242 | 247 | 0 | 0 | 17 | 0 | 0 | 260 | 0 | 0 | 143 | 0 |
| Turn Type | Perm | | | Perm | | | | | | | | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | | | | | | | |
| Actuated Green, G (s) | 10.2 | 10.2 | | | 10.2 | | | 13.7 | | | 13.7 | |
| Effective Green, g (s) | 10.2 | 10.2 | | | 10.2 | | | 13.7 | | | 13.7 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | | | 0.43 | | | 0.43 | |
| Clearance Time (s) | 4.0 | 4.0 | | | 4.0 | | | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | | | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 414 | 397 | | | 494 | | | 800 | | | 800 | |
| v/s Ratio Prot | | | | | | | | c0.14 | | | 0.08 | |
| v/s Ratio Perm | 0.19 | c0.20 | | | 0.01 | | | | | | | |
| v/c Ratio | 0.58 | 0.62 | | | 0.03 | | | 0.32 | | | 0.18 | |
| Uniform Delay, d1 | 9.1 | 9.2 | | | 7.5 | | | 6.0 | | | 5.6 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 2.1 | 3.0 | | | 0.0 | | | 0.2 | | | 0.1 | |
| Delay (s) | 11.2 | 12.2 | | | 7.5 | | | 6.3 | | | 5.7 | |
| Level of Service | B | B | | | A | | | A | | | A | |
| Approach Delay (s) | | 11.7 | | | 7.5 | | | 6.3 | | | 5.7 | |
| Approach LOS | | B | | | A | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 9.1 | HCM Level of Service | A |
| HCM Volume to Capacity ratio | 0.45 | | |
| Actuated Cycle Length (s) | 31.9 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 37.9% | ICU Level of Service | A |
| 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 | |
| Lane Util. Factor | | 1.00 | | 1.00 | 1.00 | | | | | | 0.95 | |
| Frt | | 0.96 | | 1.00 | 1.00 | | | | | | 0.98 | |
| Flt Protected | | 1.00 | | 0.95 | 1.00 | | | | | | 0.97 | |
| Satd. Flow (prot) | | 1795 | | 1770 | 1863 | | | | | | 3365 | |
| Flt Permitted | | 1.00 | | 0.95 | 1.00 | | | | | | 0.97 | |
| Satd. Flow (perm) | | 1795 | | 1770 | 1863 | | | | | | 3365 | |
| Volume (vph) | 0 | 124 | 46 | 320 | 168 | 0 | 0 | 0 | 0 | 464 | 188 | 100 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 138 | 51 | 356 | 187 | 0 | 0 | 0 | 0 | 516 | 209 | 111 |
| RTOR Reduction (vph) | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 |
| Lane Group Flow (vph) | 0 | 172 | 0 | 356 | 187 | 0 | 0 | 0 | 0 | 0 | 821 | 0 |
| Turn Type | | | | Prot | | | | | | Split | | |
| Protected Phases | | 2 | | 1 | 6 | | | | | 4 | 4 | |
| Permitted Phases | | | | | | | | | | | | |
| Actuated Green, G (s) | | 11.2 | | 16.7 | 31.9 | | | | | | 19.5 | |
| Effective Green, g (s) | | 11.2 | | 16.7 | 31.9 | | | | | | 19.5 | |
| Actuated g/C Ratio | | 0.19 | | 0.28 | 0.54 | | | | | | 0.33 | |
| Clearance Time (s) | | 4.0 | | 4.0 | 4.0 | | | | | | 4.0 | |
| Vehicle Extension (s) | | 3.0 | | 3.0 | 3.0 | | | | | | 3.0 | |
| Lane Grp Cap (vph) | | 338 | | 498 | 1001 | | | | | | 1105 | |
| v/s Ratio Prot | | c0.10 | | c0.20 | 0.10 | | | | | | c0.24 | |
| v/s Ratio Perm | | | | | | | | | | | | |
| v/c Ratio | | 0.51 | | 0.71 | 0.19 | | | | | | 0.88dl | |
| Uniform Delay, d1 | | 21.6 | | 19.2 | 7.1 | | | | | | 17.7 | |
| Progression Factor | | 1.00 | | 1.00 | 1.00 | | | | | | 1.00 | |
| Incremental Delay, d2 | | 1.2 | | 4.8 | 0.1 | | | | | | 2.7 | |
| Delay (s) | | 22.8 | | 24.0 | 7.2 | | | | | | 20.5 | |
| Level of Service | | C | | C | A | | | | | | C | |
| Approach Delay (s) | | 22.8 | | | 18.2 | | | 0.0 | | | 20.5 | |
| Approach LOS | | C | | | B | | | A | | | C | |

