Park Street Triangle Traffic Study

Final Report

Prepared for:
City of Oakland
Under
Traffic Engineering Technical Assistance Program (TETAP)

Submitted by:

Dowling Associates, Inc.
Transportation Engineering • Planning • Research • Education

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December 20, 2005

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City of Oakland Public Works Agency
250 Frank Ogawa Plaza, Suite 4344
Oakland, CA 94612-2033
Attn: Mr. Philip Ho

Subject: Final Report for Park Street Triangle Traffic Study [P04047.7]

Dear Philip:

Dowling Associates is pleased to submit the Final Report for the Park Street Triangle Traffic Study. Please contact me if you have questions or comments.

Sincerely,

Dowling Associates, Inc.

[Sent Via Email]

Mark Bowman
Principal

cc. Jeff Georgevich, MTC
Christine Atienza, MTC
V. Patel, City of Alameda
John Bates, Alameda County
Marty Beene

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Introduction

This report was prepared under the Traffic Engineering Technical Assistance Program (TETAP) for the City of Oakland. The project study area, referred to as the Park Street Triangle area, encompasses 29th Avenue, Kennedy Street, 23rd Avenue, Glascock Street, Ford Street, and the Park Street Bridge. Park Street in the City of Alameda is connected to 29th Avenue in the City of Oakland via the Park Street Bridge over the waterways of the Oakland Inner Harbor. The Park Street Triangle serves as a gateway to the Oakland waterfront and the proposed Bay Trail.

Development has occurred in the study area in recent years, primarily consisting of three- to four-story residential developments. Additional development in the area is anticipated. The increase in residential development in the area will increase the demand for pedestrian and bicycle travel.

The *North I-880 Safety and 880 Safety and Operations Study* is evaluating providing direct access to the Park Street Bridge via a new interchange at 29th Avenue. This could result in additional traffic through the area.

The existing street network is confusing to motorists and the 23rd Avenue alignment apparently invites motorists to approach the Park Street Bridge at high rate of speeds. Speeding and the lack of proper lane delineation have contributed to numerous traffic accidents over the years. The existing street network and roadway configurations will need to be re-designed to improve traffic flow, access, and safety. This may require acquisition of additional right-of-way and relocation of businesses.

The objective of the project was to evaluate measures to provide a safe and efficient street network in the Park Street Triangle area. The study was conducted to evaluate alternatives developed by the City of Oakland in cooperation with the City of Alameda and Alameda County staff representatives. The alternatives were developed to improve traffic operations and improve traffic and pedestrian safety on the streets in the study area.

Project Data

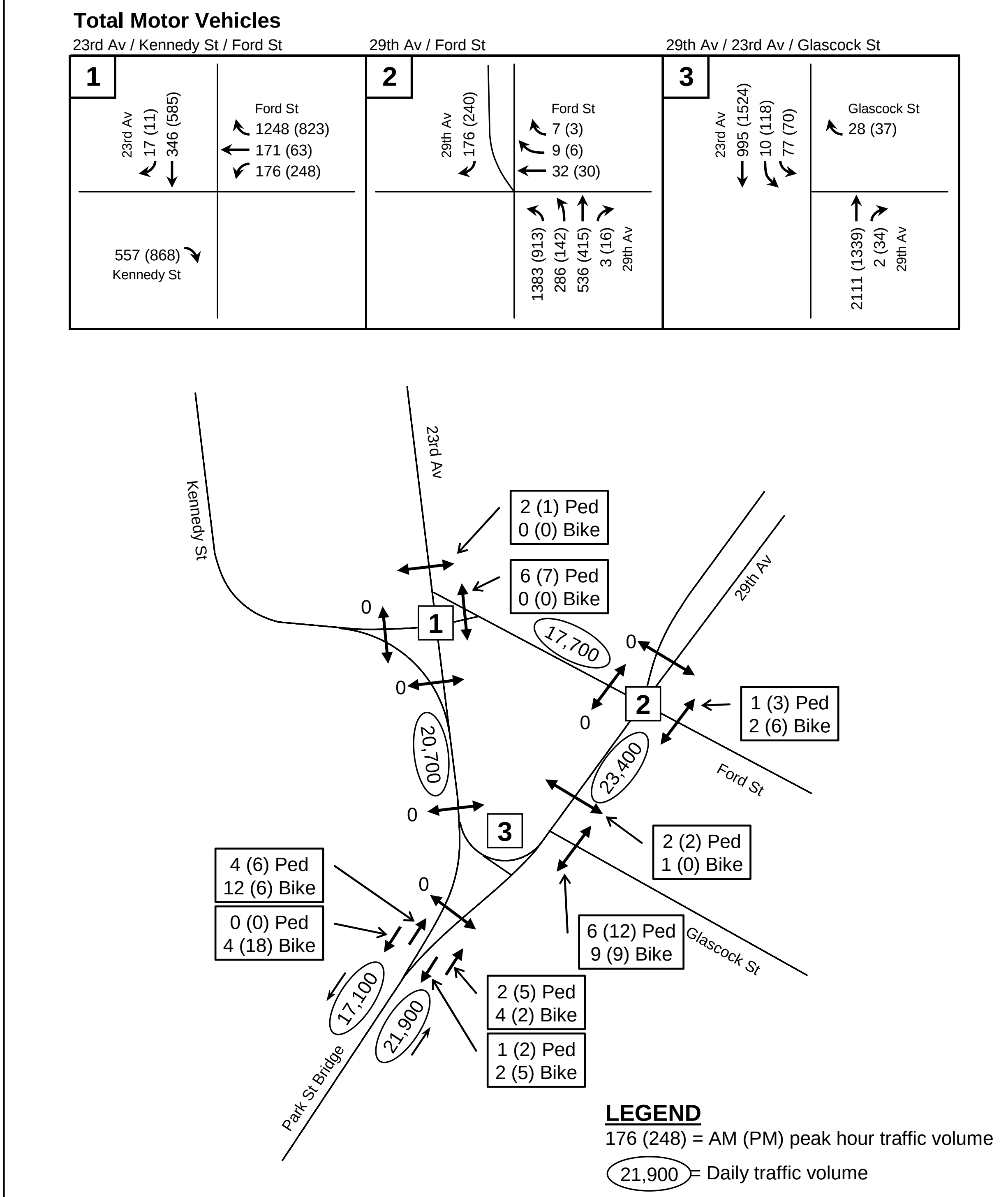
A meeting was held on April 20, 2005, to discuss the project goals, administrative process, work scope, schedule, budget, data needs and deliverables. The meeting was attended by attended by Philip Ho (City of Oakland), Virendra Patel (City of Alameda), Bob Preston (Alameda County), Jeff Georgevich, (MTC), and Mark Bowman (Dowling Associates). Currently, John Bates is the staff representative from Alameda County.

Dowling Associates conducted turning movement traffic counts during the a.m. and p.m. peak hours at three study intersections listed below:

- 29th Avenue / 23rd Avenue / Glascock Street
- 29th Avenue / Ford Street
- 23rd Avenue / Kennedy Street / Ford Street

The turning movement traffic counts were conducted on Tuesday, May 24, 2005, from 7:00 to 9:00 a.m. and from 4:00 to 6:00 p.m. The turning movement counts were classified into automobiles, commercial vehicles, buses, bicycles, and pedestrians. The total vehicles counted during the a.m. and p.m. peak hours are shown in Figure 1 along with the bicycle and pedestrian volumes[1] and the daily traffic volumes.[2] Figure 2 shows the number of commercial vehicles (trucks) and buses observed during the a.m. and p.m. peak hours on May 24, 2005.

[1] The number of bicyclists and pedestrians crossing the streets are shown in the figure.
[2] The daily traffic volumes shown at the Park Street Bridge were taken on May 27, 2004, and were provided by the City of Alameda. The daily traffic volumes on 23rd Avenue, 29th Avenue and Ford Street were collected on Thursday, September 1, 2005.



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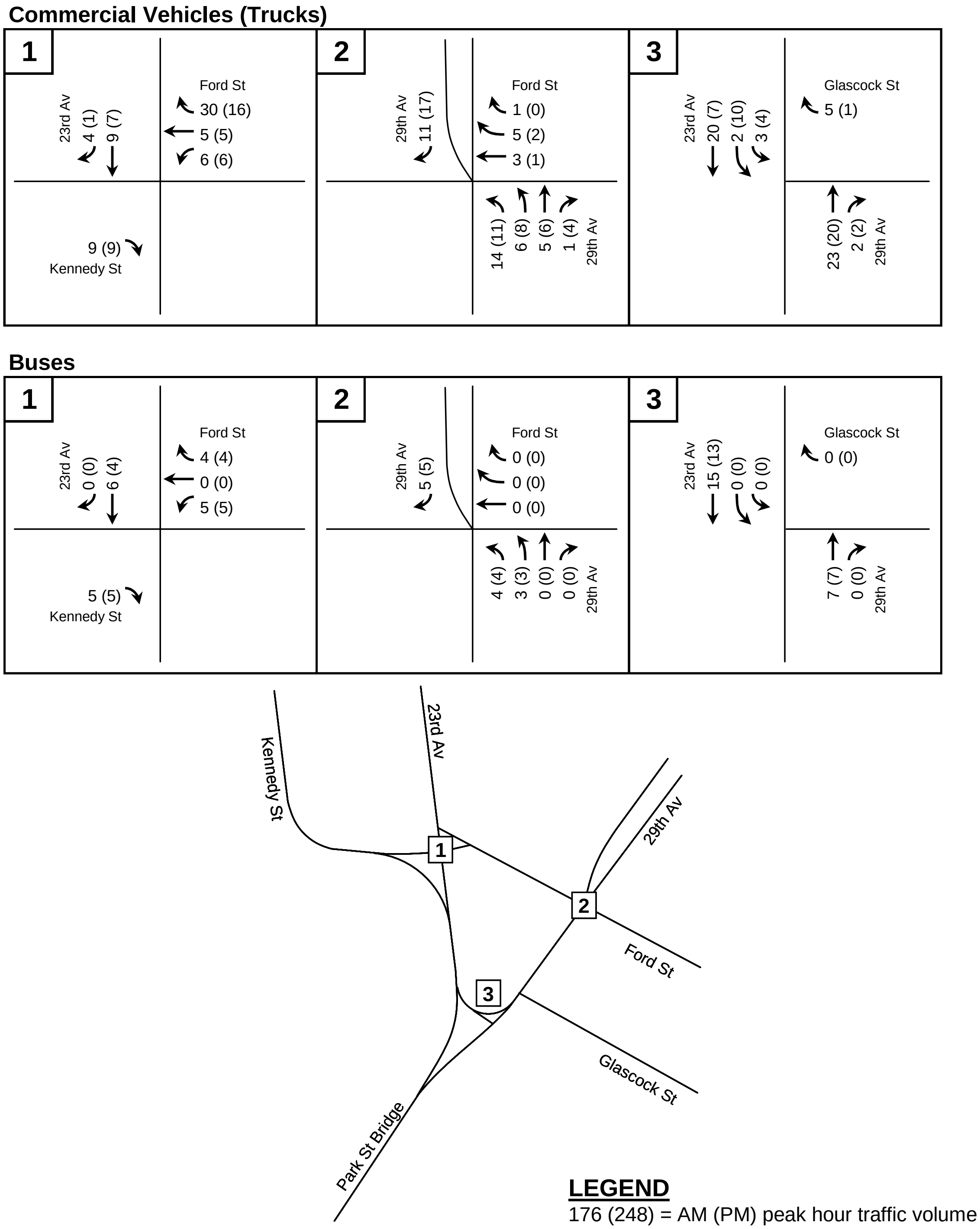
TETAP – PARK STREET TRIANGLE TRAFFIC STUDY

North

Figure 1
TRAFFIC VOLUMES
VEHICLES, PEDESTRIANS AND BICYCLISTS



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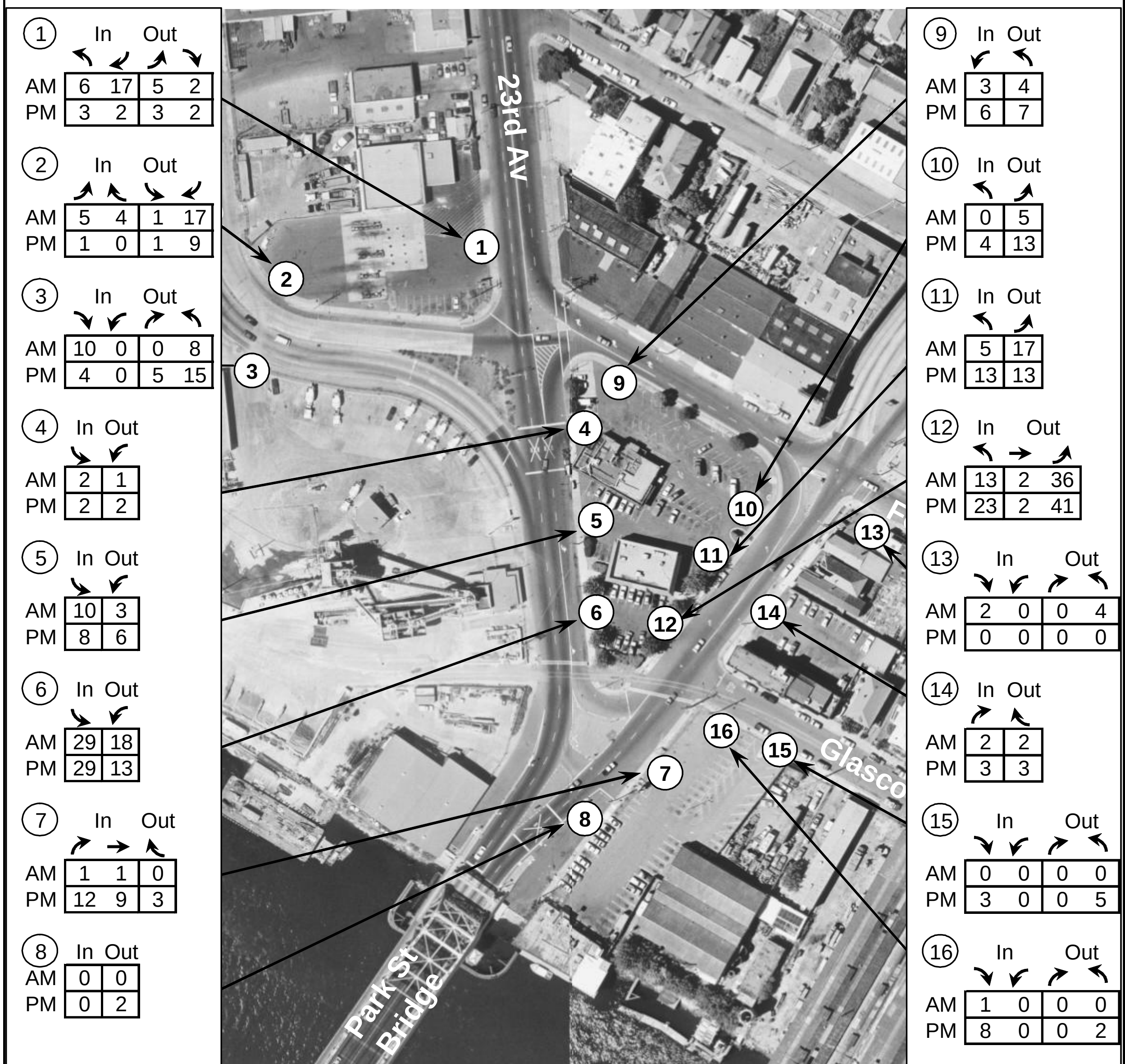
TETAP – PARK STREET TRIANGLE TRAFFIC STUDY

North

Figure 2
TRAFFIC VOLUMES
COMMERCIAL VEHICLES AND BUSES



Dowling Associates, Inc.

TETAP – PARK STREET TRIANGLE TRAFFIC STUDY

North

Figure 3
DRIVEWAY TRAFFIC VOLUMES

On the same day as the intersection turning movement counts were conducted, turning movement counts were also conducted at a service street driveway and at fifteen (15) driveways in the study area, as shown in Figure 3. The service street east of the Park Street Bridge abutment has limited width for vehicular access and essentially functions as a driveway for the purpose of this study. The service street on the west side of the bridge abutment could serve the adjacent property, but on the day of the data collection, the gate to the property was closed and no motor vehicle traffic used the access.

Park Street Bridge Traffic Volumes

Daily traffic volume data provided by the City of Alameda staff for the Park Street Bridge were evaluated. Data were provided for 2000 (Figure 4) and 2004 (Figure 5). The figures show that the peak traffic volumes were about 15 percent greater in 2000 than in 2004. Additional traffic volume data (Figure 6) were collected for the project study area. The difference between the 2004 and 2005 traffic data are within the range of normal daily and seasonal variations.

The 2000 traffic volumes also show an unusual evening peak at approximately 9:00 p.m., indicating that construction may have been occurring during the time of that data collection. Figure 4 shows variations for each day of the week. The weekdays appear to have relatively consistent traffic flows. Saturday and Sunday follow typically lower traffic patterns during the morning and late afternoon periods with slightly higher midday traffic volumes on Saturday.

