Monterey Citywide Transportation and Parking Study

Appendices

March 2013

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City of Monterey

Waterfront and Downtown Parking Study

December 2012

NELSON NYGAARD

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Overview

The Monterey Citywide Transportation and Parking Study is designed to support ongoing planning efforts for growth areas and key transportation corridors within the City of Monterey. The City is in the process of developing specific plans for several planning districts and travel corridors to guide and support future development. The Citywide Transportation and Parking Study analyzes transportation and parking alternatives to meet the city's goals to:

- Improve mobility and reduce the need for auto trips
- Improve access to downtown businesses
- Reduce out-of-way travel created by existing one-way streets
- Provide the correct amount of parking

This report is a part of the effort to meet these goals, which will be achieved, in part, by the collection of current parking data, the projections of future parking demand, and technical analyses of alternative parking management programs.

This report is intended to examine and analyze parking supply and demand conditions in the downtown study area, as a whole and in terms of issues relating to individual sub-districts. This analysis provides information from an original parking inventory and occupancy study performed in April 2011. The parking data collection program also included a turnover analysis for a specific portion of downtown.

Parking Management Planning Approach

Nelson\Nygaard's approach in undertaking this work was as follows:

- Analyzed transportation and parking opportunities and challenges in downtown Monterey, including a review of existing documents, plans, data, and policies, combined with several site visits
- Assisted the City of Monterey in obtaining original data to assess existing parking conditions for on- and off-street facilities throughout the study area
- Conducted a parking demand analysis that examined current land uses and future development potential in the downtown area
- Developed cost-effective strategies and program recommendations designed to:
  - Make the most efficient use of the existing parking supply
  - Plan for future parking demand in accommodating economic growth

Purpose of the Parking Study Report

The recommendations in this parking study are established on the premise that parking and transportation are not ends in themselves, but means to achieve broader community goals. These recommendations leverage the downtown area's existing assets, respond to its challenges, and further the overall vision for the area. As described above, this report is a part of

Monterey's effort to meet community goals related to the reduction of auto trips, the improvement of access to downtown businesses, and the provision of adequate amounts of parking.

Existing Parking Conditions

Inventory, Utilization, and Turnover

Parking supply and utilization was analyzed for downtown Monterey as a whole and separately within seven zones. A total of 7,451 parking stalls are located within the study area, 1,713 on-street and 5,738 off-street. To evaluate parking occupancy, parking occupancy counts were taken every two hours from 8 AM to 8 PM on Thursday, April 14; Friday, April 15; and Saturday, April 16. The counted parking supply included accessible on-street and off-street spaces, and public and private spaces; spaces obstructed by construction or physical barriers such as fences were excluded from the counts.

Total occupancy counts show that at the busiest period (Thursday at noon), only 55% of the area's parking supply was occupied, with on- and off-street spaces showing somewhat different occupancy rates (69% and 51%, respectively). At this peak hour, 527 on-street and 2,805 off-street spaces were vacant.

These utilization rates are far below target rates. Target occupancy rates of 85% and 90% are effective industry-standards for analyzing the demand for on- and off-street spaces, respectively. In other words, maintaining 15% and 10% vacancy rates for corresponding on- and off-street stalls help to ensure an "effective parking supply." It is at these standard occupancy levels that roughly one space per block is available, making searching or "cruising" for parking unnecessary, and allowing off-street lots to maintain adequate maneuverability. Utilization rates much below these targets indicate a diminished economic return on investment in parking facilities.

Turnover is quite high in the downtown area; however, the collected data also revealed that many vehicles were switching spots to avoid the posted time limits. It is likely that employees of downtown businesses are using on-street spaces throughout the day, periodically moving their vehicles to avoid getting a ticket. Approximately 10% of vehicles parking in the downtown area during each count day switched spaces at least once throughout the day.

Existing and Future Parking Demand Ratios

Utilizing the data gathered during the parking inventory as well as an inventory of existing land use and projected land uses, existing parking demand ratios were calculated, and these parking ratios were then used to estimate future parking demand.

- *Built Stalls to Built Land Use Ratio*. This represents the total number of existing parking stalls correlated to total existing land use square footage (occupied or vacant) within the study area. According to data provided by the City, there is approximately 3,478,543 gross square feet (GSF) of land uses in the study zone. At this time, about **2.14 parking stalls per 1,000 GSF** of build land use have been developed/provided within the study area (including both on- and off-street supplies).
- *Combined Peak Demand to Occupied Land Use Ratio.* This represents peak hour occupancy within the entire study area combining the on- and off-street supply. As such, actual <u>parked vehicles</u> were correlated with actual <u>occupied land use</u> area (also known as occupied building area; approximately 3,430,624 GSF). From this perspective, current peak hour demand stands at a ratio of approximately **1.2 occupied parking stalls per 1,000 GSF** of occupied land use. Since parking counts were conducted during both the non-peak parking season and during a period of economic stagnation, calculations were made using

historic parking occupancy rates and sales tax figures from the City to determine what parking demand would be in the future given the same amount of land use. Historical data from the Downtown garages and Waterfront lot show that from 2007 to 2009, peak period utilization rates have declined seven percentage points in the Cannery Row garage, six percentage points in both the East and West Downtown garage, and four percentage points in the Waterfront lot. In addition, downtown sales tax revenues from 2006 to 2010 declined by 16%. Given this information, future parking demand (during peak summer season and a thriving economy) is anticipated to be **1.46 occupied parking stalls per 1,000 GSF** of built land use.

Figure 1 summarizes the analysis used to determine the built ratio of parking to built land use (i.e. Column D), which is based on the correlation between total built land use of 3,478,543 GSF (i.e. Column A) and 7,451 stalls of "built" parking supply (i.e. Column C). As such, the *built ratio of parking* is 2.14 stalls per 1,000 GSF of commercial/retail building area.

Figure 1 also shows that the *actual demand* for parking is approximately 1.2 occupied stalls per 1,000 GSF currently and 1.46 occupied stalls per 1,000 GSF at peak season in the future (i.e. Column F). This number is derived by correlating actual occupied land use of 3,430,624 GSF (i.e. Column B) to the 4,119 vehicles actually parked in the peak hour currently and the 5,013 anticipated vehicles parked in the future (i.e. Column E).

Figure 1 Parking Demand – Mixed Land Use to Built Supply

A	B	C	D	E		F	
GSF (Built)	**GSF (Occupied)**	**Total Supply Inventoried in Study Area**	**Built Ratio of Parking (per 1,000 GSF)**	**Total Occupied Spaces in Peak Hour**		**Actual Ratio Parking Demand (per 1,000 GSF)**	
				Current	**Future**	**Current**	**Future**
3,478,543	3,430,624	7,451	2.14	4,119	5,013	1.20	1.46

In the future, if parking were provided at the rate of actual demand absorption (1.46 spaces per 1,000 GSF in the future), overall peak hour occupancies would near 100% *only if* current parking rates and regulations remained in place *and* between 500,000 – 700,000 square feet of new development were constructed in the area. This estimate assumes no underground parking is constructed as a part of this development, no redevelopment of existing sites occurs, and the development of 2-story to 5-story buildings on surface parking lots in the study area. Put another way, there is currently 3.4 million square feet of occupied built space resulting in 5,013 occupied spaces anticipated in the future. In order to fill the remaining 2,438 vacant spaces in the area, up to another 500,000 – 700,000 square feet could be added without any new parking being constructed. If any changes to parking pricing schemes were to be instituted in the future, peak hour occupancies would likely be less than 100%, particularly if prices were set to recommended levels to ensure a 15% vacancy rate.

To date, parking has been *built* at an average rate of 2.14 stalls per 1,000 GSF of development in downtown Monterey. This rate appears to have provided surplus parking with significant availability in both existing on- and off-street facilities, especially given that land uses in the study area only generate parking *demand* ratios of 1.2 stalls per 1,000 GSF currently and 1.46 stalls per 1,000 GSF in the future. According to this analysis, approximately 2,438 stalls will be empty and available at the peak hour of utilization (according to future estimates). This surplus of parking allows for future development to make use of existing spaces prior to the construction of new parking.

Summary of Parking Management Plan Recommendations

Recommendation #1: Install Real-Time Availability and Wayfinding Signs

Real-time availability signs should be installed in the Downtown parking garages and the Waterfront lots, and should also be accessible online. These digital displays provide real-time information about available supply, serving to increase utilization of off-street facilities, maximizing efficiency, and reducing “cruising” for available on-street spaces. This strategy also enables information sharing via the web and mobile devices, allowing residents and visitors alike to access real-time parking data from home or on their smart phone.

Wayfinding signs to major parking facilities (Downtown parking garages, Waterfront lots, and public lots) should be installed at key locations downtown (e.g. on Del Monte Avenue as a visitor approaches downtown). Such a strategy will direct visitors to underutilized off-street facilities, especially if located at the traditional entrances to downtown, near major garages and attractions, and along major arterials. Improved wayfinding in the form of new signs can help direct motorists to their desired destination and is another way to help eliminate traffic caused by cars “cruising” for parking.

Recommendation #2: Implement Valet and Tandem Parking

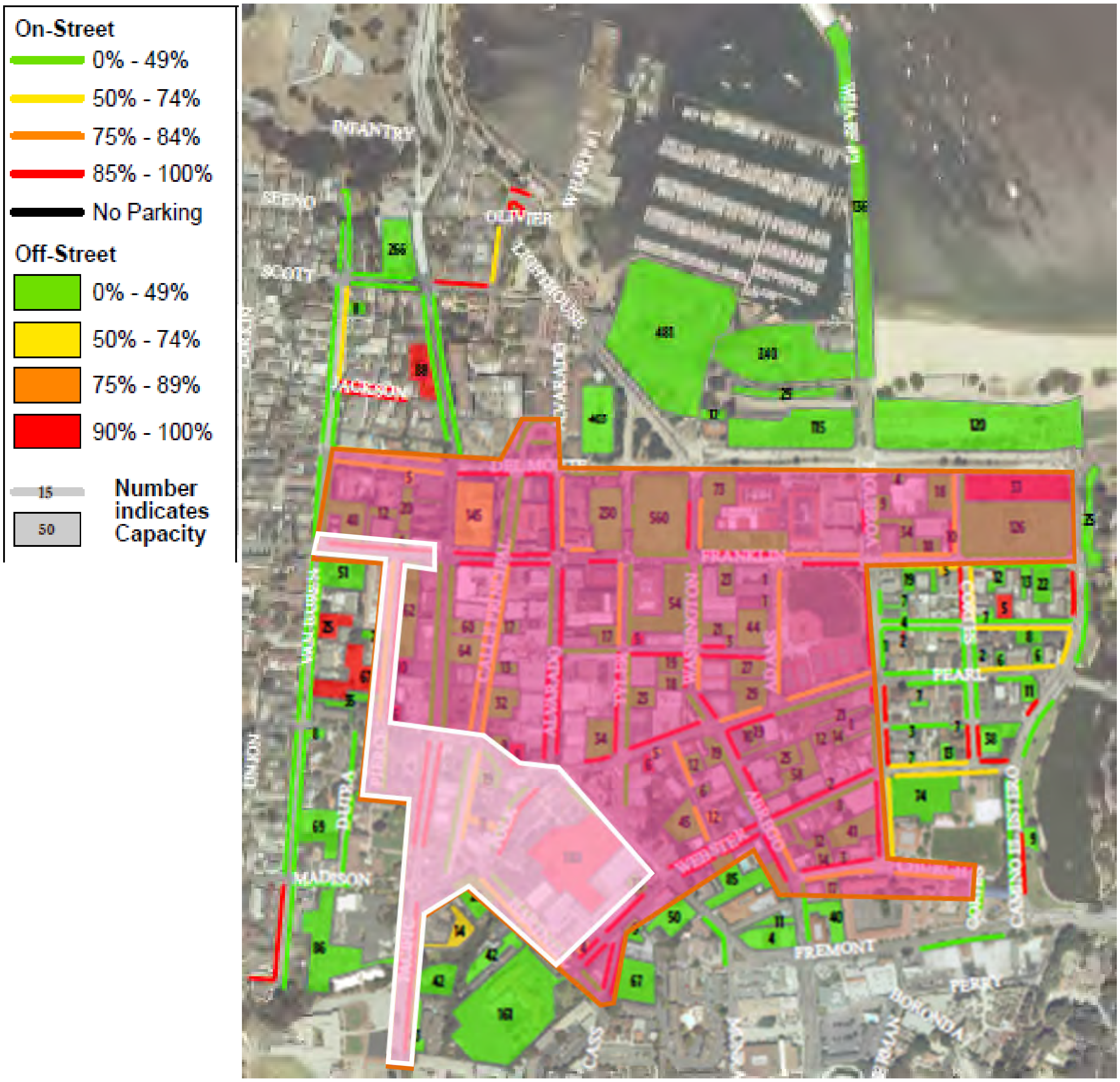
The City should implement valet and tandem parking in the Downtown parking garages and Waterfront lots during peak summer weekends. Valet parking can maximize off-street lot and garage spaces for long-term parkers such as employees, thereby freeing up more convenient curb spaces for visitors. Technology exists to make the car retrieval process customer-friendly. In addition, tandem parking can be used for employees in the Waterfront lots during summer weekends and in the Downtown parking garages both during summer weekends and when demand peaks. This strategy will increase the supply of parking downtown and is particularly effective when arrivals and departures are regular, such as an employee arriving and leaving his or her place of work. Another benefit of this strategy is that it facilitates compact development, freeing underutilized surface parking lots for new development.

Recommendation #3: Install Parking Meters where Necessary and Adjust Off-Street Prices Accordingly

The City should install on-street parking meters in the downtown areas that exceed an 85% on-street occupancy rate. Set parking prices at rates that create a 15% vacancy rate on each block and eliminate time limits during allowable parking hours. On-street rates can initially be set at $1.00 per hour and subsequently raised or lowered based on future occupancy counts. Simultaneously, off-street public garage and lot rates should be reduced to a daily rate of $1 and adjusted based on their occupancy levels. This pricing structure will encourage long-term parkers, such as employees and all-day visitors to take advantage of under-utilized off-street spaces while freeing on-street spaces for higher turnover motorists. Once the pricing structure has been implemented, dedicate parking revenues to public improvements and public services that benefit the downtown area. Create a "Parking Benefit District" to implement these recommendations (further explored in Recommendation #4).

Figure 2 presents possible zones for the installation of on-street parking meters. The white area should be metered from 9:00AM to 6:00PM, while the red area should be metered from 9:00AM to 8:00PM. Such an enforcement scheme would maximize the availability of front-door spaces, and provide alternative, cheaper on-street spaces a few blocks further from downtown's core.

Figure 2 Potential Meter Zones



Recommendation #4: Create a Residential Parking Benefit District

At the same time that parking meters are implemented for curb parking in the downtown core, implement Residential Parking Benefit Districts in adjacent residential areas. These Districts should be implemented as necessary once a parking evaluation has taken place. Residential Parking Benefit Districts are similar to residential parking permit districts, but allow a limited number of commuters to pay to use surplus on-street parking spaces in residential areas and return the resulting revenues to the neighborhood to fund public improvements such as streetscape amenities and revitalization.

Recommendation #5: Allow Shared Parking Among Different Land Uses by Right

The City of Monterey should allow different land uses to share parking. In order to make the process of securing approval for shared parking less onerous for new development and adaptive reuse projects, the City should:

- Allow parking to be shared among different uses within a single mixed-use building by right
- Allow parking to be shared between residential buildings and an off-site parking facility by right, provided that the off-site facility is within 1,000 feet of the building entrance
- Off-site shared parking located further than 1,000 feet should be considered at the discretion of staff, so long as there is documentation that reasonable provision has been made to allow off-site parkers to access the principal use (e.g. a shuttle bus, valet parking service, free transit passes, etc.)
- Mandate that new non-residential parking be available to the public during non-business hours

Recommendation #6: Eliminate/Reduce Parking Minimums, Implement Parking Maximums, and Establish an In-Lieu Fee

Reform parking requirements by eliminating non-residential minimum requirements, reducing residential minimum requirements to one-half space per unit, instituting maximum requirements, and establishing an in-lieu fee. The maximum parking requirement for both commercial and residential uses should be set at a level to allow development flexibility while meeting the City's goals of creating a vibrant, walkable downtown. As such, it is recommended that a maximum rate of four spaces per thousand square feet be set for commercial uses and two spaces per unit for residential uses.

Given the market for residential units, most new residential developments very will likely provide more than the proposed one-half space per unit minimum; however, the in-lieu fee program would provide an alternative to developers where providing required amounts of on-site parking is either cost prohibitive or undesirable. The in-lieu fee is strictly an optional payment a developer can make in lieu of providing the minimum amount of parking required. The in-lieu fee monies can then serve as a revenue stream to go towards downtown transportation improvements such as improved signage, bicycle facilities, or other enhanced features. The fee should be set at a reasonable level to both make it financially feasible for developers in special cases to meet the requirement and provide an income stream to either increase the public supply of parking or introduce alternative mode programs and improvements. As such, it is recommended that an annual in-lieu fee of $150 per space be set.

Recommendation #7: Unbundle Parking Pricing

Require all new residential development to "unbundle" the full cost of parking from the cost of the housing itself, by creating a separate parking charge. Parking costs are generally subsumed into the sale or rental price of housing for the sake of simplicity, and because that is the more traditional practice in real estate. Although the cost of parking is often hidden in this way, parking is never free. Each space in a parking structure can cost roughly $30,000, while in downtown Monterey, given land values, surface spaces can also be costly.

Charging separately for parking is a very effective strategy to encourage households to own fewer cars and rely more on walking, cycling, and transit. It is critical that residents and tenants are made aware that rents, sale prices, and lease fees are reduced because parking is charged for separately. Rather than paying "extra" for parking, the cost is simply separated out – allowing residents and businesses to choose how much they wish to purchase. No tenant, resident, employer, or employee should be required to lease any minimum amount of parking.

Recommendation #8: Implement Transportation Demand Management policies and programs

The City should consider the introduction of Transportation Demand Management (TDM) programs. These could include a parking cash-out program, universal transit passes, and mandating that employees receive benefits in exchange for giving up their parking space. TDM policies and programs have many benefits, including the following:

- Provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk, or bicycle to work. The benefit is particularly valuable to low-income employees, who are less likely to drive to work alone.
- Provides a low-cost fringe benefit that can help individual businesses recruit and retain employees.
- Employers report that parking cash-out requirements are simple to administer and enforce, typically requiring just one to two minutes per employee per month to administer.
- Increases transit ridership, reducing congestion and improving transit cost recovery.
- Reduces existing parking demand.
- Cost less than the provision of additional parking spaces. For example, a study of UCLA's universal transit pass program found that a new parking space costs more than 3 times as much as a free transit pass ($223/month versus $71/month).[1]
- Parking spaces formerly taken by employees can be freed up to provide more spaces for customers.

Chapter by Chapter

This Parking Management Plan contains a large amount of information for policy makers. In order to make full use of the document, it is important to be able to quickly refer to relevant sections of interest. The chapters of this report are summarized as follows:

Chapter 1: Existing Conditions – Describes the existing travel characteristics of the study area in relation to the City as a whole. Summarizes the study area's existing parking conditions as they relate to inventory, regulations, utilization rates, and vehicle turnover.

Chapter 2: Current and Future Parking Demand – Provides a detailed analysis of existing parking demand as it relates to current and future land uses.

[1] Jeffrey Brown, et. al. "Fare-Free Public Transit at Universities: An Evaluation." Journal of Planning and Education Research, 2003: Vol 28, No. 1, pp 69-82.

Chapter 3: Parking Management Plan – Summarizes the key points of the study's analysis and offers preliminary recommendations for parking management.

Chapter 1. Existing Conditions

Downtown Monterey is characterized by a mix of one-way and two-way streets, local shops and businesses, and a mix of multi-family and single-family residential. Parking is provided for residents and visitors alike in public and private off-street facilities and on-street spaces throughout the district. Typical parking conditions involve large numbers of visitors frequenting the Waterfront area during the weekends with employees and higher turnover shoppers parking in the heart of the downtown on weekdays.

Effective management of the area's transportation system is integral to maintaining and enhancing the ultimate success of the downtown area. By examining travel trends and existing parking conditions, this chapter facilitates a better understanding of how people are utilizing the downtown area's current parking facilities, highlights parking challenges and inefficiencies, and provides a framework for developing a targeted parking management plan.

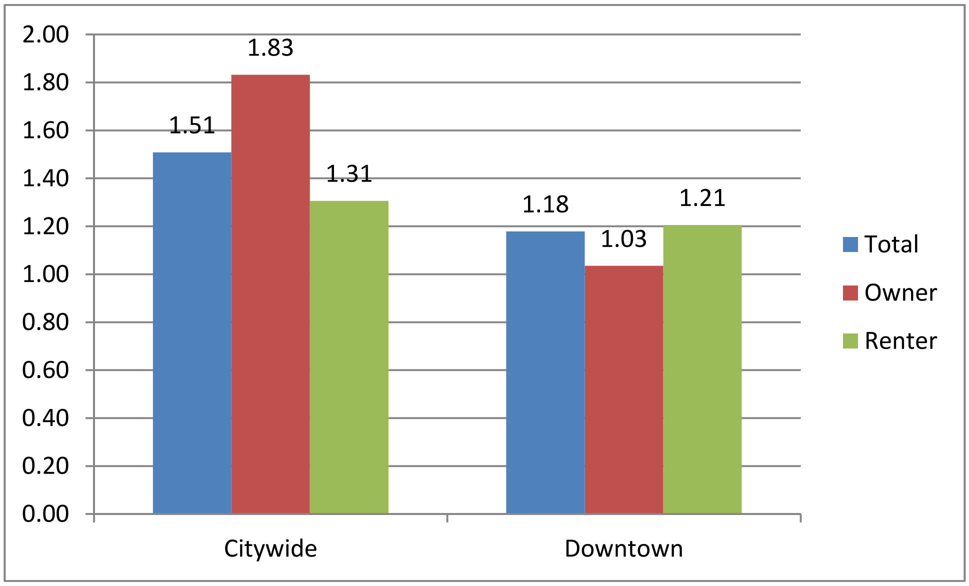
Current Travel Characteristics

Downtown Monterey's current travel characteristics offer important background information concerning existing baseline conditions. This information can be used to set performance measures and can be updated as new data becomes available.

Vehicle Ownership

Figure 3 highlights vehicle ownership by housing tenure for downtown Monterey as well as citywide. A number of key observations can be made from this graph. First, downtown vehicle ownership (average number of vehicles per housing unit) is higher for renter-occupied units than owner-occupied units. This is atypical of trends seen nationwide, where renters typically own fewer vehicles than households who own their home. It is possible that this may be due to the relatively high incomes of renters in downtown Monterey (and the correlation of high incomes to higher vehicle ownership rates) compared to renters elsewhere. Secondly, downtown has less vehicle ownership per capita than in Monterey as a whole. According to data from the Census Bureau, the city of Monterey had 1.51 vehicles per household, while downtown had 1.18. Finally, both renter households and households in downtown have fewer cars (1.21 and 1.03, respectively) than the citywide averages (1.31 and 1.83, respectively).

Figure 3 Vehicles per Household by Housing Tenure



Parking Inventory and Regulations

An inventory of parking facilities was undertaken as part of this study. This section provides a brief overview of the parking inventory, which identified the amount of parking and parking regulations, if any, by on-street block and off-street facility.

Methodology

Parking inventory and regulations were determined through field observations by City of Monterey staff (with assistance from Nelson\Nygaard staff), who walked the study area, counted parking spaces, and noted regulations on each block face and in each off-street facility.

Findings

Figure 4 shows a map of the on-street regulations by block face for the entire downtown study area. Downtown contains a mix of predominately free parking, mostly with one-hour or two-hour time limits. Some unrestricted parking exists on the east side of the downtown area, as well as some metered, 120 minute parking in the Monterey Sports Center lot. Residential Permit parking areas exist in the streets immediately west of downtown Monterey. In total, there are 1,713 on-street spaces downtown. A total of 5,738 off-street spaces exist in the downtown area, 2,398 of which are in public facilities and 3,340 of which are in private facilities.

Figure 4 On-street Parking Regulations

Figure 5 provides a more detailed breakdown of the type of parking in the study area for both on- and off- street facilities. Of the area's on-street facilities, the vast majority (75.1%) are free for use, but exhibit time limits (12 minute, 24 minute, 60 minute, 90 minute, and 120 minute). The rest are completely unrestricted (18.3%), residential permit parking (2.7%), loading spaces (3%), or disabled spaces (0.9%). Off-street spaces in the study area are mostly split between for-pay lots (49.2%) and permit or private parking (47.0%).

Figure 5 Study Area Parking Facilities, by Type

Location	Unrestricted	Time Limits	Metered/ For Pay	Permit or Private	Loading (All)	Disabled	Total	% of parking
On-Street	314	1286	0	47	51	15	1713	23.0%
	18.3%	75.1%	0.0%	2.7%	3.0%	0.9%		
Off-Street	19	49	12821	2695	22	132	5738	77.0%
	0.3%	0.9%	49.2%	47.0%	0.4%	2.3%		
Total	333	1335	2821	2742	73	147	7451	100.0%
	4.5%	17.9%	37.9%	36.8%	1.0%	2.0%		

Parking Utilization and Turnover

This section provides an overview of the results from the original parking utilization and turnover data collection effort. It includes a summary of the methodology, as well as the key findings for the complete study area and by zone.

Methodology

City of Monterey staff conducted a comprehensive occupancy and turnover study for both on- and off-street spaces using trained data collection workers with assistance from Nelson\Nygaard. The count days and times were:

- Thursday, April 14th, 2011 from 8AM – 8PM, every two hours
- Friday, April 15th, 2011 from 8AM – 8PM, every two hours
- Saturday, April 16th, 2011 from 8AM – 8PM, every two hours

Counts were conducted on these days in order to provide as wide a range of parking conditions as possible, as parking demand tends to fluctuate a great deal by day of week and time of day. The count periods specifically captured parking activity during a typical weekday and weekend. Each block face and off-street lot was counted every two hours at approximately the same time of each counting period.

Findings

Overall Study Area

Utilization

Figure 6 highlights the utilization findings for the downtown study area as a whole. In general, combined occupancy for on- and off-street facilities was relatively consistent, varying from a low of 30% occupancy to a high of 55% occupancy. The peak hour for overall parking demand in the study area was at noon on both Thursday and Friday (55% and 51%, respectively) and at 2:00 PM on Saturday (49%).

Taken *as a whole,* these overall utilization rates are far below target rates (although individual areas do experience high occupancy rates). Target occupancy rates of 85% and 90% are effective industry-standards for on- and off-street spaces, respectively. In other words, maintaining 15% and 10% vacancy rates for corresponding on- and off-street stalls will help ensure an “effective parking supply.” It is at these occupancy levels that roughly one space per block is available, making searching or “cruising” for parking unnecessary and allowing off-street lots to maintain adequate maneuverability. Utilization rates much below these targets indicate a diminished economic return on investments in parking facilities.

Figure 6 Utilization Rates, Overall Study Area

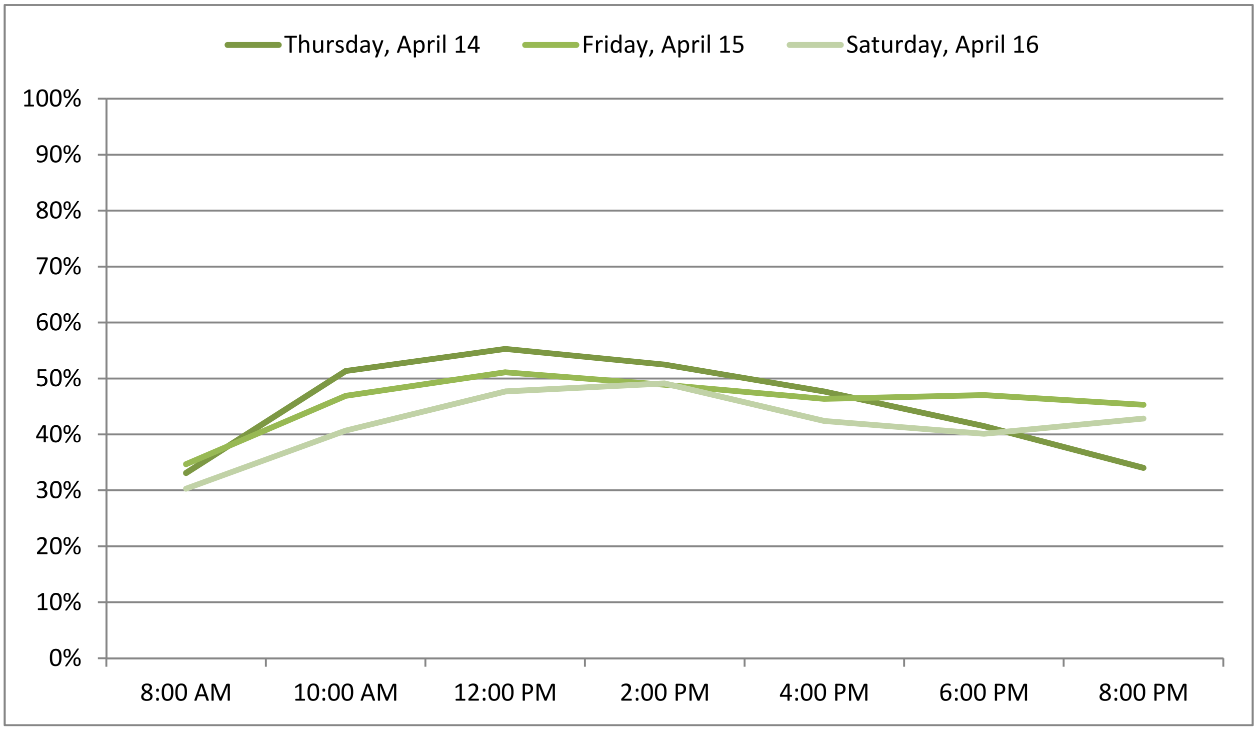


Figure 7, Figure 8, and Figure 9 show utilization rates for Thursday, Friday, and Saturday by facility type. On all count days, on-street facilities experienced higher overall demand and higher peaks than off-street parking. On Thursday, on-street demand peaked at 69% at noon, while off-street demand peaked at 51% at both noon and 2:00 PM. On Friday, on-street demand peaked at 68% at 6:00 PM, while off-street demand was highest at noon (47%). Saturday saw on-street occupancy peak at 61% (noon) and off-street occupancy peak at 47% (2:00 PM).

Figure 7 Utilization Rates by Facility Type, Thursday

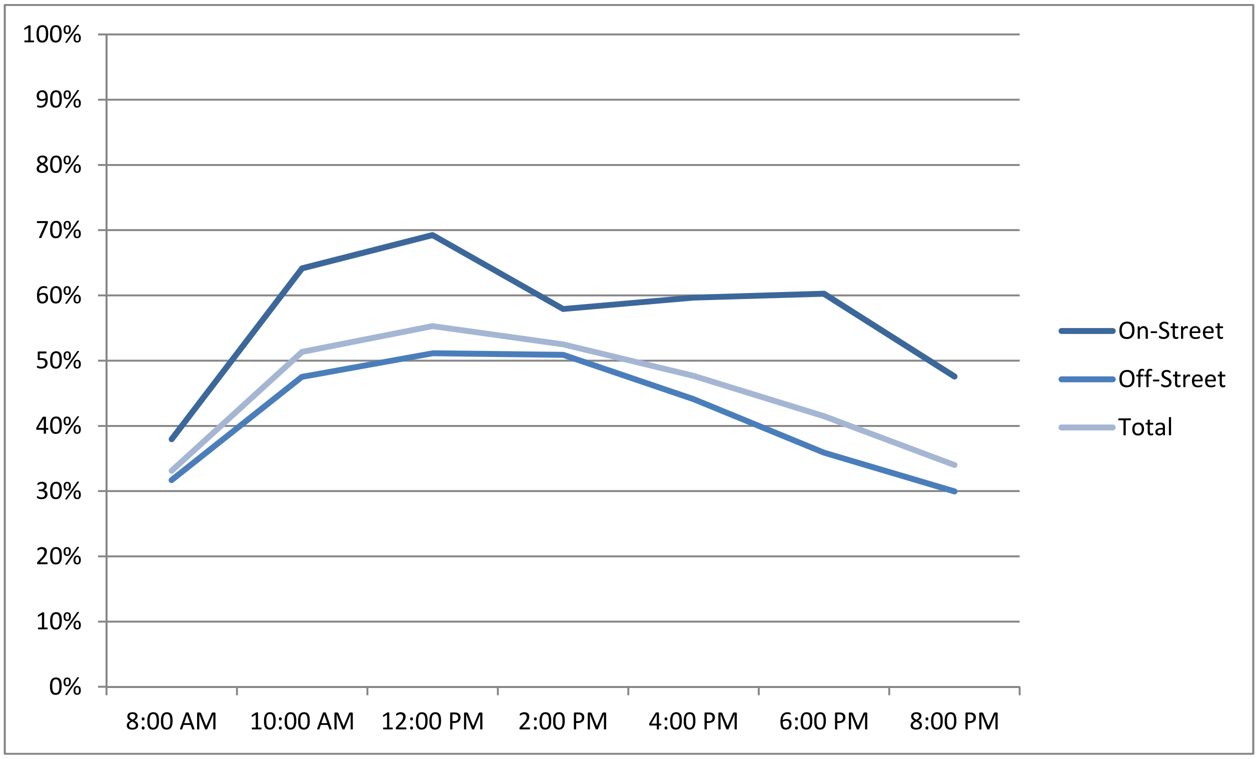


Figure 8 Utilization Rates by Facility Type, Friday

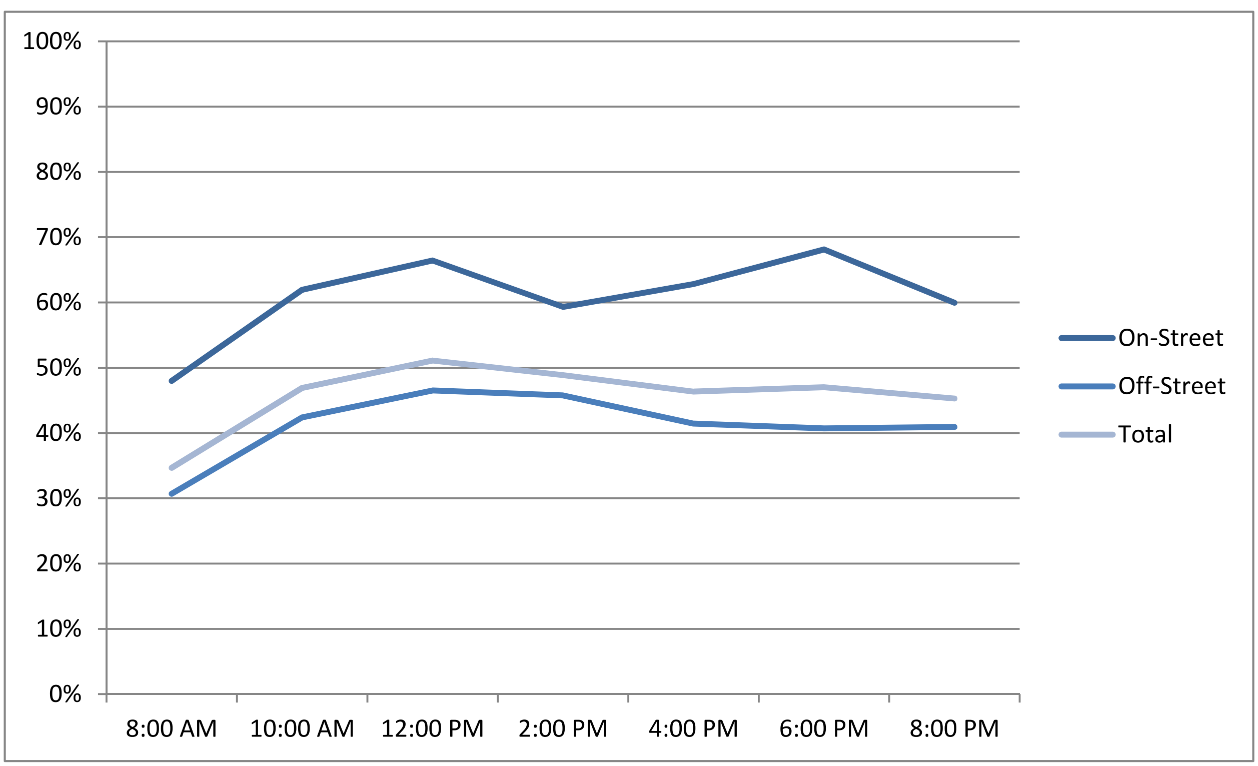


Figure 9 Utilization Rates by Facility Type, Saturday

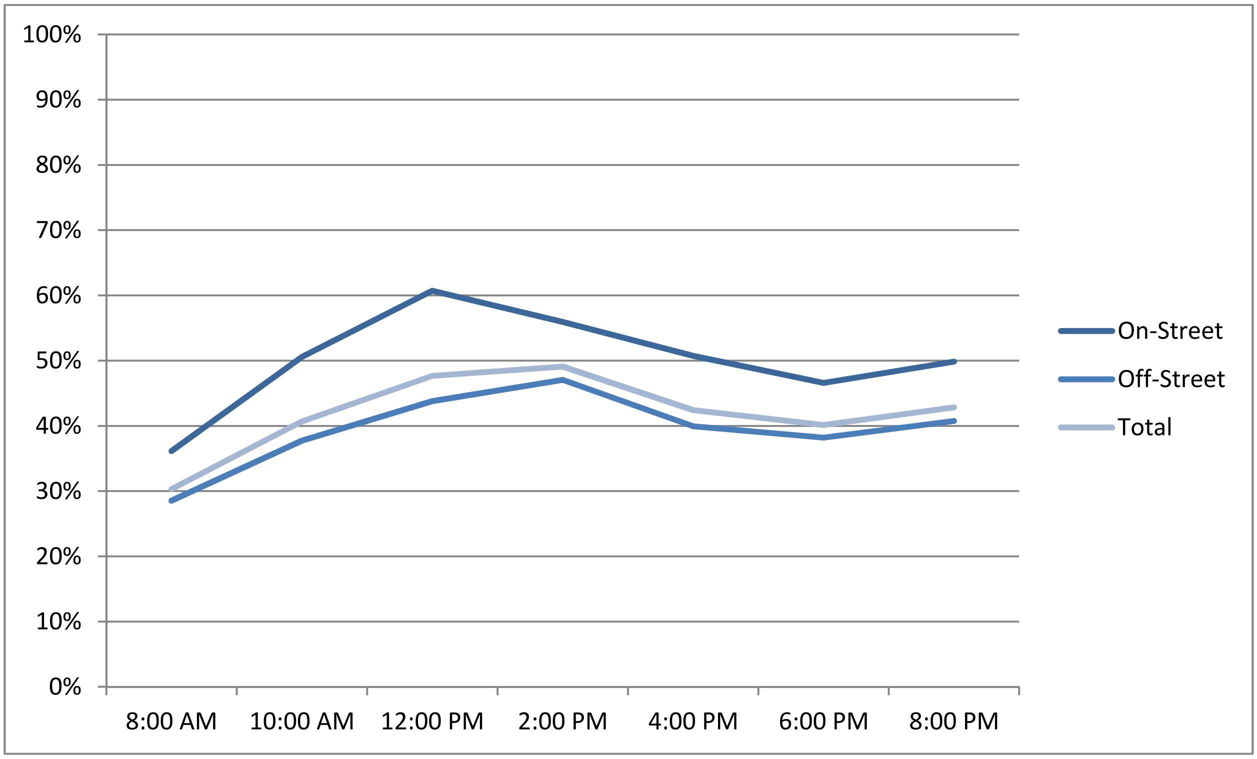


Figure 10, Figure 11, and Figure 12 show peak occupancy maps of the downtown area for Thursday (noon – 2:00PM), Friday (6:00 – 8:00PM), and Saturday (2:00 – 4:00PM). These maps show the occupancy level for each individual block face and each individual lot during the peak hour of parking demand. The maps reveal that there are some “pockets” of high demand during peak hours on several blocks in the core of the downtown and in some off-street lots. For example, on Friday evening there was high on-street occupancy in the heart of downtown where many restaurants and bars are located, but relatively low occupancy in most off-street lots. Conversely, on Saturday there was high off-street occupancy in the Waterfront area with the likely influx of visitors and generally low on-street occupancy throughout the study area. At the peak hour, Thursday saw the highest peak of total occupancy (55%) and generally high levels of on-street occupancy.

Figure 10 Peak Hour Utilization, Thursday Noon-2PM

Figure 11 Peak Hour Utilization, Friday 6-8PM

DOWNTOWN - PEAK PARKING OCCUPANCY

Figure 12 Peak Hour Utilization, Saturday 2-4PM

Turnover

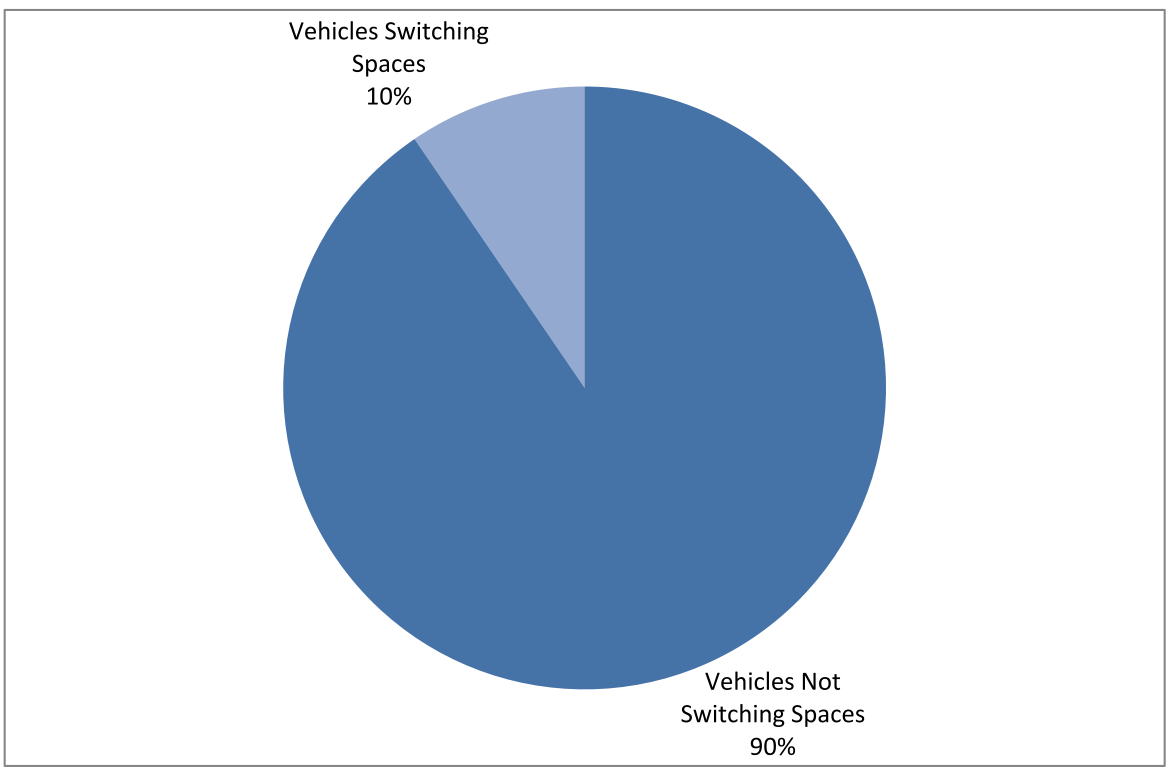
In addition to analyzing parking utilization, parking duration data (for a limited amount of on-street spaces) was also collected to gauge how often each spaces experiences "turnover." This data was collected prior to the occupancy data and involved surveyors noting the last 4 digits of each license plate, which can be used to identify vehicles without collecting any personal information. Turnover counts were conducted every hour from 8:00AM to 5:00PM on the following dates in 2011:

- Tuesday, March 15th
- Wednesday, March 16th
- Thursday, March 17th
- Friday, April 1st
- Saturday, April 2nd

On all five count days, area-wide turnover was relatively consistent in the study area. On Tuesday and Friday, it was estimated that vehicles stayed parked in the same parking space an average of 0.9 hours. On Wednesday, Thursday, and Saturday, the average stay was 1 hour.

Turnover is quite high in the downtown area. However, the collected data also revealed that many vehicles were switching spots to avoid the posted time limits. It is likely that employees of downtown businesses are using on-street spaces throughout the day, periodically moving their vehicles to avoid getting a ticket. Figure 13 shows the average percent of unique vehicles throughout all count days that are switching spaces to avoid posted time regulations. Approximately 10% of vehicles parking in the downtown area throughout each count day switched spaces at least once throughout the day.

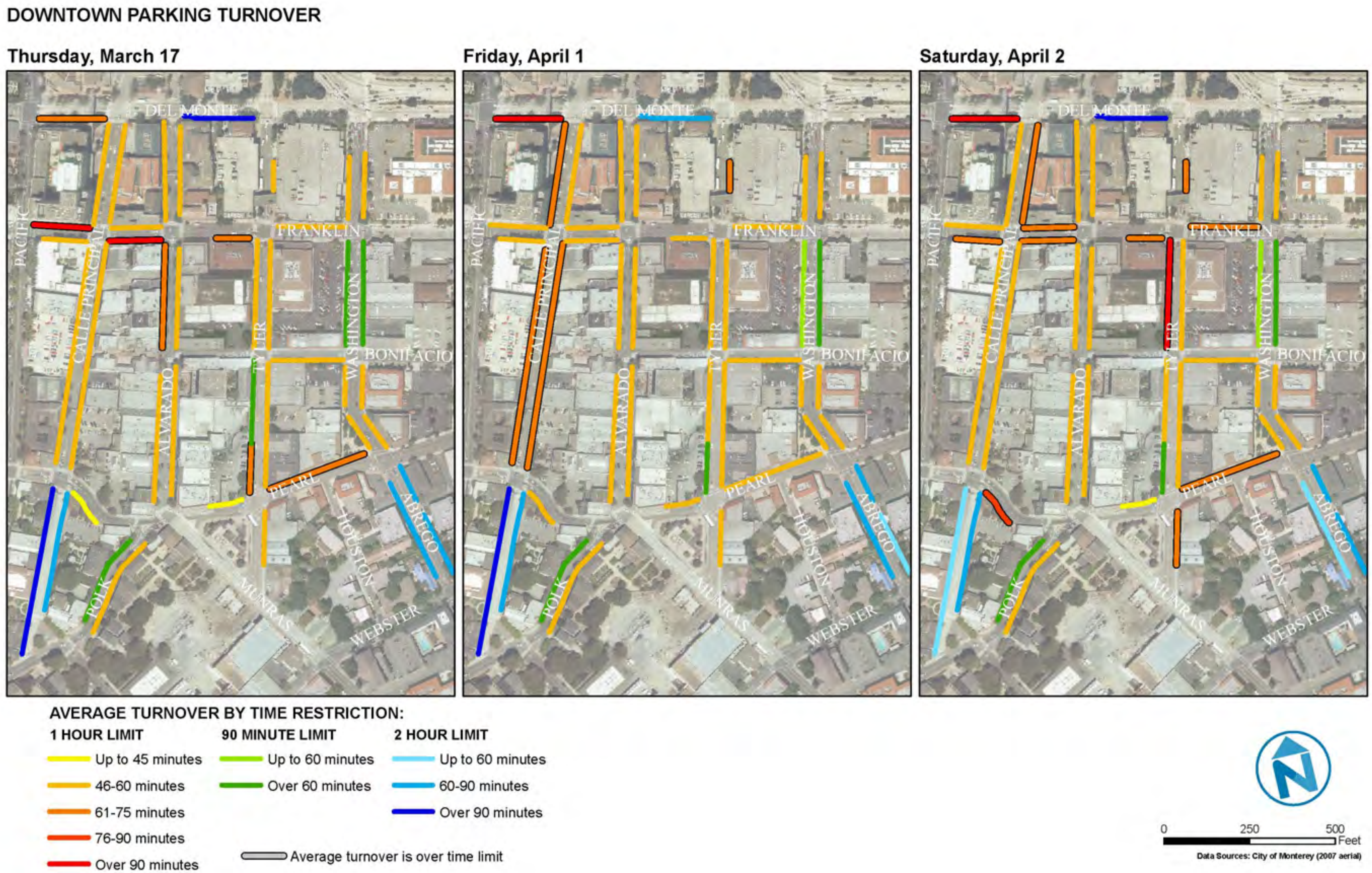
Figure 13 Average Percent of Unique Vehicles in Study Area Switching Spaces



On average and across the study area, vehicles parked on the counted downtown blocks remained parked for less time than the posted limit. However, various blocks in the area exhibited average turnover rates higher than the posted time limits. Figure 14 shows average turnover on three of the count days by block. The specific block faces where cars typically stayed parked beyond the posted time limits changes between count days. However, only blocks with one hour time limits experienced this phenomenon, those with 90 minute and 2 hour restrictions saw average stays of less than the posted limit.

The above utilization data captures an excellent snap shot of parking utilization and demand, enabling a comprehensive analysis of utilization patterns. However, it should be noted that counts were not taken during periods of absolute peak in demand (i.e. during the summer and in a strong economy). Historical data from the Downtown garages and Waterfront lot show that from 2007 to 2009, annual average peak utilization rates have declined 8 percentage points in the Cannery Row garage, 5 percentage points in the East Downtown garage, 7 percentage points in the West Downtown garage, and 6 percentage points in the Waterfront lot. We expect conditions to return to past levels after the economy has fully recovered.

Figure 14 Average Turnover by Time Restriction



Study Area Zones

The downtown area was divided into seven distinct zones in order to better understand parking supply, demand, and utilization on a smaller scale within the Lighthouse area. These zones are the following:

- Hotel District
- Civic Center
- Waterfront
- Alvarado District
- Pearl District
- East Village
- Island of Adobes

Utilization

Figure 15, Figure 16, and Figure 17 show peak hour utilization rates, by facility type and zone, for Thursday, Friday, and Saturday, respectively. On Thursday, off-street utilization rates remained below 75% in all seven zones, with blocks varying from nearly empty to full capacity. The Hotel District exhibited the highest off-street utilization rate (67%), while the Waterfront District exhibited the lowest off-street utilization rate (35%). On-street utilization exceeded 75% in the Alvarado District, East Village, and Island of Adobes zones, while it remained below 75% in all other zones. On-street utilization was highest in the Island of Adobes zone (81%) and lowest in the Civic Center zone (58%).

On Friday, off-street utilization rates also remained below 75% in all seven zones, again with blocks varying greatly in occupancy levels. As on Thursday, the Hotel district was the zone with the highest off-street utilization rate during Friday's counts (72%). The Island of Adobes zone exhibited the lowest off-street utilization rate (20%). On-street utilization exceeded 75% in three zones: East Village, the Alvarado District, and the Hotel District. The Alvarado District was the only zone to exceed an 85% on-street occupancy rate, peaking at 89% and demonstrating how restaurant and bar patrons are occupying on-street parking during the evenings in this area. The zone with the lowest on-street utilization was Island of Adobes, which reached 35%.

On Saturday, two of the seven zones (Hotel District and Waterfront) exceeded 75% occupancy in their off-street facilities. The Hotel District exhibited the highest off-street occupancy rate (83%), while the Island of Adobes zone saw the lowest (20%). No zone saw on-street occupancy rates exceed 75%. The Pearl District saw the highest on-street utilization rate (72%), while the Island of Adobes zone saw the lowest (43%).

These results indicate that in general there is an ample supply of parking in the study area and that challenges associated with parking are likely due to inefficient management of existing supply. For example, off-street facilities were consistently underutilized in most zones during all count days. Zones that saw spikes of high on-street utilization had both ample off-street capacity remaining and were adjacent to zones where both off- and on-street supplies were below 75%.

Figure 15 Peak Hour Utilization by Zone, Thursday Noon-2PM

Figure 16 Peak Hour Utilization by Zone, Friday 6PM-8PM

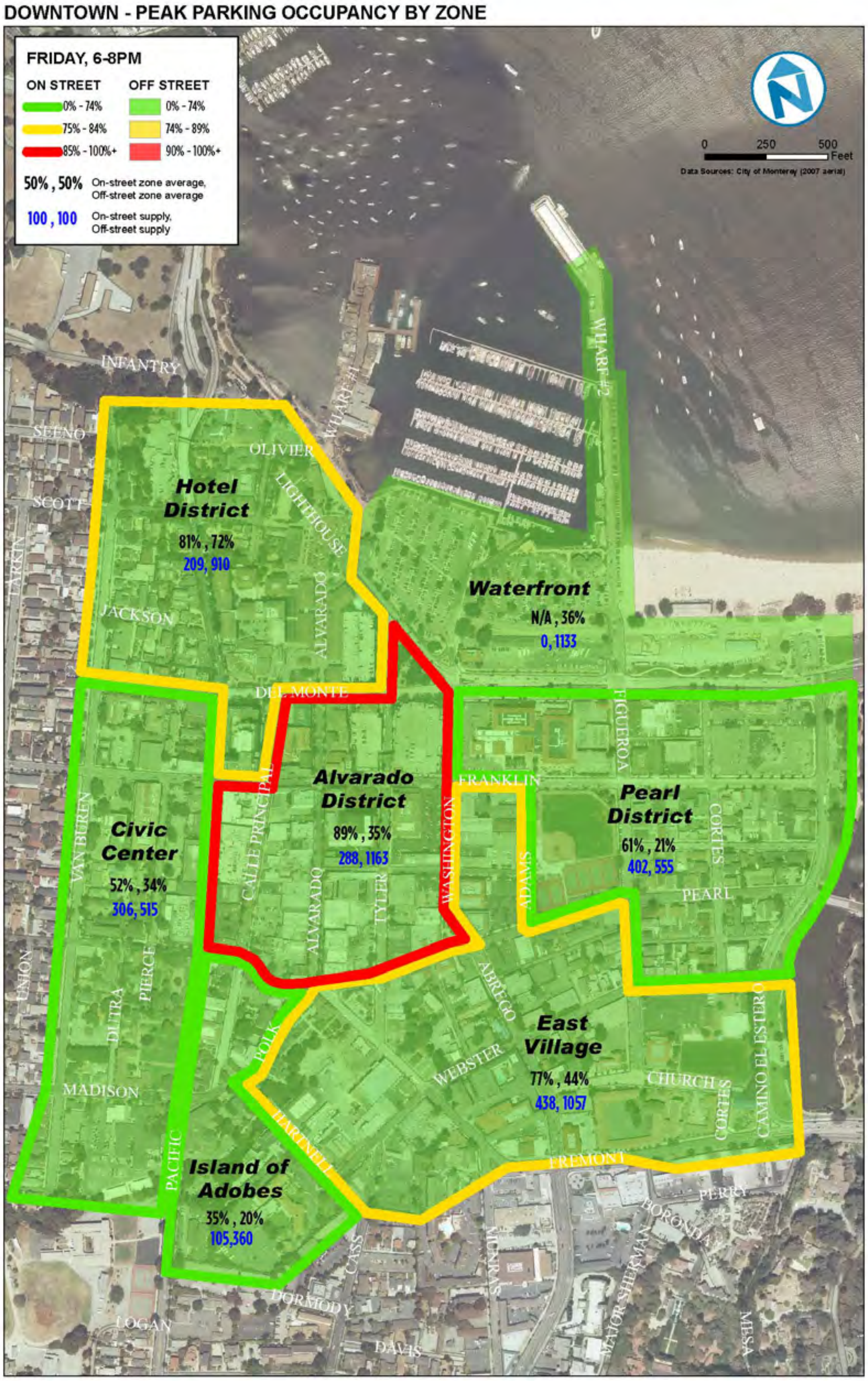


Figure 17 Peak Hour Utilization by Zone, Saturday 2PM-4PM

Chapter 2. Current and Future Parking Demand

This chapter provides an analysis of existing and future parking conditions in the study area. More specifically, it analyzes existing parking demand in relation to target occupancies and quantifies how much the study area and each zone is “over” or “under” supplied. In addition, this chapter analyzes parking demand in relation to existing and future land use and development patterns. This analysis will enable the City to demonstrate the effects of development on parking and determine whether the study area currently has more or less parking supply than existing demand requires.