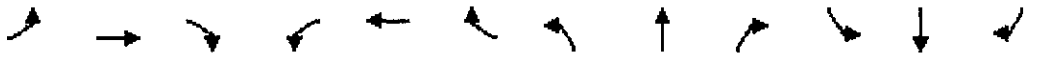
| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 20.0 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.68 | | |
| Actuated Cycle Length (s) | 59.4 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 62.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

dl Defacto Left Lane. Recode with 1 though lane as a left lane.
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 | |
| Lane Util. Factor | 0.97 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | 1.00 | 1.00 | | | 0.94 | | 1.00 | 0.96 | | | 0.87 | |
| Flt Protected | 0.95 | 1.00 | | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | 3433 | 1863 | | | 1753 | | 1770 | 1779 | | | 1619 | |
| Flt Permitted | 0.95 | 1.00 | | | 1.00 | | 0.71 | 1.00 | | | 0.99 | |
| Satd. Flow (perm) | 3433 | 1863 | | | 1753 | | 1325 | 1779 | | | 1611 | |
| Volume (vph) | 519 | 41 | 0 | 0 | 24 | 19 | 314 | 44 | 19 | 3 | 0 | 60 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 577 | 46 | 0 | 0 | 27 | 21 | 349 | 49 | 21 | 3 | 0 | 67 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 14 | 0 | 0 | 45 | 0 |
| Lane Group Flow (vph) | 577 | 46 | 0 | 0 | 30 | 0 | 349 | 56 | 0 | 0 | 25 | 0 |
| Turn Type | Prot | | | | | | Perm | | | Perm | | |
| Protected Phases | 5 | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | | | | 8 | | | 4 | | |
| Actuated Green, G (s) | 13.8 | 26.0 | | | 8.2 | | 17.1 | 17.1 | | | 17.1 | |
| Effective Green, g (s) | 13.8 | 26.0 | | | 8.2 | | 17.1 | 17.1 | | | 17.1 | |
| Actuated g/C Ratio | 0.27 | 0.51 | | | 0.16 | | 0.33 | 0.33 | | | 0.33 | |
| Clearance Time (s) | 4.0 | 4.0 | | | 4.0 | | 4.0 | 4.0 | | | 4.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | | | 3.0 | | 3.0 | 3.0 | | | 3.0 | |
| Lane Grp Cap (vph) | 927 | 948 | | | 281 | | 443 | 595 | | | 539 | |
| v/s Ratio Prot | c0.17 | 0.02 | | | c0.02 | | | 0.03 | | | | |
| *v/s Ratio Perm* | | | | | | | c0.26 | | | | 0.02 | |
| v/c Ratio | 0.62 | 0.05 | | | 0.11 | | 0.79 | 0.09 | | | 0.05 | |
| Uniform Delay, d1 | 16.4 | 6.3 | | | 18.3 | | 15.4 | 11.7 | | | 11.5 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.0 | | | 0.2 | | 9.0 | 0.1 | | | 0.0 | |
| Delay (s) | 17.7 | 6.3 | | | 18.5 | | 24.4 | 11.7 | | | 11.5 | |
| Level of Service | B | A | | | B | | C | B | | | B | |
| Approach Delay (s) | | 16.8 | | | 18.5 | | | 22.2 | | | 11.5 | |
| Approach LOS | | B | | | B | | | C | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 18.5 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.59 | | |