Figure 4: 2000 Traffic Volumes at the Park Street Bridge

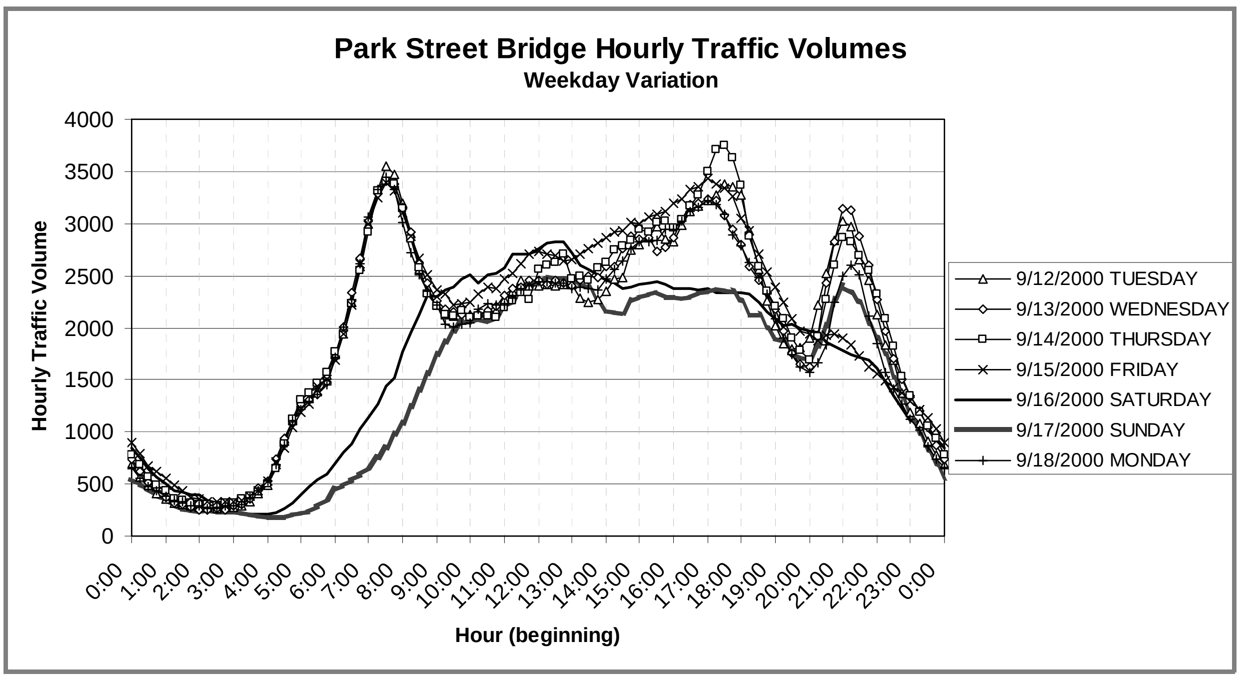


Figure 5: 2004 Traffic Volumes at the Park Street Bridge

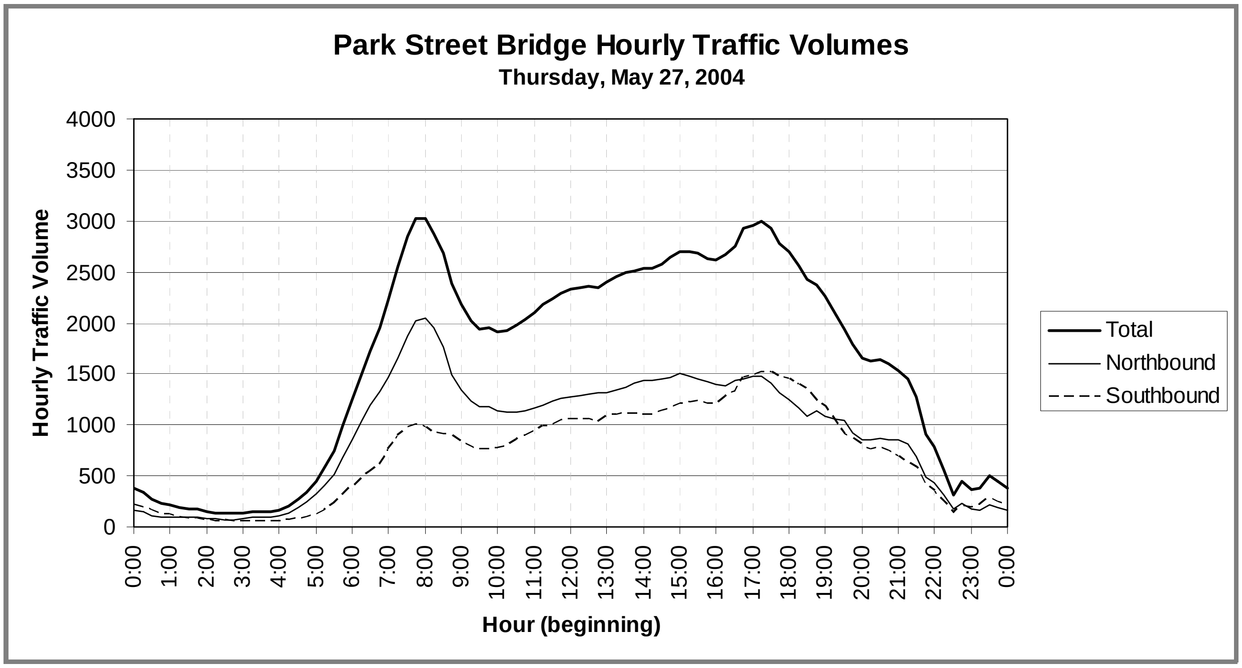
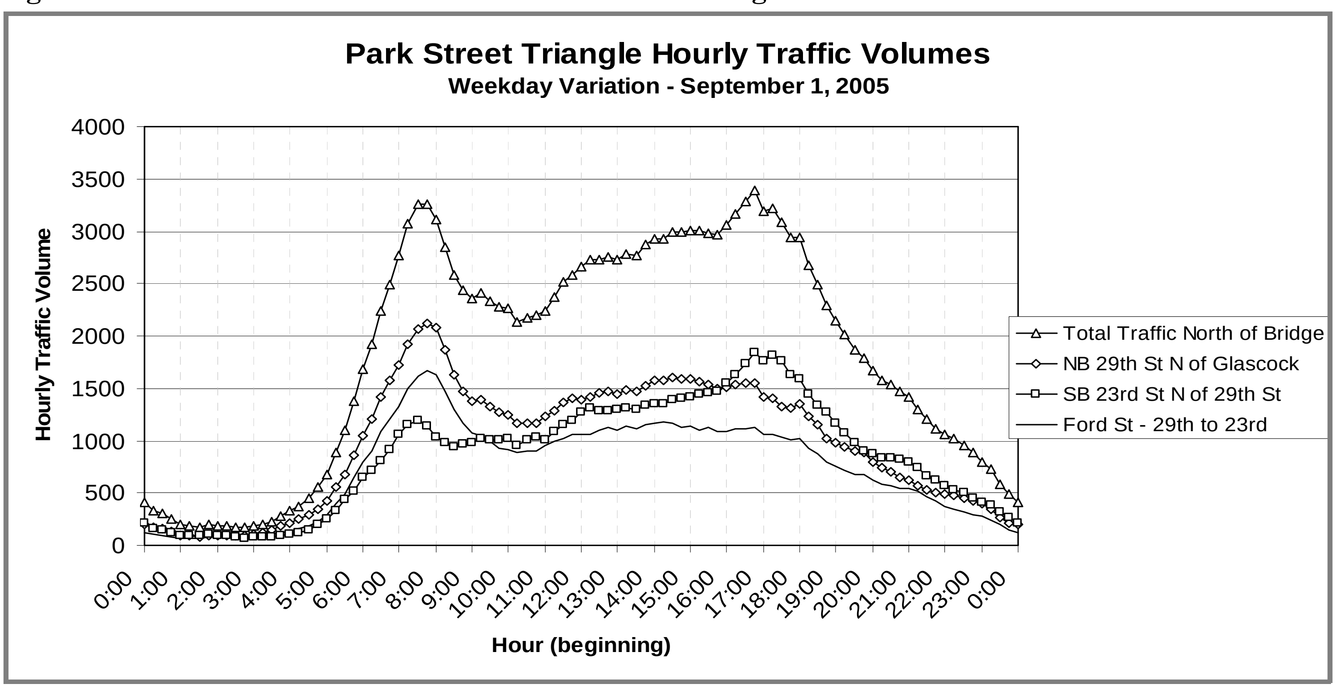


Figure 6: 2005 Traffic Volumes at the Park Street Bridge



Traffic Observations

Dowling staff observed and photograph traffic conditions in the study area on the same day as the of the turning movement traffic data collection. A general discussion of traffic circulation, operation, access, driveway ingress/egress, and safety is provided below, and is followed by a discussion of more specific issues of concern.

Traffic circulation is usually relatively unimpeded for traffic traveling to or from the Park Street Bridge. Traffic from Kennedy Street does not encounter any traffic control delay[3] between E. 7th Street and the bridge. Traffic from 23rd Avenue encounters control delay only at the traffic signal at the Ford Street intersection. Traffic traveling northbound from the bridge does not encounter any control delay within the study area. Motorists can enter any of the side streets or driveways with little impedance.

Delay is greater for vehicles trying to cross the streams of traffic traveling to and from the Park Street Bridge or trying to enter the traffic stream. Vehicles at any of the stop controlled intersections or at any of the driveways in the study area experience delay entering the traffic stream.

The numerous side streets and driveways serving local business provide many points of potential conflict in the study area. Surprisingly, the collision data provided by the City staff does not show an unusually high number of accidents in the area. Many of the drivers are repeat travelers, who have driven the route many times before.

Non-motorized travel within the study area is perhaps more difficult than motor vehicle travel. Pedestrians and bicyclists are at a distinct disadvantage when trying to access the businesses in the area. Descriptions of this and other specific concerns are provided below.

Approaching the Park Street Bridge

The southbound approach to the Park Street Bridge has a sharp horizontal curvature. Large vehicles – trucks and buses – sometimes stray outside their lane as they approach the bridge, encroaching on the adjacent lane. At other times, large vehicles slow at the approach, restricting capacity.

23rd Avenue at 29th Avenue

Traffic movements from southbound 23rd Avenue to northbound 29th Avenue are served by two separated left-turn lanes controlled by stop signs (Figure 7).

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[3] Control delay is the delay experienced by vehicles at traffic control devices such as stop signs or traffic signals.

Figure 7: Southbound 23^{rd} Avenue Approach to Northbound 29^{th} Avenue

Motorists turning from southbound 23^{rd} Avenue to northbound 29^{th} Avenue find infrequent gaps in northbound traffic sufficient to allow entry into the traffic stream, especially during the a.m. peak hour. Traffic queues sometimes develop as motorists wait for an adequate gap in traffic. Motorists positioned at the northern stop sign (Figure 7 foreground) can have their line of sight obstructed by vehicles positioned at the southern stop sign (Figure 7 background). A review of traffic collision diagrams provided by the City staff did not reveal any collisions for this approach.

City staff has indicated that large trucks making left turning movements from 23^{rd} Avenue onto 29^{th} Avenue often knock down the north stop sign (nearest the 7-Eleven convenience store). The stop sign collisions suggest that the existing turning radius may be inadequate to accommodate truck turning movements.

29^{th} Avenue / Ford Street Intersection

The vast majority of traffic heading northbound on 29th Avenue is positioned in the left lane to access westbound Ford Street. North of the intersection, the roadway splits into a one-way northbound connector to I-880 and a two-way connector to the 29^{th} Avenue overcrossing across I-880. A review of the collision diagrams provided by City staff showed that in the five-year period ending on April 30, 2004, two of the eleven collisions reported involved motor vehicle collisions with pedestrians and one involved a motor vehicle colliding with a bicyclist. The obstacles facing pedestrians and bicyclists trying to cross 29^{th} Avenue is illustrated in Figure 8. There are no crosswalks or bicycle facilities along 29^{th} Avenue.

Motorists sometimes make illegal left turns and U-turns on the southbound 29^{th} Avenue approach to the Ford Street intersection. No traffic collisions were reported for the five-year period ending on September 30, 2004.

Figure 8: Northbound 29th Avenue Approach to Ford Street

Ford Street Weaving Area

The section of Ford Street between 29th Avenue and 23rd Avenue serves a large volume of traffic from northbound 29th Avenue seeking access to northbound 23rd Avenue. Traffic making that maneuver must shift from the left lane to the right lane on Ford Street. Traffic traveling southbound from the 29th Avenue overcrossing and traffic traveling westbound from Ford Street must make a right-to-left lane change to travel southbound on 23rd Avenue. The heavy traffic volumes in this section sometimes make it difficult to change lanes.

Figure 9: Ford Street Weaving Area

23rd Avenue Weaving Area

Traffic from Kennedy Street is provided its own lane on 23rd Avenue approaching the Park Street Bridge (Figure 10). Motorists entering 23rd Avenue from Kennedy Street who want to turn left onto 29th Avenue must make two lane changes. This maneuver can be particularly difficult during the p.m. peak hour when southbound traffic on 23rd Avenue is highest. The signing on the Kennedy Street approach to the weaving section (Figure 11) illustrates a recognition of the problem. The warning sign advising motorists that they have their own lane ahead is supplemented by a yield sign – an unusual combination.

Figure 10: 23rd Avenue Weaving Area

Figure 11: Signs for Kennedy Street Traffic Approaching 23rd Avenue

Pedestrian and Bicycle Access

During the observation of traffic operations in the study area, it became apparent that bicycle and pedestrian accessibility was difficult. Although sidewalks are prevalent, there are few marked pedestrian crosswalks. There are no locations on the northbound route from the Park Street Bridge, along 29th Avenue and Ford Street where traffic control devices require vehicles to stop. The difficulty pedestrians and bicyclists face in crossing the street was illustrated previously in Figure 8.

Bicyclists traveling northbound on the east side of the Park Street Bridge who are destined for Kennedy Street must merge into northbound 29th Avenue vehicular traffic and face potential conflicts with turning traffic from southbound 23rd Avenue. On 29th Avenue, bicyclists headed toward downtown Oakland need to turn left onto Ford Street and negotiate through weaving traffic on the approach to the offset intersection across 23rd Avenue (a difficult crossing for bicyclists).

The City of Oakland's Bicycle/Pedestrian Advisory Committee (BPAC) has identified two primary concerns with access through the study area. First, the existing sweeping turns and merging movements discussed above poses access and safety problems for bicyclists and pedestrians. Second, for bicyclists, improved connections are needed between the Park Street Bridge, Embarcadero, and East 7th Street. The improvement plans for the study area should accommodate bicycle movements in both directions between each pair of these destinations.

At the Park Street Bridge, a sign requiring bicyclists to dismount before using the sidewalk is frequently ignored, as shown in Figure 12. This condition could contribute to a feeling of discomfort for pedestrians on the bridge. Thirteen (13) pedestrians and 31 bicyclists were observed using the bridge during the p.m. peak hour on the day of the traffic observations.

Figure 12: Bicyclists Approaching the Park Street Bridge from the North

Traffic Disruptions Caused by the Park Street Bridge

At approximately 8:35 a.m. on the morning of the traffic observations, the Park Street Bridge was raised to allow the passage of a waterborne vessel. The gates prevented the flow of traffic across the bridge for approximately 5 minutes. During the closure, a traffic queue developed on both 23rd Avenue and on Kennedy Street back to E. 7th Street. The queue dissipated within a short period of time after the bridge was reopened to traffic.

Park Street Bridge Operations

The Park Street Bridge is operational year-round 7 days a week, 24 hours a day. There are two vessel restriction periods. These restrictions are 8:00 a.m. to 9:00 a.m. and 4:30 p.m. to 6:00 p.m. Monday through Friday. There are no vessel restrictions on weekends or holidays. Vessels can transit the draw during closure hours if advance notice is given, an emergency, or tidal conditions dictate transit during restricted hours.[4]

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[4] Source: http://home.comcast.net/~kenseq/bridges/parkst.html

According to bridge management staff,[5] when a bridge opening is required for a recreational vessel the openings are about 5 minutes. When opening for tugs and barges or large vessels the openings are 8-10 minutes depending on the tidal conditions. Past history shows that weekends are always busier than the weekdays, with some exceptions.

Bridge openings can vary dramatically and occur on demand according to US Coast Guard regulations and Federal Law. The US Coast Guard Bridge Section Main Office (for four States) is located less than one mile from the Park Street Bridge. Currently fines for violations of bridge regulations are $10,000 per incident per bridge per day and are scheduled to go up to $25,000 by 2007.

In 2004, the Park Street Bridge was opened 1100 times, or approximately 3 times per day on average. Weekends, when recreational boating activity is greater, generally have more openings than weekdays. Similarly, the warmer months starting in May have more openings than the cooler months starting in November. For example, In January, 2004, there were 42 (low) bridge openings, in September there were 144 (high) bridge openings. In February of 1996, there were 532 bridge openings for 845 vessels and 340 barges. In February of 2005, there were only 62 openings for 80 vessels and 28 barges. These data show the high variability and unpredictability of bridge openings.

Openings during restriction periods are average 40 to 70 times per year. They are all documented by vessel type, direction of travel, date and time. Restriction period openings are closely related to the tides and currents as are the duration of the opening which can range from 4 to 11 minutes.

Railroad Operations

A rail line operated by the Union Pacific Railroad crosses 29th Avenue and 23rd Avenue on its route along the northern shore of the Oakland estuary. The railroad roadway crossing is uncontrolled (without gates) but has warning signs and pavement markings.

The rail line passes through, but does not serve RMC Cemex located on 23rd Avenue. The rail line primarily serves Con Agra Flour Milling at 2201 E 7th Street. Union Pacific Railroad (402) 544-5000 does not keep records of how often this, or any other rail line, is used. Con Agra staff[6] was able to provide information on rail operations at the 23rd/29th Avenue crossing.

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[5] Jerry Silver (Bridge & Pump Superintendent) and Ken Sequeira (Bridge Supervisor) of the County of Alameda Public Works Agency.
[6] Bart Hahlweg, Plant Manager, Con Agra Flour Milling.