Inventory, Occupancy, and Oversupply

As discussed in Chapter 1, the peak hour of parking demand was 12:00 Noon for both Thursday and Friday, and 2:00PM for Saturday. For the whole study area, peak occupancies were 55%, 51%, and 49% on those days, respectively. Once again, these occupancies are well below target levels of demand and result in an “oversupply” of parking, as demonstrated in Figure 18. This figure shows the inventory and occupancy during the peak period for all three days, calculations of the “necessary supply” needed to meet current occupancy levels and maintain the 85% target utilization rates, and the resulting oversupply of existing parking.

As shown in Figure 18, the downtown area is substantially oversupplied with parking. At peak occupancy on Thursday, 4,119 parking spaces in the study area were occupied. If one were to assume that this was meeting the target occupancy rate, then the study area would only require 4,846 spaces to account for adequate maneuverability. However, current supply in the study area is 7,451 spaces, which translates into a 54% “oversupply” of parking based on current demand. Similar trends are evident across all count days, both weekday and weekend. In short, the study area has more than enough parking spaces to meet current demand.

Figure 18 Occupancy, Inventory, and Oversupply

Day	Occupancy (a)	Necessary Supply (b) = (a/.85)	Existing Supply (c)	Oversupply (d) = (c-b)	% Oversupply (e) = (d/b)
Thursday 12:00PM	4,119	4,846	7,451	2,605	54%
Friday 12:00PM	3,807	4,479	7,451	2,972	66%
Saturday 2:00PM	3,658	4,304	7,451	3,147	73%

Peak Demand in Study Area

Current Conditions

The peak occupancy for the entire study area occurred on Thursday, April 14th at 12:00 Noon. Parking demand ratio calculations revealed two different, but equally useful correlations:

- *Built Stalls to Built Land Use Ratio*. This represents the total number of existing parking stalls correlated to total existing land use square footage (occupied or vacant) within the study area. According to data provided by the City, there is approximately 3,478,543 gross square feet (GSF) of land use in the study zone. At this time, about **2.14 parking stalls per 1,000 GSF** of build land use have been developed/provided within the study area (including both on- and off-street supplies).

- *Combined Peak Demand to Occupied Land Use Ratio.* This represents peak hour occupancy within the entire study area combining the on- and off-street supply. As such, actual parked vehicles were correlated with actual occupied land use area (also known as occupied building area; approximately 3,430,624 GSF). From this perspective, current peak hour demand stands at a ratio of approximately **1.2 occupied parking stalls per 1,000 GSF** of built land use. Historical data from the Downtown garages and Waterfront lot show that from 2007 to 2009, peak period utilization rates have declined seven percentage points in the Cannery Row garage, six percentage points in both the East and West Downtown garage, and four percentage points in the Waterfront lot. In addition, downtown sales tax revenues from 2006 to 2010 declined by 16%. Since parking counts were conducted during both the non-peak parking season and during a period of economic stagnation, calculations were made using historic parking occupancy rates and sales tax figures from the City to determine what parking demand would be in the future given the same amount of land use. Given this information, future parking demand (during peak summer season and a thriving economy) is anticipated to be **1.46 occupied parking stalls per 1,000 GSF** of built land use.

Figure 19 summarizes the analysis used to determine the built *ratio* of parking to built land use (i.e. Column D), which is based on the correlation between total built land use of 3,478,543 GSF (i.e. Column A) and 7,451 stalls of "built" parking supply (i.e. Column C). As such, the *built ratio of parking* is 2.14 stalls per 1,000 GSF of commercial/retail building area.

Figure 19 also demonstrates that the *actual demand* for parking is approximately 1.2 occupied stalls per 1,000 GSF currently and 1.46 occupied stalls per 1,000 GSF at peak season in the future (i.e. Column F). This number is derived by correlating the actual occupied land use of 3,430,624 GSF (i.e. Column B) to the 4,119 vehicles actually parked in the peak hour currently and the 5,013 anticipated parked vehicles in the future (i.e. Column E).

Figure 19 Parking Demand – Mixed Land Use to Built Supply

A	B	C	D	E		F	
GSF (Built)	GSF (Occupied)	Total Supply Inventoried in Study Area	Built Ratio of Parking Demand (per 1,000 GSF)	Total Occupied Spaces in Peak Hour		Actual Ratio of Parking Demand (per 1,000 GSF)	
				Current	Future	Current	Future
3,478,543	3,430,624	7,451	2.14	4,119	5,013	1.20	1.46

In the future, if parking were provided at the rate of actual demand absorption (1.46 spaces per 1,000 GSF in the future), overall peak hour occupancies would near 100% *only if* current parking rates and regulations remained in place *and* between 500,000 – 700,000 square feet of new development were constructed in the area. This estimate assumes no underground parking is constructed as a part of this development, no redevelopment of existing sites occurs, and the development of 2-story to 5-story buildings on surface parking lots in the study area. Put another way, there is currently 3.4 million square feet of occupied built space resulting in 5,013 occupied spaces anticipated in the future. In order to fill the remaining 2,438 vacant spaces in the area, up to another 500,000 – 700,000 square feet could be added without any new parking being constructed. If any changes to parking pricing schemes were to be instituted in the future, peak hour occupancies would likely be less than 100%, particularly if prices were set to recommended levels to ensure a 15% vacancy rate.

To date, parking has been *built* at an average rate of 2.14 stalls per 1,000 GSF of development in downtown Monterey. This rate appears to have provided surplus parking with significant availability in both existing on- and off-street facilities, especially given that land uses in the study area only generate parking *demand* ratios of 1.2 stalls per 1,000 GSF currently and a predicted 1.46 stalls per 1,000 GSF in the future. <u>Per this analysis, approximately 2,438 stalls will be empty and available at the peak hour of utilization (according to future estimates)</u>. This surplus of parking allows for future development to make use of existing spaces prior to the construction of new parking.

Figure 20 provides a summary of built supply to actual demand for other cities that the consultant team has worked with. The downtown Monterey area falls towards middle of selected cities in relation to actual amount of parking built to land use. However, the downtown area has one of the lowest demand ratios, resulting in a large gap between the level of parking supplied and what is actually needed. The main theme of this figure is that, like many American cities, *the downtown Monterey community is currently building more parking than demand indicates necessary.*

Figure 20 Built Parking Supply and Actual Demand, Selected Cities

City	Minimum Requirement / 1,000 GSF or Actual Build Supply	Actual Demand / 1,000 SF	Gap between parking built and actual parking demand (for every 1,000 GSF)
Hood River, OR	1.54	1.23	0.31
Oxnard, CA	1.7	0.98	0.72
Corvallis, OR	2	1.5	0.5
Sacramento, CA	2	1.6	0.4
Monterey, CA (Downtown)	**2.14**	**1.2**	**0.94**
Seattle, WA	2.5	1.75	0.75
Kirkland, WA	2.5	1.98	0.52
Palo Alto, CA	2.5	1.9	0.6
Santa Monica, CA	2.8	1.8	1
Ventura, CA (Westside)	2.87	1.26	1.61
Chico, CA	3	1.7	1.3
Hillsboro, OR	3	1.64	1.36
Bend, OR	3	1.8	1.2
Salem, OR	3.15	2.04	1.11
Redmond, WA	4.1	2.71	1.39
Beaverton, OR	4.15	1.85	2.3

Chapter 3. Parking Management Plan

The inventory of parking supply and regulations, the parking occupancy/turnover study, and the analysis of current parking demand in relation to existing parking requirements, current land uses, and future development patterns provide a wealth of information about parking conditions and behavior within the downtown study area. More importantly, this data will serve as the guiding framework for the City as it moves forward with reforming its parking policies and management systems. By developing regulatory processes that establish the appropriate amount of parking and then maximizing the efficiency of that supply, the City can accommodate the interests of all stakeholders, including employees, visitors, and residents.

Other cities have faced similar circumstances in managing parking and have used improved policies and management to alleviate localized inefficiencies while spurring economic growth. This chapter seeks to begin the conversation by offering several recommendations for parking reform. These concepts are informed by the data obtained in this study as well as Nelson\Nygaard's previous experience with similar cities.

Principles of Effective Parking Management

Historically, "solving the parking problem" almost always meant increasing supply. Unfortunately, constantly increasing parking supply simply encourages more auto use, as people are encouraged to drive to places that offer "plenty of free parking." While providing adequate parking is still important, it is only one tool available for managing both demand and supply. The goal of "parking demand management" is to provide the optimal amount of parking to meet parking needs, while reducing traffic congestion and accommodating new development and a variety of land uses.

Managing parking has been shown to be the single most effective tool for managing congestion, even when densities are relatively low and major investments in other modes have not been made. Parking management can also have a significant impact on commute mode choice, which translates directly to reductions in auto congestion and improved livability of commercial districts and adjacent neighborhoods.

As downtown Monterey continues to grow and evolve, its parking needs will change as well. This Plan recommends techniques to both address current challenges and adjust to future needs. Above all else, this Plan proposes a parking management approach that utilizes policies and programs that will enable more efficient utilization of existing supply, while alleviating parking congestion.

In recognition of these considerations, the following principles informed the development of parking management recommendations for the downtown community:

- Set clear parking priorities based on downtown's strengths and vision for the future
- Manage the entire parking supply as part of an integrated system
- Manage parking facilities with a focus on maintaining availability, not simply increasing supply
- Optimize investment in parking by making efficient use of all public and private parking facilities and encouraging use of viable alternative mode options—before constructing new parking
- Use any potential parking revenue to fund transportation programs that maintain adequate parking supply and support use of alternative transportation options in the downtown area

- Use of residential permit districts to address spillover concerns in residential neighborhoods
- Encourage economic revitalization and remove barriers to development and adaptive reuse projects by adopting parking standards that are tailored to the unique parking demands of mixed-use, walkable communities
- Ensure flexibility for developers by providing a variety of tools to meet and/or reduce parking requirements
- Provide flexibility to local decision makers and City staff to adapt to future changes in parking demand and travel patterns

Recommendations

Recommendation #1: Install Real-Time Availability and Wayfinding Signs

Goal: Maximize the use of current parking facilities and limit traffic caused by cars “cruising” for parking.

Recommendation:

Real-time availability signs should be installed in the Downtown parking garages and the Waterfront lots, and should also be accessible online. These digital displays provide real-time information about available supply, serving to increase utilization of off-street facilities, maximizing efficiency, and reducing “cruising” for available on-street spaces. This strategy also enables information sharing via the web and mobile devices, allowing residents and visitors alike to access real-time parking data from home or on their smart phone.

Wayfinding signs to major parking facilities (Downtown parking garages, Waterfront lots, and public lots) should be installed at key locations downtown (e.g. on Del Monte Avenue as a visitor approaches downtown). Such a strategy will direct visitors to underutilized off-street facilities, especially if located at the traditional entrances to downtown, near major garages and attractions, and along major arterials. Improved wayfinding with new signs can help direct motorists to their desired destination and is another way to help eliminate traffic caused by cars “cruising” for parking.

Recommendation #2: Implement Valet and Tandem Parking

Goal: Maximize the use of current parking facilities to increase current supply and decrease the need for the construction of additional facilities.

Recommendation:

The City should implement valet and tandem parking in the Downtown parking garages and Waterfront lots during peak summer weekends. Valet parking can maximize off-street lot and garage spaces for long-term parkers such as employees, thereby freeing up more convenient curb spaces for visitors. Technology exists to make the car retrieval process customer-friendly. In addition, tandem parking could be used for employees in the Waterfront lots during summer weekends and in the Downtown parking garages both during summer weekends and when demand peaks. This strategy will increase the supply of parking downtown and is particularly effective when arrivals and departures are regular, such as an employee arriving and leaving his or her place of work. Another benefit of this strategy is that it facilitates compact development, freeing underutilized surface parking lots for new development.

Recommendation #3: Install Parking Meters where Necessary and Adjust Off-Street Prices Accordingly

Goals:

1. Efficiently manage demand for downtown parking while accommodating customer, employee, resident, and commuter parking needs.
2. Put customers first by creating vacancies and turnover of the most convenient “front door” curb parking spaces to ensure availability for customers and visitors.
3. Generate revenues for desired improvements such as upgraded downtown security and enhanced streetscapes.

Recommendation: The City should install on-street parking meters in the downtown areas that exceed an 85% on-street occupancy rate. Set parking prices at rates that create a 15% vacancy rate on each block and eliminate time limits during allowable parking hours. On-street rates can initially be set at $1.00 per hour and subsequently raised or lowered based on future occupancy counts. Simultaneously, off-street public garage and lot rates should be reduced to a daily rate of $1 and adjusted based on their occupancy levels. This pricing structure will encourage long-term parkers, such as employees and all-day visitors to take advantage of under-utilized off-street spaces while freeing on-street spaces for higher turnover motorists. Once the pricing structure has been implemented, dedicate parking revenues to public improvements and public services that benefit the downtown area. Create a "Parking Benefit District" to implement these recommendations (further explored in Recommendation #4).

Discussion:

Install Meters Where Demand Exceeds 85%

According to the downtown parking survey, the peak occupancy rate for the total parking supply in Downtown Monterey is just 55% at the busiest hour (which occurred on Thursday at noon). At the busiest weekend hour, the peak occupancy rate for all downtown reached just 51%. However, there are several blocks that are fully occupied, while many less convenient lots and structures a block or two away remained largely vacant.

After an initial trial period, occupancy rates for each block should be reviewed and then adjusted down or up to achieve the 85% occupancy goal, as described earlier. The following procedure for adjusting parking meter rates and hours is recommended to ensure that this happens on a regular schedule, promptly, and with clear assurance to policymakers, citizens, and the downtown community that the goal of parking prices is to achieve the desired vacancy rate. This procedure is as follows:

1. *Set Policy:* By ordinance, the City Council should establish that the primary goal in setting parking meter rates and hours for each block and each lot is to achieve an 85% occupancy rate. Additionally, the ordinance should both require and authorize City staff to raise or lower parking prices to meet this goal, without requiring further action by the City Council. The City's Parking Division[2] should be charged with the responsibility of running the district, including monitoring occupancy rates and adjusting pricing as necessary.
2. *Monitor occupancy:* Modern, wirelessly networked parking meters are capable of instantly transmitting current information on the number of spaces in use on each block where the meters are installed, giving the City's Parking Division the ability to constantly monitor parking usage in the system. Reports can also be generated to track occupancy by the hour over the course of days, weeks, or months.
3. *Adjust rates:* Armed with good information on recent parking occupancy rates, the City's Parking Division should adjust the rates (and hours of operation) up or down on each block, to achieve the policy goal (an 85% occupancy rate) set by City Council. Typically, rates should be adjusted quarterly (four times per year), but in the case of major changes in downtown, such as the opening of a new development, it may be advisable to adjust rates as needed in response to particular events. To provide additional input to the process, an advisory board should review the proposed rate changes and provide feedback to the Parking Division.

Install Payment System and Metering Technology

There are several meter technologies and payment systems that Monterey could use to improve parking management. A review of best practices in cities comparable to Monterey and a review of the capabilities of existing metering technologies found that the preferred approach would balance the following goals:

[2] The Parking Division is operated as an enterprise fund through the Parking Fund. All of the Parking Division's operating expenses, debit payments, inter-department and overhead charges are paid from the Parking Fund, and all revenue generated by parking operations is deposited into the Parking Fund.

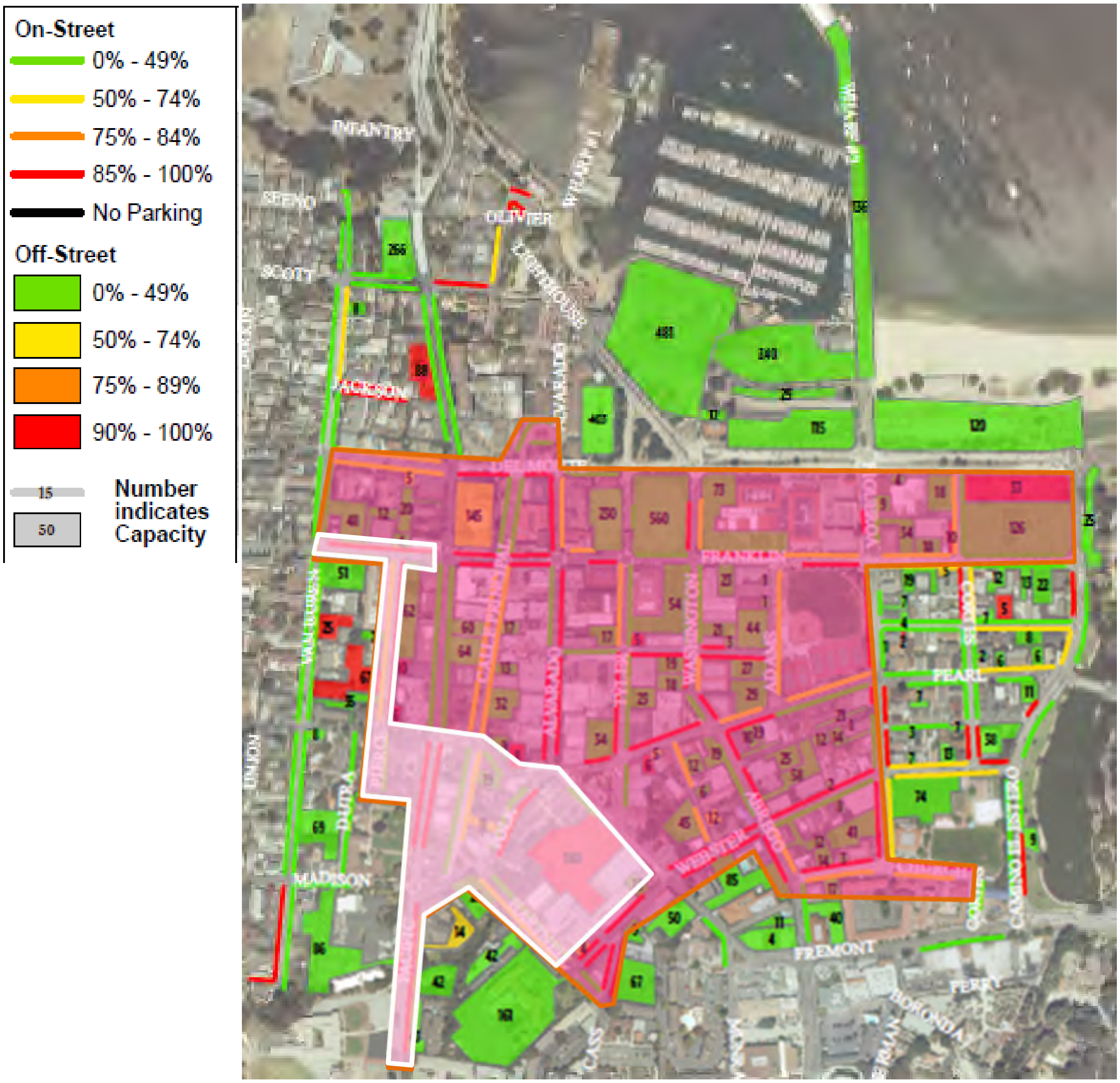
- Maximize ease of use in order to increase customer convenience and reduce uncertainty and anxiety
- Minimize capital and operations costs (administration, maintenance, and enforcement)
- Promote turnover of curb parking spaces (so that visitors can always find a space)
- Achieve other downtown revitalization goals (good urban design, cleanliness, etc.)

These goals (and a review of available technology) suggest that Monterey should install on-street smart meters with cell phone technology. The City should study potential downtown zones in which to install these meters and could vary enforcement hours based upon proximity to the downtown core. The benefits of these meters include the following:

- No need to return to car after paying
- Increases revenue streams to City
- Reduces operations and enforcement costs
- Allows for more payment options

Figure 21 presents possible zones for the installation of parking meters. The white area should be metered from 9:00AM to 6:00PM, while the red area should be metered from 9:00AM to 8:00PM. Such an enforcement scheme would maximize the availability of front-door spaces and provide alternative, cheaper, on-street spaces a few blocks from downtown's core.

Figure 21 Potential Meter Zones [3]



Eliminating Time Limits

For customers, strict enforcement can bring “ticket anxiety", the fear of getting a ticket if one lingers a minute too long (for example, in order to have dessert after lunch). As Dan Zack, Downtown Development Manager for Redwood City, CA, puts it, “Even if a visitor is quick enough to avoid a ticket, they don't want to spend the evening watching the clock and moving their car around. If a customer is having a good time in a restaurant, and they are happy to pay the market price for their parking spot, do we want them to wrap up their evening early because their time limit wasn't long enough? Do we want them to skip dessert or that last cappuccino in order to avoid a ticket?"

[3] Some areas depicted on Figure 21 are already served by either meters or pay station parking.

A recent Redwood City staff report summarizes the results found in downtown Burlingame, California:

> “In a recent "intercept" survey, shoppers in downtown Burlingame were asked which factor made their parking experience less pleasant recently...The number one response was "difficulty in finding a space" followed by "chance of getting a ticket." "Need to carry change" was third and the factor that least concerned the respondents was "cost of parking." It is interesting to note that Burlingame has the most expensive on-street parking on the [San Francisco] Peninsula ($.75 per hour) and yet cost was the least troubling factor for most people.”

This is not an isolated result. Repeatedly, surveys of downtown shoppers have shown that the *availability* of parking, rather than price, is of prime importance.

Once a policy of market rate pricing is adopted, with the goal of achieving an 85% occupancy rate on each block, even at the busiest hours, then time limits can actually be eliminated. With their elimination, much of the worry and "ticket anxiety" for downtown customers disappears. In Redwood City, where this policy was recently adopted, Dan Zack describes the thinking behind the City's decision:

“Market-rate prices are the only known way to consistently create available parking spaces in popular areas. If we institute market-rate prices, and adequate spaces are made available, then what purpose do time limits serve? None, other than to inconvenience customers. If there is a space or two available on all blocks, then who cares how long each individual car is there? The reality is that it doesn't matter.”

Create a Commercial Parking Benefit District (PBD)

By creating a PBD, revenues from on-street meters can be used to fund transportation improvements in the downtown district. The City of Pasadena (pictured) was very successful in reinvesting its meter revenues back into the community. The City could also lease private parking spaces from willing businesses to make them publically available, increasing the general supply of parking. Such programs could support local transit and possible shuttle services as well as improve the pedestrian environment.

Recommendation #4: Create a Residential Parking Benefit District

Goal: Prevent “spillover” parking in downtown adjacent neighborhoods.

Recommendation: At the same time that parking meters are implemented for curb parking in the downtown core, implement residential parking benefit districts in adjacent residential areas. These Districts should be implemented, as necessary, once a parking evaluation has taken place. Residential Parking Benefit Districts are similar to residential parking permit districts, but allow a limited number of commuters to pay to use surplus on-street parking spaces in residential areas and return the resulting revenues to the neighborhood to fund public improvements such as streetscape amenities and revitalization.

Discussion: In order to prevent spillover parking in residential neighborhoods, many cities implement *residential parking permit districts* (also known as preferential parking districts) by issuing a certain number of parking permits to residents usually for free or a nominal fee. These permits allow the residents to park within the district while all others are prohibited from parking there for more than a few hours, if at all. At least 130 cities and counties currently have residential parking permit programs in effect in the US and Canada.[4]

Residential parking permit districts are typically implemented in residential districts near large traffic generators such as central business districts, educational, medical, and recreational facilities. They do have several limitations.

Most notably, conventional residential permit districts often issue an unlimited number of permits to residents without regard to the actual number of curb parking spaces available in the district. This often leads to a situation in which on-street parking is seriously congested, and the permit functions solely as a “hunting license”, simply giving residents the right to hunt for a parking space with no guarantee that they will actually find one. (An example of this is Boston’s Beacon Hill neighborhood, where the City’s Department of Transportation has issued residents 3,933 permits for the 983 available curb spaces in Beacon Hill’s residential parking permit district, a 4-to-1 ratio.[5])

The opposite problem occurs with conventional residential permit districts in situations where there are actually surplus parking spaces (especially during the day, when many residents are away), but the permit district prevents any commuters from parking in these spaces even if demand is high and many motorists would be willing to pay to park in one of the surplus spaces.

In both cases, conventional residential parking permit districts prevent curb parking spaces from being efficiently used (promoting overuse in the former example and underuse in the latter).

To avoid these problems, Monterey should implement *residential parking benefit district*s in downtown adjacent residential areas at the same time that parking meters are implemented for

[4] “Residential Permit Parking: Informational Report.” Institute of Transportation Engineers, 2000, p1.

[5] Shoup, Donald. The High Cost of Free Parking. APA Planners Press, 2005, p516.

curb parking in the downtown core. This will prevent excessive spillover parking from commuters trying to avoid parking charges downtown and further downtown community revitalization goals.

Implementation details

The following steps should be taken to implement each residential parking benefit district:

1. Count the number of available curb parking spaces in the area where the residential parking benefit districts is being considered. Make a map showing the results of the count. On blocks where individual parking stalls are not marked, assume that one parking space exists for every 20 feet of available curb space. ("Available" curb space means curb space where parking is legal. So curb space where parking is prohibited, such as red painted curbs near fire hydrants, should be excluded.) Usually, "left over" fragments of curb space will exist after all of the segments that are at least 20 feet long have been counted. For example, if there is a 96 foot long segment of curb space where it is legal to park, then the segment contains four 20-foot-long parking spaces, plus a left over 16 foot long fragment. Similarly, it is common to find “fragments” of legally available curb space (i.e. sections of curb space that are less than 20 feet long) between driveways or between a driveway and a fire hydrant. Count any leftover fragment that is at least 16 feet long as a parking space. Disregard fragments that are less than 16 feet long. (These longer fragments may be considered to be the equivalent of compact parking spaces, while not all cars fit in a space of this length, many cars will.) On the map, clearly delineate the number of curb parking spaces on each block face.

   a. Counting the number of curb parking spaces available in an area where a residential parking benefit district is being considered is an essential first step for the Parking Division. It is the equivalent of movie theater managers knowing exactly how many seats are in their movie theaters. Just as the manager of a movie theater cannot know how many tickets to sell without knowing how many seats exist, the Parking Division cannot know how many parking permits to issue unless he or she knows how many parking spaces exist.

3. Count the number of residential units on each parcel within the same area. Add this information to the map of curb parking spaces completed in Step #1. As a base map for this effort, an Assessor's Parcel Map is often very useful. The Assessor's Parcel Map can be combined with Assessor’s Parcel Data on the ownership of each parcel to help identify how many properties exist in an area, the legal boundaries of those properties, and the homeowners and/or landlords for each residential unit. In turn, this information can help clarify the number of residential units on each property and the tenants who reside in those units.

4. Compare the existing number of residential units in the area to the number of available curb parking spaces in the area. Usually, the best visual presentation is to prepare a map showing: (a) the total number of residential units on each block, and (b) the number of available curb parking spaces on each block face. For the entire area, it is important to determine the ratio of curb parking spaces to residential units. (For example, if there are 1000 curb parking spaces and 500 residential units, then the ratio is 2.0 curb parking spaces per unit.)

5. Decide how many curb parking permits to issue to residents and what percent of spaces should be reserved for visitors. For example, the City may wish to set aside 10% of curb spaces for visitor use. Visitors should be able to purchase daily passes online (if license plate recognition enforcement is available) or at a local civic building (as Pasadena, CA does at its fire stations).

6. Resident permits should be priced on a graduated scale. For example, the first permit can be priced at ten dollars with the second at $25. If it is difficult to implement the residential district initially, it may be advisable to issue the first permit free to existing residents.
7. Set a time limit on streets of one to two hours to prevent nonresidents from occupying spaces for long periods and encourage residents to use their garages for parking rather than storage.
8. Rather than entirely prohibit nonresident parking as with many conventional residential parking permit districts, the City should sell permits for any surplus parking capacity to non-resident commuters at fair market rates. These nonresident permits, though, should only be permitted during daytime hours when residential occupancy rates are lower.
9. Finally, the rates for non-residents' parking permits should be set at fair market rates as determined by periodic city surveys. It is very likely that these non-resident permits may be priced at higher rates than resident permits due to market conditions.
10. All net revenue above and beyond the cost of administering the program should be dedicated to paying for public improvements in the neighborhood where the revenue was generated. This will visibly help improve the neighborhood and decrease resistance to the new program.

Additional Implementation Recommendations for Non-Resident Permits

Enforcement policies: Parking Enforcement Officers should follow the same enforcement policies as in Monterey's proposed downtown meter zone and should issue citations for "expired meter" or "no valid permit/meter."

Community Participation & Local Control

Residential parking benefit districts should only be implemented if a simple majority (50% +1) of property owners on a block supports the formation of the district.

Once implemented, residents, property owners, and business owners in the district should continue to have a voice in recommending to City Council how they would suggest new parking revenue be spent in their neighborhood. This could occur via City staff attendance at existing neighborhood association meetings, mail-in surveys, or public workshops. Another option is to appoint advisory committees in each parking benefit district, tasked with recommending to City Council how the revenue should be spent in their neighborhood.

Benefits of Residential Parking Benefit Districts

Residential parking benefit districts have been described as "a compromise between free curb parking that leads to overcrowding and [conventional residential] permit districts that lead to underuse…[parking] benefit districts are better for both residents and non-residents: residents get public services paid for by non-residents, and non-residents get to park at a fair-market price rather than not at all."[6]

Benefits of implementing a residential parking benefit districts in the City of Monterey would include the following:

- Excessive parking spillover into downtown adjacent neighborhoods will be prevented
- Scarce curb parking spaces will be used as efficiently as possible

[6] Ibid., p435.

- Need for additional costly downtown parking structure construction would be reduced
- Residents would have a much better chance to find a parking space at the curb

Recommendation #5: Allow Shared Parking Among Different Land Uses by Right

Goal: Maximize the use of existing parking facilities by exploiting the different periods of parking demand for different land uses.

Recommendation:

Monterey should allow different land uses to share parking. In order to make the process of securing approval for shared parking less onerous for new development and adaptive reuse projects, the City should:

- Allow parking to be shared among different uses within a single mixed-use building by right
- Allow parking to be shared between residential buildings and an off-site parking facility by right, provided that the off-site facility is within 1,000 feet of the building entrance
- Off-site shared parking located further than 1,000 feet should be considered at the discretion of staff, so long as there is documentation that reasonable provision has been made to allow off-site parkers to access the principal use (e.g. a shuttle bus, valet parking service, free transit passes, etc.)
- Mandate that new non-residential parking be available to the public during non-business hours

Discussion:

Different land uses have different periods of parking demand. For example, a bank adjacent to a night club can quite easily share a common parking facility. This principle is widely accepted in transportation planning and should be permitted in the City's parking code. This allows the Planning Director to allow a reduction when two or more uses demonstrate their patrons can share parking spaces, the City will reduce cruising for on-street spaces and encourage more compact development. This strategy can reduce the parking space needs for new development between 40% and 60%.

As discussed above, in order to facilitate the addition of more publicly accessible spaces to the shared, downtown pool of parking, private parking spaces can be leased from willing businesses using PBD funds to maximize their use.

Recommendation #6: Eliminate/Reduce Parking Minimums, Implement Parking Maximums, and Establish an In-Lieu Fee

Goal: Remove barriers to new development downtown; encourage efficiently shared public parking rather than many small, inefficient private lots; and create a healthy market for downtown parking, where parking spaces are bought, sold, rented, and leased like any normal commodity.

Recommendation:

Reform parking requirements by eliminating non-residential minimum requirements, reducing residential minimum requirements to one-half space per unit, instituting maximum requirements, and establishing an in-lieu fee. The maximum parking requirement for both commercial and residential uses should be set at a level to allow development flexibility while meeting the City's goals of creating a vibrant, walkable downtown. As such, it is recommended that a maximum rate of four spaces per thousand square feet be set for commercial uses and two spaces per unit for residential uses.

Given the market for residential units, most new residential developments very will likely provide more than the proposed one-half space per unit minimum; however, the in-lieu fee program would provide an alternative to developers where providing required amounts of on-site parking is either cost prohibitive or undesirable. The in-lieu fee is strictly an optional payment a developer can make in lieu of providing the minimum amount of parking required. The in-lieu fee monies can then serve as a revenue stream to go towards downtown transportation improvements such as improved signage, bicycle facilities, or other enhanced features. The fee should be set at a reasonable level to both make it financially feasible for developers in special cases to meet the requirement and provide an income stream to either increase the public supply of parking or introduce alternative mode programs and improvements. As such, it is recommended that an annual in-lieu fee of $150 per space be set.

Discussion:

Stimulate Economic Development

In order for Monterey to realize its goals for the ongoing revitalization of downtown, the City's parking policies must support those goals. Minimum parking requirements, however, have emerged as one of the biggest obstacles to many cities' efforts to encourage new residential and commercial development in their downtown areas. Minimum parking requirements typically require more than one square foot of parking area for every square foot of building. These requirements can be particularly damaging to uses, such as eating establishments, which help create vibrancy and life in the downtown area.

Moreover, minimum parking requirements clash with virtually all of Monterey's other adopted goals for its downtown. As UCLA professor Don Shoup describes it, "Parking requirements cause great harm: they subsidize cars, distort transportation choices, warp urban form, increase housing costs, burden low-income households, debase urban design, damage the economy, and degrade the environment… [O]ff-street parking requirements also cost a lot of money, although this cost is hidden in higher prices for everything except parking itself."

The downtown should start by eliminating its non-residential, and reducing its residential minimum parking requirements to both stimulate new development and allow existing businesses to "turnover." With 2,884 parking stalls currently vacant during the peak hour in downtown, there is more than enough parking available to cope with existing demand and any demand that could be generated by future development. With a current oversupply of parking, minimum requirements are only acting as an impediment to economic development, rather than their stated goal of ensuring adequate availability.

In addition, the City should institute maximum parking requirements for new development based on existing street capacity and traffic reduction goals. This strategy will promote a cohesive and walkable downtown area. Limits should be set high enough to accommodate future development. As noted above, it is recommended that a maximum rate of four spaces per thousand square feet be set for commercial uses and two spaces per unit for residential uses.

Establish a Fee Structure to Promote Economic Development

There are several key elements to address in devising an in-lieu fee price structure. The fee must serve the goals of the City, but it must also be flexible enough to encourage economic growth while providing an adequate pool of revenue for future parking facilities and alternative mode programs. An effective in-lieu fee program should seek to:

- **Avoid large up-front costs to developers that would deter investment.** Many cities make the mistake of creating a "simple" in-lieu fee structure based on large initial lump sum payments. These in-lieu fees can prove excessively costly to developers who ultimately forgo construction or build parking on-site that is not efficient in terms of parking or land resources.
- **Guarantee a revenue stream for the City.** A workable fee structure will both provide the City with enough initial funding to finance parking space construction (if necessary) and give the City a continuous long-term revenue stream for other transportation improvements.
- **Fully utilize existing parking capacity.** The actual fee amount should be based on the City's individual circumstances. In the case of downtown Monterey, there is already a large, vacant pool of parking for the City to take advantage of. Therefore, a fee structure that favors a long-term revenue stream over immediate funds for garage construction may be more effective.
- **Justify costs for both the City and developer.** Neither the City nor the developer should pay more than their fair share in constructing a shared pool of parking or financing alternative mode programs.

Given these guidelines, an effective in-lieu program for Downtown Monterey would establish a fee structure that includes low annual payments of $150 per space from the developer to meet the parking requirement. This arrangement allows for the City to collect a long-term revenue stream to add future spaces to the public parking supply or fund alternative mode programs.

Recommendation #7: Unbundle Parking Pricing

Goal: Reduce parking demand and vehicle trips from new development, while increasing housing affordability and choice.

Recommendation:

Require all new residential development to "unbundle" the full cost of parking from the cost of the housing itself, by creating a separate parking charge.

Discussion:

Parking costs are generally subsumed into the sale or rental price of housing for the sake of simplicity and because that is the more traditional practice in real estate. But although the cost of parking is often hidden in this way, parking is never free. Each space in a parking structure can cost roughly $30,000. In downtown Monterey, given land values, surface spaces can also be costly.

Looking at parking as a tool to achieve downtown revitalization goals requires some changes to status quo practices, since providing anything for free or at highly subsidized rates encourages use and means that more parking spaces have to be provided to achieve the same rate of availability. For both rental and for sale housing, the full cost of parking should be unbundled from the cost of the housing itself by creating a separate parking charge. This provides a financial reward to households who decide to dispense with one of their cars and helps attract that niche market of households, who wish to live in a transit-oriented neighborhood where it is possible to live well with only one car or even no cars. Unbundling parking costs changes parking from a required purchase to an optional amenity, so that households can freely choose how many spaces they wish to lease. Among households with below average vehicle ownership rates (e.g., low income people, singles and single parents, seniors on fixed incomes, and college students), allowing this choice can provide a substantial financial benefit. Unbundling parking costs means that these households no longer have to pay for parking spaces that they may not be able to use or afford.

Charging separately for parking is also a very effective strategy to encourage households to own fewer cars and rely more on walking, cycling, and transit. It is critical that residents and tenants are made aware that rents, sale prices, and lease fees are reduced because parking is charged for separately. Rather than paying “extra” for parking, the cost is simply separated out – allowing residents and businesses to choose how much they wish to purchase. No tenant, resident, employer, or employee should be required to lease any minimum amount of parking.

Recommendation #8: Implement Transportation Demand Management policies and programs

Goal: Provide incentives for commuters to carpool, take transit, bike, or walk to work.

Recommendation:

The City should consider the introduction of Transportation Demand Management (TDM) programs. These could include a parking cash-out program, universal transit passes, and/or mandating that employees receive benefits in exchange for giving up their parking spaces.

Discussion:

Parking Cash-Out

Many employers in Downtown Monterey (including the City itself) provide free or reduced price parking for their employees as a fringe benefit. Under a parking cash-out requirement, employers will be able to continue this practice *on the condition that they offer the cash value of the parking subsidy to any employee who does not drive to work*.

The cash value of the parking subsidy should be offered in one of three forms:

- A transit/vanpool subsidy equal to the value of the parking subsidy (of which up to $230 is tax-free for both employer and employee)[7]
- A bicycle subsidy equal to the value of the parking subsidy (of which up to $20 per month is tax-free for both employer and employee)
- A taxable carpool/walk subsidy equal to the value of the parking subsidy

Employees who opt to cash-out their parking subsidies would not be eligible to receive free parking from the employer, and would be responsible for their parking charges on days when they drive to work.

Universal Transit Passes

Image from Flickr user "Richard Masoner / Cyclelicious", Creative Commons License.

In recent years, growing numbers of transit agencies have teamed with universities, employers, or residential neighborhoods to provide universal transit passes. These passes typically provide unlimited rides on local or regional transit for a low monthly fee, often absorbed entirely by the employer, school, or developers. A typical example of a universal transit pass is the Eco-Pass program in downtown Boulder, which provides free transit on Denver's Regional Transportation District (RTD) light rail and buses to more than 7500 employees being employed by 700 different businesses in downtown Boulder. To fund this program, Boulder's downtown parking benefit district pays a flat fee for each employee who is enrolled in the program, regardless of whether the employee actually rides transit. Because every single employee in the downtown is enrolled in the program, the Regional Transportation District in turn provides the transit passes at a deep bulk discount. Currently, Monterey-Salinas Transit (MST) offers a Group Discount Program for its 31 Day MST GoPasses at reduced costs (discounts ranging from 10% - 35%), but future prices may vary based on the number of enrolled participants. As a local example, the Monterey Bay Aquarium currently provides bus passes to all staff members who commit to riding the bus to and from work at least three days per week at a 35% discount.

A review of existing universal transit pass programs found that the annual per employee fees are between 1% and 17% of the retail price for an equivalent annual transit pass. The principle of

[7] Under the federal "Commuter Choice" law.

employee or residential transit passes is similar to that of group insurance plans – transit agencies can offer deep bulk discounts when selling passes to a large group, with universal enrollment, on the basis that not all those offered the pass will actually use them regularly.

Benefits

TDM policies and programs have many benefits, including the following:

- Provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk, or bicycle to work. The benefit is particularly valuable to low-income employees, who are less likely to drive to work alone.
- Provides a low-cost fringe benefit that can help individual businesses recruit and retain employees.
- Employers report that parking cash-out requirements are simple to administer and enforce, typically requiring just one to two minutes per employee per month to administer.
- Increases transit ridership, reducing congestion and improving transit cost recovery.
- Reduces existing parking demand.
- Cost less than the provision of additional parking spaces. For example, a study of UCLA's universal transit pass program found that a new parking space costs more than 3 times as much as a free transit pass ($223/month versus $71/month).[8]
- Parking spaces formerly taken by employees can be freed up to provide more spaces for customers.

[8] Jeffrey Brown, et. al. "Fare-Free Public Transit at Universities: An Evaluation." Journal of Planning and Education Research, 2003: Vol 28, No. 1, pp 69-82.

City of Monterey

Cannery Row and Lighthouse Parking Study

December 2012

NELSON
NYGAARD

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Executive Summary

Overview

The Monterey Citywide Transportation and Parking Study is designed to support on-going planning efforts for growth areas and key transportation corridors within the City of Monterey. The City is in the process of developing specific plans for several planning districts and travel corridors to guide and support future development. The Citywide Transportation and Parking Study analyzes transportation and parking alternatives to meet the city's goals to:

- Improve mobility and reduce the need for auto trips
- Improve access to district businesses
- Reduce out-of-way travel created by existing one-way streets
- Provide the correct amount of parking

This report is a part of the effort to meet these goals, which will be achieved, in part, by the collection of current parking data, the projections of future parking demand, and technical analyses of alternative parking management programs.

This report is intended to examine and analyze parking supply and demand conditions in the Lighthouse study area, as a whole and in terms of issues relating to individual sub-districts. This analysis provides information from an original parking inventory and occupancy study performed in April 2011.

Parking Management Planning Approach

Nelson\Nygaard's approach in undertaking this work was as follows:

- Analyzed transportation and parking opportunities and challenges in the Lighthouse area of Monterey, including a review of existing documents, plans, data, and policies, combined with several site visits
- Completed an original data collection effort that assessed existing parking conditions for on- and off-street facilities throughout the study area
- Conducted a parking demand analysis that examined current land uses and future development potential in the area
- Developed cost-effective strategies and program recommendations designed to:
  - Make the most efficient use of the existing parking supply
  - Plan for future parking demand in accommodating economic growth

Purpose of the Parking Study Report

The recommendations in this parking study are established on the premise that parking and transportation are not ends in themselves, but means to achieve broader community goals. These recommendations leverage the Lighthouse area's existing assets, respond to its challenges, and further the overall vision for the area. As described above, this report is a part of Monterey's effort to meet community goals related to the reduction of auto trips, the improvement of access to study area businesses, and the provision of adequate amounts of parking.

Existing Parking Conditions

Inventory and Utilization

Parking supply and utilization was analyzed for the Lighthouse study area as a whole and separately within four zones. A total of 5,068 parking stalls are located within the study area, 1,080 on-street and 3,988 off-street. To evaluate parking occupancy, parking occupancy counts were taken every two hours from 8AM to 8PM on Thursday, April 7; Friday, April 8; and Saturday, April 9. The counted parking supply included accessible on-street and off-street spaces, and public and private spaces; spaces obstructed by construction or physical barriers such as fences were excluded from the counts.

Total occupancy counts show that at the busiest period (Saturday at 2:00PM), only 64% of the area's parking supply was occupied, with on- and off-street spaces showing very similar occupancy rates (65% and 63%, respectively). At this peak hour, 375 on-street and 1,470 off-street spaces were vacant.

These utilization rates are below target rates. Target occupancy rates of 85% and 90% are effective industry-standards for analyzing the demand for on- and off-street spaces, respectively. In other words, maintaining 15% and 10% vacancy rates for corresponding on- and off-street stalls help to ensure an "effective parking supply." It is at these standard occupancy levels that roughly one space per block is available, making searching or "cruising" for parking unnecessary, and allowing off-street lots to maintain adequate maneuverability. Utilization rates much below these targets indicate a diminished economic return on investment in parking facilities.

Existing and Future Parking Demand Ratios

Utilizing the data gathered during the parking inventory as well as an inventory of existing land use and projected land uses, existing parking demand ratios were calculated, and these parking ratios were then used to estimate future parking demand.

- *Built Stalls to Built Land Use Ratio*. This represents the total number of existing parking stalls correlated to total existing land use square footage (occupied or vacant) within the study area. According to data provided by the City, there is approximately 2,492,173 gross square feet (GSF) of land uses in the study zone. At this time, about **2.03 parking stalls per 1,000 GSF** of build land use have been developed/provided within the study area (including both on- and off-street supplies).

- *Combined Peak Demand to Occupied Land Use Ratio.* This represents peak hour occupancy within the entire study area combining the on- and off-street supply. As such, actual parked vehicles were correlated with actual occupied land use area (approximately 2,460,800 GSF). From this perspective, current peak hour demand stands at a ratio of approximately **1.29 occupied parking stalls per 1,000 GSF** of occupied land use. Since parking counts were conducted during both the non-peak parking season and during a period of economic stagnation, calculations were made using historic parking occupancy rates and sales tax figures from the City to determine what parking demand would be in the future given the same amount of land use. Given this information, future parking demand (during peak summer season and a thriving economy) is anticipated to be **1.74 occupied parking stalls per 1,000 GSF** of built land use.

Figure 1 summarizes the analysis used to determine the built ratio of parking to built land use (i.e. Column D), which is based on the correlation between total built land use of 2,492,173 GSF (i.e.

Column A) and 5,068 stalls of "built" parking supply (i.e. Column C). As such, the *built ratio of parking* is 2.03 stalls per 1,000 GSF of commercial/retail building area.

Error! Reference source not found. also shows that the *actual demand* for parking is approximately 1.29 occupied stalls per 1,000 GSF currently and 1.74 occupied stalls per 1,000 GSF at peak season in the future (i.e. Column F). This number is derived by correlating actual occupied land use of 2,460,800 GSF (i.e. Column B) to the 3,223 vehicles actually parked in the peak hour currently and 4,275 anticipated vehicles in the future (i.e. Column E).

Figure 1 Parking Demand – Mixed Land Use to Built Supply

A	B	C	D	E		F	
GSF (Built)	**GSF (Occupied)**	**Total Supply Inventoried in Study Area**	**Built Ratio of Parking (per 1,000 GSF)**	**Total Occupied Spaces in Peak Hour**		**Actual Ratio Parking Demand (per 1,000 GSF)**	
				Current	**Future**	**Current**	**Future**
2,492,173	2,460,800	5,068	2.03	3,223	4,275	1.29	1.74

In the future, if parking were provided at the rate of actual demand absorption (1.74 spaces per 1,000 GSF in the future), overall peak hour occupancies would near 100% *only if* current parking rates and regulations remained in place *and* between 70,000 – 100,000 square feet of new development were constructed in the area. This estimate assumes no underground parking is constructed as a part of this development, no redevelopment of existing sites occurs, and the development of 2-story to 3-story buildings on surface parking lots in the study area. Put another way, there is currently 2.4 million square feet of occupied built space resulting in 4,275 occupied spaces anticipated in the future. In order to fill the remaining 793 vacant spaces in the area, up to another 70,000 – 100,000 square feet could be added without any new parking being constructed. If any changes to parking pricing schemes were to be instituted in the future, peak hour occupancies would likely be less than 100%, particularly if prices were set to recommended levels to ensure a 15% vacancy rate.

To date, parking has been *built* at an average rate of 2.03 stalls per 1,000 GSF of development in the Lighthouse area. This rate appears to have provided surplus parking with availability in both existing on- and off-street facilities, especially given that land uses in the study area only generate parking *demand* rations of 1.29 stalls per 1,000 GSF currently and 1.74 stalls per 1,000 GSF in the future. According to this analysis, approximately 793 stalls will be empty and available at the peak hour of utilization (according to future estimates). This surplus of parking allows for future development to make use of existing spaces prior to the construction of new parking.

Summary of Parking Management Plan Recommendations

Recommendation #1: Install Real-Time Availability and Wayfinding Signs

Real-time availability signs should be installed in the Cannery Row garage and real-time availability information should also be accessible online. These digital displays provide real-time information about available supply, serving to increase utilization of off-street facilities, maximizing efficiency, and reducing "cruising" for available on-street spaces. This strategy also enables information sharing via the web and mobile devices, allowing residents and visitors alike to access real-time parking data from home or on their smart phone.

Although there are small signs currently in place on Foam Street, larger, more visible signs should be placed on Lighthouse Avenue prior to the merge onto Foam Street to direct motorists to the Cannery Row garage or other large private facilities. Such a strategy will direct visitors to underutilized off-street facilities, especially if located at the traditional entrances to the Lighthouse area, near major garages and attractions, and along major arterials. Improved wayfinding in the form of new signs can help direct motorists to their desired destination and is another way to help eliminate traffic caused by cars “cruising” for parking.

Recommendation #2: Implement Valet and Tandem Parking

The City should implement valet and tandem parking in the Cannery Row garage during summer weekends. Valet parking can maximize off-street lot and garage spaces for long-term parkers such as employees, thereby freeing up more convenient curb spaces for visitors. Technology exists to make the car retrieval process customer-friendly. In addition, tandem parking can be used for employees in the Cannery Row garage during summer weekends. This strategy will increase the supply of parking the Lighthouse area and is particularly effective when arrivals and departures are regular, such as an employee arriving and leaving his or her place of work. Another benefit of this strategy is that it facilitates compact development, freeing underutilized surface parking lots for new development.

Recommendation #3: Implement Demand Responsive Pricing

The City should set on-street parking prices at rates that create a 15% vacancy rate on each block and eliminate time limits during allowable parking hours. Parking surveys have shown that summer months in the Lighthouse area along Cannery Row and Wave Street experience significantly higher parking occupancy rates than other times of the year. In addition, Cannery Row and Wave Street are two of the areas with the most demand. As such it is recommended that rates be higher during summer months on Cannery Row and Wave Street. Current on-street prices can remain in place for Cannery Row and Wave Street during the off-season with a rate of $1.00 per hour on Foam Street. During the summer, meters on Cannery Row and Wave Street can increase to $2.00 per hour with Foam Street increasing to $1.50 per hour. Along with adjustable on-street meter rates, the Cannery Row garage can shift its pricing structure so that it costs $6 daily during the off-season and $12 daily in the summer. Occupancy rates for all of these facilities should be monitored in the future with rates raised or lowered based on future counts. Dedicate parking revenues to public improvements and public services that benefit the Lighthouse area. Create a "Parking Benefit District" to implement these recommendations (further explored in Recommendation #4).

Recommendation #4: Create a Residential Parking Benefit District

At the same time that demand responsive pricing is implemented for curb parking in the Lighthouse core-area, implement Residential Parking Benefit Districts in adjacent residential areas. These Districts should be implemented as necessary once a parking evaluation has taken place. Residential Parking Benefit Districts are similar to residential parking permit districts, but allow a limited number of commuters to pay to use surplus on-street parking spaces in residential areas and return the resulting revenues to the neighborhood to fund public improvements such as streetscape amenities and revitalization.

Recommendation #5: Allow Shared Parking Among Different Land Uses by Right

The City of Monterey should allow different land uses to share parking. In order to make the process of securing approval for shared parking less onerous for new development and adaptive reuse projects, the City should:

- Allow parking to be shared among different uses within a single mixed-use building by right
- Allow parking to be shared between residential buildings and an off-site parking facility by right, provided that the off-site facility is within 500 feet of the building entrance
- Off-site shared parking located further than 500 feet should be considered at the discretion of staff, so long as there is documentation that reasonable provision has been made to allow off-site parkers to access the principal use (e.g. a shuttle bus, valet parking service, free transit passes, etc.)
- Mandate that new non-residential parking be available to the public during non-business hours

Recommendation #6: Eliminate/Reduce Minimum Parking Requirements and Establish an In-Lieu Fee

Minimum parking requirements should be eliminated for non-residential uses and residential requirements should be set to one-half space per unit in the Lighthouse area. An in-lieu fee should also be established to both stimulate new development and allow existing businesses to "turnover." With almost 800 parking stalls anticipated to be vacant during peak summer months once the economy has recovered, there is more than enough parking available to cope with existing demand and any demand that could be generated by future development. With a current oversupply of parking, minimum requirements are only acting as an impediment to economic development, rather than their stated goal of ensuring adequate availability.

Given the market for residential units, most new residential developments very will likely provide more than the proposed one-half space per unit minimum; however, the in-lieu fee program would provide an alternative to developers where providing required amounts of on-site parking is either cost prohibitive or undesirable. The in-lieu fee is strictly an optional payment a developer can make in lieu of providing the minimum amount of parking required. The in-lieu fee monies can then serve as a revenue stream to go towards transportation improvements such as improved signage, bicycle facilities, or other enhanced features. The fee should be set at a reasonable level to both make it financially feasible for developers in special cases to meet the requirement and provide an income stream to either increase the public supply of parking or introduce alternative mode programs and improvements. As such, it is recommended that an annual in-lieu fee of $150 per space be set.

Recommendation #7: Unbundle Parking Pricing

Require all new residential development to "unbundle" the full cost of parking from the cost of the housing itself, by creating a separate parking charge. Parking costs are generally subsumed into the sale or rental price of housing for the sake of simplicity and because that is the more traditional practice in real estate. Although the cost of parking is often hidden in this way, parking is never free. Each space in a parking structure can cost upwards of $30,000, while in the Lighthouse area, given land values, surface spaces can also be costly.