| Actuated Cycle Length (s) | 51.1 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 52.2% | ICU Level of Service | A |
| 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 |
| Lane Util. Factor | | 0.95 | | | 0.95 | | | 1.00 | | | 1.00 | 1.00 |
| Frt | | 1.00 | | | 1.00 | | | 0.90 | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 1.00 | | | 0.99 | | | 0.97 | 1.00 |
| Satd. Flow (prot) | | 3538 | | | 3536 | | | 1650 | | | 1805 | 1583 |
| Flt Permitted | | 1.00 | | | 0.94 | | | 0.93 | | | 0.79 | 1.00 |
| Satd. Flow (perm) | | 3538 | | | 3336 | | | 1560 | | | 1478 | 1583 |
| Volume (vph) | 0 | 590 | 2 | 5 | 301 | 0 | 5 | 0 | 18 | 203 | 117 | 598 |
| Peak-hour factor, PHF | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Adj. Flow (vph) | 0 | 656 | 2 | 6 | 334 | 0 | 6 | 0 | 20 | 226 | 130 | 664 |
| RTOR Reduction (vph) | *0* | *0* | *0* | *0* | *0* | *0* | *0* | *10* | *0* | *0* | *0* | *109* |
| Lane Group Flow (vph) | 0 | 658 | 0 | 0 | 340 | 0 | 0 | 16 | 0 | 0 | 356 | 555 |
| Turn Type | | | | Perm | | | Perm | | | Perm | | Perm |
| Protected Phases | | 2 | | | 6 | | | 8 | | | 4 | |
| Permitted Phases | | | | 6 | | | 8 | | | 4 | | 4 |
| Actuated Green, G (s) | | 12.7 | | | 12.7 | | | 19.4 | | | 19.4 | 19.4 |
| Effective Green, g (s) | | 12.7 | | | 12.7 | | | 19.4 | | | 19.4 | 19.4 |
| Actuated g/C Ratio | | 0.32 | | | 0.32 | | | 0.48 | | | 0.48 | 0.48 |
| Clearance Time (s) | | 4.0 | | | 4.0 | | | 4.0 | | | 4.0 | 4.0 |
| Vehicle Extension (s) | | 3.0 | | | 3.0 | | | 3.0 | | | 3.0 | 3.0 |
| Lane Grp Cap (vph) | | 1121 | | | 1057 | | | 755 | | | 715 | 766 |
| v/s Ratio Prot | | c0.19 | | | | | | | | | | |
| v/s Ratio Perm | | | | | 0.10 | | | 0.01 | | | 0.24 | c0.35 |
| v/c Ratio | | 0.59 | | | 0.32 | | | 0.02 | | | 0.50 | 0.72 |
| Uniform Delay, d1 | | 11.5 | | | 10.4 | | | 5.4 | | | 7.0 | 8.2 |
| Progression Factor | | 1.00 | | | 1.00 | | | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 0.8 | | | 0.2 | | | 0.0 | | | 0.5 | 3.4 |
| Delay (s) | | 12.3 | | | 10.6 | | | 5.4 | | | 7.6 | 11.6 |
| Level of Service | | B | | | B | | | A | | | A | B |
| Approach Delay (s) | | 12.3 | | | 10.6 | | | 5.4 | | | 10.2 | |
| Approach LOS | | B | | | B | | | A | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM Average Control Delay | 10.9 | HCM Level of Service | B |
| HCM Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 40.1 | Sum of lost time (s) | 8.0 |
| Intersection Capacity Utilization | 58.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# APPENDIX E:
# PROJECT COST ESTIMATES

