APPENDIX C:

Transportation Analysis

FEHR PEERS

MEMORANDUM

Date: May 30, 2014

To: City of Emeryville

From: Kathrin Tellez, Fehr & Peers

Subject: 6701 Shellmound (City of Emeryville) Transportation Analysis

WC13-3096

This memorandum presents the results of our transportation assessment for the 6701 Shellmound Street development (project), including project description, analysis parameters, existing conditions, project conditions, and site plan review. A peer review of a parking study prepared for the project was also conducted and an assessment of near-term conditions including redevelopment at Marketplace and a hotel north of Bay Street is provided.

PROJECT DESCRIPTION

The project site is located at 6701 Shellmound Street, between Shellmound Street and Interstate 80 (I-80), south of Ashby Avenue and north of Ex'pressions College, in Emeryville. The approximately 2.27 acre site, as shown on **Figure 1** (all figures are attached at the end of this memorandum), is currently occupied by approximately 100,000 square feet of warehouse and a 10,000 square foot office. The site is zoned for Mixed-Use with Residential; the current proposal includes 211 multi-family rental units plus amenities, including a fitness center, storage, and common areas (project). A parking garage would also be constructed to support the site, providing 201 parking stalls plus 63 spaces contained within a parking lift system. Approximately 211 long-term bicycle parking spaces and 14 short-term bicycle parking would be provided. As part of the project, the existing buildings would be removed. A conceptual project site plan is shown on **Figure 2**.

Vehicular access to the site would be provided from a driveway on Shellmound Street between 67th and 66th Streets, connecting to the parking garage and loading zone. Emergency vehicle access would also be provided north of 67th Street, accessing a fire/access lane that encircles the

site and also connects to the main driveway. It is expected that the main driveway would allow for all turning movements to and from Shellmound Street.

ANALYSIS PARAMETERS

Study Area and Analysis Scenarios

The transportation assessment includes weekday evening (4 to 6 PM) and Saturday afternoon (3 to 5 PM) peak period analyses to coincide with the time periods when adjacent street traffic demands are greatest and the project generates the most traffic. The study addresses existing and near-term traffic conditions at the following intersections:

1. Potter Street/Bay Street
2. I-80 Off-Ramp/Shellmound Street
3. 67th Street/Shellmound Street
4. 67th Street/Hollis Street
5. 66th Street/Shellmound Street
6. 66th Street/Hollis Street
7. 65th Street/Shellmound Street
8. 65th Street/Hollis Street
9. Project Driveway/Shellmound Street

Intersection operations are evaluated for the following scenarios:

- Existing
- Existing Plus Project
- Existing Plus Project and Pending Developments, including planned development at the Public Market and a Hotel at Bay Street (near-term conditions)

Significance Criteria

The determination of significance for project impacts is based on applicable policies, regulations, goals, and guidelines defined by the City of Emeryville. The impacts of the project were evaluated by comparing the results of the level of service calculations under Existing With Project conditions to the results under Existing conditions. The detailed impact criteria for this study are presented below.

For this study, based on guidance contained in the City of Emeryville General Plan and recently prepared environmental documents for other projects in the City, a significant transportation-related impact would occur if:

- The project would conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit. A significant impact ***could*** be identified:
    - If a signalized intersection is projected to operate within delay ranges associated with less-than-capacity conditions (i.e., LOS D or better with an average control delay of equal to or less than 55 seconds per vehicle) without the project and the project is expected to cause the facility to operate at a LOS E or F);
    - If an intersection is projected to operate at or over capacity (i.e., LOS E or F) without the project, and the project is expected to increase the average control delay by more than 5 seconds; or
    - If the operations of an unsignalized study intersection is projected to decline with the addition of project traffic, and if the installation of a traffic signal based on the Manual on Uniform Traffic Control Devices (MUTCD) Peak Hour Signal Warrant (Warrant 3) would be warranted.

  For intersections that meet the above criteria, capacity enhancing measures that do not degrade other modes of travel should be considered, including upgrading or installing signal equipment, extending left-turn pocket storage, providing non-motorized facilities to reduce vehicular demand, enhancing capacity on a parallel route and/or enhancing transit access to a site.

- The project would conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads and highways:
    - Exceed, either individually or cumulatively, a LOS standard established by the Alameda County Transportation Commission (ACTC) for designated roads or highways;
    - For a roadway segment of the ACTC Congestion Management Program (CMP) Network, the project would cause (a) the LOS to degrade from LOS E or better to LOS

F or (b) the V/C ratio to increase 0.03 or more for a roadway segment that would operate at LOS F without the project; or

  - Cause congestion of regional significance on a roadway segment on the Metropolitan Transportation System (MTS) evaluated per the requirements of the Land Use Analysis Program of the CMP[1].

- The project substantially increases traffic hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses;
- The project results in inadequate emergency access;
- The project conflicts with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities;
- A pedestrian or bicycle impact is considered significant if it would:
  - Disrupt existing pedestrian facilities;
  - Interfere with planned pedestrian facilities; or
  - Create inconsistencies with adopted pedestrian system plans, guidelines, policies, or standards.
- A bicycle impact is considered significant if it would:
  - Disrupt existing bicycle facilities;
  - Interfere with planned bicycle facilities;
  - Create inconsistencies with adopted bicycle system plans, guidelines, policies, or standards; or
  - Not provide secure and safe bicycle parking in adequate proportion to anticipated demand.
- A transit impact is considered significant if it would result in development that is inaccessible to transit riders.

[1] The Alameda County Transportation Commission (ACTC) requires the assessment of development-driven impacts to regional roadways. Because the project would not generate more than 100 "net new" PM peak-hour trips, no further assessment is required of the MTS or CMP network.

EXISTING CONDITIONS

This section describes transportation facilities in the study area, including the surrounding roadway network, and transit, pedestrian, and bicycle facilities in the site vicinity.

Roadway System

Interstate 80 (I-80) connects the San Francisco Bay Area with the Sacramento region and continues east across the United States. In Emeryville, I-80 has a north/south orientation and provides four mixed-flow lanes and a high occupancy vehicle (HOV) lane in each direction at the Ashby Avenue/Shellmound Street interchange (Emeryville/Berkeley border). Access from I-80 to Emeryville is provided via full interchanges at Powell Street and Ashby Avenue. Access to/from northbound I-80 is provided from Shellmound Street with an off-ramp forming the northern boundary of the site, and access to the on-ramp from Potter Street. This segment of I-80 through Emeryville is also known as I-580.

Shellmound Street is a two- to four-lane north/south road with on-street parking at select locations. Shellmound Street becomes 40th Street to the south of the railroad overcrossing, continuing east beyond the MacArthur BART station. North of Ashby Avenue, Shellmound Street becomes Bay Street, where access to northbound I-80 is provided. Along the project frontage, Shellmound Street provides a single travel lane in each direction and on-street bicycle lanes. On-street parking is permitted along a portion of the west side of Shellmound Street in proximity to the project. Sidewalks are provided on the west side of Shellmound Street to Ashby Avenue; sidewalks on the east side of the street terminate at 67th Street. Shellmound Street is a designated connector street and Class II bikeway in the City's General Plan.

Hollis Street is a two-lane, north/south road approximately 1/8-mile from the project site, parallel to Shellmound Street, with on-street parking that begins in Oakland at Peralta Street and ends in Berkeley at Folger Avenue. North of Folger Avenue, Hollis Street becomes 7th Street extending northward through Berkeley. Hollis Street is a designated Transit Street in the City's General Plan.

65th Street is a two-lane, east/west road that extends east from Lacoste Street, and connects with San Pablo Avenue. Land uses along 65th Street include residential, commercial, and office, and on-street parking is generally available. An at-grade railroad crossing is located just east of Shellmound Street. (Rail activity in the area is described in further detail in a subsequent section.) Based on the General Plan designation, 65th Street between Christie Avenue and Hollis Street is a

Transit Street; east of Hollis Street it is a Connector Street. Bicycle lanes are also provided on 65th Street in the study area.

66th Street is a two-lane, east/west road that extends east from Shellmound Street and connects with San Pablo Avenue where it forms an off-set intersection. Land uses along 66th Street include residential, commercial, and office, and on-street parking is generally available. An at-grade railroad crossing is located just east of Shellmound Street. 66th Street between Shellmound Street and the City limits, just east of Vallejo Street, is a designated bicycle boulevard in the City's General Plan. Sidewalks are not provided along this roadway between Shellmound Street and Hollis Street.

67th Street is a two-lane, east/west local roadway that extends east from Shellmound Street and connects with San Pablo Avenue where it forms an off-set intersection. Land uses along 67th Street are primarily industrial/commercial, and on-street parking is generally available. An at-grade railroad crossing is located just east of Shellmound Street. Sidewalks are not provided along this roadway between Shellmound Street and Hollis Street.

Existing Pedestrian and Bicycle Facilities

Pedestrian facilities include sidewalks, crosswalks, and pedestrian signals. Pedestrian facilities are provided on some roadways adjacent to the site. In the study area, pedestrian crosswalks, push buttons and signals are provided at the signalized intersections on 65th Street. Along the Shellmound Street project frontage, a sidewalk is provided along the western side of the street, but terminates where Shellmound Street becomes Bay Street north of the I-80 off-ramp.

Pedestrian facilities are not provided across the railroad crossings at 67th and 66th Streets. At the 65th Street railroad crossing, pedestrians are directed to cross on the south side of the tracks where there are tactile domes that alert visually impaired pedestrians that they are approaching a crossing.

Sidewalks are not provided on 66th and 67th Street between Shellmound Street and Hollis Street due to the provision of perpendicular parking along building frontages. If these parcels are redeveloped, sidewalks would be constructed along these roadways.

Bicycle facilities in Emeryville include the following:

- *Bike paths (Class I)* – Paved trails that are separated from roadways. These facilities are typically shared with pedestrians, although bicycles must yield to pedestrians.
- *Bike lanes (Class II)* – Lanes on roadways designated for use by bicycles through striping, pavement legends, and signs. There may or may not be parking allowed on the roadway.
- *Bike routes (Class III)* – Designated roadways for bicycle use by signs only; may or may not include additional pavement width for cyclists.
- *Bicycle Boulevard* – A street classification on which bicycles have priority, and which may or may not have bike lanes.

Shellmound Street and 65th Street are Class II bicycle facilities with marked lanes and signage. Overland Street, located on the east side of the railroad tracks, is a marked bicycle boulevard that connects 65th Street to 62nd Street. 66th Street is a designated bicycle boulevard, but there are no current plans to install pavement markings or signage along the corridor. The Emeryville Greenway, east of Hollis Street, is a Class I facility with mid-block crossings at 67th, 66th and 65th Streets.

Existing Transit Service

The project site is located approximately 1,000 feet from an Emery Go-Round stop on 65th Street, west of Shellmound Street and approximately 1,000 feet from an Emery Go-Round stop on Hollis Street at 65th Street. Several AC Transit Routes serve the area, with stops at the intersections of Ashby Avenue at 7th Street, Christie Avenue at 65th Street, and Shellmound Street at Powell Street; the closest AC Transit stop is an approximately 5-minute walk from the project site. AC Transit and Emery Go-Round connect the study area to neighboring cities in the East Bay as well as the MacArthur BART Station and Downtown Oakland.

Buses on the Emery Go-Round Hollis Route, which stop at the intersection of Hollis Street/65th Street, operate on 10 minute headways during the peak hours and 15 to 20 minute headways during off-peak hours. Travel time from the Hollis Street/65th Street stop to/from the MacArthur BART station is approximately 12 minutes. Buses on the Emery Go-Round Shellmound/Powell Route, which stop on 65th Street just west of Shellmound Street, operate on 15 minute headways throughout the day. Travel time from the 65th Street/Shellmound Street stop to the MacArthur BART station is approximately 16 minutes, and travel time from the MacArthur BART station to the 65th Street/Shellmound Street stop is approximately 11 minutes.

AC Transit Transbay Routes J and Z, as well as local route 26, are within walking distance of the project site. Route 26 operates on 20 minute headways, and connects the study area to the West Oakland BART station as well as Downtown Oakland. Route J provides seven morning trips to downtown San Francisco between 5:45 AM and 8:50 AM, and seven evening trips from downtown San Francisco between 4:45 PM and 7:30 PM, on approximately 30 minute headways. Route Z provides two inbound trips to San Francisco departing Emeryville at approximately 7:30 and 8:30 AM and two return trips in the evening departing San Francisco at 4:45 and 5:45 PM.

The Bay Area Rapid Transit (BART) system provides regional rail transit service connecting San Francisco, Alameda County, Contra Costa County, and parts of San Mateo County. From the MacArthur BART station, direct connections to destinations on the Richmond/Millbrae, Richmond/Fremont line, and Pittsburgh/Bay Point/Millbrae line are provided. During peak periods, trains operate on less than 10 minute headways to/from San Francisco. Trains run to/from San Francisco with 15 to 20 minute headways during off-peak periods.

Amtrak provides passenger rail service approximately 1/2 mile to the southeast of the project site, running through the City of Emeryville. Service from the Emeryville Amtrak station provides inter-regional travel to Sacramento, the Central Valley, Southern California, and Northern California.

Several carshaing companies have locations in Emeryville, including City CarShare and Zipcar. City CarShare has one car sharing pod on 66th Street, west of Hollis Street. Zipcar has seven car sharing pods in Emeryville, with the closest pods located at the Public Market on Shellmound Street (approximately 1/2-mile from the site) and at the Courtyards on 65th Street (approximately 1/4-mile from the site). Zipcar and City CarShare are membership-based car sharing companies whose members can reserve a vehicle for a specified amount of time, i.e. hourly or daily. Gas, parking, insurance and maintenance are included in the reservation fee. The availability of car sharing has been shown to lower vehicle ownership rates per household, particularly in urban areas with access to transit and other modes of travel, as it provides a vehicle when needed without the costs of vehicle ownership.

Existing Roadway Operations

Weekday evening (4:00 to 6:00 PM) and Saturday afternoon (3:00 to 5:00 PM) peak period intersection vehicle turning movement counts were conducted in December 2013 at the intersections identified for inclusion in the study. Separate counts of pedestrian and bicycle activity were also collected. For the study intersections, the single hour with the highest traffic

volumes during the count periods was identified. For this study, the weekday evening and Saturday peak hours are the periods with the most traffic flow on area roadways. These time periods also coincide with the periods when the project is expected to generate the most vehicle traffic (See Table 4). The peak hour volumes for weekday evening and Saturday afternoon are presented on **Figure 3** along with the existing lane configuration and traffic control. Existing pedestrian and bicycle volumes at the study intersections are shown on **Figure 4.** Truck counts were also collected, which shows large trucks constitute about 1 percent of total traffic through the area, except at the 67th and 66th Street intersections with Hollis Street, where large trucks comprise about 2 percent of total traffic volumes. The traffic count data are provided in the Appendix.

The operations of roadway facilities for vehicles are typically described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, representing free flow conditions with minimal delay, to LOS F, representing over-capacity conditions. LOS E represents "at-capacity" operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. The City of Emeryville does not have a level of service policy for vehicles, but strives to achieve a Quality of Service. Quality of Service recognizes that people travel by a variety of modes, not just in vehicles, and the use of an auto-focused level of service standard does not address the mobility needs for non-auto roadway users. **Appendix A** describes the LOS analysis method for vehicles.

Results of the existing conditions analysis are presented in **Table 1**, which shows the intersections that provide access to the project site generally operate at an overall LOS D or better during both peak hours for vehicles, including transit vehicles, when considered as isolated intersections. Bicyclists also experience similar levels of delay as vehicles, but since bicyclists can typically maneuver to the front of the intersection on a red light, they can bypass queued vehicles.

A signal warrant analysis was also conducted for the unsignalized study intersections[2] to assess the need to install additional traffic control at the unsignalized study locations in either the

[2] Unsignalized intersection warrant analysis is intended to examine the general correlation between existing conditions and the need to install new traffic signals. Existing peak-hour volumes are compared against a subset of the standard traffic signal warrants recommended in the MUTCD and associated State guidelines. This analysis should not serve as the only basis for deciding whether and when to install a signal. To reach such a decision, the full set of warrants should be investigated based on field-measured traffic data and a thorough study of traffic and roadway conditions by an experienced engineer. Furthermore, the decision to install a signal should not be based solely on the warrants because the

existing or forecast scenarios. Results of the traffic signal warrant assessment are presented in **Table 2,** which indicates the 66th Street/Hollis Street intersection currently satisfies the peak hour volume warrant during the weekday PM peak hour. Pedestrian warrants were also reviewed at the unsignalized crossings: no unsignalized crossing location evaluated as part of this study satisfies the peak period pedestrian volume warrants.

There are unique conditions in the study area that contribute to worse intersection operations, for periods of time, than presented in Table 1, including at-grade rail crossing activity, and vehicle queue spillback from regional facilities, including I-80 and the Ashby Road corridor. These conditions are discussed in more detail below.

The site is located in close proximity to three at-grade rail crossings at 67th, 66th and 65th Streets, with three tracks serving northbound and southbound Amtrak passenger trains and freight trains. During the first week of December 2013, the amount of rail activity was observed to document the range of rail activity, including the number of trains per day, the average length of trains, trains per peak hour, average duration of gate closures, total duration of gate closures during peak hours, and other data. Results of the data collection effort are summarized in **Table 3**, which indicates about 50 to 65 daily railroad crossings on a typical weekday with access to 67th, 66th and 65th Streets blocked for about 10 minutes during the PM peak hour.

When the rail crossing gate arms are activated, traffic backups occur through the Shellmound Street corridor as well as on 67th, 66th and 65th Streets, increasing delays for vehicles, including transit vehicles. For brief periods at the beginning of rail crossing activity, northbound and southbound traffic on Shellmound Street is able to continue. A few minutes into the rail crossing activity, vehicle queues for turning movements to 65th, 66th or 67th Streets block the ability of through traffic to proceed along the route. When there are back-to-back trains during periods with high travel demand, vehicle queues that form from one gate closure period may not have an opportunity to clear before the next gate crossing is activated.

At the Shellmound Street/65th Street intersection, vehicle queues are further exacerbated by the close proximity of the Overland Street/65th Street intersection.

---

installation of signals can lead to certain types of collisions. The responsible State or local agency should undertake regular monitoring of actual traffic conditions and accident data and conduct a timely re-evaluation of the full set of warrants in order to prioritize and program intersections for signalization.

Along the Hollis Street corridor, vehicle queues from the Ashby Avenue/7th Street intersection periodically queue through the corridor extending south beyond 65th Street, affecting operations at the 67th and 66th Street unsignalized intersections. Vehicles attempting to turn onto Hollis street from these side streets may experience long delays while waiting for a gap in traffic. The queue periodically subsides, allowing for vehicles from the side street to either turn onto Hollis Street or continue along the travel way.

Along the Shellmound Street corridor, vehicle queues extend from the Potter Street/Bay Street intersection due to congestion on I-80 and the northbound I-80 on-ramp. Vehicles entering the freeway from Potter Street form queues along Shellmound Street past 65th Street, delaying vehicles turning onto Shellmound Street from 67th, 66th and 65th Streets as well as driveways to the Ex'pressions campus and the project driveway.

Pedestrian volumes are low near the project site, with the majority of pedestrian activity occurring to the south of the study area near the Emeryville Public Market site. Pedestrians can access the area through sidewalks on the east and west sides of Shellmound Street. There are currently no sidewalks along 66th or 67th street due to on-street parking. Additionally, pedestrian crossing at the railroad crossings and sidewalks are not provided at 66th and 67th Streets, although count data indicates that pedestrians are crossing at these locations. There is a sidewalk along 65th Street and pedestrian crossing is allowed at the railroad on the south side only. The pedestrian crossing is paved but has no barrier or gate during train crossings.

PROJECT CONDITIONS

Project Trip Generation

Trip generation refers to the process of estimating the amount of vehicular traffic a project might add to the local roadway network. In addition to estimates of daily traffic, estimates are also created for the peak one-hour periods during the morning (AM) and evening (PM) commute hours, when traffic volumes on adjacent streets are typically at their highest. For this project, estimates for peak Saturday conditions were also prepared since traffic volumes in the area are higher on Saturdays than weekdays due to the retail centers on Shellmound Street, including IKEA, Bay Street and the Public Market. Although there are active uses on the site that would be removed with the project, the observed trip generation of these uses during the analysis periods is minimal (three weekday PM peak hour trips and zero Saturday peak hour trips).

The traditional methods commonly used by traffic engineers to calculate the trip generating potential of developments in urban areas with a variety of travel options can overestimate their traffic impacts because the methods do not accurately reflect the amount of trips made by transit, biking, and/or walking. This results in increased development costs due to oversized infrastructure, and skewed public perception of the likely impacts of development.