Charging separately for parking is a very effective strategy to encourage households to own fewer cars and rely more on walking, cycling, and transit. It is critical that residents and tenants are made aware that rents, sale prices, and lease fees are reduced because parking is charged for separately. Rather than paying "extra" for parking, the cost is simply separated out – allowing residents and businesses to choose how much they wish to purchase. No tenant, resident, employer, or employee should be required to lease any minimum amount of parking.

Recommendation #8: Implement Transportation Demand Management policies and programs.

The City should consider the introduction of Transportation Demand Management (TDM) programs. These could include a parking cash-out program, universal transit passes, and mandating that employees receive benefits in exchange for giving up their parking space. TDM policies and programs have many benefits, including the following:

- Provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk, or bicycle to work. The benefit is particularly valuable to low-income employees, who are less likely to drive to work alone.
- Provides a low-cost fringe benefit that can help individual businesses recruit and retain employees.
- Employers report that parking cash-out requirements are simple to administer and enforce, typically requiring just one to two minutes per employee per month to administer.
- Increases transit ridership, reducing congestion and improving transit cost recovery.
- Reduces existing parking demand.
- Cost less than the provision of additional parking spaces. For example, a study of UCLA's universal transit pass program found that a new parking space costs more than 3 times as much as a free transit pass ($223/month versus $71/month).[1]
- Parking spaces formerly taken by employees can be freed up to provide more spaces for customers.

Chapter by Chapter

This Parking Management Plan contains a large amount of information for policy makers. In order to make full use of the document, it is important to be able to quickly refer to relevant sections of interest. The chapters of this report are summarized as follows:

Chapter 1: Existing Conditions – Describes the existing travel characteristics of the study area in relation to the City as a whole. Summarizes the study area's existing parking conditions as they relate to inventory, regulations, and utilization rates.

Chapter 2: Current and Future Parking Demand – Provides a detailed analysis of existing parking demand as it relates to current and future land uses.

Chapter 3: Parking Management Plan – Summarizes the key points of the study's analysis and offers preliminary recommendations for parking management.

[1] Jeffrey Brown, et. al. "Fare-Free Public Transit at Universities: An Evaluation." Journal of Planning and Education Research, 2003: Vol 28, No. 1, pp 69-82.

Chapter 1. Existing Conditions

The Lighthouse study area is distinguished by a large summertime influx of visitors coming to Cannery Row and the subsequent parking strains placed on both the area's commercial and residential streets. Large off-street facilities such as the Cannery Row garage are well-placed to meet peak demand times, but uneven pricing incentives do not effectively encourage long-term parkers to the most appropriate locations.

Effective management of the area's transportation system is integral to maintaining and enhancing the ultimate success of the Lighthouse area. By examining travel trends and existing parking conditions, this chapter facilitates a better understanding of how people are utilizing the Lighthouse area's current parking facilities, highlights parking challenges and inefficiencies, and provides a framework for developing a targeted parking management plan.

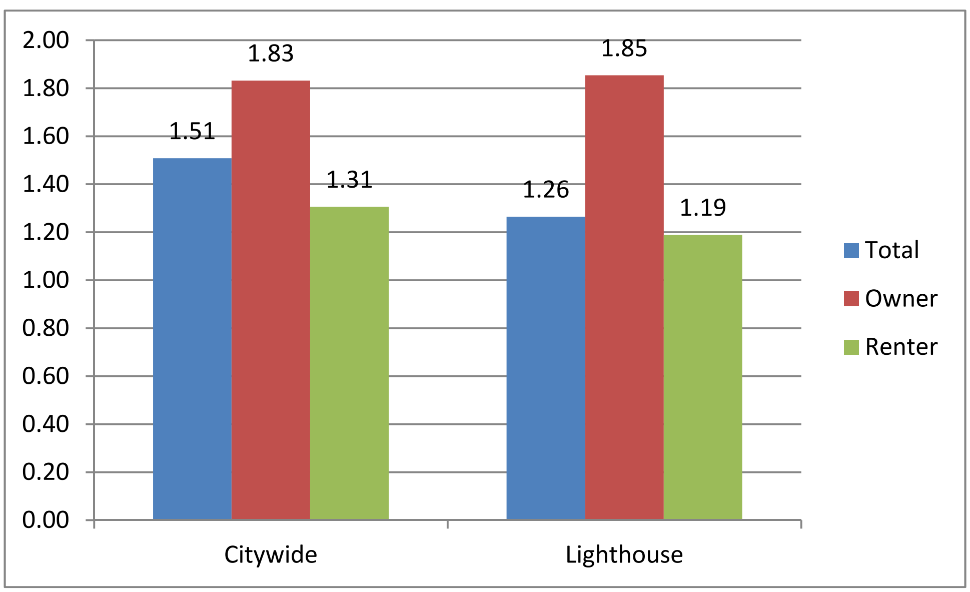
Current Demographics and Travel Characteristics

The Lighthouse area's current travel characteristics offer important background information concerning existing baseline conditions. This information can be used to set performance measures and can be updated as new data becomes available.

Vehicle Ownership

Figure 2 highlights vehicle ownership by housing tenure for the Lighthouse area as well as citywide. As seen in this graph, the Lighthouse area exhibits slightly lower overall vehicle ownership rates than the city as a whole; while the average household owns 1.51 cars citywide, in the Lighthouse district, households on average own 1.26 vehicles. Comparing households that own their housing units, Lighthouse residents have slightly more vehicles than the city average for homeowners (1.85 and 1.83, respectively). Renters in the Lighthouse district, however, own fewer vehicles per household (1.19) than the citywide average for renters (1.31).

Figure 2 Vehicles per Household, by Housing Tenure



Parking Inventory and Regulations

An inventory of parking facilities was undertaken as part of this study. This section provides a brief overview of the parking inventory, which identified the amount of parking and parking regulations, if any, by on-street block and off-street facility.

Methodology

Parking inventory and regulations were determined through field observations by City of Monterey staff (with assistance from Nelson\Nygaard staff), who walked the study area, counted parking spaces, and noted regulations on each block face and in each off-street facility.

Findings

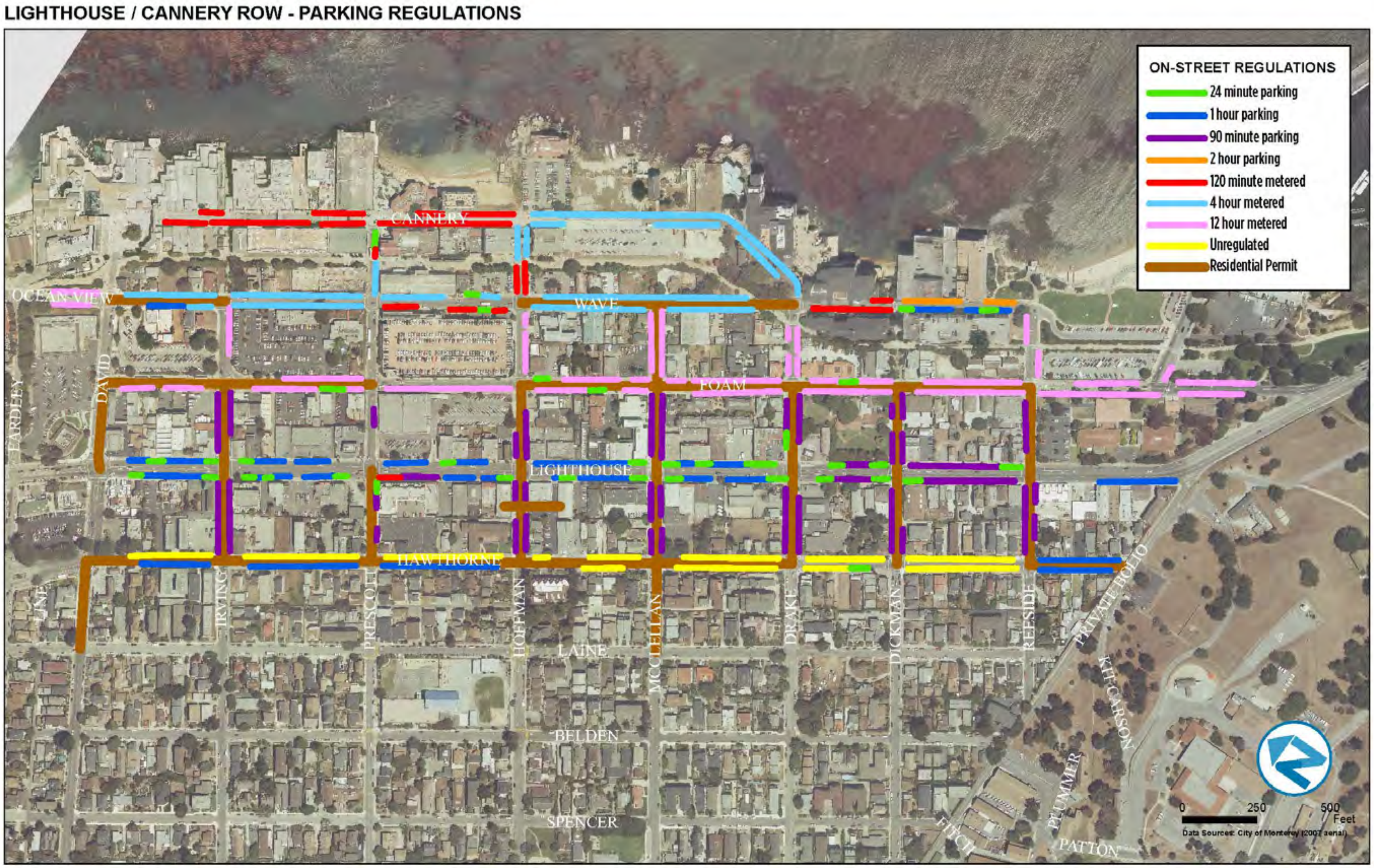
In total, there are 5,068 parking spaces in the study area, 1,080 of which are on-street and 3,988 of which are off-street. Of the off-street spaces, 1,352 are in public facilities, while 2,636 are in private facilities. Of the on-street facilities, 54.2% of spaces are time restricted, while 29.8% are metered or for pay. Only 11.5% of on-street spaces in the Lighthouse area are completely unrestricted. Off-street spaces are typically in a private lot (59.9%) or for pay (37%). Figure 3 provides a more detailed breakdown of the type of parking in the study area for both on- and off-street facilities

Figure 3 Study Area Parking Facilities, by Type

Location	Unrestricted	Time Limits	Metered or Paid	Private Lot	Disabled	Other	Loading	Total	% of parking
On-Street	124	585	322	0	4	12	33	1080	21.3%
	11.5%	54.2%	29.8%	0.0%	0.4%	1.1%	3.1%		
Off-Street	0	2	1,475	2,389	95	24	3	3,988	78.7%
	0.0%	0.1%	37.0%	59.9%	2.4%	0.6%	0.1%		
Total	124	587	1,797	2,389	99	36	36	5,068	100.0%
	2.4%	11.6%	35.5%	47.2%	2.0%	0.7%	0.7%		

Figure 4 shows a map of the on-street parking regulations by block face for the entire study area. The Lighthouse district contains a mix of 24 minute parking, 60 minute parking, and 90 minute parking. Meters exist along many of the street adjacent to the Cannery Row area and Monterey Bay Aquarium ranging from 120 minute, 4 hour, and 12 hour time limits. Some entirely unregulated parking exists along Hawthorne Street. Residential permit parking areas exist along many streets in the study area.

Figure 4 On-street Parking Regulations



Parking Utilization

This section provides an overview of the results from the original parking utilization data collection effort. It includes a summary of the methodology, as well as the key findings for the complete study area and by zone.

Methodology

City of Monterey staff conducted a comprehensive occupancy study for both on- and off-street spaces using trained data collection workers with assistance from Nelson\Nygaard. The count days and times were:

- Thursday, April 7th, 2011 from 8AM – 8PM, every two hours
- Friday, April 8th, 2011 from 8AM – 8PM, every two hours
- Saturday, April 9th, 2011 from 8AM – 8PM, every two hours

Counts were conducted on these days in order to provide as wide a range of parking conditions as possible as parking demand tends to fluctuate a great deal by day of week and time of day. The count periods specifically captured parking activity during a typical weekday and weekend. Each block face and off-street lot was counted every two hours at approximately same time of each counting period.

Findings

Overall Study Area

Utilization

Figure 5 highlights the utilization findings for the Lighthouse study area as a whole. In general, combined occupancy for all on- and off-street facilities in the area exhibited distinctive peaking between noon and 2PM on all count days. On Thursday, utilization peaked at 46% (noon and 2PM), while on Friday, utilization peaked at 49% (noon and 2PM). Overall utilization rates where the highest on Saturday, when peak utilization reached 64% at 2PM.

These overall utilization rates are far below target rates. Target occupancy rates of 85% and 90% are effective industry-standards for on- and off-street spaces, respectively. In other words, maintaining 15% and 10% vacancy rates for corresponding on- and off-street stalls will help ensure an “effective parking supply.” It is at these occupancy levels that roughly one space per block is available, making searching or “cruising” for parking unnecessary and allowing off-street lots to maintain adequate maneuverability. Utilization rates much below these targets indicate a diminished economic return on investments in parking facilities.

Figure 5 Utilization Rates, Overall Study Area

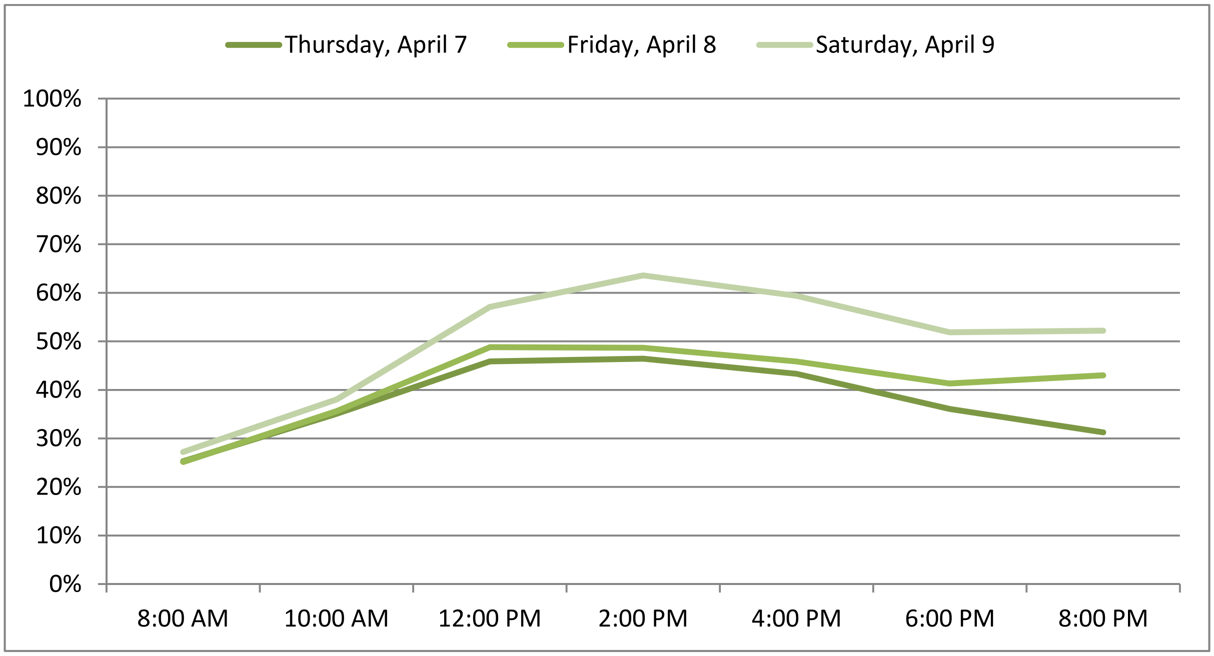


Figure 6, Figure 7, and Figure 8 show utilization rates for Thursday, Friday, and Saturday by facility type. At most times during all count days, on-street facilities saw higher utilization rates than off-street facilities. On Thursday, off-street utilization peaked at 46% (2:00PM), while on-street utilization peaked at 50% (4:00PM). On Friday, off-street utilization peaked at 48% (noon and 2:00PM), while on-street utilization peaked at 53% (noon and 6:00PM). Conversely, Saturday saw peak off-street utilization at 2:00PM (63%), while on-street utilization peaked at 8:00PM (67%). Both Friday and Saturday saw on-street demand increase rapidly between 6:00 and 8:00PM without a corresponding increase in off-street demand. This suggests many people are parking in or searching for the district's prime "front-door" parking spaces instead of taking advantage of the many off-street facilities with ample parking capacity.

Figure 6 Utilization Rates by Facility Type, Thursday

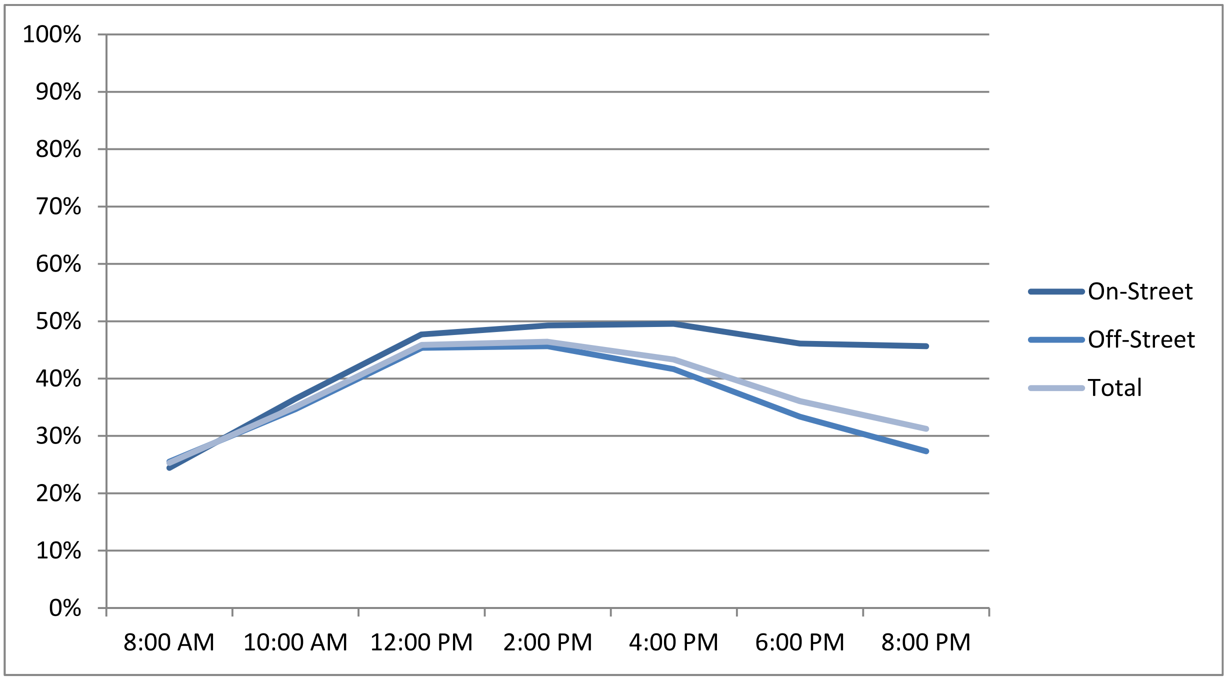


Figure 7 Utilization by Facility Type, Friday

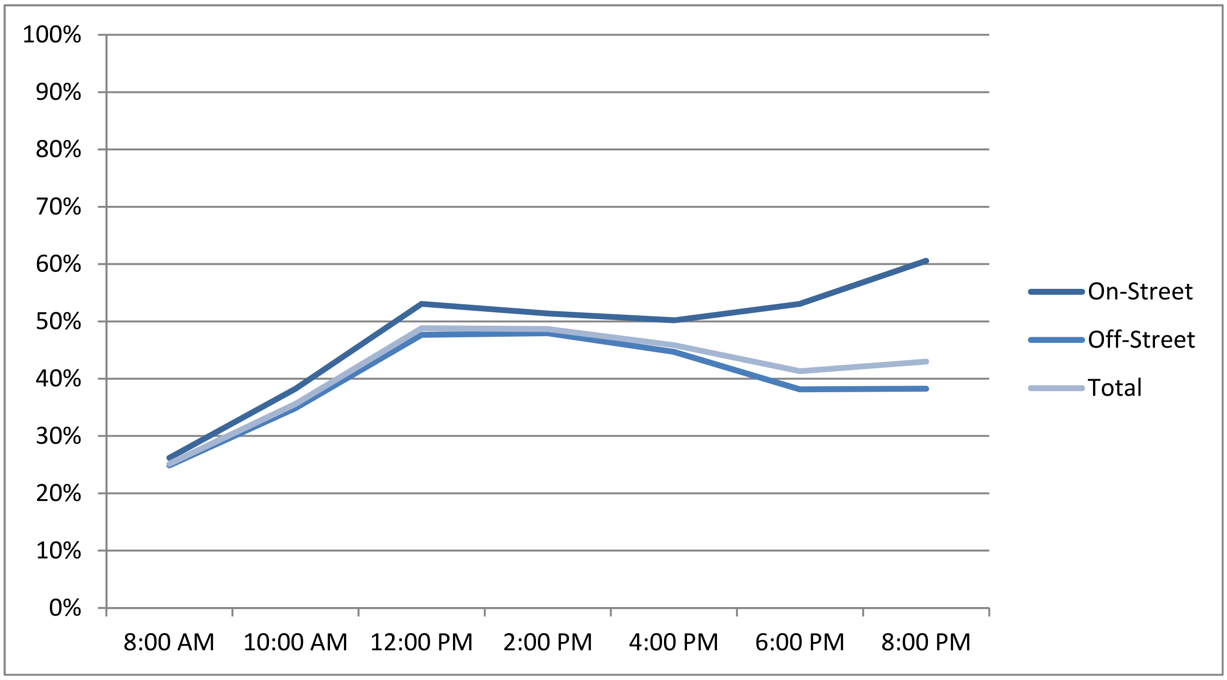


Figure 8 Utilization by Facility Type, Saturday

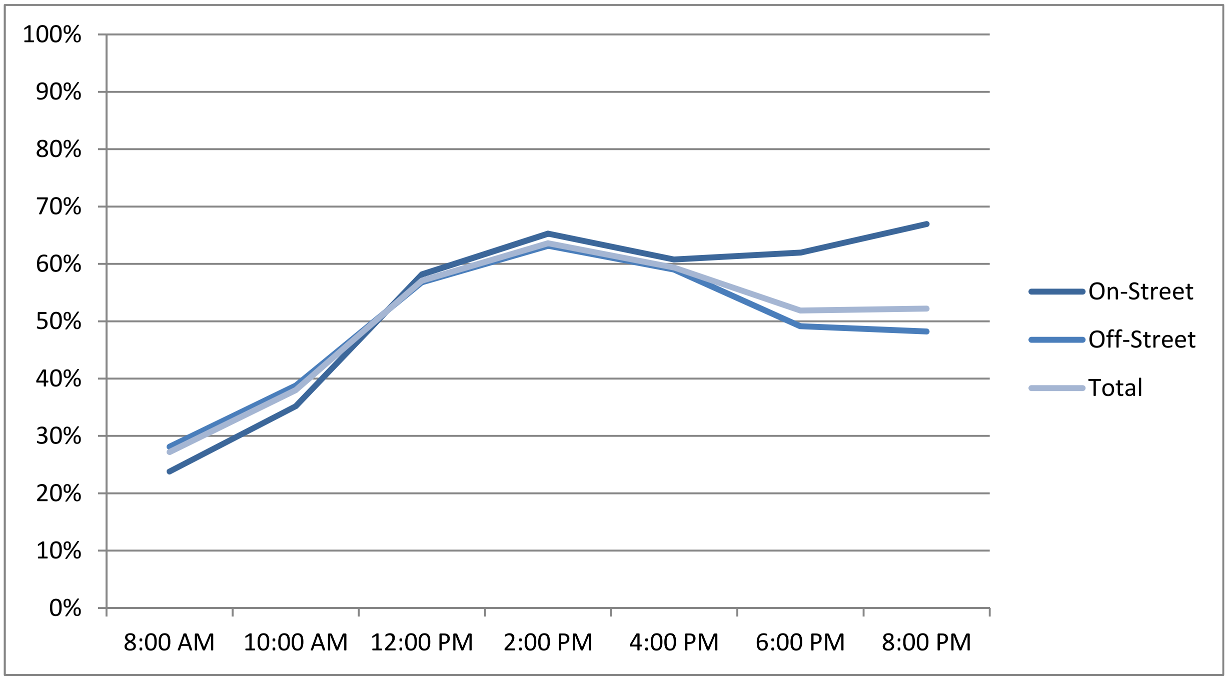


Figure 9, Figure 10, and Figure 11 show peak hour utilization maps of the Lighthouse Avenue area for Thursday (noon – 2:00PM), Friday (8:00 – 10:00PM), and Saturday (2:00 – 4:00PM). These maps show the occupancy level for each individual block face and each individual lot during the peak hour of parking demand. The maps reveal that there are some "pockets" of high demand during peak hours on a few blocks and in some lots throughout the study area. For example, during Thursday's peak hour, Hawthorne Avenue and Cannery Row exhibited the highest on-street utilization rates (above 90%), as did various private lots within the study area. On Friday during the peak hour, utilization was highest along the northern and western blocks of the study area, mostly along Cannery Row, Wave Street, Lighthouse Avenue, and Hawthorne. Private restaurant parking lots saw the highest off-street utilization rates. During Saturday's peak period, private and public off-street facilities near Cannery Row and the Monterey Bay Aquarium exhibited some of the highest utilization rates, as did on-street segments along Hawthorne, Wave, and Cannery.

Figure 9 Peak Hour Utilization, Thursday 2-4PM

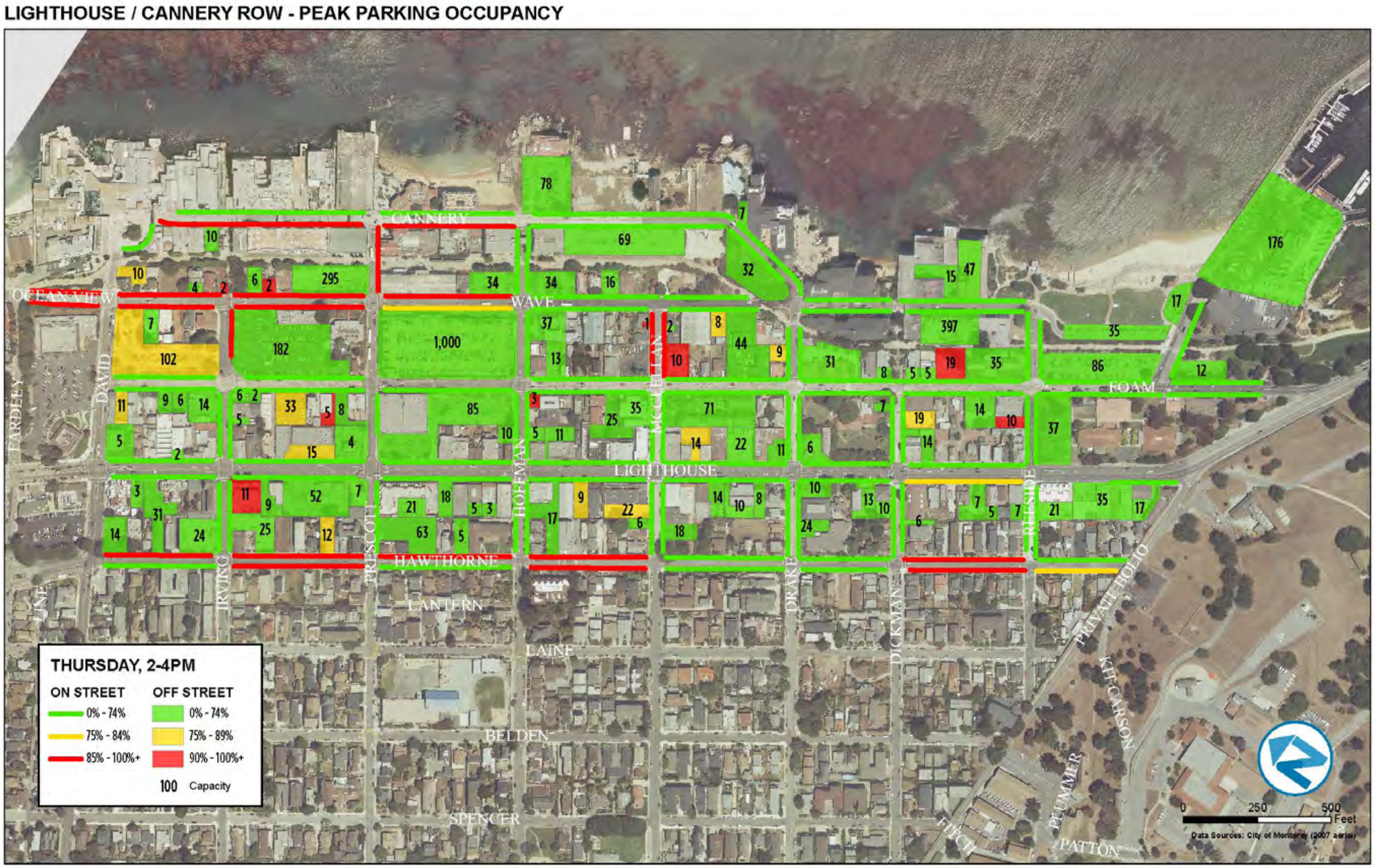


Figure 10 Peak Hour Utilization, Friday 8-10PM

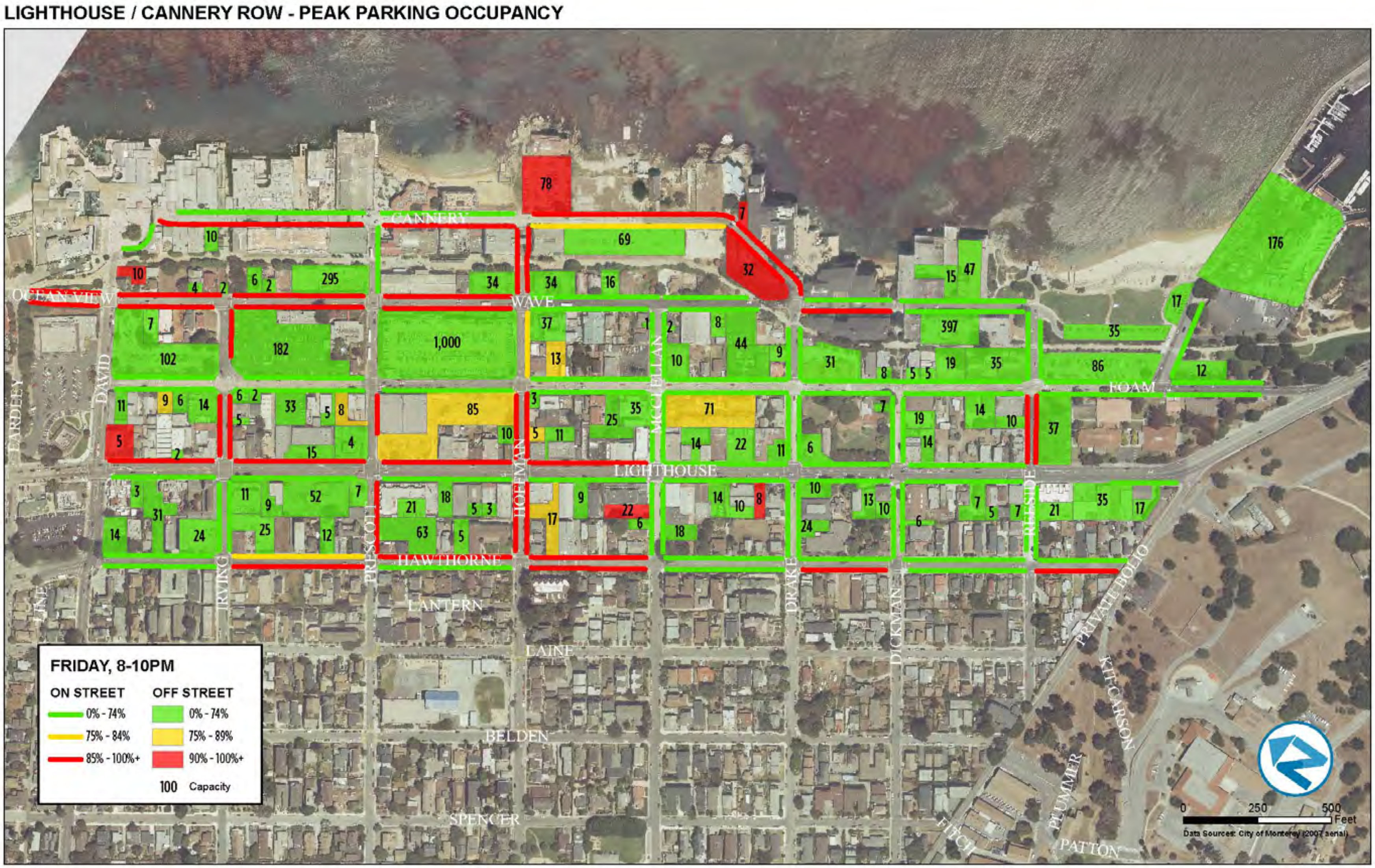
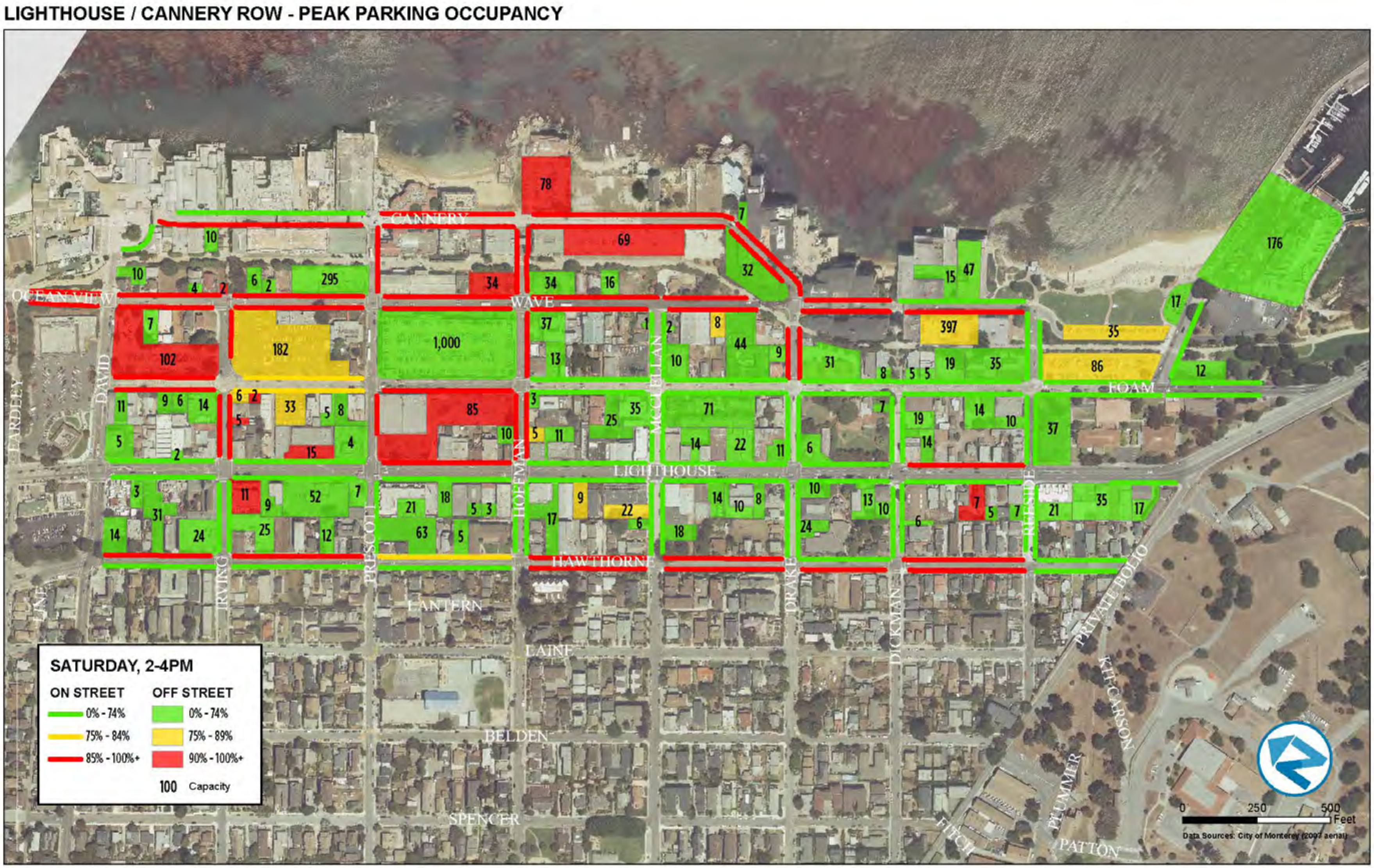


Figure 11 Peak Hour Utilization, Saturday 2-4PM



Study Area Zones

The Lighthouse study area was divided into four distinct zones to better understand parking supply, demand, and utilization on a smaller scale within the Lighthouse area. These zones included the following:

- Cannery Row North, roughly bound by Lighthouse Avenue, the Monterey Bay, Drake Avenue, and David Avenue
- Cannery Row South, roughly bound by Foam Street, the Monterey Bay, and Drake Avenue
- Lighthouse North, bound by Lighthouse Avenue, Hawthorne Street, Drake Avenue, and David Avenue
- Lighthouse South, bound by Foam Street, Hawthorne Street, and Drake Avenue

Utilization

Figure 12, Figure 13, and Figure 14 show peak hour utilization rates by facility type and zone for Thursday, Friday, and Saturday, respectively. On both Thursday and Friday, occupancy rates were well below target levels with blocks varying from nearly empty to full capacity. On Thursday, in no zone and neither facility type did occupancy exceed 54%. On Friday, 70% was the highest rate study area-wide (on-street, Cannery Row North). Saturday saw higher utilization rates in all zones, but only the on-street spaces of Cannery Row North (78%) exceeded 74% utilization. These results indicate that in general there is an ample supply of parking in the study area and that challenges associated with parking are likely due to inefficient management of existing supply.

Figure 12 Peak Hour Utilization by Zone, Thursday 2-4PM

LIGHTHOUSE / CANNERY ROW - PEAK PARKING OCCUPANCY BY ZONE

Figure 13 Peak Hour Utilization by Zone, Friday 8-10PM

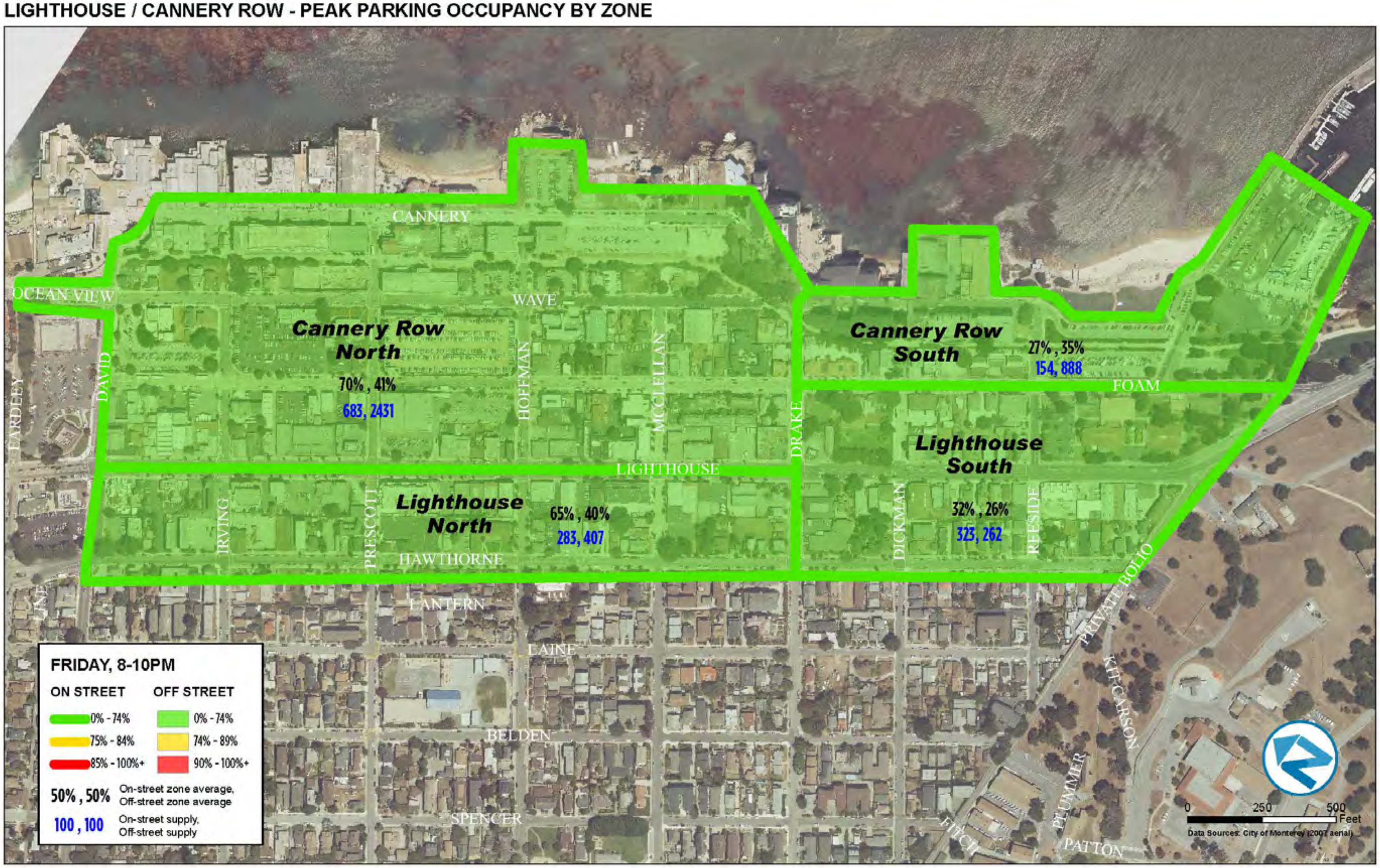
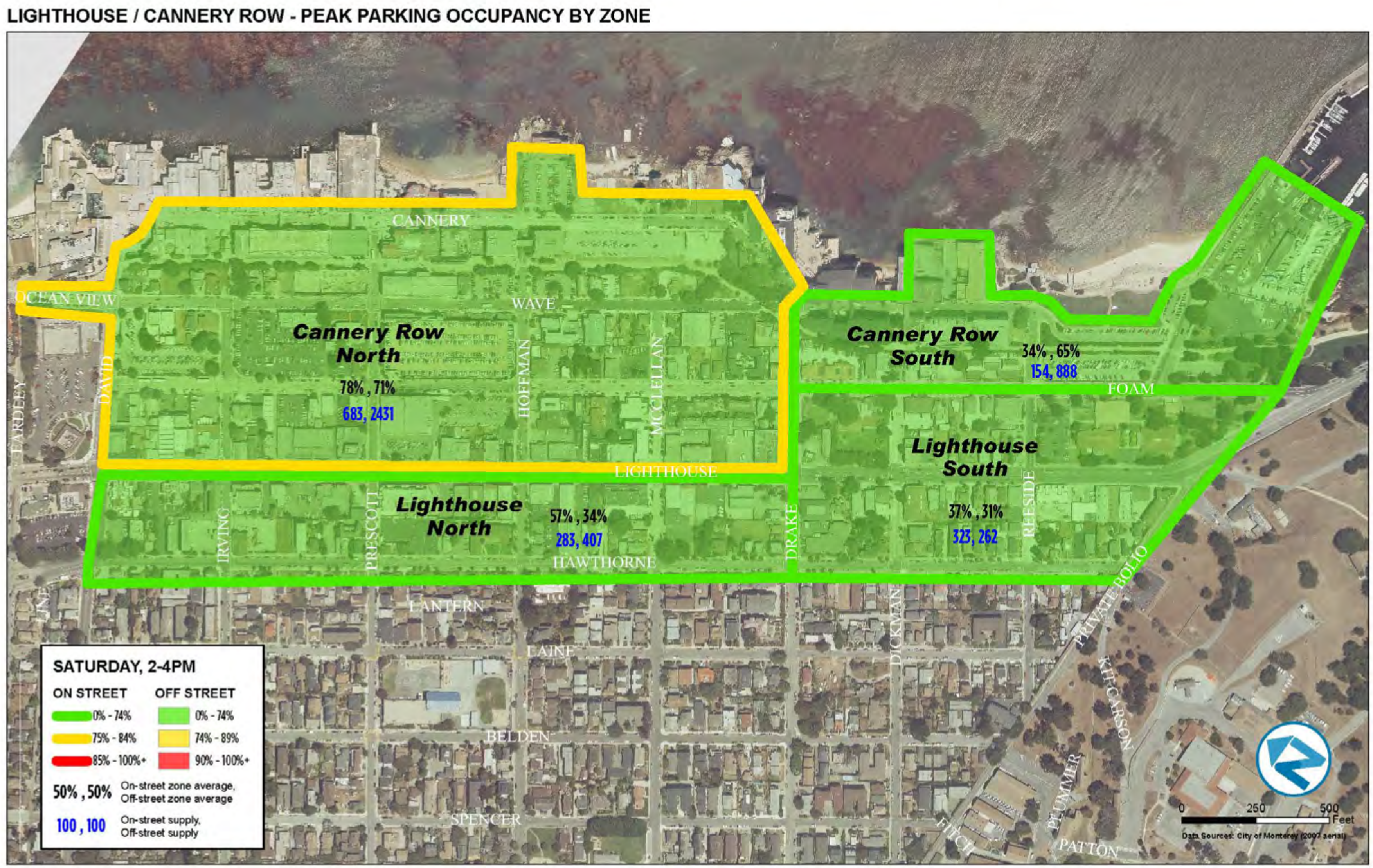


Figure 14 Peak Hour Utilization by Zone, Saturday 2-4PM



Chapter 2. Current and Future Parking Demand

This chapter provides an analysis of existing and future parking conditions in the study area. More specifically, it analyzes existing parking demand in relation to target occupancies and quantifies how much the study area and each zone is “over” or “under” supplied. In addition, this chapter analyzes parking demand in relation to existing and future land use and development patterns. This analysis will enable the City to demonstrate the effects of development on parking and determine whether the study area currently has more or less parking supply than existing demand requires.

Inventory, Occupancy, and Oversupply

As discussed in Chapter 1, the peak hour of parking demand was at 12:00 Noon and 2:00PM for both Thursday and Friday, and 2:00 PM for Saturday. For the whole study area, peak occupancies were 46%, 49%, and 64% on those days, respectively. Once again, these occupancies are well below target levels of demand and result in an “oversupply” of parking, as demonstrated in Figure 15. This figure shows the inventory and occupancy during the peak period for all three days, calculations of the “necessary supply” needed to meet current occupancy levels and maintain the 85% target utilization rates, and the resulting oversupply of existing parking.

As shown in Figure 15, the Lighthouse area is oversupplied with parking. At peak occupancy on Saturday, 3,223 parking spaces in the study area were occupied. If one were to assume that this was meeting the target occupancy rate, then the study area would only require 3,792 spaces. However, current supply in the study area is 5,068 spaces, which translates into a 34% “oversupply” of parking based on current demand. Similar trends are evident across all count days, both weekday and weekend. In fact, on Thursdays and Fridays the area is even more oversupplied with parking, with 85% and 74% more parking than necessary based upon demand on those days, respectively. In short, the study area has more than enough parking spaces to meet current demand.

Figure 15 Occupancy, Inventory, and Oversupply

Day	Occupancy (a)	Necessary Supply (b) = (a/.85)	Existing Supply (c)	Oversupply (d) = (c-b)	% Oversupply (e) = (d/b)
Thursday 12:00PM	2,324	2,734	5,068	2,334	85%
Friday 12:00PM	2,473	2,909	5,068	2,159	74%
Saturday 2:00PM	3,223	3,792	5,068	1,276	34%

Peak Demand in Study Area

Current Conditions

The peak occupancy for the entire study area occurred on Saturday, April 9th at 2:00PM. Parking demand ratio calculations revealed two different, but equally useful correlations:

- *Built Stalls to Built Land Use Ratio*. This represents the total number of existing parking stalls correlated to total existing land use square footage (occupied or vacant) within the study area. According to data provided by the City, there is approximately 2,492,173 gross square feet (GSF) of land use in the study zone. At this time, about **2.03 parking stalls per 1,000 GSF** of build land use have been developed/provided within the study area (including both on- and off-street supplies).
- *Combined Peak Demand to Occupied Land Use Ratio.* This represents peak hour occupancy within the entire study area combining the on- and off-street supply. As such, actual <u>parked vehicles</u> were correlated with actual <u>occupied land use</u> area (approximately 2,460,800 GSF). From this perspective, current peak hour demand stands at a ratio of approximately **1.29 occupied parking stalls per 1,000 GSF** of built land use. Since parking counts were conducted during both the non-peak parking season and during a period of economic stagnation, calculations were made using historic parking occupancy rates and sales tax figures from the City to determine what parking demand would be in the future given the same amount of land use. Given this information, future parking demand (during peak summer season and a thriving economy) is anticipated to be **1.74 occupied parking stalls per 1,000 GSF** of built land use.

Figure 16 summarizes the analysis used to determine the built *ratio* of parking to built land use (i.e. Column D), which is based on the correlation between total built land use of 2,492,173 GSF (i.e. Column A) and 5,068 stalls of “built” parking supply (i.e. Column C). As such, the *built ratio of parking* is 2.03 stalls per 1,000 GSF of commercial/retail building area.

Figure 16 also demonstrates that the *actual demand* for parking is approximately 1.29 occupied stalls per 1,000 GSF currently and 1.74 occupied stalls per 1,000 GSF at peak season in the future (i.e. Column F). These numbers are derived by correlating actual occupied land use area of 2,460,800 (i.e. Column B) to the 3,223 vehicles actually parked in the peak hour currently and 4,275 anticipated vehicles in the future (i.e. Column E).

Figure 16 Parking Demand – Mixed Land Use to Built Supply

A	B	C	D	E		F	
GSF (Built)	**GSF (Occupied)**	**Total Supply Inventoried in Study Area**	**Built Ratio of Parking Demand (per 1,000 GSF)**	**Total Occupied Spaces in Peak Hour**		**Actual Ratio of Parking Demand (per 1,000 GSF)**	
				Current	**Future**	**Current**	**Future**
2,492,173	2,460,800	5,068	2.03	3,223	4,275	1.29	1.74

In the future, if parking were provided at the rate of actual demand absorption (1.74 spaces per 1,000 GSF in the future), overall peak hour occupancies would near 100% *only if* current parking rates and regulations remained in place *and* between 70,000 – 100,000 square feet of new development were constructed in the area. This estimate assumes no underground parking is constructed as a part of this development, no redevelopment of existing sites occurs, and the development of 2-story to 5-story buildings on surface parking lots in the study area. Put another way, there is currently 2.4 million square feet of occupied built space resulting in 4,275 occupied spaces anticipated in the future. In order to fill the remaining 793 vacant spaces in the area, up to another 70,000 – 100,000 square feet could be added without any new parking being constructed. If any changes to parking pricing schemes were to be instituted in the future, peak hour occupancies would likely be less than 100%, particularly if prices were set to recommended levels to ensure a 15% vacancy rate.

To date, parking has been *built* at an average rate of 2.03 stalls per 1,000 GSF of development in the Lighthouse area. This rate appears to have provided surplus parking with availability in both existing on- and off-street facilities, especially given that land uses in the study area only generate parking *demand* ratios of 1.29 stalls per 1,000 GSF currently and a predicted 1.74 stalls per 1,000 GSF in the future. <u>Per this analysis, approximately 793 stalls will be empty and available at the peak hour of utilization (according to future estimates)</u>. This surplus of parking allows for future development to make use of existing spaces prior to the construction of new parking.

Figure 17 provides a summary of built supply to actual demand for other cities that the consultant team has worked with. The Lighthouse area of Monterey falls towards middle of selected cities in relation to actual amount of parking built to land use. However, the study area has one of the lowest demand ratios, resulting in a large gap between the level of parking supplied and what is actually needed. The main theme of this figure is that, like many American cities, *the Lighthouse community is currently building more parking than demand indicates necessary.*

Figure 17 Built Parking Supply and Actual Demand, Selected Cities

City	Minimum Requirement / 1,000 GSF or Actual Build Supply	Actual Demand / 1,000 SF	Gap between parking built and actual parking demand (for every 1,000 GSF)
Hood River, OR	1.54	1.23	0.31
Oxnard, CA	1.7	0.98	0.72
Corvallis, OR	2	1.5	0.5
Sacramento, CA	2	1.6	0.4
Monterey, CA (Lighthouse)	**2.03**	**1.29**	**0.74**
Seattle, WA	2.5	1.75	0.75
Kirkland, WA	2.5	1.98	0.52
Palo Alto, CA	2.5	1.9	0.6
Santa Monica, CA	2.8	1.8	1
Ventura, CA (Westside)	2.87	1.26	1.61
Chico, CA	3	1.7	1.3
Hillsboro, OR	3	1.64	1.36
Bend, OR	3	1.8	1.2
Salem, OR	3.15	2.04	1.11
Redmond, WA	4.1	2.71	1.39
Beaverton, OR	4.15	1.85	2.3

Chapter 3. Parking Management Plan

The inventory of parking supply and regulations, the parking occupancy/turnover study, and the analysis of current parking demand in relation to existing parking requirements, current land uses, and future development patterns provide a wealth of information about parking conditions and behavior within the Lighthouse study area. More importantly, this data will serve as the guiding framework for the City as it moves forward with reforming its parking policies and management systems. By developing regulatory processes that establish the appropriate amount of parking and then maximizing the efficiency of that supply, the City can accommodate the interests of all stakeholders, including employees, visitors, and residents.

Other cities have faced similar circumstances in managing parking and have used improved policies and management to alleviate localized inefficiencies while spurring economic growth. This chapter seeks to begin the conversation by offering several recommendations for parking reform. These concepts are informed by the data obtained in this study as well as Nelson\Nygaard's previous experience with similar cities.

Principles of Effective Parking Management

Historically, "solving the parking problem" almost always meant increasing supply. Unfortunately, constantly increasing parking supply simply encourages more auto use, as people are encouraged to drive to places that offer "plenty of free parking." While providing adequate parking is still important, it is only one tool available for managing both demand and supply. The goal of "parking demand management" is to provide the optimal amount of parking to meet parking needs, while reducing traffic congestion and accommodating new development and a variety of land uses.