# City of Oakland

PRELIMINARY ENGINEER'S ESTIMATE
TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTIONS 1, 2
**LEONA QUARRY**
*OAKLAND, CALIFORNIA*

13-Jul-06

| Item | Description | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| | **I-580 WESTBOUND ON-RAMP/ EDWARDS AVE, I-580 EASTBOUND OFF RAMP/ EDWARDS AVE IMPROVEMENTS** | | | | |
| | *Improvements* | | | | |
| 1 | Burckhalter Park driveway construction | 1 | LS | $55,638 | $55,638 |
| 2 | Interchange modification construction | 1 | LS | $747,928 | $747,928 |
| | **TOTAL** | | | | **$803,566** |
| | **DESIGN ENGINEERING** | | | | **$110,900** |
| | **FEES PAID TO CITY** | | | | **$46,841** |
| | **TOTAL *(rounded to nearest $100)*** | | | | **$961,300** |

*Note:*

1. *Actual construction cost and design engineering cost provided by David Chapman, DeSilva Group.*
2. *Actual fees paid for inspection, permits, plan review, etc. provided by Marcel Uzegbu, City of Oakland.*

# City of Oakland

PRELIMINARY ENGINEER'S ESTIMATE
TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTION 4
**LEONA QUARRY**
OAKLAND, CALIFORNIA

13-Jul-06

| Item | Description | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| | **EDWARDS AVE./GREENLY DR.** | | | | |
| | IMPROVEMENTS | | | | |
| | *Improvements* | | | | |
| 1 | Construction | 1 | LS | $77,605 | $77,605 |
| | **TOTAL** | | | | **$77,605** |
| | **DESIGN ENGINEERING** | | | | **$14,100** |
| | **FEES PAID TO CITY** | | | | **$16,127** |
| | **TOTAL** ***(rounded to nearest $100)*** | | | | **$107,800** |

*Note:*

1. *Actual construction cost and design engineering cost provided by David Chapman, DeSilva Group.*
2. *Actual fees for inspection, permits, plan review, etc. provided by Marcel Uzegbu, City of Oakland.*

# City of Oakland

PRELIMINARY ENGINEER'S ESTIMATE
*TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTION 6*
**LEONA QUARRY**
OAKLAND, CALIFORNIA

16-Feb-06

| Item | Description | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| | **73rd AVE./MacARTHUR BLVD./FOOTHILL BLVD.** | | | | |
| | IMPROVEMENTS | | | | |
| | *Street Work* | | | | |
| 1 | Saw Cut | 250 | LF | $5 | $1,250 |
| 2 | AC/AB Pavement (6" AC/30" AB) | 2,200 | SF | $35 | $77,000 |
| 3 | Median Curb | 220 | LF | $25 | $5,500 |
| 4 | Miscellaneous Improvements/Utility Relocation | 1 | LS | $11,300 | $11,300 |
| 5 | Landscaping | 1 | LS | $25,000 | $25,000 |
| 6 | Water Meter (relocate) | 1 | EA | $11,300 | $11,300 |
| 7 | HC Ramps | 3 | EA | $2,900 | $8,700 |
| 8 | Signing/Striping | 1 | LS | $25,000 | $25,000 |
| 9 | Remove curb and gutter | 220 | LF | $20 | $4,400 |
| 10 | Remove tree | 6 | EA | $900 | $5,400 |
| | Subtotal | | | | $174,850 |
| | *Signalization* | | | | |
| 11 | Modify Traffic Signal | 1 | LS | $135,600 | $135,600 |
| 12 | Interconnect | 600 | LF | $25 | $15,000 |
| | *Subtotal* | | | | *$150,600* |
| | **TOTAL** | | | | **$325,450** |



*Updated: 9/27/2006*

**CITY OF OAKLAND PUBLIC WORKS AGENCY / ENGINEERING DESIGN AND RIGHT-OF-WAY MANAGEMENT**
**PRELIMINARY PROJECT ESTIMATE**

| | | | |
|---|---|---|---|
| **Project:** | 73rd/MacArthur Blvd/Foothill Blvd #6 | **Estimate by:** | M. Uzegbu |
| | | **Date Estimated** | 5/4/2006 |
| **Project No.:** | P27710 | **Checked by:** | |

| | | | |
|---|---|---|---|
| CONSTRUCTION COSTS | ESTIMATED CONSTRUCTION COST | | $ 325,450 |
| | Contingency | 25.0% | $ 81,363 |
| | Inspection | 9.0% | $ 29,291 |
| | Construction Services (Survey and Testing) | 2.0% | $ 6,509 |
| | TOTAL CONSTRUCTION COSTS | 36.0% | $ 442,612 |
| | | | |
| | **DESIGN COST** | | |
| | Engineering studies(traffic studies) | 3.0% | $ 13,278 |
| | Environmental studies | 3.0% | $ 13,278 |
| DSG | Design/Engineering | 15.0% | $ 66,392 |
| | Constructibility Plan Review Cost | 5.0% | $ 22,131 |
| | ***TOTAL DESIGN COST*** | 26.0% | $ 115,079 |
| | | | |
| ADMINISTRATIVE COSTS | **ADMINISTRATION** | | |
| | Project Management ( Administration, bidding etc ) | 8.0% | $ 35,409 |
| | Printing/Duplication/Advertising/Postage | 0.5% | $ 2,213 |
| | Other Agencies Permit (PGE power) | 0.5% | $ 2,213 |
| | Contract Compliance | 3.0% | $ 13,278 |
| | TOTAL ADMINISTRATIVE COSTS | 12.0% | $ 53,113 |
| TOTALS | | | |
| | ***SUB TOTAL PROJECT COST*** | | $ 610,805 |
| | Project Contingency | 10.0% | $ 11,508 |
| | ***TOTAL PROJECT COST:*** | | ***$ 622,312*** |