The most common method used by traffic engineers is outlined in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (9th Edition). This method contains data primarily collected at suburban, single-use, freestanding sites. This limits the applicability of the data to urban areas, such as the project, which is located in a dense, walkable, urban setting with a mix of land uses, and with nearby local and regional transit service. This method does not adequately account for key variables that influence travel such as development density and scale, location efficiency, land use mix in close proximity to the site, urban design and transit orientation.

Two significant new research studies provide the opportunity to improve the state of practice. One study sponsored by the US EPA[3] and another by the Transportation Research Board[4] have developed means to improve trip generation estimation for mixed-use developments (MXDs) and those located in urban areas. The two studies examined over 260 MXD sites throughout the U.S. and, using different approaches, developed new quantification methods. Fehr & Peers has reviewed the two methods, including the basis, capabilities, and appropriate uses of each, to produce a new method (MXD+) that combines the strengths of the two individual methods. MXD+ recognizes that traffic generation by mixed-use and other forms of sustainable development relate closely to the density, diversity, design, destination accessibility, transit proximity, and scale of development. MXD+ improves the accuracy of vehicle trip estimation and gives planners a tool to balance land use mix and to incorporate urban design, context compatibility, and transit orientation to create lower impact development.

The MXD+ methodology starts with ITE trip generation estimates but then adjusts those estimates to account for the mixed-use and environment characteristics. Use of the MXD+ methodology requires more input data than a traditional trip generation application. Data detailing the geographic layout of the site, land use in the surrounding area, and socioeconomic

---

[3] *Traffic Generated by Mixed-Use Developments—A Six-Region Study Using Consistent Built Environmental Measures* (Ewing et al, ASCE UP0146, Sept 2011).

[4] National Cooperative Highway Research Program (NCHRP) Report 684 *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments* (Bochner et al, March 2011).

data of both the site and the surrounding area were collected to inform the MXD+ methodology. Sources used to collect this data include the Metropolitan Transportation Commission (MTC) travel demand model, Census and American Community Survey (ACS), the Bay Area Travel Survey (BATS), and the project site plan.

The MXD+ model has been approved for use by the EPA[5]. It has also been peer-reviewed in the ASCE Journal of Urban Planning and Development[6], peer-reviewed in a 2012 TRB paper evaluating various smart growth trip generation methodologies[7], recommended by SANDAG for use on mixed-use smart growth developments[8], and has been used successfully in multiple certified EIRs (Environmental Impact Reports) in California.

For 27 mixed-use sites that were surveyed in California and across the country, the ITE method overestimated daily traffic generation by 24 percent and peak hour traffic by 35 percent to 37 percent. The MXD+ method explains 97 percent of the variation in trip generation among MXDs, compared to 65 percent for the methods previously recommended by ITE. While remaining slightly (2 percent to 4 percent) conservative to avoid systematically understating impacts, MXD+ substantially reduces the 35 percent - 37 percent average overestimate of traffic generation produced by conventional ITE methods. The MXD+ method has been locally validated to dozens of transit oriented development (TOD) sites in the Bay Area and across the country. Outputs of this tool include external vehicle trip generation, internal trips, and external walking/bicycling/transit trips. This tool has been used to refine trip generation estimates for recently approved projects in Emeryville, including the MAZ project.

Table 4 shows the estimated trip generation for the project. In terms of ITE trip generation, which represents the total trip generation of the project for all travel modes, the project is expected to generate approximately 1,400 weekday daily trips, including about 110 morning peak hour and 130 evening peak hour trips. On a typical Saturday, the project would generate approximately 1,350 trips, including 110 during the peak hour. However, there are a number of factors that

---

[5] Trip Generation Tool for Mixed-Use Developments (2012). www.epa.gov/dced/mxd_tripgeneration.html
[6] "Traffic Generated by Mixed-Use Developments—Six-Region Study Using Consistent Built Environmental Measures." Journal of Urban Planning and Development, 137(3), 248–261.
[7] Shafizadeh, Kevan, Richard Lee et al. "Evaluation of the Operation and Accuracy of Available Smart Growth Trip Generation Methodologies for Use in California". Presented at 91st Annual Meeting of the Transportation Research Board, Washington, D.C., 2012.
[8] SANDAG Smart Growth Trip Generation and Parking Study.
http://www.sandag.org/index.asp?projectid=378&fuseaction=projects.detail

would reduce the overall number of trips made by a vehicle to/from this site, as a number of trips are expected to be walk/bike trips or transit trips.

Based on the MXD+ model, approximately 15 percent of trips would arrive at/depart the site by walking or biking as the primary model of travel. During peak periods, approximately 20 percent of trips would be primarily transit trips, with 5 percent of daily trips made by transit. Application of the vehicle trip reduction factors results in approximately 25 percent fewer vehicle trips on a daily basis, 35 percent fewer trips during the morning and evening peak hours. On a Saturday, the overall reduction is expected to be approximately 20 percent on a daily basis and 25 percent during the peak hour as compared to standard ITE rates.

When considering the MXD+ reductions described above, the project is expected to add up to 1,050 daily vehicle trips, including approximately 70 morning peak hour and 90 evening peak hour trips to the regional roadway network. On a Saturday, the project could generate up to 1,080 vehicle trips, including 70 peak hour trips.

Project Trip Distribution and Assignment

Project trip distribution refers to the directions of approach and departure that vehicles would take to access and leave the site. Estimates of regional project trip distribution were developed based on existing travel patterns in the area, as presented on **Figure 5**. The net new vehicle traffic expected to be generated by the project was then assigned to streets in the local roadway system for the PM and Saturday peak hours considering the access limitations at intersections in the vicinity of the site. The resulting trip assignment through each study intersection is shown on **Figure 6**[9].

Project intersection volumes were added to existing traffic counts, to show Existing Plus Project traffic conditions. The resulting traffic volumes are shown on **Figure 7**.

Traffic Forecasts

Approved developments have the potential to increase activity within the study area. These developments include:

[9] The volumes on Figures 6, 7 and 8 reflect development of 220 units at the site, as this was the proposed project at the time of analysis.

- Marketplace Redevelopment
- Hyatt Place Hotel at Christie Avenue/Bay Street

A full-service hotel with approximately 170 rooms is proposed at Site A, located at the north end of Bay Street, east of Shellmound Street at Christie Avenue. The Marketplace Redevelopment project proposes to construct approximately 71,300 square feet of additional restaurant/retail space and 735 residential units. 190 residential units are currently under construction at the 64th/Christie site.

Vehicle traffic expected to be generated by each of these projects was assigned to the roadway network to develop Near-term Without Project forecasts. The potential trip generation was estimated using a similar method as for project trips. Vehicle trips expected to be generated by the project were then added to estimate Near-term With Project forecasts, which are presented on **Figure 8**.

Future Intersection Operations

Future intersection operations were evaluated using the same methods as for Existing conditions for the weekday PM and Saturday afternoon peak hours based on the volumes presented on Figures 7 and 8, as presented in Table 1.

With the addition of vehicle traffic from the project, delay at intersections is expected to increase for vehicles and transit vehicles. Additional traffic through the area would also exacerbate existing vehicle queue spillback through the study area that originates outside Emeryville, such as from congested conditions on I-80 or the Ashby Avenue corridor.

The provision of an exclusive left-turn pocket from Shellmound Street to the project driveway was reviewed. Traffic volumes entering the driveway and the opposing through volumes do not warrant the provision of an exclusive left-turn lane into the site. When vehicle queues occur on Shellmound Street, either from a train event or congestion on I-80 spilling back along the Shellmound Street corridor, a left-turn pocket into the site would not appreciably change the delay either for someone waiting to turn into the site, or traveling on Shellmound. There are also constructability issues, as the provision of a left-turn pocket into the site driveway would eliminate a portion of the lane for vehicles to queue out of the through lane (from northbound Shellmound Street turning right to 67th Street) when the rail crossing gates are activated, and reduce the width the northbound bike lane. Widening on the west side of the roadway is not feasible due to

the location of the adjacent building. Removing on-street parking is an option, but that would result in the loss of about 6-8 on-street parking spaces and would also result realignment of the bike lane in the southbound direction. Based on the above considerations, an exclusive left-turn lane into the site is not warranted nor recommended.

Peak hour signal warrants would not be triggered at additional intersections with the addition of project traffic, although they would continue to be met at the Hollis Street/66th Street intersection. Signalization of this intersection was considered, but was rejected for a number of reasons, including proximity to the signalized 65th Street/Hollis Street intersection, vehicle queue spillback from Ashby Avenue that would affect the future operation of this intersection regardless of traffic control, and potential to increase vehicle traffic at the unsignalized mid-block Emeryville Greenway Crossings on 67th, 66th and 65th Streets. The project, as well as other developments in the area, is projected to increase traffic volumes at these crossings, potentially increasing pedestrian and bicycle conflicts with vehicles and contributing to the need to provide a multi-modal street network within the City of Emeryville to maintain mobility. Signalizing the Hollis Street/66th Street intersection could encourage additional vehicle traffic along these corridors further increasing pedestrian and bicycle conflicts with vehicles.

The City of Emeryville is updating their Transportation Impact Fee (TIF) in combination with establishing new fees. Improvements to transportation facilities included in the fee are designed to improve the efficiency of the street network, reduce vehicle trips, and enhance the transportation system for walking, bicycling, and using transit. Shifting existing and new trips that would otherwise be made by a private auto to pedestrian, bicycle and transit trips improves the efficiency of the transportation system for all users and achieve General Plan goals such as avoiding pavement additions to the street network and minimizing adverse environmental impacts associated with vehicle use.

When there is rail activity in the area, roadway network operations are significantly worse than shown in Table 1, which would be worsened with new vehicle traffic from the project as well as other pending developments in the area.

> ***Recommendation 1:*** The City of Emeryville has plans to create a railroad quiet zone for the at-grade railroad crossings of the Union Pacific Railroad located just east of Shellmound Street at 65th, 66th, and 67th Streets. A quiet zone will cease the routine sounding of train horns by improving the safety of the at-grade crossing for both vehicles and pedestrians. This project is included in the preliminary update of the Transportation

Impact Fee, to which the project applicant would contribute their fair share of the cost through their payment of the fee.

General Plan Comparison

The City of Emeryville General Plan land use designation and the zoning for the site are Mixed-Use with Residential. The General Plan EIR transportation analysis considered development of a 200-room hotel and 40,000 square feet of retail on the site, in conjunction with the removal of existing site uses. The net-new trip generation from site development assumed in the General Plan EIR analysis is also shown in **Table 4**. The currently proposed project would generate more traffic than assumed in the General Plan EIR analysis during the weekday morning peak hour, similar levels during the weekday evening peak hour, and significantly less traffic during the Saturday peak hour. As the trip generating potential of the proposed project is similar to or less than what was included in the General Plan EIR analysis for the critical analysis time periods (weekday PM and Saturday peak hour), the project is not expected to result in new or substantially more severe transportation impacts than described in the General Plan EIR.

Prior studies in the area have included evaluation of weekday morning peak hour operations of intersections along the Shellmound Street and Hollis Street corridor, as documented in the Marketplace Redevelopment EIR, June 2007. Results of that assessment indicate that traffic volumes and associated levels of delay for travel along the corridors are less during the morning peak hour than at other times of day. Recent traffic counts collected in January 2013 by the City for the purposes of retiming traffic signals on a City-wide basis were reviewed for the Shellmound Street/Shellmound Way, Shellmound Way/Christie Avenue and Hollis Street/65th Street intersections. This review indicates that traffic volumes are 40 to 50 percent higher during the weekday PM peak hour than the weekday AM peak hour. Based on these considerations, evaluation of morning peak hour operations would not provide additional information to aid in the decision making process.

TABLE 1
INTERSECTION LEVEL OF SERVICE RESULTS

Intersection[1]	Peak Hour	Existing		Existing Plus Project[4]		Near-Term With Project[4]	
		Delay[2+5]	LOS[3]	Delay[2+5]	LOS[3]	Delay[2+5]	LOS[3]
1. Potter Street/Bay Street (SSSC)	PM SAT	12 (12) 13 (16)	B (B) B (C)	12 (12) 13 (16)	B (B) B (C)	13 (13) 16 (16)	B (B) C (C)
2. I-80 Off-Ramp/ Shellmound Street (SSSC)	PM SAT	1 (9) 3 (11)	A (A) A (B)	1 (9) 3 (11)	A (A) A (B)	1 (9) 3 (11)	A (A) A (B)
3. 67th Street/Shellmound Street (SSSC)	PM SAT	2 (13) 2 (13)	A (B) A (B)	3 (13) 2 (14)	A (B) A (B)	3 (16) 2 (16)	A (C) A (C)
4. 67th Street/Hollis Street (SSSC)	PM SAT	6 (95) 2 (19)	A (F) A (C)	8 (<120) 3 (20)	A (F) A (C)	23 (<120) 4 (26)	C (F) A (D)
5. 66th Street/Shellmound Street (SSSC)	PM SAT	3 (14) 2 (13)	A (B) A (B)	3 (14) 2 (14)	A (B) A (B)	3 (17) 3 (18)	A (C) A (C)
6. 66th Street/Hollis Street (SSSC)	PM SAT	36 (<120) 3 (18)	E (F) A (C)	41 (<120) 3 (18)	E (F) A (C)	63 (<120) 3 (19)	F (F) A (C)
7. 65th Street/Shellmound Street (Signal)	PM SAT	10 14	A B	11 14	B B	11 14	B B
8. 65th Street/Hollis Street (Signal)	PM SAT	36 12	D B	38 12	D B	51 13	D B
9. Project Driveway/ Shellmound Street (SSSC)	PM SAT	1 (10) 0 (0)	A (B) A (A)	1 (11) 1 (12)	A (B) A (B)	1 (11) 1 (12)	A (B) A (B)

Notes:
1. Signal = Signalized Intersection; SSSC = Side-street stop-controlled intersections, traffic from the major roadway does not stop
2. Delay presented in seconds per vehicle; for side-street stop-controlled intersections, delay presented as intersection average (worst approach)
3. LOS = Level of Service.
4. Results reflect 220 apartment units, which was the level of development proposed at the time the analysis was conducted. Overall conclusions would not change with the currently proposed 211 unit project.
5. Actual delay may be worse than shown above during a rail crossing event or when congested conditions occur on I-80 or the Ashby Avenue corridor and vehicle queues spillback through the area.

Source: Fehr & Peers, May 2014.

TABLE 2
PEAK HOUR VOLUME SIGNAL WARRANT ASSESSMENT SUMMARY

Intersection[1]	Peak Hour	Existing	Existing Plus Project	Near-Term With Project
1. Potter Street/Bay Street (SSSC)	PM SAT	No No	No No	No No
2. I-80 Off-Ramp/ Shellmound Street (SSSC)	PM SAT	No No	No No	No No
3. 67th Street/Shellmound Street (SSSC)	PM SAT	No No	No No	No No
4. 67th Street/Hollis Street (SSSC)	PM SAT	No No	No No	No No
5. 66th Street/Shellmound Street (SSSC)	PM SAT	No No	No No	No No
6. 66th Street/Hollis Street (SSSC)	PM SAT	Yes No	Yes No	Yes No
9. Project Driveway/ Shellmound Street (SSSC)	PM SAT	No No	No No	No No

Source: Fehr & Peers, May 2014.

TABLE 3
67TH, 66TH AND 65TH STREETS RAILROAD CROSSINGS
DECEMBER 2013 OBSERVED ACTIVITY[1]

	Weekday	Weekend
Average Trains Per Day	57.17	44.5
Range of Trains Per Day	50-63	44-45
Average Total Durations of Gate Closure Time During Peak Hour	00:09:02	00:20:36
Average Trains during Peak Hour	6.17	9
Average Rail Cars Per Train Per Day	19	17
Max Individual Gate Closure	00:31:54	00:10:53
Max Individual Gate Closure During Peak Hour	00:10:35	00:07:07
Total Number of Gate Closures Observed during Data Collection Period[1]	347	91
% of Crossings with Duration > 5 Min	8.65%	6.59%
% of Crossings with Duration > 30 Min	1.44%	0.00%
Max Crossing Period	9-10 AM	9-10 AM

Notes: 1. Data collection period from December 2, 2013 to December 9, 2013.
Source: Fehr & Peers, 2014.

TABLE 4

TRIP GENERATION ESTIMATES

Use	Size	Weekday							Saturday			
		Daily	AM Peak Hour			PM Peak Hour			Daily	Peak Hour		
			In	Out	Total	In	Out	Total		In	Out	Total
Residential[1]	211 Units	1,400	22	86	108	85	46	131	1,350	56	54	110
	Less Trip Reductions											
	External Walk/Bike Trips[2]	-210	-3	-13	-16	-13	-7	-20	-200	-8	-8	-16
	External Transit Trips[3]	-140	-4	-17	-21	-18	-10	-28	-70	-11	-11	-22
Net New Vehicle Trips to Transportation Network[4] (A)		**1,050**	**15**	**56**	**71**	**55**	**30**	**85**	**1,080**	**37**	**35**	**72**
Net New Site Trip Generation Assumed in General Plan Transportation Analysis (B)		--	17	21	38	44	33	77	--	90	68	158
Difference between Current Proposal and General Plan Assumptions(C = B-A)		--	-2	35	33	11	-3	8	--	-53	-33	-86

1. Based on *Trip Generation* (9th Edition) trip generation rates for land use 220, Apartment
2. 15 percent of trips are expected to be external walk/bike trips.
3. 10 percent of weekday daily trips and 15 percent of weekday peak hour trips are expected to be transit trips to/from the site. On a Saturday, 5 percent of daily and 10 percent of peak hour trips would be transit trips.
4. The net driveway vehicle trip estimates presented above represent a 20-35% reduction compared to using the ITE methodology alone.

Source: Fehr & Peers, May 2014

SITE ACCESS, CIRCULATION AND PARKING

This section discusses site access and internal circulation for vehicles, pedestrians, bicycles, and emergency vehicles based on the site plan presented previously on Figure 2. A parking assessment was also conducted. Site recommendations are presented on **Figure 9**.

Vehicle Access and Circulation

The analysis results shown in the previous section indicate that the single vehicular access point would operate acceptably for vehicles with no northbound left-turn pocket into the site from Shellmound Street. The driveway is proposed to be 20-feet wide, which accommodates two-way vehicular travel, with a three foot buffer on the south side between the roadway and the adjacent building. A five-foot sidewalk would be provided on the north side of the access roadway. It appears that garage access would be gate restricted. It is unclear how guests would be able to access the garage.

> ***Recommendation 2:*** Provide details regarding proposed access restrictions and guest access to the parking garage.

Emergency access is also provided on the northern side of the building, which accesses a 20-foot clear path that encircles the building. Separate gated access for pedestrians and emergency vehicles would be provided. A meandering pedestrian path would be provided in this area, which would provide pedestrian access to the ground floor townhomes.

Access to the loading zone and design of the parking garage circulation are discussed in subsequent sections.

Delivery Vehicle Access

The City of Emeryville Planning Regulations outlines loading zone requirements for a variety of uses, as detailed in Table 9-4.409 of the regulations. For multi-family projects with between 150 and 300 units, two small loading zones are required, resulting in a loading zone requirement of two spaces. Two small loading zones should be designed with a width of no less than ten-feet, a length of no less than 25-feet and a vertical clearance of no less than eight-feet. The Planning Director and Planning Commission are provided discretion to modify the number and size of loading areas.

Two off-street loading areas are currently shown on the site plan with access from the driveway connecting to the parking garage. An AutoTURN assessment was conducted to demonstrate how trucks (approximately 24-feet in total length) would access the loading area, as shown on **Figure 10**. This analysis shows that moving trucks that would typically be used to accommodate the contents of a two bedroom dwelling unit would be accommodated by the proposed loading area. However, inexperienced drivers may require assistance to back into the loading area. If vehicles pull forward into the loading area, the active loading/unloading of household goods could occur into the main driveway area, resulting in conflicts between loading/unloading activities and driveway operations. Trucks longer than 24-feet in length would have difficultly accessing the loading area unless driven by a professional mover/driver, and would need to park on Shellmound Street. Given the size of the proposed units, frequent use of trucks longer than 24-feet is not anticipated.

> ***Recommendation 3:*** All vehicles should be required to back into the loading area.

Two trash collection rooms are shown on the site plan on the first floor of the garage, one on the western end and one on the eastern end of the parking garage. Two trash chute locations appear to be provided on each floor of the building. The loading area is also designated as the trash staging area. However, it is not clear from the project site plans how refuse containers would be staged in the area.

> ***Recommendation 4:*** Refuse collection procedures should be reviewed by City and WMAC staff. Staging of trash receptacles in the loading area should not permanently reduce the effective depth of the loading area.