Con Agra currently receives grain shipments three times per week by rail. Trains up to a maximum of 14 cars long typically access the Con Agra plant on Mondays, Wednesdays, and Fridays, although shipments may not always arrive on those days. The trains cross 23rd and 29th Avenue entering and leaving the plant, so there would be two crossings on the days of rail deliveries.

Previously, Union Pacific served the Con Agra plant five times per week, but had to cut back service because of reduced engine capacity. Con Agra has considered expanding their operations, but if they did so, would not be able to receive additional shipments by rail because of the UPRR service limitations.

Existing Intersection Levels of Service

An analysis was performed of the efficiency of traffic operations at the intersections in the Park Street Triangle study area. The analysis was performed according to the methods in the *Highway Capacity Manual* (Transportation Research Board, Washington, D.C., 2000) using the Synchro software package.

Signalized intersection analyses were conducted using the operational methodology outlined in the *Highway Capacity Manual* (Chapters 10 and 16). This procedure calculates an average stopped delay per vehicle at a signalized intersection, and assigns a level of service designation based upon the delay. Table 1 shows level of service criteria for signalized intersections.

Stop sign controlled intersections were analyzed using the methodology outlined in the *Highway Capacity Manual* (Chapters 10 and 17). This methodology determines the Level of Service by calculating an average total delay per vehicle for each controlled movement. Table 2 shows the relationship of total delay to level of service for stop controlled intersections.

The existing a.m. and p.m. peak hour operating conditions at the study area intersections are shown in Table 3.

The level of service analysis confirms our assessment of field conditions. All of the intersections operate within the City of Oakland's service standard of LOS D except for the northernmost left turning movement from southbound 23rd Avenue to 29th Avenue. That movement operates at LOS E during the a.m. peak hour when northbound traffic volumes on the 29th Avenue are heaviest. The level of service analysis does not reflect the line of sight obstruction discussed above, which may make the service worse than the level of service analysis would otherwise indicate.

Clearly, the level of service analysis does not address conditions when the Park Street Bridge closure stops all street traffic flow nor does it address conditions when railroad operations block the street. When those conditions occur, traffic operations deteriorate, temporarily, until the street closures are ended. Some of the traffic movements can continue to function during the early portions of street closures for the bridge or railroad. Ford Street can usually continue to function through much of the road closure, and access to 29th Avenue can be easier during the road closure until queues develop that prevent vehicles from accessing the roadway. As previously described, traffic along 23rd Avenue and Kennedy Street comes to a standstill.

Table 1: Level of Service Descriptions – Signalized Intersections

Level of Service (LOS)	Average Delay (seconds/vehicle)	Description
A	≤ 10	Very Low Delay: This level of service occurs when progression is extremely favorable and most vehicles arrive during a green phase. Most vehicles do not stop at all.
B	> 10 and < 20	Minimal Delays: This level of service generally occurs with good progression, short cycle lengths, or both. More vehicles stop than at LOS A, causing higher levels of average delay.
C	> 20 and < 35	Acceptable Delay: Delay increases due to only fair progression, longer cycle lengths, or both. Individual cycle failures (to service all waiting vehicles) may begin to appear at this level of service. The number of vehicles stopping is significant, though many still pass through the intersection without stopping.
D	> 35 and < 55	Approaching Unstable Operation/Significant Delays: The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume / capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	> 55 and < 80	Unstable Operation/Substantial Delays: These high delay values generally indicate poor progression, long cycle lengths, and high volume / capacity ratios. Individual cycle failures are frequent occurrences.
F	> 80	Excessive Delays: This level, considered unacceptable to most drivers, often occurs with oversaturation (that is, when arrival traffic volumes exceed the capacity of the intersection). It may also occur at nearly saturated conditions with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

SOURCE: Transportation Research Board, Highway Capacity Manual, Washington, D.C., 2000, pages 10-16 and 16-2).

Table 2: Level of Service Descriptions - Unsignalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)
A	0 - 10
B	>10 - 15
C	>15 - 25
D	>25 - 35
E	>35 - 50

F	>50

SOURCE: Transportation Research Board, Highway Capacity Manual, Washington, D.C., 2000, pages 10-16 and 16-2).

Table 3: Intersection Levels of Service – Existing Conditions

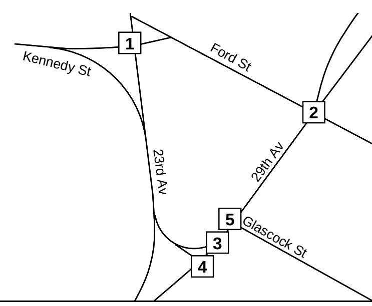
Intersection (Approach)	Traffic Control	Peak Hour	LOS[1]	Delay[2]
1. 23rd Av / Ford St	Signal	AM	B	17
		PM	B	13
2. Ford St / 29th Av (Westbound Ford St)	Stop Sign	AM	C	24
		PM	C	18
3. 23rd Av / 29th Av (Eastbound #1 Left Turn)	Stop Sign	AM	E	38
		PM	C	20
4. 23rd Av / 29th Av (Eastbound #2 Left Turn)	Stop Sign	AM	C	25
		PM	C	21
5. 29th Av / Glascock St (Westbound Glascock St)	Stop Sign	AM	D	29
		PM	C	16

Source: Dowling Associates, Inc., July 2005.

[1] LOS = Level of Service

[2] Weighted average control delay in seconds

Intersection Location Key



Description of Alternatives

The City of Oakland developed three alternatives to address the traffic operations issues described above. Two of the alternatives are very similar, differing only in the land use on and access to the triangular portion of land bounded by Ford Street, 23rd Avenue, and 29th Avenue. Alternative 1 would convert the existing commercial land use in the triangle to a neighborhood park, and businesses would be relocated elsewhere. Alternative 2 would retain the businesses that want to stay, and would require reconfiguration to accommodate vehicular access and on-site parking.

Both Alternative 1 and Alternative 2 would have the following features, illustrated in Figure 13.

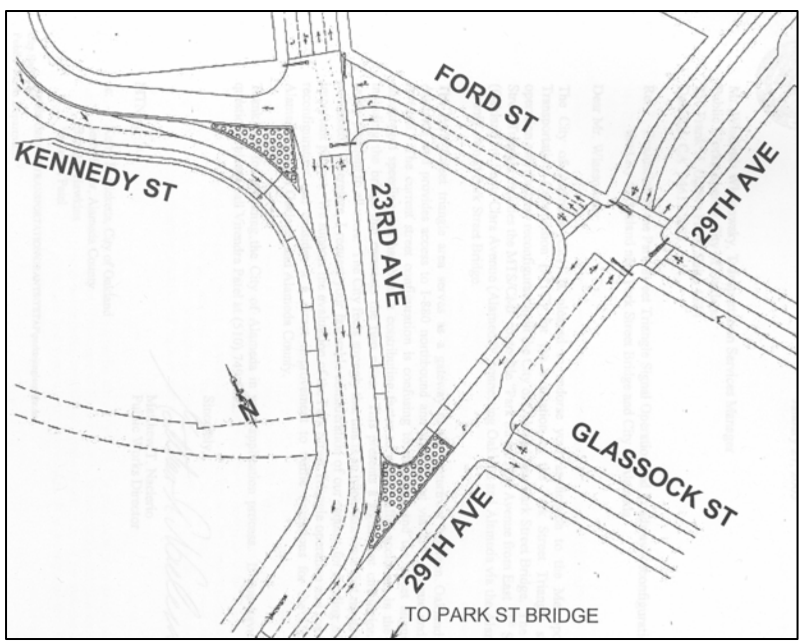
1. Permanent closure of 23rd Avenue from 29th Avenue to Ford Street

2. Acquisition of additional right-of-way around the existing triangular parcel as identified in EDAW's *Oakland Waterfront Bay Trail Feasibility Study*.
3. Reconfiguration of 29th Avenue, 23rd Avenue, Ford Street, and the Park Street Bridge approach to meet traffic demand and traffic operations, access, and safety requirements.
4. Installation of a traffic signal at the 23rd Avenue / Kennedy Street intersection, the 29th Avenue / Glascock Street intersection, and/or the 29th Avenue Ford Street intersection.
5. Construction of a multi-use bicycle/pedestrian path to connect Kennedy Street to Glascock Street or to Ford Street across the triangular parcel.

Figure 13: Plan for Alternative 1 and Alternative 2 – 23rd Avenue Closure

Alternative 3 would not close any existing streets and would convert the existing one-way streets surrounding the Park Street Triangle to two-way operations, except for the section of 29th Avenue between 23rd Avenue and Glascock Street, which would remain one-way northbound. The lane configurations would be as shown in Figure 14. It is anticipated that all roadway and intersection reconfiguration would be accommodated within existing right-of-way. Modifications to vehicular access and/or on-site parking may be necessary within the triangular parcel.

Figure 14: Alternative 3 – Two-Way Operations on Existing Streets



Alternative 3 is substantially different than Alternatives 1 and 2 and will be studied in greater detail. An initial evaluation was performed to determine the relative desirability of

Alternatives 1 and 2 with the purpose of eliminating one or the other from a more detailed evaluation.

Both Alternative 1 and 2 have certain advantages and disadvantages in comparison to each other. Alternative 1 would require fewer access points to serve the triangular parcel and would therefore result in less friction on the surrounding streets. Although driveway friction has not currently been identified as a problem, the conversion of Ford Street and 29th Avenue to two-way operations would increase the importance of access control. Regardless of which alternative is chosen, the City may wish to consider installation of raised medians to limit access to right-in and right-out turning movements, only.

Alternative 1 would be more compatible with construction of a Bay Trail connection through the triangular parcel and would also provide fewer vehicle conflicts for pedestrians. Alternative 1 would require relocation of the existing businesses – a distinct disadvantage compared to Alternative 2.

Our recommendation is to analyze a hybrid of Alternative 1 and 2 that would create a pocket park along the Bay Trail connection and in the small triangle south of the Bay Trail connection near Glascock Street. The larger portion of the triangle, north of the Bay Trail connection could remain commercial.

For the purposes of a more detailed traffic analysis, a mostly commercial site would provide a conservative analysis. If a plan is developed that functions adequately for the mostly commercial alternative, a later decision to revert to Alternative 1 (the park alternative) could be easily accommodated.

The evaluation of Park Street Triangle traffic operations improvement alternatives will need to address pedestrian access through the project area and the types of traffic control necessary to provide safe pedestrian crossings.

Evaluation of Alternatives

Dowling Associates conducted an evaluation of two (2) project alternatives. The evaluation included a quantitative analysis and a qualitative assessment of the transportation systems that would result from implementation of the two project alternatives.

The quantitative analysis included calculation of intersection level of service and vehicular delays during a.m. and p.m. peak conditions using the Highway Capacity Manual method in the Synchro software package. In addition, a micro-simulation of the study street network and intersections was performed for all modes of transportation on the two project alternatives using VISSIM. The measures of effectiveness for vehicles include levels of service, delays, vehicular speeds, and 95th percentile queue lengths. Measures of effectiveness for bicycles and pedestrians include systems delay.

The qualitative assessment included an evaluation of circulation, operation, access, driveway ingress/egress, and safety issues for all modes of transportation including automobiles, commercial vehicles, buses, bicycling and walking.

Alternatives Refinement

During the analysis of traffic operations, it became apparent that refinements would be needed to achieve acceptable operating standards – LOS D or better.

Alternative 1.5

The hybrid of Alternative 1 and Alternative 2 (identified as Alternative 1.5 in subsequent discussion) assumes a Bay Trail connection on the south side of the Glascock intersection with 29th Avenue as shown previously in Figure 13. The number of lanes for 29th Avenue and Ford Street was not specified and was based on the requirements for acceptable traffic operations. The number of lanes and peak hour motor vehicle traffic volumes for Alternative 1.5 are shown in Figure 15. Existing traffic volumes were reassigned to the shortest path in proportion to the traffic volumes entering and leaving the study area.

The analysis showed that five lanes would be required on 29th Avenue and Ford Street to accommodate the traffic demand. The two lanes for northbound traffic on the Park Street Bridge would expand to three lanes immediately north of the bridge. Two northbound left-turn lanes would be required to accommodate traffic volumes at the signalized 29th Avenue / Ford Street intersection. The traffic signal would eliminate the current weaving movement on Ford Street between 29th Avenue and 23rd Avenue. Two travel lanes would serve westbound traffic on Ford Street.

Two through lanes would serve eastbound traffic on the Kennedy Street approach to the 23rd Avenue intersection and would continue eastward to 29th Avenue and southward to the Park Street Bridge.

Traffic signals would control traffic movements at all three study intersections. In addition to the pedestrian path assumed between the 23rd Avenue / Kennedy Street / Ford Street intersection and the 29th Avenue / Glascock Street intersection, signalized pedestrian crosswalks were assumed at the following locations:

- 29th Avenue / Glascock Street (north and east legs of the intersection)
- 29th Avenue / Ford Street (south, east and north legs of the intersection)
- 23rd Avenue / Kennedy Street / Ford Street (north and west legs of the intersection)

The pedestrian crossing at Glascock Street would be provided on the north side of the intersection because the location of the railroad tracks across the south side would create difficulties for bicyclists, wheelchairs and strollers because of the acute angle of the tracks.

Two new driveways would be provided to serve existing businesses within the triangular parcel. The first driveway would form the south leg of the 23rd Avenue / Kennedy Street / Ford Street intersection where 23rd Avenue is currently located. The second driveway would form the west leg of the 29th Avenue / Glascock Street intersection. Both of these driveways would be served by the traffic signals proposed at these two intersections.

A driveway would be provided just north of the Park Street Bridge on the west side of 29th Avenue to provide access to the bridge for maintenance. On the east side of 29th Avenue, maintenance access to the bridge will be provided similarly to existing access.

The RMC cement plant located on the west side of 23rd Avenue has three driveways including one on Kennedy Street and two on 23rd Avenue. The driveway closest to the Park Street bridge abutment is gated and appears not to be in use. The project would not affect the Kennedy Drive driveway. Alternative 1.5 would require closing of the two driveways on 23rd Avenue.

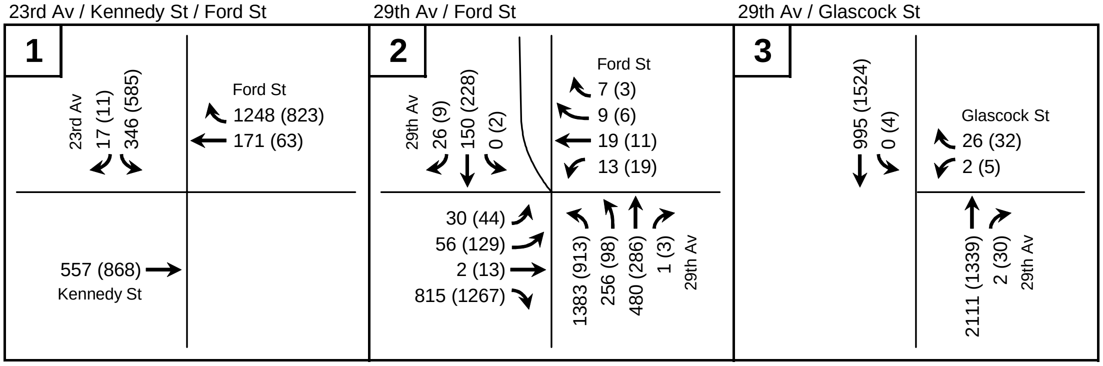
At 23rd Avenue / Kennedy Street, the intersection design shown in Figure 15 will need to be modified to better address the potential conflicts of westbound right turning traffic with pedestrians and bicyclists. The dual-lane right turning movement will be modified to a right-angle turn.

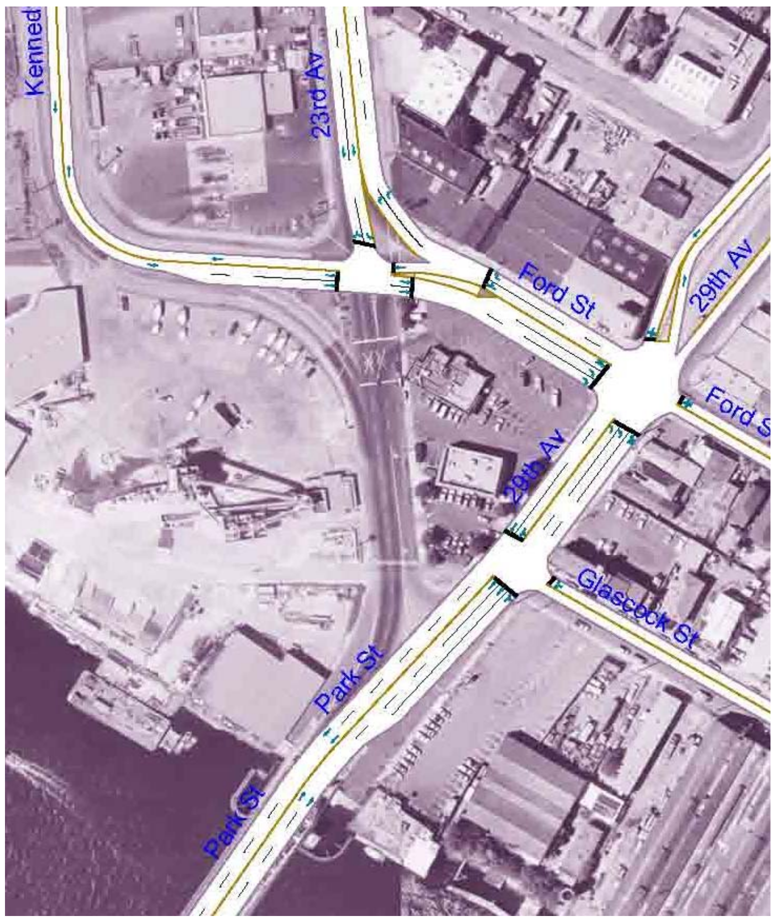
For Alternative 1.5, Ford Street would need to be approximately 81 feet wide to accommodate five travel lanes, two 5-foot bike lanes, a 4-foot median, and a 10-foot parking lane on the north side of the street to accommodate large trucks. The existing street is 36-feet wide and the distance from the north edge of curb on Ford Street to Nikko's Restaurant is approximately 96 feet. Widening Ford Street would bring the south edge of the roadway on Ford Street to within 15 to 20 feet of Nikko's.