# City of Oakland

PRELIMINARY ENGINEER'S ESTIMATE
TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTION 7
**LEONA QUARRY**
OAKLAND, CALIFORNIA

06-Jan-06

| Item | Description | | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|---|
| | **MOUNTAIN BLVD./KELLER AVE.** | | | | | |
| | IMPROVEMENTS | | | | | |
| | *Improvements* | | | | | |
| 1 | Miscellaneous Improvements/Utility Relocation | | 1 | LS | $11,300 | $11,300 |
| 2 | Signing/Striping | | 1 | LS | $21,000 | $21,000 |
| 3 | HC Ramps | | 4 | EA | $2,900 | $11,600 |
| | | Subtotal | | | | $43,900 |
| | *Signalization* | | | | | |
| 4 | Traffic Signal | | 2 | LS | $180,800 | $361,600 |
| 5 | Interconnect | | 1,000 | LF | $25 | $25,000 |
| | | Subtotal | | | | $386,600 |
| | | **TOTAL** | | | | **$430,500** |

**CITY OF OAKLAND PUBLIC WORKS AGENCY / ENGINEERING DESIGN AND RIGHT-OF-WAY MANAGEMENT**
**PRELIMINARY PROJECT ESTIMATE**

| | | | |
|---|---|---|---|
| **Project:** | Mountain Blvd/Keller Avenue # 7 | **Estimate by:** | M. Uzegbu |
| | | **Date Estimated** | 5/4/2006 |
| **Project No.:** | P27710 | **Checked by:** | |

| | | | | |
|---|---|---|---|---|
| CONSTRUCTION COSTS | ESTIMATED CONSTRUCTION COST | | $ | 430,500 |
| | Contingency | 25.0% | $ | 107,625 |
| | Inspection | 9.0% | $ | 38,745 |
| | Construction Services (Survey and Testing) | 2.0% | $ | 8,610 |
| | *TOTAL CONSTRUCTION COSTS* | 36.0% | $ | 586,480 |
| | **DESIGN COST** | | | |
| | *Engineering studies(traffic studies)* | 3.0% | $ | 17,564 |
| | Environmental studies | 3.0% | $ | 17,564 |
| DSG | Design/Engineering | 15.0% | $ | 87,822 |
| | Constructibility Plan Review Cost | 5.0% | $ | 29,274 |
| | ***TOTAL DESIGN COST*** | 26.0% | $ | 152,225 |
| | **ADMINISTRATION** | | | |
| ADMINISTRATIVE COSTS | Project Management ( Administration, bidding etc ) | 8.0% | $ | 46,838 |
| | Printing/Duplication/Advertising/Postage | 0.5% | $ | 2,927 |
| | Other Agencies Permit9eg. PGE power) | 0.5% | $ | 2,927 |
| | Contract Compliance | 3.0% | $ | 17,564 |
| | *TOTAL ADMINISTRATIVE COSTS* | 12.0% | $ | 70,256 |
| | ***SUB TOTAL PROJECT COST*** | | $ | 807,962 |
| | *Project Contingency* | 10.0% | $ | 15,222 |
| | ***TOTAL PROJECT COST:*** | | **$** | ***823,185*** |

## City of Oakland

PRELIMINARY ENGINEER'S ESTIMATE
TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTION 8
**LEONA QUARRY**
OAKLAND, CALIFORNIA