Pedestrian

Pedestrian access to the site would be provided from Shellmound Street. Eight-foot sidewalks would be constructed along the Shellmound Street project frontage within a wider pedestrian zone. Along the southern boundary of the site, five-foot sidewalks would be provided along the northern side of the access road. A pedestrian gate just west of the garage entry would provide pedestrian access to a path that encircles the site and also serves as an emergency access road.

The project would also increase the potential for pedestrian activity across Shellmound Street at 67th Street, and the potential for pedestrian crossings of the at-grade railroad crossing. There are

currently no pedestrian accommodations across Shellmound Street or the railroad crossing at 67th Street although pedestrian activity was observed.

> ***Recommendation 5:*** Install a high visibility crosswalk with advance signage across the south side of Shellmound Street at 67th Street and provide an ADA compliant pedestrian crossing of the railroad tracks, similar to what is provided on 65th Street.

Bicycle

Shellmound Street has Class II bicycle facilities (striped bike lanes) that connect to other existing and planned bicycle facilities in the area. The project would not disrupt existing bicycle facilities, nor interfere with planned facilities. Bicycle parking and internal circulation is discussed in a subsequent section.

Transit

Several transit routes are within walking distance to the project site, although access to the Hollis Route of the Emery Go-Round system could encourage pedestrian activity across at-grade railroad crossings. Measures to address this were discussed in a prior section. The project would not disrupt existing transit facilities, nor interfere with planned facilities. The project would be subject to annual assessment to fund the operations of the Emery Go-Round service, which is required of all commercial entities including for-rent residential projects of more than three units. Although the project is expected to increase transit ridership in the area, annual contributions would also be made to fund transit service in the area.

Parking

The project proposes to provide capacity to park approximately 264 vehicles, including 131 standard parking spaces with independent utility, 70 parking stalls that would be used in conjunction with the proposed puzzle parking system, and an additional 63 parking spaces that would be gained through the use of a parking lift system. The actual system that would be employed for this project is still under consideration, but the first level of the garage is being designed to provide 14-foot clearance to accommodate vertically stacked vehicles.

> ***Recommendation 6:*** Review the design and operations of the parking lift system when selected, considering items such as vertical clearances, vehicle access, ease of operation,

speed to disperse vehicles and pedestrian access to/from the vehicle once in the lift system.

The parking required under the Emeryville Planning Regulations is presented in **Table 5** which shows a minimum parking requirement of 314 spaces for the project as currently contemplated, which is more than currently proposed for inclusion in the project considering the parking lift system. The code required parking for the site results in the provision of 1.5 parking spaces per unit, while the proposed parking supply results in approximately 1.25 parking spaces per unit. Although up to 10 percent more parking can be provided than required by code, a conditional use permit would need to be issued to provide less than the code-required parking.

TABLE 5
PROPOSED PROJECT AND CITY CODE AUTOMOBILE PARKING REQUIREMENTS

Bedrooms/	# Units	Base Requirement	Reductions Applied Per Code	Base Off Street Parking Requirement
Studio	11	1 per unit	None	11
1-bed	101	1 per unit	None	101
2-bed	88	1.5 per unit	None	132
3-bed	11	1.5 per unit	None	17
Guest	211	0.25 per unit	None	53
			Total	**314**
			Proposed Supply	**264**
			Surplus/(Deficit)	**(50)**

Source: City of Emeryville Planning Regulations, Fehr & Peers, 2014.

The Project Applicant retained W-Trans to prepare a parking demand study of similar developments in the study area. We have peer reviewed their memorandum dated March 3, 2014 which documents parking surveys at two similar projects in Emeryville, Archstone and Avenue 64, as well as published data from the Institute of Transportation Engineers (ITE) in the *Parking Generation Manual*. As part of the parking surveys, on-site and on-street parking demand was documented for a weekend night and a weekday night to represent the time periods when residential parking demand is typically the highest.

Results of the parking demand surveys indicate an average observed parking demand of 1.33 spaces per dwelling unit for similar projects in the surrounding area (ranging between 1.27 to 1.39 spaces per unit), including on-street parking that captures potential guest parking demand (and may potentially overstate demand). The parking assessment also notes that ITE documents an average parking demand of 1.20 spaces per apartment unit in urban areas and 1.23 spaces per apartment unit in suburban areas. W-Trans concludes that considering on-street parking in the vicinity of the project site, sufficient parking would be provided for the project to accommodate expected typical peak parking demand.

The two apartment complexes included in the survey are in close proximity to the project site and it is expected that the residents of the proposed project would be similar to the surveyed sites. Although the W-Trans parking assessment correctly references the observed average peak parking demand for urban apartments, the observed range of parking demand documented by ITE for urban apartments is 0.66 to 2.50 on a weekday and 0.80 to 1.43 on a Saturday. The observed parking demand for both surveyed sites falls within the observed demand documented by ITE. However, it should be noted that limited details are provided about the locations included in the ITE survey data and use of local survey data is recommended over national averages.

As part of our assessment, Fehr & Peers reviewed auto-ownership per household as documented by the American Community Survey (ACS), 2008-2012 for Emeryville. For rental units in Emeryville, vehicle ownership rates are approximately 1.10 vehicles per household, with vehicle ownership rates increasing to approximately 1.40 for owner-occupied units in Emeryville. Approximately 70 percent of rental households have one vehicle, with 10 percent having none. The remaining households have two or more vehicles available.

W-Trans estimates that the total parking demand for the project would be 1.33 spaces per unit (the average of the maximum observed parking demand at the two sites) or 281 parking spaces. W-Trans concludes that on-site parking may be insufficient to accommodate the expected peak parking demand, but assuming use of on-street parking along Shellmound Street in combination with the on-site supplies, sufficient parking would be provided. It should be noted that on-street parking cannot be used to satisfy the off-street parking requirement unless the project is adding on-street parking where there currently is none.

Based on our review of the parking demand assessment, published data from ITE, and census data reflective of the City of Emeryville, ***the proposed on-site parking supply of 1.25 spaces per***

unit is expected to be insufficient to accommodate peak resident and guest parking demand.

> ***Recommendation 7*:** Increase the on-site vehicle parking supply to the average observed demand from the parking demand assessment plus five percent to account for typical daily fluctuations in parking demand. The resulting parking supply would be **1.40 spaces per unit, or 295 spaces**. The current parking supply results in a 31 space deficit from the expected parking demand.

If increasing the on-site parking supply is not feasible, parking demand strategies would need to be implemented, monitored and adjusted to reflect the actual tenant profiles of the project, to reduce parking demand to a level that could be accommodated with the proposed on-site supply.

> ***Recommendation 8:*** To manage the proposed parking demand and supply, the project applicant shall develop and implement a parking management plan and monitoring program prior to issuance of temporary certificate of occupancy. The plan should identify provisions for monitoring parking demand as the residential units become occupied to assess the effectiveness of the strategies detailed below and to work with the City of Emeryville to implement additional strategies, if necessary. The parking monitoring shall be performed by an independent firm to be approved by the Director of Planning and Building and shall consist of a survey of typical weekday (at least two observations between 9 PM and 6 AM) and weekend (at least two observations between 9 PM and 6 AM) parking demand when the project is approximately 75 percent occupied and well as three to six months after full occupancy (at least 95 percent occupancy). On-street parking demand should also be included in the assessment on Shellmound Street between 65th Street and 67th Street.
>
> The monitoring report shall document the observed parking demand in the guest and resident spaces, as well as on-street parking supplies, provide a comparison of the parking demand to the supply, the status of parking demand management strategies being employed, and recommendations for additional parking demand management strategies that could be employed, if needed.
>
> Unbundling of parking cost from the rent is a requirement of all multi-family residential projects, and results in residents paying one price for the residential unit and a separate

price for parking, should they opt for a space. The cost of parking can be adjusted such that resident parking demand and supply are in equilibrium (see item 5 below).

Elements of the parking management plan should include (items 1-6 are required elements of the plan, items 7-10 are suggestions for consideration):

1. Provide AC transit passes to residents for the first year of their tenancy, or other specified time period (5 to 15 percent parking demand reduction expected)

2. Provide information to new residents about the availability of transit in the area (parking demand reduction negligible, supporting measure to provision of AC transit passes)

3. Provide a carshare pod within the building or other location in close proximity to the project (within 800 feet) (up to 5 percent parking demand reduction expected)

4. Assign specific parking spaces to tenants (parking demand reduction negligible, but would manage supplies) who opt to lease a parking space and provide flexible parking space lease terms that allow for termination of the parking space lease during the residential lease term

5. Implement variable parking pricing such that each subsequent parking space leased by a unit costs more than the previous space, (i.e., the second parking space is more expensive than the first; the third is more expensive than the second, etc.), and if the percentage of leased parking spaces is higher than the percentage of leased units, the parking price is adjusted until equilibrium is reached. For example, if 90 percent of parking spaces are leased but only 85 percent of units are leased, the monthly cost of parking should be increased such that new tenants opt to lease parking at a lower rate—higher cost—than existing tenants. The effectiveness of this strategy ranges from 3 to 20 percent, depending on the pricing of the parking.

6. Provide long-term bicycle parking above the code-required amount at a ratio of 1.5 bicycle parking spaces for each vehicle parking space provided below the expected demand

7. Implement restrictions on the use of guest parking spaces, such as: requiring guest vehicles to be registered with the building management; limiting the number of times the same guest vehicle can park overnight within the garage; limiting the number of guest permits a resident can request per

month (strategy could increase on-street demand and would need to be monitored for effectiveness).

8. Implement time restrictions on guest parking during daytime hours
9. Evaluate use of guest parking spaces and potentially assign to residents
   Review the parking garage layout to evaluate potential to increase parking supplies through the use of tandem parking stalls

Implementation of the above measures are expected to reduce parking demand by at least 38 spaces, resulting in an estimated on-site demand of 257 parking spaces (295 spaces - 38 spaces), which would be accommodated by the proposed on-site parking supplies.

Although there is some on-street parking in the vicinity of the site (approximately 20 spaces on Shellmound Street from the project site south to 65th Street), it is limited along the project frontage. Parking is also available on 67th and 66th Streets, but the railroad crossings and lack of pedestrian facilities connecting the project site to the east side of the railroad tracks makes it undesirable to encourage on-street parking by site residents and guests. Therefore, parking demand management strategies should aim to reduce actual parking demand, not shift the demand from off-street parking supplies to on-street supplies.

Parking Area Design

Layout of the parking areas was reviewed based on the plan shown on Figure 2. The review was based on design guidelines provided in Section 9-4.406 of the City's Planning Regulations. Parking aisle widths generally conform to the City requirement of 24-feet wide for perpendicular parking. Most of the parking stall lengths generally conform to the City's minimum requirement of 18-feet, with a width of 8.5-feet. City of Emeryville Parking Code requires parking stalls adjacent to a wall be one foot wider than a standard stall, which appears to be satisfied throughout the garage.

Although the stalls appear to meet standards, some would be difficult to access as indicated on Figure 9.

> ***Recommendation 9:*** Consider eliminating these parking stalls or convert to motorcycle parking. Each of the four motorcycle spaces is equivalent to a vehicle stall per Emeryville Planning Regulations.

Other Parking Considerations

Based on the Emeryville Planning Regulations, the project would be required to equip at least three percent of the residential parking supplies with electric vehicle (EV) charging infrastructure, resulting in 8 electric vehicle charging stations based on the current proposed supply. No EV charging infrastructure is shown on the site plan.

> ***Recommendation 10:*** Update the site plan to show the location of EV charging stations. Charging stations can be clustered together. At least one charging station should be reserved for guests.

Short term and long term bicycle parking is also required for the project. For the residential portion of the project, one short-term space is required for every four visitor vehicle spaces and one long-term space is required for each unit. This results in a requirement of 14 short-term and 211 long-term bicycle parking spaces for the residential portion of the project. Three bicycle storage rooms are provided within the first level of the parking garage, and two bicycle storage rooms are provided on the second floor of the parking garage. The total long-term supply indicated on the site plan is 211 spaces.

MBH Architects provided information related to the access routes from Shellmound Street to each bicycle storage room, as shown on **Figure 11**. Access to the first floor bicycle storage room adjacent to the bicycle spa is located in close proximity to the building entrances/exits from Shellmound Street. Access to the westernmost bicycle storage rooms on the first level of the garage would be from the path that encircles the site. One of the access routes requires travel through three sets of doors – two to enter the building and a third to enter the bicycle room. Access to the northernmost bicycle storage room on the second floor of the garage is shown from an elevator from the first floor of the parking garage, presumably with entry to the garage from the exterior path. Access to the southern bicycle storage room is shown from stairs connecting to an entrance on the first level, accessed from the sidewalk connecting to the main garage entry, requiring bicyclists to cross the main garage entry and climb a set of stairs with their bike. Most bicyclists would likely ride their bikes through the parking garage and use the vehicle ramping system, creating the potential for bicycle/vehicle conflicts, or take their bike in the elevator from the exterior path.

> ***Recommendation 11:*** The applicant shall provide access improvements and signage to enable a safe path of travel for bicyclists through the garage. A revised plan showing the

path of travel from street to each long-term storage room shall be reviewed and approved by the Director of Planning and Building prior to issuance of any building permit.

1. The pathway connecting Shellmound Street to the bicycle storage rooms on the northern side of the site should be well lit and signage directing bicyclists to this area should be provided.
2. Curb ramps shall be provided within the parking garage where bicyclists need to traverse a curb area to access the bicycle storage facilities.
3. Access to the bicycle storage rooms on the second floor of the garage shall be provided via elevator with appropriate signing and striping within the garage. This may require elimination of a guest parking stall to provide a clear path from the elevator to the bicycle room.
4. Doors leading to bicycle storage rooms shall have a push button mechanism such that bicyclists can enter/exit the building without having to prop open doors while wheeling their bicycle. These doors shall also have a mechanism to close behind the user for security. All bicycle storage rooms shall be access-restricted with locking mechanism.

Dimensions of the proposed bicycle storage room were also reviewed and compared to best practices for bicycle parking layout as described in *Bicycle Parking Guidelines, 2nd Edition,* A set of Recommendations from the Association of Pedestrian and Bicycle Professionals as well as guidance provided in the Emeryville Planning Regulations. This review is based on the dimension of a typical bicycle and the area needed to store and circulate bicycles within a storage room. As the type of rack proposed is not indicated, this review was based on the use of traditional racks and the dimensions of typical bicycles[10].

Based on our review and lack of specification regarding the type of bicycle rack mechanism, it is difficult to ascertain if the bicycle parking supply indicated on the site plan is feasible to be provided within the proposed bicycle storage rooms, as use of traditional racks would not yield the storage capacity shown on Figure 11. For example, based on the size of a typical bicycle and the needed space for maneuvering and storage, the primary bicycle storage room on the first

[10] Typical bicycles are 72 inches (6 feet) long, with a span of 24 inches (2 feet) at widest point (handlebars), and a height of 48 inches (4 feet). A bicycle storage room using traditional racks should provide 96 inches (72 inch minimum) of distance between the wall and a circulation aisle, in which the rack would be placed. The circulation aisle should be 60 inches wide (48 inch minimum). The distance between each rack should be 48 inches (30 inch minimum).

level is not wide enough to accommodate two rows of bicycle parking as the room is 11 feet, 8 inches wide, and 57 feet long. Assuming minimum required widths, approximately 46 bicycles could be accommodated in this room on a single level with two bicycles per rack, as opposed to the 74 spaces shown on the plan. Although wall mounted racks or two-tiered system could yield some additional capacity, it is not clear how those racks would be accommodated in this space.

> ***Recommendation 12:*** Provide additional details regarding the proposed bicycle rack systems within each of the bicycle storage rooms to confirm the proposed supply. Depending on the final vehicle parking supply, indicate where additional bicycle parking will be provided (see Recommendation 8). If modifications to the parking garage design are infeasible or impracticable to provide additional bicycle storage, consider providing bicycle storage on each floor of the building for residents of that floor.
>
> Consider providing a variety of bicycle storage options, including bicycle lockers that could be rented for an additional fee, double decked systems that maximize capacity, and traditional bicycle racks.

Bicycle lockers provide the most security and could be appealing to those who have invested heavily into their bicycle, and have bicycle accessories that are at risk for theft. Double decked systems increase capacity, but some users can have difficulties using the rack system. These systems also tend to require more maintenance as they have moving parts. Traditional system are less space efficient, but are more cost efficient, require less maintenance, and are generally easiest for bicyclist to use.

Accessible parking spaces, as required by the Americans with Disabilities Act (ADA), would also need to be provided within the project site, with the requirement based on the total number of parking spaces. For parking areas with between 201 and 301 parking spaces, seven ADA accessible stalls are required with a least one stall designed to be van accessible. For parking areas with 301 to 400 parking spaces, eight ADA accessible stalls are required with a least one stall designed to be van accessible. Eight accessible stalls are shown on the current site plan, which meets the requirement based on the required parking supply.

This completes our transportation assessment of 6701 Shellmound Street. Please call Kathrin with questions or comments.

Attachments:

Figure 1	Site Vicinity
Figure 2	Conceptual Project Site Plan
Figure 3	Existing Weekday PM Peak Hour and Saturday Peak Hour Intersection Turning Movement Volumes and Intersection Lane Configurations/Traffic Control
Figure 4	Existing Weekday PM Peak Hour and Saturday Peak Hour Pedestrian and Bicycle Volumes
Figure 5	Preliminary Project Trip Distribution
Figure 6	Preliminary Project Trip Assignment
Figure 7	Existing With Project Weekday PM Peak Hour and Saturday Peak Hour Intersection Turning Movement Volumes
Figure 8	Near-Term With Project Weekday PM Peak Hour and Saturday Peak Hour Intersection Turning Movement Volumes
Figure 9	Consultant Site Plan Recommendations
Figure 10	Loading Zone Access
Figure 11	Bicycle Access Routes

Attachment A	Level of Service Analysis Methods
Attachment B	Traffic Count Worksheets
Attachment C	Level of Service Worksheets