Managing parking has been shown to be the single most effective tool for managing congestion, even when densities are relatively low and major investments in other modes have not been made. Parking management can also have a significant impact on commute mode choice, which translates directly to reductions in auto congestion and improved livability of commercial districts and adjacent neighborhoods.

As the Lighthouse district continues to grow and evolve, its parking needs will change as well. This Plan recommends techniques to both address current challenges and adjust to future needs. Above all else, this Plan proposes a parking management approach that utilizes policies and programs that will enable more efficient utilization of existing supply, while alleviating parking congestion.

In recognition of these considerations, the following principles informed the development of parking management recommendations for the Lighthouse community:

- Set clear parking priorities based on the district's strengths and vision for the future
- Manage the entire parking supply as part of an integrated system
- Manage parking facilities with a focus on maintaining availability, not simply increasing supply
- Optimize investment in parking by making efficient use of all public and private parking facilities and encouraging use of viable alternative mode options—before constructing new parking

- Use any potential parking revenue to fund transportation programs that maintain adequate parking supply and support use of alternative transportation options in the Lighthouse area
- Use of residential permit districts to address spillover concerns in residential neighborhoods
- Encourage economic revitalization and remove barriers to development and adaptive reuse projects by adopting parking standards that are tailored to the unique parking demands of mixed-use, walkable communities
- Ensure flexibility for developers by providing a variety of tools to meet and/or reduce parking requirements
- Provide flexibility to local decision makers and City staff to adapt to future changes in parking demand and travel patterns

Recommendations

Recommendation #1: Install Real-Time Availability and Wayfinding Signs

Goal: Maximize the use of current parking facilities and limit traffic caused by cars "cruising" for parking.

Recommendation:

Real-time availability signs should be installed in the Cannery Row garage and real-time availability information should also be accessible online. These digital displays provide real-time information about available supply, serving to increase utilization of off-street facilities, maximizing efficiency, and reducing "cruising" for available on-street spaces. This strategy also enables information sharing via the web and mobile devices, allowing residents and visitors alike to access real-time parking data from home or on their smart phone.

Although there are small signs currently in place on Foam Street, larger, more visible signs should be placed on Lighthouse Avenue prior to the merge onto Foam Street to direct motorists to the Cannery Row garage or other large private facilities. Such a strategy will direct visitors to underutilized off-street facilities, especially if located at the traditional entrances to the Lighthouse area, near major garages and attractions, and along major arterials. Improved wayfinding with new signs can help direct motorists to their desired destination and is another way to help eliminate traffic caused by cars "cruising" for parking.

Recommendation #2: Implement Valet and Tandem Parking

Goal: Maximize the use of current parking facilities to increase current supply and decrease the need for the construction of additional facilities.

Recommendation:

The City should implement valet and tandem parking in the Cannery Row garage during summer weekends. Valet parking can maximize off-street lot and garage spaces for long-term parkers such as employees, thereby freeing up more convenient curb spaces for visitors. Technology exists to make the car retrieval process customer-friendly. In addition, tandem parking can be employed for employees in the Cannery Row garage during summer weekends. This strategy will increase the supply of parking the Lighthouse area and is particularly effective when arrivals and departures are regular, such as an employee arriving and leaving his or her place of work. Another benefit of this strategy is that it facilitates compact development, freeing underutilized surface parking lots for new development.

Recommendation #3: Implement Demand Responsive Pricing

Goals:

1. Efficiently manage demand for parking while accommodating customer, employee, resident, and commuter parking needs
2. Put customers first by creating vacancies and turnover in the most convenient “front door” curb parking spaces to ensure availability for customers and visitors
3. Generate revenues for desired improvements such as upgraded security and enhanced streetscapes

Recommendation:

Set on-street parking prices at rates that create a 15% vacancy rate on each block, and eliminate time limits during allowable parking hours. Parking surveys have shown that summer months in the Lighthouse area along Cannery Row and Wave Street experience significantly higher parking occupancy rates than other times of the year. In addition, Cannery Row and Wave Street are two of the areas with the most demand. As such it is recommended that rates be higher during summer months on Cannery Row and Wave Street. Current on-street prices can remain in place for Cannery Row and Wave Street during the off-season with a rate of $1.00 per hour on Foam Street. During the summer, meters on Cannery Row and Wave Street can increase to $2.00 per hour with Foam Street increasing to $1.50 per hour. Along with adjustable on-street meter rates, the Cannery Row garage can shift its pricing structure so that it costs $6 daily during the off-season and $12 daily in the summer. Occupancy rates for all of these facilities should be monitored in the future with rates raised or lowered based on future counts. Dedicate parking revenues to public improvements and public services that benefit the Lighthouse area. Create a "Parking Benefit District" to implement these recommendations (further explored in Recommendation #4).

Discussion:

Parking demand management strategies aim to decrease demand for parking, minimizing the need for additional on- and off- street capacity. Charging motorists directly for using parking facilities with dynamic prices that include lower rates during off-peak periods and higher rates at peak times and locations creates vacancies and turnover in the most convenient “front door” curb parking spaces to ensure availability for customers and visitors. The City should impose higher on-street parking prices with no time limits in certain areas and lower off-street parking prices with no limits in Lighthouse facilities. This strategy would serve to effectively distribute parking demand. Keeping occupancy rates at 85% is the industry standard, meaning 1 in 8 of the most convenient spaces will always be available.

According to the parking survey, the peak occupancy rate for the total parking supply in the Lighthouse area is just 64% at the busiest hour (which occurred on Saturday at 2PM). At the busiest weekday hour, the peak occupancy rate for the study area reached just 49%. However, there are several blocks that are fully occupied while many less convenient lots and structures a block or two away remained largely vacant.

After adjusting fee rates, occupancy rates for each block should be reviewed and then adjusted down or up to achieve the 85% occupancy goal, as previously described. To ensure that this happens on a regular schedule, promptly, and with clear assurance to policymakers, citizens and the Lighthouse community that the goal of parking prices is to achieve the desired vacancy rate, the following procedure for adjusting parking meter rates and hours is recommended:

1. *Set Policy:* By ordinance, the City Council should establish that the primary goal in setting parking meter rates and hours for each block and each lot is to achieve an 85% occupancy rate. Additionally, the ordinance should both require and authorize City staff to raise or lower parking prices to meet this goal, without requiring further action by the City

Council. The City's Parking Division[2] should be charged with the responsibility of running the district, including monitoring occupancy rates and pricing as necessary.

2. *Monitor occupancy:* Modern, wirelessly networked parking meters are capable of instantly transmitting current information on the number of spaces in use on each block where the meters are installed, giving the City's Parking Division the ability to constantly monitor parking usage in the system. Reports can also be generated to track occupancy by the hour over the course of days, weeks, or months.
3. *Adjust rates:* Armed with good information on recent parking occupancy rates, the City's Parking Division should adjust the rates (and hours of operation) up or down on each block, to achieve the policy goal (an 85% occupancy rate) set by City Council. Typically, rates should be adjusted quarterly (four times per year), but in the case of major changes in the Lighthouse area, such as the opening of a new development, it may be advisable to adjust rates as needed in response to particular events. To provide additional input to the process, an advisory board should review the proposed rate changes and provide feedback to the Parking Division.

Eliminating Time Limits

For customers, strict enforcement can bring "ticket anxiety", the fear of getting a ticket if one lingers a minute too long (for example, in order to have dessert after lunch). As Dan Zack, Downtown Development Manager for Redwood City, CA, puts it, "Even if a visitor is quick enough to avoid a ticket, they don't want to spend the evening watching the clock and moving their car around. If a customer is having a good time in a restaurant, and they are happy to pay the market price for their parking spot, do we want them to wrap up their evening early because their time limit wasn't long enough? Do we want them to skip dessert or that last cappuccino in order to avoid a ticket?"

A recent Redwood City staff report summarizes the results found in downtown Burlingame, California:

> "In a recent "intercept" survey, shoppers in downtown Burlingame were asked which factor made their parking experience less pleasant recently... The number one response was "difficulty in finding a space" followed by "chance of getting a ticket." "Need to carry change" was third, and the factor that least concerned the respondents was "cost of parking." It is interesting to note that Burlingame has the most expensive on-street parking on the [San Francisco] Peninsula ($.75 per hour) and yet cost was the least troubling factor for most people."

This is not an isolated result. Repeatedly, surveys of shoppers have shown that the *availability* of parking, rather than price, is of prime importance.

Once a policy of market rate pricing is adopted, with the goal of achieving an 85% occupancy rate on each block, even at the busiest hours, then time limits can actually be eliminated. With their elimination, much of the worry and "ticket anxiety" for parking customers disappears. In Redwood City, where this policy was recently adopted, Dan Zack describes the thinking behind the City's decision:

[2] The Parking Division is operated as an enterprise fund through the Parking Fund. All of the Parking Division's operating expenses, debit payments, inter-department and overhead charges are paid from the Parking Fund, and all revenue generated by parking operations is deposited into the Parking Fund.

> "Market-rate prices are the only known way to consistently create available parking spaces in popular areas. If we institute market-rate prices, and adequate spaces are made available, then what purpose do time limits serve? None, other than to inconvenience customers. If there is a space or two available on all blocks, then who cares how long each individual car is there? The reality is that it doesn't matter."

Create a Commercial Parking Benefit District (PBD)

By creating a PBD, revenues from on-street meters can be used to fund transportation improvements in the Lighthouse district. The City could also lease private parking spaces from willing businesses to make them publically available, increasing the general supply of parking. Such programs could support local transit and possible shuttle services as well as improve the pedestrian environment.

Recommendation #4: Create a Residential Parking Benefit District

Goal: Prevent "spillover" parking in adjacent neighborhoods.

Recommendation: At the same time that demand responsive pricing is implemented for curb parking in the Lighthouse core-area, implement residential parking benefit districts in adjacent residential areas. These Districts should be implemented, as necessary, once a parking evaluation has taken place. Residential parking benefit districts are similar to residential parking permit districts, but allow a limited number of commuters to pay to use surplus on-street parking spaces in residential areas and return the resulting revenues to the neighborhood to fund public improvements such as streetscape amenities and revitalization.

Discussion: In order to prevent spillover parking in residential neighborhoods, many cities implement *residential permit districts* (also known as preferential parking districts) by issuing a certain number of parking permits to residents usually for free or a nominal fee. These permits allow the residents to park within the district while all others are prohibited from parking there for more than a few hours, if at all. At least 130 cities and counties currently have residential parking permit programs in effect in the US and Canada.[3]

Residential parking permit districts are typically implemented in residential districts near large traffic generators such as central business districts, educational, medical, and recreational facilities. They do have several limitations.

Most notably, conventional residential permit districts often issue an unlimited

[3] "Residential Permit Parking: Informational Report." Institute of Transportation Engineers, 2000, p1.

number of permits to residents without regard to the actual number of curb parking spaces available in the district. This often leads to a situation in which on-street parking is seriously congested, and the permit functions solely as a “hunting license”, simply giving residents the right to hunt for a parking space with no guarantee that they will actually find one. (An example of this is Boston’s Beacon Hill neighborhood, where the City’s Department of Transportation has issued residents 3,933 permits for the 983 available curb spaces in Beacon Hill’s residential parking permit district, a 4-to-1 ratio.[4])

The opposite problem occurs with conventional residential permit districts in situations where there are actually surplus parking spaces (especially during the day, when many residents are away), but the permit district prevents any commuters from parking in these spaces even if demand is high and many motorists would be willing to pay to park in one of the surplus spaces.

In both cases, conventional residential parking permit districts prevent curb parking spaces from being efficiently used (promoting overuse in the former example and underuse in the latter).

To avoid these problems, Monterey should implement *residential parking benefit district*s in Lighthouse adjacent residential areas at the same time that dynamic pricing is implemented for curb parking in the district core. This will prevent excessive spillover parking from commuters trying to avoid parking charges and further community revitalization goals.

Implementation details

The following steps should be taken to implement each residential parking benefit district:

1. Count the number of available curb parking spaces in the area where the residential parking benefit districts is being considered. Make a map showing the results of the count. On blocks where individual parking stalls are not marked, assume that one parking space exists for every 20 feet of available curb space. ("Available" curb space means curb space where parking is legal. So curb space where parking is prohibited, such as red painted curbs near fire hydrants, should be excluded.) Usually, "left over" fragments of curb space will exist after all of the segments that are at least 20 feet long have been counted. For example, if there is a 96 foot long segment of curb space where it is legal to park, then the segment contains four 20-foot-long parking spaces, plus a left over 16 foot long fragment. Similarly, it is common to find “fragments” of legally available curb space (i.e. sections of curb space that are less than 20 feet long) between driveways or between a driveway and a fire hydrant. Count any leftover fragment that is at least 16 feet long as a parking space. Disregard fragments that are less than 16 feet long. (These longer fragments may be considered to be the equivalent of compact parking spaces, while not all cars fit in a space of this length, many cars will.) On the map, clearly delineate the number of curb parking spaces on each block face.

    a. Counting the number of curb parking spaces available in an area where a residential parking benefit district is being considered is an essential first step for any Parking Manager. It is the equivalent of movie theater managers knowing exactly how many seats are in their movie theaters. Just as the manager of a movie theater cannot know how many tickets to sell without knowing how many seats exist, a parking manager cannot know how many parking permits to issue unless he or she knows how many parking spaces exist.

3. Count the number of residential units on each parcel within the same area. Add this information to the map of curb parking spaces completed in Step #1. As a base map for

[4] Shoup, Donald. The High Cost of Free Parking. APA Planners Press, 2005, p516.

this effort, an Assessor's Parcel Map is often very useful. The Assessor's Parcel Map can be combined with Assessor's Parcel Data on the ownership of each parcel to help identify how many properties exist in an area, the legal boundaries of those properties, and the homeowners and/or landlords for each residential unit. In turn, this information can help clarify the number of residential units on each property and the tenants who reside in those units.

4. Compare the existing number of residential units in the area to the number of available curb parking spaces in the area. Usually, the best visual presentation is to prepare a map showing: (a) the total number of residential units on each block, and (b) the number of available curb parking spaces on each block face. For the entire area, it is important to determine the ratio of curb parking spaces to residential units. (For example, if there are 1000 curb parking spaces and 500 residential units, then the ratio is 2.0 curb parking spaces per unit.)
5. Decide how many curb parking permits to issue to residents and what percent of spaces should be reserved for visitors. For example, the City may wish to set aside 10% of curb spaces for visitor use. Visitors should be able to purchase daily passes online (if license plate recognition enforcement is available) or at a local civic building (as Pasadena, CA does at its fire stations).
6. Resident permits should be priced on a graduated scale. For example, the first permit can be priced at ten dollars with the second at $25. If it is difficult to implement the residential district initially, it may be advisable to issue the first permit free to existing residents.
7. Set a time limit on streets of one to two hours to prevent nonresidents from occupying spaces for long periods and encourage residents to use their garages for parking rather than storage.
8. Rather than entirely prohibit nonresident parking as with many conventional residential parking permit districts, the City should sell permits for any surplus parking capacity to non-resident commuters at fair market rates. These nonresident permits, though, should only be permitted during daytime hours when residential occupancy rates are lower.
9. Finally, the rates for non-residents' parking permits should be set at fair market rates as determined by periodic city surveys. It is very likely that these non-resident permits may be priced at higher rates than resident permits due to market conditions.
10. All net revenues above and beyond the cost of administering the program should be dedicated to paying for public improvements in the neighborhood where the revenue was generated. This will visibly help improve the neighborhood and decrease resistance to the new program.

Additional Implementation Recommendations for Non-Resident Permits

Enforcement policies: Parking Enforcement Officers should follow the same enforcement policies as in Monterey's current Lighthouse meter zone and should issue citations for "expired meter" or "no valid permit/meter."

Community Participation & Local Control

Residential parking benefit districts should only be implemented if a simple majority (50% +1) of property owners on a block supports the formation of the district.

Once implemented, residents, property owners, and business owners in the district should continue to have a voice in recommending to City Council how they would suggest new parking revenue be spent in their neighborhood. This could occur via City staff attendance at existing neighborhood association meetings, mail-in surveys, or public workshops. Another option is to appoint advisory committees in each parking benefit district, tasked with recommending to City Council how the revenue should be spent in their neighborhood.

Benefits of Residential Parking Benefit Districts

Residential parking benefit districts have been described as "a compromise between free curb parking that leads to overcrowding and [conventional residential] permit districts that lead to underuse…[parking] benefit districts are better for both residents and non-residents: residents get public services paid for by non-residents, and non-residents get to park at a fair-market price rather than not at all."[5]

Benefits of implementing a residential parking benefit districts in the City of Monterey would include the following:

- Excessive parking spillover into adjacent neighborhoods will be prevented
- Scarce curb parking spaces will be used as efficiently as possible
- Need for additional costly parking structure construction would be reduced
- Residents would have a much better chance to find a parking space at the curb

Recommendation #5: Allow Shared Parking Among Different Land Uses by Right

Goal: Maximize the use of existing parking facilities by exploiting the different periods of parking demand for different land uses.

Recommendation:

Monterey should allow different land uses to share parking. In order to make the process of securing approval for shared parking less onerous for new development and adaptive reuse projects, the City should:

- Allow parking to be shared among different uses within a single mixed-use building by right
- Allow parking to be shared between residential buildings and an off-site parking facility by right, provided that the off-site facility is within 500 feet of the building entrance
- Off-site shared parking located further than 500 feet should be considered at the discretion of staff, so long as there is documentation that reasonable provision has been made to allow off-site parkers to access the principal use (e.g. a shuttle bus, valet parking service, free transit passes, etc.)
- Mandate that new non-residential parking be available to the public during non-business hours

[5] Ibid., p435.

Discussion:

Different land uses have different periods of parking demand. For example, a bank adjacent to a night club can quite easily share a common parking facility. This principle is widely accepted in transportation planning and should be permitted in the City's parking code. This allows the Planning Director to allow a reduction when two or more uses demonstrate their patrons can share parking spaces, the City will reduce cruising for on-street spaces and encourage more compact development. This strategy can reduce the parking space needs for new development between 40% and 60%.

As discussed above, in order to facilitate the addition of more publicly accessible spaces to the shared pool of parking, private parking spaces can be leased from willing businesses using PBD funds to maximize their use.

Recommendation #6: Eliminate/Reduce Minimum Parking Requirements and Establish an In-Lieu Fee

Goal: Remove barriers to new development; encourage efficiently shared public parking rather than many small, inefficient private lots; and create a healthy market for parking, where parking spaces are bought, sold, rented, and leased like any normal commodity.

Recommendation:

Minimum parking requirements should be eliminated for non-residential uses and residential requirements should be set to one-half space per unit in the Lighthouse area. An in-lieu fee should also be established to both stimulate new development and allow existing businesses to "turnover." With almost 800 parking stalls anticipated to be vacant during peak summer months once the economy has recovered, there is more than enough parking available to cope with existing demand and any demand that could be generated by future development. With a current oversupply of parking, minimum requirements are only acting as an impediment to economic development, rather than their stated goal of ensuring adequate availability.

Given the market for residential units, most new residential developments very will likely provide more than the proposed one-half space per unit minimum; however, the in-lieu fee program would provide an alternative to developers where providing required amounts of on-site parking is either cost prohibitive or undesirable. The in-lieu fee is strictly an optional payment a developer can make in lieu of providing the minimum amount of parking required. The in-lieu fee monies can then serve as a revenue stream to go towards transportation improvements such as improved signage, bicycle facilities, or other enhanced features. The fee should be set at a reasonable level to both make it financially feasible for developers in special cases to meet the requirement and provide an income stream to either increase the public supply of parking or introduce alternative mode programs and improvements. As such, it is recommended that an annual in-lieu fee of $150 per space be set.

Discussion:

Stimulate Economic Development

In order for Monterey to realize its goals for the revitalization of the Lighthouse area, the City's parking policies must support those goals. Minimum parking requirements, however, have emerged as one of the biggest obstacles to many cities' efforts to encourage new residential and commercial development in revitalizing areas. Minimum parking requirements typically require more than one square foot of parking area for every square foot of building. These requirements can be particularly damaging to uses, such as eating establishments, which help create vibrancy and life in the area.

Moreover, minimum parking requirements clash with virtually all of Monterey's other adopted goals for its Lighthouse district. As UCLA professor Don Shoup describes it, "Parking requirements cause great harm: they subsidize cars, distort transportation choices, warp urban form, increase housing costs, burden low-income households, debase urban design, damage the economy, and degrade the environment… [O]ff-street parking requirements also cost a lot of money, although this cost is hidden in higher prices for everything except parking itself."

Establish a Fee Structure to Promote Economic Development

There are several key elements to address in devising an in-lieu fee price structure. The fee must serve the goals of the City, but it must also be flexible enough to encourage economic growth while providing an adequate pool of revenue for future parking facilities and alternative mode programs. An effective in-lieu fee program should seek to:

- **Avoid large up-front costs to developers that would deter investment.** Many cities make the mistake of creating a "simple" in-lieu fee structure based on large initial lump sum payments. These in-lieu fees can prove excessively costly to developers who ultimately forgo construction or build parking on-site that is not efficient in terms of parking or land resources.
- **Guarantee a revenue stream for the City.** A workable fee structure will both provide the City with enough initial funding to finance parking space construction (if necessary) and give the City a continuous long-term revenue stream for other transportation improvements.
- **Fully utilize existing parking capacity.** The actual fee amount should be based on the City's individual circumstances. In the case of the Lighthouse area, there is already a large, vacant pool of parking for the City to take advantage of. Therefore, a fee structure that favors a long-term revenue stream over immediate funds for garage construction may be more effective.
- **Justify costs for both the City and developer.** Neither the City nor the developer should pay more than their fair share in constructing a shared pool of parking or financing alternative mode programs.

Given these guidelines, an effective in-lieu program for the Lighthouse would establish a fee structure that includes low annual payments of $150 per space from the developer to meet the parking requirement. This arrangement allows for the City to collect a long-term revenue stream to add future spaces to the public parking supply or fund alternative mode programs.

Recommendation #7: Unbundle Parking Pricing

Goal: Reduce parking demand and vehicle trips from new development while increasing housing affordability and choice.

Recommendation:

Require all new residential development to “unbundle” the full cost of parking from the cost of the housing itself, by creating a separate parking charge.

Discussion:

Parking costs are generally subsumed into the sale or rental price of housing for the sake of simplicity and because that is the more traditional practice in real estate. But although the cost of parking is often hidden in this way, parking is never free. Each space in a parking structure can cost upwards of $30,000, while in Monterey, given land values, surface spaces can also be costly.

Looking at parking as a tool to achieve revitalization goals requires some changes to status quo practices, since providing anything for free or at highly subsidized rates encourages use and means that more parking spaces have to be provided to achieve the same rate of availability. For both rental and for sale housing, the full cost of parking should be unbundled from the cost of the housing itself by creating a separate parking charge. This provides a financial reward to households who decide to dispense with one of their cars and helps attract that niche market of households, who wish to live in a transit-oriented neighborhood where it is possible to live well with only one car or even no cars. Unbundling parking costs changes parking from a required purchase to an optional amenity, so that households can freely choose how many spaces they wish to lease. Among households with below average vehicle ownership rates (e.g., low income people, singles and single parents, seniors on fixed incomes, and college students), allowing this choice can provide a substantial financial benefit. Unbundling parking costs means that these households no longer have to pay for parking spaces that they may not be able to use or afford.

Charging separately for parking is also a very effective strategy to encourage households to own fewer cars and rely more on walking, cycling, and transit. It is critical that residents and tenants are made aware that rents, sale prices, and lease fees are reduced because parking is charged for separately. Rather than paying “extra” for parking, the cost is simply separated out – allowing residents and businesses to choose how much they wish to purchase. No tenant, resident, employer, or employee should be required to lease any minimum amount of parking.

Recommendation #8: Implement Transportation Demand Management policies and programs

Goal: Provide incentives for commuters to carpool, take transit, bike, or walk to work.

Recommendation:

The City should consider the introduction of Transportation Demand Management (TDM) programs. These could include a parking cash-out program, universal transit passes, and/or mandating that employees receive benefits in exchange for giving up their parking spaces.

Discussion:

Parking Cash-Out

Many employers in Monterey provide free or reduced price parking for their employees as a fringe benefit. Under a parking cash-out requirement, employers will be able to continue this practice *on the condition that they offer the cash value of the parking subsidy to any employee who does not drive to work*.

The cash value of the parking subsidy should be offered in one of three forms:

- A transit/vanpool subsidy equal to the value of the parking subsidy (of which up to $230 is tax-free for both employer and employee)[6]
- A bicycle subsidy equal to the value of the parking subsidy (of which up to $20 per month is tax-free for both employer and employee)
- A taxable carpool/walk subsidy equal to the value of the parking subsidy

Employees who opt to cash-out their parking subsidies would not be eligible to receive free parking from the employer, and would be responsible for their parking charges on days when they drive to work.

Universal Transit Passes

In recent years, growing numbers of transit agencies have teamed with universities, employers, or residential neighborhoods to provide universal transit passes. These passes typically provide unlimited rides on local or regional transit for a low monthly fee, often absorbed entirely by the employer, school, or developers. A typical example of a universal transit pass is the Eco-Pass program in downtown Boulder, which provides free transit on Denver's Regional Transportation

[6] Under the federal "Commuter Choice" law.

District (RTD) light rail and buses to more than 7500 employees being employed by 700 different businesses in downtown Boulder. To fund this program, Boulder's downtown parking benefit district pays a flat fee for each employee who is enrolled in the program, regardless of whether the employee actually rides transit. Because every single employee in the downtown is enrolled in the program, the Regional Transportation District in turn provides the transit passes at a deep bulk discount. Currently, Monterey-Salinas Transit (MST) offers a Group Discount Program for its 31 Day MST GoPasses at reduced costs (discounts ranging from 10% - 35%), but future prices may vary based on the number of enrolled participants. As a local example, the Monterey Bay Aquarium currently provides bus passes to all staff members who commit to riding the bus to and from work at least three days per week at a 35% discount.[7]

A review of existing universal transit pass programs found that the annual per employee fees are between 1% and 17% of the retail price for an equivalent annual transit pass. The principle of employee or residential transit passes is similar to that of group insurance plans – transit agencies can offer deep bulk discounts when selling passes to a large group, with universal enrollment, on the basis that not all those offered the pass will actually use them regularly.

Benefits

TDM policies and programs have many benefits, including the following:

- Provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk, or bicycle to work. The benefit is particularly valuable to low-income employees, who are less likely to drive to work alone.
- Provides a low-cost fringe benefit that can help individual businesses recruit and retain employees.
- Employers report that parking cash-out requirements are simple to administer and enforce, typically requiring just one to two minutes per employee per month to administer.
- Increases transit ridership, reducing congestion and improving transit cost recovery.
- Reduces existing parking demand.
- Cost less than the provision of additional parking spaces. For example, a study of UCLA's universal transit pass program found that a new parking space costs more than 3 times as much as a free transit pass ($223/month versus $71/month).[8]
- Parking spaces formerly taken by employees can be freed up to provide more spaces for customers.

[7] Image from Flickr user "Richard Masoner / Cyclelicious", Creative Commons License.

[8] Jeffrey Brown, et. al. "Fare-Free Public Transit at Universities: An Evaluation." Journal of Planning and Education Research, 2003: Vol 28, No. 1, pp 69-82.

City of Monterey

North Fremont Parking Study

December 2012

NELSON
NYGAARD

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Executive Summary

Overview

The Monterey Citywide Transportation and Parking Study is designed to support on-going planning efforts for growth areas and key transportation corridors within the City of Monterey. The City is in the process of developing specific plans for several planning districts and travel corridors to guide and support future development. The Citywide Transportation and Parking Study analyzes transportation and parking alternatives to meet the city's goals to:

- Improve mobility and reduce the need for auto trips
- Improve access to area businesses
- Reduce out-of-way travel created by existing one-way streets
- Provide the correct amount of parking

This report is a part of the effort to meet these goals, which will be achieved, in part, by the collection of current parking data, the projections of future parking demand, and technical analyses of alternative parking management programs.

This report is intended to examine and analyze parking supply and demand conditions in the North Fremont study area as a whole and in terms of issues relating to individual sub-districts. This analysis provides information from an original parking inventory and occupancy study performed in February 2011.

Parking Management Planning Approach

Nelson\Nygaard's approach in undertaking this work was as follows:

- Analyzed transportation and parking opportunities and challenges in the North Fremont area of Monterey, including a review of existing documents, plans, data, and policies, combined with several site visits
- Completed an original data collection effort that assessed existing parking conditions for on- and off-street facilities throughout the study area
- Conducted a parking demand analysis that examined current land uses and future development potential in the area
- Developed cost-effective strategies and program recommendations designed to:
    - Make the most efficient use of the existing parking supply
    - Plan for future parking demand in accommodating economic growth

Purpose of the Parking Study Report

The recommendations in this parking study are established on the premise that parking and transportation are not ends in themselves, but means to achieve broader community goals. These recommendations leverage the North Fremont area's existing assets, respond to its challenges, and further the overall vision for the area. As described above, this report is a part of Monterey's effort to meet community goals related to the reduction of auto trips, the improvement of access to study area businesses, and the provision of adequate amounts of parking.

Existing Parking Conditions

Inventory and Utilization

Parking supply and utilization was analyzed for the North Fremont study area. A total of 2,384 parking stalls are located within the study area, 231 on-street and 2,153 off-street. To evaluate parking occupancy, parking occupancy counts were taken every two hours from 8AM to 8PM on Thursday, February 17; Friday, February 18; and Saturday, February 19. The counted parking supply included accessible on-street and off-street spaces, and public and private spaces; spaces obstructed by construction or physical barriers such as fences were excluded from the counts.

Total occupancy counts show that at the busiest period (Saturday at 6:00PM), only 34% of the area's parking supply was occupied, with on- and off-street spaces showing somewhat varied occupancy rates (29% and 37%, respectively). At this peak hour, 163 on-street and 1,352 off-street spaces were vacant.

These utilization rates are well below target rates. Target occupancy rates of 85% and 90% are effective industry-standards for analyzing the demand for on- and off-street spaces, respectively. In other words, maintaining 15% and 10% vacancy rates for corresponding on- and off-street stalls help to ensure an "effective parking supply." It is at these standard occupancy levels that roughly one space per block is available, making searching or "cruising" for parking unnecessary, and allowing off-street lots to maintain adequate maneuverability. Utilization rates much below these targets indicate a diminished economic return on investment in parking facilities.

Existing and Future Parking Demand Ratios

Utilizing the data gathered during the parking inventory as well as an inventory of existing land use and projected land uses, existing parking demand ratios were calculated, and these parking ratios were then used to estimate future parking demand.

- *Built Stalls to Built Land Use Ratio*. This represents the total number of existing parking stalls correlated to total existing land use square footage (occupied or vacant) within the study area. According to data provided by the City, there is approximately 842,693 gross square feet (GSF) of land uses in the study zone. At this time, about 2.83 parking stalls per 1,000 GSF of build land use have been developed/provided within the study area (including both on- and off-street supplies).
- *Combined Peak Demand to Occupied Land Use Ratio.* This represents peak hour occupancy within the entire study area combining the on- and off-street supply. As such, actual parked vehicles were correlated with actual occupied land use area (approximately 842,142 GSF). From this perspective, current peak hour demand stands at a ratio of approximately **.95 occupied parking stalls per 1,000 GSF** of occupied land use. Since parking counts were conducted during both the non-peak parking season and during a period of economic stagnation, calculations were made using historic parking occupancy rates and hotel occupancy information from the City to determine what parking demand would be in the future given the same amount of land use. Given this information, future parking demand (during peak summer season and a thriving economy) is anticipated to be **1.33 occupied parking stalls per 1,000 GSF** of built land use.

Figure 1 summarizes the analysis used to determine the built ratio of parking to built land use (i.e. Column D), which is based on the correlation between total built land use of 842,693 GSF (i.e. Column A) and 2,384 stalls of "built" parking supply (i.e. Column C). As such, the *built ratio of parking* is 2.83 stalls per 1,000 GSF of commercial/retail building area.

Figure 1 also shows that the *actual demand* for parking is approximately 0.95 occupied stalls per 1,000 GSF currently and 1.33 occupied stalls per 1,000 GSF at peak season in the future (i.e. Column F). This number is derived by correlating actual occupied land use area of 842,142 GSF (i.e. Column B) to the 801 vehicles actually parked in the peak hour currently and 1,122 vehicles anticipated vehicles parked in the future (i.e. Column E).

Figure 1 Parking Demand – Mixed Land Use to Built Supply

A	B	C	D	E		F	
GSF (Built)	GSF (Occupied)	Total Supply Inventoried in Study Area	Built Ratio of Parking (per 1,000 GSF)	Total Occupied Spaces in Peak Hour		Actual Ratio Parking Demand (per 1,000 GSF)	
				Current	Future	Current	Future
842,693	842,142	2,384	2.83	801	1,122	0.95	1.33

In the future, if parking were provided at the rate of actual demand absorption (0.95 currently and 1.33 during the summer), overall peak hour occupancies would near 100% *only if* current parking rates and regulations remained in place *and* between 320,000 – 470,000 square feet of new development were constructed in the area. This estimate assumes no underground parking is constructed as a part of this development, no redevelopment of existing sites occurs, and the development of 2-story to 3-story buildings on surface parking lots in the study area. Put another way, there is currently 842,142 square feet of occupied built space resulting in 801 occupied parking spaces during non-summer months, and 1,122 occupied spaces during summer months. In order to fill the remaining 1,583 – 1,262 vacant spaces in the area, up to another 320,000 – 470,000 square feet could be added without any new parking being constructed. If any changes to parking pricing schemes were to be instituted in the future, peak hour occupancies would likely be less than 100%, particularly if prices were set to recommended levels to ensure a 15% vacancy rate.

To date, parking has been *built* at an average rate of 2.83 stalls per 1,000 GSF of development in the North Fremont area. This rate appears to have provided surplus parking with significant availability in both existing on- and off-street facilities, especially given that land uses in the study area only generate parking *demand* rations of 1.33 stalls per 1,000 GSF in the future. <u>According to this analysis, approximately 1,262 stalls are empty and available at the peak hour of utilization (according to future estimates)</u>. This surplus of parking allows for future development to make use of existing spaces prior to the construction of new parking.

Summary of Parking Management Plan Recommendations

Recommendation #1: Encourage the Implementation of Valet Parking, Tandem Parking, and Special Event Parking Management

The City should encourage the Fairgrounds to implement valet and tandem parking in various off-street lots during special events. Valet parking can maximize the space in off-street lots for long-term parkers such as employees or all-day visitors. Technology exists to make the car retrieval process customer-friendly. Tandem parking could be used for event staff in off-street lots when demand peaks during special events at the Monterey County Fairgrounds.

This strategy will increase the supply of parking the North Fremont area and is particularly effective when arrivals and departures are regular, such as an employee arriving and leaving his or her place of work, or a visitor attending a special event.

Special event parking management should be used to limit the spillover problems associated with events at the Fairgrounds. Such a management scheme should include:

- Exploring additional locations for satellite parking and parking shuttles for visitors and employees of the area
- Providing incentives to staff associated with Fairground events to arrive via alternative modes
- Increased enforcement to limit spillover in adjacent neighborhoods, including special tow-away regulations during fair days

Recommendation #2: Create a Residential Parking Benefit District

The City should implement Residential Parking Benefit Districts in commercial-adjacent residential areas. These Districts should be implemented as necessary once a parking evaluation has taken place. Residential Parking Benefit Districts are similar to residential parking permit districts, but allow a limited number of commuters to pay to use surplus on-street parking spaces in residential areas and return the resulting revenues to the neighborhood to fund public improvements such as streetscape amenities and revitalization.

Recommendation #3: Allow Share Parking Among Different Land Uses by Right

The City of Monterey should allow different land uses to share parking. In order to make the process of securing approval for shared parking less onerous for new development and adaptive reuse projects, the City should:

- Allow parking to be shared among different uses within a single mixed-use building by right
- Residential uses: Allow parking to be shared between residential buildings and an off-site parking facility by right, provided that the off-site facility is within 500 feet of the building entrance
- Non-residential uses: Allow parking to be shared between non-residential buildings and an off-site parking facility by right, provided that the off-site facility is within 1,250 feet of the building entrance
- Off-site shared parking located further than 1,250 feet should be considered at the discretion of staff, so long as there is documentation that reasonable provision has been made to allow off-site parkers to access the principal use (e.g. a shuttle bus, valet parking service, free transit passes, etc.)

Recommendation #4: Reduce Parking Minimums and an Establish In-Lieu Fee

Reform minimum parking requirements by creating a single, blended, non-residential requirement of two spaces per 1,000 GSF to facilitate development and allow for easy “turnover” of businesses. In addition, reduce residential requirements so that one space per unit is required for studios and one bedroom units to better meet actual levels of vehicle ownership. The in-lieu fee should be set at a reasonable level to both make it financially feasible for developers in special cases to exceed the maximum requirement and to provide an income stream to either increase the public supply of parking or introduce alternative mode programs or improvements. As such, it is recommended that an annual in-lieu fee of $150 per space be set.

Given the development market for both non-residential and residential uses, it is likely that many new developments will provide equal to or more than the required minimums either to meet anticipated tenant/owner demands or to secure financing. The in-lieu fee program would provide an alternative to developers where providing required amounts of on-site parking is either cost prohibitive or undesirable. The in-lieu fee is strictly an optional payment a developer can make in lieu of providing the minimum amount of parking required.

Recommendation #5: Unbundle Parking Pricing

Require all new residential development to “unbundle” the full cost of parking from the cost of the housing itself, by creating a separate parking charge. Parking costs are generally subsumed into the sale or rental price of housing for the sake of simplicity and because that is the more traditional practice in real estate. Although the cost of parking is often hidden in this way, parking is never free. Given the construction costs as well as the land values in Monterey, surface spaces can be costly.

Charging separately for parking is a very effective strategy to encourage households to own fewer cars and rely more on walking, cycling, and transit. It is critical that residents and tenants are made aware that rents, sale prices, and lease fees are reduced because parking is charged for separately. Rather than paying “extra” for parking, the cost is simply separated out – allowing residents and businesses to choose how much they wish to purchase. No tenant, resident, employer, or employee should be required to lease any minimum amount of parking.

Recommendation #6: Implement Transportation Demand Management policies and programs.

The City should consider the introduction of Transportation Demand Management (TDM) programs. These could include a parking cash-out program, universal transit passes, and mandating that employees receive benefits in exchange for giving up their parking space. TDM policies and programs have many benefits, including the following:

- Provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk, or bicycle to work. The benefit is particularly valuable to low-income employees, who are less likely to drive to work alone.
- Provides a low-cost fringe benefit that can help individual businesses recruit and retain employees.
- Employers report that parking cash-out requirements are simple to administer and enforce, typically requiring just one to two minutes per employee per month to administer.
- Increases transit ridership, reducing congestion and improving transit cost recovery.
- Reduces existing parking demand.

- Cost less than the provision of additional parking spaces. For example, a study of UCLA's universal transit pass program found that a new parking space costs more than 3 times as much as a free transit pass ($223/month versus $71/month).[1]
- Parking spaces formerly taken by employees can be freed up to provide more spaces for customers.

Chapter by Chapter

This Parking Management Plan contains a large amount of information for policy makers. In order to make full use of the document, it is important to be able to quickly refer to relevant sections of interest. The chapters of this report are summarized as follows:

Chapter 1: Existing Conditions – Describes the existing travel characteristics of the study area in relation to the City as a whole. Summarizes the study area's existing parking conditions as they relate to inventory, regulations, and utilization rates.

Chapter 2: Current and Future Parking Demand – Provides a detailed analysis of existing parking demand as it relates to current and future land uses.

Chapter 3: Parking Management Plan – Summarizes the key points of the study's analysis and offers preliminary recommendations for parking management.

[1] Jeffrey Brown, et. al. "Fare-Free Public Transit at Universities: An Evaluation." Journal of Planning and Education Research, 2003: Vol 28, No. 1, pp 69-82.

Chapter 1. Existing Conditions

The North Fremont Street area is located west of downtown Monterey, south of Highway 1, and north of the Monterey Peninsula Airport. The area is largely commercial and is comprised of restaurants, retail outlets, and various hotels and motels concentrated along Fremont Street. This commercial corridor is surrounded by residences to the north and south, including both single family and multi-family structures. The Monterey County Fairgrounds, located one block south of Fremont Street along Fairground Road, hold large events at various times of the year. Some events attract over 1,000 visitors to the area, which causes significant spillover parking in the surrounding neighborhood. While the Fairgrounds have satellite parking facilities, most on-street parking is free and unregulated in the North Fremont area, allowing many fairgoers to park in the neighborhood during special events.

Effective management of the area's transportation system is integral to maintaining and enhancing the ultimate success of the North Fremont area. By examining travel trends and existing parking conditions, this chapter facilitates a better understanding of how people are utilizing the area's current parking facilities, highlights parking challenges and inefficiencies, and provides a framework for developing a targeted parking management plan.

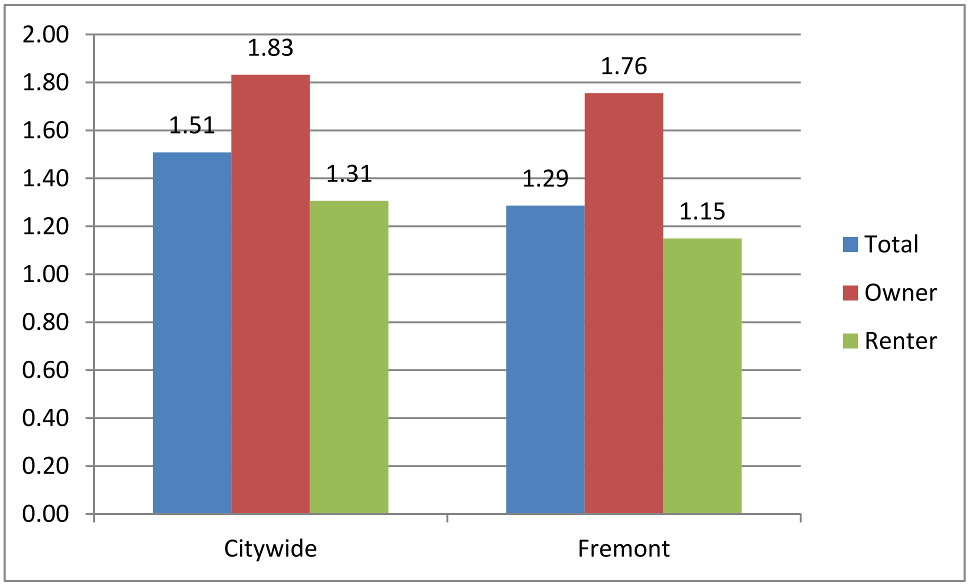
Current Demographics and Travel Characteristics

The North Freemont Street area's current travel characteristics offer important background information concerning existing baseline conditions. This information can be used to set performance measures and can be updated as new data becomes available.

Vehicle Ownership

Figure 2 highlights household vehicle ownership by housing tenure for the North Fremont area as well as citywide. The North Fremont study area exhibits similar car ownership rates when compared to citywide averages. Households who own their homes tend to have more cars, while renters tend to have fewer cars. The overall average of cars per household is slightly lower in the North Fremont area compared to the entire city (1.29 vs. 1.51). Households that own their homes in North Fremont have slightly lower vehicle per households ratios than the citywide average for homeowners (1.76 vs. 1.83). Renters in the North Fremont area also own fewer cars than the citywide average for renting households (1.15 per household compared to 1.31).

Figure 2 Vehicles per Household, by Housing Tenure



Parking Inventory and Regulations

An inventory of parking facilities was undertaken as part of this study. This section provides a brief overview of the parking inventory, which identified the amount of parking and parking regulations, if any, by on-street block and off-street facility.

Methodology

Parking inventory and regulations were determined through field observations by City of Monterey staff (with assistance from Nelson\Nygaard staff), who walked the study area, counted parking spaces, and noted regulations on each block face and in each off-street facility.

Findings

A total of 2,384 parking spaces exist in the study area, 231 of which are on-street spaces. Of the 2,153 total off-street spaces, 154 are in public facilities, while 1,999 are in private facilities. Of the on-street spaces, the vast majority (97.8%) are free and un-regulated. A total of 5 spaces, representing 2.2% of the total on-street supply, contain time limits ranging from 24 minutes to 60 minutes. Off-street spaces in the study area are located mostly within private lots (79.7%), while approximately 14.8% are unrestricted.

Figure 3 provides a more detailed breakdown of the type of parking in the study area for both on- and off- street facilities.

Figure 3 Study Area Parking Facilities, by Type

Location	Unrestricted	Time Limits	Private Lot	Disabled	Other	Total	% of Parking
On-Street	226	5	0	0	0	231	9.7%
	97.8%	2.2%	0.0%	0.0%	0.0%		
Off-Street	128	11	1,900	97	17	2,153	90.3%
	5.9%	0.5%	88.2%	4.5%	0.8%		
Total	354	16	1,900	97	17	2,384	100.0%
	14.8%	0.7%	79.7%	4.1%	0.7%		

Parking Utilization

This section provides an overview of the results from the original parking utilization data collection effort. It includes a summary of the methodology, as well as the key findings for the study area.

Methodology

City of Monterey staff conducted a comprehensive occupancy and turnover study for both on- and off-street spaces using trained data collection workers with assistance from Nelson\Nygaard. The count days and times were:

- Thursday, February 17th, 2011 from 8AM – 8PM, every two hours
- Friday, February 18th, 2011 from 8AM – 8PM, every two hours
- Saturday, February 19th, 2011 from 8AM – 8PM, every two hours

Counts were conducted on these days in order to provide as wide a range of parking conditions as possible, as parking demand tends to fluctuate a great deal by day of week and time of day. The count periods specifically captured parking activity during a typical weekday and weekend. Each block face and off-street lot was counted every two hours at approximately the same time point of each hour count period.

Findings

Utilization

Figure 4 highlights the utilization findings for the North Fremont study area as a whole. In general, combined occupancy for on- and off-street facilities was consistently low, varying from an overall low of 23% at 8:00AM on Friday, to an overall high of 34% at 6:00PM on Saturday. The peak hour demand for parking, area wide, occurred at 6:00PM on all count days (31% on Thursday, 33% on Friday, and 34% on Saturday).

These overall utilization rates are far below target rates. Target occupancy rates of 85% and 90% are effective industry-standards for on- and off-street spaces, respectively. In other words, maintaining 15% and 10% vacancy rates for corresponding on- and off-street stalls will help ensure an “effective parking supply.” It is at these occupancy levels that roughly one space per block is available, making searching or “cruising” for parking unnecessary, and off-street lots maintain adequate maneuverability. Utilization rates much below these targets indicate a diminished economic return on investment in parking facilities.

Figure 4 Utilization Rates, Overall Study Area

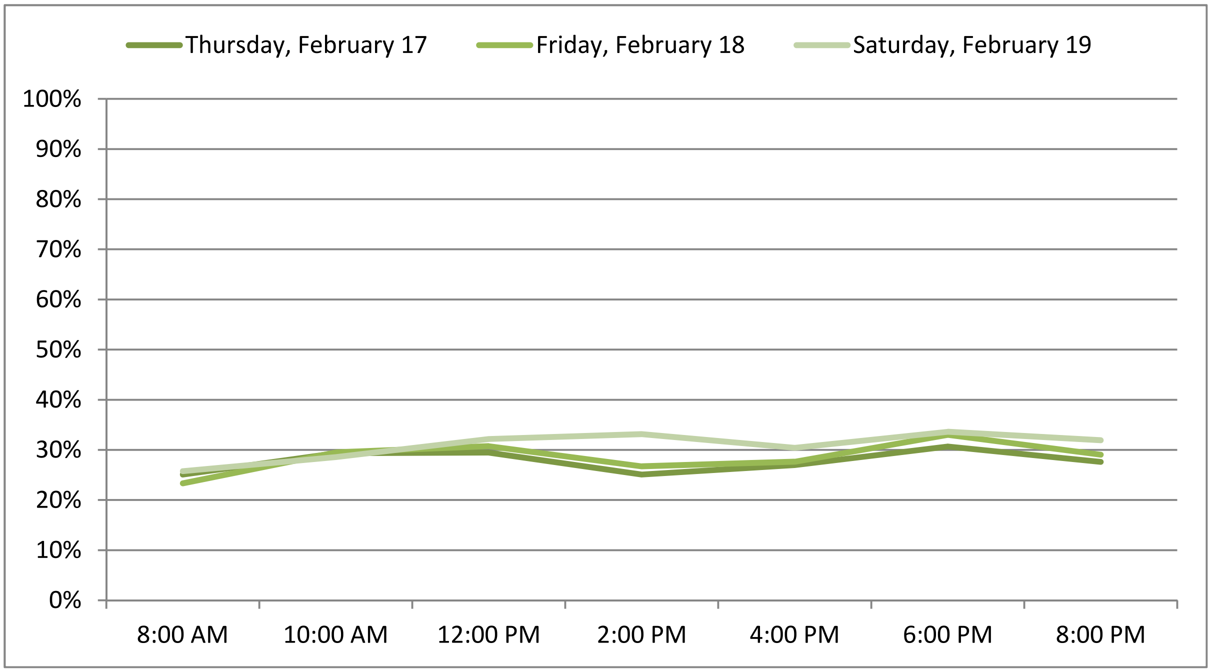


Figure 5, Figure 6, and Figure 7 show utilization rates by facility type for Thursday, Friday, and Saturday, respectively. On Thursday, on-street occupancy peaked at 36% (noon and 4:00PM), while off-street occupancy peaked at 33% (6:00PM). Friday's peak rates included 38% for on-street facilities (noon) and 36% for off-street facilities (6:00PM). On Saturday, peak on-street occupancy occurred at 4:00PM (35%), while peak off-street occupancy occurred at 6:00PM (37%). Again, on every hour of every count day, utilization rates for both on- and off-street facilities were well below target rates.

Figure 5 Utilization Rates by Facility Type, Thursday

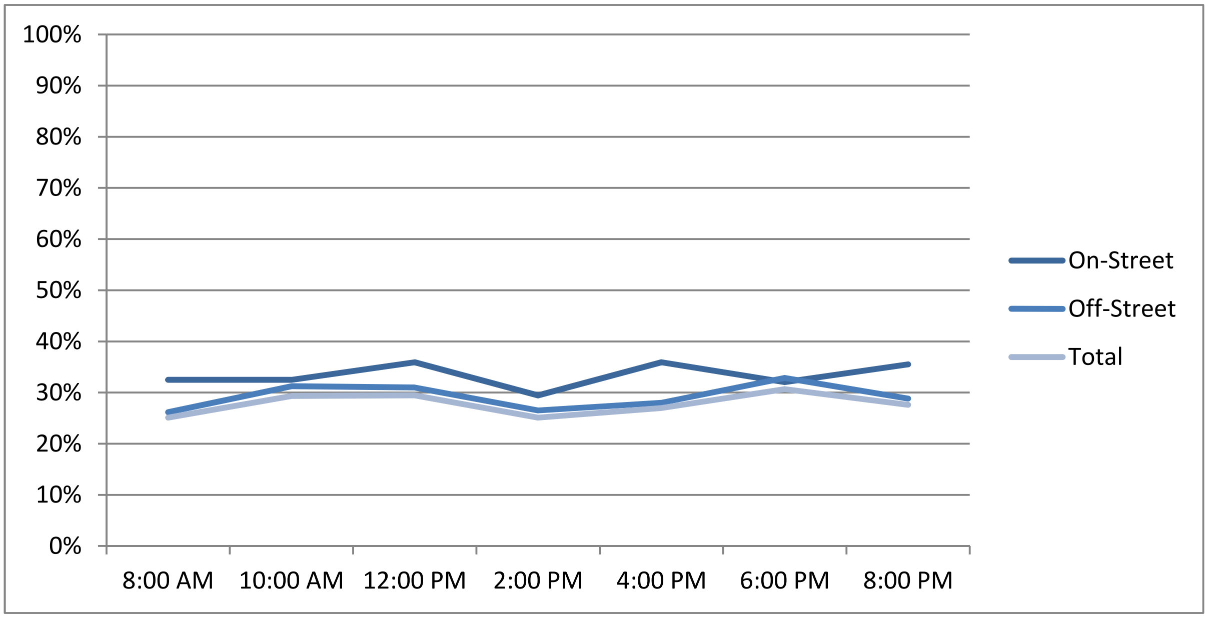


Figure 6 Utilization by Facility Type, Friday

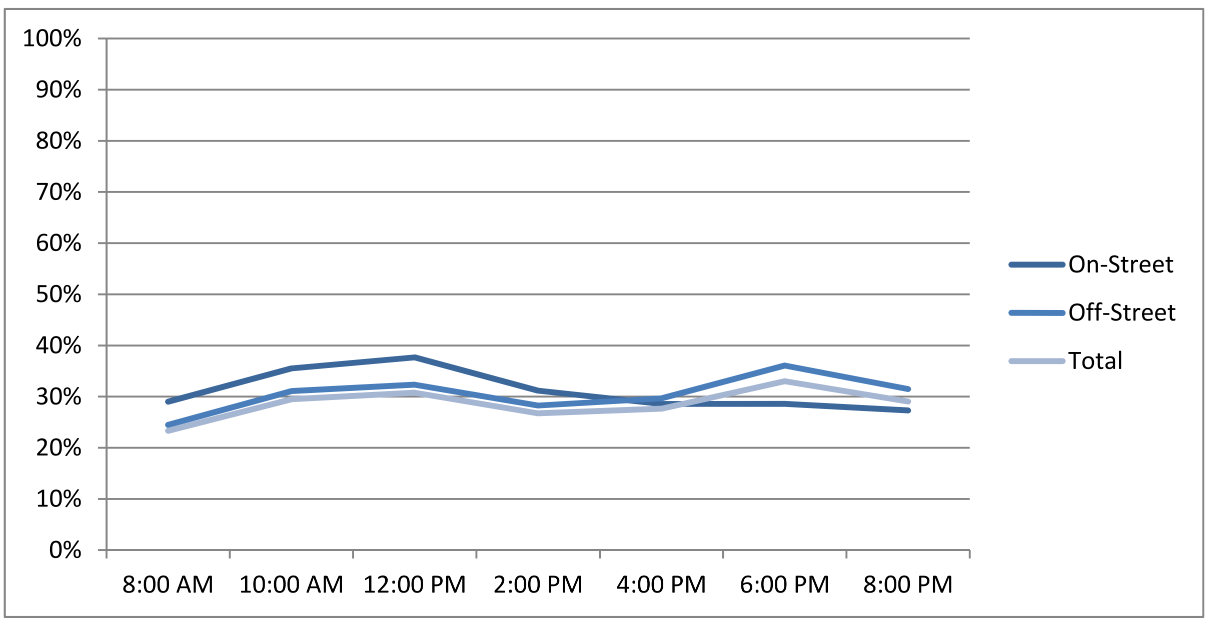


Figure 7 Utilization by Facility Type, Saturday

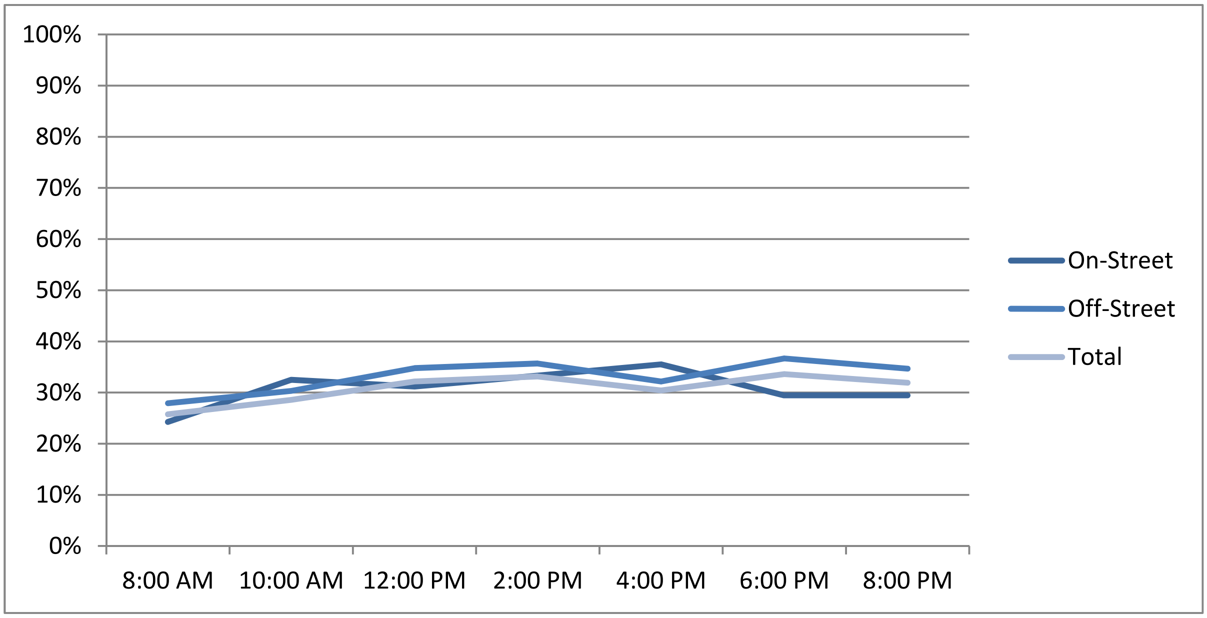


Figure 8, Figure 9, Figure 10 are peak hour occupancy maps of the study area for Thursday, Friday, and Saturday, respectively. Peak hour occurred at 6:00PM on each count day. These maps show the occupancy level for each individual block face and each individual lot during the peak hour of parking demand. The maps reveal that there are very few “pockets” of high demand, on a few blocks and in some lots in the study area. On Thursday, only Casa Verde Way, Dela Vina Avenue, and Hannon Avenue experience occupancies above 75%, while no off-street facilities did so. On Friday, the East side of Casa Verde and the In Shape Health Club lot were the only two facilities to surpass 75% occupancy. On Saturday, the West side of Palo Verde Avenue was the only facility to reach a utilization rate above 75%.