16-Feb-06

| Item | Description | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| | **I-580 WESTBOUND OFF-RAMP/MOUNTAIN BLVD.** | | | | |
| | IMPROVEMENTS | | | | |
| | *Improvements* | | | | |
| 1 | Construction | 1 | LS | $212,385 | $212,385 |
| | **TOTAL** | | | | **$212,385** |

*Note:*

1. *Actual construction cost (based on bids received) provided by David Chapman, DeSilva Group.*



*Updated: 9/27/2006*

**CITY OF OAKLAND PUBLIC WORKS AGENCY / ENGINEERING DESIGN AND RIGHT-OF-WAY MANAGEMENT**
**PRELIMINARY PROJECT ESTIMATE**

| | | | |
|---|---|---|---|
| **Project:** | I-580 Westbound off-ramp/Mountain Blvd/Shone # 8 | **Estimate by:** | M. Uzegbu |
| | | **Date Estimated** | 5/4/2006 |
| **Project No.:** | P27710 | **Checked by:** | |

| | | | | |
|---|---|---|---|---|
| CONSTRUCTION COSTS | ESTIMATED CONSTRUCTION COST | | $ | 212,385 |
| | Contingency | 25.0% | $ | 53,096 |
| | Inspection | 9.0% | $ | 19,115 |
| | Construction Services (Survey and Testing) | 3.0% | $ | 6,372 |
| | TOTAL CONSTRUCTION COSTS | 37.0% | $ | 290,967 |
| | **DESIGN COST** | | | |
| | Engineering studies(traffic studies) | 3.0% | $ | 8,729 |
| | Environmental studies | 3.0% | $ | 8,729 |
| DSG | Design/Engineering | 15.0% | $ | 43,645 |
| | Constructibility Plan Review Cost | 5.0% | $ | 14,548 |
| | ***TOTAL DESIGN COST*** | 26.0% | $ | 75,652 |
| ADMINISTRATIVE COSTS | **ADMINISTRATION** | | | |
| | Project Management ( Administration, bidding etc ) | 8.0% | $ | 23,277 |
| | Printing/Duplication/Advertising/Postage | 0.5% | $ | 1,455 |
| | Other Agencies Permit eg. PGE Power) | 0.5% | $ | 1,455 |
| | Contract Compliance | 3.0% | $ | 8,729 |
| | TOTAL ADMINISTRATIVE COSTS | 12.0% | $ | 34,916 |
| | ***SUB TOTAL PROJECT COST*** | | $ | 401,535 |
| | Project Contingency | 10.0% | $ | 7,565 |
| | ***TOTAL PROJECT COST:*** | | ***$*** | ***409,100*** |

PRELIMINARY ENGINEER'S ESTIMATE
TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTION 9
**LEONA QUARRY**
OAKLAND, CALIFORNIA

16-Feb-06

| Item | Description | | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|---|
| | **I-580 EASTBOUND OFF-RAMP/KELLER AVE.** | | | | | |
| | IMPROVEMENTS | | | | | |
| | *Improvements* | | | | | |
| 1 | Miscellaneous Improvements/Utility Relocation | | 1 | LS | $11,300 | $11,300 |
| 2 | HC Ramps | | 4 | EA | $2,900 | $11,600 |
| 3 | Signing/Striping | | 1 | LS | $13,000 | $13,000 |
| | | Subtotal | | | | $35,900 |
| | *Signalization* | | | | | |
| 4 | Traffic Signal | | 1 | LS | $180,800 | $180,800 |
| | | Subtotal | | | | $180,800 |
| | | **TOTAL** | | | | **$216,700** |

## CITY OF OAKLAND PUBLIC WORKS AGENCY / ENGINEERING DESIGN AND RIGHT-OF-WAY MANAGEMENT
## PRELIMINARY PROJECT ESTIMATE

| | | | |
|---|---|---|---|
| **Project:** | Eastbound Off-Ramp/Keller Avenue # 9 | **Estimate by:** | M. Uzegbu |
| | | **Date Estimated** | 5/4/2006 |
| **Project No.:** | P27710 | **Checked by:** | |