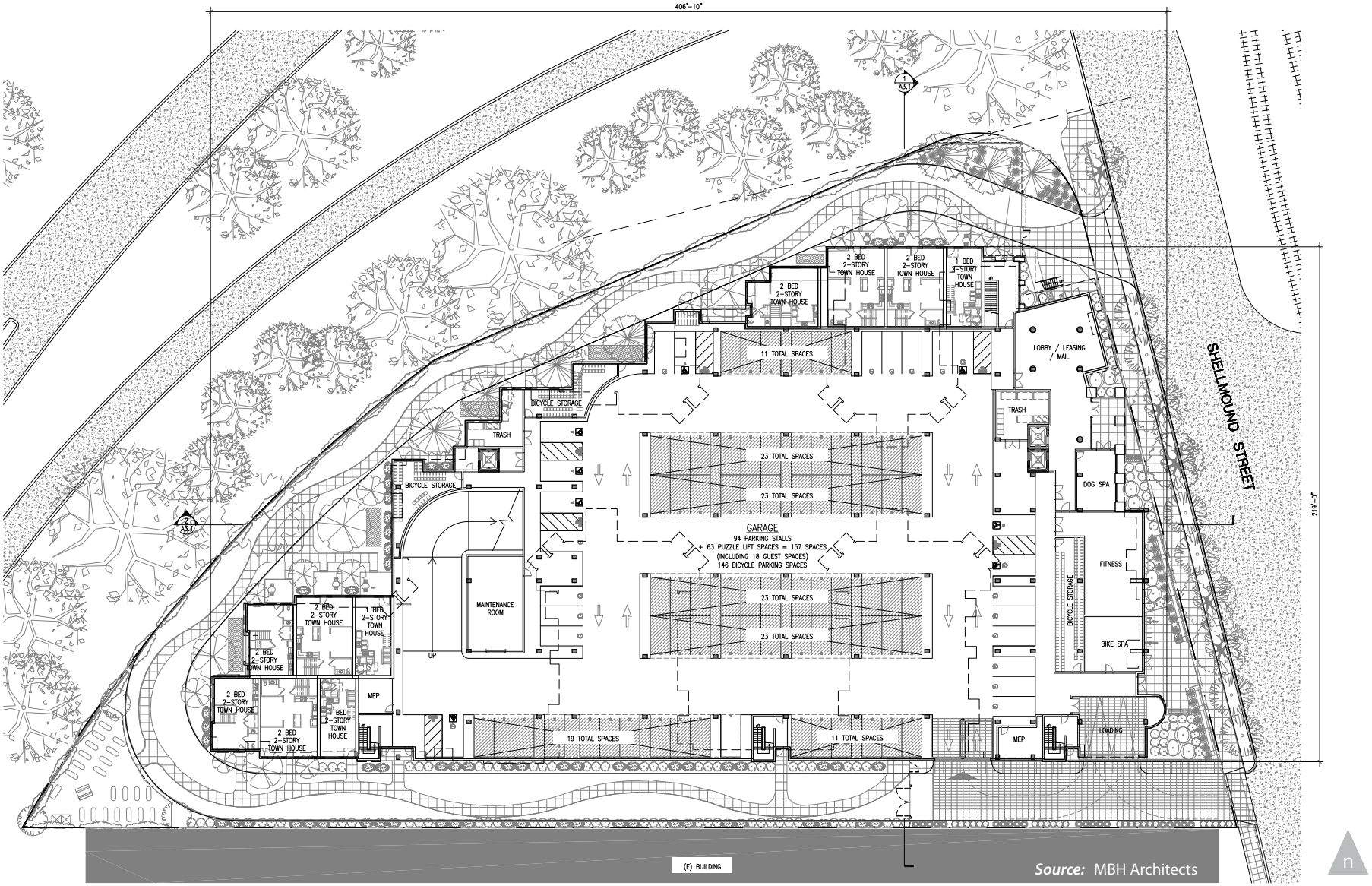
WC13-3096_1_SiteVic

LEGEND

Study Intersection

Figure 1

Project Site Vicinity Map and Intersection Analysis Locations

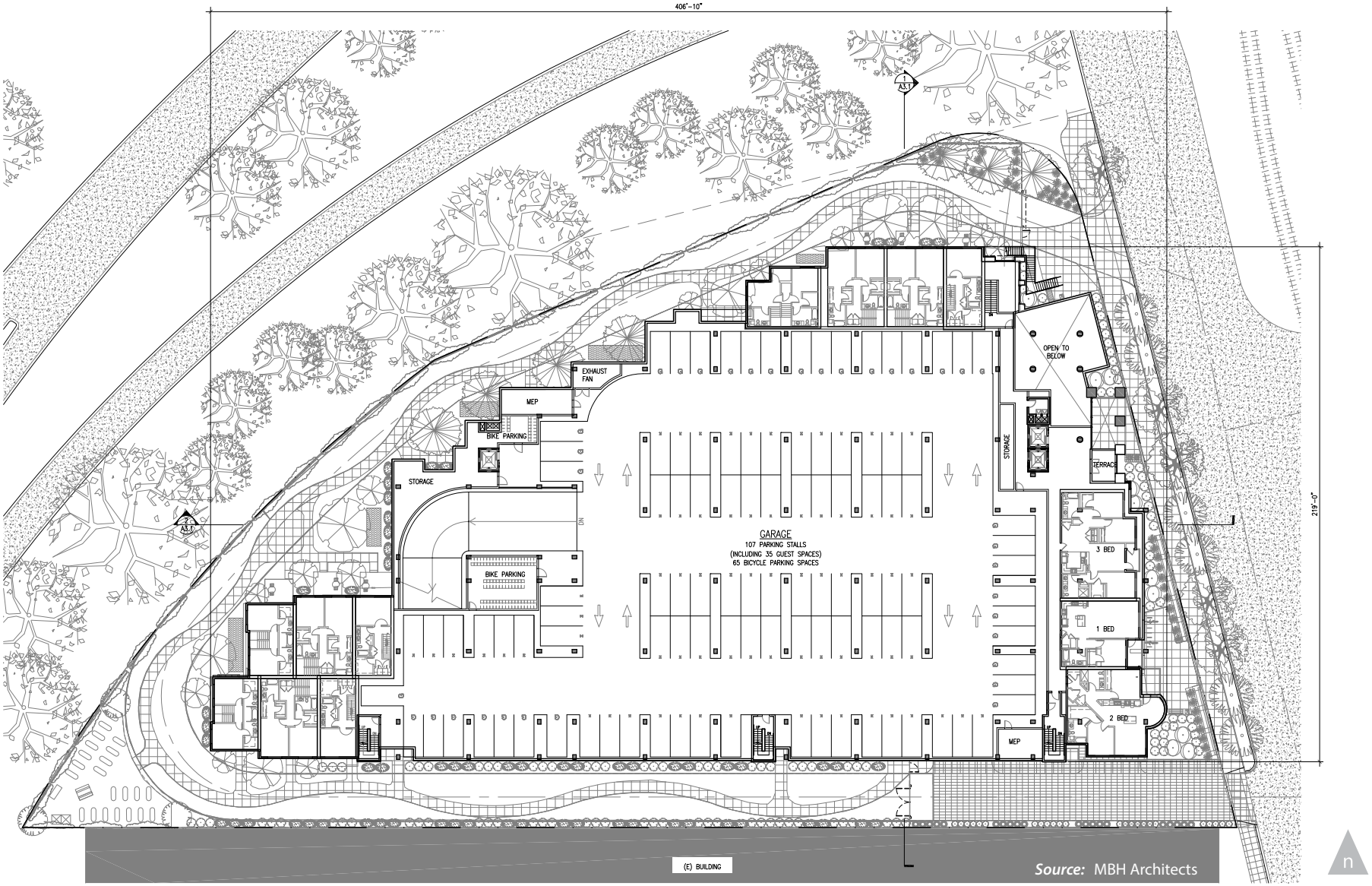


Source: MBH Architects

WC13-3096_2A_SitePlan

Figure 2A

Conceptual Project Site Plan – First Floor Plan

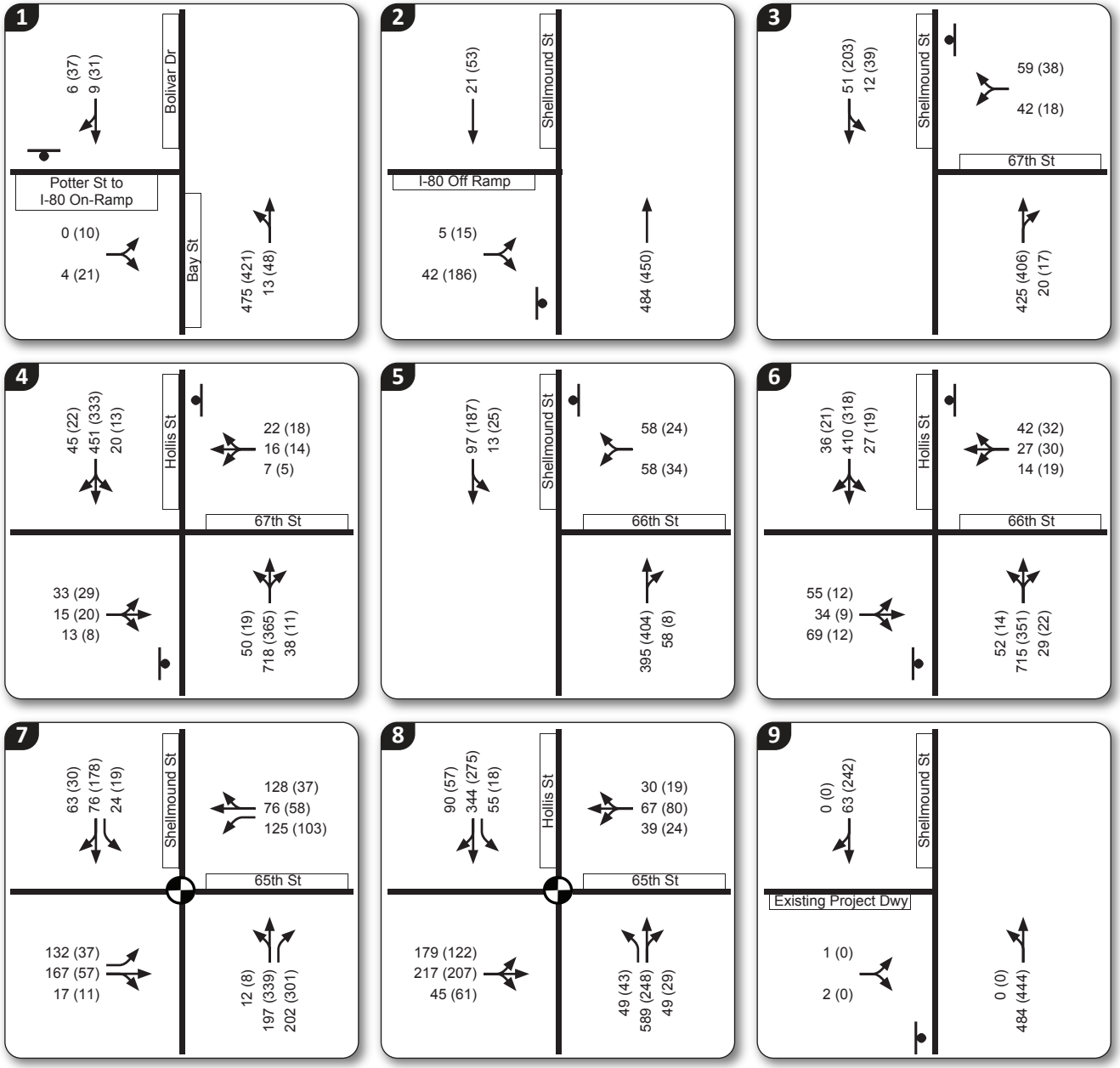


Source: MBH Architects

WC13-3096_2B_SitePlan

Figure 2B

Conceptual Project Site Plan – Second Floor Plan



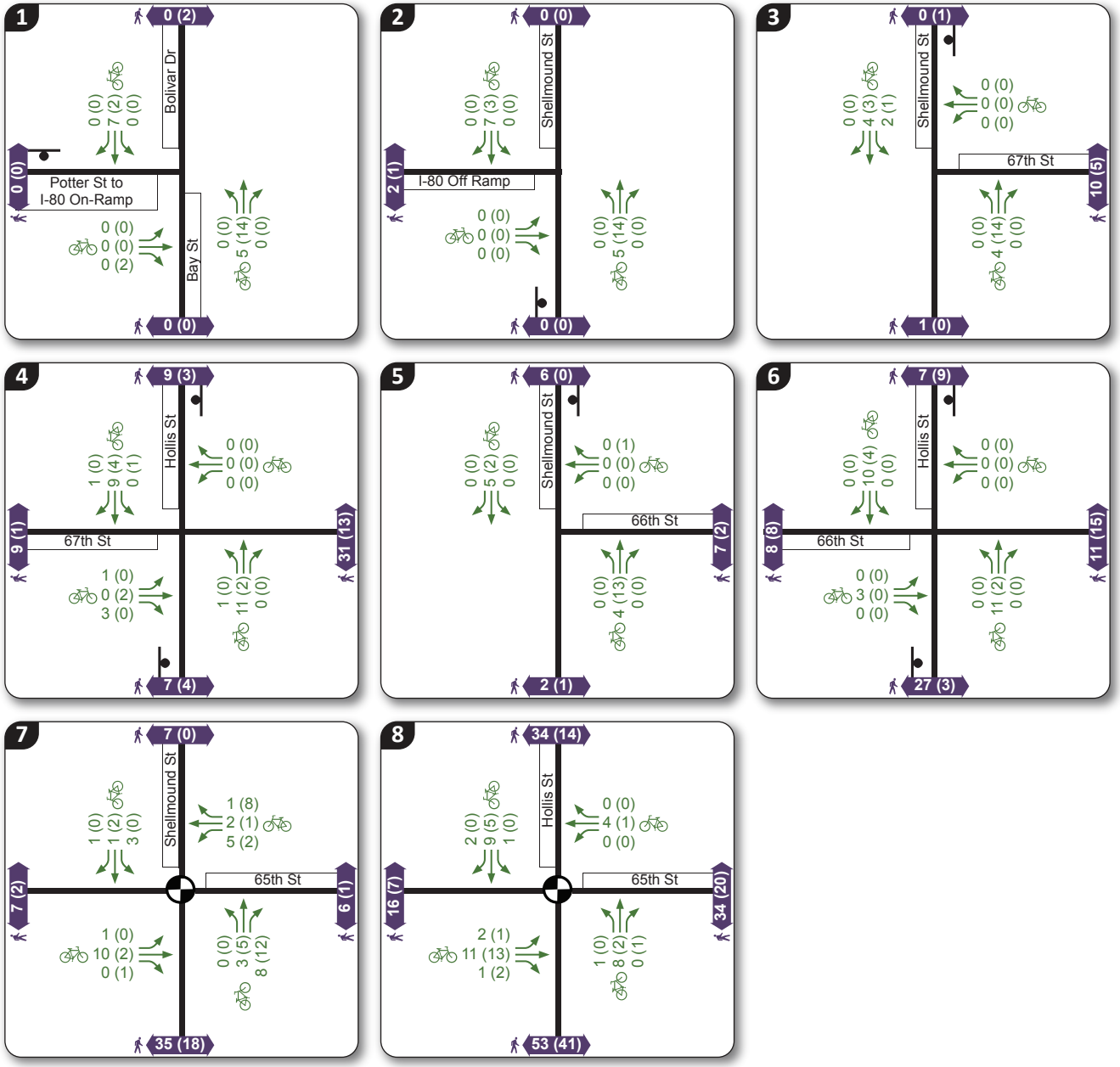
LEGEND

XX (YY)	Weekday PM (Saturday) Peak Hour Traffic Volumes
◐	Signalized Intersection
●	Stop Sign
#	Study Intersection

WC13-3096_3_ExVol

Figure 3

Existing Weekday PM Peak Hour and Saturday Peak Hour Intersection Turning Movement Volumes, Lane Configurations and Traffic Control



LEGEND

- x (y) — Weekday PM (Saturday) Peak Hour Pedestrian Volumes
- x (y) → — Weekday PM (Saturday) Peak Hour Bicycle Volumes
- Signalized Intersection
- Stop Sign
- # — Study Intersection

WC13-3096_4_PedBikeVol

Figure 4

Existing Peak Hour Pedestrian and Bicycle Volumes

WC13-3096_5_TripDistro

LEGEND

Study Intersection

Project Site

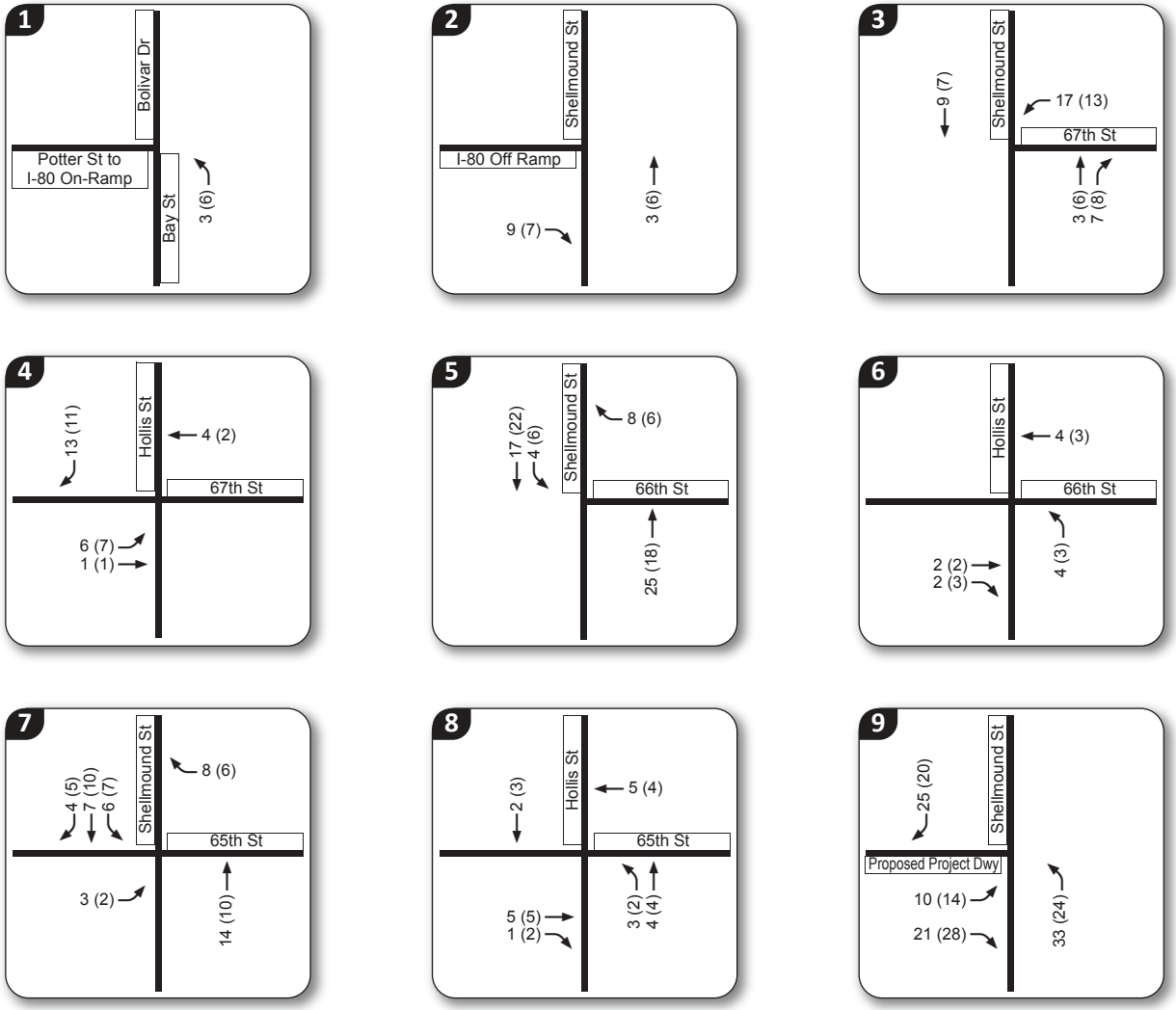
A% (B%) | C% (D%)