The existing 29th Avenue is 56 feet wide curb-to-curb. Alternative 1.5 would require approximately 71 feet to serve five travel lanes (three northbound and two southbound lanes), two 5-foot bicycle lanes, and a 4-foot raised median. The remaining width of approximately 11 feet (between the face of curb and the face of the 7-Eleven Store building) would accommodate a sidewalk and landscaping (if any). Under Alternative 1.5, no on-street parking would be provided on 29th Avenue between Ford Street and the Park Street Bridge abutment.

Total Motor Vehicles

23rd Av / Kennedy St / Ford St — 29th Av / Ford St — 29th Av / Glascock St





LEGEND

176 (248) = AM (PM) peak hour traffic volume

Dowling Associates, Inc.

TETAP – PARK STREET TRIANGLE TRAFFIC STUDY

North

Figure 15
ALTERNATIVE 1.5 REFINED
23RD AVENUE CLOSURE

Alternative 3

Alternative 3 would reconfigure the street network within the existing street right-of-way. Travel lanes and peak hour traffic volumes for Alternative 3 are shown in Figure 16. Existing traffic volumes were reassigned to the shortest path in proportion to the traffic volumes entering and leaving the study area.

Traffic signals would control traffic turning movements at the two study intersections on Ford Street including:

- 29th Avenue / Ford Street
- 23rd Avenue / Kennedy Street / Ford Street

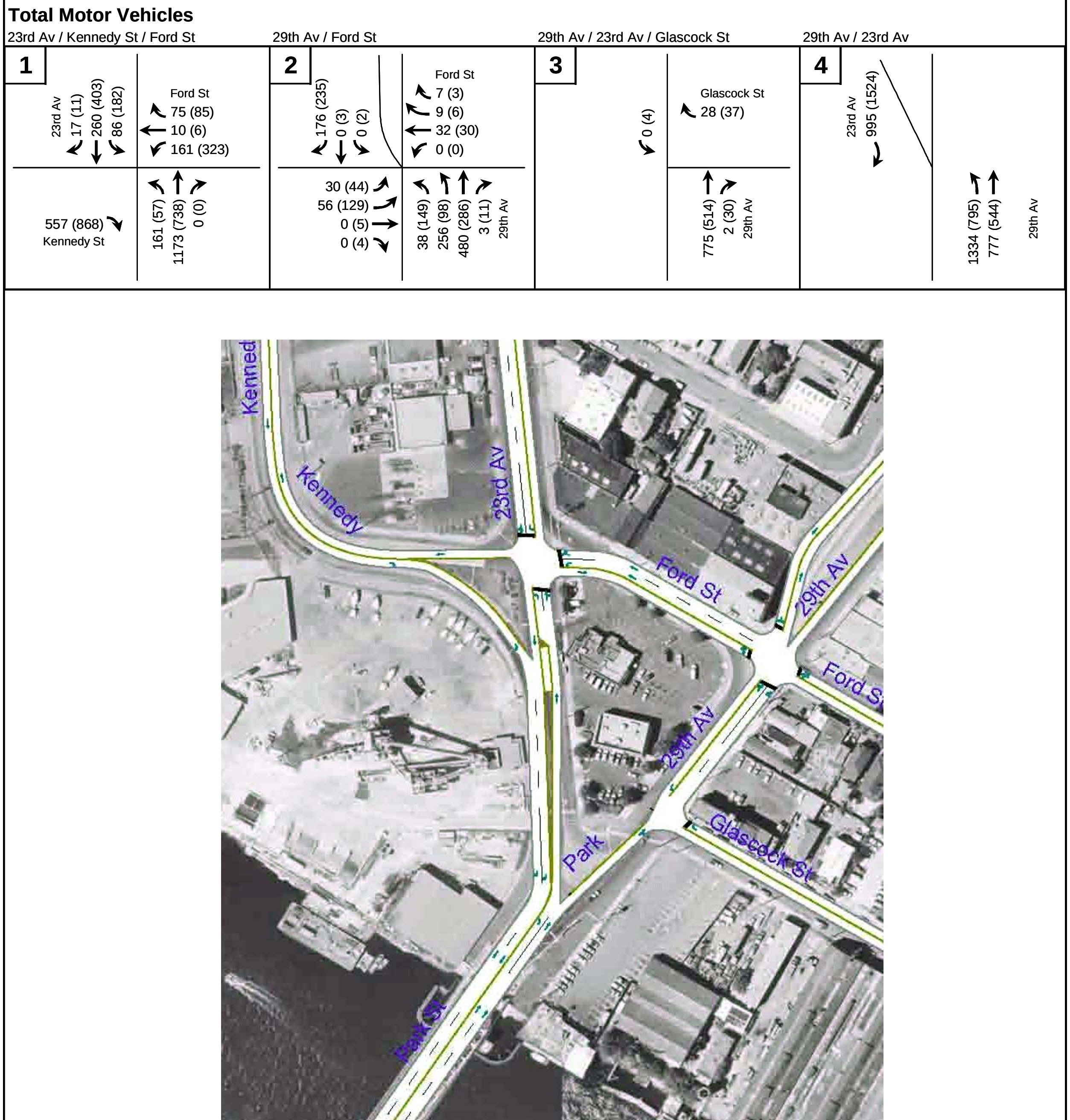
A crosswalk was assumed across Glascock Street at the 29th Avenue intersection but no crosswalks were assumed across 29th Avenue at this intersection. Only the Glascock Street approach would be controlled by a stop sign.

Alternative 3 assumes no widening of existing streets. Hence, Ford Street would only be wide enough to accommodate the three travel lanes within its curb-to-curb width of 36 feet. No bike lanes could be accommodated and the existing parking on the north side of Ford Street would have to be removed.

On 29th Avenue, the existing curb-to-curb width of 56 feet could accommodate three 12-foot travel lanes, two 5-foot bike lanes, and on-street parking on the east side of the street. The southbound bike lane would have to be terminated at Glascock Street.

On 23rd Avenue, a southbound bike lane could be accommodated within the existing curb-to-curb width of 56 feet although on-street parking would have to be removed along a portion, if not all, of 23rd Avenue between Ford Street and the Park Street Bridge abutment. No northbound bike lane would be feasible nor would it be needed in this section.

The schematic layout of Alternative 3 is essentially the same as shown in Figure 14, except that the lane assignment for the southbound 23rd Avenue approach at Kennedy Street was modified to provide a left-turn lane and a shared through-right lane. This change was made to optimize traffic operations.



LEGEND

176 (248) = AM (PM) peak hour traffic volume

Dowling Associates, Inc.

TETAP – PARK STREET TRIANGLE TRAFFIC STUDY

North

Figure 16
ALTERNATIVE 3 REFINED
TWO-WAY OPERATIONS ON EXISTING STREETS

Ideally, a third lane should be added in the middle of the northbound lanes just after the Park Street Bridge to allow motorists to either continue to travel north on 23rd Avenue or 29th Avenue once motorists exit the bridge. However, the separation between the Park Street Bridge and the 23rd Avenue / 29th Avenue split is to short to provide such a third lane. It would be possible to provide a left lane from which vehicles could proceed to either 23rd Avenue or 29th Avenue. One lane would be carried north along 23rd Avenue and two lanes would be carried north along 29th Avenue, where the second left lane would terminate at Glascock Street as a left-turn lane. Vehicles in the right lane would be required to proceed north on 29th Avenue, with the potential for erratic maneuvering or stopping to merge into 23rd Avenue at the 23rd Avenue / 29th Avenue split.

One option considered was to provide an optional movement in the right lane coming off the bridge. However, this option would carry two travel lanes north along 23rd Avenue, and result in a smaller turning radius for the southbound vehicles approaching the Park Street Bridge. This option was found to be infeasible.

Alternative 3 would not accommodate extension of the Bay Trail through the study area.

Traffic Operations

Traffic operations were analyzed using the *Highway Capacity Manual* (HCM) methods previously described for existing conditions. The a.m. and p.m. peak hour operating conditions at the study area intersections are shown for the two project alternatives in Table 4.

Table 4: Intersection Levels of Service

Intersection (Approach)	Peak Hour	Alternative 1.5			Alternative 3		
		Traffic Control	LOS[1]	Delay[2]	Traffic Control	LOS[1]	Delay[2]
23rd Av / Ford St	AM	Signal	B	13	Signal	C	25
	PM		B	15		C	30
Ford St / 29th Av	AM	Signal	B	11	Signal	B	14
	PM		B	14		C	26
29th Av / Glascock St[3]	AM	Signal	A	2	Stop Sign	C	16
	PM		A	2		B	13

Source: Dowling Associates, Inc., September 2005.
[1] LOS = Level of Service
[2] Weighted average control delay in seconds
[3] For Alternative 3, the delay is provided for the westbound Glascock Street approach.

The HCM traffic operations analysis showed that Alternative 1.5 would have somewhat better levels of service and less delay for motor vehicle traffic than Alternative 3.

A summary of 95th percentile peak hour traffic queues is provided in Table 5. Traffic queues would exceed the storage capacity for both alternatives.

Table 5: Queue Length Summary

Intersection (Approach)	Turning Movement	Alternative 1.5 Storage Capacity (feet)	Alternative 1.5 95th Percentile Queue		Alternative 3 Storage Capacity (feet)	Alternative 3 95th Percentile Queue	
			AM	PM		AM	PM
23rd Av / Ford St	EBT	139	137	**199**			
	WBL				250	155	m#207
	WBT	50	47	36	250	46	m3
	NBL				120	48	22
	NBT				400+	**#954**	299
	SBL	400+	90	141	400+	#111	#173
	SBT				400+	69	124
Ford St / 29th Av	EBT	182	86	#146	182	m20	m34
	EBR	250	15	98			
	WBT	400+	53	37	400+	24	22
	NBL	184+	67	**#269**			
	NBT	184+	4	82	184+	93	129
	NBR				184+	**#233**	146
	SBT	400+	#188	171	400+	0	37
29th Av / Glascock St	WBT	400+	30	24	400+	7	7
	NBT	250	233	121			
	SBT	184+	140	**192**			

Source: Dowling Associates, Inc., September 2005.
\# 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Alternative 1.5

The queue spillovers would occur during the p.m. peak hour for Alternative 1.5. The eastbound through movement on Kennedy Street at the 23rd Avenue intersection would create a 95th percentile queue that would exceed the storage capacity of the two-lane roadway section by 60 feet. This condition could be alleviated by extending the two-lane section further to the west along Kennedy Street, where there is existing pavement to accommodate such an extension.

The northbound 29th Avenue left turning movement at Ford Street would create a 95th percentile queue that would exceed the storage capacity between Ford Street and Glascock Street by 85 feet and potentially block traffic movements at Glascock Street. The potential for queues to block traffic movements at Glascock Street could be alleviated by providing "KEEP CLEAR" pavement markings on 29th Avenue at the Glascock Street intersection. "KEEP CLEAR" pavement markings would effectively extend the queue 85 feet beyond the Glascock intersection.

The southbound 29th Avenue through movement at Glascock Street create a 95th percentile queue that would exceed the distance available between Glascock Street and Ford Street by 8 feet. No solution was identified to remedy this queue overflow.

Alternative 3

The northbound through movement on 23rd Street at the Ford Street intersection would create a 95th percentile queue in excess of 900 feet. This queue would extend well onto the Park Street Bridge. No solution was identified to remedy the queue overflow.

The northbound 29th Avenue right turning movement at Ford Street would create a 95th percentile queue that would exceed the storage capacity between Ford Street and Glascock Street by 59 feet and potentially block traffic movements at Glascock Street. The potential for queues to block traffic movements at Glascock Street could be alleviated by providing "KEEP CLEAR" pavement markings on 29th Avenue at the Glascock Street intersection. "KEEP CLEAR" pavement markings would effectively extend the queue 59 feet beyond the Glascock intersection.

The total system delay for pedestrians and bicyclists in the study area would differ somewhat between the two alternatives. Alternative 1.5 would produce 49 seconds of system delay and Alternative 3 would produce 41 seconds of system delay during the peak hour. The additional system delay for pedestrians and bicyclists for Alternative 1.5 is primarily associated with pedestrian and bicycle crossings at the Ford Street / 23rd Avenue intersection.

Qualitative Traffic Assessment

Accessibility to and from the surrounding land uses would be affected by both project alternatives. Both alternatives would result in some left turning movements across oncoming traffic to access local businesses and to depart from those businesses. For Alternative 1.5, it would be more difficult to make left turns to and from driveway on 29th Avenue and on Ford Street. For Alternative 3, it would be more difficult to make left turns on 23rd Avenue.

Alternative 1.5 would eliminate the existing sharp horizontal curve for the southbound 23rd Avenue approach to the Park Street Bridge and improve safety and capacity for that approach. Alternative 3 would not change the existing southbound 23rd Avenue approach to the Park Street Bridge.

Both alternatives would eliminate the sight distance restriction that currently exists for southbound traffic on 23rd Avenue turning left onto 29th Avenue. Both alternatives would substantially reduce or eliminate weaving on westbound Ford Street and on southbound 23rd Avenue.

Alternative 1.5 would improve pedestrian and bicycle access through the area and would provide for the extension of the Bay Trail as called for in the Oakland Waterfront Bay Trail Feasibility Study. Alternative 3 would not provide a trail, but would improve pedestrian and bicycle access through the area. Both alternatives would provide signalized street crossings for pedestrians and bicyclists and improve access and safety. Both alternatives would provide improved connections between each pair of destinations between the Park Street Bridge, Embarcadero, and East 7th Street.

Alternative 3 has the potential to trap motorists in lanes that they do not intend to occupy. As a result, this condition might reduce the efficiency of traffic operations below the level shown in this study. Northbound traffic leaving the Park Street Bridge in the left lane would have to turn left onto northbound 23rd Avenue. Similarly, northbound traffic leaving the Park Street Bridge in the right lane would have to bear right onto northbound 29th Avenue. Motorists that get trapped may slow or stop to make a lane change because of the surprise of not being able to go to their intended destination from the lane they find themselves in. This condition could also result in reduced levels of safety. Modifying the design to allow an optional movement from the left lane coming off the bridge would help this condition; however, it would not eliminate the potential lane trap for the right lane.

Alternative 3 also has the potential to trap motorists heading southbound on 29th Avenue where vehicles would be forced to turn left onto Glascock Street. This design could result in motorists turning right into the triangle parcel area (private property) to turn around.

Effects of Trains and Draw Bridge

No quantitative analysis was performed to assess the effects of trains and the Park Street draw bridge. Three trains pass through the area each week and do not typically pass during the peak hours of motor vehicle traffic. Of course, when a train (a maximum of 14 cars long) crosses 23rd Avenue and 29th Avenue traffic movements would be blocked temporarily – approximately 2 minutes. Street closures due to train movements would affect both alternatives similarly.

It is anticipated that the traffic control for Alternative 1.5 would include the incorporation of highway-rail crossing flashing light signals in the traffic signal installation at the 29th Avenue / Glascock Street intersection. The highway-rail crossing flashing light signals would be mounted on the traffic signal pole or mast arm depending upon decisions made during final design. Alternative 3 would not have a traffic signal at Glascock Street but would need to at least have highway-rail crossing flashing light signals at the tracks. For both alternatives, it may also be necessary to improve the surfacing along the railroad tracks to facilitate bicycle and pedestrian crossings.

Initial coordination with the California Public Utilities Commission (CPUC) has been conducted. It will be necessary to further coordinate with the CPUC and the Union Pacific, the City of Oakland and Alameda County (bridge operators) and conduct a diagnostic review of the proposed crossing to determine the appropriate type of highway-rail crossing warning devices early in the design process. Typically, in cases where all affected parties are in agreement with the proposal, modification of a rail crossing involves a request to CPUC staff. A response to a request is typically provided within 45 days.

The effects of draw bridge openings would be more significant for both project alternatives. Typical draw bridge openings range from about 5 minutes for recreational vessels to 10 minutes for barges. Draw bridge openings would affect both alternatives similarly; however, the close proximity of a traffic signal at the 29th Avenue / Glascock Street intersection may require special treatment for Alternative 1.5. If a pedestrian actuates the signal to cross 29th Avenue just before the bridge operator lowers the gates for the bridge approach, traffic queues might not be able to clear the bridge before it is raised. Additional study may be required to determine if this condition would pose a problem for bridge operations. If so, it may be necessary to change bridge operating procedures (by lowering the gate earlier for the northbound bridge approach) or provide preemption of the traffic signal.

Traffic queues for Alternative 3 would extend from the 23rd Avenue/Ford Street intersection onto the Park Street Bridge. This condition also may require signal preemption to provide the bridge operator to clear motor vehicle traffic from the bridge before raising the bridge to allow waterborne traffic to pass.