While there were areas of high demand during all three count days, ample parking was available throughout all count days within easy walking distance of each “pocket” of high demand.

Figure 8 Peak Hour Utilization, Thursday 6-8PM

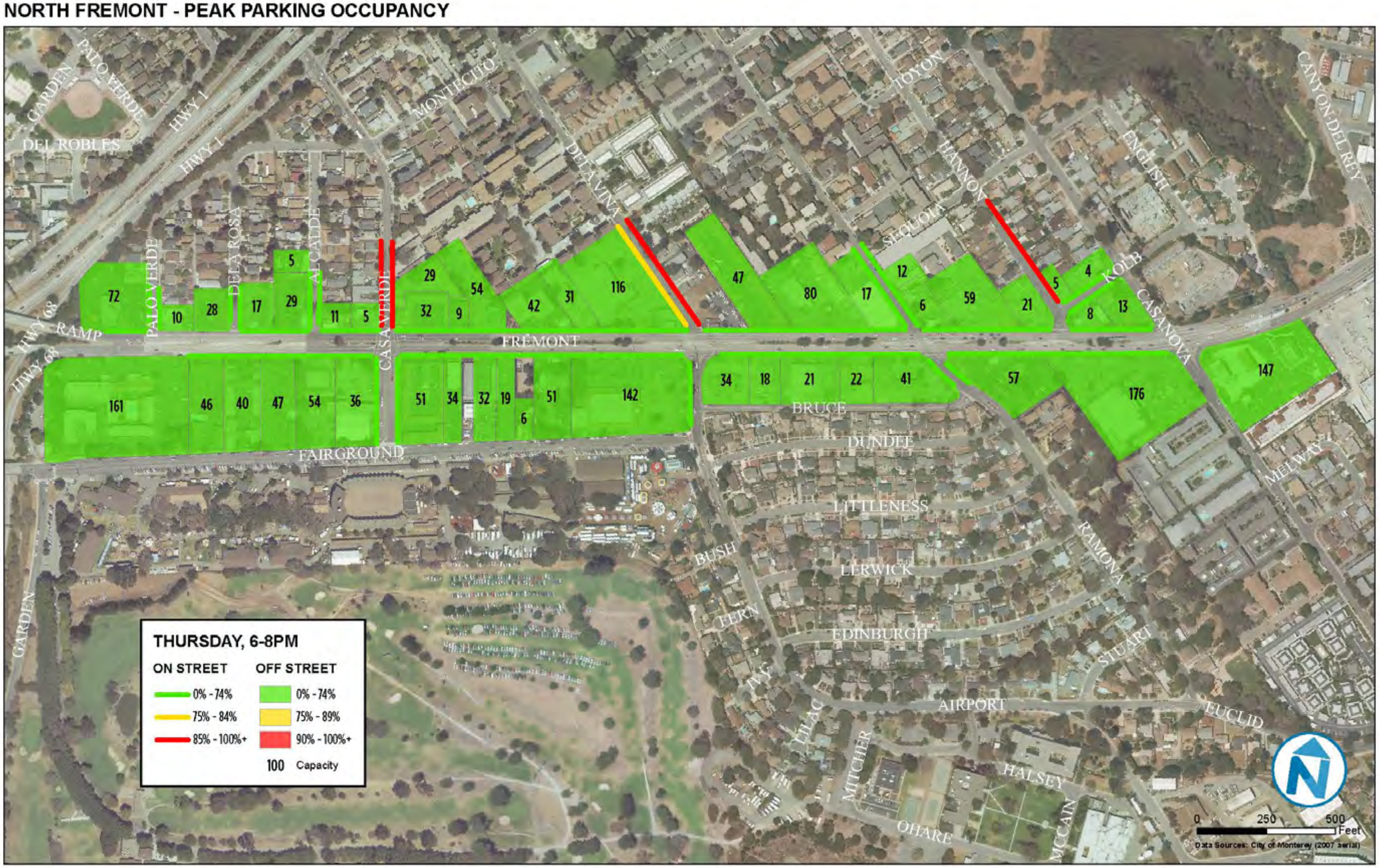


Figure 9 Peak Hour Utilization, Friday 6-8PM

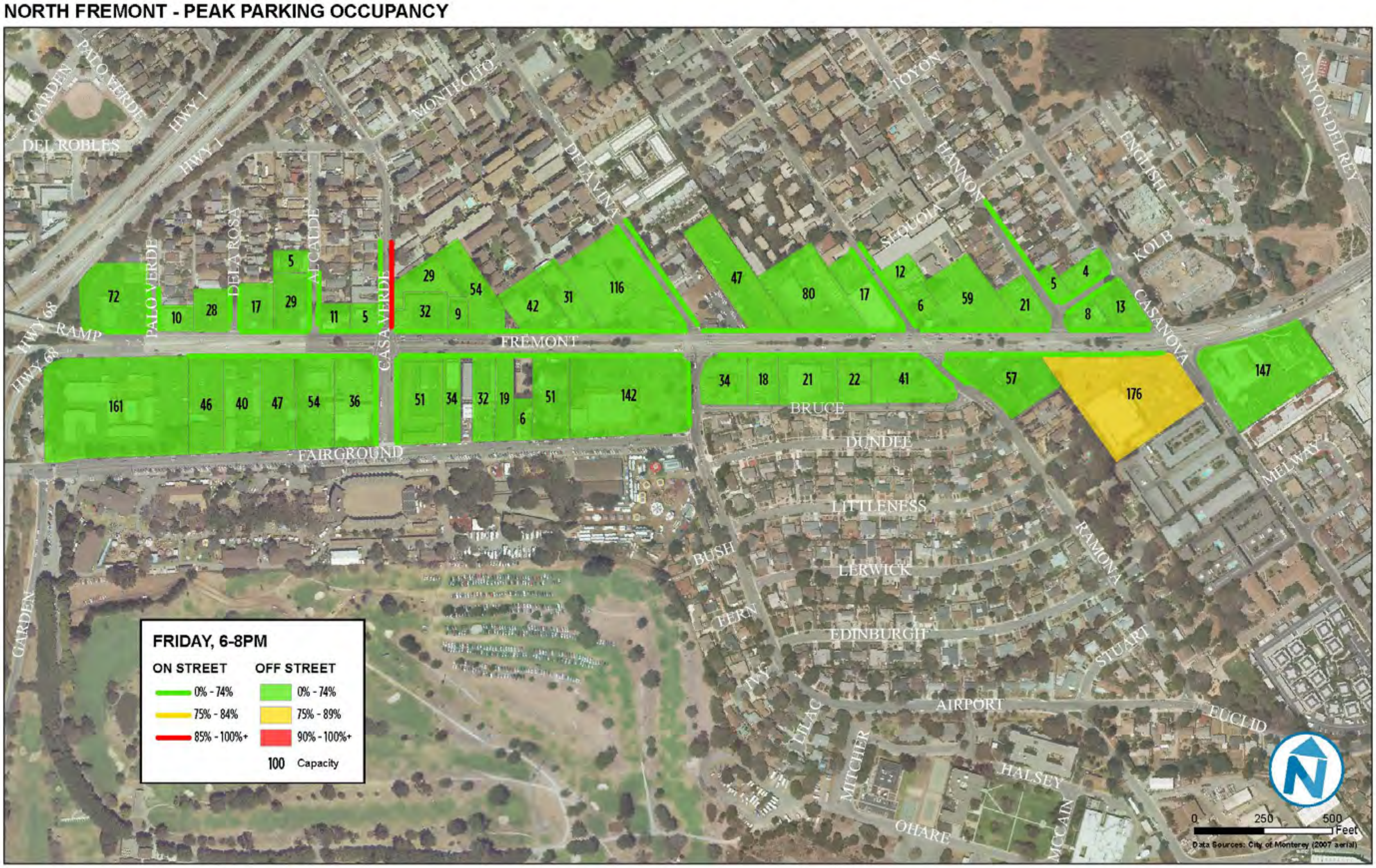


Figure 10 Peak Hour Utilization, Saturday 8-6PM

Chapter 2. Current and Future Parking Demand

This chapter provides an analysis of existing and future parking conditions in the study area. More specifically, it analyzes existing parking demand in relation to target occupancies and quantifies how much the study area is "over" or "under" supplied. In addition, this chapter analyzes parking demand in relation to existing and future land use and development patterns. This analysis will enable the City to demonstrate the effects of development on parking and determine whether the study area currently has more or less parking supply than existing demand requires.

Inventory, Occupancy, and Oversupply

As discussed in Chapter 1, the peak hour of parking demand was at 6:00PM for all count days (Thursday, Friday, and Saturday). For the whole study area, peak occupancies were 31%, 33%, and 34% on those days, respectively. Once again, these occupancies are well below target levels of demand and result in a substantial "oversupply" of parking, as demonstrated in Figure 11. This figure shows the inventory and occupancy during the peak period for all three days, calculations of the "necessary supply" needed to meet current occupancy levels and maintain the 85% target utilization rates, and the resulting oversupply of existing parking.

As shown in Figure 11, the North Fremont area is oversupplied with parking. At peak occupancy on Saturday, 801 parking spaces in the study area were occupied. If one were to assume that this was meeting the target occupancy rate, then the study area would only require 942 spaces. However, current supply in the study area is 2,384 spaces, which translates into a 153% "oversupply" of parking based on current demand. Similar trends are evident across all count days, both weekday and weekend. In short, the study area has more than enough parking spaces to meet current demand.

Figure 11 Occupancy, Inventory, and Oversupply

Day	Occupancy (a)	Necessary Supply (b) = (a/.85)	Existing Supply (c)	Oversupply (d) = (c-b)	% Oversupply (e) = (d/b)
Thursday 6:00PM	731	860	2,384	1,524	177%
Friday 6:00PM	787	926	2,384	1,458	157%
Saturday 6:00PM	801	942	2,384	1,442	153%

Peak Demand in Study Area

Current Conditions

The peak occupancy for the entire study area occurred on Saturday, February 19th at 6:00PM. Parking demand ratio calculations revealed two different, but equally useful correlations:

- *Built Stalls to Built Land Use Ratio*. This represents the total number of existing parking stalls correlated to total existing land use square footage (occupied or vacant) within the study area. According to data provided by the City, there is approximately 842,693 gross square feet (GSF) of land use in the study zone. At this time, about **2.83 parking stalls per 1,000 GSF** of build land use have been developed/provided within the study area (including both on- and off-street supplies).

- *Combined Peak Demand to Occupied Land Use Ratio.* This represents peak hour occupancy within the entire study area combining the on- and off-street supply. As such, actual parked vehicles were correlated with actual occupied land use area (approximately 842,142 GSF). From this perspective, current peak hour demand stands at a ratio of approximately **.95 occupied parking stalls per 1,000 GSF** of built land use. Since parking counts were conducted during both the non-peak parking season and during a period of economic stagnation, calculations were made using historic parking occupancy rates and hotel occupancy figures from the City to determine what parking demand would be in the future given the same amount of land use. Given this information, future parking demand (during peak summer season and a thriving economy) is anticipated to be **1.33 occupied parking stalls per 1,000 GSF** of built land use.

Figure 12 summarizes the analysis used to determine the built ratio of parking to built land use (i.e. Column D), which is based on the correlation between total built land use of 842,693 GSF (i.e. Column A) and 2,384 stalls of "built" parking supply (i.e. Column C). As such, the *built ratio of parking* is 2.83 stalls per 1,000 GSF of commercial/retail building area.

Figure 12 also demonstrates that the actual demand for parking is approximately .95 occupied stalls per 1,000 GSF currently and 1.33 occupied stalls per 1,000 GSF at peak season in the future (i.e. Column F). These numbers are derived by correlating actual occupied land use area of 842,142 (Column B) to the 801 vehicles actually parked in the peak hour currently and 1,122 anticipated vehicles parked in the future (i.e. Column E).

Figure 12 Parking Demand – Mixed Land Use to Built Supply

A	B	C	D	E		F	
GSF (Built)	**GSF (Occupied)**	**Total Supply Inventoried in Study Area**	**Built Ratio of Parking Demand (per 1,000 GSF)**	**Total Occupied Spaces in Peak Hour**		**Actual Ratio of Parking Demand (per 1,000 GSF)**	
				Current	**Summer**	**Current**	**Summer**
842,693	842,142	2,384	2.83	801	1,122	0.95	1.33

In the future, if parking were provided at the rate of actual demand absorption (1.33 spaces per 1,000 GSF in the future), overall peak hour occupancies would near 100% *only if* current parking rates and regulations remained in place *and* between 320,000 – 470,000 square feet of new development were constructed in the area. This estimate assumes no underground parking is constructed as a part of this development, no redevelopment of existing sites occurs, and the development of 2-story to 5-story buildings on surface parking lots in the study area. Put another way, there is currently 842,142 square feet of occupied built space resulting in 1,122 occupied spaces anticipated in the future. In order to fill the remaining 1,262 vacant spaces in the area, up to another 320,000 – 470,000 square feet could be added without any new parking being constructed. If any changes to parking pricing schemes were to be instituted in the future, peak hour occupancies would likely be less than 100%, particularly if prices were set to recommended levels to ensure a 15% vacancy rate.

To date, parking has been *built* at an average rate of 2.83 stalls per 1,000 GSF of development in the North Fremont area. This rate appears to have provided surplus parking with significant availability in both existing on- and off-street facilities, especially given that land uses in the study area only generate parking *demand* ratios of 0.95 stalls per 1,000 GSF currently and a predicted 1.33 stalls per 1,000 GSF in the future. Per this analysis, approximately 1,262 stalls will be empty and available at the peak hour of utilization (according to future estimates). This surplus of parking allows for future development to make use of existing spaces prior to the construction of new parking.

Figure 13 provides a summary of built supply to actual demand for other cities that the consultant team has worked with. The North Fremont area of Monterey falls towards middle of selected cities in relation to actual amount of parking built to land use. However, the study area has one of the lowest demand ratios, resulting in a large gap between the level of parking supplied and what is actually needed. The main theme of this figure is that, like many American cities, *the North Fremont community is currently building more parking than demand indicates necessary.*

Figure 13 Built Parking Supply and Actual Demand, Selected Cities

City	Minimum Requirement / 1,000 GSF or Actual Build Supply	Actual Demand / 1,000 SF	Gap between parking built and actual parking demand (for every 1,000 GSF)
Hood River, OR	1.54	1.23	0.31
Oxnard, CA	1.7	0.98	0.72
Corvallis, OR	2	1.5	0.5
Sacramento, CA	2	1.6	0.4
Monterey, CA (N Fremont)	**2.83**	**0.95**	**1.88**
Seattle, WA	2.5	1.75	0.75
Kirkland, WA	2.5	1.98	0.52
Palo Alto, CA	2.5	1.9	0.6
Santa Monica, CA	2.8	1.8	1
Ventura, CA (Westside)	2.87	1.26	1.61
Chico, CA	3	1.7	1.3
Hillsboro, OR	3	1.64	1.36
Bend, OR	3	1.8	1.2
Salem, OR	3.15	2.04	1.11
Redmond, WA	4.1	2.71	1.39
Beaverton, OR	4.15	1.85	2.3

Chapter 3. Parking Management Plan

The inventory of parking supply and regulations, the parking occupancy study, and the analysis of current parking demand in relation to existing parking requirements, current land uses, and future development patterns provide a wealth of information about parking conditions and behavior within the North Fremont study area. More importantly, this data will serve as the guiding framework for the City as it moves forward with reforming its parking policies and management systems. By developing regulatory processes that establish the appropriate amount of parking and then maximizing the efficiency of that supply, the City can accommodate the interests of all stakeholders, including employees, visitors, and residents.

Other cities have faced similar circumstances in managing parking and have used improved policies and management to alleviate localized inefficiencies while spurring economic growth. This chapter seeks to begin the conversation by offering several recommendations for parking reform. These concepts are informed by the data obtained in this study as well as Nelson\Nygaard's previous experience with similar cities.

Principles of Effective Parking Management

Historically, "solving the parking problem" almost always meant increasing supply. Unfortunately, constantly increasing parking supply simply encourages more auto use, as people are encouraged to drive to places that offer "plenty of free parking." While providing adequate parking is still important, it is only one tool available for managing both demand and supply. The goal of "parking demand management" is to provide the optimal amount of parking to meet parking needs, while reducing traffic congestion and accommodating new development and a variety of land uses.

Managing parking has been shown to be the single most effective tool for managing congestion, even when densities are relatively low and major investments in other modes have not been made. Parking management can also have a significant impact on commute mode choice, which translates directly to reductions in auto congestion and improved livability of commercial districts and adjacent neighborhoods.

As the North Fremont area continues to grow and evolve, its parking needs will change as well. This Plan recommends techniques to both address current challenges and adjust to future needs. Above all else, this Plan proposes a parking management approach that utilizes policies and programs that will enable more efficient utilization of existing supply, while alleviating parking congestion.

In recognition of these considerations, the following principles informed the development of parking management recommendations for the North Fremont community:

- Set clear parking priorities based on the area's strengths and vision for the future
- Manage the entire parking supply as part of an integrated system
- Manage parking facilities with a focus on maintaining availability, not simply increasing supply
- Optimize investment in parking by making efficient use of all public and private parking facilities and encouraging use of viable alternative mode options—before constructing new parking

- Use any potential parking revenue to fund transportation programs that maintain adequate parking supply and support use of alternative transportation options in the North Fremont area
- Use of residential permit districts to address spillover concerns in residential neighborhoods
- Encourage economic revitalization and remove barriers to development and adaptive reuse projects by adopting parking standards that are tailored to the unique parking demands of mixed-use, walkable communities
- Ensure flexibility for developers by providing a variety of tools to meet and/or reduce parking requirements
- Provide flexibility to local decision makers and City staff to adapt to future changes in parking demand and travel patterns

Recommendations

Recommendation #1: Encourage the Implementation of Valet Parking, Tandem Parking, and Special Event Parking Management

Goal: Maximize the use of current parking facilities to increase current supply and decrease the need for the construction of additional facilities, while also managing spillover parking on special event days.

Recommendation:

The City should encourage the Fairgrounds to implement valet and tandem parking in various off-street lots during special events. Valet parking can maximize the space in off-street lots for long-term parkers such as employees or all-day visitors. Technology exists to make the car retrieval process customer-friendly. Tandem parking could be employed for employees or Fairground event staff in various off-street lots when demand peaks during special events at the Monterey County Fairgrounds. This strategy will increase the supply of parking the North Fremont area and is particularly effective when arrivals and departures are regular, such as an employee arriving and leaving his or her place of work, or a visitor attending a special event. Another benefit of this strategy is that it facilitates compact development, freeing underutilized surface parking lots for new development.

Special event parking management can be used during the rare days that large events bring an influx of visitors to the North Fremont area. Such a management scheme should include:

- Exploring additional locations for satellite parking and parking shuttles for visitors and employees of the area

- Providing incentives to staff associated with Fairground events to arrive via alternative modes
- Increased enforcement to limit spillover in adjacent neighborhoods, including special tow-away regulations during fair days.

Discussion:

The Monterey County Fairgrounds, located one block south of Fremont Street, causes significant spillover to the surrounding neighborhoods during special events. The lack of parking regulation for on-street facilities in the North Fremont area leads to fairgoers parking in the neighborhood during special event days, meaning the most convenient “front-door” spaces are unavailable for shoppers and residents. By exploring additional sites for satellite parking facilities and implementing shuttle services from these lots to the fairgrounds, the City can encourage fairgoers to parking in specified areas outside of the North Fremont district. Furthermore, valet parking and tandem parking arrangements will maximize the use of the existing off-street supply, keeping the most convenient on-street spaces vacant for shoppers and residents during summer months and on special event days.

However, as most on-street parking in the area is free and unregulated, during special events there exists little disincentive for visitors to park in the North Fremont area. As such, implementing special regulations for neighborhood, on-street facilities during fair days that specify the blocks as tow-away zones for cars without parking permits (see Recommendation #2 below) would greatly curtail overflow parking in the neighborhoods around the Fairgrounds. While many parkers are willing to risk the potential of a parking ticket, tow-away zones greatly curtail illegal parking practices.

Furthermore, providing incentives for fairground event staff and employees to commute to work via alternative modes would lessen the amount of required satellite parking and would decrease the pressure on neighborhood on-street facilities. Such incentives could include subsidized transit passes, parking cash-out, the installation of bicycle parking or showering facilities, or other internal incentive programs (see Recommendation #6 below).

Recommendation #2: Create a Residential Parking Benefit District

Goal: Prevent “spillover” parking in adjacent neighborhoods.

Recommendation:

The City should implement residential parking benefit districts in adjacent residential areas. These Districts should be implemented, as necessary, once a parking evaluation has taken place. Residential parking benefit districts are similar to residential parking permit districts, but allow a limited number of commuters to pay to use surplus on-street parking spaces in residential areas and return the resulting revenues to the neighborhood to fund public improvements such as streetscape amenities and revitalization.

Discussion:

In order to prevent spillover parking in residential neighborhoods, many cities implement *residential permit districts* (also known as preferential parking districts) by issuing a certain number of parking permits to residents usually for free or a nominal fee. These permits allow the residents to park within the district while all others are prohibited from parking there for more than a few hours, if at all. At least 130 cities and counties currently have residential parking permit programs in effect in the US and Canada.[2]

Residential parking permit districts are typically implemented in residential districts near large traffic generators such as central business districts, educational, medical, and recreational facilities. They do have several limitations.

Most notably, conventional residential permit districts often issue an unlimited number of permits to residents without regard to the actual number of curb parking spaces available in the district. This often leads to a situation in which on-street parking is seriously congested, and the permit functions solely as a "hunting license", simply giving residents the right to hunt for a parking space with no guarantee that they will actually find one. (An example of this is Boston's Beacon Hill neighborhood, where the City's Department of Transportation has issued residents 3,933 permits for the 983 available curb spaces in Beacon Hill's residential parking permit district, a 4-to-1 ratio.[3])

The opposite problem occurs with conventional residential permit districts in situations where there are actually surplus parking spaces (especially during the day, when many residents are away), but the permit district prevents any commuters from parking in these spaces even if demand is high and many motorists would be willing to pay to park in one of the surplus spaces.

In both cases, conventional residential parking permit districts prevent curb parking spaces from being efficiently used (promoting overuse in the former example and underuse in the latter).

To avoid these problems, Monterey should implement *residential parking benefit district*s in the North Fremont adjacent residential area. This will prevent excessive spillover parking from commuters trying to avoid parking charges and further community revitalization goals.

Implementation details

The following steps should be taken to implement each residential parking benefit district:

1. Count the number of available curb parking spaces in the area where the residential parking benefit districts is being considered. Make a map showing the results of the count. On blocks where individual parking stalls are not marked, assume that one parking space exists for every 20 feet of available curb space. ("Available" curb space means curb space where parking is legal. So curb space where parking is prohibited, such as red painted curbs near fire hydrants, should be excluded.) Usually, "left over" fragments of curb space will exist after all of the segments that are at least 20 feet long have been counted. For example, if there is a 96 foot long segment of curb space where it is legal to park, then the

[2] "Residential Permit Parking: Informational Report." Institute of Transportation Engineers, 2000, p1.

[3] Shoup, Donald. The High Cost of Free Parking. APA Planners Press, 2005, p516.

segment contains four 20-foot-long parking spaces, plus a left over 16 foot long fragment. Similarly, it is common to find “fragments” of legally available curb space (i.e. sections of curb space that are less than 20 feet long) between driveways or between a driveway and a fire hydrant. Count any leftover fragment that is at least 16 feet long as a parking space. Disregard fragments that are less than 16 feet long. (These longer fragments may be considered to be the equivalent of compact parking spaces, while not all cars fit in a space of this length, many cars will.) On the map, clearly delineate nthe number of curb parking spaces on each block face.

a. Counting the number of curb parking spaces available in an area where a residential parking benefit district is being considered is an essential first step for any Parking Manager. It is the equivalent of movie theater managers knowing exactly how many seats are in their movie theaters. Just as the manager of a movie theater cannot know how many tickets to sell without knowing how many seats exist, a parking manager cannot know how many parking permits to issue unless he or she knows how many parking spaces exist.

3. Count the number of residential units on each parcel within the same area. Add this information to the map of curb parking spaces completed in Step #1. As a base map for this effort, an Assessor's Parcel Map is often very useful. The Assessor's Parcel Map can be combined with Assessor’s Parcel Data on the ownership of each parcel to help identify how many properties exist in an area, the legal boundaries of those properties, and the homeowners and/or landlords for each residential unit. In turn, this information can help clarify the number of residential units on each property and the tenants who reside in those units.

4. Compare the existing number of residential units in the area to the number of available curb parking spaces in the area. Usually, the best visual presentation is to prepare a map showing: (a) the total number of residential units on each block, and (b) the number of available curb parking spaces on each block face. For the entire area, it is important to determine the ratio of curb parking spaces to residential units. (For example, if there are 1000 curb parking spaces and 500 residential units, then the ratio is 2.0 curb parking spaces per unit.)

5. Decide how many curb parking permits to issue to residents and what percent of spaces should be reserved for visitors. For example, the City may wish to set aside 10% of curb spaces for visitor use. Visitors should be able to purchase daily passes online (if license plate recognition enforcement is available) or at a local civic building (as Pasadena, CA does at its fire stations).

6. Resident permits should be priced on a graduated scale. For example, the first permit can be priced at ten dollars with the second at $25. If it is difficult to implement the residential district initially, it may be advisable to issue the first permit free to existing residents.

7. Set a time limit on streets of one to two hours to prevent nonresidents from occupying spaces for long periods and encourage residents to use their garages for parking rather than storage.

8. Rather than entirely prohibit nonresident parking as with many conventional residential parking permit districts, the City should sell permits for any surplus parking capacity to non-resident commuters at fair market rates. These nonresident permits, though, should only be permitted during daytime hours when residential occupancy rates are lower.

9. Finally, the rates for non-residents' parking permits should be set at fair market rates as determined by periodic city surveys. It is very likely that these non-resident permits may be priced at higher rates than resident permits due to market conditions.
10. All net revenues above and beyond the cost of administering the program should be dedicated to paying for public improvements in the neighborhood where the revenue was generated. This will visibly help improve the neighborhood and decrease resistance to the new program.

Additional Implementation Recommendations for Non-Resident Permits

Enforcement policies: Parking Enforcement Officers should follow the same enforcement policies as in Monterey's current meter zones and should issue citations for "expired meter" or "no valid permit/meter."

Community Participation & Local Control

Residential parking benefit districts should only be implemented if a simple majority (50% +1) of property owners on a block supports the formation of the district.

Once implemented, residents, property owners, and business owners in the district should continue to have a voice in recommending to City Council how they would suggest new parking revenue be spent in their neighborhood. This could occur via City staff attendance at existing neighborhood association meetings, mail-in surveys, or public workshops. Another option is to appoint advisory committees in each parking benefit district, tasked with recommending to City Council how the revenue should be spent in their neighborhood.

Benefits of Residential Parking Benefit Districts

Residential parking benefit districts have been described as "a compromise between free curb parking that leads to overcrowding and [conventional residential] permit districts that lead to underuse…[parking] benefit districts are better for both residents and non-residents: residents get public services paid for by non-residents, and non-residents get to park at a fair-market price rather than not at all."[4]

Benefits of implementing a residential parking benefit districts in the City of Monterey would include the following:

- Excessive parking spillover into adjacent neighborhoods will be prevented
- Scarce curb parking spaces will be used as efficiently as possible
- Need for additional costly parking structure construction would be reduced
- Residents would have a much better chance to find a parking space at the curb

Recommendation #3: Allow Shared Parking Among Different Land Uses by Right

Goal: Maximize the use of existing parking facilities by exploiting the different periods of parking demand for different land uses.

[4] Ibid., p435.

Recommendation:

Monterey should allow different land uses to share parking. In order to make the process of securing approval for shared parking less onerous for new development and adaptive reuse projects, the City should:

- Allow parking to be shared among different uses within a single mixed-use building by right
- Residential uses: Allow parking to be shared between residential buildings and an off-site parking facility by right, provided that the off-site facility is within 500 feet of the building entrance
- Non-residential uses: Allow parking to be shared between non-residential buildings and an off-site parking facility by right, provided that the off-site facility is within 1,250 feet of the building entrance
- Off-site shared parking located further than 1,250 feet should be considered at the discretion of staff, so long as there is documentation that reasonable provision has been made to allow off-site parkers to access the principal use (e.g. a shuttle bus, valet parking service, free transit passes, etc.)

Discussion:

Different land uses have different periods of parking demand. For example, a bank adjacent to a night club can quite easily share a common parking facility. This principle is widely accepted in transportation planning and should be permitted in the City's parking code. By allowing the Planning Director to allow reduction when two or more uses demonstrate their patrons can share parking spaces, the City will reduce cruising for on-street spaces and encourage more compact development. This strategy typically reduces the parking requirement for new development between 40 and 60%.

Recommendation #4: Reduce Parking Minimums and Establish an In-Lieu Fee

Goal: Remove barriers to new development; encourage efficiently shared public parking rather than many small, inefficient private lots; and create a healthy market for parking, where parking spaces are bought, sold, rented, and leased like any normal commodity.

Recommendation:

Reform minimum parking requirements by creating a single, blended, non-residential requirement of two spaces per 1,000 GSF to allow for facilitate development and allow for easy "turnover" of businesses. In addition, reduce residential requirements so that one space per unit is required for studios and one bedroom units to better meet actual levels of vehicle ownership. The in-lieu fee should be set at a reasonable level to both make it financially feasible for developers in special cases to exceed the maximum requirement and to provide an income stream to either increase the public supply of parking or introduce alternative mode programs or improvements. As such, it is recommended that an annual in-lieu fee of $150 per space be set.

Given the development market for both non-residential and residential uses, it is likely that many new developments will provide equal to or more than the required minimums either to meet anticipated tenant/owner demands or to secure financing. The in-lieu fee program would provide an alternative to developers where providing required amounts of on-site parking is either cost prohibitive or undesirable. The in-lieu fee is strictly an optional payment a developer can make in lieu of providing the minimum amount of parking required.

Discussion:

Stimulate Economic Development

In order for Monterey to realize its goals for the revitalization of the North Fremont area, the City's parking policies must support those goals. Minimum parking requirements, however, have emerged as one of the biggest obstacles to many cities' efforts to encourage new residential and commercial development in revitalizing areas. Minimum parking requirements typically require more than one square foot of parking area for every square foot of building. These requirements can be particularly damaging to uses, such as eating establishments, which help create vibrancy and life in the area.

Moreover, minimum parking requirements clash with virtually all of Monterey's other adopted goals for its North Fremont district. As UCLA professor Don Shoup describes it, "Parking requirements cause great harm: they subsidize cars, distort transportation choices, warp urban form, increase housing costs, burden low-income households, debase urban design, damage the economy, and degrade the environment… [O]ff-street parking requirements also cost a lot of money, although this cost is hidden in higher prices for everything except parking itself."

With 1,520 parking stalls currently vacant during the peak hour in the North Fremont area, there is more than enough parking available to cope with existing demand and any demand that could be generated by future development. With a current oversupply of parking, excessive minimum requirements are only acting as an impediment to economic development, rather than their stated goal of ensuring adequate availability.

Establish a Fee Structure to Promote Economic Development

There are several key elements to address in devising an in-lieu fee price structure. The fee must serve the goals of the City, but it must also be flexible enough to encourage economic growth while providing an adequate pool of revenue for future parking facilities and alternative mode programs. An effective in-lieu fee program should seek to:

- **Avoid large up-front costs to developers that would deter investment.** Many cities make the mistake of creating a "simple" in-lieu fee structure based on large initial lump sum payments. These in-lieu fees can prove excessively costly to developers who ultimately forgo construction or build parking on-site that is not efficient in terms of parking or land resources.
- **Guarantee a revenue stream for the City.** A workable fee structure will both provide the City with enough initial funding to finance parking space construction (if necessary) and

give the City a continuous long-term revenue stream for other transportation improvements.

- **Fully utilize existing parking capacity.** The actual fee amount should be based on a City's individual circumstances. In the case of the North Fremont area, there is already a large, vacant pool of parking for the City to take advantage of. Therefore, a fee structure that favors a long-term revenue stream over immediate funds for garage construction may be more effective.
- **Justify costs for both the City and developer.** Neither the City nor the developer should pay more than their fair share in constructing a shared pool of parking or financing alternative mode programs.

Given these guidelines, an effective in-lieu program for the North Fremont area would establish a fee structure that includes low annual payments of $150 per space from the developer to meet the minimum parking requirement. This arrangement allows for the City to collect a long-term revenue stream to add future spaces to the public parking supply or fund alternative mode programs.

Recommendation #5: Unbundle Parking Pricing

Goal: Reduce parking demand and vehicle trips from new development while increasing housing affordability and choice.

Recommendation:

Require all new residential development to "unbundle" the full cost of parking from the cost of the housing itself, by creating a separate parking charge.

Discussion:

Parking costs are generally subsumed into the sale or rental price of housing for the sake of simplicity and because that is the more traditional practice in real estate. But although the cost of parking is often hidden in this way, parking is never free. Given the construction costs as well as the land values in Monterey, surface spaces can be very costly.

Looking at parking as a tool to achieve revitalization goals requires some changes to status quo practices, since providing anything for free or at highly subsidized rates encourages use and means that more parking spaces have to be provided to achieve the same rate of availability. For both rental and for sale housing, the full cost of parking should be unbundled from the cost of the housing itself by creating a separate parking charge. This provides a financial reward to households who decide to dispense with one of their cars and helps attract that niche market of households, who wish to live in a transit-oriented neighborhood where it is possible to live well with only one car or even no cars. Unbundling parking costs changes parking from a required purchase to an optional amenity, so that households can freely choose how many spaces they wish to lease. Among households with below average vehicle ownership rates (e.g., low income people, singles and single parents, seniors on fixed incomes, and college students), allowing this choice can provide a substantial financial benefit. Unbundling parking costs means that these households no longer have to pay for parking spaces that they may not be able to use or afford.

Charging separately for parking is also a very effective strategy to encourage households to own fewer cars and rely more on walking, cycling, and transit. It is critical that residents and tenants are made aware that rents, sale prices, and lease fees are reduced because parking is charged for separately. Rather than paying “extra” for parking, the cost is simply separated out – allowing residents and businesses to choose how much they wish to purchase. No tenant, resident, employer, or employee should be required to lease any minimum amount of parking.

Recommendation #6: Implement Transportation Demand Management policies and programs

Goal: Provide incentives for commuters to carpool, take transit, bike, or walk to work.

Recommendation:

The City should consider the introduction of Transportation Demand Management (TDM) programs. These could include a parking cash-out program, universal transit passes, and/or mandating that employees receive benefits in exchange for giving up their parking spaces.

Discussion:

Parking Cash-Out

Many employers in Monterey provide free or reduced price parking for their employees as a fringe benefit. Under a parking cash-out requirement, employers will be able to continue this practice *on the condition that they offer the cash value of the parking subsidy to any employee who does not drive to work*.

The cash value of the parking subsidy should be offered in one of three forms:

- A transit/vanpool subsidy equal to the value of the parking subsidy (of which up to $230 is tax-free for both employer and employee)[5]
- A bicycle subsidy equal to the value of the parking subsidy (of which up to $20 per month is tax-free for both employer and employee)
- A taxable carpool/walk subsidy equal to the value of the parking subsidy

Employees who opt to cash-out their parking subsidies would not be eligible to receive free parking from the employer, and would be responsible for their parking charges on days when they drive to work.

[5] Under the federal “Commuter Choice” law.

Universal Transit Passes

In recent years, growing numbers of transit agencies have teamed with universities, employers, or residential neighborhoods to provide universal transit passes. These passes typically provide unlimited rides on local or regional transit for a low monthly fee, often absorbed entirely by the employer, school, or developers. A typical example of a universal transit pass is the Eco-Pass program in downtown Boulder, which provides free transit on Denver's Regional Transportation District (RTD) light rail and buses to more than 7500 employees being employed by 700 different businesses in downtown Boulder. To fund this program, Boulder's downtown parking benefit district pays a flat fee for each employee who is enrolled in the program, regardless of whether the employee actually rides transit. Because every single employee in the downtown is enrolled in the program, the Regional Transportation District in turn provides the transit passes at a deep bulk discount. Currently, Monterey-Salinas Transit (MST) offers a Group Discount Program for its 31 Day MST GoPasses at reduced costs (discounts ranging from 10% - 35%), but future prices may vary based on the number of enrolled participants. As a local example, the Monterey Bay Aquarium currently provides bus passes to all staff members who commit to riding the bus to and from work at least three days per week at a 35% discount.[6]

A review of existing universal transit pass programs found that the annual per employee fees are between 1% and 17% of the retail price for an equivalent annual transit pass. The principle of employee or residential transit passes is similar to that of group insurance plans – transit agencies can offer deep bulk discounts when selling passes to a large group, with universal enrollment, on the basis that not all those offered the pass will actually use them regularly.

Benefits

TDM policies and programs have many benefits, including the following:

- Provides an equal transportation subsidy to employees who ride transit, carpool, vanpool, walk, or bicycle to work. The benefit is particularly valuable to low-income employees, who are less likely to drive to work alone.
- Provides a low-cost fringe benefit that can help individual businesses recruit and retain employees.
- Employers report that parking cash-out requirements are simple to administer and enforce, typically requiring just one to two minutes per employee per month to administer.
- Increases transit ridership, reducing congestion and improving transit cost recovery.
- Reduces existing parking demand.

[6] Image from Flickr user "Richard Masoner / Cyclelicious", Creative Commons License.

- Cost less than the provision of additional parking spaces. For example, a study of UCLA's universal transit pass program found that a new parking space costs more than 3 times as much as a free transit pass ($223/month versus $71/month).[7]
- Parking spaces formerly taken by employees can be freed up to provide more spaces for customers.

[7] Jeffrey Brown, et. al. "Fare-Free Public Transit at Universities: An Evaluation." Journal of Planning and Education Research, 2003: Vol 28, No. 1, pp 69-82.

FEHR & PEERS

MEMORANDUM

Date: May 31, 2012

To: City of Monterey

From: Ian Barnes, Dave Stanek and Matt Haynes, Fehr & Peers

Subject: VISSIM Simulation for Del Monte Avenue Corridor Interim BRT Improvements

SJ10-1219

BACKGROUND

Fehr & Peers is preparing the Citywide Transportation and Parking Study (CTPS) for the City of Monterey. As part of the CTPS, several bus transit service improvements have been identified for Downtown Monterey, including a new Transit Center on Washington Street between DeL Monte Avenue and Franklin Street. In addition, the Transportation Agency of Monterey County (TAMC) is proposing to construct a new Monterey Branch Line Light Rail Transit (LRT) line that would run along Del Monte Avenue and have its southern endpoint in Downtown Monterey. Because funding has not yet been identified for the Monterey Branch Line project, the City has proposed that an "interim" Bus Rapid Transit (BRT) corridor be explored to improve transit options along the Del Monte Avenue corridor.

This analysis covers the evaluation of several BRT options along the Del Monte Avenue corridor. BRT service typically includes transit signal priority (TSP), which improves bus service quality of service through designing signals to extend their green when a bus vehicle is approaching the intersection. The utilization of advanced microsimulation packages, such as VISSIM, should be used to accurately model corridor traffic operations when transit priority features are evaluated.

PROPOSED ALTERNATIVES

Based on coordination with the City of Monterey, Monterey-Salinas Transit (MST) and TAMC, three BRT alternatives were developed for the Del Monte Avenue corridor. These alternatives were evaluated in VISSIM to determine which improvements would provide the greatest transit travel time savings in the future. These improvements are as follows:

- **Alternative 1** – Addition of side-running bus/right turn-only lanes from Camino El Estero to Sloat Avenue, with TSP at the key intersections, including Camino El Estero, Camino Aguajito and Sloat Avenue. The side-running bus/right turn-only lane establishes a dedicated space for bus travel on the right-most travel lane.
- **Alternative 2a** – Addition of a bidirectional bus only lane from Camino El Estero to Sloat Avenue, with TSP at the Camino El Estero and Sloat Avenue intersections. The eastbound U-turn pocket at Del Monte Avenue/Camino El Estero would be converted to bus-only. A bus/right turn-only lane would be provided along westbound Del Monte Avenue on the approach to the Sloat Avenue intersection and exiting the Camino El Estero intersection.
- **Alternative 2b** – Extension of the BRT lane in Alternative 2a farther east to Casa Verde Way, roughly paralleling the Monterey Bay Coastal Trail along former railroad right-of-way now owned by the City of Monterey.

A base scenario was developed using existing traffic volumes and roadway configurations, with minor modifications made for access changes that would result from the BRT project (in order to provide a more direct comparison of operational changes solely attributable to the BRT project alternatives). This base scenario, or “modified” existing conditions model, was used as a basis for development of the alternative models. The intersections analyzed with the microsimulation software are listed below in **Table 1**.

TABLE 1
STUDY INTERSECTIONS FOR BRT ANALYSIS SCENARIOS

Del Monte Avenue Intersection		Intersection Control	Modified Existing Conditions	Future Conditions without BRT	BRT Alternative 1	BRT Alternative 2a	BRT Alternative 2b
1	Figueroa Street	Signalized	X	X	-[1]	-[1]	-[1]
2	Camino El Estero	Signalized	X	X	X	X	X
3	Camino Aguajito	Signalized	X	X	X	X[2]	X[2]
4	Park Avenue	Side Street Stop Controlled	X	X	X	X[2]	X[2]
5	Ocean Avenue	Side Street Stop Controlled	X	X	X	X[2]	X[2]
6	Sloat Avenue	Signalized	X	X	X	X	X[2]
7	Cunningham Road	Signalized	X	X	-[1]	-[1]	-[2]
8	Casa Verde Way	Signalized	-	-	-	-	X

Notes:
X Intersection included in alternative model
[1] No BRT improvements at this intersection. Intersection was used to meter traffic into VISSIM network.
[2] Intersection bypassed by buses in BRT alternatives.
Source: Fehr & Peers, 2012

Figure 1 shows the intersection locations along the Del Monte Avenue corridor. The intersections were modeled using the VISSIM traffic analysis software (Build Version 5.40-01). The following section describes the development of the simulation model and the analysis results.

Monterey Citywide Study

FEHR PEERS

May 2012
SJ10-1219

BRT Study Intersections

Figure 1

MODEL DEVELOPMENT

Many components are needed in the development of the VISSIM model. These components include lane geometries, signal timings, traffic volumes and vehicle behavior characteristics.

LANE GEOMETRIES

Lane geometries for the modified existing conditions model were developed using field observations, aerial imagery and conceptual plans for the BRT improvements. Turn pocket lengths were estimated using scaled aerial images.

The alternative models used the modified existing conditions as a base and added the BRT improvements to the model. The alternatives models used the conceptual plans of each BRT alternative and are presented in **Figure 2**.

SIGNAL TIMINGS

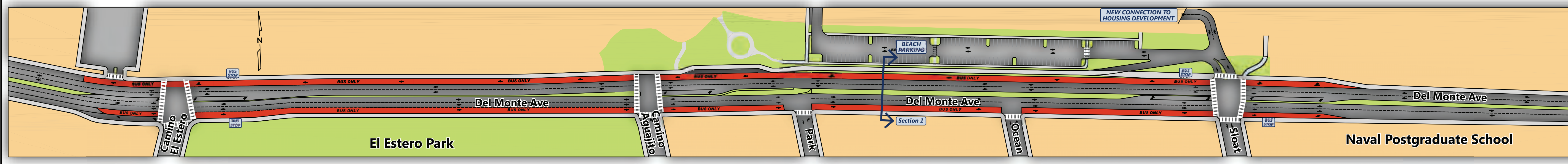
Signal timing data for the existing conditions model were provided by City of Monterey staff. This data was entered into the Synchro (Version 7) model and then exported to VISSIM.

Signal timings for the alternatives scenarios were developed using Synchro. Changes in travel patterns along the corridor are expected due to future traffic growth. The Synchro software was used to optimize signal timing splits, cycle lengths and coordination offsets along the corridor based on forecast traffic and transit travel patterns.

The Synchro-based signal timings were imported into VISSIM and modified to provide transit signal priority (TSP) along the corridor. The signal phase splits were also adjusted in VISSIM to better serve specific movements associated with BRT improvements.

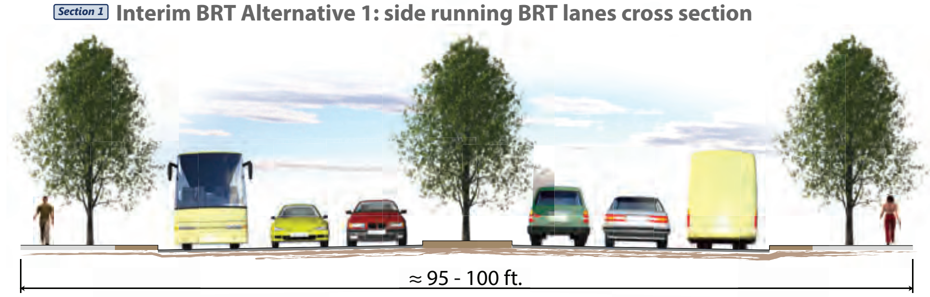
TRAFFIC VOLUMES

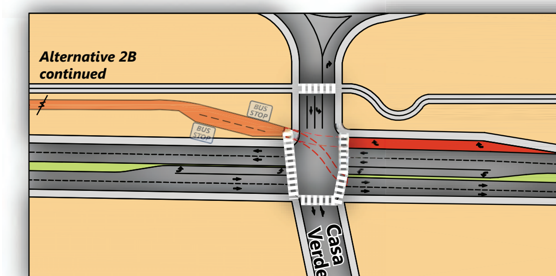
Traffic volumes for the existing conditions simulation were developed using data collected by Fehr & Peers and data provided by City staff for the PM peak hour. Turning movement data was balanced using Synchro in order to account for any volume imbalances between intersections.



Interim BRT Alternative 1: side running BRT lanes

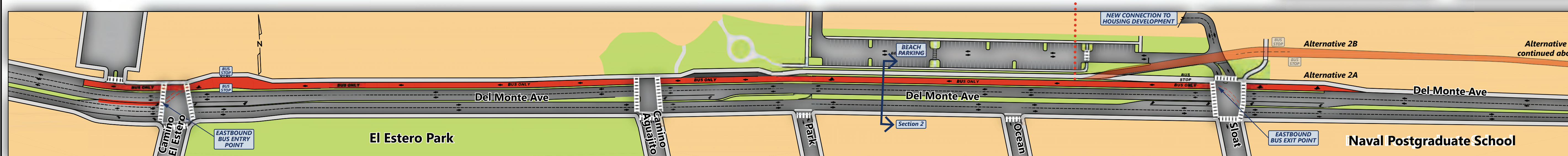
Section 1 Interim BRT Alternative 1: side running BRT lanes cross section





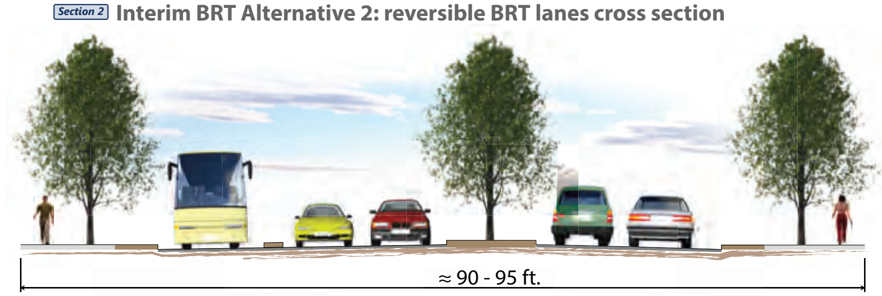
Alternative 2A :
Bus lane ends at Sloat, eastbound buses merge back with auto traffic

Alternative 2B :
Bus lane continues east to Casa Verde, using city-owned rail right-of-way



Interim BRT Alternative 2: reversible BRT lanes

Section 2 Interim BRT Alternative 2: reversible BRT lanes cross section



Conceptual Layouts of BRT Alternatives

Figure 2

Future traffic volumes were developed based on “water constrained” land use forecasts for growth within Monterey and in surrounding areas. Water constrained traffic forecasts were developed as part of the CTPS. The additional traffic from planned future land use development was added to the roadway network along the Del Monte Avenue corridor. The same set of future traffic volumes was used in all BRT study scenarios.

VEHICLE BEHAVIOR CHARACTERISTICS

Vehicle behavior characteristics (such as speed and vehicle compositions) were determined using data collected in the field or obtained through Google Maps. Desired speed decisions were based on posted speed limits along the roadway study segments. Pedestrians were assumed to have an average walking speed of 3.5 feet per second - the nationally recommended speed specified in the Manual of Uniform Traffic Control Devises (2009). For all models, the vehicle fleet mix was set to two percent heavy vehicles and 98 percent automobiles. Buses were modeled as public transportation lines in VISSIM using published MST schedule data (as of April 2012). The modeling of bus operations included all existing bus stops in the corridor.

ANALYSIS RESULTS

The VISSIM models for each scenario were run 20 times each, with the best ten runs chosen for further analysis – the ten outliers in terms of delay and/or volume served were discarded. Data on percent of demand served, intersection delay, total network delay, and corridor travel time were collected for each model run. The average of these key performance measures are presented below.

CORRIDOR TRAVEL TIMES

Travel times for buses and all other traffic were measured along the length of the BRT improvements in each scenario. In general, for Modified Existing Conditions, Alternative 1 and Alternative 2a, the travel time segments ran along Del Monte Avenue from Camino El Estero to Sloat Avenue (approximately 0.55 miles). For Alternative 2b, the travel time segments ran from Camino El Estero to Casa Verde Way (approximately 1.25 miles). The corridor travel times and travel time standard deviations (a measure of travel time reliability) are presented below in **Table 2**.

TABLE 2
TRAVEL TIMES FOR BRT SCENARIOS

Travel Time Segment	Modified Existing Conditions	Future Conditions without BRT	BRT Alternative 1	BRT Alternative 2a	BRT Alternative 2b[1]
	Travel Time	Travel Time	Travel Time	Travel Time	Travel Time
Eastbound Buses[2]	2:09	4:09	2:48	4:24	8:24
Eastbound All Others	1:26	2:57	1:59	2:45	4:32
Westbound Buses[2]	1:48	2:55	2:41	2:51	7:33
Westbound All Others	1:03	1:48	1:46	1:34	3:18

Notes:
[1] Travel time segment approximately 0.7 miles longer than for other models
[2] Travel time includes two stops (BRT 1 and BRT 2a) or three stops (BRT 2b), with stop time averaging 20 seconds, with a standard deviation of 2 seconds.
Source: Fehr & Peers, 2012

As expected, travel times are worse in the corridor in the future without BRT. In the side-running BRT lanes alternative (BRT Alternative 1) travel time reliability, as measured by the standard deviation of travel time, stays nearly the same as in the modified existing conditions model. When taking into account the time the buses are stopped (an average of 20 seconds per stop) at the two bus stops in this scenario, the bus travel times are competitive with other traffic along the corridor in the side-running BRT lanes alternative. The introduction of transit signal preemption (all BRT models in this analysis employed transit signal priority as a base for analysis) may improve bus travel times further.