Inbound (Outbound) Weekday PM Peak Hour

Inbound (Outbound) Saturday Peak Hour

Figure 5

Preliminary Project Trip Distribution



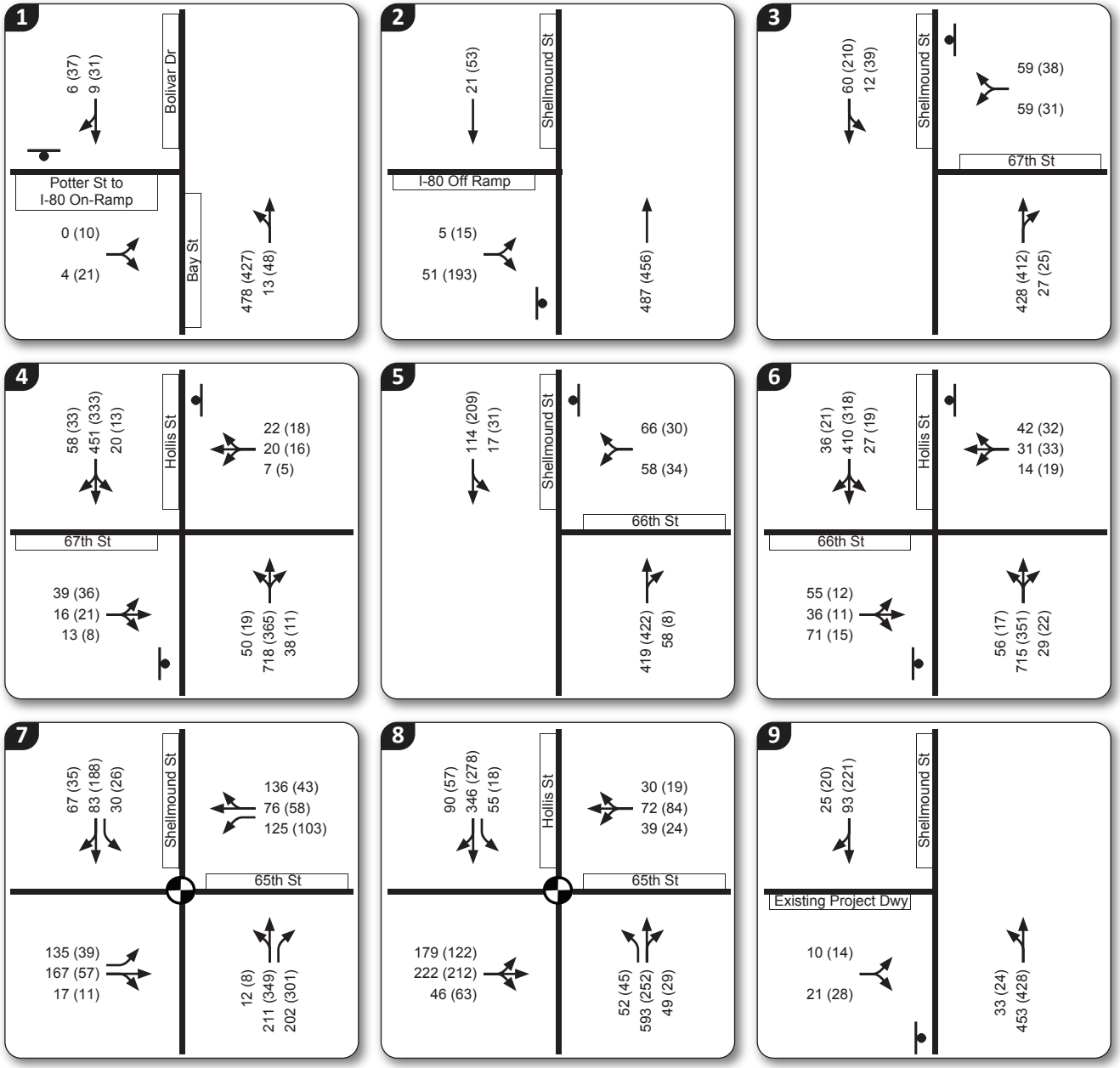
LEGEND

XX (YY)	Weekday PM (Saturday) Peak Hour Traffic Volumes
#	Study Intersection

WC13-3096_6_PTA

Figure 6

Project Trip Assignment



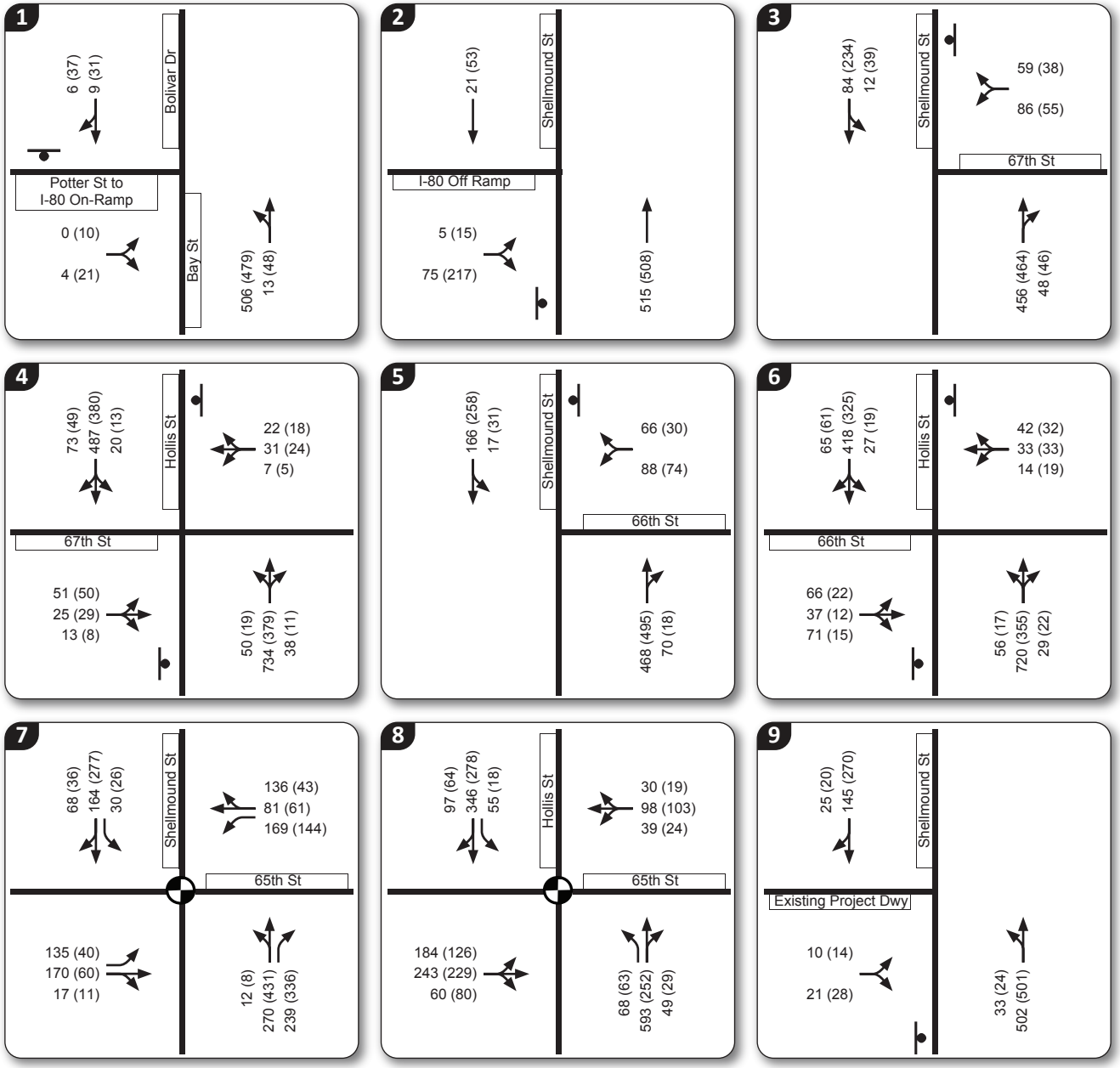
LEGEND

XX (YY)	Weekday PM (Saturday) Peak Hour Traffic Volumes
◐	Signalized Intersection
●	Stop Sign
#	Study Intersection

WC13-3096_7_Ex+ProjVol

Figure 7

Existing Plus Project Weekday PM Peak Hour and Saturday Peak Hour Intersection Turning Movement Volumes, Lane Configurations and Traffic Control



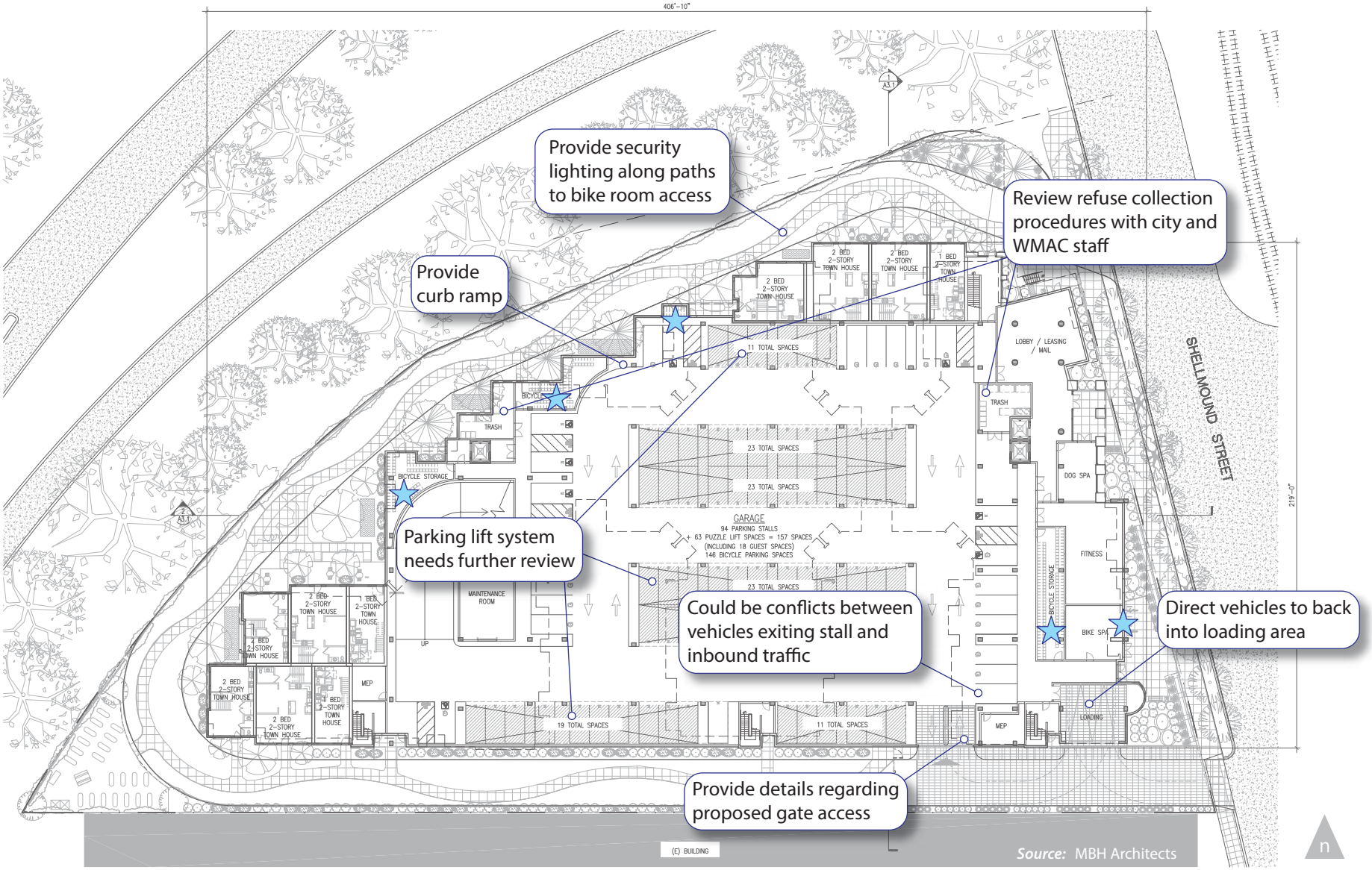
LEGEND

XX (YY)	Weekday PM (Saturday) Peak Hour Traffic Volumes
	Signalized Intersection
	Stop Sign
#	Study Intersection

WC13-3096_8_NT+ProjVol

Figure 8

Near-Term With Project Weekday PM Peak Hour and Saturday Peak Hour Intersection Turning Movement Volumes, Lane Configurations and Traffic Control



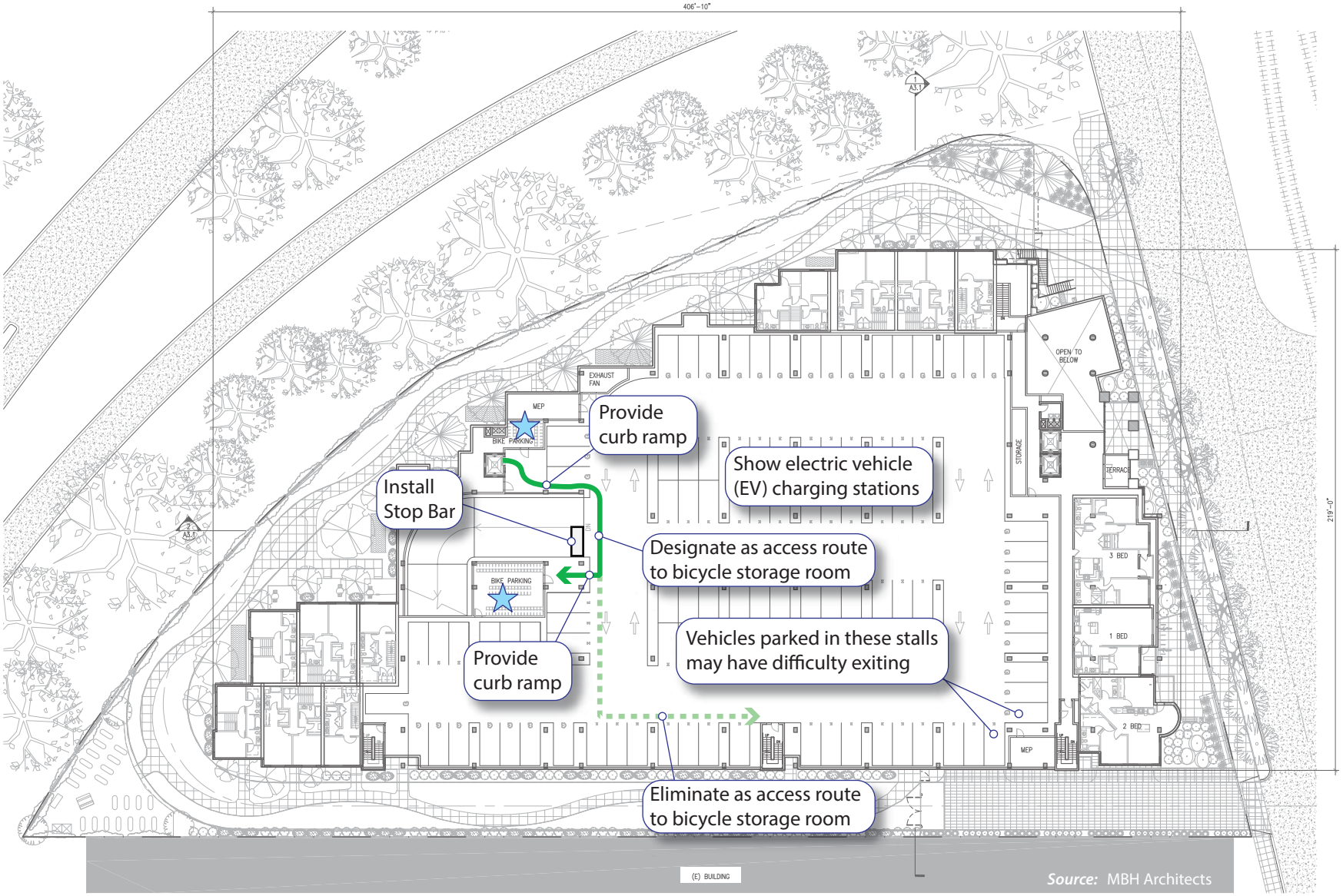
WC13-3096_9A_SitePlanRec1

LEGEND

★ Provide Details on Bike Storage Racks to Confirm Total Supply

Figure 9A

Consultant Site Plan Recommendations – First Floor Plan



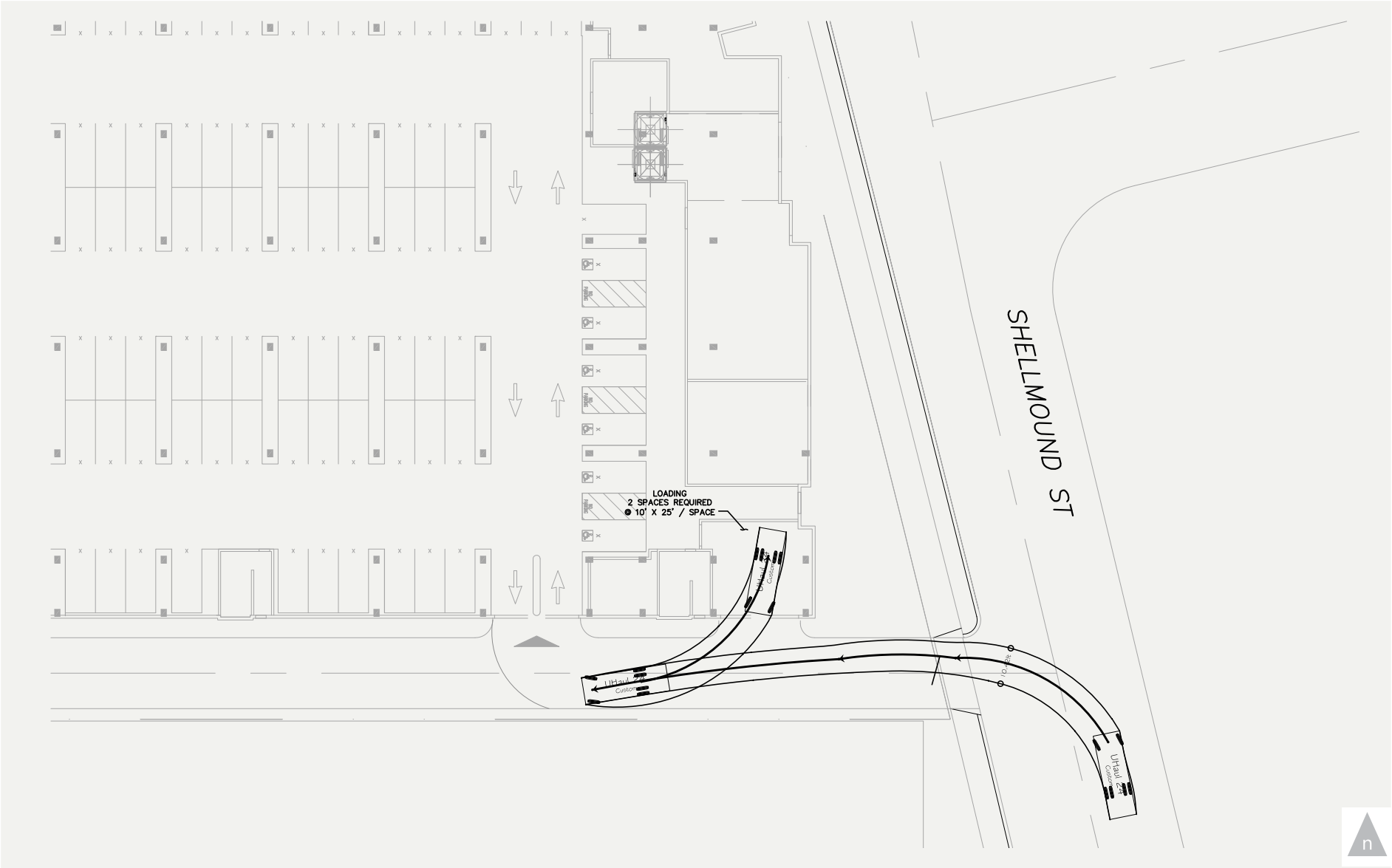
WC13-3096_9B_SitePlanRec2

LEGEND

Provide Details on Bike Storage Racks to Confirm Total Supply

Figure 9B

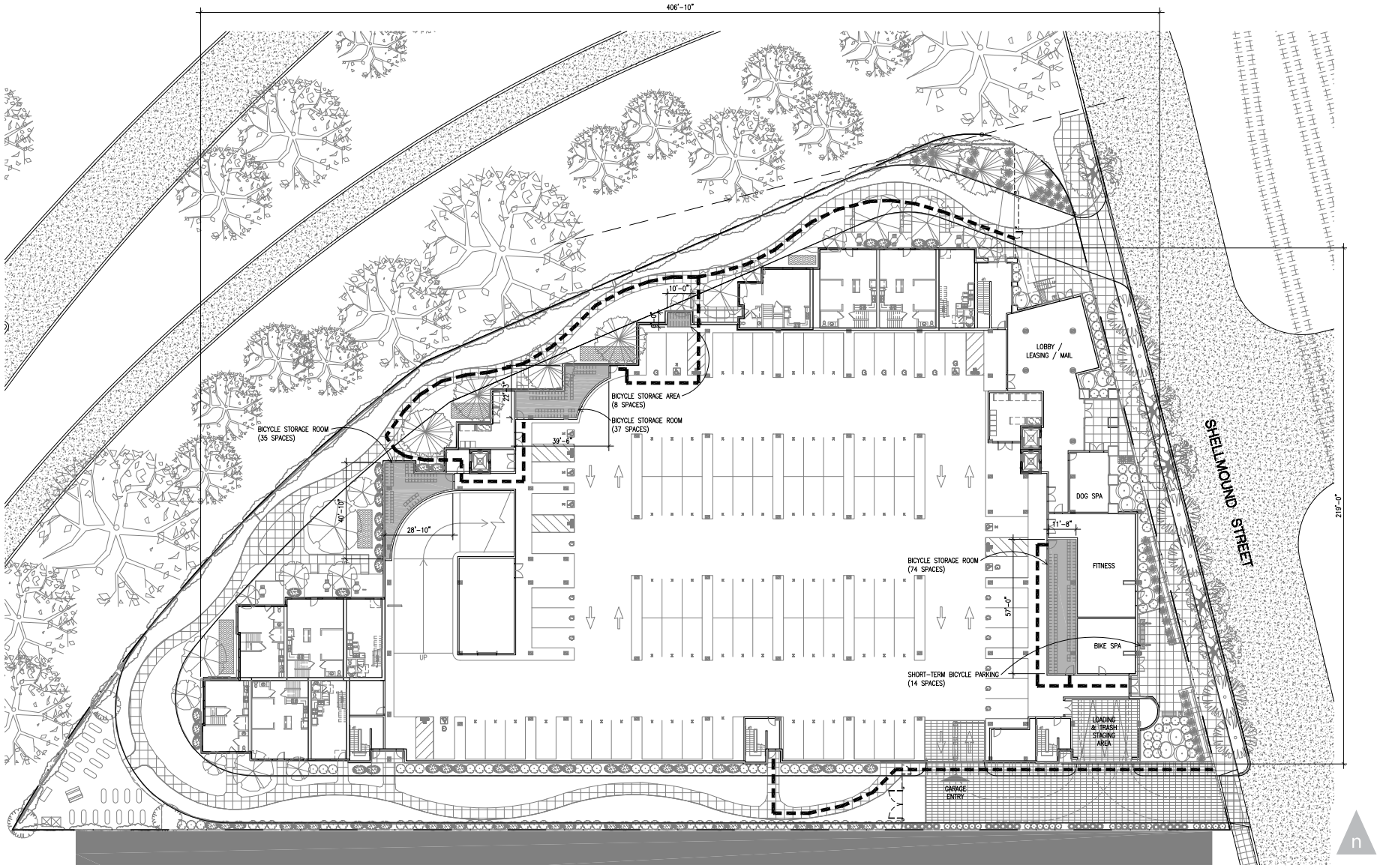
Consultant Site Plan Recommendations – Second Floor Plan