During preemption, all motor vehicle and pedestrian signal phases would be terminated except for the phase serving the northbound traffic movement, which would receive a green traffic signal indication. County of Alameda Public Works Agency staff responsible for bridge operation has stated that signal preemption should be acceptable at Glascock Street. There is signal preemption at the traffic signal on the City of Alameda side of the bridge and there is signal preemption at the High Street Bridge. The City of Oakland would be responsible for maintaining the signal preemption equipment at the signal. A preemption "switch" would need to be provided at the bridge control station and integrated with the program logic controller that activates bridge openings. Jerry Silver (Bridge & Pump Superintendent with the County of Alameda Public Works Agency) indicated that there may not be conduit capacity or available wiring for the connection to the bridge. An alternative communication technology may be required.

If preemption is provided for traffic signals under either Alternative 1.5 or 3, preemption may also be required of the highway-rail crossing flashing light signals, and train signals may need to be installed for both the eastbound and westbound train approaches to the street crossing to require the train to stop during the preemption phase.

Conclusions

If Alternative 1.5 is developed, it may be advisable to provide a raised median along 29th Avenue from the Park Street Bridge to Ford Street and on Ford Street between 23rd Avenue and 29th Avenue.

If Alternative 3 is implemented, the design of the northbound split just north of the Park Street Bridge should be modified to allow an optional movement from the right lane coming off the bridge would help this condition if space permits. The second northbound lane that would result on 23rd Avenue would have to be terminated shortly after the diverge area.

The City of Alameda staff has expressed a preference to have the pedestrian crossing at the 29th Avenue/Ford Street intersection instead of at the 29th Avenue/Glascock Street intersection as shown in Figure 13. The more northerly location would separate the pedestrian crossing further from the Park Street Bridge and reduce the potential for conflicts between bridge operations and signal operation at Glascock Street. The alignment of the trail on the south side of Ford Street would require additional right-of-way on Ford Street and on 29th Avenue, and would impact the two businesses in the triangular parcel.

The traffic operations problems associated with Alternative 3 appear to be greater than those for Alternative 1.5. The long queues that would occur on the 23rd Avenue northbound lane (extending onto the Park Street Bridge) cannot be alleviated without additional right-of-way. With some refinement, Alternative 1.5 would provide better traffic operations and safer access, and would improve mobility for all users, including pedestrians and bicyclists.

The draft study was reviewed by public agency staff members of the three participating jurisdictions and participants at a Community Meeting held on December 1, 2005. Comments from the Community Meeting and responses to comments are provided in Appendix A.

Based on input from public agency staff, technical advisory committee members, other stakeholders, and community members, it is recommended that Alternative 1.5 be selected as the preferred alternative. Refinements to this preferred alternative developed as part of the review process are included in the discussion of Alternative 1.5, above.

Recommendations for Further Study

Based on the comments received during the review of the study, additional study may be required to address items that are outside the scope of work for the study described in this report.

1. Strategies need to be developed to reduce the potential for bicyclists to ride the wrong way on the narrow Park Street Bridge walkways. As mentioned in this report, signs require bicyclists to dismount before entering the bridge. Violations of this regulation are routine rather than exceptions. Strategies will need to be developed to improve pedestrian safety and reduce conflicts between pedestrians and bicyclists.

2. Signing and pavement markings outside of the study area will need to be addressed outside the scope of this study. Other comments provide by Bike Alameda will need to be addressed outside the scope of this study.

3. Specialized treatments for motor vehicles, pedestrians and bicyclists (such as bicycle detectors) will be addressed during the design phase of project development. Similarly, details regarding access, parking and landscaping for the areas affected by the project will need to be addressed outside the scope of this study.

4. Consideration should be given to removing the prohibition of left turns and U-turns for southbound traffic on 29th Avenue at Ford Street. Motorists have been observed making these maneuvers in violation of the traffic signs that prohibit the movements, and no collisions have been reported involving those maneuvers.

APPENDIX A – Community Meeting #1 Comments and Responses

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Dowling Associates, Inc.

Date: December 16, 2005

Memorandum

To: Philip Ho

From: Mark Bowman, P.E. and Allen Huang

Subject: Park Street Triangle Traffic Study P04047.7
Community Meeting #1 Comments and Responses

The first community meeting for the Park Street Triangle Traffic Study was held on December 1, 2005. The meeting was attended by 20 people from representatives of participating public agencies, and community groups including business owners, pedestrian and bicycle advocates, and residents. Responses to the questions and comments are provided below. An email and a letter were received subsequent to the community meeting and are attached to this memo. Responses to the email and letter are provided at the end of the public comments, below.

RESPONSES TO PUBLIC COMMENTS AND QUESTIONS AT THE COMMUNITY MEETING ON DECEMBER 1, 2005

Comment/Question #1: How would the intersections operate for both alternatives in comparison to existing conditions?

Response #1: For existing conditions, traffic along the main route is relatively unimpeded; however, egress from side streets and driveways is problematic, and pedestrian and bicycle travel is difficult. Currently, the southbound left turning movement from 23rd Avenue to 29th Avenue operates at level of service (LOS) E during the a.m. peak hour. Alternative 1.5 would improve traffic operations to LOS B or better at all intersections. Alternative 3 would improve traffic operations to LOS C or better at all intersections. Alternative 3 would result in vehicle queues that would extend onto the Park Street Bridge; Alternative 1.5 would accommodate vehicle queue north of the bridge.

Comment/Question #2: Could the driveway on 29th Avenue across from Glascock Street be served by the traffic signal?

Response #2: It appears to be possible to serve the driveway with the traffic signal included in the Alternative 1.5 concept. There is no traffic signal proposed at Glascock Street for Alternative 3, so for that alternative, it probably is not possible.

Comment/Question #3: Will these new traffic signals (Alternative 1.5) slow down traffic flow and create more congestion?

Response #3: The new traffic signals will stop traffic to provide protection for vehicles, pedestrians and bicyclists who wish to cross the main flow of traffic. The traffic signals will be coordinated to provide for the efficient flow of traffic. For Alternative 1.5, the streets will be widened to provide sufficient capacity to maintain adequate traffic flow. Alternative 3 would not require any street widening and would not be as efficient as Alternative 1.5.

Comment/Question #4: Why don't you provide two left turn lanes and one right turn lane for vehicles exiting the bridge for Alternative 3?

Response #4: If three lanes are provided northbound coming off the Park Street Bridge and two of the lanes serve left turning vehicles and one lane serves right turning vehicles, there are likely to be erratic maneuvers by motorists approaching the location where the roadway splits. Motorists in the middle lane (who suddenly realize they should move to the right lane to proceed north on 29th Avenue) and motorists in the right lane (who suddenly realize they should move to the middle lane to proceed north on 23rd Avenue) may brake sharply or come to a stop to make lane changes. This conflict is likely to cause traffic congestion and reduce safety.

Comment/Question #5: Is no change of the existing geometry a possible alternative?

Response #5: Safety is a primary objective of the study. The proposed scenario will improve the traffic circulation and safety of all users including vehicles, pedestrians and bicyclists. To accommodate the proposed multiple purpose trail through the area as well as residential development that is occurring in the area, the existing street configuration will need to be modified to facilitate traffic circulation and improve safety for all users.

Comment/Question #6: Can we just get rid of the southbound second left turn lane at intersection #3, since it's very close to the bridge?

Response #6: If only one left turn lane were provided at this location, the queues and delays for the left turn movement during the a.m. peak hour would be excessive and would likely prevent traffic turning right from Kennedy Street from being able to access the back of the queue.

Comment/Question #7: The raised median proposed for Alternative 1.5 will block access to the business in the middle island.

Response #7: For Alternative 1.5, a raised median would be necessary to provide safe and efficient traffic flow. Northbound vehicles on 29th Avenue and westbound vehicles on Ford Street would have to make a U-turn at a signalized intersection to access the parcel in the existing middle island.

Comment/Question #8: The ramp metering slows down the access to I-880. It creates traffic back-up on the local streets. Will it be possible to remove ramp metering?

Response #8: The ramp metering maintains the traffic flow on the freeway system and is under the jurisdiction of Caltrans. The ramp metering is not likely to be removed.

Comment/Question #9: Are business owners considered stakeholders? Why aren't we invited for stakeholders' meetings?

Response #9: All community members are invited to Community Meetings where they can provide input on the project. Stakeholder Meetings previously held were, in fact, Technical Advisory Committee (TAC) Meetings. TAC Meetings are designed for public agency representatives (primarily engineers and planners) to discuss technical issues and engineering solutions. Community meetings, not TAC meetings, are an appropriate forum for community input and discussions.

Comment/Question #10: Why didn't you survey the driveways at the northeast corner of 23rd Avenue and Ford Street? Alternative 1.5 will prohibit semi-trucks from gaining access to my carpet business. Can you study the access at this location?

Response #10: We did not expect the project to affect the existing driveways or require additional right of way on the north side of Ford Street. Trucks and vehicles would continue to access the property located at the corner of Ford Street and 23rd Avenue although they may need to use a different route to enter and exit the property.

Comment/Question #11: The first stop light in Alameda blocks the traffic when the bridge opens and closes. When the bridge goes down, the light turns green for 15 seconds and then turns red, so it creates very long traffic back-ups.

Response #11: The scope of the study did not extend to traffic operations in the City of Alameda. Traffic operations in Alameda are not anticipated to affect the need for, or selection of, an alternative to the existing street design on the Oakland side of the Park Street Bridge.

Comment/Question #12: Do you propose to widen Chapman Street?

Response #12: Chapman Street is not in the study area and is not anticipated to be widened as a part of this project.

Comment/Question #13: Has there been concern about access to the concrete plant? The cement plant driveways on 23rd Avenue have not been in use for two years.

Response#13: City staff is currently in discussion with the RMC plant manager. The cement plant has three driveways including one on Kennedy Street and two on 23rd Avenue. The driveway closest to the Park Street bridge abutment is gated and appears not to be in use. The project will not affect the Kennedy Drive driveway. Alternative 1.5 requires closing of the two driveways on 23rd Avenue.

Comment/Question #14: Why not look at Alternative 3 with the same right of way acquisition as Alternative 1.5? It would be comparing oranges with apples, if you don't evaluate this scenario.

Response #14: Alternative 3 was developed specifically with the idea of avoiding the acquisition of right-of-way from adjacent properties.

Comment/Question #15: Current traffic flow is all right. The change will disrupt residents, business, etc. The less disruption is the best.

Response #15: Please See Answer #5.

Comment/Question #16: What positive effect would Alternative 3 have for bikes and pedestrians?

Response #16: There will be traffic signal improvements at 29th Avenue/Ford Street and 23rd Avenue/Ford Street to accommodate bicyclists and pedestrians. Bike lanes would be provided along 29th Avenue and 23rd Avenue; however, bike lanes would not be provided along Ford Street. Alternative 3 would not include a multiple purpose trail through the project study area.

Comment/Question #17: I would like to applaud the improved service for bikes. I am the owner of a bike shop in Alameda and also the President of the Alameda Bicycle Coalition. Unlike Oregon or Washington States, Bay Area provides very limited bicycle access and it ends up with lower percentage for riding bicycles to work. It's a chicken first or egg first issue. When we provided the bicycle facility at Fruitvale BART station, we increased the usage for riding bicycles to work. It saves energy, environment, etc. I really like to empower the City for providing more bicycle access to the community.

Response #17: Comment noted.

Comment/Question #18: What about leaving existing geometry with new traffic signals at Ford/29th Avenue and Glasscock/29th Avenue?

Response #18: The signal warrants need to be met for installing new traffic signals, which include traffic volumes and accident rates. The City maintains a priority list for installing new traffic signals. Based on the existing conditions, these locations either do not meet signal warrants or are not ranked at the top of the priority list.

Comment/Question #19: What about providing a grade separation for pedestrian access in the area?

Response #19: A grade separation would need to meet the American Disability Acts (ADA) requirements for grade (steepness), side slope, landing area, etc. A bridge would require a lot of space on both sides to satisfy ADA requirements and a bridge may not be used. The water table in the area would likely prohibit construction of a pedestrian tunnel.

Comment/Question #20: I live in Alameda and I bike to work everyday. It's very dangerous for bicyclist making northbound left turn at the 29th Avenue/Ford Streets intersection. The merging traffic at Ford Street is the critical movement for those vehicles going from 29th Avenue to I-880. The double northbound left turn lanes for Alternative 1.5 can really help improve traffic operations and service for bikes at this intersection.

Response #20: Comment noted.

Comment/Question #21: Will the existing bike connections to bridge remain?

Response #21: The existing bike connections to the bridge would remain in both Alternatives 1.5 and 3.

Comment/Question #22: 200 units at Glascock Street will be built. Did you evaluate the future traffic condition with this development?

Response #22: No, we did not evaluate future traffic conditions.

Comment/Question #23: The Port of Oakland owns a piece of the land west of 23rd Avenue and south of the railroad tracks. Why don't you improve the southbound access to the bridge using this property?

Response #23: The horizontal curvature of 23rd Avenue at the approach to the Park Street Bridge is already too sharp and results in the slowing or encroachment of large vehicles into the adjacent lane. Shifting 23rd Avenue to the west near the bridge would compound this problem.

Comment/Question #24: Will both alternatives accommodate the extension of the Bay Trail through the study area?

Response #24: Alternative 1.5 would accommodate the trail through the study area but Alternative 3 would not.

Comment/Question #25: Will Pier 29 stay in the area?

Response #25: Neither of the project alternatives would affect Pier 29. We do not know the future plans of Pier 29.

Comment/Question #26: Will bicycle lanes be installed on Ford Street for Alternative 1.5?

Response #26: Bicycle lanes are planned along Ford Street for Alternative 1.5; however, this may require the removal of parking along the north side of Park Street.

Comment/Question #27: Kent Andrews took a photo that reads "Restaurant and County Use Only" on the approach to the stop sign from 23rd Ave SB to 29th Ave. This sign was knocked down earlier this year and has not yet been replaced. The stop sign has a "No right turn" sign under it, but it should have a "No left turn" sign on it as well since the "Restaurant and County Use Only" sign already indicates that traffic should not turn left at the stop sign. Such left turn would run into traffic coming out of Glascock Street.

Response #27: The "Restaurant and County Use Only" sign is not enforceable..

Comment/Question #28: Since traffic is moving rather smoothly through the area, we should simply install two traffic signals on 29th Avenue to solve all of the traffic and safety problems without making any other drastic changes to the street network, and see if it works.

Response #28: Installing two traffic signals on 29th Avenue would not address many of the safety and traffic operations issues identified in the traffic study and may cause long traffic queues on the Park Street Bridge. The cost to install two traffic signals and change the traffic signs and pavement markings as required to accommodate the signals would likely exceed $500,000.

ADDITIONAL PUBLIC COMMENTS AND QUESTIONS OUTSIDE OF THE COMMUNITY MEETING

Comment/Question #29: Richard Cochran: Make Ford Street between 23rd and 29th two way. Put a signal at the corner of 29th and Ford, with no left turn to 29th. Make this the access to the neighborhood. Get rid of the left turns that have to challenge bridge traffic to enter the neighborhood. When people exit Alameda on the bridge, make the freeway traffic stay in the right lane, and make the Oakland traffic stay in the left and go over the 29th bridge to E 12th.

Response #29: The concept described by Mr. Cochran would cause impacts beyond the study area and would likely require widening the 29th Avenue Bridge. Analysis of this concept is outside the scope of work for this study.

Comment/Question #30: Kevin Reilly: I am a bicyclist who rides from my residence in the Upper Fruitvale neighborhood to the Park Street Triangle. The area is very tricky for bicyclists trying to get from the bridge to the bike trail along the estuary or to any route leading to downtown Oakland. I have actually rode on the sidewalk against traffic in order to avoid having to cross over traffic to get to the bike trail. Motorists do not heed or yield much at all to cyclists. It is a dangerous conjunction.

Response #30: Comment noted. The alternatives analyzed in the study should address Mr. Reilly's concerns.

Comment/Question #31: Susan Moyski: I live and own a house on Chapman Street. My suggestion is to put in a pedestrian walkway that bypasses the traffic. Maybe an overpass that goes over the traffic. It is impossible to cross that street as a pedestrian to catch a bus on the other side. A friend of mine was hit by a car as a pedestrian and lost her spleen as a result of the current traffic situation. Something has to be done for pedestrians.

Response #31: Please See Answer #19.

COMMENTS FROM TECHNICAL ADVISORY COMMITTEE AND OTHER STAKEHOLDERS

Comment/Question #32: Kathryn Hughes (TSD): When cyclists on the bridge ride counter to the direction of traffic flow, they pose a problem for pedestrians. Also, they need to transition to the "right" side of the road after they exit the bridge. This maneuver is usually quite difficult.

Response #32: Comment noted. The alternatives analyzed in the study should address Ms. Hughes concerns.

Comment/Question #33: Kathryn Hughes (TSD): The condition of the existing RR tracks and pavement is not identified in the report. Are there any RR tracks that need to be upgraded to reduce gaps between rail and the street surface? Gaps may pose an issue for bikes and wheelchairs. The City has repaired a number of these RR track crossings in this area.

Response #33: The pavement is in relatively good shape at the railroad crossings. The crossings would need to be upgraded to a rubber grade crossing system to improve safety for bicyclists.

Comment/Question #34: Philip Ho: Under Alternative #1.5, the proposed multi-purpose trail crosses the RR track within the 29th/Glascock intersection at a very small angle of about 15 degrees. This is problematic for bikes, wheelchairs, and strollers. RR tracks are very smooth and slippery (especially in wet weather) compared to regular AC or rubberized AC surfaces. For safety reasons, crossings at RR tracks should ideally be at 90 degrees where possible. Let's discuss how we can resolve the trail alignment at the RR tracks.