Travel times for the bidirectional bus lane alternatives (BRT 2a and BRT 2b) are somewhat higher than the non-bus traffic in the corridor – the signaling system used to control access to the bus lane introduces the added delay. Enhanced coordination of bus schedules could alleviate this source of delay, as could shortening the distance between signal controls along the counterflow bus lane segment. Transit signal preemption may improve bus travel times further, especially for eastbound buses.

Intersection Delay, Intersection Level of Service and Total Network Delay

Intersection delay and total network delay were calculated directly from the VISSIM models. Intersection Level of Service (LOS) was determined using the calculated intersection delay and

Highway Capacity Manual (Transportation Research Board, 2000) guidelines. The *Highway Capacity Manual* LOS criteria for signalized and unsignalized intersections are presented below in **Tables 3 and 4.** According to the City of Monterey General Plan (2005), the intersection LOS standard for the City of Monterey is LOS D for automobile corridors, and LOS F (averaged over two-hours) for transit corridors.

TABLE 3
SIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Average 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.	10.1 to 20.0
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	20.1 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	55.1 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 4 UNSIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS		
Level of Service	**Description**	**Average Delay Per Vehicle (Seconds)**
A	Little or no delay.	≤ 10.0
B	Short traffic delay.	10.1 to 15.0
C	Average traffic delays.	15.1 to 25.0
D	Long traffic delays.	25.1 to 35.0
E	Very long traffic delays.	35.1 to 50.0
F	Extreme traffic delays with intersection capacity exceeded.	> 50.0
Source: *Highway Capacity Manual*, Transportation Research Board, 2000.		

Intersection delay, intersection LOS and total network delay for the models for all scenarios are presented below in **Table 5**.

TABLE 5
FRIDAY PM PEAK HOUR INTERSECTION DELAY AND LEVEL OF SERVICE

Del Monte Avenue Intersection		Intersection Control	Modified Existing Conditions		Future Conditions without BRT		BRT Alternative 1		BRT Alternative 2a		BRT Alternative 2b	
			Delay	LOS[2]	Delay	LOS[2]	Delay	LOS[2]	Delay	LOS[2]	Delay	LOS[2]
1	Figueroa Street	Signalized	12	B	16	B	19	B	14	B	18	B
2	Camino El Estero	Signalized	17	B	48	D	33	C	49	D	55	D
3	Camino Aguajito	Signalized	20	B	40	D	36	D	35	D	40	D
4	Park Avenue	Side Street Stop[1]	5	A	8	A	1	A	7	A	4	A
5	Ocean Avenue	Side Street Stop[1]	**37**[3]	**E**	**50**[3]	**F**	9	A	**49**[3]	**E**	29	D
6	Sloat Avenue	Signalized	20	B	28	C	38	D	28	C	25	C
7	Cunningham Road	Signalized	3	A	4	A	4	A	4	A	3	A
8	Casa Verde Way	Signalized	-	-	-	-	-	-	-	-	23	C
Total Network Delay (hours)			*69.3*	-	*145.4*	-	*96.6*	-	*140.1*	-	*175.6*	-
Total Network Delay Per Intersection Studied (hours)			*9.9*	-	*20.8*	-	*13.8*	-	*20.0*	-	*22.0*	-

Notes: **Bold** indicates deficient intersection operations versus City of Monterey baseline intersection LOS standard (LOS D for automobile corridors). However, based on the existing transit frequency, the Del Monte Avenue corridor would be designated a multimodal corridor, with an LOS standard of F for the peak two hours.

[1] For side-street stop control, the worst case movement delay is reported.

[2] LOS as per *Highway Capacity Manual* (Transportation Research Board, 2000)

[3] The standard deviation for delay is high – the actual delay value for the side street approach may be higher.

Source: Fehr & Peers, 2012

In general, future growth in traffic volumes will degrade intersection operations. However, the signalized study intersections under the BRT Alternatives would operate at LOS D or better. The northbound right turn movement at Del Monte Avenue/Ocean Avenue would operate at LOS E, but with a very high standard deviation of delay (42.4 seconds). This shows that, while the average delay is unacceptable, it is highly variable. Local traffic may divert away from Del Monte Avenue/Ocean Avenue in favor of Del Monte Avenue/Sloat Avenue. Also, since the eastbound and westbound approaches are uncontrolled at Del Monte Avenue/Ocean Avenue (no signal or stop sign), the average delay for all vehicles at the intersection is very low (less than 5 seconds – LOS A). While the intersection of Del Monte Avenue/Camino Aguajito operates at LOS D in all three BRT alternatives, the eastbound approach (one through lane and one though-right shared lane) is over capacity during the peak hour. A sensitivity analysis (presented later in this section) analyzes the effects on intersection operations and corridor travel times with the addition of a short right turn pocket to this approach.

PERCENT OF VEHICLE DEMAND SERVED

Percent of demand is an indication of the level of congestion within the VISSIM network. Typically, a freely flowing or lightly congested network that can adequately handle traffic demand has a percent served value near 100 percent. Networks that are more congested, especially where intersections are unable to handle demand (typically where the volume-to-capacity ratio is greater than 1.0 on one or more external approaches to the network) will have percent of demand served values significantly less than 100 percent. Values of percent of demand served above 100 percent are not uncommon in freely flowing networks because VISSIM is a stochastic model, which causes variability in volumes between model runs. **Table 6** shows the percent of demand served at the intersections for all scenarios.

TABLE 6
PERCENT OF DEMAND SERVED AT INTERSECTIONS IN VISSIM MODELS

Del Monte Avenue Intersection		Modified Existing Conditions	Future Conditions without BRT	BRT Alternative 1	BRT Alternative 2a	BRT Alternative 2b
1	Figueroa Street	101%	100%	100%	100%	99%
2	Camino El Estero	101%	98%	99%	98%	97%
3	Camino Aguajito	101%	98%	99%	98%	97%
4	Park Avenue	101%	96%	99%	97%	96%
5	Ocean Avenue	100%	95%	99%	97%	95%
6	Sloat Avenue	101%	99%	99%	99%	97%
7	Cunningham Road	101%	99%	100%	100%	98%
8	Casa Verde Way	-	-	-	-	98%

Source: Fehr & Peers, 2012

While the model runs show that there is a slight degradation in the model intersection operations in the future scenarios versus (modified) existing conditions, overall intersection operations are expected to remain acceptable without high levels of congestion

ALTERNATIVES ANALYSIS – EASTBOUND RIGHT TURN POCKET AT CAMINO AGUAJITO

As noted above, the eastbound Del Monte approach to the Camino Aguajito intersection operates slightly over capacity in the BRT 2a and BRT 2b alternatives. The model demonstrates that queues would sometimes back up from Camino Aguajito into the Camino El Estero intersection, hindering both regular traffic and bus operations. Because the peak hour right turn volume on this approach is substantial (more than 200 vehicles), a short (50 feet) right turn pocket was tested to see how intersection delay at Camino Aguajito and corridor travel times might improve. **Table 7** shows the results of this analysis.

TABLE 7
ALTERNATIVES ANALYSIS – TURN POCKET EFFECT ON INTERSECTION DELAY AND CORRIDOR TRAVEL TIME

Intersection		BRT Alternative 2a		BRT Alternative 2a with RT Pocket		BRT Alternative 2b		BRT Alternative 2b with RT Pocket	
		Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[2]
3	Camino Aguajito	35	D	33	C	40	D	24	C
Travel Time Segment		**Travel Time**	**Standard Deviation**	**Travel Time**	**Standard Deviation**	**Travel Time[3]**	**Standard Deviation**	**Travel Time[3]**	**Standard Deviation**
Eastbound Buses		4:24	0:12	4:16	0:11	8:24	0:23	8:33	0:14
Eastbound All Others		2:45	0:06	2:35	0:12	4:32	0:06	3:56	0:06

Notes: **Bold** indicates deficient intersection operations versus City of Monterey intersection LOS standard (LOS D)
[1] For side-street stop control, the worst case movement delay is reported.
[2] LOS as per *Highway Capacity Manual* (Transportation Research Board, 2000)
[3] Travel time corridor is approximately 0.7 miles longer than for BRT Alternative 2a
Source: Fehr & Peers, 2012

The alternatives analysis results shows that the addition of the right turn pocket would reduce delay for regular traffic, but would not significantly improve travel time for buses. Alternative 1 is not summarized above because it does not have this issue because the Camino Aguajito intersection essentially operates in this configuration in the side-running BRT lane scenario (i.e. the BRT lane functions as a longer right turn pocket).

MULTIMODAL CONSIDERATIONS

The three BRT alternatives will enhance pedestrian access to local destinations by providing a fast and efficient alternative to driving along the Del Monte Avenue corridor. The side-running BRT lane alternative will increase crossing distances at intersections by approximately 24 feet, but it will still provide access between Estero Park and the beach. The bidirectional BRT lane alternative will also increase crossing distances at Del Monte Avenue/Camino El Estero by approximately 24 feet, but the BRT lanes will have a smaller volume relative to the main lanes of Del Monte Avenue. To minimize this impact, median refuge islands for pedestrians could be provided between regular traffic and the bus-only lanes to provide comfortable waiting area Also, the bus stops in the bidirectional BRT lane alternatives will provide all riders with direct access to Municipal Beach without the need to cross Del Monte Avenue.

Bicycles can currently use the Monterey Bay Coastal Trail to parallel Del Monte Avenue. The bidirectional BRT alternatives will eliminate the need for bicyclists that use the bus to cross Del Monte Avenue in order to reach the trail because the BRT lanes are positioned on the north side of the street

The side-running BRT lane alternative will eliminate parallel parking along Del Monte Avenue from Camino El Estero to Camino Aguajito. Most of these parking spaces are likely used for beachgoers and/or El Estero Park users, so the enhanced bus service may provide a suitable alternative to driving and parking at these destinations. As currently envisioned, the bidirectional BRT lanes will not require the removal of existing parallel parking.

The bidirectional BRT alternative can be constructed with a gap between the BRT lane and the mainline that allows for the planting of native fauna or other landscaping treatments. The side running BRT alternative will widen the street by at least 24 feet; however, construction will allow for landscaping treatments to be provided on the north side of the road in place of existing buildings that will need to be acquired prior to construction.

Aside from the construction of new bus stops and intersection modifications under the bidirectional BRT lane alternatives, the bidirectional BRT alternatives could be constructed without significant disruption to traffic operations on Del Monte Avenue. The longer running bidirectional BRT alternative would pass through a grove of trees near Cunningham Road, which may be environmentally sensitive. The side running BRT alternative will require twice as much widening as the bidirectional BRT alternative. All BRT alternatives will require acquiring properties along the north side of Del Monte Avenue from Camino Aguajito to Sloat Avenue.

All alternatives would be compatible with future light rail transit (LRT) implementation. The bidirectional BRT alternative provides a dedicated right of way for future LRT implementation. The side-running BRT lane configuration would need to be modified to provide a dedicated right of way in the center or north side of the roadway. Signal modifications would be needed as part of the LRT implementation.

SUMMARY OF RESULTS

Of the three BRT alternatives evaluated, the side-running BRT alternative (Alternative 1) provides a reasonably competitive bus travel time along the corridor, while providing extra right turn capacity that can enhance travel for all vehicles in the corridor. It would reduce eastbound travel times for buses and automobiles by roughly one minute, and peak hour network delay would decrease by about 50 total hours, or 35%, compared to future no project conditions. However, drawbacks to this alternative are that it will increase pedestrian crossing distances along the corridor and be slightly less compatible with the implementation of LRT than other alternatives.

The bidirectional BRT alternatives (Alternatives 2a and 2b) will provide a dedicated right of way for bus operations and future LRT implementation. These alternatives would be more pedestrian friendly since pedestrian crossing distances would be shorter and access to the Municipal Beach would be more direct. However, these alternatives are not as competitive with respect to travel time as the side-running BRT lanes and would have higher travel times than the side-running BRT alternative. The segment of bidirectional BRT lane from Camino El Estero to Sloat Avenue would be straightforward to construct; however, the segment from Sloat Avenue to Casa Verde Way may pass through an environmentally sensitive area with limited right of way, depending on alignment and future environmental study to be completed by the City.

FEHR & PEERS

MEMORANDUM

Date: May 28, 2012

To: Kimberly Cole, Elizabeth Caraker, Rich Deal, City of Monterey

From: Monica Altmaier, Fehr & Peers

Subject: Monterey Citywide Transportation and Parking Study - Traffic Analysis Assumptions

SJ10-1219

The following memorandum summarizes the Synchro and SimTraffic model development process used to determine existing and project intersection operations for the Citywide Transportation and Parking Study (CTPS). The *Guidelines for Applying Traffic Microsimulation Modeling Software* (September 2002) developed by Caltrans were used for model development, calibration and validation.

TRAFFIC OPERATIONS MODEL DEVELOPMENT

Evening peak hour Synchro (Version 7) models were developed for the three study areas: Downtown, Lighthouse Avenue, and North Fremont Street. The models were coded with existing peak hour traffic volumes (representing Friday afternoon conditions in August – when peak hour volumes are generally highest), posted speed limits, truck percentages, and existing signal timings. Traffic signal information such as phasing and initial timings (minimum green, maximum green, clearance intervals, etc.) for all signalized study intersections was developed in coordination with City staff. Additional details, such as turn pocket lengths and intersection spacing, were coded based on field measurements and aerial photographs.

The Synchro models developed for Downtown Monterey were converted to SimTraffic format in order to simulate existing traffic operations. The Synchro models developed for the Lighthouse Avenue and North Fremont Street corridors were not analyzed in SimTraffic (though SimTraffic was used in the model calibration/validation process for each corridor).

The Downtown SimTraffic models simulate the effects of upstream and downstream closely-spaced intersections in a grid-based street network. The following initial default SimTraffic parameters were used in the modeling prior to calibration:

- Free flow speed = posted speed limit

- Left-turn lane capacity = 1,770 passenger cars per hour per lane (pcphpl)
- Through lane capacity = 1,863 pcphpl
- Right-turn lane capacity = 1,583 pcphpl
- Left-turn turning speed = 15 mph
- Right-turn turning speed = 9 mph
- Vehicle lengths
  - Car 1 = 14 feet
  - Car 2 = 16 feet
  - Car 3 = 18 feet
- Vehicle Occurrence
  - Cars:
    - 33% Car 1
    - 33% Car 2
    - 34% Car 3
  - Trucks:
    - 90% Single unit truck
    - 10% Semi truck 2
- Driver Behavior
  - Yellow reaction time for drivers 1-4 set equal to driver 5
  - Green reaction time for drivers 1-4 set equal to driver 5
  - Gap acceptance factor for drivers 1-4 set equal to driver 5
- Pedestrian and Bicycle Volumes
  - Based on counts conducted by the City of Monterey, as well as visual observations

MODEL CALIBRATION AND VALIDATION

SimTraffic models reflecting existing field conditions require calibration to ensure that traffic volumes, queue lengths, and other operational observations are satisfactorily replicated. The final calibration settings were carried forward for the alternatives analysis.

The following calibration process was employed to replicate existing traffic conditions:

1. Make a base model run with default parameters
2. Compare predicted and field-observed performance measures and assess differences
3. Assess differences between predicted and field-observed performance measures, including vehicle queues and travel times
4. Select reasonable model input changes to reduce differences

5. Make a new model run with selected input changes
6. Repeat process until predictions are acceptable

MODEL PARAMETER ADJUSTMENTS

The model parameters were adjusted where appropriate to more closely match field observed conditions. Driver aggressiveness factors and turning speeds were the most common adjustments made to the model. Driver aggressiveness factors refer to factors such as green reaction times and gap acceptance factors. These factors impact the vehicle headways and ultimately the saturation flow rates. Headways in urban areas with congested conditions are often lower than areas with uncongested conditions, resulting in higher saturation flow rates as drivers follow other vehicles more closely and drive more aggressively. Turning speeds were also adjusted where vehicle turn speeds would be higher than the default values.

The following model adjustments were made to more closely match conditions within the future Downtown "Expanded Grid" model. These adjustments were made to reflect the anticipated travel behaviors and conditions.

- <u>Del Monte / Tyler Street</u>
    - Southbound headway factor adjusted to 1.0
    - Increased southbound left turn speed from 15 to 22 mph
- <u>Del Monte / Figueroa Street</u>
    - Increased westbound right turn speed from 9 to 15 mph
    - Intersection assumed to be "master" for signal coordination
- <u>Franklin Street / Pacific Street</u>
    - Southbound headway factor adjusted to 0.9 to replicate shorter vehicle headways
- <u>Franklin Street / Calle Principal</u>
    - Eastbound headway factor adjusted to 0.9 to replicate shorter vehicle headways
- <u>Franklin Street / Alvarado Street</u>
    - Eastbound headway factor adjusted to 0.9 to replicate shorter vehicle headways
- <u>Franklin Street / Tyler Street</u>
    - Eastbound headway factor adjusted to 0.9 to replicate shorter vehicle headways

- Alvarado Street/Polk Street/ Pearl Street
  - The new signal at this intersection was coded with an 80 second cycle length. It operates as the "master" and coordinates with the new signal at Munras Avenue/Tyler Street and the existing signal at Munras Avenue/Webster Street.
- Hartnell Street/ Calle Principal and Jefferson Street/ Calle Principal Roundabouts
  - The two new single-lane roundabouts are coded with default turning speeds and lane widths.
- Del Monte Avenue and Franklin Street Signal Coordination
  - The signals for the Downtown "Expanded Grid" network were optimized to have 110 second cycle lengths at Pacific Street / Franklin Street and along Del Monte Avenue, with the exception of Calle Principal and Alvarado Street which have half-cycle lengths of 55 seconds. The signalized study intersections along Franklin Street were also coded to have 55 second cycle lengths.

In addition to the local intersection changes presented above, some characteristics associated with driver aggressiveness were modified. The following SimTraffic driver parameters were adjusted for each of the models to reflect the urban characteristics of the downtown study area:

- Vehicle Parameters - Added 2 feet to default vehicle length for cars (18 feet for Car 1, 16 feet for Car2)
- Vehicle Occurrence - 50%/50% for Car1/Car2 and 50%/50% for Truck SU/SemiTrk2
- Mandatory and Positioning Distance - Changed the ranges to 125% through 80%

Subsequent to making calibration adjustments, the Downtown SimTraffic models were also validated against observed volumes, queues, and travel times.

MODEL ANALYSIS

Following the model development process, proposed street reconfigurations alternatives were iteratively tested and modeled in Synchro and SimTraffic based on "water constrained" travel forecasts developed as part of the project. Water constrained forecasts were developed for August Friday afternoon traffic conditions – in general traffic volumes during other months, other days of the week and other hours in the day are lower than Friday afternoon conditions. Therefore the results presented in the CTPS represent worst case traffic conditions, and actual traffic delay will generally be lower than reported.

Future intersection level of service (LOS) results for each study area are included on the following pages.

TABLE 1 DOWNTOWN INTERSECTION LEVELS OF SERVICE

Intersection	Peak Hour[1]	Intersection Control	Existing		Future- No Project		Future- Two Way Circulation and "Expanded Grid"	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Del Monte Avenue/ Pacific	PM	Signal	39.1	D	**56.8**	**E**	29.4	C
Del Monte Avenue/ Calle Principal	PM	Signal	6.2	A	6.5	A	5.8	A
Del Monte Avenue/ Alvarado Street	PM	Signal	5.1	A	6.0	A	9.6	A
Del Monte Avenue/ Tyler Street	PM	Signal	9.7	A	9.7	A	19.4	B
Del Monte Avenue/ Washington Street	PM	Signal	22.9	C	24.0	C	30.7 (42.3 – interim)[4]	C D
N Del Monte Avenue/ Washington Street	PM	Signal	-	-	-	-	24.6	C
Del Monte Avenue/ Figueroa Street	PM	Signal	32.2	C	34.7	C	20.8	C

TABLE 1 DOWNTOWN INTERSECTION LEVELS OF SERVICE

Intersection	Peak Hour[1]	Intersection Control	Existing		Future- No Project		Future- Two Way Circulation and "Expanded Grid"	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
N Del Monte Avenue/ Figueroa Street	-	-	-	-	-	-	4.7	A
Del Monte Avenue/ Camino El Estero	PM	Signal	18.4	B	37.8	D	18.1	B
Del Monte Avenue/ Camino Aguajito	PM	Signal	11.8	B	12.2	B	11.7	B
Franklin Street/ Pacific Street	PM	Signal	15.6	B	75.3	E	22.2	C
Franklin Street/ Calle Principal	PM	Signal	14.9	B	14.3	B	10.8	B
Franklin Street/ Alvarado Street	PM	Signal	7.9	A	6.9	A	14.0	B
Franklin Street/ Tyler Street	PM	Signal	7.6	A	7.8	A	40,6	D

TABLE 1 DOWNTOWN INTERSECTION LEVELS OF SERVICE

Intersection	Peak Hour[1]	Intersection Control	Existing		Future- No Project		Future- Two Way Circulation and "Expanded Grid"	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Franklin Street/ Washington Street	PM	Signal	11.7	B	14.8	B	16.4	B
Franklin Street/ Figueroa Street	PM	Signal	16.8	B	18.1	B	12.8	B
Franklin Street/ Camino El Estero	PM	Unsignalized	17.6	C	**39.7**	**E**	22.7	C
Jefferson Street/ Pacific Street	PM	Signal	15.8	B	16.1	B	14.9	B
Jefferson Street/ Calle Principal	PM	Unsignalized	9.6	A	10.5	B	19.0	C
Pearl Street/ Alvarado Street	PM	Unsignalized *(Signal with project only)*	17.9	C	150.5	F	23.8	C
Pearl Street/ Washington Street	PM	Signal	13.9	B	16.0	C	13.4	B
Madison Street/ Pacific Street	PM	Signal	11.5	B	11.7	B	9.9	A

TABLE 1 DOWNTOWN INTERSECTION LEVELS OF SERVICE

Intersection	Peak Hour[1]	Intersection Control	Existing		Future- No Project		Future- Two Way Circulation and "Expanded Grid"	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Madison Street/ Calle Principal	PM	Unsignalized	17.0	B	25.2	C	5.0[5]	A[5]
Tyler Street/ Munras Avenue	PM	Unsignalized *(Signal with project)*	32.9	D	98.2	F	15.5	B
Webster Street/ Munras Avenue	PM	Unsignalized *(Signal with project)*	15.3	B	16.8	B	20.2	C
Fremont Street/ Abrego Street	PM	Signal	44.3	D	54.1	D	46.5	D
Fremont Street/ Camino El Estero	PM	Signal	15.1	B	16.0	B	12.3	B

Note:
1. PM= Friday Afternoon Peak Hour (August peak month conditions)
2. Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections using methodology described in the 2000 HCM.
3. LOS Level of Service using Synchro LOS.
4. Del Monte/ Washington operates at LOS D with a delay of 42.3 seconds for the "interim" Downtown alternative including two-way streets for Downtown and existing configuration for this intersection; the Expanded Grid configuration would operate at LOS C and is considered a longer term alternative.
5. LOS reporting FHWA Roundabout Operational Methodology (2000).
Unacceptable LOS shown in **bold** text. Methodology consistent with CEQA standards but Monterey General Plan states that LOS E or F is acceptable along major corridors so the unacceptable LOS highlighted above meets City standards. General Plan also allows for analysis of non-summer peak conditions. Therefore, the results in this study, which utilize August peak month traffic data, reflect the "worst case" conditions and not what typically would occur.
Source: Fehr & Peers, 2012.

TABLE 2 LIGHTHOUSE INTERSECTION LEVELS OF SERVICE

Intersection	Peak Hour[1]	Intersection Control	Existing		Future[4]	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)	LOS
Foam Street/ Reeside Avenue	PM	Signal	39.3	D	**62.5**	**E**
Foam Street / Drake Avenue	PM	Signal	13.5	B	13.9	B
Foam Street /Hoffman Avenue	PM	Signal	15.2	B	13.4	B
Foam Street / Prescott Avenue	PM	Signal	9.1	A	9.0	A
Foam Street / Irving Avenue	PM	Signal	7.6	A	7.4	A
Foam Street / David Avenue	PM	Signal	10.5	B	10.6	B
Lighthouse Avenue/Reeside Avenue	PM	Signal	31.9	C	51.4	D
Lighthouse Avenue / Dickman Avenue	PM	Signal	16.1	B	24.0	C
Lighthouse Avenue / Drake Avenue	AM PM	Signal	11.9	B	13.5	B
Lighthouse Avenue / McClellan Avenue	PM	Signal	4.6	A	6.7	A
Lighthouse Avenue / Hoffman Avenue	PM	Signal	15.8	B	16.1	B
Lighthouse Avenue /Prescott Avenue	PM	Signal	11.5	B	11.2	B
Lighthouse Avenue / Irving Avenue	PM	Signal	16.1	B	18.0	B

TABLE 2 LIGHTHOUSE INTERSECTION LEVELS OF SERVICE

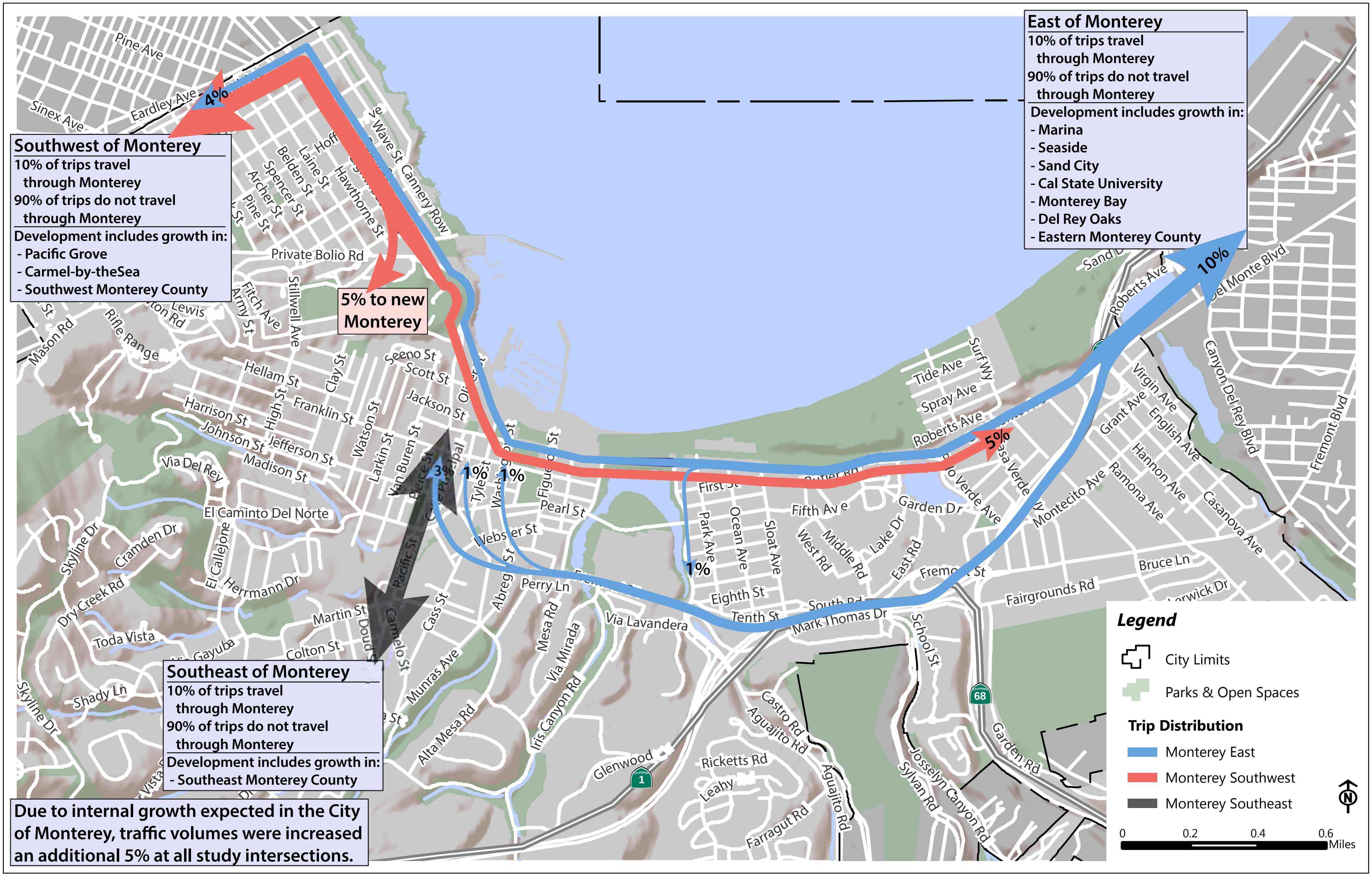
Intersection	Peak Hour[1]	Intersection Control	Existing		Future[4]	
			Delay (sec/veh)[2]	LOS[3]	Delay (sec/veh)	LOS
Lighthouse Avenue / David Avenue	PM	Signal	**66.3**	**E**	**113.5**	**F**
Hawthorne Street / Reeside Avenue	PM	Unsignalized	7.3	A	7.3	A
Hawthorne Street / Drake Avenue	PM	Unsignalized	11.1	B	11.2	B
Hawthorne Street / McCllean Avenue	PM	Unsignalized	2.4	A	2.5	A
Hawthorne Street / Hoffman Avenue	PM	Unsignalized	11.7	B	11.9	B
Hawthorne Street / Prescott Avenue	PM	Unsignalized	12.7	B	12.9	B
Hawthorne Street / Irving Avenue	PM	Unsignalized	3.3	A	3.3	A
Hawthorne Street / David Avenue	PM	Signal	11.5	B	11.7	B

Note:
1. PM= Friday Afternoon Peak Hour (August peak month conditions)
2. Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections using methodology described in the 2000 HCM.
3. LOS Level of Service using Synchro LOS.
4. Future configuration same with or without the project. Project configuration, including bulb-out and streetscape improvements, are not expect to affect traffic conditions along the corridor.
Unacceptable LOS shown in **bold**. Methodology consistent with CEQA standards but Monterey General Plan states that LOS E or F is acceptable along major corridors so the unacceptable LOS highlighted above meets City standards. General Plan also allows for analysis of non-summer peak conditions. Therefore, the results in this study, which utilize August peak month traffic data, reflect the "worst case" conditions and not what typically would occur.
Source: Fehr & Peers, 2012.

TABLE 3 NORTH FREMONT INTERSECTION LEVELS OF SERVICE

Intersection	Peak Hour[1]	Intersection Control	Existing		Future[5]	
			Delay (sec/veh)[2]	LOS[3,4]	Delay (sec/veh)	LOS
Fremont Street/ Casa Verde Way	PM	Signal	22.2	C	27.5	C
Fremont Street/ Dela Vina Avenue	PM	Signal	19.2	B	19.8	C
Fremont Street/Romana Avenue	PM	Signal	13.0	B	15.8	B
Fremont Street/ Casanova Avenue	PM	Signal	19.1	B	21.6	C

Note:
1. PM= Friday Afternoon Peak Hour (August peak month conditions)
2. Whole intersection weighted average control delay expressed in seconds per vehicle for signalized intersections using methodology described in the 2000 HCM.
3. LOS Level of Service using Synchro LOS.
4. Methodology consistent with CEQA standards but Monterey General Plan states that LOS E or F is acceptable along major corridors. General Plan also allows for analysis of non-summer peak conditions. Therefore, the results in this study, which utilize August peak month traffic data, reflect the “worst case” conditions and not what typically would occur.
5. Future configuration same with or without the project. Project configuration, including bus stop improvements and streetscape enhancements, are not expect to affect traffic conditions along the corridor.
Source: Fehr & Peers, 2012.



Monterey Citywide Study

FEHR PEERS

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Trip Distribution

Figure 1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	112	0	14	182	189	194	6	311	0	0	700	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	12	12	12	10	10	10	10	10	10
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00		0.90	1.00	1.00	0.86	1.00	1.00			1.00	0.97
Flpb, ped/bikes	0.91		1.00	0.93	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00		0.85	1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00	0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)	1443		1200	1489	1676	1223	1482	1565			1565	1284
Flt Permitted	0.63		1.00	0.95	1.00	1.00	0.15	1.00			1.00	1.00
Satd. Flow (perm)	961		1200	1489	1676	1223	231	1565			1565	1284
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	118	0	15	192	199	204	6	327	0	0	737	40
RTOR Reduction (vph)	0	0	9	0	0	126	0	0	0	0	0	8
Lane Group Flow (vph)	118	0	6	192	199	78	6	327	0	0	737	32
Confl. Peds. (#/hr)	95		50	50		95	10		69	69		10
Turn Type	custom		custom	Perm		Perm	custom					Perm
Protected Phases					8						6	
Permitted Phases	4		4	8		8	2	2				6
Actuated Green, G (s)	23.0		23.0	23.0	23.0	23.0	27.0	27.0			27.0	27.0
Effective Green, g (s)	23.0		23.0	23.0	23.0	23.0	27.0	27.0			27.0	27.0
Actuated g/C Ratio	0.38		0.38	0.38	0.38	0.38	0.45	0.45			0.45	0.45
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Grp Cap (vph)	368		460	571	642	469	104	704			704	578
v/s Ratio Prot					0.12						c0.47	
v/s Ratio Perm	0.12		0.00	c0.13		0.06	0.03	0.21				0.02
v/c Ratio	0.32		0.01	0.34	0.31	0.17	0.06	0.46			1.05	0.05
Uniform Delay, d1	13.0		11.5	13.1	12.9	12.2	9.3	11.5			16.5	9.3
Progression Factor	1.00		1.00	1.33	1.33	4.12	1.20	1.20			1.00	1.00
Incremental Delay, d2	2.3		0.0	1.5	1.2	0.7	0.9	1.9			46.8	0.2
Delay (s)	15.3		11.5	18.9	18.4	51.0	12.1	15.7			63.3	9.5
Level of Service	B		B	B	B	D	B	B			E	A
Approach Delay (s)		14.9			29.7			15.6			60.5	
Approach LOS		B			C			B			E	

Intersection Summary			
HCM Average Control Delay	39.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.5%	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)	0	0	0	183	478	0	87	0	0	0	0	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0				5.0	
Lane Util. Factor					0.91		1.00				1.00	
Frpb, ped/bikes					1.00		1.00				0.94	
Flpb, ped/bikes					0.97		0.95				1.00	
Frt					1.00		1.00				0.86	
Flt Protected					0.99		0.95				1.00	
Satd. Flow (prot)					4378		1510				1357	
Flt Permitted					0.99		0.74				1.00	
Satd. Flow (perm)					4378		1182				1357	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	193	503	0	92	0	0	0	0	21
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	13	0
Lane Group Flow (vph)	0	0	0	0	696	0	92	0	0	0	8	0
Confl. Peds. (#/hr)				76			65					65
Turn Type				Perm			custom					
Protected Phases					8						6	
Permitted Phases				8			2				6	
Actuated Green, G (s)					26.0		24.0				24.0	
Effective Green, g (s)					26.0		24.0				24.0	
Actuated g/C Ratio					0.43		0.40				0.40	
Clearance Time (s)					5.0		5.0				5.0	
Lane Grp Cap (vph)					1897		473				543	
v/s Ratio Prot											0.01	
v/s Ratio Perm					0.16		c0.08					
v/c Ratio					0.37		0.19				0.02	
Uniform Delay, d1					11.5		11.7				10.9	
Progression Factor					0.45		0.70				1.00	
Incremental Delay, d2					0.5		0.9				0.1	
Delay (s)					5.7		9.1				10.9	
Level of Service					A		A				B	
Approach Delay (s)		0.0			5.7			9.1			10.9	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	6.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	400	20	241	22	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0	5.0				
Lane Util. Factor					0.91		0.95	0.95				
Frpb, ped/bikes					0.99		1.00	1.00				
Flpb, ped/bikes					1.00		1.00	1.00				
Frt					0.99		1.00	1.00				
Flt Protected					1.00		0.95	0.96				
Satd. Flow (prot)					4517		1513	1529				
Flt Permitted					1.00		0.95	0.96				
Satd. Flow (perm)					4517		1513	1529				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	0	421	21	254	23	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	80	68	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	433	0	57	72	0	0	0	0
Confl. Peds. (#/hr)						64						
Turn Type							Perm					
Protected Phases					8			2				
Permitted Phases							2					
Actuated Green, G (s)					25.0		25.0	25.0				
Effective Green, g (s)					25.0		25.0	25.0				
Actuated g/C Ratio					0.42		0.42	0.42				
Clearance Time (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					1882		630	637				
v/s Ratio Prot					c0.10							
v/s Ratio Perm							0.04	0.05				
v/c Ratio					0.23		0.09	0.11				
Uniform Delay, d1					11.3		10.6	10.7				
Progression Factor					0.64		0.07	0.14				
Incremental Delay, d2					0.3		0.3	0.3				
Delay (s)					7.5		1.0	1.9				
Level of Service					A		A	A				
Approach Delay (s)		0.0			7.5			1.4			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.17		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	74.4%	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)	0	0	0	155	405	0	0	0	0	0	112	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0						5.0	5.0
Lane Util. Factor					0.91						0.95	1.00
Frpb, ped/bikes					1.00						1.00	0.96
Flpb, ped/bikes					1.00						1.00	1.00
Frt					1.00						1.00	0.85
Flt Protected					0.99						1.00	1.00
Satd. Flow (prot)					4498						3185	1363
Flt Permitted					0.99						1.00	1.00
Satd. Flow (perm)					4498						3185	1363
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	0	163	426	0	0	0	0	0	118	16
RTOR Reduction (vph)	0	0	0	0	82	0	0	0	0	0	0	11
Lane Group Flow (vph)	0	0	0	0	508	0	0	0	0	0	118	5
Confl. Peds. (#/hr)				14								36
Turn Type				Perm								Perm
Protected Phases					8						6	
Permitted Phases				8								6
Actuated Green, G (s)					30.0						20.0	20.0
Effective Green, g (s)					30.0						20.0	20.0
Actuated g/C Ratio					0.50						0.33	0.33
Clearance Time (s)					5.0						5.0	5.0
Lane Grp Cap (vph)					2249						1062	454
v/s Ratio Prot											c0.04	
v/s Ratio Perm					0.11							0.00
v/c Ratio					0.23						0.11	0.01
Uniform Delay, d1					8.5						13.8	13.4
Progression Factor					1.00						1.00	1.00
Incremental Delay, d2					0.2						0.2	0.0
Delay (s)					8.7						14.1	13.4
Level of Service					A						B	B
Approach Delay (s)		0.0			8.7			0.0			14.0	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.18		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBT	WBR	NBL2	NBL	NBT	NBR	SBR2	SEL
Lane Configurations								
Volume (vph)	480	1382	80	306	35	178	0	1566
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	6.0	6.0	6.0	6.0		5.0
Lane Util. Factor	0.95	0.88	1.00	0.95	0.95	1.00		0.94
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.90		1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85		1.00
Flt Protected	1.00	1.00	0.95	0.95	0.96	1.00		0.95
Satd. Flow (prot)	3539	2787	1770	1681	1702	1428		4990
Flt Permitted	1.00	1.00	0.95	0.95	0.96	1.00		0.95
Satd. Flow (perm)	3539	2787	1770	1681	1702	1428		4990
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	505	1455	84	322	37	187	0	1648
RTOR Reduction (vph)	0	0	72	0	0	160	0	0
Lane Group Flow (vph)	505	1455	12	177	182	27	0	1648
Confl. Peds. (#/hr)						82		
Turn Type		custom	Split	Split		Perm	Free	
Protected Phases	5	2	3	3	3			6
Permitted Phases						3	Free	
Actuated Green, G (s)	17.1	75.6	14.4	14.4	14.4	14.4		52.5
Effective Green, g (s)	17.1	75.6	14.4	14.4	14.4	14.4		52.5
Actuated g/C Ratio	0.17	0.76	0.14	0.14	0.14	0.14		0.52
Clearance Time (s)	5.0	4.0	6.0	6.0	6.0	6.0		5.0
Vehicle Extension (s)	1.0	2.0	0.5	0.5	0.5	0.5		3.0
Lane Grp Cap (vph)	605	2107	255	242	245	206		2620
v/s Ratio Prot	c0.14	c0.52	0.01	0.11	c0.11			0.33
v/s Ratio Perm						0.02		
v/c Ratio	0.83	0.69	0.05	0.73	0.74	0.13		0.63
Uniform Delay, d1	40.1	6.2	36.9	40.9	41.0	37.3		16.8
Progression Factor	1.39	0.81	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	6.1	1.2	0.0	9.4	10.1	0.1		0.5
Delay (s)	61.8	6.3	36.9	50.3	51.2	37.4		17.3
Level of Service	E	A	D	D	D	D		B
Approach Delay (s)	20.6				45.0			17.3
Approach LOS	C				D			B

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	1619	68	106	1556	150	185	44	81	183	66	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	10	10	11	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	0.97	1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.97	1.00	1.00	0.98	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5045		1770	4993		1608	1739	1436	1626	1801	1519
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00	1.00	0.73	1.00	1.00
Satd. Flow (perm)	1770	5045		1770	4993		1205	1739	1436	1245	1801	1519
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	1704	72	112	1638	158	195	46	85	193	69	127
RTOR Reduction (vph)	0	4	0	0	11	0	0	0	57	0	0	85
Lane Group Flow (vph)	60	1772	0	112	1785	0	195	46	28	193	69	42
Confl. Peds. (#/hr)			12			23	32		18	18		32
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2		2	6		6
Actuated Green, G (s)	9.0	39.0		13.0	43.0		33.0	33.0	33.0	33.0	33.0	33.0
Effective Green, g (s)	9.0	39.0		13.0	43.0		33.0	33.0	33.0	33.0	33.0	33.0
Actuated g/C Ratio	0.09	0.39		0.13	0.43		0.33	0.33	0.33	0.33	0.33	0.33
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	159	1968		230	2147		398	574	474	411	594	501
v/s Ratio Prot	0.03	c0.35		c0.06	c0.36			0.03			0.04	
v/s Ratio Perm							c0.16		0.02	0.16		0.03
v/c Ratio	0.38	0.90		0.49	0.83		0.49	0.08	0.06	0.47	0.12	0.08
Uniform Delay, d1	42.9	28.7		40.4	25.3		26.8	23.1	22.9	26.6	23.3	23.1
Progression Factor	0.87	1.08		0.98	0.98		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.4	5.9		6.2	3.4		4.3	0.3	0.2	3.8	0.4	0.3
Delay (s)	42.8	36.9		45.7	28.2		31.0	23.3	23.1	30.4	23.7	23.4
Level of Service	D	D		D	C		C	C	C	C	C	C
Approach Delay (s)		37.1			29.2			27.9			26.9	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	32.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	10	1612	261	69	1532	280	330
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	0.97	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	1.00	1.00	0.90
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1434	1770	5085	3433	1420
Flt Permitted	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	1434	1770	5085	3433	1420
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1697	275	73	1613	295	347
RTOR Reduction (vph)	0	0	122	0	0	0	93
Lane Group Flow (vph)	11	1697	153	73	1613	295	254
Confl. Peds. (#/hr)			41				68
Turn Type	Prot		Perm	Prot			Perm
Protected Phases	7	4		3	8	2	
Permitted Phases			4				2
Actuated Green, G (s)	6.0	55.0	55.0	8.0	57.0	22.0	22.0
Effective Green, g (s)	6.0	55.0	55.0	8.0	57.0	22.0	22.0
Actuated g/C Ratio	0.06	0.55	0.55	0.08	0.57	0.22	0.22
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	106	1946	789	142	2898	755	312
v/s Ratio Prot	0.01	c0.48		c0.04	0.32	0.09	
v/s Ratio Perm			0.11				c0.18
v/c Ratio	0.10	0.87	0.19	0.51	0.56	0.39	0.81
Uniform Delay, d1	44.5	19.5	11.3	44.1	13.5	33.3	37.1
Progression Factor	1.02	0.61	0.10	1.04	0.78	1.00	1.00
Incremental Delay, d2	1.1	3.3	0.3	11.0	0.7	1.5	20.4
Delay (s)	46.5	15.2	1.5	56.8	11.2	34.8	57.4
Level of Service	D	B	A	E	B	C	E
Approach Delay (s)		13.4			13.2	47.0	
Approach LOS		B			B	D	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1666	276	55	1364	237	93
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	
Lane Util. Factor	0.95		1.00	0.95	0.97	
Frpb, ped/bikes	0.99		1.00	1.00	0.98	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	3438		1770	3539	3290	
Flt Permitted	1.00		0.06	1.00	0.97	
Satd. Flow (perm)	3438		106	3539	3290	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1754	291	58	1436	249	98
RTOR Reduction (vph)	10	0	0	0	26	0
Lane Group Flow (vph)	2035	0	58	1436	321	0
Confl. Peds. (#/hr)		16	16		15	15
Turn Type			Perm			
Protected Phases	4			8	2	
Permitted Phases			8			
Actuated Green, G (s)	75.1		75.1	75.1	14.9	
Effective Green, g (s)	75.1		75.1	75.1	14.9	
Actuated g/C Ratio	0.75		0.75	0.75	0.15	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	2582		80	2658	490	
v/s Ratio Prot	c0.59			0.41	c0.10	
v/s Ratio Perm			0.55			
v/c Ratio	0.79		0.72	0.54	0.65	
Uniform Delay, d1	7.6		6.8	5.2	40.1	
Progression Factor	1.09		1.00	1.00	1.00	
Incremental Delay, d2	1.2		43.8	0.8	3.1	
Delay (s)	9.5		50.6	6.0	43.3	
Level of Service	A		D	A	D	
Approach Delay (s)	9.5			7.7	43.3	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	76.8%	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)	27	331	58	0	0	0	77	290	96	342	446	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	12	12	12	10	12	12	10	12	12
Total Lost time (s)		5.0	5.0				5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00	1.00				1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	0.91				1.00	0.99		1.00	0.99	
Flpb, ped/bikes		1.00	1.00				0.98	1.00		0.98	1.00	
Frt		1.00	0.85				1.00	0.96		1.00	0.97	
Flt Protected		1.00	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1667	1212				1464	1597		1463	1607	
Flt Permitted		1.00	1.00				0.33	1.00		0.47	1.00	
Satd. Flow (perm)		1667	1212				505	1597		727	1607	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	28	348	61	0	0	0	81	305	101	360	469	114
RTOR Reduction (vph)	0	0	43	0	0	0	0	20	0	0	14	0
Lane Group Flow (vph)	0	376	18	0	0	0	81	386	0	360	569	0
Confl. Peds. (#/hr)	15		42	42		15	29		31	31		29
Turn Type	Perm		Perm				Perm			Perm		
Protected Phases		4						2			6	
Permitted Phases	4		4				2			6		
Actuated Green, G (s)		18.0	18.0				32.0	32.0		32.0	32.0	
Effective Green, g (s)		18.0	18.0				32.0	32.0		32.0	32.0	
Actuated g/C Ratio		0.30	0.30				0.53	0.53		0.53	0.53	
Clearance Time (s)		5.0	5.0				5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		500	364				269	852		388	857	
v/s Ratio Prot								0.24			0.35	
v/s Ratio Perm		0.23	0.02				0.16			c0.50		
v/c Ratio		0.75	0.05				0.30	0.45		0.93	0.66	
Uniform Delay, d1		19.0	14.9				7.8	8.6		12.9	10.1	
Progression Factor		1.00	1.00				0.65	0.61		0.61	0.64	
Incremental Delay, d2		10.0	0.3				2.7	1.7		17.1	1.8	
Delay (s)		29.0	15.2				7.8	6.9		25.0	8.3	
Level of Service		C	B				A	A		C	A	
Approach Delay (s)		27.1			0.0			7.1			14.7	
Approach LOS		C			A			A			B	

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	700	51	0	0	0	0	69	50	80	103	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0						5.0			5.0	
Lane Util. Factor		0.95						1.00			1.00	
Frpb, ped/bikes		0.99						0.97			1.00	
Flpb, ped/bikes		1.00						1.00			0.97	
Frt		0.99						0.94			1.00	
Flt Protected		1.00						1.00			0.98	
Satd. Flow (prot)		3114						1526			1597	
Flt Permitted		1.00						1.00			0.83	
Satd. Flow (perm)		3114						1526			1347	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	19	737	54	0	0	0	0	73	53	84	108	0
RTOR Reduction (vph)	0	9	0	0	0	0	0	33	0	0	0	0
Lane Group Flow (vph)	0	801	0	0	0	0	0	93	0	0	192	0
Confl. Peds. (#/hr)	117		72						72	72		
Turn Type	Perm									Perm		
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		27.0						23.0			23.0	
Effective Green, g (s)		27.0						23.0			23.0	
Actuated g/C Ratio		0.45						0.38			0.38	
Clearance Time (s)		5.0						5.0			5.0	
Lane Grp Cap (vph)		1401						585			516	
v/s Ratio Prot								0.06				
v/s Ratio Perm		0.26									c0.14	
v/c Ratio		0.57						0.16			0.37	
Uniform Delay, d1		12.2						12.2			13.3	
Progression Factor		1.03						1.00			1.47	
Incremental Delay, d2		1.0						0.6			1.9	
Delay (s)		13.6						12.7			21.5	
Level of Service		B						B			C	
Approach Delay (s)		13.6			0.0			12.7			21.5	
Approach LOS		B			A			B			C	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	797	0	0	0	0	0	230	95	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0						5.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						0.91				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.96				
Flt Protected		1.00						1.00				
Satd. Flow (prot)		3165						2784				
Flt Permitted		1.00						1.00				
Satd. Flow (perm)		3165						2784				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	839	0	0	0	0	0	242	100	0	0	0
RTOR Reduction (vph)	0	5	0	0	0	0	0	67	0	0	0	0
Lane Group Flow (vph)	0	869	0	0	0	0	0	275	0	0	0	0
Confl. Peds. (#/hr)	106								287			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4											
Actuated Green, G (s)		30.0						20.0				
Effective Green, g (s)		30.0						20.0				
Actuated g/C Ratio		0.50						0.33				
Clearance Time (s)		5.0						5.0				
Lane Grp Cap (vph)		1583						928				
v/s Ratio Prot								c0.10				
v/s Ratio Perm		0.27										
v/c Ratio		0.55						0.30				
Uniform Delay, d1		10.3						14.8				
Progression Factor		0.36						1.00				
Incremental Delay, d2		1.2						0.8				
Delay (s)		4.9						15.6				
Level of Service		A						B				
Approach Delay (s)		4.9			0.0			15.6			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	7.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	800	92	0	0	0	0	0	58	130	150	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		5.0							5.0	5.0	5.0	
Lane Util. Factor		0.95							1.00	1.00	1.00	
Frpb, ped/bikes		0.98							0.95	1.00	1.00	
Flpb, ped/bikes		1.00							1.00	0.96	1.00	
Frt		0.98							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	1.00	
Satd. Flow (prot)		3086							1379	1535	1565	
Flt Permitted		1.00							1.00	0.95	1.00	
Satd. Flow (perm)		3086							1379	1535	1565	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	842	97	0	0	0	0	0	61	137	158	0
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	42	87	0	0
Lane Group Flow (vph)	0	925	0	0	0	0	0	0	19	50	158	0
Confl. Peds. (#/hr)			82						38	38		
Turn Type									custom	Perm		
Protected Phases		4									6	
Permitted Phases									2	6		
Actuated Green, G (s)		31.0							19.0	19.0	19.0	
Effective Green, g (s)		31.0							19.0	19.0	19.0	
Actuated g/C Ratio		0.52							0.32	0.32	0.32	
Clearance Time (s)		5.0							5.0	5.0	5.0	
Lane Grp Cap (vph)		1594							437	486	496	
v/s Ratio Prot		c0.30									c0.10	
v/s Ratio Perm									0.01	0.03		
v/c Ratio		0.58							0.04	0.10	0.32	
Uniform Delay, d1		10.0							14.2	14.5	15.6	
Progression Factor		0.33							1.00	1.07	0.87	
Incremental Delay, d2		1.4							0.2	0.4	1.7	
Delay (s)		4.6							14.4	15.8	15.3	
Level of Service		A							B	B	B	
Approach Delay (s)		4.6			0.0			14.4			15.5	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	61.7%	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)	229	606	153	0	0	0	0	326	59	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	16	12	12	12	12
Total Lost time (s)		5.0						5.0				
Lane Util. Factor		0.95						1.00				
Frpb, ped/bikes		0.99						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		0.98						0.98				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		3042						1852				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		3042						1852				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	241	638	161	0	0	0	0	343	62	0	0	0
RTOR Reduction (vph)	0	73	0	0	0	0	0	11	0	0	0	0
Lane Group Flow (vph)	0	967	0	0	0	0	0	394	0	0	0	0
Confl. Peds. (#/hr)	11		25						18			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4											
Actuated Green, G (s)		28.0						22.0				
Effective Green, g (s)		28.0						22.0				
Actuated g/C Ratio		0.47						0.37				
Clearance Time (s)		5.0						5.0				
Lane Grp Cap (vph)		1420						679				
v/s Ratio Prot								c0.21				
v/s Ratio Perm		0.32										
v/c Ratio		0.68						0.58				
Uniform Delay, d1		12.5						15.3				
Progression Factor		0.53						1.00				
Incremental Delay, d2		2.3						3.6				
Delay (s)		8.9						18.9				
Level of Service		A						B				
Approach Delay (s)		8.9			0.0			18.9			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	63.4%	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)	95	493	51	0	0	0	0	215	39	23	217	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	10	12	16	12
Total Lost time (s)		5.0						5.0	5.0		5.0	
Lane Util. Factor		0.95						1.00	1.00		1.00	
Frpb, ped/bikes		1.00						1.00	0.95		1.00	
Flpb, ped/bikes		0.99						1.00	1.00		1.00	
Frt		0.99						1.00	0.85		1.00	
Flt Protected		0.99						1.00	1.00		1.00	
Satd. Flow (prot)		3082						1314	1257		1584	
Flt Permitted		0.99						1.00	1.00		0.96	
Satd. Flow (perm)		3082						1314	1257		1531	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	100	519	54	0	0	0	0	226	41	24	228	0
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	23	0	0	0
Lane Group Flow (vph)	0	662	0	0	0	0	0	226	18	0	252	0
Confl. Peds. (#/hr)	41		18						46	46		
Bus Blockages (#/hr)	0	0	0	0	0	0	0	40	0	0	40	0
Turn Type	Perm								Perm	Perm		
Protected Phases		4						2			6	
Permitted Phases	4								2	6		
Actuated Green, G (s)		24.0						26.0	26.0		26.0	
Effective Green, g (s)		24.0						26.0	26.0		26.0	
Actuated g/C Ratio		0.40						0.43	0.43		0.43	
Clearance Time (s)		5.0						5.0	5.0		5.0	
Lane Grp Cap (vph)		1233						569	545		663	
v/s Ratio Prot								c0.17				
v/s Ratio Perm		0.21							0.01		0.16	
v/c Ratio		0.54						0.40	0.03		0.38	
Uniform Delay, d1		13.8						11.6	9.8		11.5	
Progression Factor		1.33						1.00	1.00		1.00	
Incremental Delay, d2		1.3						2.1	0.1		1.7	
Delay (s)		19.6						13.7	9.9		13.2	
Level of Service		B						B	A		B	
Approach Delay (s)		19.6			0.0			13.1			13.2	
Approach LOS		B			A			B			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	62.6%	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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	340	0	215	5	0	7	0	263	0	14	316	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	358	0	226	5	0	7	0	277	0	15	333	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1
Volume Total (vph)	358	226	13	185	92	347
Volume Left (vph)	358	0	5	0	0	15
Volume Right (vph)	0	226	7	0	0	0
Hadj (s)	0.53	-0.67	-0.23	0.03	0.03	0.04
Departure Headway (s)	7.0	5.8	7.5	7.0	7.0	6.7
Degree Utilization, x	0.70	0.37	0.03	0.36	0.18	0.64
Capacity (veh/h)	492	601	407	494	491	525
Control Delay (s)	23.5	10.9	10.7	12.5	10.3	20.9
Approach Delay (s)	18.6		10.7	11.8		20.9
Approach LOS	C		B	B		C