WC13-3096_10_AutoTurn

Figure 10

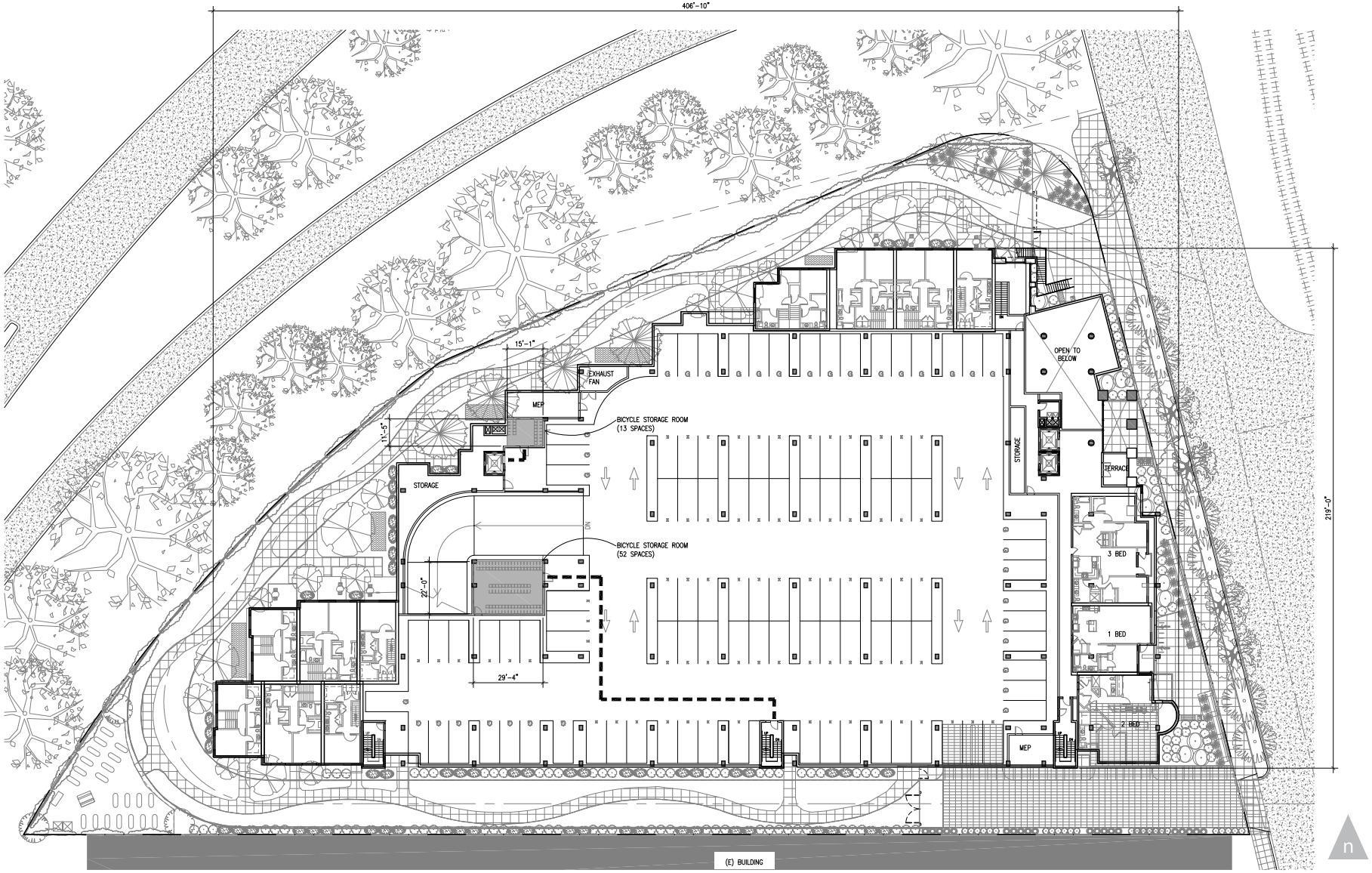
Loading Zone Access



WC13-3096_11A_BikeStorageAcc

Figure 11A

Bicycle Storage Room Access Routes – Level 1



WC13-3096_11B_BikeStorageAcc

Figure 11B

Bicycle Storage Room Access Routes – Level 2

ATTACHMENT A – INTERSECTION ANALYSIS METHODS

The operations of roadway facilities are for vehicles described with the term "level of service" (LOS). LOS is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels of service are defined ranging from LOS A (i.e., free-flow operating conditions) to LOS F (over capacity operating conditions). LOS E corresponds to operations "at capacity." When volumes exceed capacity, stop-and-go conditions result and operations are designated as LOS F. The City of Emeryville does not have a level of service policy for vehicles, but strives to achieve a Quality of Service for all modes of travel.

Signalized Intersections

Traffic conditions at signalized intersections were evaluated using the method from Chapter 16 of the Transportation Research Board's 2000 *Highway Capacity Manual*. This operations analysis method uses various intersection characteristics (such as traffic volumes, lane geometry, and signal phasing) to estimate the average control delay experienced by motorists traveling through an intersection. Control delay incorporates delay associated with deceleration, acceleration, stopping, and moving up in the queue. **Table A-1** summarizes the relationship between average delay per vehicle and LOS for signalized intersections.

Unsignalized Intersections

Traffic conditions at unsignalized intersections were evaluated using the method from Chapter 17 of the 2000 *Highway Capacity Manual*. With this method, operations are defined by the average control delay per vehicle (measured in seconds) for each movement that must yield the right-of-way. At two-way or side street-controlled intersections, the control delay (and LOS) is calculated for each controlled movement, as well as the left-turn movement from the major street, and the entire intersection. For controlled approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. The delays for the entire intersection and for the movement or approach with the highest delay are reported. **Table A-2** summarizes the relationship between delay and LOS for unsignalized intersections.

TABLE A-1
SIGNALIZED INTERSECTION LOS CRITERIA

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Operations with very low delay occurring with favorable progression and/or short cycle lengths.	≤ 10. 0
B	Operations with low delay occurring with good progression and/or short cycle lengths.	> 10. 0 to 20. 0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	> 20. 0 to 35. 0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and/or high volume-to-capacity (V/C) ratios. Many vehicles stop and individual cycle failures are noticeable.	> 35. 0 to 55. 0
E	Operations with long delays indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55. 0 to 80. 0
F	Operations with delays unacceptable to most drivers occurring due to over saturation, poor progression, or very long cycle lengths.	> 80. 0

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

TABLE A-2
UNSIGNALIZED INTERSECTION LOS CRITERIA

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Little or no delays	≤ 10. 0
B	Short traffic delays	> 10. 0 to 15. 0
C	Average traffic delays	> 15. 0 to 25. 0
D	Long traffic delays	> 25. 0 to 35. 0
E	Very long traffic delays	> 35. 0 to 50. 0
F	Extreme traffic delays with intersection capacity exceeded	> 50. 0

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

ATTACHMENT B – TRAFFIC COUNT WORKSHEETS

6701 Shellmound

PM Peak Hour Traffic Counts

DATE	TIME	N/S Street	E/W Street	INTID
12/4/2013	1700	Bay St	Potter St	13-7711-001
12/4/2013	1700	Shellmound St	I-80 Off Ramps	13-7711-002
12/4/2013	1700	Shellmound St	67th St	13-7711-003
12/4/2013	1700	Hollis St	67th St	13-7711-004
12/4/2013	1700	Shellmound St	66th St	13-7711-005
12/4/2013	1700	Hollis St	66th St	13-7711-006
12/4/2013	1700	Shellmound St	65th St	13-7711-007
12/4/2013	1700	Hollis St	65th St	13-7711-008

INTID	NBL	NBT	NBR	NBU	EBL	EBT	EBR	EBU	SBL	SBT	SBR	SBU	WBL	WBT	WBR	WBU
13-7711-001	475	13	0	0	0	0	4	0	0	9	6	0	0	0	0	0
13-7711-002	0	484	0	0	5	0	42	0	0	21	0	0	0	0	0	0
13-7711-003	0	425	20	0	1	1	2	0	12	51	0	0	42	0	59	0
13-7711-004	50	718	38	0	33	15	13	0	20	451	45	0	7	16	22	0
13-7711-005	0	395	58	0	0	0	0	0	13	97	0	0	58	0	58	0
13-7711-006	52	715	29	0	55	34	69	0	27	410	36	0	14	27	42	0
13-7711-007	12	197	202	0	132	167	17	0	24	76	63	0	125	76	128	0
13-7711-008	49	589	49	0	179	217	45	0	55	344	90	0	39	67	30	0

6701 Shellmound

Saturday Peak Hour Traffic Counts

DATE	TIME	N/S Street	E/W Street	INTID
12/7/2013	1500	Bay St	Potter St	13-7711-001
12/7/2013	1500	Shellmound St	I-80 Off Ramps	13-7711-002
12/7/2013	1500	Shellmound St	67th St	13-7711-003
12/7/2013	1500	Hollis St	67th St	13-7711-004
12/7/2013	1500	Shellmound St	66th St	13-7711-005
12/7/2013	1500	Hollis St	66th St	13-7711-006
12/7/2013	1500	Shellmound St	65th St	13-7711-007
12/7/2013	1500	Hollis St	65th St	13-7711-008

INTID	NBL	NBT	NBR	NBU	EBL	EBT	EBR	EBU	SBL	SBT	SBR	SBU	WBL	WBT	WBR	WBU
13-7711-001	421	48	0	0	10	0	21	0	0	31	37	0	0	0	0	0
13-7711-002	0	450	0	0	15	0	186	0	0	53	0	0	0	0	0	0
13-7711-003	0	406	17	0	0	0	0	0	39	203	0	0	18	0	38	0
13-7711-004	19	365	11	0	29	20	8	0	13	333	22	0	5	14	18	0
13-7711-005	0	404	8	0	0	0	0	0	25	187	0	0	34	0	24	0
13-7711-006	14	351	22	0	12	9	12	0	19	318	21	0	19	30	32	0
13-7711-007	8	339	301	0	37	57	11	0	19	178	30	0	103	58	37	0
13-7711-008	43	248	29	0	122	207	61	0	18	275	57	0	24	80	19	0

ATTACHMENT C – LEVEL OF SERVICE WORKSHEETS

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	4	475	13	9	6
Sign Control	Free			Yield	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	4	475	13	9	6
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	0		12	2	4	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		12	2	4	0
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	100		52	99	99	99
cM capacity (veh/h)	1623		991	894	891	1085

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	4	488	15
Volume Left	0	475	0
Volume Right	4	0	6
cSH	1623	988	960
Volume to Capacity	0.00	0.49	0.02
Queue Length 95th (ft)	0	70	1
Control Delay (s)	0.0	12.1	8.8
Lane LOS		B	A
Approach Delay (s)	0.0	12.1	8.8
Approach LOS		B	A

Intersection Summary			
Average Delay	11.9		
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	42	0	484	21	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	42	0	484	21	0
Pedestrians	2					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				970		
pX, platoon unblocked						
vC, conflicting volume	507	23	23			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	507	23	23			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	96	100			
cM capacity (veh/h)	525	1052	1589			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	47	484	21
Volume Left	5	0	0
Volume Right	42	0	0
cSH	950	1700	1700
Volume to Capacity	0.05	0.28	0.01
Queue Length 95th (ft)	4	0	0
Control Delay (s)	9.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	42	59	425	20	12	53
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	42	59	425	20	12	53
Pedestrians	10		1			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	1		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			682			
pX, platoon unblocked						
vC, conflicting volume	513	435			455	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	513	435			455	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	90			99	
cM capacity (veh/h)	511	616			1097	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	101	425	20	65
Volume Left	42	0	0	12
Volume Right	59	0	20	0
cSH	567	1700	1700	1097
Volume to Capacity	0.18	0.25	0.01	0.01
Queue Length 95th (ft)	16	0	0	1
Control Delay (s)	12.7	0.0	0.0	1.6
Lane LOS	B			A
Approach Delay (s)	12.7	0.0		1.6
Approach LOS	B			

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	33	15	13	7	16	22	50	718	38	20	451	45
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	33	15	13	7	16	22	50	718	38	20	451	45
Pedestrians		9			31			7			9	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			3			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								710			1055	
pX, platoon unblocked	0.76	0.76		0.76	0.76	0.76				0.76		
vC, conflicting volume	1398	1410	490	1409	1413	777	505			787		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1366	1380	490	1380	1385	545	505			558		
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 %	53	85	98	90	84	94	95			97		
cM capacity (veh/h)	71	98	571	71	97	394	1052			747		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	61	45	806	516
Volume Left	33	7	50	20
Volume Right	13	22	38	45
cSH	95	141	1052	747
Volume to Capacity	0.64	0.32	0.05	0.03
Queue Length 95th (ft)	78	32	4	2
Control Delay (s)	94.9	42.1	1.2	0.7
Lane LOS	F	E	A	A
Approach Delay (s)	94.9	42.1	1.2	0.7
Approach LOS	F	E		

Intersection Summary			
Average Delay	6.3		
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	58	58	395	58	13	97
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	58	58	395	58	13	97
Pedestrians	7		2			6
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		0			1
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			356			
pX, platoon unblocked						
vC, conflicting volume	556	437			460	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	556	437			460	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	91			99	
cM capacity (veh/h)	483	613			1095	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	116	453	110
Volume Left	58	0	13
Volume Right	58	58	0
cSH	540	1700	1095
Volume to Capacity	0.21	0.27	0.01
Queue Length 95th (ft)	20	0	1
Control Delay (s)	13.5	0.0	1.1
Lane LOS	B		A
Approach Delay (s)	13.5	0.0	1.1
Approach LOS	B		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	34	69	14	27	42	52	715	29	27	410	36
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	55	34	69	14	27	42	52	715	29	27	410	36
Pedestrians		8			11			27			7	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			2			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								369				
pX, platoon unblocked	0.69	0.69		0.69	0.69	0.69				0.69		
vC, conflicting volume	1386	1349	463	1440	1352	748	454			755		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1334	1280	463	1412	1285	403	454			414		
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 %	7	67	88	70	74	90	95			97		
cM capacity (veh/h)	59	103	582	47	102	437	1099			778		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	158	83	796	473
Volume Left	55	14	52	27
Volume Right	69	42	29	36
cSH	115	126	1099	778
Volume to Capacity	1.37	0.66	0.05	0.03
Queue Length 95th (ft)	271	88	4	3
Control Delay (s)	283.3	76.6	1.2	1.0
Lane LOS	F	F	A	A
Approach Delay (s)	283.3	76.6	1.2	1.0
Approach LOS	F	F		

Intersection Summary			
Average Delay	34.8		
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	132	167	17	125	76	128	12	197	202	24	76	63
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98			1.00	0.97	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.91			1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1671	1731		1648	1563			1759	1449	1673	1625	
Flt Permitted	0.63	1.00		0.64	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (perm)	1108	1731		1113	1563			1734	1449	1673	1625	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	132	167	17	125	76	128	12	197	202	24	76	63
RTOR Reduction (vph)	0	5	0	0	84	0	0	0	128	0	31	0
Lane Group Flow (vph)	132	179	0	125	120	0	0	209	74	24	108	0
Confl. Peds. (#/hr)	7		35	35		7	7		6	6		7
Confl. Bikes (#/hr)			11			8			11			5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Prot	NA	
Protected Phases		2			5			8		7	4	
Permitted Phases	2			5			8		8			
Actuated Green, G (s)	8.5	8.5		8.5	8.5			12.4	12.4	0.8	17.2	
Effective Green, g (s)	8.5	8.5		8.5	8.5			12.4	12.4	0.8	17.2	
Actuated g/C Ratio	0.25	0.25		0.25	0.25			0.37	0.37	0.02	0.51	
Clearance Time (s)	4.0	4.0		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	3.0	3.0	
Lane Grp Cap (vph)	279	436		280	394			638	533	39	829	
v/s Ratio Prot		0.10			0.08					c0.01	0.07	
v/s Ratio Perm	c0.12			0.11				c0.12	0.05			
v/c Ratio	0.47	0.41		0.45	0.31			0.33	0.14	0.62	0.13	
Uniform Delay, d1	10.7	10.5		10.6	10.2			7.7	7.1	16.3	4.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	0.6		1.1	0.4			0.3	0.1	25.5	0.1	
Delay (s)	12.0	11.1		11.8	10.6			8.0	7.2	41.8	4.4	
Level of Service	B	B		B	B			A	A	D	A	
Approach Delay (s)		11.5			11.1			7.6			9.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	33.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	179	217	45	39	67	30	49	589	49	55	344	90
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.2			4.2		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		0.99			0.98		1.00	0.99		1.00	0.99	
Flpb, ped/bikes		0.98			0.99		1.00	1.00		1.00	1.00	
Frt		0.99			0.97		1.00	0.99		1.00	0.97	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1653			1642		1676	1733		1676	1690	
Flt Permitted		0.82			0.83		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1385			1379		1676	1733		1676	1690	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	179	217	45	39	67	30	49	589	49	55	344	90
RTOR Reduction (vph)	0	6	0	0	16	0	0	4	0	0	13	0
Lane Group Flow (vph)	0	435	0	0	120	0	49	634	0	55	421	0
Confl. Peds. (#/hr)	34		53	53		34	16		34	34		16
Confl. Bikes (#/hr)			14			4			9			12
Parking (#/hr)						2						
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4								
Actuated Green, G (s)		19.3			19.3		5.1	28.8		5.2	28.9	
Effective Green, g (s)		18.8			18.8		4.6	29.3		4.7	29.4	
Actuated g/C Ratio		0.29			0.29		0.07	0.45		0.07	0.45	
Clearance Time (s)		3.7			3.7		3.5	4.5		3.5	4.5	
Vehicle Extension (s)		2.5			2.5		2.5	3.0		2.5	2.0	
Lane Grp Cap (vph)		400			398		118	781		121	764	
v/s Ratio Prot							0.03	c0.37		c0.03	0.25	
v/s Ratio Perm		c0.31			0.09							
v/c Ratio		1.09			0.30		0.42	0.81		0.45	0.55	
Uniform Delay, d1		23.1			18.0		28.9	15.5		28.9	13.0	
Progression Factor		1.00			1.00		1.16	0.66		1.00	1.00	
Incremental Delay, d2		70.2			0.3		0.9	4.9		2.0	2.9	
Delay (s)		93.3			18.3		34.4	15.1		30.9	15.8	
Level of Service		F			B		C	B		C	B	
Approach Delay (s)		93.3			18.3			16.5			17.5	
Approach LOS		F			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	36.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	1	2	0	484	63	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1	2	0	484	63	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				764		
pX, platoon unblocked						
vC, conflicting volume	547	63	63			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	547	63	63			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	498	1002	1540			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	3	484	63
Volume Left	1	0	0
Volume Right	2	0	0
cSH	749	1540	1700
Volume to Capacity	0.00	0.00	0.04
Queue Length 95th (ft)	0	0	0
Control Delay (s)	9.8	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.8	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	21	421	48	31	37
Sign Control	Free			Yield	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	21	421	48	31	37
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2		83	32	43	2
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2		83	32	43	2
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	99		50	94	96	97
cM capacity (veh/h)	1618		844	853	842	1080

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	31	469	68
Volume Left	10	421	0
Volume Right	21	0	37
cSH	1618	845	957
Volume to Capacity	0.01	0.56	0.07
Queue Length 95th (ft)	0	87	6
Control Delay (s)	2.4	14.5	9.0
Lane LOS	A	B	A
Approach Delay (s)	2.4	14.5	9.0
Approach LOS		B	A