Response #34: The location of the 29th Avenue Bay Trail crossing on the south side of the Glascock Street intersection would require cyclists and other wheeled vehicles on the trail to cross the railroad tracks at a very sharp angle. A crossing on the north side of the Clascock Street intersection would not require trail users to cross the tracks as they cross 29th Avenue but would require them to cross Glascock Street and cross the tracks at a right angle. This north crossing would be better for trail users but would require relocating the trail further to the north where the 7-Eleven store is currently located.

Comment/Question #35: Lauren Eisele (Port of Oakland): City should not design around the current street layout, but should change the street layout all together to improve overall flow, and reduce the number of feeder streets into the intersections. If land use and ownership are going to be manipulated, there is an opportunity to manipulate the street layout pattern as well.

Response #35: The concept described by Ms. Eisele would cause impacts beyond the study area. Analysis of this concept is outside the scope of work for this study.

RESPONSES TO E-MAIL COMMENTS BY TOM STRAUS, OWNER OF STRAUS CARPETS, DATED DECEMBER 3, 2005

Comment/Question #1: My name is Tom Straus and I own the carpet company on Ford St. and 23rd Ave. Thank you for arranging the meeting of last Thursday 12-1. To be candid, I find several flaws in the study conducted by Dowling Associates and I wonder if erroneous data is affecting some of the decisions to mitigate traffic in our area.

Response #1: All data collected and all of the analyses performed for this study were prepared with care and were carefully reviewed to minimize errors. After a careful review of the comments in the e-mail, we did not find any erroneous data.

Comment/Question #2: We have 3 driveways in our parking lot, two on Ford St. and one on 23rd Ave. We have a coffee stand in our parking lot that serves at least one hundred cars per day during the week, with a maximum of 175 per day and our warehouse that loads up to 20 vans per day and receives 5 semi-trailers per day. For reasons I cannot fathom, our business was not counted in your car totals or commercial vehicle totals for Driveway Traffic Volumes on Page 8 of the study. Why not? Were the murals too demure and not able to catch the attention of the people proposing the study? Would these numbers have any impact upon the decisions made in this study? Had we been included, our count would have rivaled that of 7/11 and exceeded all other businesses and their driveways in your survey. We have 5 Times the traffic of Driveways 1 or 3 and 2 1/2 times their combined totals.

Response #2: Please see Answer #10. The number of vehicles using the driveways on Ford Street in question does not affect the layout of the proposed design alternatives or the study findings.

Comment/Question #3: Turning Ford St. into a 2 way street would seriously impede access to the bridge. If anyone has done any type of study of fluid dynamics, the obvious outcome of such a move would slow traffic and impede progress while increasing the danger of head-on collisions. It's not wide enough to avoid the weaving seen now, but adding a second direction will not improve its load carrying capacity.

Response #3: The traffic analysis shows that traffic would operate in compliance with City of Oakland standards for either project alternatives. The travel distance to the Park Street Bridge would be slightly increased by Alternative 1.5, but the flow of traffic would not be impeded, and safety and service would be improved for pedestrians and bicyclists. Head-on collisions would be unlikely if a raised median is installed, as recommended. The weaving movements that create safety concerns for bicyclists under the existing street configuration would be eliminated in either of the project alternatives.

Comment/Question #4: You may want to check, but I believe the area in front of the bridge on the 23rd Ave. side is owned by the Port of Oakland. With minor road work, the elbow on the approach to the bridge could be straightened and trucks and buses would have an easier approach. You would not have to change the flow of traffic to straighten 30 feet of roadway.

Response #4: Please see Answer #23, above.

Comment/Question #5: The "23rd Ave. Weaving Area" was created by the City when the right lane was restructured a few years ago and now forces cars in the right lane to turn right. The solution (as it existed in the past) would be to allow both lanes to accomodate traffic that flows straight ahead to the bridge and accomodate vehicles that wish to make a right turn on to Kennedy St., rather than force the issue and create the weaving pattern. We never had the problem before the City "fixed" it.

Response #5: If two right turn lanes are provided for eastbound Kennedy Street, there would still be a weaving problem. Although eastbound Kennedy Street traffic would have to weave across one lane instead of two to get to northbound 29th Avenue, southbound 23rd Avenue would have to weave to the right to access the bridge. Currently, no weaving maneuver is required for southbound 23rd Avenue traffic.

Comment/Question #6: A crosswalk at the light on 23rd that crosses 23rd and is activated by pushing a button would accomodate both pedestrians and bicyclists. It's true that bicyclists would have to dismount, but you require that on the bridge now. The fact that your photos prove that bicyclists do not obey that rule should not mean that it is a bad rule, but rather that it is not enforced.

Response #6: A crosswalk at the 23rd Avenue/Kennedy Street/Ford Street intersection would improve access for pedestrians and bicyclists, but would not address the other safety concerns for pedestrians and bicyclists in the study area. The study does not recommend removal of the sign requiring bicyclists to dismount before using the sidewalk across the bridge. Those who do not dismount increase the risk to themselves and other non-motorized users of the bridge. Enforcement has to be prioritized where the need for safety and security is greatest in the City. It is unlikely that enforcement will be increased at this location considering the greater need for safety and security in other areas.

Comment/Question #7: Speaking of enforcement, when is the last time a police officer issued a ticket at the No Left Turn sign at the bottom of the ramp on 29th? We see at least a dozen violations per day and yet nothing is done to stop this very dangerous practice. Good revenue for the City and increased safety for motorists and pedestrians would go hand in hand

Response #7: The study did not show any collisions during the five years between July 1999 and September 2004 resulting from left-turning maneuvers from the bottom of the ramp on 29th Avenue.

Comment/Question #8: A stoplight on Glascock was proposed at the meeting and you said a study would have to be undertaken to justify the placement. If it was a "smart" light with a vehicle sensor on Glascock and a pedestrian button with crosswalk to 7/11, the cost would be a tiny fraction of the solutions forwarded by Dowling Associates. There are quite a few people that will be added to area and they have as much right to cross the street as anybody in any other area of Oakland. They also have the right to merge into traffic and to do so safely. The proposals as designed do not accomodate residents, future growth that is obvious (at least to anyone who can see murals on a building), or existing businesses in the area. If people wish to continue walking or biking to Kennedy Street, they can cross at the light on 23rd that is already in existence.

Response #8: Installation of a traffic signal at the intersection of 29th Avenue and Glascock Street without widening 29th Avenue would cause traffic to queue up onto the Park Street Bridge. The alternatives evaluated in this study were not "forwarded by Dowling Associates." The alternatives developed by the City staff and evaluated by Dowling Associates in this study were developed to address the needs of motorists, pedestrians and bicyclists, and to address the land use changes that are occurring in the area.

Comment/Question #9: Lastly, I would like to address the term used by the City to invite people to any meetings regarding this area. The word "sharehoders" was used. I asked if a business that employs Oakland residents, pays Oakland property taxes, pays Oakland business taxes, donates to many of Oakland's public schools, and is willing to attend these meetings is considered a shareholder. I was told that such consideration had never been given. Why not? What more can we do to qualify? Why does a bicyclist have a voice, yet I and others like me are excluded from these shareholder meetings. Something is VERY wrong and should be immediately redressed.

Response #9: The public notice of the community meeting did not use the word "shareholders." The previous meeting held that involved public agency staff was named "Stakeholder Meeting" which was no different from Technical Advisory Committee Meeting. Please see Answer #9, above.

RESPONSES TO A LETTER FROM LUCY GIGLI, PRESIDENT OF BIKE ALAMEDA, DATED DECEMBER 5, 2005

Comment/Question #1: Thank you for reviewing the plans with me. Please accept the below recommendations from BikeAlameda.

General recommendations regardless of which alternative is chosen:

• All actuated signals should be bicycle sensitive, including left turn lanes.

Response #1: Vehicle detectors will be designed to detect bicycles.

Comment 2: Traveling from Alameda (towards 29th, 23rd and Embarcadero):

1. Clear signage directing cyclists with the safest routes to the Embarcadero.

2. Bike lanes along 29th Ave all the way to the cycling underpass at E 7th Street. This should include highly visible markings directing cyclists to the underpass and alerting them that this is the safest way to the Embarcadero.

While the following recommendations may not be entirely within the scope of this specific project, we would like to see them completed, since any changes to the triangle area will not be effective unless the gaps are closed.

1. Wider curb cuts at the E 7th Street underpass to better allow cyclists to turn from the bike lane into the underpass while negotiating high speed traffic

2. Traffic calming along 29th Ave to the freeway entrance. It is not possible to use the onramp at high speed, yet traffic is traveling 35-45 mph in the section directly before it, endangering cyclists who are trying to travel the proper bike route.

Response #2: Signing and pavement markings outside of the study area will need to be addressed outside the scope of this study. Specific directional signs identified by City staff for regional bicycle travel will be shown on the drawings prepared for this study. Design elements at the E 7th Street underpass and traffic calming along 29th Avenue will need to be addressed outside the scope of this study.

Comment 3: Traveling to Alameda (from Embarcadero and 23rd/29th):

While the following recommendations may not be entirely within the scope of this specific project, we would like to see them completed, since any changes to the triangle area will not be effective unless the gaps are closed.

1. Kennedy bike lane approach needs resurfacing. Massive and dangerous separation of road materials (concrete shoulder and bitumen road surface) in the bike lane. Gaps of 2-3 inches and mounding of materials 2-3 inches high.

2. Signage at the corner of E 7th and Kennedy directing cyclists to Alameda. Current signage only directs to Fruitvale.

Response #3: Items listed will need to be addressed outside the scope of this study.

Comment 4: Alternative specific suggestions

Alternative 1.5

• This alternative improves bay trail access considerably by making a crossing close to the Park Street bridge.

• This will improve the safety for those many cyclists who currently chose to travel north on the west side of the Park Street bridge. (counterflow cyclists)

Response #4: Comment noted.

Comment 5: Traveling to Alameda:

This is an amazing improvement! A right on Kennedy at 23rd to the path and onto the bridge walkway makes this travel easy. Bicyclists coming south on 29th are able to travel straight on the bike lanes at 29th and Ford to the bridge without disruptive merging or turns.

Response #5: Comments noted.

Comment 6: Traveling from Alameda:

1. Bike lanes on 29th Street to E 7th Street. Crossing on the east side of the Park Street bridge heading north on 29th to E 7th requires bike lanes.

2. A bike path loop detector at Kennedy and 23rd. For bicyclists traveling north to turn left onto bike lanes on Kennedy or Class I bike path along west side of 23rd to E 7th with bike path loop detector at E 7th and 23rd. For bicyclists traveling north to turn left onto E 7th.

3. Bicycle loop detectors for left turn (if actuated signals) at Kennedy and E 7th. This would be needed if the bike path ends at Kennedy and bicyclists are using bike lanes on Kennedy to get to the Embarcadero bike lanes.

4. Ford Street bike lanes to connect to Kennedy bike lanes for those bicyclists heading west from Ford Street. This may be more amenable to commuting cyclists.

Cyclists coming from 29th Ave are forced to deal with vehicles that do not yield (despite signage) and must negotiate crossing 2 lanes to get to the bridge path.

<u>Response #6</u>: Bike lanes along 29th Street within the study area will be shown on the drawings for the preferred alternative. Bike loop detectors will be included in the design of the preferred alternative, although they are greater detail than will be shown on the drawings for the preferred alternative. Bike lanes on westbound Ford Street will be included in the plan.

<u>Comment 7:</u> Alternative 3

• This alternative does not improve bay trail.

• This does not improve the safety for counterflow cyclists.

• Unless bike lanes are added to 29th and Ford Street this does little to improve safety for bicyclists.

<u>Response #7</u>: First two statements are noted. In response to the last statement, a bike lane is not recommended for southbound 29th Avenue because it would lead cyclists into oncoming traffic from the 23rd Avenue/29th Avenue split. A 5-foot bike lane could be provided northbound on 29th Avenue by reducing the three vehicle travel lanes from a total of 36 feet to 35 feet or by reducing the parking stalls from 8 feet wide to 7.5 feet wide (the total street width is shown as 56 feet on the *29th Avenue Gateway Improvements* plans, dated June 20, 2003). No bike lanes would be possible on Ford Street for this alternative.

<u>Comment 8</u>: Traveling to Alameda:

1. Bike lanes on Ford Street would bring bay trail access closer to the bridge. This access would be an improvement over E 7th, since the left turn at 29th and Ford would be signalized.

2. Signalized loop detectors for cyclists at Ford and 23rd and Ford and 29th for cyclists traveling south on 29th.

<u>Response #8</u>: No bike lanes would be possible on Ford Street for this alternative. Bike loop detectors will be included in the design of the preferred alternative.

<u>Comment 9</u>: Traveling from Alameda:

1. Bike lanes on 29th to E 7th. Bicyclists would have the options of reaching the Embarcadero by turning left on Ford to reach the bike lanes on Kennedy or at the E 7th underpass.

<u>Response #9:</u> Please see response to Comment 7.

COMMENTS FROM STEVE KANG, OWNER OF 7-ELEVEN STORE, ON DECEMBER 8, 2005

Comment/Question #1: Alternative 1.5 will cut off the parking off and shut down the 7-Eleven store and Nikko's Restaurant just to put a small park in there. The area is bad and scary, so no one will use the park. 7-Eleven will lose 10 jobs and Nikko's Restaurant will lose about 10 jobs.

Response #1: It is possible that the 7-Eleven store may need to be relocated if Alternative 1.5 is implemented. It appears unlikely that either Alternative 1.5 or 3.0 would require the relocation of Nikko's Restaurant, although Nikko's may be closed if the triangular parcel is redeveloped as a neighborhood park.

Comment/Question #2: The accident rate is low and traffic flow is OK, so it doesn't make sense. It is a waste of money. Bike lanes are not important. There is already a bike lane.

Response #2: Although the number of accidents reported in the past several years is low, the number of bike and pedestrian collisions with autos is relatively high. The proposed extension of the trail through the area and the amount of residential development that is planned will increase the exposure of bicyclists and pedestrians to motor vehicular conflicts

Comment/Question #3: You should put a in signal light and paint to let pedestrians cross.

Response #3: Signals and paint alone will not solve the many traffic operational problems associated with the existing street system. Please see the traffic study report for discussion of existing problems.

Comment/Question #4: More traffic signals will cause more traffic delay in rush hours and non-rush hours. Traffic will be much worse than now.

Response #4: The additional lanes proposed for Alternative 1.5 would improve traffic operations for motor vehicles even though new signals would be added to protect pedestrians and bicyclists.

Comment/Question #5: The two alternatives do not allow trucks to make U-turns and park on the side of the street as they do now. None of the alternatives are acceptable.

Response #5: Access would be more limited for either of the alternatives than for the existing condition. The trade-off would be that safety should be improved for all users of the street system, especially non-motorized system users.

ADDITIONAL COMMENTS BY TOM STRAUS, OWNER OF STRAUS CARPETS, ON DECEMBER 9, 2005

Comment/Question #1: Did you see the accident as reported on the news last night? No bicycles, no pedestrians, only an idiotic driver trying to pass another car while turning from 29th on to Ford St. and hitting the building on the corner. Can you imagine what would have happened if Plan 1.5 had been implemented and 2 way traffic had been allowed on Ford St.? This is the second such accident at the same location in 5 weeks. The previous accident involved a speeding car hitting a parked truck on Ford St. and then fleeing the scene. The proposals as stated in the traffic report are not going to increase safety for anyone and may lead to catastrophic results if implemented as planned. Please respond as we who work in this area are very concerned with what appears to be the traffic planner's ivory tower approach to very real situations.

Response #1: Alternative 1.5 would be designed according to City of Oakland and Caltrans design standards, which have been developed to provide safe and efficient transportation systems for a variety of users. . A recommendation has been made to include a raised median to separate two-way traffic. Even well-designed streets and traffic control systems cannot prevent willful violations (speeding, reckless driving, fleeing from an accident scene, etc.) of traffic laws; however, safety can be improved by designing systems that reduce motor vehicle weaving maneuvers and provide adequate facilities to accommodate pedestrian and bicycle mobility needs.

RESPONSES TO E-MAIL COMMENTS BY LEE HUO, ASSOCIATION OF BAY AREA GOVERNMENTS, DATED DECEMBER 14, 2005

Comment/Question #1: We are supportive of the Bay Trail alignment chosen in Options 1, 1.5, and 2 since it reflects the interim Bay Trail alignment identified in the Oakland Waterfront Trail - Bay Trail Feasibility and Design Guidelines Study (Oakland Bay Trail Study). The Bay Trail alignments in the Oakland Bay Trail Study were adopted by Oakland's City Council this year. We have a vested interest in seeing that the Bay Trail is implemented as identified in the Oakland Bay Trail Study since we contributed a $200,000 grant towards the development of the Study. Until the City is able to implement the final alignment of the Bay Trail identified in the Oakland Bay Trail Study, this interim alignment will provide a safe and convenient alternative.

Response #1: Comment noted.

Comment/Question #2: Since we currently do not have any specific design information on the proposed Bay Trail alignment through this area, it is difficult to give detailed comments. As such we are providing general comments that the proposed Bay Trail meet the Bay Trail Design Standards and that the Bay Trail corridor be designed in a manner that provides a safe, enjoyable, and usable trail.

Response #2: The traffic study is intended to accommodate the trail as defined in the *Oakland Waterfront Bay Trail Feasibility Study* (EDAW). The trail within the study area would be designed according to Caltrans standards for a multi-purpose trail.