Intersection Summary			
Delay	17.6		
HCM Level of Service	C		
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	69	88	61	65	147	153	47	241	32	78	366	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	12	12	10	12	12	10	12	12	10	12	12
Total Lost time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.98			1.00	0.89	1.00	0.99		1.00	0.99	
Flpb, ped/bikes		0.98			0.99	1.00	0.99	1.00		0.97	1.00	
Frt		0.96			1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected		0.98			0.98	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1532			1640	1271	1466	1635		1446	1630	
Flt Permitted		0.84			0.85	1.00	0.41	1.00		0.57	1.00	
Satd. Flow (perm)		1302			1419	1271	636	1635		860	1630	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	73	93	64	68	155	161	49	254	34	82	385	63
RTOR Reduction (vph)	0	23	0	0	0	105	0	8	0	0	10	0
Lane Group Flow (vph)	0	207	0	0	223	56	49	280	0	82	438	0
Confl. Peds. (#/hr)	54		21	21		54	18		25	25		18
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		21.0			21.0	21.0	29.0	29.0		29.0	29.0	
Effective Green, g (s)		21.0			21.0	21.0	29.0	29.0		29.0	29.0	
Actuated g/C Ratio		0.35			0.35	0.35	0.48	0.48		0.48	0.48	
Clearance Time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		456			497	445	307	790		416	788	
v/s Ratio Prot								0.17			c0.27	
v/s Ratio Perm		c0.16			0.16	0.04	0.08			0.10		
v/c Ratio		0.45			0.45	0.13	0.16	0.35		0.20	0.56	
Uniform Delay, d1		15.1			15.0	13.3	8.7	9.7		8.9	11.0	
Progression Factor		1.00			1.00	1.00	0.92	0.98		1.53	1.49	
Incremental Delay, d2		3.2			2.9	0.6	1.1	1.2		0.8	2.2	
Delay (s)		18.3			17.9	13.8	9.1	10.6		14.4	18.5	
Level of Service		B			B	B	A	B		B	B	
Approach Delay (s)		18.3			16.2			10.4			17.9	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.4%	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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	45	0	150	35	304	55	39	45	0	0	110	22
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	47	0	158	37	320	58	41	47	0	0	116	23

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	205	197	218	88	139
Volume Left (vph)	47	37	0	41	0
Volume Right (vph)	158	0	58	0	23
Hadj (s)	-0.38	0.13	-0.15	0.13	-0.07
Departure Headway (s)	4.8	5.5	5.2	5.7	5.4
Degree Utilization, x	0.27	0.30	0.32	0.14	0.21
Capacity (veh/h)	705	629	665	569	604
Control Delay (s)	9.6	9.7	9.4	9.6	9.9
Approach Delay (s)	9.6	9.5		9.6	9.9
Approach LOS	A	A		A	A

Intersection Summary			
Delay	9.6		
HCM Level of Service	A		
Intersection Capacity Utilization	61.5%	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)	54	62	95	16	106	102	288	179	10	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	57	65	100	17	112	107	303	188	11	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1			2						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	904	795	0	877	795	188	0			188		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	904	795	0	877	795	188	0			188		
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 %	56	75	91	90	57	87	81			100		
cM capacity (veh/h)	130	261	1085	170	261	854	1623			1386		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	222	236	492	11
Volume Left	57	17	303	0
Volume Right	100	107	0	11
cSH	311	456	1623	1700
Volume to Capacity	0.71	0.52	0.19	0.01
Queue Length 95th (ft)	128	73	17	0
Control Delay (s)	40.9	23.0	5.4	0.0
Lane LOS	E	C	A	
Approach Delay (s)	40.9	23.0	5.3	
Approach LOS	E	C		

Intersection Summary			
Average Delay	17.9		
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	10	75	43	61	117	57	43	255	53	26	211	39
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	79	45	64	123	60	45	268	56	27	222	41

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	135	247	369	291
Volume Left (vph)	11	64	45	27
Volume Right (vph)	45	60	56	41
Hadj (s)	-0.15	-0.06	-0.03	-0.03
Departure Headway (s)	6.2	6.0	5.6	5.7
Degree Utilization, x	0.23	0.41	0.57	0.46
Capacity (veh/h)	489	540	606	572
Control Delay (s)	11.0	13.1	15.8	13.5
Approach Delay (s)	11.0	13.1	15.8	13.5
Approach LOS	B	B	C	B

Intersection Summary			
Delay	13.9		
HCM Level of Service	B		
Intersection Capacity Utilization	59.3%	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 (vph)	31	108	89	79	94	36	78	253	112	108	368	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	12	12	10	12	12	10	12	12	10	12	12
Grade (%)		-5%			5%			-2%			2%	
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	0.99		1.00	1.00	0.94	1.00	1.00	
Flpb, ped/bikes	0.98	1.00		0.98	1.00		0.99	1.00	1.00	0.97	1.00	
Frt	1.00	0.93		1.00	0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1492	1572		1426	1547		1489	1693	1348	1427	1647	
Flt Permitted	0.67	1.00		0.62	1.00		0.47	1.00	1.00	0.59	1.00	
Satd. Flow (perm)	1051	1572		924	1547		732	1693	1348	893	1647	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	33	114	94	83	99	38	82	266	118	114	387	17
RTOR Reduction (vph)	0	49	0	0	23	0	0	0	57	0	2	0
Lane Group Flow (vph)	33	159	0	83	114	0	82	266	61	114	402	0
Confl. Peds. (#/hr)	16		14	14		16	10		28	28		10
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	19.0	19.0		19.0	19.0		31.0	31.0	31.0	31.0	31.0	
Effective Green, g (s)	19.0	19.0		19.0	19.0		31.0	31.0	31.0	31.0	31.0	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.52	0.52	0.52	0.52	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	333	498		293	490		378	875	696	461	851	
v/s Ratio Prot		c0.10			0.07			0.16			c0.24	
v/s Ratio Perm	0.03			0.09			0.11		0.05	0.13		
v/c Ratio	0.10	0.32		0.28	0.23		0.22	0.30	0.09	0.25	0.47	
Uniform Delay, d1	14.5	15.6		15.4	15.1		7.9	8.3	7.3	8.0	9.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.80	0.86	
Incremental Delay, d2	0.6	1.7		2.4	1.1		1.3	0.9	0.2	1.1	1.6	
Delay (s)	15.1	17.3		17.8	16.2		9.2	9.2	7.6	7.5	9.6	
Level of Service	B	B		B	B		A	A	A	A	A	
Approach Delay (s)		17.0			16.8			8.8			9.1	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	65.1%	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 (veh/h)	10	106	212	0	0	0	182	74	77	28	240	27
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	112	223	0	0	0	192	78	81	29	253	28
Pedestrians					20			20			20	
Lane Width (ft)					0.0			12.0			12.0	
Walking Speed (ft/s)					3.5			3.5			3.5	
Percent Blockage					0			2			2	
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		252										
pX, platoon unblocked												
vC, conflicting volume	20			355			419	284	263	323	396	20
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	20			355			419	284	263	323	396	20
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			38	87	89	94	51	97
cM capacity (veh/h)	1566			1181			310	597	761	480	517	1038

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	345	351	311
Volume Left	11	192	29
Volume Right	223	81	28
cSH	1566	478	538
Volume to Capacity	0.01	0.73	0.58
Queue Length 95th (ft)	1	150	91
Control Delay (s)	0.3	30.6	20.4
Lane LOS	A	D	C
Approach Delay (s)	0.3	30.6	20.4
Approach LOS		D	C

Intersection Summary			
Average Delay	17.0		
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	21	98	90	35	21	82	444	78	12	88	11
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	13	22	103	95	37	22	86	467	82	13	93	12
Pedestrians		76			63			136			25	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		3.5			3.5			3.5			3.5	
Percent Blockage		7			6			13			2	
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								266				
pX, platoon unblocked	0.79	0.79		0.79	0.79	0.79				0.79		
vC, conflicting volume	905	985	310	1066	950	596	180			612		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	751	851	310	954	807	363	180			383		
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 %	92	88	82	4	82	96	93			99		
cM capacity (veh/h)	165	189	589	99	201	497	1294			878		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	138	154	86	549	117
Volume Left	13	95	86	0	13
Volume Right	103	22	0	82	12
cSH	715	130	1294	1700	878
Volume to Capacity	0.19	1.18	0.07	0.32	0.01
Queue Length 95th (ft)	18	231	5	0	1
Control Delay (s)	16.8	202.9	8.0	0.0	1.1
Lane LOS	C	F	A		A
Approach Delay (s)	16.8	202.9	1.1		1.1
Approach LOS	C	F			

Intersection Summary			
Average Delay	32.9		
Intersection Capacity Utilization	54.6%	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 (vph)	49	92	337	6	66	46	184	508	18	24	228	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	0.96		1.00	0.95	1.00	1.00		1.00	0.99	
Flpb, ped/bikes		0.99	1.00		1.00	1.00	0.99	1.00		0.99	1.00	
Frt		1.00	0.85		1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected		0.98	1.00		1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1813	1514		1852	1503	1749	1850		1749	1827	
Flt Permitted		0.89	1.00		0.98	1.00	0.54	1.00		0.23	1.00	
Satd. Flow (perm)		1634	1514		1823	1503	990	1850		431	1827	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	52	97	355	6	69	48	194	535	19	25	240	25
RTOR Reduction (vph)	0	0	231	0	0	31	0	2	0	0	6	0
Lane Group Flow (vph)	0	149	124	0	75	17	194	552	0	25	259	0
Confl. Peds. (#/hr)	23		18	18		23	23		21	21		23
Turn Type	Perm		Perm	Perm		Perm	pm+pt			Perm		
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		21.0	21.0		21.0	21.0	29.0	29.0		18.0	18.0	
Effective Green, g (s)		21.0	21.0		21.0	21.0	29.0	29.0		18.0	18.0	
Actuated g/C Ratio		0.35	0.35		0.35	0.35	0.48	0.48		0.30	0.30	
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		572	530		638	526	554	894		129	548	
v/s Ratio Prot							0.03	c0.30			0.14	
v/s Ratio Perm		c0.09	0.08		0.04	0.01	0.13			0.06		
v/c Ratio		0.26	0.23		0.12	0.03	0.35	0.62		0.19	0.47	
Uniform Delay, d1		13.9	13.8		13.2	12.8	11.2	11.4		15.6	17.1	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.1	1.0		0.4	0.1	1.7	3.2		3.3	2.9	
Delay (s)		15.1	14.8		13.6	12.9	12.9	14.6		18.9	20.0	
Level of Service		B	B		B	B	B	B		B	C	
Approach Delay (s)		14.9			13.3			14.2			19.9	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.1%	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)	12	522	51	209	692	72	100	328	407	194	253	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1593	3128		1593	3124		1583	1676	1425	1586	1647	
Flt Permitted	0.95	1.00		0.95	1.00		0.42	1.00	1.00	0.33	1.00	
Satd. Flow (perm)	1593	3128		1593	3124		693	1676	1425	548	1647	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	13	549	54	220	728	76	105	345	428	204	266	27
RTOR Reduction (vph)	0	10	0	0	11	0	0	0	55	0	5	0
Lane Group Flow (vph)	13	593	0	220	793	0	105	345	373	204	288	0
Confl. Peds. (#/hr)			16			18	23		24	24		23
Turn Type	Prot			Prot			pm+pt		pt+ov	pm+pt		
Protected Phases	7	4		3	8		5	2	2 3	1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	6.0	18.0		8.0	20.0		24.0	18.0	31.0	24.0	18.0	
Effective Green, g (s)	6.0	18.0		8.0	20.0		24.0	18.0	31.0	24.0	18.0	
Actuated g/C Ratio	0.09	0.26		0.11	0.29		0.34	0.26	0.44	0.34	0.26	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	137	804		182	893		314	431	631	277	424	
v/s Ratio Prot	0.01	0.19		c0.14	c0.25		0.03	c0.21	0.26	c0.06	0.17	
v/s Ratio Perm							0.09			0.19		
v/c Ratio	0.09	0.74		1.21	0.89		0.33	0.80	0.59	0.74	0.68	
Uniform Delay, d1	29.5	23.8		31.0	23.9		16.4	24.3	14.7	18.6	23.4	
Progression Factor	1.00	1.00		0.88	1.62		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.4	6.0		131.4	11.8		2.9	14.4	4.0	16.0	8.5	
Delay (s)	30.9	29.8		158.6	50.5		19.2	38.8	18.8	34.6	31.9	
Level of Service	C	C		F	D		B	D	B	C	C	
Approach Delay (s)		29.8			73.7			26.7			33.0	
Approach LOS		C			E			C			C	

Intersection Summary			
HCM Average Control Delay	44.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	56	902	767	320	536	59
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00	0.93	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	3539	1476	3433	1519
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	3539	1476	3433	1519
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	59	949	807	337	564	62
RTOR Reduction (vph)	0	0	0	197	0	44
Lane Group Flow (vph)	59	949	807	140	564	18
Confl. Peds. (#/hr)				25		25
Turn Type	Prot			Perm		custom
Protected Phases	7	4	8			
Permitted Phases				8	6	6
Actuated Green, G (s)	6.0	40.0	29.0	29.0	20.0	20.0
Effective Green, g (s)	6.0	40.0	29.0	29.0	20.0	20.0
Actuated g/C Ratio	0.09	0.57	0.41	0.41	0.29	0.29
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	152	2022	1466	611	981	434
v/s Ratio Prot	0.03	c0.27	c0.23			
v/s Ratio Perm				0.09	c0.16	0.01
v/c Ratio	0.39	0.47	0.55	0.23	0.57	0.04
Uniform Delay, d1	30.3	8.8	15.6	13.3	21.4	18.1
Progression Factor	0.93	0.76	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.2	0.6	1.5	0.9	2.5	0.2
Delay (s)	33.3	7.2	17.0	14.1	23.8	18.2
Level of Service	C	A	B	B	C	B
Approach Delay (s)		8.7	16.2		23.3	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	0	20	220	240	210	10	440	0	0	830	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	12	12	12	10	10	10	10	10	10
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Util. Factor	1.00		1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frpb, ped/bikes	1.00		0.90	1.00	1.00	0.86	1.00	1.00			1.00	0.97
Flpb, ped/bikes	0.91		1.00	0.93	1.00	1.00	1.00	1.00			1.00	1.00
Frt	1.00		0.85	1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected	0.95		1.00	0.95	1.00	1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)	1453		1200	1489	1676	1223	1486	1565			1565	1284
Flt Permitted	0.59		1.00	0.95	1.00	1.00	0.15	1.00			1.00	1.00
Satd. Flow (perm)	904		1200	1489	1676	1223	232	1565			1565	1284
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)	120	0	20	220	240	210	10	440	0	0	830	40
RTOR Reduction (vph)	0	0	12	0	0	125	0	0	0	0	0	8
Lane Group Flow (vph)	120	0	8	220	240	85	10	440	0	0	830	32
Confl. Peds. (#/hr)	95		50	50		95	10		69	69		10
Turn Type	custom		custom	Perm		Perm	custom					Perm
Protected Phases					8						6	
Permitted Phases	4		4	8		8	2	2				6
Actuated Green, G (s)	23.0		23.0	23.0	23.0	23.0	27.0	27.0			27.0	27.0
Effective Green, g (s)	23.0		23.0	23.0	23.0	23.0	27.0	27.0			27.0	27.0
Actuated g/C Ratio	0.38		0.38	0.38	0.38	0.38	0.45	0.45			0.45	0.45
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0	5.0	5.0			5.0	5.0
Lane Grp Cap (vph)	347		460	571	642	469	104	704			704	578
v/s Ratio Prot					0.14						c0.53	
v/s Ratio Perm	0.13		0.01	c0.15		0.07	0.04	0.28				0.03
v/c Ratio	0.35		0.02	0.39	0.37	0.18	0.10	0.62			1.18	0.06
Uniform Delay, d1	13.2		11.5	13.4	13.3	12.3	9.5	12.6			16.5	9.3
Progression Factor	1.00		1.00	1.33	1.33	3.86	1.04	0.97			1.00	1.00
Incremental Delay, d2	2.7		0.1	1.9	1.6	0.8	1.4	3.3			94.8	0.2
Delay (s)	15.9		11.5	19.7	19.3	48.2	11.3	15.6			111.3	9.5
Level of Service	B		B	B	B	D	B	B			F	A
Approach Delay (s)		15.3			28.5			15.5			106.7	
Approach LOS		B			C			B			F	

Intersection Summary			
HCM Average Control Delay	56.8	HCM Level of Service	E
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	200	550	0	100	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0					
Lane Util. Factor					0.91		1.00					
Frpb, ped/bikes					1.00		1.00					
Flpb, ped/bikes					0.97		0.95					
Frt					1.00		1.00					
Flt Protected					0.99		0.95					
Satd. Flow (prot)					4386		1508					
Flt Permitted					0.99		0.76					
Satd. Flow (perm)					4386		1202					
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)	0	0	0	200	550	0	100	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	750	0	100	0	0	0	0	0
Confl. Peds. (#/hr)				76			65					65
Turn Type				Perm			custom					
Protected Phases					8						6	
Permitted Phases				8			2				6	
Actuated Green, G (s)					26.0		24.0					
Effective Green, g (s)					26.0		24.0					
Actuated g/C Ratio					0.43		0.40					
Clearance Time (s)					5.0		5.0					
Lane Grp Cap (vph)					1901		481					
v/s Ratio Prot												
v/s Ratio Perm					0.17		c0.08					
v/c Ratio					0.39		0.21					
Uniform Delay, d1					11.6		11.8					
Progression Factor					0.48		0.66					
Incremental Delay, d2					0.6		0.9					
Delay (s)					6.2		8.7					
Level of Service					A		A					
Approach Delay (s)		0.0			6.2			8.7			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	430	30	280	30	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0	5.0				
Lane Util. Factor					0.91		0.95	0.95				
Frpb, ped/bikes					0.99		1.00	1.00				
Flpb, ped/bikes					1.00		1.00	1.00				
Frt					0.99		1.00	1.00				
Flt Protected					1.00		0.95	0.96				
Satd. Flow (prot)					4495		1513	1531				
Flt Permitted					1.00		0.95	0.96				
Satd. Flow (perm)					4495		1513	1531				
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)	0	0	0	0	430	30	280	30	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	90	74	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	447	0	64	83	0	0	0	0
Confl. Peds. (#/hr)						64						
Turn Type							Perm					
Protected Phases					8			2				
Permitted Phases							2					
Actuated Green, G (s)					25.0		25.0	25.0				
Effective Green, g (s)					25.0		25.0	25.0				
Actuated g/C Ratio					0.42		0.42	0.42				
Clearance Time (s)					5.0		5.0	5.0				
Lane Grp Cap (vph)					1873		630	638				
v/s Ratio Prot					c0.10							
v/s Ratio Perm							0.04	0.05				
v/c Ratio					0.24		0.10	0.13				
Uniform Delay, d1					11.3		10.7	10.8				
Progression Factor					0.63		0.29	0.37				
Incremental Delay, d2					0.3		0.3	0.4				
Delay (s)					7.4		3.4	4.4				
Level of Service					A		A	A				
Approach Delay (s)		0.0			7.4			3.9			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	6.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.18		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	81.4%	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)	0	0	0	170	460	0	0	0	0	0	120	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0						5.0	5.0
Lane Util. Factor					0.91						0.95	1.00
Frpb, ped/bikes					1.00						1.00	0.96
Flpb, ped/bikes					1.00						1.00	1.00
Frt					1.00						1.00	0.85
Flt Protected					0.99						1.00	1.00
Satd. Flow (prot)					4500						3185	1363
Flt Permitted					0.99						1.00	1.00
Satd. Flow (perm)					4500						3185	1363
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)	0	0	0	170	460	0	0	0	0	0	120	20
RTOR Reduction (vph)	0	0	0	0	85	0	0	0	0	0	0	13
Lane Group Flow (vph)	0	0	0	0	545	0	0	0	0	0	120	7
Confl. Peds. (#/hr)				14								36
Turn Type				Perm								Perm
Protected Phases					8						6	
Permitted Phases				8								6
Actuated Green, G (s)					30.0						20.0	20.0
Effective Green, g (s)					30.0						20.0	20.0
Actuated g/C Ratio					0.50						0.33	0.33
Clearance Time (s)					5.0						5.0	5.0
Lane Grp Cap (vph)					2250						1062	454
v/s Ratio Prot											c0.04	
v/s Ratio Perm					0.12							0.00
v/c Ratio					0.24						0.11	0.01
Uniform Delay, d1					8.5						13.9	13.4
Progression Factor					1.00						1.00	1.00
Incremental Delay, d2					0.3						0.2	0.1
Delay (s)					8.8						14.1	13.5
Level of Service					A						B	B
Approach Delay (s)		0.0			8.8			0.0			14.0	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.19		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	38.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBT	WBR	NBL2	NBL	NBT	NBR	SBR2	SEL
Lane Configurations								
Volume (vph)	530	1510	100	310	70	190	0	1710
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	4.0	6.0	6.0	6.0	6.0		5.0
Lane Util. Factor	0.95	0.88	1.00	0.95	0.95	1.00		0.94
Frpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	0.90		1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85		1.00
Flt Protected	1.00	1.00	0.95	0.95	0.97	1.00		0.95
Satd. Flow (prot)	3539	2787	1770	1681	1715	1428		4990
Flt Permitted	1.00	1.00	0.95	0.95	0.97	1.00		0.95
Satd. Flow (perm)	3539	2787	1770	1681	1715	1428		4990
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	530	1510	100	310	70	190	0	1710
RTOR Reduction (vph)	0	0	85	0	0	162	0	0
Lane Group Flow (vph)	530	1510	15	189	191	28	0	1710
Confl. Peds. (#/hr)						82		
Turn Type		custom	Split	Split		Perm	Free	
Protected Phases	5	2	3	3	3			6
Permitted Phases						3	Free	
Actuated Green, G (s)	17.6	75.1	14.9	14.9	14.9	14.9		51.5
Effective Green, g (s)	17.6	75.1	14.9	14.9	14.9	14.9		51.5
Actuated g/C Ratio	0.18	0.75	0.15	0.15	0.15	0.15		0.52
Clearance Time (s)	5.0	4.0	6.0	6.0	6.0	6.0		5.0
Vehicle Extension (s)	1.0	2.0	0.5	0.5	0.5	0.5		3.0
Lane Grp Cap (vph)	623	2093	264	250	256	213		2570
v/s Ratio Prot	c0.15	c0.54	0.01	c0.11	0.11			0.34
v/s Ratio Perm						0.02		
v/c Ratio	0.85	0.72	0.06	0.76	0.75	0.13		0.67
Uniform Delay, d1	39.9	6.8	36.5	40.8	40.7	36.9		17.9
Progression Factor	1.42	0.84	1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	6.4	1.3	0.0	11.0	9.9	0.1		0.7
Delay (s)	63.3	7.0	36.5	51.8	50.6	37.0		18.6
Level of Service	E	A	D	D	D	D		B
Approach Delay (s)	21.6				45.0			18.6
Approach LOS	C				D			B

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	1770	80	120	1710	160	200	50	90	200	70	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	10	10	11	12
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	0.97	1.00	1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.97	1.00	1.00	0.98	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	5042		1770	4995		1608	1739	1436	1626	1801	1519
Flt Permitted	0.95	1.00		0.95	1.00		0.71	1.00	1.00	0.72	1.00	1.00
Satd. Flow (perm)	1770	5042		1770	4995		1204	1739	1436	1240	1801	1519
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)	60	1770	80	120	1710	160	200	50	90	200	70	130
RTOR Reduction (vph)	0	5	0	0	11	0	0	0	60	0	0	87
Lane Group Flow (vph)	60	1845	0	120	1859	0	200	50	30	200	70	43
Confl. Peds. (#/hr)			12			23	32		18	18		32
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2		2	6		6
Actuated Green, G (s)	9.0	39.0		13.0	43.0		33.0	33.0	33.0	33.0	33.0	33.0
Effective Green, g (s)	9.0	39.0		13.0	43.0		33.0	33.0	33.0	33.0	33.0	33.0
Actuated g/C Ratio	0.09	0.39		0.13	0.43		0.33	0.33	0.33	0.33	0.33	0.33
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	159	1966		230	2148		397	574	474	409	594	501
v/s Ratio Prot	0.03	c0.37		c0.07	c0.37			0.03			0.04	
v/s Ratio Perm							c0.17		0.02	0.16		0.03
v/c Ratio	0.38	0.94		0.52	0.87		0.50	0.09	0.06	0.49	0.12	0.09
Uniform Delay, d1	42.9	29.3		40.6	25.9		26.9	23.1	22.9	26.8	23.4	23.1
Progression Factor	0.84	1.13		0.97	0.99		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.2	8.3		7.0	4.3		4.5	0.3	0.3	4.1	0.4	0.3
Delay (s)	41.2	41.5		46.3	29.9		31.4	23.4	23.2	30.9	23.8	23.4
Level of Service	D	D		D	C		C	C	C	C	C	C
Approach Delay (s)		41.5			30.9			28.1			27.2	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	34.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	20	1760	280	80	1680	300	510
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	0.97	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	1.00	1.00	0.90
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1434	1770	5085	3433	1420
Flt Permitted	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	1434	1770	5085	3433	1420
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	20	1760	280	80	1680	300	510
RTOR Reduction (vph)	0	0	120	0	0	0	91
Lane Group Flow (vph)	20	1760	160	80	1680	300	419
Confl. Peds. (#/hr)			41				68
Turn Type	Prot		Perm	Prot			Perm
Protected Phases	7	4		3	8	2	
Permitted Phases			4				2
Actuated Green, G (s)	6.0	55.0	55.0	8.0	57.0	22.0	22.0
Effective Green, g (s)	6.0	55.0	55.0	8.0	57.0	22.0	22.0
Actuated g/C Ratio	0.06	0.55	0.55	0.08	0.57	0.22	0.22
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	106	1946	789	142	2898	755	312
v/s Ratio Prot	0.01	c0.50		c0.05	0.33	0.09	
v/s Ratio Perm			0.11				c0.29
v/c Ratio	0.19	0.90	0.20	0.56	0.58	0.40	1.34
Uniform Delay, d1	44.7	20.1	11.4	44.3	13.8	33.3	39.0
Progression Factor	1.02	0.68	0.10	1.03	0.77	1.00	1.00
Incremental Delay, d2	1.9	3.9	0.3	12.8	0.7	1.6	174.0
Delay (s)	47.3	17.6	1.5	58.3	11.4	34.9	213.0
Level of Service	D	B	A	E	B	C	F
Approach Delay (s)		15.7			13.5	147.0	
Approach LOS		B			B	F	

Intersection Summary			
HCM Average Control Delay	37.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1960	290	60	1520	250	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	
Lane Util. Factor	0.95		1.00	0.95	0.97	
Frpb, ped/bikes	0.99		1.00	1.00	0.98	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	3448		1770	3539	3289	
Flt Permitted	1.00		0.05	1.00	0.97	
Satd. Flow (perm)	3448		100	3539	3289	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1960	290	60	1520	250	100
RTOR Reduction (vph)	9	0	0	0	17	0
Lane Group Flow (vph)	2241	0	60	1520	333	0
Confl. Peds. (#/hr)		16	16		15	15
Turn Type			Perm			
Protected Phases	4			8	2	
Permitted Phases			8			
Actuated Green, G (s)	74.7		74.7	74.7	15.3	
Effective Green, g (s)	74.7		74.7	74.7	15.3	
Actuated g/C Ratio	0.75		0.75	0.75	0.15	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	2576		75	2644	503	
v/s Ratio Prot	c0.65			0.43	c0.10	
v/s Ratio Perm			0.60			
v/c Ratio	0.87		0.80	0.57	0.66	
Uniform Delay, d1	9.1		8.0	5.6	39.9	
Progression Factor	0.95		1.00	1.00	1.00	
Incremental Delay, d2	1.2		58.3	0.9	3.3	
Delay (s)	9.8		66.2	6.5	43.2	
Level of Service	A		E	A	D	
Approach Delay (s)	9.8			8.8	43.2	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	350	70	0	0	0	90	420	110	490	490	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	12	12	12	10	12	12	10	12	12
Total Lost time (s)		5.0	5.0				5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00	1.00				1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	0.91				1.00	0.99		1.00	0.99	
Flpb, ped/bikes		1.00	1.00				0.99	1.00		0.99	1.00	
Frt		1.00	0.85				1.00	0.97		1.00	0.97	
Flt Protected		1.00	1.00				0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1667	1212				1465	1610		1468	1607	
Flt Permitted		1.00	1.00				0.31	1.00		0.37	1.00	
Satd. Flow (perm)		1667	1212				473	1610		571	1607	
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)	30	350	70	0	0	0	90	420	110	490	490	120
RTOR Reduction (vph)	0	0	49	0	0	0	0	16	0	0	14	0
Lane Group Flow (vph)	0	380	21	0	0	0	90	514	0	490	596	0
Confl. Peds. (#/hr)	15		42	42		15	29		31	31		29
Turn Type	Perm		Perm				Perm			Perm		
Protected Phases		4						2			6	
Permitted Phases	4		4				2			6		
Actuated Green, G (s)		18.0	18.0				32.0	32.0		32.0	32.0	
Effective Green, g (s)		18.0	18.0				32.0	32.0		32.0	32.0	
Actuated g/C Ratio		0.30	0.30				0.53	0.53		0.53	0.53	
Clearance Time (s)		5.0	5.0				5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		500	364				252	859		305	857	
v/s Ratio Prot								0.32			0.37	
v/s Ratio Perm		0.23	0.02				0.19			c0.86		
v/c Ratio		0.76	0.06				0.36	0.60		1.61	0.69	
Uniform Delay, d1		19.0	15.0				8.1	9.6		14.0	10.4	
Progression Factor		1.00	1.00				0.72	0.69		0.61	0.67	
Incremental Delay, d2		10.4	0.3				3.7	2.9		277.4	1.4	
Delay (s)		29.4	15.3				9.5	9.4		286.0	8.3	
Level of Service		C	B				A	A		F	A	
Approach Delay (s)		27.2			0.0			9.4			132.0	
Approach LOS		C			A			A			F	

Intersection Summary			
HCM Average Control Delay	75.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
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)	20	870	60	0	0	0	0	80	60	90	110	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0						5.0			5.0	
Lane Util. Factor		0.95						1.00			1.00	
Frpb, ped/bikes		0.99						0.96			1.00	
Flpb, ped/bikes		1.00						1.00			0.97	
Frt		0.99						0.94			1.00	
Flt Protected		1.00						1.00			0.98	
Satd. Flow (prot)		3118						1524			1596	
Flt Permitted		1.00						1.00			0.81	
Satd. Flow (perm)		3118						1524			1326	
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)	20	870	60	0	0	0	0	80	60	90	110	0
RTOR Reduction (vph)	0	8	0	0	0	0	0	33	0	0	0	0
Lane Group Flow (vph)	0	942	0	0	0	0	0	107	0	0	200	0
Confl. Peds. (#/hr)	117		72						72	72		
Turn Type	Perm									Perm		
Protected Phases		4						2			6	
Permitted Phases	4									6		
Actuated Green, G (s)		27.0						23.0			23.0	
Effective Green, g (s)		27.0						23.0			23.0	
Actuated g/C Ratio		0.45						0.38			0.38	
Clearance Time (s)		5.0						5.0			5.0	
Lane Grp Cap (vph)		1403						584			508	
v/s Ratio Prot								0.07				
v/s Ratio Perm		0.30									c0.15	
v/c Ratio		0.67						0.18			0.39	
Uniform Delay, d1		13.0						12.3			13.4	
Progression Factor		0.98						1.00			1.47	
Incremental Delay, d2		0.2						0.7			2.1	
Delay (s)		12.9						13.0			21.9	
Level of Service		B						B			C	
Approach Delay (s)		12.9			0.0			13.0			21.9	
Approach LOS		B			A			B			C	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.3%	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)	40	970	0	0	0	0	0	270	100	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0						5.0				
Lane Util. Factor		0.95						0.95				
Frpb, ped/bikes		1.00						0.92				
Flpb, ped/bikes		1.00						1.00				
Frt		1.00						0.96				
Flt Protected		1.00						1.00				
Satd. Flow (prot)		3166						2814				
Flt Permitted		1.00						1.00				
Satd. Flow (perm)		3166						2814				
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	970	0	0	0	0	0	270	100	0	0	0
RTOR Reduction (vph)	0	5	0	0	0	0	0	55	0	0	0	0
Lane Group Flow (vph)	0	1005	0	0	0	0	0	315	0	0	0	0
Confl. Peds. (#/hr)	106								287			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4											
Actuated Green, G (s)		30.0						20.0				
Effective Green, g (s)		30.0						20.0				
Actuated g/C Ratio		0.50						0.33				
Clearance Time (s)		5.0						5.0				
Lane Grp Cap (vph)		1583						938				
v/s Ratio Prot								c0.11				
v/s Ratio Perm		0.32										
v/c Ratio		0.63						0.34				
Uniform Delay, d1		11.0						15.0				
Progression Factor		0.33						0.71				
Incremental Delay, d2		1.5						0.9				
Delay (s)		5.1						11.6				
Level of Service		A						B				
Approach Delay (s)		5.1			0.0			11.6			0.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	980	100	0	0	0	0	0	70	170	160	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		5.0							5.0	5.0	5.0	
Lane Util. Factor		0.95							1.00	1.00	1.00	
Frpb, ped/bikes		0.99							0.95	1.00	1.00	
Flpb, ped/bikes		1.00							1.00	0.96	1.00	
Frt		0.99							0.86	1.00	1.00	
Flt Protected		1.00							1.00	0.95	1.00	
Satd. Flow (prot)		3096							1379	1535	1565	
Flt Permitted		1.00							1.00	0.95	1.00	
Satd. Flow (perm)		3096							1379	1535	1565	
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)	0	980	100	0	0	0	0	0	70	170	160	0
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	38	60	0	0
Lane Group Flow (vph)	0	1067	0	0	0	0	0	0	32	110	160	0
Confl. Peds. (#/hr)			82						38	38		
Turn Type									custom	Perm		
Protected Phases		4									6	
Permitted Phases									2	6		
Actuated Green, G (s)		31.0							19.0	19.0	19.0	
Effective Green, g (s)		31.0							19.0	19.0	19.0	
Actuated g/C Ratio		0.52							0.32	0.32	0.32	
Clearance Time (s)		5.0							5.0	5.0	5.0	
Lane Grp Cap (vph)		1600							437	486	496	
v/s Ratio Prot		c0.34									c0.10	
v/s Ratio Perm									0.02	0.07		
v/c Ratio		0.67							0.07	0.23	0.32	
Uniform Delay, d1		10.7							14.3	15.1	15.6	
Progression Factor		0.32							1.00	0.86	0.90	
Incremental Delay, d2		1.8							0.3	1.1	1.7	
Delay (s)		5.2							14.7	14.0	15.7	
Level of Service		A							B	B	B	
Approach Delay (s)		5.2			0.0			14.7			14.8	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	800	170	0	0	0	0	370	70	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	16	12	12	12	12
Total Lost time (s)		5.0						5.0				
Lane Util. Factor		0.95						1.00				
Frpb, ped/bikes		0.99						1.00				
Flpb, ped/bikes		1.00						1.00				
Frt		0.98						0.98				
Flt Protected		0.99						1.00				
Satd. Flow (prot)		3056						1850				
Flt Permitted		0.99						1.00				
Satd. Flow (perm)		3056						1850				
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)	250	800	170	0	0	0	0	370	70	0	0	0
RTOR Reduction (vph)	0	60	0	0	0	0	0	11	0	0	0	0
Lane Group Flow (vph)	0	1160	0	0	0	0	0	429	0	0	0	0
Confl. Peds. (#/hr)	11		25						18			
Turn Type	Perm											
Protected Phases		4						2				
Permitted Phases	4											
Actuated Green, G (s)		28.0						22.0				
Effective Green, g (s)		28.0						22.0				
Actuated g/C Ratio		0.47						0.37				
Clearance Time (s)		5.0						5.0				
Lane Grp Cap (vph)		1426						678				
v/s Ratio Prot								c0.23				
v/s Ratio Perm		0.38										
v/c Ratio		0.81						0.63				
Uniform Delay, d1		13.8						15.7				
Progression Factor		0.63						1.00				
Incremental Delay, d2		4.2						4.4				
Delay (s)		12.9						20.1				
Level of Service		B						C				
Approach Delay (s)		12.9			0.0			20.1			0.0	
Approach LOS		B			A			C			A	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	680	60	0	0	0	0	230	50	30	230	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	10	12	16	12
Total Lost time (s)		5.0						5.0	5.0		5.0	
Lane Util. Factor		0.95						1.00	1.00		1.00	
Frpb, ped/bikes		1.00						1.00	0.95		1.00	
Flpb, ped/bikes		0.99						1.00	1.00		1.00	
Frt		0.99						1.00	0.85		1.00	
Flt Protected		0.99						1.00	1.00		0.99	
Satd. Flow (prot)		3098						1314	1257		1581	
Flt Permitted		0.99						1.00	1.00		0.95	
Satd. Flow (perm)		3098						1314	1257		1512	
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)	100	680	60	0	0	0	0	230	50	30	230	0
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	28	0	0	0
Lane Group Flow (vph)	0	830	0	0	0	0	0	230	22	0	260	0
Confl. Peds. (#/hr)	41		18						46	46		
Bus Blockages (#/hr)	0	0	0	0	0	0	0	40	0	0	40	0
Turn Type	Perm								Perm	Perm		
Protected Phases		4						2			6	
Permitted Phases	4								2	6		
Actuated Green, G (s)		24.0						26.0	26.0		26.0	
Effective Green, g (s)		24.0						26.0	26.0		26.0	
Actuated g/C Ratio		0.40						0.43	0.43		0.43	
Clearance Time (s)		5.0						5.0	5.0		5.0	
Lane Grp Cap (vph)		1239						569	545		655	
v/s Ratio Prot								c0.17				
v/s Ratio Perm		0.27							0.02		0.17	
v/c Ratio		0.67						0.40	0.04		0.40	
Uniform Delay, d1		14.8						11.7	9.8		11.6	
Progression Factor		1.32						1.00	1.00		1.00	
Incremental Delay, d2		1.6						2.1	0.1		1.8	
Delay (s)		21.2						13.8	9.9		13.4	
Level of Service		C						B	A		B	
Approach Delay (s)		21.2			0.0			13.1			13.4	
Approach LOS		C			A			B			B	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.0%	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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	520	0	230	10	0	10	0	280	0	20	340	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)	520	0	230	10	0	10	0	280	0	20	340	0

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1
Volume Total (vph)	520	230	20	187	93	360
Volume Left (vph)	520	0	10	0	0	20
Volume Right (vph)	0	230	10	0	0	0
Hadj (s)	0.53	-0.67	-0.17	0.03	0.03	0.05
Departure Headway (s)	7.2	6.0	8.0	7.5	7.5	7.0
Degree Utilization, x	1.04	0.38	0.04	0.39	0.19	0.70
Capacity (veh/h)	495	594	402	474	472	505
Control Delay (s)	77.8	11.5	11.3	13.9	11.0	25.2
Approach Delay (s)	57.5		11.3	12.9		25.2
Approach LOS	F		B	B		D

Intersection Summary			
Delay	39.7		
HCM Level of Service	E		
Intersection Capacity Utilization	81.1%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	100	70	70	160	260	50	260	40	90	410	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	12	12	10	12	12	10	12	12	10	12	12
Total Lost time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.98			1.00	0.89	1.00	0.99		1.00	0.99	
Flpb, ped/bikes		0.98			0.99	1.00	0.99	1.00		0.97	1.00	
Frt		0.96			1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected		0.98			0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1531			1640	1271	1468	1630		1447	1628	
Flt Permitted		0.83			0.85	1.00	0.38	1.00		0.55	1.00	
Satd. Flow (perm)		1290			1421	1271	592	1630		843	1628	
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)	80	100	70	70	160	260	50	260	40	90	410	70
RTOR Reduction (vph)	0	23	0	0	0	169	0	9	0	0	10	0
Lane Group Flow (vph)	0	227	0	0	230	91	50	291	0	90	470	0
Confl. Peds. (#/hr)	54		21	21		54	18		25	25		18
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		21.0			21.0	21.0	29.0	29.0		29.0	29.0	
Effective Green, g (s)		21.0			21.0	21.0	29.0	29.0		29.0	29.0	
Actuated g/C Ratio		0.35			0.35	0.35	0.48	0.48		0.48	0.48	
Clearance Time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		452			497	445	286	788		407	787	
v/s Ratio Prot								0.18			c0.29	
v/s Ratio Perm		c0.18			0.16	0.07	0.08			0.11		
v/c Ratio		0.50			0.46	0.20	0.17	0.37		0.22	0.60	
Uniform Delay, d1		15.4			15.1	13.7	8.7	9.7		9.0	11.3	
Progression Factor		1.00			1.00	1.00	0.91	0.96		1.49	1.41	
Incremental Delay, d2		3.9			3.1	1.0	1.3	1.3		1.0	2.6	
Delay (s)		19.3			18.2	14.7	9.2	10.7		14.3	18.5	
Level of Service		B			B	B	A	B		B	B	
Approach Delay (s)		19.3			16.3			10.5			17.8	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	81.7%	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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	50	0	160	40	410	60	50	50	0	0	120	30
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	0	160	40	410	60	50	50	0	0	120	30

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	210	245	265	100	150
Volume Left (vph)	50	40	0	50	0
Volume Right (vph)	160	0	60	0	30
Hadj (s)	-0.38	0.12	-0.12	0.13	-0.09
Departure Headway (s)	5.0	5.6	5.4	6.0	5.7
Degree Utilization, x	0.29	0.38	0.40	0.17	0.24
Capacity (veh/h)	670	619	650	534	578
Control Delay (s)	10.1	10.8	10.6	10.2	10.4
Approach Delay (s)	10.1	10.7		10.2	10.4
Approach LOS	B	B		B	B

Intersection Summary			
Delay	10.5		
HCM Level of Service	B		
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	60	70	120	110	120	20	400	220	20	0	0	0
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)	60	70	120	110	120	20	400	220	20	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			1			1						
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1090	1020	0	1115	1020	220	0			220		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1090	1020	0	1115	1020	220	0			220		
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 %	16	61	89	0	33	98	75			100		
cM capacity (veh/h)	72	178	1085	94	178	820	1623			1349		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	250	250	620	20
Volume Left	60	110	400	0
Volume Right	120	20	0	20
cSH	197	135	1623	1700
Volume to Capacity	1.27	1.86	0.25	0.01
Queue Length 95th (ft)	339	482	24	0
Control Delay (s)	202.6	469.2	5.9	0.0
Lane LOS	F	F	A	
Approach Delay (s)	202.6	469.2	5.7	
Approach LOS	F	F		

Intersection Summary			
Average Delay	150.5		
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	80	50	70	130	60	50	290	60	30	230	50
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)	20	80	50	70	130	60	50	290	60	30	230	50

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	150	260	400	310
Volume Left (vph)	20	70	50	30
Volume Right (vph)	50	60	60	50
Hadj (s)	-0.14	-0.05	-0.03	-0.04
Departure Headway (s)	6.5	6.3	5.8	6.0
Degree Utilization, x	0.27	0.46	0.65	0.52
Capacity (veh/h)	461	502	584	549
Control Delay (s)	12.0	14.5	19.0	15.2
Approach Delay (s)	12.0	14.5	19.0	15.2
Approach LOS	B	B	C	C

Intersection Summary			
Delay	16.0		
HCM Level of Service	C		
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	120	100	90	100	40	90	280	120	130	390	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	12	12	10	12	12	10	12	12	10	12	12
Grade (%)		-5%			5%			-2%			2%	
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	0.99		1.00	1.00	0.94	1.00	1.00	
Flpb, ped/bikes	0.98	1.00		0.98	1.00		0.99	1.00	1.00	0.97	1.00	
Frt	1.00	0.93		1.00	0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1492	1571		1426	1544		1489	1693	1348	1428	1645	
Flt Permitted	0.67	1.00		0.60	1.00		0.46	1.00	1.00	0.58	1.00	
Satd. Flow (perm)	1049	1571		897	1544		724	1693	1348	874	1645	
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	120	100	90	100	40	90	280	120	130	390	20
RTOR Reduction (vph)	0	50	0	0	24	0	0	0	58	0	3	0
Lane Group Flow (vph)	40	170	0	90	116	0	90	280	62	130	407	0
Confl. Peds. (#/hr)	16		14	14		16	10		28	28		10
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	19.0	19.0		19.0	19.0		31.0	31.0	31.0	31.0	31.0	
Effective Green, g (s)	19.0	19.0		19.0	19.0		31.0	31.0	31.0	31.0	31.0	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.52	0.52	0.52	0.52	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Grp Cap (vph)	332	497		284	489		374	875	696	452	850	
v/s Ratio Prot		c0.11			0.08			0.17			c0.25	
v/s Ratio Perm	0.04			0.10			0.12		0.05	0.15		
v/c Ratio	0.12	0.34		0.32	0.24		0.24	0.32	0.09	0.29	0.48	
Uniform Delay, d1	14.6	15.7		15.6	15.1		8.0	8.4	7.3	8.2	9.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.80	0.85	
Incremental Delay, d2	0.7	1.9		2.9	1.1		1.5	1.0	0.3	1.3	1.6	
Delay (s)	15.3	17.6		18.5	16.3		9.5	9.4	7.6	7.9	9.5	
Level of Service	B	B		B	B		A	A	A	A	A	
Approach Delay (s)		17.2			17.1			9.0			9.1	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	67.8%	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 (veh/h)	20	130	230	0	0	0	200	80	90	30	260	30
Sign Control		Free			Free			Stop			Stop	
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)	20	130	230	0	0	0	200	80	90	30	260	30
Pedestrians					20			20			20	
Lane Width (ft)					0.0			12.0			12.0	
Walking Speed (ft/s)					3.5			3.5			3.5	
Percent Blockage					0			2			2	
Right turn flare (veh)									2			
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		252										
pX, platoon unblocked												
vC, conflicting volume	20			380			465	325	285	365	440	20
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	20			380			465	325	285	365	440	20
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			26	86	88	93	46	97
cM capacity (veh/h)	1566			1156			269	563	740	437	486	1038

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	380	370	320
Volume Left	20	200	30
Volume Right	230	90	30
cSH	1566	417	505
Volume to Capacity	0.01	0.89	0.63
Queue Length 95th (ft)	1	230	109
Control Delay (s)	0.5	52.1	23.6
Lane LOS	A	F	C
Approach Delay (s)	0.5	52.1	23.6
Approach LOS		F	C

Intersection Summary			
Average Delay	25.2		
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	30	110	100	40	30	90	620	90	20	120	20
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)	20	30	110	100	40	30	90	620	90	20	120	20
Pedestrians		76			63			136			25	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		3.5			3.5			3.5			3.5	
Percent Blockage		7			6			13			2	
Right turn flare (veh)			2									
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								266				
pX, platoon unblocked	0.71	0.71		0.71	0.71	0.71				0.71		
vC, conflicting volume	1121	1199	342	1284	1164	753	216			773		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	968	1077	342	1197	1028	451	216			479		
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	76	81	0	69	92	93			97		
cM capacity (veh/h)	90	123	566	52	131	398	1256			725		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	160	170	90	710	160
Volume Left	20	100	90	0	20
Volume Right	110	30	0	90	20
cSH	350	74	1256	1700	725
Volume to Capacity	0.46	2.29	0.07	0.42	0.03
Queue Length 95th (ft)	57	399	6	0	2
Control Delay (s)	28.5	712.4	8.1	0.0	1.5
Lane LOS	D	F	A		A
Approach Delay (s)	28.5	712.4	0.9		1.5
Approach LOS	D	F			

Intersection Summary			
Average Delay	98.2		
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	100	360	10	70	50	200	650	20	30	250	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	0.96		1.00	0.95	1.00	1.00		1.00	0.99	
Flpb, ped/bikes		0.99	1.00		1.00	1.00	0.99	1.00		0.99	1.00	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.98	
Flt Protected		0.98	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1809	1514		1847	1503	1751	1852		1755	1822	
Flt Permitted		0.87	1.00		0.96	1.00	0.52	1.00		0.22	1.00	
Satd. Flow (perm)		1607	1514		1793	1503	954	1852		411	1822	
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)	60	100	360	10	70	50	200	650	20	30	250	30
RTOR Reduction (vph)	0	0	234	0	0	33	0	2	0	0	7	0
Lane Group Flow (vph)	0	160	126	0	80	18	200	668	0	30	273	0
Confl. Peds. (#/hr)	23		18	18		23	23		21	21		23
Turn Type	Perm		Perm	Perm		Perm	pm+pt			Perm		
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		21.0	21.0		21.0	21.0	29.0	29.0		18.0	18.0	
Effective Green, g (s)		21.0	21.0		21.0	21.0	29.0	29.0		18.0	18.0	
Actuated g/C Ratio		0.35	0.35		0.35	0.35	0.48	0.48		0.30	0.30	
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)		562	530		628	526	541	895		123	547	
v/s Ratio Prot							0.04	c0.36			0.15	
v/s Ratio Perm		c0.10	0.08		0.04	0.01	0.14			0.07		
v/c Ratio		0.28	0.24		0.13	0.03	0.37	0.75		0.24	0.50	
Uniform Delay, d1		14.1	13.8		13.3	12.8	11.6	12.5		15.9	17.3	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		1.3	1.1		0.4	0.1	1.9	5.6		4.7	3.2	
Delay (s)		15.3	14.9		13.7	12.9	13.6	18.2		20.5	20.5	
Level of Service		B	B		B	B	B	B		C	C	
Approach Delay (s)		15.0			13.4			17.1			20.5	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	540	60	220	840	110	110	350	430	210	270	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00	1.00	1.00	1.00	
Frt	1.00	0.98		1.00	0.98		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1593	3122		1593	3110		1584	1676	1425	1586	1645	
Flt Permitted	0.95	1.00		0.95	1.00		0.40	1.00	1.00	0.32	1.00	
Satd. Flow (perm)	1593	3122		1593	3110		673	1676	1425	534	1645	
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)	20	540	60	220	840	110	110	350	430	210	270	30
RTOR Reduction (vph)	0	12	0	0	14	0	0	0	54	0	6	0
Lane Group Flow (vph)	20	588	0	220	936	0	110	350	376	210	294	0
Confl. Peds. (#/hr)			16			18	23		24	24		23
Turn Type	Prot			Prot			pm+pt		pt+ov	pm+pt		
Protected Phases	7	4		3	8		5	2	2 3	1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	6.0	18.0		8.0	20.0		24.0	18.0	31.0	24.0	18.0	
Effective Green, g (s)	6.0	18.0		8.0	20.0		24.0	18.0	31.0	24.0	18.0	
Actuated g/C Ratio	0.09	0.26		0.11	0.29		0.34	0.26	0.44	0.34	0.26	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Grp Cap (vph)	137	803		182	889		309	431	631	273	423	
v/s Ratio Prot	0.01	0.19		c0.14	c0.30		0.03	c0.21	0.26	c0.07	0.18	
v/s Ratio Perm							0.09			0.20		
v/c Ratio	0.15	0.73		1.21	1.05		0.36	0.81	0.60	0.77	0.70	
Uniform Delay, d1	29.6	23.8		31.0	25.0		16.5	24.4	14.8	18.9	23.5	
Progression Factor	1.00	1.00		0.83	1.62		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.2	5.9		128.0	42.1		3.2	15.3	4.1	18.6	9.1	
Delay (s)	31.9	29.6		153.9	82.6		19.7	39.7	18.9	37.6	32.6	
Level of Service	C	C		F	F		B	D	B	D	C	
Approach Delay (s)		29.7			96.0			27.2			34.7	
Approach LOS		C			F			C			C	