Intersection Summary			
Average Delay	13.1		
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	186	0	450	53	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	15	186	0	450	53	0
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				918		
pX, platoon unblocked						
vC, conflicting volume	504	54	54			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	504	54	54			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	82	100			
cM capacity (veh/h)	527	1012	1550			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	201	450	53
Volume Left	15	0	0
Volume Right	186	0	0
cSH	947	1700	1700
Volume to Capacity	0.21	0.26	0.03
Queue Length 95th (ft)	20	0	0
Control Delay (s)	9.8	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.8	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	18	38	406	17	39	203
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	18	38	406	17	39	203
Pedestrians	5					1
Lane Width (ft)	12.0					12.0
Walking Speed (ft/s)	4.0					4.0
Percent Blockage	0					0
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			725			
pX, platoon unblocked						
vC, conflicting volume	700	420			428	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	700	420			428	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	94			97	
cM capacity (veh/h)	390	630			1127	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	56	423	242
Volume Left	18	0	39
Volume Right	38	17	0
cSH	526	1700	1127
Volume to Capacity	0.11	0.25	0.03
Queue Length 95th (ft)	9	0	3
Control Delay (s)	12.7	0.0	1.6
Lane LOS	B		A
Approach Delay (s)	12.7	0.0	1.6
Approach LOS	B		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	29	20	8	5	14	18	19	365	11	13	333	22
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	29	20	8	5	14	18	19	365	11	13	333	22
Pedestrians		1			13			4			3	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								718			1023	
pX, platoon unblocked												
vC, conflicting volume	808	798	349	814	804	386	356			389		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	808	798	349	814	804	386	356			389		
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 %	89	93	99	98	95	97	98			99		
cM capacity (veh/h)	272	307	691	267	305	653	1202			1157		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	57	37	395	368
Volume Left	29	5	19	13
Volume Right	8	18	11	22
cSH	311	401	1202	1157
Volume to Capacity	0.18	0.09	0.02	0.01
Queue Length 95th (ft)	16	8	1	1
Control Delay (s)	19.2	14.9	0.5	0.4
Lane LOS	C	B	A	A
Approach Delay (s)	19.2	14.9	0.5	0.4
Approach LOS	C	B		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	34	24	404	8	25	187
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	34	24	404	8	25	187
Pedestrians	2		1			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			348			
pX, platoon unblocked	0.94	0.94			0.94	
vC, conflicting volume	648	410			414	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	593	339			344	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	96			98	
cM capacity (veh/h)	429	659			1140	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	58	412	212
Volume Left	34	0	25
Volume Right	24	8	0
cSH	502	1700	1140
Volume to Capacity	0.12	0.24	0.02
Queue Length 95th (ft)	10	0	2
Control Delay (s)	13.1	0.0	1.1
Lane LOS	B		A
Approach Delay (s)	13.1	0.0	1.1
Approach LOS	B		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	9	12	19	30	32	14	351	22	19	318	21
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	12	9	12	20	31	33	15	366	23	20	331	22
Pedestrians		8			15			3			9	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			0			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								352				
pX, platoon unblocked	0.96	0.96		0.96	0.96	0.96				0.96		
vC, conflicting volume	854	822	353	823	822	401	361			404		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	824	791	353	792	791	350	361			353		
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 %	95	97	98	93	89	95	99			98		
cM capacity (veh/h)	231	293	684	267	293	649	1190			1138		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	34	84	403	373
Volume Left	12	20	15	20
Volume Right	12	33	23	22
cSH	329	363	1190	1138
Volume to Capacity	0.10	0.23	0.01	0.02
Queue Length 95th (ft)	9	22	1	1
Control Delay (s)	17.2	17.9	0.4	0.6
Lane LOS	C	C	A	A
Approach Delay (s)	17.2	17.9	0.4	0.6
Approach LOS	C	C		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	37	57	11	103	58	37	8	339	301	19	178	30
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98			1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.94			1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1676	1708		1643	1630			1763	1454	1676	1721	
Flt Permitted	0.70	1.00		0.71	1.00			0.99	1.00	0.95	1.00	
Satd. Flow (perm)	1227	1708		1232	1630			1756	1454	1676	1721	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	37	57	11	103	58	37	8	339	301	19	178	30
RTOR Reduction (vph)	0	9	0	0	32	0	0	0	100	0	4	0
Lane Group Flow (vph)	37	59	0	103	63	0	0	347	201	19	204	0
Confl. Peds. (#/hr)			18	18			2		1	1		2
Confl. Bikes (#/hr)			3			11			17			2
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Prot	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2		2			
Actuated Green, G (s)	9.2	9.2		9.2	9.2			44.4	44.4	0.8	49.2	
Effective Green, g (s)	9.2	9.2		9.2	9.2			44.4	44.4	0.8	49.2	
Actuated g/C Ratio	0.14	0.14		0.14	0.14			0.67	0.67	0.01	0.74	
Clearance Time (s)	4.0	4.0		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	3.0	3.0	
Lane Grp Cap (vph)	170	236		170	225			1174	972	20	1275	
v/s Ratio Prot		0.03			0.04					c0.01	0.12	
v/s Ratio Perm	0.03			c0.08				c0.20	0.14			
v/c Ratio	0.22	0.25		0.61	0.28			0.30	0.21	0.95	0.16	
Uniform Delay, d1	25.4	25.5		26.9	25.6			4.5	4.2	32.8	2.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	0.6		6.0	0.7			0.6	0.5	175.6	0.3	
Delay (s)	26.1	26.1		32.9	26.3			5.2	4.7	208.4	2.8	
Level of Service	C	C		C	C			A	A	F	A	
Approach Delay (s)		26.1			29.7			5.0			20.0	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	66.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	122	207	61	24	80	19	43	248	29	18	275	57
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		0.98	1.00	
Frt		0.98			0.98		1.00	0.98		1.00	0.97	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1671			1693		1671	1728		1648	1713	
Flt Permitted		0.86			0.90		0.51	1.00		0.58	1.00	
Satd. Flow (perm)		1467			1544		898	1728		999	1713	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	122	207	61	24	80	19	43	248	29	18	275	57
RTOR Reduction (vph)	0	17	0	0	11	0	0	11	0	0	19	0
Lane Group Flow (vph)	0	373	0	0	112	0	43	266	0	18	313	0
Confl. Peds. (#/hr)	14		41	41		14	7		20	20		7
Confl. Bikes (#/hr)			16			1			3			5
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		16.0			16.0		16.0	16.0		16.0	16.0	
Effective Green, g (s)		16.0			16.0		16.0	16.0		16.0	16.0	
Actuated g/C Ratio		0.40			0.40		0.40	0.40		0.40	0.40	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)		586			617		359	691		399	685	
v/s Ratio Prot								0.15			c0.18	
v/s Ratio Perm		c0.25			0.07		0.05			0.02		
v/c Ratio		0.64			0.18		0.12	0.39		0.05	0.46	
Uniform Delay, d1		9.7			7.8		7.6	8.5		7.3	8.8	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		5.2			0.6		0.7	1.6		0.2	2.2	
Delay (s)		14.9			8.4		8.2	10.1		7.5	11.0	
Level of Service		B			A		A	B		A	B	
Approach Delay (s)		14.9			8.4			9.9			10.8	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	0	0	444	242	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	0	444	242	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				808		
pX, platoon unblocked						
vC, conflicting volume	686	242	242			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	686	242	242			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	413	797	1324			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	0	444	242
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1324	1700
Volume to Capacity	0.00	0.00	0.14
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	28.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: Shellmound St & I-80 On Ramp

3/17/2014

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	4	478	13	9	6
Sign Control	Free			Yield	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	4	478	13	9	6
Pedestrians	7					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	1					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		20	2	4	7
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		20	2	4	7
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	100		51	99	99	99
cM capacity (veh/h)	1623		975	894	891	1069

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	4	491	15
Volume Left	0	478	0
Volume Right	4	0	6
cSH	1623	973	955
Volume to Capacity	0.00	0.50	0.02
Queue Length 95th (ft)	0	73	1
Control Delay (s)	0.0	12.4	8.8
Lane LOS		B	A
Approach Delay (s)	0.0	12.4	8.8
Approach LOS		B	A

Intersection Summary			
Average Delay	12.2		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	51	0	487	21	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	51	0	487	21	0
Pedestrians	2					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				970		
pX, platoon unblocked						
vC, conflicting volume	510	23	23			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	510	23	23			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	95	100			
cM capacity (veh/h)	522	1052	1589			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	56	487	21
Volume Left	5	0	0
Volume Right	51	0	0
cSH	965	1700	1700
Volume to Capacity	0.06	0.29	0.01
Queue Length 95th (ft)	5	0	0
Control Delay (s)	9.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	59	59	428	27	12	60
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	59	59	428	27	12	60
Pedestrians	10		1			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	1		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			682			
pX, platoon unblocked						
vC, conflicting volume	536	452			465	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	536	452			465	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	90			99	
cM capacity (veh/h)	495	603			1087	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	118	455	72
Volume Left	59	0	12
Volume Right	59	27	0
cSH	544	1700	1087
Volume to Capacity	0.22	0.27	0.01
Queue Length 95th (ft)	20	0	1
Control Delay (s)	13.4	0.0	1.5
Lane LOS	B		A
Approach Delay (s)	13.4	0.0	1.5
Approach LOS	B		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	39	16	13	7	20	22	50	718	38	20	451	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	39	16	13	7	20	22	50	718	38	20	451	58
Pedestrians		9			31			7			9	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			3			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								710			1055	
pX, platoon unblocked	0.76	0.76		0.76	0.76	0.76				0.76		
vC, conflicting volume	1407	1416	496	1416	1426	777	518			787		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1377	1389	496	1389	1402	543	518			556		
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 %	41	83	98	90	79	94	95			97		
cM capacity (veh/h)	66	96	566	69	95	394	1040			747		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	68	49	806	529
Volume Left	39	7	50	20
Volume Right	13	22	38	58
cSH	88	133	1040	747
Volume to Capacity	0.78	0.37	0.05	0.03
Queue Length 95th (ft)	99	38	4	2
Control Delay (s)	125.7	47.1	1.2	0.7
Lane LOS	F	E	A	A
Approach Delay (s)	125.7	47.1	1.2	0.7
Approach LOS	F	E		

Intersection Summary			
Average Delay	8.4		
Intersection Capacity Utilization	81.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	58	66	419	58	17	114
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	58	66	419	58	17	114
Pedestrians	7		2			6
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		0			1
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			356			
pX, platoon unblocked	0.98	0.98			0.98	
vC, conflicting volume	605	461			484	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	587	441			464	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	89			98	
cM capacity (veh/h)	452	598			1070	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	124	477	131
Volume Left	58	0	17
Volume Right	66	58	0
cSH	520	1700	1070
Volume to Capacity	0.24	0.28	0.02
Queue Length 95th (ft)	23	0	1
Control Delay (s)	14.1	0.0	1.2
Lane LOS	B		A
Approach Delay (s)	14.1	0.0	1.2
Approach LOS	B		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	42.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	36	71	14	31	42	56	715	29	27	410	36
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	55	36	71	14	31	42	56	715	29	27	410	36
Pedestrians		8			11			27			7	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			2			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								369				
pX, platoon unblocked	0.68	0.68		0.68	0.68	0.68				0.68		
vC, conflicting volume	1396	1357	463	1450	1360	748	454			755		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1348	1291	463	1428	1296	399	454			410		
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 %	0	64	88	68	69	90	95			97		
cM capacity (veh/h)	55	101	582	44	100	438	1099			778		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	162	87	800	473
Volume Left	55	14	56	27
Volume Right	71	42	29	36
cSH	110	120	1099	778
Volume to Capacity	1.48	0.72	0.05	0.03
Queue Length 95th (ft)	293	100	4	3
Control Delay (s)	327.8	89.7	1.3	1.0
Lane LOS	F	F	A	A
Approach Delay (s)	327.8	89.7	1.3	1.0
Approach LOS	F	F		

Intersection Summary			
Average Delay	41.0		
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	167	17	125	76	136	12	211	202	30	83	67
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98			1.00	0.96	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.90			1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1671	1731		1646	1560			1760	1446	1673	1626	
Flt Permitted	0.63	1.00		0.64	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (perm)	1100	1731		1112	1560			1734	1446	1673	1626	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	135	167	17	125	76	136	12	211	202	30	83	67
RTOR Reduction (vph)	0	5	0	0	81	0	0	0	134	0	35	0
Lane Group Flow (vph)	135	179	0	125	131	0	0	223	68	30	115	0
Confl. Peds. (#/hr)	7		35	35		7	7		6	6		7
Confl. Bikes (#/hr)			11			8			11			5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Prot	NA	
Protected Phases		2			5			8		7	4	
Permitted Phases	2			5			8		8			
Actuated Green, G (s)	11.5	11.5		11.5	11.5			11.6	11.6	0.8	16.4	
Effective Green, g (s)	11.5	11.5		11.5	11.5			11.6	11.6	0.8	16.4	
Actuated g/C Ratio	0.32	0.32		0.32	0.32			0.32	0.32	0.02	0.46	
Clearance Time (s)	4.0	4.0		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	3.0	3.0	
Lane Grp Cap (vph)	352	554		356	499			560	467	37	742	
v/s Ratio Prot		0.10			0.08					c0.02	0.07	
v/s Ratio Perm	c0.12			0.11				c0.13	0.05			
v/c Ratio	0.38	0.32		0.35	0.26			0.40	0.15	0.81	0.15	
Uniform Delay, d1	9.5	9.3		9.3	9.1			9.4	8.6	17.5	5.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.3		0.6	0.3			0.5	0.1	76.5	0.1	
Delay (s)	10.2	9.6		9.9	9.3			9.9	8.8	93.9	5.8	
Level of Service	B	A		A	A			A	A	F	A	
Approach Delay (s)		9.8			9.6			9.4			20.5	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	35.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	179	222	46	39	72	30	52	593	49	55	346	90
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.2			4.2		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		0.99			0.98		1.00	1.00		1.00	0.99	
Flpb, ped/bikes		0.98			0.99		1.00	1.00		1.00	1.00	
Frt		0.99			0.97		1.00	0.99		1.00	0.97	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1654			1644		1676	1738		1676	1690	
Flt Permitted		0.82			0.83		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1382			1384		1676	1738		1676	1690	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	179	222	46	39	72	30	52	593	49	55	346	90
RTOR Reduction (vph)	0	6	0	0	15	0	0	4	0	0	13	0
Lane Group Flow (vph)	0	441	0	0	126	0	52	638	0	55	423	0
Confl. Peds. (#/hr)	34		53	53		34	34		16	34		16
Confl. Bikes (#/hr)			14			9			5			12
Parking (#/hr)						2						
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4								
Actuated Green, G (s)		19.3			19.3		5.1	28.8		5.2	28.9	
Effective Green, g (s)		18.8			18.8		4.6	29.3		4.7	29.4	
Actuated g/C Ratio		0.29			0.29		0.07	0.45		0.07	0.45	
Clearance Time (s)		3.7			3.7		3.5	4.5		3.5	4.5	
Vehicle Extension (s)		2.5			2.5		2.5	3.0		2.5	2.0	
Lane Grp Cap (vph)		399			400		118	783		121	764	
v/s Ratio Prot							0.03	c0.37		c0.03	0.25	
v/s Ratio Perm		c0.32			0.09							
v/c Ratio		1.10			0.32		0.44	0.82		0.45	0.55	
Uniform Delay, d1		23.1			18.1		29.0	15.5		28.9	13.0	
Progression Factor		1.00			1.00		1.16	0.66		1.00	1.00	
Incremental Delay, d2		76.3			0.3		1.0	5.0		2.0	2.9	
Delay (s)		99.4			18.4		34.5	15.2		30.9	15.9	
Level of Service		F			B		C	B		C	B	
Approach Delay (s)		99.4			18.4			16.7			17.6	
Approach LOS		F			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	37.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	21	33	453	93	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	21	33	453	93	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				578		
pX, platoon unblocked						
vC, conflicting volume	624	106	118			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	624	106	118			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	98			
cM capacity (veh/h)	439	949	1470			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	31	486	118
Volume Left	10	33	0
Volume Right	21	0	25
cSH	690	1470	1700
Volume to Capacity	0.04	0.02	0.07
Queue Length 95th (ft)	4	2	0
Control Delay (s)	10.5	0.7	0.0
Lane LOS	B	A	
Approach Delay (s)	10.5	0.7	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	21	427	48	31	37
Sign Control	Free			Yield	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	21	427	48	31	37
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2		83	32	43	2
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2		83	32	43	2
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	99		49	94	96	97
cM capacity (veh/h)	1618		844	853	842	1080

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	31	475	68
Volume Left	10	427	0
Volume Right	21	0	37
cSH	1618	845	957
Volume to Capacity	0.01	0.56	0.07
Queue Length 95th (ft)	0	89	6
Control Delay (s)	2.4	14.6	9.0
Lane LOS	A	B	A
Approach Delay (s)	2.4	14.6	9.0
Approach LOS		B	A

Intersection Summary			
Average Delay	13.3		
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	193	0	456	53	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	15	193	0	456	53	0
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				918		
pX, platoon unblocked						
vC, conflicting volume	510	54	54			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	510	54	54			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	81	100			
cM capacity (veh/h)	523	1012	1550			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	208	456	53
Volume Left	15	0	0
Volume Right	193	0	0
cSH	948	1700	1700
Volume to Capacity	0.22	0.27	0.03
Queue Length 95th (ft)	21	0	0
Control Delay (s)	9.9	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.9	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	31	38	412	25	39	210
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	31	38	412	25	39	210
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			725			
pX, platoon unblocked						
vC, conflicting volume	718	430			442	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	718	430			442	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	94			96	
cM capacity (veh/h)	381	623			1113	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	69	437	249
Volume Left	31	0	39
Volume Right	38	25	0
cSH	484	1700	1113
Volume to Capacity	0.14	0.26	0.04
Queue Length 95th (ft)	12	0	3
Control Delay (s)	13.7	0.0	1.6
Lane LOS	B		A
Approach Delay (s)	13.7	0.0	1.6
Approach LOS	B		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	36	21	8	5	16	18	19	365	11	13	333	33
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	36	21	8	5	16	18	19	365	11	13	333	33
Pedestrians		1			13			4			3	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								718			1023	
pX, platoon unblocked												
vC, conflicting volume	814	804	354	820	814	386	367			389		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	814	804	354	820	814	386	367			389		
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 %	87	93	99	98	95	97	98			99		
cM capacity (veh/h)	268	305	686	264	300	653	1191			1157		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	65	39	395	379
Volume Left	36	5	19	13
Volume Right	8	18	11	33
cSH	302	390	1191	1157
Volume to Capacity	0.22	0.10	0.02	0.01
Queue Length 95th (ft)	20	8	1	1
Control Delay (s)	20.1	15.2	0.5	0.4
Lane LOS	C	C	A	A
Approach Delay (s)	20.1	15.2	0.5	0.4
Approach LOS	C	C		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	34	30	422	8	31	209
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	34	30	422	8	31	209
Pedestrians	2		1			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			348			
pX, platoon unblocked	0.93	0.93			0.93	
vC, conflicting volume	700	428			432	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	640	347			352	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	95			97	
cM capacity (veh/h)	397	646			1121	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	64	430	240
Volume Left	34	0	31
Volume Right	30	8	0
cSH	484	1700	1121
Volume to Capacity	0.13	0.25	0.03
Queue Length 95th (ft)	11	0	2
Control Delay (s)	13.6	0.0	1.3
Lane LOS	B		A
Approach Delay (s)	13.6	0.0	1.3
Approach LOS	B		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	11	15	19	33	32	17	351	22	19	318	21
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	12	11	15	19	33	32	17	351	22	19	318	21
Pedestrians		8			15			3			9	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			0			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								352				
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	828	796	340	801	796	386	347			388		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	796	763	340	768	762	333	347			335		
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 %	95	96	98	93	89	95	99			98		
cM capacity (veh/h)	241	303	696	275	304	663	1204			1154		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	38	84	390	358
Volume Left	12	19	17	19
Volume Right	15	32	22	21
cSH	353	371	1204	1154
Volume to Capacity	0.11	0.23	0.01	0.02
Queue Length 95th (ft)	9	21	1	1
Control Delay (s)	16.4	17.5	0.5	0.6
Lane LOS	C	C	A	A
Approach Delay (s)	16.4	17.5	0.5	0.6
Approach LOS	C	C		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	57	11	103	58	43	8	349	301	26	188	35
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98			1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.94			1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1676	1708		1643	1618			1763	1454	1676	1717	
Flt Permitted	0.69	1.00		0.71	1.00			0.99	1.00	0.95	1.00	
Satd. Flow (perm)	1221	1708		1233	1618			1755	1454	1676	1717	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	39	57	11	103	58	43	8	349	301	26	188	35
RTOR Reduction (vph)	0	9	0	0	37	0	0	0	105	0	5	0
Lane Group Flow (vph)	39	59	0	103	64	0	0	357	196	26	218	0
Confl. Peds. (#/hr)			18	18			2		1	1		2
Confl. Bikes (#/hr)			3			11			17			2
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Prot	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2		2			
Actuated Green, G (s)	9.2	9.2		9.2	9.2			42.6	42.6	1.6	48.2	
Effective Green, g (s)	9.2	9.2		9.2	9.2			42.6	42.6	1.6	48.2	
Actuated g/C Ratio	0.14	0.14		0.14	0.14			0.65	0.65	0.02	0.74	
Clearance Time (s)	4.0	4.0		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	3.0	3.0	
Lane Grp Cap (vph)	171	240		173	227			1143	947	41	1265	
v/s Ratio Prot		0.03			0.04					c0.02	0.13	
v/s Ratio Perm	0.03			c0.08				c0.20	0.13			
v/c Ratio	0.23	0.24		0.60	0.28			0.31	0.21	0.63	0.17	
Uniform Delay, d1	24.9	25.0		26.4	25.1			5.0	4.6	31.6	2.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.5		5.4	0.7			0.7	0.5	27.9	0.3	
Delay (s)	25.6	25.5		31.8	25.8			5.7	5.1	59.5	2.9	
Level of Service	C	C		C	C			A	A	E	A	
Approach Delay (s)		25.6			28.8			5.4			8.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	65.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	122	212	63	24	84	19	45	252	29	18	278	57
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		0.99			0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		0.98	1.00	
Frt		0.98			0.98		1.00	0.98		1.00	0.97	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1670			1695		1671	1729		1648	1714	
Flt Permitted		0.87			0.91		0.51	1.00		0.57	1.00	
Satd. Flow (perm)		1468			1549		892	1729		991	1714	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	122	212	63	24	84	19	45	252	29	18	278	57
RTOR Reduction (vph)	0	17	0	0	11	0	0	10	0	0	19	0
Lane Group Flow (vph)	0	380	0	0	116	0	45	271	0	18	316	0
Confl. Peds. (#/hr)	14		41	41		14	7		20	20		7
Confl. Bikes (#/hr)			16			1			3			5
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		16.0			16.0		16.0	16.0		16.0	16.0	
Effective Green, g (s)		16.0			16.0		16.0	16.0		16.0	16.0	
Actuated g/C Ratio		0.40			0.40		0.40	0.40		0.40	0.40	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)		587			619		356	691		396	685	
v/s Ratio Prot								0.16			c0.18	
v/s Ratio Perm		c0.26			0.07		0.05			0.02		
v/c Ratio		0.65			0.19		0.13	0.39		0.05	0.46	
Uniform Delay, d1		9.7			7.8		7.6	8.5		7.3	8.8	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		5.5			0.7		0.7	1.7		0.2	2.2	
Delay (s)		15.2			8.4		8.3	10.2		7.5	11.1	
Level of Service		B			A		A	B		A	B	
Approach Delay (s)		15.2			8.4			9.9			10.9	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	14	28	24	428	221	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	14	28	24	428	221	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				598		
pX, platoon unblocked	0.97					
vC, conflicting volume	707	231	241			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	683	231	241			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	97	98			
cM capacity (veh/h)	395	808	1326			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	42	452	241
Volume Left	14	24	0
Volume Right	28	0	20
cSH	600	1326	1700
Volume to Capacity	0.07	0.02	0.14
Queue Length 95th (ft)	6	1	0
Control Delay (s)	11.5	0.6	0.0
Lane LOS	B	A	
Approach Delay (s)	11.5	0.6	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	4	506	13	9	6
Sign Control	Free			Yield	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	4	506	13	9	6
Pedestrians	7					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	1					
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	0		20	2	4	7
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		20	2	4	7
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	100		48	99	99	99
cM capacity (veh/h)	1623		975	894	891	1069