Comment/Question #3: Page 29 of the Traffic Study identifies preemption of the traffic signal to resolve concerns of motor vehicles backing on to the draw bridge at Park Street. The Traffic Study did not elaborate on the details of this preemption, so we cannot provide comments at this time. We would request that the Traffic Study elaborate on what the signal preemption would entail, so that we may comment on this potential solution. We would also suggest that coordinating signal timing on the Oakland and Alameda sides of the bridge could also be a solution.

Response #3: Traffic signal preemption would be used at the proposed Glascock Street signal to prevent northbound traffic from queuing onto the bridge when the bridge must be raised. During preemption, all motor vehicle and pedestrian signal phases would be terminated except for the phase serving the northbound traffic movement, which would receive a green traffic signal indication. County of Alameda Public Works Agency staff responsible for bridge operation has stated that signal preemption should be acceptable at Glascock Street. There is signal preemption at the traffic signal on the City of Alameda side of the bridge and there is signal preemption at the High Street Bridge. The City of Oakland would be responsible for maintaining the signal preemption equipment at the signal. A preemption "switch" would need to be provided at the bridge control station and integrated with the program logic controller that activates bridge openings.

Comment/Question #4: The City of Alameda has expressed a preference to move the bicycle and pedestrian crossing from 29th/Glascock to 29th/Ford in order to reduce the potential of traffic backing up on to the bridge. This change would entail moving the Bay Trail alignment to parallel Ford and Park Streets. We believe that this alignment is less desirable than the original alignment identified under Options 1, 1.5, and 2. This original alignment provides a safer and more enjoyable alignment by moving bicyclists and pedestrians away from traffic and potential conflicts with curb cuts. In addition, there are also alternative solutions other than moving the crossing to resolve this concern such as readjusting signal controls and timing.

Response #4: Comment noted. Extension of the trail along Ford Street for Alternatives 1, 1.5, and 2 would require the trail to pass between the widened section of Ford Street and Nikko's Restaurant. The trail would encroach very close to the Nikko's Restaurant building. After crossing 29th Avenue, the trail would then need to proceed along the east side of 29th Avenue to Glascock Street. The area between the edge of the existing roadway and the buildings located along the east side of 29th Avenue is occupied by a sidewalk that is too narrow to accommodate the trail.

Comment/Question #5: The Traffic Study did not provide a description of how bicyclists and pedestrians would be accommodated under Option 3. This detail needs to be provided in order to allow readers to understand what is being proposed and to comment on this option.

Response #5: Alternative 3 would require bicycle traffic to share the travel lanes with vehicular traffic along 23rd Avenue and along Ford Street much as they do today. Bike lanes could be provided along 29th Avenue if parking were removed from one side of the street. Pedestrians would be served by existing sidewalks and by new crosswalks at the signalized intersections of Ford Street with 23rd Avenue and 29th Avenue. A new unsignalized crosswalk would be provided across 29th Avenue at Glascock Street.

APPENDIX B – Level of Service Calculations

Existing Conditions - AM Peak Hour
1: Ford St & 23rd Av

7/29/2005

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
Lane Util. Factor					1.00						1.00	1.00
Frt					1.00						1.00	0.85
Flt Protected					0.98						1.00	1.00
Satd. Flow (prot)					1817						1863	1583
Flt Permitted					0.98						1.00	1.00
Satd. Flow (perm)					1817						1863	1583
Volume (vph)	0	0	0	176	171	0	0	0	0	0	346	17
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	191	186	0	0	0	0	0	376	18
RTOR Reduction (vph)	0	0	0	0	62	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	0	0	0	316	0	0	0	0	0	376	11
Turn Type				Perm								Perm
Protected Phases					8						6	
Permitted Phases				8								6
Actuated Green, G (s)					16.0						37.0	37.0
Effective Green, g (s)					15.0						37.0	37.0
Actuated g/C Ratio					0.25						0.62	0.62
Clearance Time (s)					3.0						4.0	4.0
Lane Grp Cap (vph)					454						1149	976
v/s Ratio Prot											c0.20	
v/s Ratio Perm					0.17							0.01
v/c Ratio					0.69						0.33	0.01
Uniform Delay, d1					20.4						5.5	4.4
Progression Factor					1.00						1.00	1.00
Incremental Delay, d2					8.5						0.8	0.0
Delay (s)					28.9						6.3	4.5
Level of Service					C						A	A
Approach Delay (s)		0.0			28.9			0.0			6.2	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Existing Conditions - AM Peak Hour
2: Ford St & 29th Av

7/29/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	0	0	0	32	16	0	822	3	0	0	176
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	35	17	0	893	3	0	0	191
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	930	897	0	991	1086	895	191			897		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	930	897	0	991	1086	895	191			897		
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 %	100	100	100	100	84	95	100			100		
cM capacity (veh/h)	206	279	1085	225	216	339	1382			757		

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	52	897	191
Volume Left	0	0	0
Volume Right	17	3	191
cSH	246	1700	1700
Volume to Capacity	0.21	0.53	0.11
Queue Length 95th (ft)	20	0	0
Control Delay (s)	23.5	0.0	0.0
Lane LOS	C		
Approach Delay (s)	23.5	0.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

Existing Conditions - AM Peak Hour
3: SB_Left_#1 & 29th Av

7/29/2005

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	77	0	0	2123	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	84	0	0	2308	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1154	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1154	0	0			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	56	100	100			
cM capacity (veh/h)	190	1084	1622			

Direction, Lane #	EB 1	NE 1	NE 2
Volume Total	84	1154	1154
Volume Left	84	0	0
Volume Right	0	0	0
cSH	190	1700	1700
Volume to Capacity	0.44	0.68	0.68
Queue Length 95th (ft)	51	0	0
Control Delay (s)	37.9	0.0	0.0
Lane LOS	E		
Approach Delay (s)	37.9	0.0	
Approach LOS	E		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		

Existing Conditions - AM Peak Hour
4: SB_Left_#2 & 29th Av

7/29/2005

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	10	0	0	2113	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	0	2297	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1148	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1148	0	0			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	100	100			
cM capacity (veh/h)	192	1084	1622			

Direction, Lane #	EB 1	NE 1	NE 2
Volume Total	11	1148	1148
Volume Left	11	0	0
Volume Right	0	0	0
cSH	192	1700	1700
Volume to Capacity	0.06	0.68	0.68
Queue Length 95th (ft)	4	0	0
Control Delay (s)	24.9	0.0	0.0
Lane LOS	C		
Approach Delay (s)	24.9	0.0	
Approach LOS	C		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	28	2198	2	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	30	2389	2	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2390	1196			2391	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2390	1196			2391	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	83			100	
cM capacity (veh/h)	28	179			198	

Direction, Lane #	WB 1	NE 1	NE 2
Volume Total	30	1593	799
Volume Left	0	0	0
Volume Right	30	0	2
cSH	179	1700	1700
Volume to Capacity	0.17	0.94	0.47
Queue Length 95th (ft)	15	0	0
Control Delay (s)	29.3	0.0	0.0
Lane LOS	D		
Approach Delay (s)	29.3	0.0	
Approach LOS	D		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
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
Lane Util. Factor					1.00						1.00	1.00
Frt					1.00						1.00	0.85
Flt Protected					0.96						1.00	1.00
Satd. Flow (prot)					1791						1863	1583
Flt Permitted					0.96						1.00	1.00
Satd. Flow (perm)					1791						1863	1583
Volume (vph)	0	0	0	248	63	0	0	0	0	0	585	11
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	270	68	0	0	0	0	0	636	12
RTOR Reduction (vph)	0	0	0	0	203	0	0	0	0	0	0	5
Lane Group Flow (vph)	0	0	0	0	136	0	0	0	0	0	636	7
Turn Type				Perm								Perm
Protected Phases					8						6	
Permitted Phases				8								6
Actuated Green, G (s)					16.0						37.0	37.0
Effective Green, g (s)					15.0						37.0	37.0
Actuated g/C Ratio					0.25						0.62	0.62
Clearance Time (s)					3.0						4.0	4.0
Lane Grp Cap (vph)					448						1149	976
v/s Ratio Prot											c0.34	
v/s Ratio Perm					0.08							0.00
v/c Ratio					0.30						0.55	0.01
Uniform Delay, d1					18.3						6.7	4.4
Progression Factor					1.00						1.00	1.00
Incremental Delay, d2					1.7						1.9	0.0
Delay (s)					20.0						8.6	4.4
Level of Service					B						A	A
Approach Delay (s)		0.0			20.0			0.0			8.5	
Approach LOS		A			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	106.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	0	0	0	30	9	0	557	16	0	0	240
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	33	10	0	605	17	0	0	261
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	640	623	0	745	875	614	261			623		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	640	623	0	745	875	614	261			623		
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 %	100	100	100	100	89	98	100			100		
cM capacity (veh/h)	347	402	1085	330	288	492	1304			958		

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	42	623	261
Volume Left	0	0	0
Volume Right	10	17	261
cSH	318	1700	1700
Volume to Capacity	0.13	0.37	0.15
Queue Length 95th (ft)	11	0	0
Control Delay (s)	18.0	0.0	0.0
Lane LOS	C		
Approach Delay (s)	18.0	0.0	0.0
Approach LOS	C		

Intersection Summary

Average Delay	0.8		
Intersection Capacity Utilization	40.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	70	0	0	1491	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	0	0	1621	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	810	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	810	0	0			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	100	100			
cM capacity (veh/h)	318	1084	1622			

Direction, Lane #	EB 1	NE 1	NE 2
Volume Total	76	810	810
Volume Left	76	0	0
Volume Right	0	0	0
cSH	318	1700	1700
Volume to Capacity	0.24	0.48	0.48
Queue Length 95th (ft)	23	0	0
Control Delay (s)	19.9	0.0	0.0
Lane LOS	C		
Approach Delay (s)	19.9	0.0	
Approach LOS	C		

Intersection Summary

Average Delay	0.9		
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBR	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	118	0	0	1373	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	128	0	0	1492	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	746	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	746	0	0			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	63	100	100			
cM capacity (veh/h)	349	1084	1622			

Direction, Lane #	EB 1	NE 1	NE 2
Volume Total	128	746	746
Volume Left	128	0	0
Volume Right	0	0	0
cSH	349	1700	1700
Volume to Capacity	0.37	0.44	0.44
Queue Length 95th (ft)	41	0	0
Control Delay (s)	21.2	0.0	0.0
Lane LOS	C		
Approach Delay (s)	21.2	0.0	
Approach LOS	C		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	WBL	WBR	NET	NER	SWL	SWT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	0	37	1339	34	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	40	1455	37	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1474	746			1492	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1474	746			1492	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	89			100	
cM capacity (veh/h)	117	356			446	

Direction, Lane #	WB 1	NE 1	NE 2
Volume Total	40	970	522
Volume Left	0	0	0
Volume Right	40	0	37
cSH	356	1700	1700
Volume to Capacity	0.11	0.57	0.31
Queue Length 95th (ft)	9	0	0
Control Delay (s)	16.4	0.0	0.0
Lane LOS	C		
Approach Delay (s)	16.4	0.0	
Approach LOS	C		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Alternative 1.5 - AM Peak Hour
1: Kennedy St & 23rd Av

9/28/2005

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	
Lane Util. Factor		0.95	1.00		0.97	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		0.99	
Flt Protected		1.00	1.00		0.95	
Satd. Flow (prot)		3539	1863		3412	
Flt Permitted		1.00	1.00		0.95	
Satd. Flow (perm)		3539	1863		3412	
Volume (vph)	0	557	171	0	346	17
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	605	186	0	376	18
RTOR Reduction (vph)	0	0	0	0	5	0
Lane Group Flow (vph)	0	605	186	0	390	0
Confl. Peds. (#/hr)				20		20
Confl. Bikes (#/hr)				20		20
Turn Type						
Protected Phases		2	6		4	
Permitted Phases						
Actuated Green, G (s)		37.0	37.0		35.0	
Effective Green, g (s)		37.0	37.0		35.0	
Actuated g/C Ratio		0.46	0.46		0.44	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		1637	862		1493	
v/s Ratio Prot		c0.17	0.10		c0.11	
v/s Ratio Perm						
v/c Ratio		0.37	0.22		0.26	
Uniform Delay, d1		13.9	12.8		14.3	
Progression Factor		1.00	0.36		1.00	
Incremental Delay, d2		0.1	0.5		0.4	
Delay (s)		14.1	5.1		14.7	
Level of Service		B	A		B	
Approach Delay (s)		14.1	5.1		14.7	
Approach LOS		B	A		B	

Intersection Summary			
HCM Average Control Delay	12.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	92.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Alternative 1.5 - AM Peak Hour
2: Ford St & 29th Av

9/28/2005

Movement	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
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			1.00	0.88		1.00			0.97	1.00		
Frpb, ped/bikes			1.00	1.00		0.96			1.00	0.95		
Flpb, ped/bikes			1.00	1.00		1.00			1.00	1.00		
Frt			1.00	0.85		0.95			1.00	0.90		
Flt Protected			0.95	1.00		0.99			0.95	1.00		
Satd. Flow (prot)			1776	2787		1681			3433	1605		
Flt Permitted			0.81	1.00		0.91			0.95	1.00		
Satd. Flow (perm)			1503	2787		1556			3433	1605		
Volume (vph)	30	56	2	815	13	19	9	7	1383	256	480	1
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	61	2	886	14	21	10	8	1503	278	522	1
RTOR Reduction (vph)	0	0	0	107	0	7	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	96	779	0	46	0	0	1503	801	0	0
Confl. Peds. (#/hr)				20			20					20
Confl. Bikes (#/hr)				20			20					
Turn Type	Perm	Perm		pt+ov	Perm				Prot	Prot		
Protected Phases			4	4 5		8			5	2		
Permitted Phases	4	4			8							
Actuated Green, G (s)			10.6	59.1		10.6			44.5	61.4		
Effective Green, g (s)			10.6	59.1		10.6			44.5	61.4		
Actuated g/C Ratio			0.13	0.74		0.13			0.56	0.77		
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)			199	2059		206			1910	1232		
v/s Ratio Prot				0.28					c0.44	c0.50		
v/s Ratio Perm			c0.06			0.03						
v/c Ratio			0.48	0.38		0.22			0.79	0.65		
Uniform Delay, d1			32.2	3.8		31.0			14.0	4.3		
Progression Factor			0.86	0.50		1.00			0.84	0.81		
Incremental Delay, d2			1.8	0.1		0.6			2.0	2.4		
Delay (s)			29.6	2.0		31.6			13.7	5.9		
Level of Service			C	A		C			B	A		
Approach Delay (s)			4.7			31.6				10.9		
Approach LOS			A			C				B		

Intersection Summary			
HCM Average Control Delay	10.8	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	76.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR
Lane Configurations		
Ideal Flow (vphpl)	1900	1900
Total Lost time (s)	4.0	
Lane Util. Factor	1.00	
Frpb, ped/bikes	1.00	
Flpb, ped/bikes	1.00	
Frt	0.98	
Flt Protected	1.00	
Satd. Flow (prot)	1826	
Flt Permitted	1.00	
Satd. Flow (perm)	1826	
Volume (vph)	150	26
Peak-hour factor, PHF	0.92	0.92
Adj. Flow (vph)	163	28
RTOR Reduction (vph)	8	0
Lane Group Flow (vph)	183	0
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Turn Type		
Protected Phases	6	
Permitted Phases		
Actuated Green, G (s)	12.9	
Effective Green, g (s)	12.9	
Actuated g/C Ratio	0.16	
Clearance Time (s)	4.0	
Vehicle Extension (s)	3.0	
Lane Grp Cap (vph)	294	
v/s Ratio Prot	0.10	
v/s Ratio Perm		
v/c Ratio	0.62	
Uniform Delay, d1	31.3	
Progression Factor	1.00	
Incremental Delay, d2	4.1	
Delay (s)	35.4	
Level of Service	D	
Approach Delay (s)	35.4	
Approach LOS	D	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
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	
Lane Util. Factor					1.00			0.91			0.95	
Frpb, ped/bikes					1.00			1.00			1.00	
Flpb, ped/bikes					1.00			1.00			1.00	
Frt					0.87			1.00			1.00	
Flt Protected					1.00			1.00			1.00	
Satd. Flow (prot)					1619			5084			3539	
Flt Permitted					1.00			1.00			1.00	
Satd. Flow (perm)					1619			5084			3539	
Volume (vph)	0	0	0	2	0	26	0	2111	2	0	995	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	2	0	28	0	2295	2	0	1082	0
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	20	0	0	2297	0	0	1082	0
Confl. Peds. (#/hr)			20	20					20			
Confl. Bikes (#/hr)			20						20			
Turn Type				Perm						Perm		
Protected Phases					4			2			6	
Permitted Phases				4						6		
Actuated Green, G (s)					4.6			67.4			67.4	
Effective Green, g (s)					4.6			67.4			67.4	
Actuated g/C Ratio					0.06			0.84			0.84	
Clearance Time (s)					4.0			4.0			4.0	
Vehicle Extension (s)					3.0			3.0			3.0	
Lane Grp Cap (vph)					93			4283			2982	
v/s Ratio Prot								c0.45			0.31	
v/s Ratio Perm					0.01							
v/c Ratio					0.21			0.54			0.36	
Uniform Delay, d1					36.0			1.8			1.4	
Progression Factor					1.00			1.00			0.99	
Incremental Delay, d2					1.1			0.5			0.1	
Delay (s)					37.1			2.3			1.5	
Level of Service					D			A			A	
Approach Delay (s)		0.0			37.1			2.3			1.5	
Approach LOS		A			D			A			A	

Intersection Summary

HCM Average Control Delay	2.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