| | | | | |
|---|---|---|---|---|
| CONSTRUCTION COSTS | ESTIMATED CONSTRUCTION COST | | $ | 216,700 |
| | Contingency | 25.0% | $ | 54,175 |
| | Inspection | 9.0% | $ | 19,503 |
| | Construction Services (Survey and Testing) | 2.0% | $ | 4,334 |
| | *TOTAL CONSTRUCTION COSTS* | 36.0% | $ | 294,712 |
| | | | | |
| DSG | **DESIGN COST** | | | |
| | Engineering studies(traffic studies) | 3.0% | $ | 8,841 |
| | Environmental studies | 3.0% | $ | 8,841 |
| | Design/Engineering | 15.0% | $ | 44,207 |
| | Constructibility Plan Review Cost | 5.0% | $ | 14,736 |
| | ***TOTAL DESIGN COST*** | 26.0% | $ | 76,625 |
| | | | | |
| ADMINISTRATIVE COSTS | **ADMINISTRATION** | | | |
| | Project Management ( Administration, bidding etc ) | 7.0% | $ | 20,630 |
| | Printing/Duplication/Advertising/Postage | 0.5% | $ | 1,474 |
| | Other Agencies Permit(PGE power etc) | 0.5% | $ | 1,474 |
| | Contract Compliance | 3.0% | $ | 8,841 |
| | *TOTAL ADMINISTRATIVE COSTS* | 11.0% | $ | 32,418 |
| TOTALS | | | | |
| | ***SUB TOTAL PROJECT COST*** | | $ | 403,755 |
| | Project Contingency | 10.0% | $ | 7,663 |
| | ***TOTAL PROJECT COST:*** | | ***$*** | ***411,418*** |

PRELIMINARY ENGINEER'S ESTIMATE
TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTION 16
**LEONA QUARRY**
OAKLAND, CALIFORNIA

17-Jan-06

| Item | Description | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| | **I-580 WESTBOUND OFF-RAMP/KUHNLE AVE./MOUNTAIN BLVD.** | | | | |
| | IMPROVEMENTS | | | | |
| | *Street Work* | | | | |
| 1 | Saw Cut | 300 | LF | $5 | $1,500 |
| 2 | AC/AB (6" AC/30" AB) | 1,200 | SF | $35 | $42,000 |
| 3 | Curb and Gutter | 300 | LF | $21 | $6,300 |
| 4 | Miscellaneous Improvements/Utility Relocation | 1 | LS | $116,700 | $116,700 |
| 5 | HC Ramps | 4 | EA | $2,900 | $11,600 |
| 8 | Signing/Striping | 1 | LS | $22,000 | $22,000 |
| | Subtotal | | | | $200,100 |
| | *Signalization* | | | | |
| 7 | Traffic Signal | 1 | LS | $180,800 | $180,800 |
| 8 | Interconnect | 600 | LF | $25 | $15,000 |
| | Subtotal | | | | $195,800 |
| | **TOTAL** | | | | **$395,900** |

**CITY OF OAKLAND PUBLIC WORKS AGENCY / ENGINEERING DESIGN AND RIGHT-OF-WAY MANAGEMENT**
**PRELIMINARY PROJECT ESTIMATE**

| | | | |
|---|---|---|---|
| **Project:** | I.580 Westbound off.ramp/Kunle Avenue/Mountain Blvd #16 | **Estimate by:** | M. Uzegbu |
| | | **Date Estimated** | 5/4/2006 |
| **Project No.:** | P27710 | **Checked by:** | |