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	4	519	15
Volume Left	0	506	0
Volume Right	4	0	6
cSH	1623	973	955
Volume to Capacity	0.00	0.53	0.02
Queue Length 95th (ft)	0	81	1
Control Delay (s)	0.0	12.8	8.8
Lane LOS		B	A
Approach Delay (s)	0.0	12.8	8.8
Approach LOS		B	A

Intersection Summary			
Average Delay	12.6		
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	75	0	515	21	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	75	0	515	21	0
Pedestrians	2					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				970		
pX, platoon unblocked						
vC, conflicting volume	538	23	23			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	538	23	23			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	93	100			
cM capacity (veh/h)	503	1052	1589			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	80	515	21
Volume Left	5	0	0
Volume Right	75	0	0
cSH	985	1700	1700
Volume to Capacity	0.08	0.30	0.01
Queue Length 95th (ft)	7	0	0
Control Delay (s)	9.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	9.0	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	40.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	86	59	456	48	12	84
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	86	59	456	48	12	84
Pedestrians	10		1			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	1		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			682			
pX, platoon unblocked						
vC, conflicting volume	599	490			514	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	599	490			514	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	90			99	
cM capacity (veh/h)	455	573			1043	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	145	504	96
Volume Left	86	0	12
Volume Right	59	48	0
cSH	497	1700	1043
Volume to Capacity	0.29	0.30	0.01
Queue Length 95th (ft)	30	0	1
Control Delay (s)	15.2	0.0	1.2
Lane LOS	C		A
Approach Delay (s)	15.2	0.0	1.2
Approach LOS	C		

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	51	25	13	7	31	22	50	734	38	20	487	73
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	51	25	13	7	31	22	50	734	38	20	487	73
Pedestrians		9			31			7			9	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			3			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								710			1055	
pX, platoon unblocked	0.76	0.76		0.76	0.76	0.76				0.76		
vC, conflicting volume	1472	1476	540	1480	1493	793	569			803		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1463	1468	540	1474	1491	564	569			577		
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 %	0	71	98	87	63	94	95			97		
cM capacity (veh/h)	49	86	535	53	83	384	996			733		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	89	60	822	580
Volume Left	51	7	50	20
Volume Right	13	22	38	73
cSH	66	107	996	733
Volume to Capacity	1.35	0.56	0.05	0.03
Queue Length 95th (ft)	185	66	4	2
Control Delay (s)	339.0	74.8	1.3	0.7
Lane LOS	F	F	A	A
Approach Delay (s)	339.0	74.8	1.3	0.7
Approach LOS	F	F		

Intersection Summary			
Average Delay	23.3		
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	88	66	468	70	17	166
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	88	66	468	70	17	166
Pedestrians	7		2			6
Lane Width (ft)	12.0		12.0			12.0
Walking Speed (ft/s)	4.0		4.0			4.0
Percent Blockage	1		0			1
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			356			
pX, platoon unblocked	0.92	0.92			0.92	
vC, conflicting volume	712	516			545	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	640	426			457	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	88			98	
cM capacity (veh/h)	393	570			1005	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	154	538	183
Volume Left	88	0	17
Volume Right	66	70	0
cSH	453	1700	1005
Volume to Capacity	0.34	0.32	0.02
Queue Length 95th (ft)	37	0	1
Control Delay (s)	17.0	0.0	1.0
Lane LOS	C		A
Approach Delay (s)	17.0	0.0	1.0
Approach LOS	C		

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	66	37	71	14	33	42	56	720	29	27	418	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	66	37	71	14	33	42	56	720	29	27	418	65
Pedestrians		8			11			27			7	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			2			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								369				
pX, platoon unblocked	0.68	0.68		0.68	0.68	0.68				0.68		
vC, conflicting volume	1424	1384	486	1478	1402	752	491			760		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1390	1331	486	1469	1357	406	491			417		
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 %	0	61	87	65	64	90	95			97		
cM capacity (veh/h)	49	95	565	40	92	434	1065			773		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	174	89	805	510
Volume Left	66	14	56	27
Volume Right	71	42	29	65
cSH	93	110	1065	773
Volume to Capacity	1.87	0.81	0.05	0.03
Queue Length 95th (ft)	364	116	4	3
Control Delay (s)	504.3	112.7	1.3	1.0
Lane LOS	F	F	A	A
Approach Delay (s)	504.3	112.7	1.3	1.0
Approach LOS	F	F		

Intersection Summary			
Average Delay	63.0		
Intersection Capacity Utilization	86.5%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	170	17	169	81	136	12	270	239	30	164	68
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98			1.00	0.96	1.00	0.99	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.91			1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1670	1731		1641	1564			1761	1447	1676	1673	
Flt Permitted	0.62	1.00		0.64	1.00			0.98	1.00	0.95	1.00	
Satd. Flow (perm)	1094	1731		1105	1564			1737	1447	1676	1673	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	135	170	17	169	81	136	12	270	239	30	164	68
RTOR Reduction (vph)	0	5	0	0	75	0	0	0	122	0	17	0
Lane Group Flow (vph)	135	182	0	169	142	0	0	282	117	30	215	0
Confl. Peds. (#/hr)	7		35	35		7	7		6	6		7
Confl. Bikes (#/hr)			11			8			11			5
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Prot	NA	
Protected Phases		2			5			8		7	4	
Permitted Phases	2			5			8		8			
Actuated Green, G (s)	14.1	14.1		14.1	14.1			14.4	14.4	1.9	20.3	
Effective Green, g (s)	14.1	14.1		14.1	14.1			14.4	14.4	1.9	20.3	
Actuated g/C Ratio	0.33	0.33		0.33	0.33			0.34	0.34	0.04	0.48	
Clearance Time (s)	4.0	4.0		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	3.0	3.0	
Lane Grp Cap (vph)	363	575		367	520			589	491	75	800	
v/s Ratio Prot		0.11			0.09					0.02	c0.13	
v/s Ratio Perm	0.12			c0.15				c0.16	0.08			
v/c Ratio	0.37	0.32		0.46	0.27			0.48	0.24	0.40	0.27	
Uniform Delay, d1	10.8	10.6		11.2	10.4			11.0	10.1	19.7	6.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.6	0.3		0.9	0.3			0.6	0.3	3.5	0.2	
Delay (s)	11.4	10.9		12.1	10.7			11.7	10.3	23.2	6.8	
Level of Service	B	B		B	B			B	B	C	A	
Approach Delay (s)		11.1			11.3			11.0			8.7	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	42.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	184	243	60	39	98	30	68	593	49	55	346	97
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.2			4.2		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		0.98			0.98		1.00	1.00		1.00	0.99	
Flpb, ped/bikes		0.98			0.99		1.00	1.00		1.00	1.00	
Frt		0.98			0.98		1.00	0.99		1.00	0.97	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1651			1664		1676	1738		1676	1686	
Flt Permitted		0.80			0.84		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1350			1409		1676	1738		1676	1686	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	184	243	60	39	98	30	68	593	49	55	346	97
RTOR Reduction (vph)	0	8	0	0	12	0	0	4	0	0	14	0
Lane Group Flow (vph)	0	479	0	0	155	0	68	638	0	55	429	0
Confl. Peds. (#/hr)	34		53	53		34	34		16	34		16
Confl. Bikes (#/hr)			14			9			5			12
Parking (#/hr)						2						
Turn Type	Perm	NA		Perm	NA		Prot	NA		Prot	NA	
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8			4								
Actuated Green, G (s)		19.3			19.3		5.4	28.8		5.2	28.6	
Effective Green, g (s)		18.8			18.8		4.9	29.3		4.7	29.1	
Actuated g/C Ratio		0.29			0.29		0.08	0.45		0.07	0.45	
Clearance Time (s)		3.7			3.7		3.5	4.5		3.5	4.5	
Vehicle Extension (s)		2.5			2.5		2.5	3.0		2.5	2.0	
Lane Grp Cap (vph)		390			407		126	783		121	754	
v/s Ratio Prot							c0.04	c0.37		0.03	0.25	
v/s Ratio Perm		c0.36			0.11							
v/c Ratio		1.23			0.38		0.54	0.82		0.45	0.57	
Uniform Delay, d1		23.1			18.4		29.0	15.5		28.9	13.3	
Progression Factor		1.00			1.00		1.14	0.66		1.00	1.00	
Incremental Delay, d2		123.6			0.4		1.8	5.0		2.0	3.1	
Delay (s)		146.7			18.9		34.8	15.2		30.9	16.4	
Level of Service		F			B		C	B		C	B	
Approach Delay (s)		146.7			18.9			17.1			18.0	
Approach LOS		F			B			B			B	

Intersection Summary			
HCM 2000 Control Delay	51.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.2
Intersection Capacity Utilization	99.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	21	33	502	145	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	21	33	502	145	25
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				578		
pX, platoon unblocked						
vC, conflicting volume	726	158	170			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	726	158	170			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	98	98			
cM capacity (veh/h)	383	888	1407			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	31	535	170
Volume Left	10	33	0
Volume Right	21	0	25
cSH	623	1407	1700
Volume to Capacity	0.05	0.02	0.10
Queue Length 95th (ft)	4	2	0
Control Delay (s)	11.1	0.7	0.0
Lane LOS	B	A	
Approach Delay (s)	11.1	0.7	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	21	479	48	31	37
Sign Control	Free			Yield	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	10	21	479	48	31	37
Pedestrians					2	
Lane Width (ft)					12.0	
Walking Speed (ft/s)					4.0	
Percent Blockage					0	
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2		83	32	43	2
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2		83	32	43	2
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	99		43	94	96	97
cM capacity (veh/h)	1618		844	853	842	1080

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	31	527	68
Volume Left	10	479	0
Volume Right	21	0	37
cSH	1618	844	957
Volume to Capacity	0.01	0.62	0.07
Queue Length 95th (ft)	0	112	6
Control Delay (s)	2.4	16.1	9.0
Lane LOS	A	C	A
Approach Delay (s)	2.4	16.1	9.0
Approach LOS		C	A

Intersection Summary			
Average Delay	14.6		
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	217	0	508	53	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	15	217	0	508	53	0
Pedestrians	1					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				918		
pX, platoon unblocked						
vC, conflicting volume	562	54	54			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	562	54	54			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	79	100			
cM capacity (veh/h)	488	1012	1550			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	232	508	53
Volume Left	15	0	0
Volume Right	217	0	0
cSH	946	1700	1700
Volume to Capacity	0.25	0.30	0.03
Queue Length 95th (ft)	24	0	0
Control Delay (s)	10.0	0.0	0.0
Lane LOS	B		
Approach Delay (s)	10.0	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	55	38	464	46	39	234
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	55	38	464	46	39	234
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			725			
pX, platoon unblocked	0.94	0.94			0.94	
vC, conflicting volume	804	492			515	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	760	429			453	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	84	94			96	
cM capacity (veh/h)	337	587			1038	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	93	510	273
Volume Left	55	0	39
Volume Right	38	46	0
cSH	408	1700	1038
Volume to Capacity	0.23	0.30	0.04
Queue Length 95th (ft)	22	0	3
Control Delay (s)	16.4	0.0	1.6
Lane LOS	C		A
Approach Delay (s)	16.4	0.0	1.6
Approach LOS	C		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	50	29	8	5	24	18	19	379	11	13	380	49
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	50	29	8	5	24	18	19	379	11	13	380	49
Pedestrians		1			13			4			3	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		0			1			0			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								718			1023	
pX, platoon unblocked												
vC, conflicting volume	887	872	410	892	892	400	430			403		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	887	872	410	892	892	400	430			403		
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 %	78	90	99	98	91	97	98			99		
cM capacity (veh/h)	232	277	639	228	270	641	1129			1143		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	87	47	409	442
Volume Left	50	5	19	13
Volume Right	8	18	11	49
cSH	262	339	1129	1143
Volume to Capacity	0.33	0.14	0.02	0.01
Queue Length 95th (ft)	35	12	1	1
Control Delay (s)	25.5	17.3	0.6	0.4
Lane LOS	D	C	A	A
Approach Delay (s)	25.5	17.3	0.6	0.4
Approach LOS	D	C		

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	74	30	495	18	31	258
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	74	30	495	18	31	258
Pedestrians	2		1			
Lane Width (ft)	12.0		12.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			348			
pX, platoon unblocked	0.88	0.88			0.88	
vC, conflicting volume	827	506			515	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	734	368			379	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	78	95			97	
cM capacity (veh/h)	329	594			1035	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	104	513	289
Volume Left	74	0	31
Volume Right	30	18	0
cSH	378	1700	1035
Volume to Capacity	0.28	0.30	0.03
Queue Length 95th (ft)	28	0	2
Control Delay (s)	18.1	0.0	1.2
Lane LOS	C		A
Approach Delay (s)	18.1	0.0	1.2
Approach LOS	C		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	22	12	15	19	33	32	17	355	22	19	325	61
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	22	12	15	19	33	32	17	355	22	19	325	61
Pedestrians		8			15			3			9	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			0			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								352				
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	859	828	366	832	847	390	394			392		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	828	795	366	801	816	337	394			339		
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 %	90	96	98	93	88	95	99			98		
cM capacity (veh/h)	228	290	673	259	283	660	1157			1150		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	49	84	394	405
Volume Left	22	19	17	19
Volume Right	15	32	22	61
cSH	306	352	1157	1150
Volume to Capacity	0.16	0.24	0.01	0.02
Queue Length 95th (ft)	14	23	1	1
Control Delay (s)	19.0	18.4	0.5	0.6
Lane LOS	C	C	A	A
Approach Delay (s)	19.0	18.4	0.5	0.6
Approach LOS	C	C		

Intersection Summary				
Average Delay		3.1		
Intersection Capacity Utilization		44.0%	ICU Level of Service	A
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	60	11	144	61	43	8	431	336	26	277	36
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.98			1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.94			1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1676	1711		1642	1627			1763	1453	1676	1730	
Flt Permitted	0.69	1.00		0.71	1.00			0.99	1.00	0.95	1.00	
Satd. Flow (perm)	1217	1711		1228	1627			1755	1453	1676	1730	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	60	11	144	61	43	8	431	336	26	277	36
RTOR Reduction (vph)	0	9	0	0	35	0	0	0	130	0	4	0
Lane Group Flow (vph)	40	62	0	144	69	0	0	439	206	26	309	0
Confl. Peds. (#/hr)			18	18			2		1	1		2
Confl. Bikes (#/hr)			3			11			17			2
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Prot	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8			2		2			
Actuated Green, G (s)	12.9	12.9		12.9	12.9			42.0	42.0	1.6	47.6	
Effective Green, g (s)	12.9	12.9		12.9	12.9			42.0	42.0	1.6	47.6	
Actuated g/C Ratio	0.19	0.19		0.19	0.19			0.61	0.61	0.02	0.69	
Clearance Time (s)	4.0	4.0		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	3.0	3.0	
Lane Grp Cap (vph)	229	322		231	306			1076	890	39	1202	
v/s Ratio Prot		0.04			0.04					c0.02	0.18	
v/s Ratio Perm	0.03			c0.12				c0.25	0.14			
v/c Ratio	0.17	0.19		0.62	0.23			0.41	0.23	0.67	0.26	
Uniform Delay, d1	23.3	23.4		25.6	23.6			6.8	6.0	33.2	3.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	0.3		5.2	0.4			1.1	0.6	35.5	0.5	
Delay (s)	23.7	23.7		30.7	23.9			8.0	6.6	68.7	4.4	
Level of Service	C	C		C	C			A	A	E	A	
Approach Delay (s)		23.7			27.9			7.4			9.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	68.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	126	229	80	24	103	19	63	252	29	18	278	64
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		0.98			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		0.98	1.00	
Frt		0.98			0.98		1.00	0.98		1.00	0.97	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1663			1705		1671	1729		1648	1709	
Flt Permitted		0.87			0.91		0.50	1.00		0.57	1.00	
Satd. Flow (perm)		1460			1564		877	1729		991	1709	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	126	229	80	24	103	19	63	252	29	18	278	64
RTOR Reduction (vph)	0	20	0	0	11	0	0	10	0	0	21	0
Lane Group Flow (vph)	0	415	0	0	135	0	63	271	0	18	321	0
Confl. Peds. (#/hr)	14		41	41		14	7		20	20		7
Confl. Bikes (#/hr)			16			1			3			5
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		16.0			16.0		16.0	16.0		16.0	16.0	
Effective Green, g (s)		16.0			16.0		16.0	16.0		16.0	16.0	
Actuated g/C Ratio		0.40			0.40		0.40	0.40		0.40	0.40	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Grp Cap (vph)		584			625		350	691		396	683	
v/s Ratio Prot								0.16			c0.19	
v/s Ratio Perm		c0.28			0.09		0.07			0.02		
v/c Ratio		0.71			0.22		0.18	0.39		0.05	0.47	
Uniform Delay, d1		10.1			7.9		7.8	8.5		7.3	8.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		7.2			0.8		1.1	1.7		0.2	2.3	
Delay (s)		17.2			8.7		8.9	10.2		7.5	11.2	
Level of Service		B			A		A	B		A	B	
Approach Delay (s)		17.2			8.7			10.0			11.0	
Approach LOS		B			A			A			B	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	40.0	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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	14	28	24	501	270	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	14	28	24	501	270	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				598		
pX, platoon unblocked	0.91					
vC, conflicting volume	829	280	290			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	760	280	290			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	96	98			
cM capacity (veh/h)	333	759	1272			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	42	525	290
Volume Left	14	24	0
Volume Right	28	0	20
cSH	532	1272	1700
Volume to Capacity	0.08	0.02	0.17
Queue Length 95th (ft)	6	1	0
Control Delay (s)	12.4	0.6	0.0
Lane LOS	B	A	
Approach Delay (s)	12.4	0.6	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	58.4%	ICU Level of Service	B
Analysis Period (min)	15		