1: Kennedy St & 23rd Av

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	
Lane Util. Factor		0.95	1.00		0.97	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		1.00	
Flt Protected		1.00	1.00		0.95	
Satd. Flow (prot)		3539	1863		3430	
Flt Permitted		1.00	1.00		0.95	
Satd. Flow (perm)		3539	1863		3430	
Volume (vph)	0	868	63	0	585	11
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	943	68	0	636	12
RTOR Reduction (vph)	0	0	0	0	2	0
Lane Group Flow (vph)	0	943	68	0	646	0
Confl. Peds. (#/hr)				20		20
Confl. Bikes (#/hr)				20		20
Turn Type						
Protected Phases		2	6		4	
Permitted Phases						
Actuated Green, G (s)		33.0	33.0		29.0	
Effective Green, g (s)		33.0	33.0		29.0	
Actuated g/C Ratio		0.47	0.47		0.41	
Clearance Time (s)		4.0	4.0		4.0	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		1668	878		1421	
v/s Ratio Prot		c0.27	0.04		c0.19	
v/s Ratio Perm						
v/c Ratio		0.57	0.08		0.45	
Uniform Delay, d1		13.3	10.1		14.8	
Progression Factor		1.00	1.09		1.00	
Incremental Delay, d2		0.4	0.2		1.1	
Delay (s)		13.8	11.2		15.8	
Level of Service		B	B		B	
Approach Delay (s)		13.8	11.2		15.8	
Approach LOS		B	B		B	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

2: Ford St & 29th Av

Movement	EBL2	EBL	EBT	EBR	WBL	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2
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			1.00	0.88		1.00			0.97	1.00		
Frpb, ped/bikes			1.00	1.00		0.98			1.00	0.95		
Flpb, ped/bikes			1.00	1.00		1.00			1.00	1.00		
Frt			1.00	0.85		0.97			1.00	0.89		
Flt Protected			0.96	1.00		0.98			0.95	1.00		
Satd. Flow (prot)			1780	2787		1722			3433	1577		
Flt Permitted			0.71	1.00		0.83			0.95	1.00		
Satd. Flow (perm)			1322	2787		1469			3433	1577		
Volume (vph)	44	129	13	1267	19	11	6	3	913	98	286	3
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	140	14	1377	21	12	7	3	992	107	311	3
RTOR Reduction (vph)	0	0	0	161	0	2	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	202	1216	0	41	0	0	992	421	0	0
Confl. Peds. (#/hr)				20			20					20
Confl. Bikes (#/hr)				20			20					
Turn Type	Perm	Perm		pt+ov	Perm				Prot	Prot		
Protected Phases			4	4 5		8			5	2		
Permitted Phases	4	4			8							
Actuated Green, G (s)			14.9	45.8		14.9			26.9	47.1		
Effective Green, g (s)			14.9	45.8		14.9			26.9	47.1		
Actuated g/C Ratio			0.21	0.65		0.21			0.38	0.67		
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)			281	1823		313			1319	1061		
v/s Ratio Prot				c0.44					c0.29	0.27		
v/s Ratio Perm			0.15			0.03						
v/c Ratio			0.72	0.67		0.13			0.75	0.40		
Uniform Delay, d1			25.6	7.4		22.3			18.7	5.1		
Progression Factor			0.95	0.83		1.00			0.90	0.85		
Incremental Delay, d2			8.4	0.9		0.2			2.4	1.1		
Delay (s)			32.9	7.1		22.5			19.1	5.4		
Level of Service			C	A		C			B	A		
Approach Delay (s)			10.4			22.5				15.0		
Approach LOS			B			C				B		

Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

2: Ford St & 29th Av

Movement	SBL	SBT	SBR
Lane Configurations			
Ideal Flow (vphpl)	1900	1900	1900
Total Lost time (s)		4.0	
Lane Util. Factor		1.00	
Frpb, ped/bikes		1.00	
Flpb, ped/bikes		1.00	
Frt		0.99	
Flt Protected		1.00	
Satd. Flow (prot)		1852	
Flt Permitted		1.00	
Satd. Flow (perm)		1847	
Volume (vph)	2	228	9
Peak-hour factor, PHF	0.92	0.92	0.92
Adj. Flow (vph)	2	248	10
RTOR Reduction (vph)	0	2	0
Lane Group Flow (vph)	0	258	0
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Turn Type	Perm		
Protected Phases		6	
Permitted Phases	6		
Actuated Green, G (s)		16.2	
Effective Green, g (s)		16.2	
Actuated g/C Ratio		0.23	
Clearance Time (s)		4.0	
Vehicle Extension (s)		3.0	
Lane Grp Cap (vph)		427	
v/s Ratio Prot			
v/s Ratio Perm		c0.14	
v/c Ratio		0.60	
Uniform Delay, d1		24.0	
Progression Factor		1.00	
Incremental Delay, d2		2.4	
Delay (s)		26.4	
Level of Service		C	
Approach Delay (s)		26.4	
Approach LOS		C	

Intersection Summary

Alternative 1.5 - PM Peak Hour
9/28/2005

3: Glascock St & 29th Av

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
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	
Lane Util. Factor					1.00			0.91			0.95	
Frpb, ped/bikes					1.00			1.00			1.00	
Flpb, ped/bikes					1.00			1.00			1.00	
Frt					0.88			1.00			1.00	
Flt Protected					0.99			1.00			1.00	
Satd. Flow (prot)					1627			5060			3539	
Flt Permitted					0.99			1.00			0.95	
Satd. Flow (perm)					1627			5060			3370	
Volume (vph)	0	0	0	5	0	32	0	1339	30	4	1524	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	5	0	35	0	1455	33	4	1657	0
RTOR Reduction (vph)	0	0	0	0	33	0	0	2	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	7	0	0	1486	0	0	1661	0
Confl. Peds. (#/hr)			20	20					20			
Confl. Bikes (#/hr)			20						20			
Turn Type				Perm						Perm		
Protected Phases					4			2			6	
Permitted Phases				4						6		
Actuated Green, G (s)					4.5			57.5			57.5	
Effective Green, g (s)					4.5			57.5			57.5	
Actuated g/C Ratio					0.06			0.82			0.82	
Clearance Time (s)					4.0			4.0			4.0	
Vehicle Extension (s)					3.0			3.0			3.0	
Lane Grp Cap (vph)					105			4156			2768	
v/s Ratio Prot								0.29				
v/s Ratio Perm					0.00						c0.49	
v/c Ratio					0.07			0.36			0.60	
Uniform Delay, d1					30.8			1.6			2.2	
Progression Factor					1.00			1.00			0.64	
Incremental Delay, d2					0.3			0.2			0.3	
Delay (s)					31.1			1.8			1.7	
Level of Service					C			A			A	
Approach Delay (s)		0.0			31.1			1.8			1.7	
Approach LOS		A			C			A			A	

Intersection Summary

HCM Average Control Delay	2.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

M. Bowman
Dowling Associates, Inc.
HCM Signalized Intersection Capacity Analysis

1: Kennedy St & 23rd Av

9/28/2005

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				1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes				1.00	0.90		1.00	1.00		1.00	0.99	
Flpb, ped/bikes				1.00	1.00		1.00	1.00		1.00	1.00	
Frt				1.00	0.87		1.00	1.00		1.00	0.99	
Flt Protected				0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)				1770	1453		1770	1863		1770	1837	
Flt Permitted				0.95	1.00		0.57	1.00		0.06	1.00	
Satd. Flow (perm)				1770	1453		1061	1863		113	1837	
Volume (vph)	0	0	0	161	10	75	161	1173	0	86	260	17
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	175	11	82	175	1275	0	93	283	18
RTOR Reduction (vph)	0	0	0	0	67	0	0	0	0	0	3	0
Lane Group Flow (vph)	0	0	0	175	26	0	175	1275	0	93	298	0
Confl. Peds. (#/hr)			20			20			20			20
Confl. Bikes (#/hr)			20			20			20			20
Turn Type				Split			Perm			Perm		
Protected Phases				2	2			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)				16.0	16.0		66.0	66.0		66.0	66.0	
Effective Green, g (s)				16.0	16.0		66.0	66.0		66.0	66.0	
Actuated g/C Ratio				0.18	0.18		0.73	0.73		0.73	0.73	
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)				315	258		778	1366		83	1347	
v/s Ratio Prot				c0.10	0.02			0.68			0.16	
v/s Ratio Perm							0.17			c0.82		
v/c Ratio				0.56	0.10		0.22	0.93		1.12	0.22	
Uniform Delay, d1				33.8	31.0		3.8	10.1		12.0	3.8	
Progression Factor				0.97	0.93		1.00	1.00		1.00	1.00	
Incremental Delay, d2				6.8	0.8		0.1	11.8		135.1	0.1	
Delay (s)				39.7	29.5		4.0	21.9		147.1	3.9	
Level of Service				D	C		A	C		F	A	
Approach Delay (s)		0.0			36.1			19.7			37.7	
Approach LOS		A			D			B			D	

Intersection Summary

HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

2: Ford St & 29th Av

9/28/2005

Movement	EBL2	EBL	EBT	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2	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			1.00	1.00				1.00	1.00		1.00	
Frpb, ped/bikes			1.00	0.96				1.00	1.00		0.96	
Flpb, ped/bikes			1.00	1.00				1.00	1.00		1.00	
Frt			1.00	0.95				1.00	0.85		0.86	
Flt Protected			0.95	1.00				0.99	1.00		1.00	
Satd. Flow (prot)			1770	1711				1851	1583		1548	
Flt Permitted			0.72	1.00				0.95	1.00		1.00	
Satd. Flow (perm)			1346	1711				1765	1583		1548	
Volume (vph)	30	56	0	32	9	7	38	256	480	3	0	176
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	61	0	35	10	8	41	278	522	3	0	191
RTOR Reduction (vph)	0	0	0	5	0	0	0	0	1	0	112	0
Lane Group Flow (vph)	0	0	94	48	0	0	0	319	524	0	79	0
Confl. Peds. (#/hr)					20	20				20		20
Confl. Bikes (#/hr)					20	20				20		20
Turn Type	Perm	Perm					Perm	Perm				
Protected Phases			2	6					8		4	
Permitted Phases	2	2					8	8				
Actuated Green, G (s)			18.5	18.5				18.5	18.5		18.5	
Effective Green, g (s)			18.5	18.5				18.5	18.5		18.5	
Actuated g/C Ratio			0.41	0.41				0.41	0.41		0.41	
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)			553	703				726	651		636	
v/s Ratio Prot				0.03					c0.33		0.05	
v/s Ratio Perm			c0.07					0.18				
v/c Ratio			0.17	0.07				0.44	0.81		0.12	
Uniform Delay, d1			8.4	8.0				9.5	11.7		8.2	
Progression Factor			1.05	1.00				1.00	1.00		1.00	
Incremental Delay, d2			0.1	0.2				0.4	7.2		0.1	
Delay (s)			8.9	8.2				9.9	18.9		8.3	
Level of Service			A	A				A	B		A	
Approach Delay (s)			8.9	8.2				15.5			8.3	
Approach LOS			A	A				B			A	

Intersection Summary

HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Alternative 3 - AM Peak Hour
3: Glascock St & 29th Av

9/28/2005

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	0	0	0	0	28	0	775	2	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	30	0	842	2	0	0	0
Pedestrians					20							
Lane Width (ft)					12.0							
Walking Speed (ft/s)					4.0							
Percent Blockage					2							
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)											264	
pX, platoon unblocked												
vC, conflicting volume	874	865	0	863	863	863	0			865		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	874	865	0	863	863	863	0			865		
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 %	100	100	100	100	100	91	100			100		
cM capacity (veh/h)	243	287	1085	267	287	348	1623			765		

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	30	845	0
Volume Left	0	0	0
Volume Right	30	2	0
cSH	348	1700	1700
Volume to Capacity	0.09	0.50	0.00
Queue Length 95th (ft)	7	0	0
Control Delay (s)	16.3	0.0	0.0
Lane LOS	C		
Approach Delay (s)	16.3	0.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

Alternative 3 - PM Peak Hour
1: Kennedy St & 23rd Av

9/28/2005

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				1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes				1.00	0.93		1.00	1.00		1.00	1.00	
Flpb, ped/bikes				1.00	1.00		1.00	1.00		1.00	1.00	
Frt				1.00	0.86		1.00	1.00		1.00	1.00	
Flt Protected				0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)				1770	1486		1770	1863		1770	1852	
Flt Permitted				0.95	1.00		0.42	1.00		0.16	1.00	
Satd. Flow (perm)				1770	1486		783	1863		291	1852	
Volume (vph)	0	0	0	323	6	85	57	738	0	182	403	11
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	351	7	92	62	802	0	198	438	12
RTOR Reduction (vph)	0	0	0	0	62	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	0	0	351	37	0	62	802	0	198	448	0
Confl. Peds. (#/hr)						20			20			20
Confl. Bikes (#/hr)						20			20			20
Turn Type				Split			Perm			Perm		
Protected Phases				2	2			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)				19.8	19.8		32.2	32.2		32.2	32.2	
Effective Green, g (s)				19.8	19.8		32.2	32.2		32.2	32.2	
Actuated g/C Ratio				0.33	0.33		0.54	0.54		0.54	0.54	
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)				584	490		420	1000		156	994	
v/s Ratio Prot				c0.20	0.03			0.43			0.24	
v/s Ratio Perm							0.08			c0.68		
v/c Ratio				0.60	0.08		0.15	0.80		1.27	0.45	
Uniform Delay, d1				16.8	13.8		7.0	11.3		13.9	8.5	
Progression Factor				0.67	0.30		1.00	1.00		1.00	1.00	
Incremental Delay, d2				4.0	0.3		0.2	4.7		161.9	0.3	
Delay (s)				15.3	4.5		7.2	16.0		175.8	8.8	
Level of Service				B	A		A	B		F	A	
Approach Delay (s)		0.0			12.9			15.4			59.8	
Approach LOS		A			B			B			E	

Intersection Summary			
HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL2	EBL	EBT	EBR	WBT	WBR	WBR2	NBL	NBT	NBR	NBR2	SBL	SBT	SBR
Lane Configurations														
Ideal Flow (vphpl)	1900	1900	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			1.00		1.00				1.00	1.00			1.00	
Frpb, ped/bikes			1.00		0.97				1.00	1.00			0.95	
Flpb, ped/bikes			1.00		1.00				1.00	1.00			1.00	
Frt			1.00		0.97				1.00	0.85			0.87	
Flt Protected			0.95		1.00				0.97	1.00			1.00	
Satd. Flow (prot)			1771		1755				1808	1583			1537	
Flt Permitted			0.72		1.00				0.57	1.00			1.00	
Satd. Flow (perm)			1338		1755				1060	1583			1534	
Volume (vph)	44	129	5	4	30	6	3	149	98	286	11	2	3	235
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	140	5	4	33	7	3	162	107	311	12	2	3	255
RTOR Reduction (vph)	0	0	1	0	1	0	0	0	0	3	0	0	184	0
Lane Group Flow (vph)	0	0	196	0	42	0	0	0	269	320	0	0	76	0
Confl. Peds. (#/hr)				20		20	20				20			20
Confl. Bikes (#/hr)				20		20	20				20			20
Turn Type	Perm	Perm						Perm	Perm			Perm		
Protected Phases			2		6					8			4	
Permitted Phases	2	2						8	8			4		
Actuated Green, G (s)			35.4		35.4				16.6	16.6			16.6	
Effective Green, g (s)			35.4		35.4				16.6	16.6			16.6	
Actuated g/C Ratio			0.59		0.59				0.28	0.28			0.28	
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)			789		1035				293	438			424	
v/s Ratio Prot					0.02					0.20				
v/s Ratio Perm			c0.15						c0.25				0.05	
v/c Ratio			0.25		0.04				0.92	0.73			0.18	
Uniform Delay, d1			5.9		5.2				21.0	19.7			16.5	
Progression Factor			1.09		1.00				1.00	1.00			1.00	
Incremental Delay, d2			0.2		0.1				31.7	6.2			0.2	
Delay (s)			6.7		5.2				52.7	25.9			16.7	
Level of Service			A		A				D	C			B	
Approach Delay (s)			6.7		5.2				38.1				16.7	
Approach LOS			A		A				D				B	

Intersection Summary

HCM Average Control Delay	26.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Alternative 3 - PM Peak Hour
2: Ford St & 29th Av 9/28/2005

Intersection Summary

M. Bowman
Dowling Associates, Inc.
HCM Signalized Intersection Capacity Analysis

Movement	WBL	WBR	WBR2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Sign Control	Stop			Stop			Free			Free	
Grade	0%			0%			0%			0%	
Volume (veh/h)	0	0	37	0	0	0	514	30	4	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	40	0	0	0	559	33	4	0	0
Pedestrians	20										
Lane Width (ft)	12.0										
Walking Speed (ft/s)	4.0										
Percent Blockage	2										
Right turn flare (veh)											
Median type	None			None							
Median storage veh)											
Upstream signal (ft)										264	
pX, platoon unblocked											
vC, conflicting volume	604	604	595	620	0	0			611		
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol	604	604	595	620	0	0			611		
tC, single (s)	7.1	6.5	6.2	6.5	6.2	4.1			4.1		
tC, 2 stage (s)											
tF (s)	3.5	4.0	3.3	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	92	100	100	100			100		
cM capacity (veh/h)	397	404	496	395	1085	1623			952		

Direction, Lane #	WB 1	NE 1	SW 1
Volume Total	40	591	4
Volume Left	0	0	4
Volume Right	40	33	0
cSH	496	1700	952
Volume to Capacity	0.08	0.35	0.00
Queue Length 95th (ft)	7	0	0
Control Delay (s)	12.9	0.0	8.8
Lane LOS	B		A
Approach Delay (s)	12.9	0.0	8.8
Approach LOS	B		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		