| | | | | |
|---|---|---|---|---|
| CONSTRUCTION COSTS | ESTIMATED CONSTRUCTION COST | | $ | 395,900 |
| | Contingency | 25.0% | $ | 98,975 |
| | Inspection | 9.0% | $ | 35,631 |
| | Construction Services (Survey and Testing) | 2.0% | $ | 7,918 |
| | TOTAL CONSTRUCTION COSTS | 36.0% | $ | 538,424 |
| | | | | |
| | **DESIGN COST** | | | |
| | Engineering studies(traffic studies) | 3.0% | $ | 16,153 |
| | Environmental studies | 3.0% | $ | 16,153 |
| DSG | Design/Engineering | 15.0% | $ | 80,764 |
| | Constructibility Plan Review Cost | 5.0% | $ | 26,921 |
| | ***TOTAL DESIGN COST*** | 26.0% | $ | 139,990 |
| | | | | |
| ADMINISTRATIVE COSTS | **ADMINISTRATION** | | | |
| | Project Management ( Administration, bidding etc ) | 8.0% | $ | 43,074 |
| | Printing/Duplication/Advertising/Postage | 0.5% | $ | 2,692 |
| | Other Agencies Permit | 0.5% | $ | 2,692 |
| | Contract Compliance | 3.0% | $ | 16,153 |
| | TOTAL ADMINISTRATIVE COSTS | 12.0% | $ | 64,611 |
| | | | | |
| | ***SUB TOTAL PROJECT COST*** | | $ | 743,025 |
| | Project Contingency | 10.0% | $ | 13,999 |
| | ***TOTAL PROJECT COST:*** | | ***$*** | ***757,024*** |

PRELIMINARY ENGINEER'S ESTIMATE
TRAFFIC INTERSECTION IMPROVEMENTS - INTERSECTION 18
**LEONA QUARRY**
OAKLAND, CALIFORNIA

06-Jan-06

| Item | Description | Quantity | Unit | Unit Price | Amount |
|---|---|---|---|---|---|
| | **I-580 EASTBOUND OFF-RAMP/SEMINARY AVE./OVERDALE AVE.** | | | | |
| | IMPROVEMENTS | | | | |
| | *Street Work* | | | | |
| 1 | Miscellaneous Improvements/Utility Relocation | 1 | LS | $11,300 | $11,300 |
| 2 | Signing/Striping | 1 | LS | $15,000 | $15,000 |
| | Subtotal | | | | $26,300 |
| | *Signalization* | | | | |
| 3 | *Traffic Signal* | 1 | LS | $180,800 | $180,800 |
| 4 | Interconnect | 1 | LS | $11,300 | $11,300 |
| | Subtotal | | | | $192,100 |
| | **TOTAL** | | | | **$218,400** |

**CITY OF OAKLAND PUBLIC WORKS AGENCY / ENGINEERING DESIGN AND RIGHT-OF-WAY MANAGEMENT**
**PRELIMINARY PROJECT ESTIMATE**

| | | | |
|---|---|---|---|
| **Project:** | I.580 eastbound off.ramp/Seminary Avenue/Overdale Ave #18 | **Estimate by:** | M. Uzegbu |
| | | **Date Estimated** | 5/4/2006 |
| **Project No.:** | P27710 | **Checked by:** | |

| | | | | |
|---|---|---|---|---|
| CONSTRUCTION COSTS | ESTIMATED CONSTRUCTION COST | | $ | 218,400 |
| | Contingency | 25.0% | $ | 54,600 |
| | Inspection | 9.0% | $ | 19,656 |
| | Construction Services (Survey and Testing) | 2.0% | $ | 4,368 |
| | *TOTAL CONSTRUCTION COSTS* | 36.0% | $ | 297,024 |
| | | | | |
| DSG | **DESIGN COST** | | | |
| | Engineering studies(traffic studies) | 3.0% | $ | 8,911 |
| | Environmental studies | 3.0% | $ | 8,911 |
| | Design/Engineering | 15.0% | $ | 44,554 |
| | Constructibility Plan Review Cost | 5.0% | $ | 14,851 |
| | ***TOTAL DESIGN COST*** | 26.0% | $ | 77,226 |
| | | | | |
| ADMINISTRATION COSTS | **ADMINISTRATION** | | | |
| | Project Management ( administration, bidding etc ) | 8.0% | $ | 23,762 |
| | Printing/Duplication/Advertising/Postage | 0.5% | $ | 1,485 |
| | Other Agencies Permit (PGE power) | 0.5% | $ | 1,485 |
| | Contract Compliance | 3.0% | $ | 8,911 |
| | *TOTAL ADMINISTRATIVE COSTS* | 12.0% | $ | 35,643 |
| | | | | |
| | ***SUB TOTAL PROJECT COST*** | | $ | 409,893 |
| | Project Contingency | 10.0% | $ | 7,723 |
| | ***TOTAL PROJECT COST:*** | | ***$*** | ***417,616*** |