Intersection Summary			
HCM Average Control Delay	54.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	60	970	1000	340	570	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	0.95	1.00	0.97	1.00
Frpb, ped/bikes	1.00	1.00	1.00	0.93	1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	3539	1476	3433	1519
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	3539	1476	3433	1519
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	60	970	1000	340	570	70
RTOR Reduction (vph)	0	0	0	199	0	50
Lane Group Flow (vph)	60	970	1000	141	570	20
Confl. Peds. (#/hr)				25		25
Turn Type	Prot			Perm		custom
Protected Phases	7	4	8			
Permitted Phases				8	6	6
Actuated Green, G (s)	6.0	40.0	29.0	29.0	20.0	20.0
Effective Green, g (s)	6.0	40.0	29.0	29.0	20.0	20.0
Actuated g/C Ratio	0.09	0.57	0.41	0.41	0.29	0.29
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	152	2022	1466	611	981	434
v/s Ratio Prot	0.03	c0.27	c0.28			
v/s Ratio Perm				0.10	c0.17	0.01
v/c Ratio	0.39	0.48	0.68	0.23	0.58	0.05
Uniform Delay, d1	30.3	8.9	16.7	13.3	21.4	18.1
Progression Factor	0.92	0.76	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.3	0.6	2.6	0.9	2.5	0.2
Delay (s)	33.3	7.3	19.3	14.2	23.9	18.3
Level of Service	C	A	B	B	C	B
Approach Delay (s)		8.8	18.0		23.3	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	260	50	100	310	80	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	
Lane Util. Factor	1.00		1.00	1.00	1.00	
Frpb, ped/bikes	0.98		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		0.94	1.00	0.94	
Frt	0.98		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	1609		1490	1676	1426	
Flt Permitted	1.00		0.57	1.00	0.96	
Satd. Flow (perm)	1609		897	1676	1426	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	260	50	100	310	80	30
RTOR Reduction (vph)	7	0	0	0	26	0
Lane Group Flow (vph)	303	0	100	310	84	0
Confl. Peds. (#/hr)		76	76		65	65
Turn Type			Perm			
Protected Phases	4			8		
Permitted Phases			8		2	
Actuated Green, G (s)	37.4		37.4	37.4	7.6	
Effective Green, g (s)	37.4		37.4	37.4	7.6	
Actuated g/C Ratio	0.68		0.68	0.68	0.14	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	1094		610	1140	197	
v/s Ratio Prot	c0.19			0.18		
v/s Ratio Perm			0.11		c0.06	
v/c Ratio	0.28		0.16	0.27	0.43	
Uniform Delay, d1	3.5		3.2	3.5	21.7	
Progression Factor	1.00		0.54	0.54	1.00	
Incremental Delay, d2	0.6		0.6	0.6	1.5	
Delay (s)	4.1		2.3	2.4	23.2	
Level of Service	A		A	A	C	
Approach Delay (s)	4.1			2.4	23.2	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	5.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	55.2%	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)	20	160	120	100	240	30	150	70	30	20	80	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.95		1.00	0.99		1.00	0.97		1.00	0.98	
Flpb, ped/bikes		1.00		0.94	1.00		0.95	1.00		0.91	1.00	
Frt		0.95		1.00	0.98		1.00	0.95		1.00	0.96	
Flt Protected		1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1501		1492	1627		1512	1545		1457	1577	
Flt Permitted		0.97		0.62	1.00		0.69	1.00		0.69	1.00	
Satd. Flow (perm)		1468		976	1627		1092	1545		1062	1577	
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)	20	160	120	100	240	30	150	70	30	20	80	30
RTOR Reduction (vph)	0	30	0	0	6	0	0	24	0	0	24	0
Lane Group Flow (vph)	0	270	0	100	264	0	150	76	0	20	86	0
Confl. Peds. (#/hr)	64		64	64		64	64		64	64		64
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		33.4		33.4	33.4		11.6	11.6		11.6	11.6	
Effective Green, g (s)		33.4		33.4	33.4		11.6	11.6		11.6	11.6	
Actuated g/C Ratio		0.61		0.61	0.61		0.21	0.21		0.21	0.21	
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		891		593	988		230	326		224	333	
v/s Ratio Prot					0.16			0.05			0.05	
v/s Ratio Perm		c0.18		0.10			c0.14			0.02		
v/c Ratio		0.30		0.17	0.27		0.65	0.23		0.09	0.26	
Uniform Delay, d1		5.2		4.7	5.1		19.9	18.0		17.5	18.1	
Progression Factor		0.76		0.11	0.14		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.9		0.5	0.6		6.5	0.4		0.2	0.4	
Delay (s)		4.8		1.0	1.3		26.3	18.4		17.6	18.5	
Level of Service		A		A	A		C	B		B	B	
Approach Delay (s)		4.8			1.2			23.2			18.4	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	65.6%	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)	0	0	190	130	340	0	0	0	30	1710	160	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			5.0		5.0				5.0	5.0	5.0	
Lane Util. Factor			1.00		0.95				1.00	0.91	0.91	
Frpb, ped/bikes			1.00		1.00				1.00	1.00	1.00	
Flpb, ped/bikes			1.00		0.99				1.00	1.00	1.00	
Frt			0.86		1.00				0.86	1.00	1.00	
Flt Protected			1.00		0.99				1.00	0.95	0.97	
Satd. Flow (prot)			1450		3107				1450	2899	1463	
Flt Permitted			1.00		0.99				1.00	0.95	0.97	
Satd. Flow (perm)			1450		3107				1450	2899	1463	
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)	0	0	190	130	340	0	0	0	30	1710	160	20
RTOR Reduction (vph)	0	0	164	0	0	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	0	26	0	470	0	0	0	30	1248	641	0
Confl. Peds. (#/hr)			14	14								36
Turn Type			custom	pm+pt					Over	Split		
Protected Phases			4	3	8				3	6	6	
Permitted Phases			4	8								
Actuated Green, G (s)			15.2		24.4				4.2	75.6	75.6	
Effective Green, g (s)			15.2		24.4				4.2	75.6	75.6	
Actuated g/C Ratio			0.14		0.22				0.04	0.69	0.69	
Clearance Time (s)			5.0		5.0				5.0	5.0	5.0	
Vehicle Extension (s)			3.0		3.0				3.0	3.0	3.0	
Lane Grp Cap (vph)			200		689				55	1992	1005	
v/s Ratio Prot			0.02		c0.03				0.02	0.43	c0.44	
v/s Ratio Perm					0.13							
v/c Ratio			0.13		0.68				0.55	0.63	0.64	
Uniform Delay, d1			41.6		39.2				52.0	9.4	9.6	
Progression Factor			1.00		0.93				1.00	1.00	1.00	
Incremental Delay, d2			0.3		2.6				10.6	1.5	3.1	
Delay (s)			41.9		39.0				62.6	10.9	12.7	
Level of Service			D		D				E	B	B	
Approach Delay (s)		41.9			39.0			62.6			11.5	
Approach LOS		D			D			E			B	

Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	80.5%	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)	0	1710	30	100	380	40	50	380	190	160	100	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		0.91		1.00	1.00		1.00	0.95		1.00	1.00	
Frpb, ped/bikes		1.00		1.00	0.99		1.00	0.98		1.00	0.99	
Flpb, ped/bikes		1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt		1.00		1.00	0.99		1.00	0.95		1.00	0.96	
Flt Protected		1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		5064		1770	1813		1770	3304		1770	1756	
Flt Permitted		1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		5064		1770	1813		1770	3304		1770	1756	
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)	0	1710	30	100	380	40	50	380	190	160	100	40
RTOR Reduction (vph)	0	2	0	0	3	0	0	63	0	0	14	0
Lane Group Flow (vph)	0	1738	0	100	417	0	50	507	0	160	126	0
Confl. Peds. (#/hr)			25			74			41			41
Turn Type				Prot			Prot			Prot		
Protected Phases		4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)		48.1		7.0	60.1		6.2	23.9		11.0	28.7	
Effective Green, g (s)		48.1		7.0	60.1		6.2	23.9		11.0	28.7	
Actuated g/C Ratio		0.44		0.06	0.55		0.06	0.22		0.10	0.26	
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		2214		113	991		100	718		177	458	
v/s Ratio Prot		c0.34		c0.06	0.23		0.03	c0.15		c0.09	c0.07	
v/s Ratio Perm												
v/c Ratio		0.79		0.88	0.42		0.50	0.71		0.90	0.28	
Uniform Delay, d1		26.5		51.1	14.7		50.4	39.8		49.0	32.4	
Progression Factor		0.67		0.90	0.99		1.00	1.00		0.85	1.52	
Incremental Delay, d2		2.3		47.8	1.2		3.9	3.2		37.1	0.3	
Delay (s)		20.2		93.6	15.8		54.3	43.0		78.5	49.4	
Level of Service		C		F	B		D	D		E	D	
Approach Delay (s)		20.2			30.8			43.9			64.9	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM Average Control Delay	30.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		

c   Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	230	30	0	480	1530	50	380	120	1710	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0	5.0		5.0	5.0	5.0		
Lane Util. Factor		0.95			0.95	0.88		0.95	1.00	0.94		
Frpb, ped/bikes		0.99			1.00	1.00		1.00	0.92	1.00		
Flpb, ped/bikes		1.00			1.00	1.00		1.00	1.00	1.00		
Frt		0.98			1.00	0.85		1.00	0.85	1.00		
Flt Protected		1.00			1.00	1.00		0.99	1.00	0.95		
Satd. Flow (prot)		3448			3539	2787		3519	1464	4990		
Flt Permitted		1.00			1.00	1.00		0.99	1.00	0.95		
Satd. Flow (perm)		3448			3539	2787		3519	1464	4990		
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)	0	230	30	0	480	1530	50	380	120	1710	0	0
RTOR Reduction (vph)	0	9	0	0	0	489	0	0	89	0	0	0
Lane Group Flow (vph)	0	251	0	0	480	1041	0	430	31	1710	0	0
Confl. Peds. (#/hr)			25			20			41			
Turn Type						custom	Split		Perm	Prot		
Protected Phases		1			1	2	3	3		6		
Permitted Phases									3			
Actuated Green, G (s)		39.4			39.4	54.8		18.4	18.4	37.2		
Effective Green, g (s)		39.4			39.4	54.8		18.4	18.4	37.2		
Actuated g/C Ratio		0.36			0.36	0.50		0.17	0.17	0.34		
Clearance Time (s)		5.0			5.0	5.0		5.0	5.0	5.0		
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0	3.0		
Lane Grp Cap (vph)		1235			1268	1388		589	245	1688		
v/s Ratio Prot		0.07			0.14	c0.37		c0.12		c0.34		
v/s Ratio Perm									0.02			
v/c Ratio		0.20			0.38	0.75		0.73	0.13	1.01		
Uniform Delay, d1		24.4			26.2	22.1		43.4	39.0	36.4		
Progression Factor		0.81			1.04	1.17		0.91	1.06	1.00		
Incremental Delay, d2		0.3			0.7	3.0		3.8	0.2	25.2		
Delay (s)		20.3			28.0	28.8		43.5	41.4	61.6		
Level of Service		C			C	C		D	D	E		
Approach Delay (s)		20.3			28.6			43.0			61.6	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM Average Control Delay	42.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	81.1%	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)	60	1910	80	120	450	1420	60	200	90	50	20	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	10	10	10	11	12
Total Lost time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.91		1.00	1.00	0.88	1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.96	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	5044		1770	1863	2787	1652	1739	1434	1652	1605	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	5044		1770	1863	2787	1652	1739	1434	1652	1605	
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)	60	1910	80	120	450	1420	60	200	90	50	20	20
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	72	0	17	0
Lane Group Flow (vph)	60	1987	0	120	450	1420	60	200	18	50	23	0
Confl. Peds. (#/hr)			12						18			32
Turn Type	Prot			Prot		pt+ov	Prot		Perm	Prot		
Protected Phases	7	4		3	8	8 1	5	2		1	6	
Permitted Phases									2			
Actuated Green, G (s)	4.8	56.0		8.0	59.2	70.2	8.9	20.0	20.0	6.0	17.1	
Effective Green, g (s)	4.8	56.0		8.0	59.2	70.2	8.9	20.0	20.0	6.0	17.1	
Actuated g/C Ratio	0.04	0.51		0.07	0.54	0.64	0.08	0.18	0.18	0.05	0.16	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	77	2568		129	1003	1779	134	316	261	90	250	
v/s Ratio Prot	0.03	0.39		c0.07	0.24	c0.51	0.04	c0.12		0.03	0.01	
v/s Ratio Perm									0.01			
v/c Ratio	0.78	0.77		0.93	0.45	0.80	0.45	0.63	0.07	0.56	0.09	
Uniform Delay, d1	52.1	21.9		50.7	15.5	14.7	48.2	41.6	37.3	50.7	39.8	
Progression Factor	1.36	0.52		0.91	1.17	0.86	1.00	1.00	1.00	1.43	0.27	
Incremental Delay, d2	26.2	1.5		53.9	1.3	2.3	2.4	4.1	0.1	7.0	0.2	
Delay (s)	97.2	12.8		100.2	19.3	14.9	50.6	45.7	37.4	79.5	10.9	
Level of Service	F	B		F	B	B	D	D	D	E	B	
Approach Delay (s)		15.3			21.0			44.4			49.0	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBU	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations							
Volume (vph)	20	1760	280	80	1680	300	380
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.91	0.97	1.00
Frpb, ped/bikes	1.00	1.00	0.90	1.00	1.00	1.00	0.89
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	1770	3539	1422	1770	5085	3433	1406
Flt Permitted	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	1770	3539	1422	1770	5085	3433	1406
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	20	1760	280	80	1680	300	380
RTOR Reduction (vph)	0	0	105	0	0	0	83
Lane Group Flow (vph)	20	1760	175	80	1680	300	297
Confl. Peds. (#/hr)			41				68
Turn Type	Prot		Perm	Prot			Perm
Protected Phases	7	4		3	8	2	
Permitted Phases			4				2
Actuated Green, G (s)	2.4	63.7	63.7	6.0	67.3	25.3	25.3
Effective Green, g (s)	2.4	63.7	63.7	6.0	67.3	25.3	25.3
Actuated g/C Ratio	0.02	0.58	0.58	0.05	0.61	0.23	0.23
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	39	2049	823	97	3111	790	323
v/s Ratio Prot	0.01	c0.50		c0.05	c0.33	0.09	
v/s Ratio Perm			0.12				c0.21
v/c Ratio	0.51	0.86	0.21	0.82	0.54	0.38	0.92
Uniform Delay, d1	53.2	19.4	11.1	51.5	12.4	35.7	41.3
Progression Factor	1.31	0.33	0.00	0.99	0.79	1.00	1.00
Incremental Delay, d2	7.6	3.5	0.4	36.0	0.6	0.3	29.8
Delay (s)	77.2	9.8	0.4	87.2	10.4	36.0	71.1
Level of Service	E	A	A	F	B	D	E
Approach Delay (s)		9.2			13.9	55.7	
Approach LOS		A			B	E	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1840	290	60	1520	250	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0	5.0	
Lane Util. Factor	0.95		1.00	0.95	0.97	
Frpb, ped/bikes	0.99		1.00	1.00	0.98	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.98		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	3441		1770	3539	3285	
Flt Permitted	1.00		0.05	1.00	0.97	
Satd. Flow (perm)	3441		94	3539	3285	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1840	290	60	1520	250	100
RTOR Reduction (vph)	9	0	0	0	44	0
Lane Group Flow (vph)	2121	0	60	1520	306	0
Confl. Peds. (#/hr)		16			15	15
Turn Type			pm+pt			
Protected Phases	4		3	8	2	
Permitted Phases			8			
Actuated Green, G (s)	74.2		84.6	84.6	15.4	
Effective Green, g (s)	74.2		84.6	84.6	15.4	
Actuated g/C Ratio	0.67		0.77	0.77	0.14	
Clearance Time (s)	5.0		5.0	5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	2321		155	2722	460	
v/s Ratio Prot	c0.62		0.02	c0.43	c0.09	
v/s Ratio Perm			0.28			
v/c Ratio	0.91		0.39	0.56	0.67	
Uniform Delay, d1	15.2		22.0	5.1	44.9	
Progression Factor	0.38		1.00	1.00	1.00	
Incremental Delay, d2	3.6		1.6	0.8	3.6	
Delay (s)	9.3		23.6	6.0	48.5	
Level of Service	A		C	A	D	
Approach Delay (s)	9.3			6.6	48.5	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	40	1400	220	370	60	0	0	250	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					5.0		5.0	5.0			5.0	
Lane Util. Factor					0.91		1.00	1.00			0.95	
Frpb, ped/bikes					0.98		1.00	1.00			0.98	
Flpb, ped/bikes					1.00		1.00	1.00			1.00	
Frt					0.98		1.00	1.00			0.97	
Flt Protected					1.00		0.95	1.00			1.00	
Satd. Flow (prot)					4866		1770	1863			3392	
Flt Permitted					1.00		0.95	1.00			1.00	
Satd. Flow (perm)					4866		1770	1863			3392	
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)	0	0	0	40	1400	220	370	60	0	0	250	50
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	0	0	16	0
Lane Group Flow (vph)	0	0	0	0	1644	0	370	60	0	0	284	0
Confl. Peds. (#/hr)				50		50			50			50
Turn Type				Split			Split					
Protected Phases				8	8		2	2			6	
Permitted Phases												
Actuated Green, G (s)					53.4		27.3	27.3			14.3	
Effective Green, g (s)					53.4		27.3	27.3			14.3	
Actuated g/C Ratio					0.49		0.25	0.25			0.13	
Clearance Time (s)					5.0		5.0	5.0			5.0	
Vehicle Extension (s)					3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)					2362		439	462			441	
v/s Ratio Prot					c0.34		c0.21	0.03			c0.08	
v/s Ratio Perm												
v/c Ratio					0.70		0.84	0.13			0.64	
Uniform Delay, d1					22.0		39.3	32.1			45.4	
Progression Factor					0.83		0.44	0.30			1.00	
Incremental Delay, d2					1.6		12.1	0.1			3.2	
Delay (s)					19.7		29.6	9.9			48.7	
Level of Service					B		C	A			D	
Approach Delay (s)		0.0			19.7			26.8			48.7	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	80.2%	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)	0	0	0	0	0	0	1610	50	0	0	70	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)							5.0	5.0			5.0	
Lane Util. Factor							0.91	0.91			1.00	
Frpb, ped/bikes							1.00	1.00			0.96	
Flpb, ped/bikes							1.00	1.00			1.00	
Frt							1.00	1.00			0.95	
Flt Protected							0.95	0.96			1.00	
Satd. Flow (prot)							3221	1621			1696	
Flt Permitted							0.95	0.96			1.00	
Satd. Flow (perm)							3221	1621			1696	
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)	0	0	0	0	0	0	1610	50	0	0	70	40
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	20	0
Lane Group Flow (vph)	0	0	0	0	0	0	1111	549	0	0	90	0
Confl. Peds. (#/hr)						50			50			50
Turn Type				Split			Split			Split		
Protected Phases				8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)							88.9	88.9			11.1	
Effective Green, g (s)							88.9	88.9			11.1	
Actuated g/C Ratio							0.81	0.81			0.10	
Clearance Time (s)							5.0	5.0			5.0	
Vehicle Extension (s)							3.0	3.0			3.0	
Lane Grp Cap (vph)							2603	1310			171	
v/s Ratio Prot							c0.34	0.34			c0.05	
v/s Ratio Perm												
v/c Ratio							0.43	0.42			0.53	
Uniform Delay, d1							3.1	3.1			47.0	
Progression Factor							0.43	0.41			1.00	
Incremental Delay, d2							0.4	0.7			2.9	
Delay (s)							1.7	1.9			49.9	
Level of Service							A	A			D	
Approach Delay (s)		0.0			0.0			1.8			49.9	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM Average Control Delay	4.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	10.0
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)	120	20	20	140	110	140	10	510	130	170	660	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	12	12	12	10	10	10	10	10	10
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.92		1.00	0.86		1.00	0.96		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.93		1.00	0.92		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1593	1425		1593	1327		1486	1456		1486	1547	
Flt Permitted	0.95	1.00		0.95	1.00		0.23	1.00		0.27	1.00	
Satd. Flow (perm)	1593	1425		1593	1327		362	1456		426	1547	
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)	120	20	20	140	110	140	10	510	130	170	660	40
RTOR Reduction (vph)	0	18	0	0	42	0	0	8	0	0	2	0
Lane Group Flow (vph)	120	22	0	140	208	0	10	632	0	170	698	0
Confl. Peds. (#/hr)			50			95	10		69	69		10
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	11.3	12.0		21.5	22.2		61.5	61.5		61.5	61.5	
Effective Green, g (s)	11.3	12.0		21.5	22.2		61.5	61.5		61.5	61.5	
Actuated g/C Ratio	0.10	0.11		0.20	0.20		0.56	0.56		0.56	0.56	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	164	155		311	268		202	814		238	865	
v/s Ratio Prot	c0.08	0.02		0.09	c0.16			0.43			c0.45	
v/s Ratio Perm							0.03			0.40		
v/c Ratio	0.73	0.14		0.45	0.77		0.05	0.78		0.71	0.81	
Uniform Delay, d1	47.9	44.3		39.0	41.5		11.0	18.9		17.8	19.5	
Progression Factor	1.00	1.00		1.00	1.00		0.93	0.76		0.75	0.76	
Incremental Delay, d2	15.4	0.4		1.0	13.1		0.4	6.2		12.8	6.0	
Delay (s)	63.3	44.8		40.1	54.6		10.6	20.4		26.0	20.8	
Level of Service	E	D		D	D		B	C		C	C	
Approach Delay (s)		58.7			49.4			20.3			21.8	
Approach LOS		E			D			C			C	

Intersection Summary			
HCM Average Control Delay	29.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	200	70	60	130	100	90	470	50	220	500	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	12	12	12	10	12	12	10	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.96		1.00	0.97		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	0.97	1.00		0.94	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.96		1.00	0.93		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1551	1550		1493	1523		1474	1634		1474	1594	
Flt Permitted	0.41	1.00		0.32	1.00		0.36	1.00		0.36	1.00	
Satd. Flow (perm)	662	1550		507	1523		554	1634		558	1594	
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)	90	200	70	60	130	100	90	470	50	220	500	120
RTOR Reduction (vph)	0	13	0	0	27	0	0	3	0	0	7	0
Lane Group Flow (vph)	90	257	0	60	203	0	90	517	0	220	613	0
Confl. Peds. (#/hr)	15		42	42		15	29		31	31		29
Turn Type	Perm			Perm			pm+pt			pm+pt		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	22.8	22.8		22.8	22.8		69.8	64.1		77.2	69.5	
Effective Green, g (s)	22.8	22.8		22.8	22.8		69.8	64.1		77.2	69.5	
Actuated g/C Ratio	0.21	0.21		0.21	0.21		0.63	0.58		0.70	0.63	
Clearance Time (s)	5.0	5.0		5.0	5.0		2.0	5.0		2.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	137	321		105	316		399	952		484	1007	
v/s Ratio Prot		c0.17			0.13		0.01	0.32		c0.05	c0.38	
v/s Ratio Perm	0.14			0.12			0.13			0.27		
v/c Ratio	0.66	0.80		0.57	0.64		0.23	0.54		0.45	0.61	
Uniform Delay, d1	40.0	41.4		39.2	39.9		8.4	14.0		7.3	12.1	
Progression Factor	1.00	1.00		0.90	0.90		1.00	1.00		0.78	0.49	
Incremental Delay, d2	10.8	13.4		7.1	4.3		0.3	2.2		0.5	2.0	
Delay (s)	50.8	54.8		42.2	40.0		8.7	16.2		6.2	7.9	
Level of Service	D	D		D	D		A	B		A	A	
Approach Delay (s)		53.8			40.5			15.1			7.5	
Approach LOS		D			D			B			A	

Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	400	40	20	240	30	30	60	80	50	100	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		0.99			0.98			0.94			0.99	
Flpb, ped/bikes		0.99			1.00			0.99			0.98	
Frt		0.99			0.99			0.94			0.98	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		1629			1609			1454			1566	
Flt Permitted		0.98			0.96			0.92			0.86	
Satd. Flow (perm)		1604			1555			1356			1362	
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)	20	400	40	20	240	30	30	60	80	50	100	30
RTOR Reduction (vph)	0	4	0	0	6	0	0	65	0	0	15	0
Lane Group Flow (vph)	0	456	0	0	284	0	0	105	0	0	165	0
Confl. Peds. (#/hr)	117		72	72		117	50		72	72		50
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		34.6			34.6			10.4			10.4	
Effective Green, g (s)		34.6			34.6			10.4			10.4	
Actuated g/C Ratio		0.63			0.63			0.19			0.19	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		1009			978			256			258	
v/s Ratio Prot												
v/s Ratio Perm		c0.28			0.18			0.08			c0.12	
v/c Ratio		0.45			0.29			0.41			0.64	
Uniform Delay, d1		5.3			4.6			19.6			20.6	
Progression Factor		0.76			0.81			1.00			1.00	
Incremental Delay, d2		1.3			0.7			1.1			5.1	
Delay (s)		5.3			4.5			20.7			25.7	
Level of Service		A			A			C			C	
Approach Delay (s)		5.3			4.5			20.7			25.7	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	10.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.3%	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)	40	460	30	40	120	30	110	170	100	60	190	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.99			0.97		1.00	0.83		1.00	0.96	
Flpb, ped/bikes		0.99			0.99		0.89	1.00		0.72	1.00	
Frt		0.99			0.98		1.00	0.94		1.00	0.97	
Flt Protected		1.00			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1626			1559		1425	1320		1143	1567	
Flt Permitted		0.97			0.86		0.55	1.00		0.50	1.00	
Satd. Flow (perm)		1582			1354		826	1320		596	1567	
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	460	30	40	120	30	110	170	100	60	190	50
RTOR Reduction (vph)	0	3	0	0	10	0	0	43	0	0	19	0
Lane Group Flow (vph)	0	527	0	0	180	0	110	227	0	60	221	0
Confl. Peds. (#/hr)	106		100	100		100	100		287	287		100
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		31.2			31.2		13.8	13.8		13.8	13.8	
Effective Green, g (s)		31.2			31.2		13.8	13.8		13.8	13.8	
Actuated g/C Ratio		0.57			0.57		0.25	0.25		0.25	0.25	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		897			768		207	331		150	393	
v/s Ratio Prot								c0.17			0.14	
v/s Ratio Perm		c0.33			0.13		0.13			0.10		
v/c Ratio		0.59			0.23		0.53	0.69		0.40	0.56	
Uniform Delay, d1		7.7			5.9		17.8	18.6		17.2	18.0	
Progression Factor		0.65			0.59		1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.6			0.6		2.6	5.8		1.7	1.8	
Delay (s)		7.6			4.2		20.4	24.5		18.9	19.8	
Level of Service		A			A		C	C		B	B	
Approach Delay (s)		7.6			4.2			23.3			19.6	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	72.1%	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)	20	570	40	20	130	70	30	50	70	240	250	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	12	12	12	10	12
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		0.99			0.96			0.98			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			0.99	
Frt		0.99			0.96			0.94			0.99	
Flt Protected		1.00			1.00			0.99			0.98	
Satd. Flow (prot)		1641			1531			1517			1492	
Flt Permitted		0.99			0.94			0.87			0.79	
Satd. Flow (perm)		1622			1443			1328			1204	
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)	20	570	40	20	130	70	30	50	70	240	250	30
RTOR Reduction (vph)	0	4	0	0	31	0	0	41	0	0	4	0
Lane Group Flow (vph)	0	626	0	0	189	0	0	109	0	0	516	0
Confl. Peds. (#/hr)	67		82	82		67	30		38	38		30
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		22.0			22.0			23.0			23.0	
Effective Green, g (s)		22.0			22.0			23.0			23.0	
Actuated g/C Ratio		0.40			0.40			0.42			0.42	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		649			577			555			503	
v/s Ratio Prot												
v/s Ratio Perm		c0.39			0.13			0.08			c0.43	
v/c Ratio		0.96			0.33			0.20			1.03	
Uniform Delay, d1		16.1			11.4			10.1			16.0	
Progression Factor		0.90			0.99			1.00			1.00	
Incremental Delay, d2		24.8			1.4			0.2			46.8	
Delay (s)		39.3			12.7			10.3			62.8	
Level of Service		D			B			B			E	
Approach Delay (s)		39.3			12.7			10.3			62.8	
Approach LOS		D			B			B			E	

Intersection Summary			
HCM Average Control Delay	40.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	560	70	30	50	20	50	330	70	20	90	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	10	12	12	12
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99			0.99			0.97	
Flpb, ped/bikes	0.99	1.00		0.99	1.00			1.00			1.00	
Frt	1.00	0.98		1.00	0.96			0.98			0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.99			1.00	
Satd. Flow (prot)	1578	1639		1576	1595			1509			1510	
Flt Permitted	0.71	1.00		0.25	1.00			0.94			0.95	
Satd. Flow (perm)	1182	1639		415	1595			1426			1442	
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)	250	560	70	30	50	20	50	330	70	20	90	120
RTOR Reduction (vph)	0	8	0	0	11	0	0	12	0	0	73	0
Lane Group Flow (vph)	250	622	0	30	59	0	0	438	0	0	157	0
Confl. Peds. (#/hr)	11		25	25		11	20		18	18		20
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	25.9	25.9		25.9	25.9			19.1			19.1	
Effective Green, g (s)	25.9	25.9		25.9	25.9			19.1			19.1	
Actuated g/C Ratio	0.47	0.47		0.47	0.47			0.35			0.35	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	557	772		195	751			495			501	
v/s Ratio Prot		c0.38			0.04							
v/s Ratio Perm	0.21			0.07				c0.31			0.11	
v/c Ratio	0.45	0.81		0.15	0.08			0.88			0.31	
Uniform Delay, d1	9.8	12.4		8.3	8.0			16.9			13.1	
Progression Factor	0.55	0.54		0.96	1.01			1.00			1.00	
Incremental Delay, d2	1.0	3.5		1.6	0.2			16.9			0.4	
Delay (s)	6.3	10.1		9.6	8.3			33.8			13.5	
Level of Service	A	B		A	A			C			B	
Approach Delay (s)		9.0			8.7			33.8			13.5	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	440	60	20	50	20	30	230	50	30	180	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	12	10	10	12	16	12
Total Lost time (s)		5.0			5.0			5.0	5.0		5.0	
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	
Frpb, ped/bikes		1.00			0.98			1.00	0.91		0.99	
Flpb, ped/bikes		0.99			1.00			1.00	1.00		0.99	
Frt		0.99			0.97			1.00	0.85		0.99	
Flt Protected		0.99			0.99			0.99	1.00		0.99	
Satd. Flow (prot)		1618			1576			1302	1217		1549	
Flt Permitted		0.93			0.87			0.94	1.00		0.93	
Satd. Flow (perm)		1523			1389			1233	1217		1451	
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)	100	440	60	20	50	20	30	230	50	30	180	20
RTOR Reduction (vph)	0	6	0	0	9	0	0	0	36	0	7	0
Lane Group Flow (vph)	0	594	0	0	81	0	0	260	14	0	223	0
Confl. Peds. (#/hr)	41		18	18		41	32		46	46		32
Bus Blockages (#/hr)	0	0	0	0	0	0	0	40	0	0	40	0
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)		29.5			29.5			15.5	15.5		15.5	
Effective Green, g (s)		29.5			29.5			15.5	15.5		15.5	
Actuated g/C Ratio		0.54			0.54			0.28	0.28		0.28	
Clearance Time (s)		5.0			5.0			5.0	5.0		5.0	
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		817			745			347	343		409	
v/s Ratio Prot												
v/s Ratio Perm		c0.39			0.06			c0.21	0.01		0.15	
v/c Ratio		0.73			0.11			0.75	0.04		0.54	
Uniform Delay, d1		9.7			6.3			18.0	14.4		16.8	
Progression Factor		0.23			1.00			1.00	1.00		1.00	
Incremental Delay, d2		3.3			0.3			8.6	0.0		1.5	
Delay (s)		5.5			6.6			26.6	14.4		18.2	
Level of Service		A			A			C	B		B	
Approach Delay (s)		5.5			6.6			24.6			18.2	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	390	0	130	10	0	10	50	280	0	20	340	30
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)	390	0	130	10	0	10	50	280	0	20	340	30

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	NB 2	SB 1
Volume Total (vph)	390	130	20	190	140	390
Volume Left (vph)	390	0	10	50	0	20
Volume Right (vph)	0	130	10	0	0	30
Hadj (s)	0.53	-0.67	-0.17	0.17	0.03	0.00
Departure Headway (s)	7.3	6.1	8.0	7.3	7.1	6.8
Degree Utilization, x	0.80	0.22	0.04	0.38	0.28	0.74
Capacity (veh/h)	476	569	391	464	480	506
Control Delay (s)	32.0	9.7	11.4	13.5	11.7	26.8
Approach Delay (s)	26.4		11.4	12.7		26.8
Approach LOS	D		B	B		D

Intersection Summary			
Delay	22.7		
HCM Level of Service	C		
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	200	70	70	160	260	50	260	40	150	390	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	12	12	10	12	12	10	12	12	10	12	12
Total Lost time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		0.99			1.00	0.90	1.00	0.99		1.00	0.99	
Flpb, ped/bikes		0.99			1.00	1.00	0.99	1.00		0.98	1.00	
Frt		0.97			1.00	0.85	1.00	0.98		1.00	0.98	
Flt Protected		0.99			0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1575			1643	1281	1467	1630		1449	1626	
Flt Permitted		0.87			0.79	1.00	0.42	1.00		0.57	1.00	
Satd. Flow (perm)		1379			1321	1281	651	1630		867	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)	80	200	70	70	160	260	50	260	40	150	390	70
RTOR Reduction (vph)	0	18	0	0	0	179	0	9	0	0	10	0
Lane Group Flow (vph)	0	332	0	0	230	81	50	291	0	150	450	0
Confl. Peds. (#/hr)	54		21	21		54	18		25	25		18
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8		8	2			6		
Actuated Green, G (s)		17.1			17.1	17.1	27.9	27.9		27.9	27.9	
Effective Green, g (s)		17.1			17.1	17.1	27.9	27.9		27.9	27.9	
Actuated g/C Ratio		0.31			0.31	0.31	0.51	0.51		0.51	0.51	
Clearance Time (s)		5.0			5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		429			411	398	330	827		440	825	
v/s Ratio Prot								0.18			c0.28	
v/s Ratio Perm		c0.24			0.17	0.06	0.08			0.17		
v/c Ratio		0.77			0.56	0.20	0.15	0.35		0.34	0.55	
Uniform Delay, d1		17.2			15.8	13.9	7.2	8.1		8.1	9.2	
Progression Factor		1.00			1.00	1.00	1.09	1.01		1.00	1.00	
Incremental Delay, d2		8.5			1.7	0.3	1.0	1.2		2.1	2.6	
Delay (s)		25.7			17.5	14.2	8.8	9.4		10.2	11.8	
Level of Service		C			B	B	A	A		B	B	
Approach Delay (s)		25.7			15.7			9.3			11.4	
Approach LOS		C			B			A			B	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	86.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Yield	Yield		Yield	
Volume (vph)	50	340	480	130	90	30
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	50	340	480	130	90	30

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	390	610	120
Volume Left (vph)	50	0	90
Volume Right (vph)	0	130	30
Hadj (s)	0.06	-0.09	0.03
Departure Headway (s)	5.1	4.7	6.2
Degree Utilization, x	0.55	0.80	0.21
Capacity (veh/h)	680	752	531
Control Delay (s)	14.2	23.7	10.9
Approach Delay (s)	14.2	23.7	10.9
Approach LOS	B	C	B

Intersection Summary			
Delay	19.0		
HCM Level of Service	C		
Intersection Capacity Utilization	81.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Volume (vph)	450	320	210	30	60	330
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.99		1.00	
Flpb, ped/bikes	1.00	1.00	1.00		1.00	
Frt	1.00	1.00	0.98		0.89	
Flt Protected	0.95	1.00	1.00		0.99	
Satd. Flow (prot)	1593	1676	1634		1474	
Flt Permitted	0.95	1.00	1.00		0.99	
Satd. Flow (perm)	1593	1676	1634		1474	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	450	320	210	30	60	330
RTOR Reduction (vph)	0	0	6	0	234	0
Lane Group Flow (vph)	450	320	234	0	156	0
Confl. Peds. (#/hr)				20	20	
Turn Type	Prot					
Protected Phases	5	2	6		4	
Permitted Phases					4	
Actuated Green, G (s)	46.2	68.7	18.5		13.3	
Effective Green, g (s)	46.2	68.7	18.5		13.3	
Actuated g/C Ratio	0.51	0.76	0.21		0.15	
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	818	1279	336		218	
v/s Ratio Prot	c0.28	0.19	c0.14		c0.11	
v/s Ratio Perm						
v/c Ratio	0.55	0.25	0.70		0.71	
Uniform Delay, d1	14.9	3.1	33.2		36.5	
Progression Factor	0.54	0.75	1.00		1.00	
Incremental Delay, d2	2.1	0.4	6.2		10.6	
Delay (s)	10.2	2.7	39.4		47.1	
Level of Service	B	A	D		D	
Approach Delay (s)		7.1	39.4		47.1	
Approach LOS		A	D		D	

Intersection Summary			
HCM Average Control Delay	23.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.8%	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)	40	120	100	90	100	40	90	280	120	120	390	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	12	12	10	12	12	10	12	12	10	12	12
Grade (%)		-5%			5%			-2%			2%	
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.98		1.00	0.99		1.00	1.00	0.94	1.00	1.00	
Flpb, ped/bikes	0.98	1.00		0.99	1.00		0.99	1.00	1.00	0.97	1.00	
Frt	1.00	0.93		1.00	0.96		1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1495	1572		1428	1545		1489	1693	1353	1431	1645	
Flt Permitted	0.67	1.00		0.55	1.00		0.51	1.00	1.00	0.59	1.00	
Satd. Flow (perm)	1050	1572		820	1545		795	1693	1353	885	1645	
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	120	100	90	100	40	90	280	120	120	390	20
RTOR Reduction (vph)	0	68	0	0	33	0	0	0	44	0	2	0
Lane Group Flow (vph)	40	152	0	90	107	0	90	280	76	120	408	0
Confl. Peds. (#/hr)	16		14	14		16	10		28	28		10
Turn Type	Perm			Perm			Perm		Perm	Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Actuated Green, G (s)	10.2	10.2		10.2	10.2		34.8	34.8	34.8	34.8	34.8	
Effective Green, g (s)	10.2	10.2		10.2	10.2		34.8	34.8	34.8	34.8	34.8	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.63	0.63	0.63	0.63	0.63	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	195	292		152	287		503	1071	856	560	1041	
v/s Ratio Prot		0.10			0.07			0.17			c0.25	
v/s Ratio Perm	0.04			c0.11			0.11		0.06	0.14		
v/c Ratio	0.21	0.52		0.59	0.37		0.18	0.26	0.09	0.21	0.39	
Uniform Delay, d1	19.0	20.2		20.5	19.6		4.2	4.4	3.9	4.3	4.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	0.74	0.69	
Incremental Delay, d2	0.2	0.8		4.1	0.3		0.8	0.6	0.2	0.7	0.9	
Delay (s)	19.2	21.0		24.6	19.9		5.0	5.0	4.1	3.9	4.4	
Level of Service	B	C		C	B		A	A	A	A	A	
Approach Delay (s)		20.7			21.7			4.8			4.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	SBL	SBR	NWL	NWR
Right Turn Channelized						
Volume (veh/h)	130	230	230	30	220	200
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	130	230	230	30	220	200
Approach Volume (veh/h)	360		260		420	
Crossing Volume (veh/h)	230		220		130	
High Capacity (veh/h)	1156		1166		1251	
High v/c (veh/h)	0.31		0.22		0.34	
Low Capacity (veh/h)	954		962		1040	
Low v/c (veh/h)	0.38		0.27		0.40	

Intersection Summary			
Maximum v/c High	0.34		
Maximum v/c Low	0.40		
Intersection Capacity Utilization	77.1%	ICU Level of Service	D

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	190	190	590	90	40	530
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	0.95	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1593	1356	1609		1593	1676
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1593	1356	1609		1593	1676
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	190	190	590	90	40	530
RTOR Reduction (vph)	0	158	5	0	0	0
Lane Group Flow (vph)	190	32	675	0	40	530
Confl. Peds. (#/hr)		25		63		
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	15.0	15.0	57.0		3.0	65.0
Effective Green, g (s)	15.0	15.0	57.0		3.0	65.0
Actuated g/C Ratio	0.17	0.17	0.63		0.03	0.72
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	266	226	1019		53	1210
v/s Ratio Prot	c0.12		c0.42		0.03	c0.32
v/s Ratio Perm		0.02				
v/c Ratio	0.71	0.14	0.66		0.75	0.44
Uniform Delay, d1	35.5	32.0	10.4		43.1	5.1
Progression Factor	1.00	1.00	0.36		0.96	1.03
Incremental Delay, d2	8.8	0.3	3.0		34.2	0.8
Delay (s)	44.2	32.3	6.7		75.6	6.0
Level of Service	D	C	A		E	A
Approach Delay (s)	38.3		6.7			10.9
Approach LOS	D		A			B

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	64.9%	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)	60	100	330	10	130	50	200	650	20	50	670	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frpb, ped/bikes		1.00	0.96		1.00	0.93	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		0.99	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.98	1.00		1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1803	1524		1852	1479	1770	1851		1764	1845	
Flt Permitted		0.83	1.00		0.98	1.00	0.19	1.00		0.30	1.00	
Satd. Flow (perm)		1521	1524		1813	1479	361	1851		563	1845	
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)	60	100	330	10	130	50	200	650	20	50	670	30
RTOR Reduction (vph)	0	0	101	0	0	40	0	1	0	0	1	0
Lane Group Flow (vph)	0	160	229	0	140	10	200	669	0	50	699	0
Confl. Peds. (#/hr)	23		18	18		23	23		21	21		23
Turn Type	Perm		pm+ov	Perm		Perm	pm+pt			pm+pt		
Protected Phases		4	5		8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		
Actuated Green, G (s)		18.5	27.5		18.5	18.5	61.4	52.4		51.6	47.5	
Effective Green, g (s)		18.5	27.5		18.5	18.5	61.4	52.4		51.6	47.5	
Actuated g/C Ratio		0.21	0.31		0.21	0.21	0.68	0.58		0.57	0.53	
Clearance Time (s)		5.0	5.0		5.0	5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		313	550		373	304	387	1078		377	974	
v/s Ratio Prot			c0.04				c0.05	0.36		0.01	c0.38	
v/s Ratio Perm		c0.11	0.11		0.08	0.01	0.30			0.07		
v/c Ratio		0.51	0.42		0.38	0.03	0.52	0.62		0.13	0.72	
Uniform Delay, d1		31.7	24.9		30.8	28.6	10.6	12.3		9.3	16.1	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		0.59	0.99	
Incremental Delay, d2		1.4	0.5		0.6	0.0	1.2	2.7		0.1	4.2	
Delay (s)		33.1	25.4		31.4	28.6	11.8	15.0		5.7	20.3	
Level of Service		C	C		C	C	B	B		A	C	
Approach Delay (s)		27.9			30.7			14.3			19.3	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	98.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	890	90	220	840	110	110	350	430	150	240	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00	1.00	1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1593	3126		1593	3109		1580	1676	1425	1588	1641	
Flt Permitted	0.95	1.00		0.95	1.00		0.46	1.00	1.00	0.25	1.00	
Satd. Flow (perm)	1593	3126		1593	3109		760	1676	1425	423	1641	
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)	20	890	90	220	840	110	110	350	430	150	240	30
RTOR Reduction (vph)	0	10	0	0	12	0	0	0	52	0	5	0
Lane Group Flow (vph)	20	970	0	220	938	0	110	350	378	150	265	0
Confl. Peds. (#/hr)			16			18	23		24	24		23
Turn Type	Prot	NA		Prot	NA		pm+pt	NA	pt+ov	pm+pt	NA	
Protected Phases	7	4		3	8		5	2	2 3	1	6	
Permitted Phases							2			6		
Actuated Green, G (s)	2.4	23.0		12.0	32.6		23.8	19.0	36.0	26.2	20.2	
Effective Green, g (s)	2.4	23.0		12.0	32.6		23.8	19.0	36.0	26.2	20.2	
Actuated g/C Ratio	0.03	0.29		0.15	0.41		0.30	0.24	0.45	0.33	0.25	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	47	898		238	1266		275	398	641	225	414	
v/s Ratio Prot	0.01	c0.31		c0.14	0.30		0.02	c0.21	0.27	c0.05	0.16	
v/s Ratio Perm							0.09			0.17		
v/c Ratio	0.43	1.08		0.92	0.74		0.40	0.88	0.59	0.67	0.64	
Uniform Delay, d1	38.1	28.5		33.6	20.1		21.4	29.4	16.5	20.9	26.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.1	54.1		38.1	3.9		1.0	23.1	1.4	7.3	7.4	
Delay (s)	44.2	82.6		71.6	24.1		22.3	52.5	17.9	28.1	34.0	
Level of Service	D	F		E	C		C	D	B	C	C	
Approach Delay (s)		81.8			33.0			32.0			31.9	
Approach LOS		F			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	46.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	330	12	137	991	174	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-7%			0%			0%			0%	
Total Lost time (s)					4.0			4.0				
Lane Util. Factor					1.00			0.95				
Frpb, ped/bikes					1.00			0.99				
Flpb, ped/bikes					1.00			1.00				
Frt					1.00			0.98				
Flt Protected					1.00			0.99				
Satd. Flow (prot)					1398			2763				
Flt Permitted					1.00			0.99				
Satd. Flow (perm)					1398			2763				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	0	359	13	149	1077	189	0	0	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	45	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	369	0	0	1370	0	0	0	0
Confl. Peds. (#/hr)			4			54	5		13			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	0	0	0	0	0
Parking (#/hr)					10			20				
Turn Type							Perm					
Protected Phases					6			8				
Permitted Phases							8					
Actuated Green, G (s)					14.6			20.4				
Effective Green, g (s)					15.6			21.4				
Actuated g/C Ratio					0.35			0.48				
Clearance Time (s)					5.0			5.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)					485			1314				
v/s Ratio Prot					c0.26							
v/s Ratio Perm								0.50				
v/c Ratio					0.76			1.04				
Uniform Delay, d1					13.0			11.8				
Progression Factor					1.00			0.80				
Incremental Delay, d2					6.9			35.0				
Delay (s)					19.9			44.4				
Level of Service					B			D				
Approach Delay (s)		0.0			19.9			44.4			0.0	
Approach LOS		A			B			D			A	

Intersection Summary			
HCM Average Control Delay	39.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	0	19	984	0	0
Sign Control	Stop			Free	Free	
Grade	-8%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	0	21	1070	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				450	350	
pX, platoon unblocked	0.70					
vC, conflicting volume	576	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0	0	0			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	100	99			
cM capacity (veh/h)	708	1088	1622			

Direction, Lane #	EB 1	NB 1	NB 2
Volume Total	38	377	713
Volume Left	38	21	0
Volume Right	0	0	0
cSH	708	1622	1700
Volume to Capacity	0.05	0.01	0.42
Queue Length 95th (ft)	4	1	0
Control Delay (s)	10.4	0.5	0.0
Lane LOS	B	A	
Approach Delay (s)	10.4	0.2	
Approach LOS	B		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	41.0%	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)	35	70	0	0	105	15	75	833	111	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-11%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			1.00			1.00				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.98				
Flt Protected		0.98			1.00			1.00				
Satd. Flow (prot)		1485			1402			2778				
Flt Permitted		0.86			1.00			1.00				
Satd. Flow (perm)		1298			1402			2778				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	76	0	0	114	16	82	905	121	0	0	0
RTOR Reduction (vph)	0	0	0	0	12	0	0	15	0	0	0	0
Lane Group Flow (vph)	0	114	0	0	118	0	0	1093	0	0	0	0
Confl. Peds. (#/hr)			53			21	14		11			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		10			10			20				
Turn Type	Perm						Perm					
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		9.2			9.2			25.8				
Effective Green, g (s)		10.2			10.2			26.8				
Actuated g/C Ratio		0.23			0.23			0.60				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		294			318			1654				
v/s Ratio Prot					0.08							
v/s Ratio Perm		c0.09						0.39				
v/c Ratio		0.39			0.37			0.66				
Uniform Delay, d1		14.8			14.7			6.1				
Progression Factor		0.86			1.00			2.10				
Incremental Delay, d2		0.7			0.7			0.5				
Delay (s)		13.3			15.4			13.2				
Level of Service		B			B			B				
Approach Delay (s)		13.3			15.4			13.2			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	50	0	0	7	9	59	805	19	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		-8%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	54	0	0	8	10	64	875	21	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								460			460	
pX, platoon unblocked	0.91	0.91		0.91	0.91	0.91				0.91		
vC, conflicting volume	579	1024	0	1041	1014	448	0			896		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	333	823	0	842	812	188	0			682		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	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	80	100	100	97	99	96			100		
cM capacity (veh/h)	510	270	1088	193	273	749	1622			823		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	82	17	502	458
Volume Left	27	0	64	0
Volume Right	0	10	0	21
cSH	321	425	1622	1700
Volume to Capacity	0.25	0.04	0.04	0.27
Queue Length 95th (ft)	25	3	3	0
Control Delay (s)	20.0	13.8	1.3	0.0
Lane LOS	C	B	A	
Approach Delay (s)	20.0	13.8	0.7	
Approach LOS	C	B		

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	45.3%	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)	42	27	0	0	158	78	95	689	50	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-7%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			0.98			0.99				
Flpb, ped/bikes		1.00			1.00			0.99				
Frt		1.00			0.96			0.99				
Flt Protected		0.97			1.00			0.99				
Satd. Flow (prot)		1437			1343			2767				
Flt Permitted		0.76			1.00			0.99				
Satd. Flow (perm)		1128			1343			2767				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	29	0	0	172	85	103	749	54	0	0	0
RTOR Reduction (vph)	0	0	0	0	40	0	0	10	0	0	0	0
Lane Group Flow (vph)	0	75	0	0	217	0	0	896	0	0	0	0
Confl. Peds. (#/hr)			48			50	60		50			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		10			10			20				
Turn Type							Perm					
Protected Phases		2			6			8				
Permitted Phases							8					
Actuated Green, G (s)		16.0			16.0			19.0				
Effective Green, g (s)		17.0			17.0			20.0				
Actuated g/C Ratio		0.38			0.38			0.44				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		426			507			1230				
v/s Ratio Prot					c0.16							
v/s Ratio Perm		0.07						0.32				
v/c Ratio		0.18			0.43			0.73				
Uniform Delay, d1		9.3			10.4			10.3				
Progression Factor		1.00			1.00			1.34				
Incremental Delay, d2		0.0			0.6			3.0				
Delay (s)		9.3			11.0			16.8				
Level of Service		A			B			B				
Approach Delay (s)		9.3			11.0			16.8			0.0	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	70	0	0	84	11	123	509	49	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-7%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			0.99			1.00				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.99				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		1449			1647			2774				
Flt Permitted		0.83			1.00			0.99				
Satd. Flow (perm)		1222			1647			2774				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	76	0	0	91	12	134	553	53	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	10	0	0	0	0
Lane Group Flow (vph)	0	136	0	0	94	0	0	730	0	0	0	0
Confl. Peds. (#/hr)			94			49	18		13			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		10						20				
Turn Type	Perm						Perm					
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		10.1			10.1			24.9				
Effective Green, g (s)		11.1			11.1			25.9				
Actuated g/C Ratio		0.25			0.25			0.58				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		301			406			1597				
v/s Ratio Prot					0.06							
v/s Ratio Perm		c0.11						0.26				
v/c Ratio		0.45			0.23			0.46				
Uniform Delay, d1		14.4			13.5			5.5				
Progression Factor		0.88			1.00			1.27				
Incremental Delay, d2		0.9			0.3			0.7				
Delay (s)		13.5			13.8			7.7				
Level of Service		B			B			A				
Approach Delay (s)		13.5			13.8			7.7			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	45	0	0	48	15	86	432	55	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-6%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			0.99			1.00				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.99				
Flt Protected		0.99			1.00			0.99				
Satd. Flow (prot)		1432			1612			2765				
Flt Permitted		0.91			1.00			0.99				
Satd. Flow (perm)		1326			1612			2765				
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	49	0	0	52	16	93	470	60	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	12	0	0	0	0
Lane Group Flow (vph)	0	65	0	0	55	0	0	611	0	0	0	0
Confl. Peds. (#/hr)			44			30	17		21			17
Heavy Vehicles (%)	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	4	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		10						20				
Turn Type	Perm						Perm					
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		7.7			7.7			27.3				
Effective Green, g (s)		8.7			8.7			28.3				
Actuated g/C Ratio		0.19			0.19			0.63				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		256			312			1739				
v/s Ratio Prot					0.03							
v/s Ratio Perm		c0.05						0.22				
v/c Ratio		0.25			0.18			0.35				
Uniform Delay, d1		15.4			15.2			4.0				
Progression Factor		1.16			1.00			1.30				
Incremental Delay, d2		0.4			0.3			0.5				
Delay (s)		18.2			15.4			5.7				
Level of Service		B			B			A				
Approach Delay (s)		18.2			15.4			5.7			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	7.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	167	0	0	190	301	158
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Grade (%)	-10%			0%	0%	
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	1.00			0.95	1.00	1.00
Frpb, ped/bikes	1.00			1.00	1.00	0.93
Flpb, ped/bikes	1.00			1.00	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	1750			3167	1267	1029
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	1750			3167	1267	1029
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	182	0	0	207	327	172
RTOR Reduction (vph)	0	0	0	0	0	72
Lane Group Flow (vph)	182	0	0	207	327	100
Confl. Peds. (#/hr)		51				36
Bus Blockages (#/hr)	0	0	0	0	0	6
Parking (#/hr)					20	20
Turn Type						Perm
Protected Phases	2			6	8	
Permitted Phases						8
Actuated Green, G (s)	9.9			9.9	25.1	25.1
Effective Green, g (s)	10.9			10.9	26.1	26.1
Actuated g/C Ratio	0.24			0.24	0.58	0.58
Clearance Time (s)	5.0			5.0	5.0	5.0
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Lane Grp Cap (vph)	424			767	735	597
v/s Ratio Prot	c0.10			0.07	c0.26	
v/s Ratio Perm						0.10
v/c Ratio	0.43			0.27	0.44	0.17
Uniform Delay, d1	14.4			13.8	5.3	4.4
Progression Factor	0.90			1.00	0.90	2.16
Incremental Delay, d2	0.7			0.2	1.9	0.6
Delay (s)	13.7			14.0	6.7	10.1
Level of Service	B			B	A	B
Approach Delay (s)	13.7			14.0	7.9	
Approach LOS	B			B	A	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	410	50	7	0	984	0	0	1697	8
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	11	11	12	10	10	10	10	10	10
Grade (%)		0%			7%			0%			0%	
Total Lost time (s)				4.0	4.0			4.0			4.0	
Lane Util. Factor				0.95	0.95			0.95			0.95	
Frpb, ped/bikes				1.00	1.00			1.00			1.00	
Flpb, ped/bikes				0.99	0.99			1.00			1.00	
Frt				1.00	1.00			1.00			1.00	
Flt Protected				0.95	0.96			1.00			1.00	
Satd. Flow (prot)				1368	1193			2639			2634	
Flt Permitted				0.95	0.96			1.00			1.00	
Satd. Flow (perm)				1368	1193			2639			2634	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	446	54	8	0	1093	0	0	1886	9
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	254	252	0	0	1093	0	0	1895	0
Confl. Peds. (#/hr)				7		49			6			58
Bus Blockages (#/hr)	0	0	0	4	0	0	0	4	0	0	4	0
Parking (#/hr)					10			20			20	
Turn Type				Perm								
Protected Phases					6			8			4	
Permitted Phases				6								
Actuated Green, G (s)				20.0	20.0			60.0			60.0	
Effective Green, g (s)				21.0	21.0			61.0			61.0	
Actuated g/C Ratio				0.23	0.23			0.68			0.68	
Clearance Time (s)				5.0	5.0			5.0			5.0	
Vehicle Extension (s)				3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)				319	278			1789			1785	
v/s Ratio Prot								0.41			c0.72	
v/s Ratio Perm				0.19	0.21							
v/c Ratio				0.80	0.91			0.61			1.06	
Uniform Delay, d1				32.5	33.6			8.0			14.5	
Progression Factor				0.86	0.85			1.00			0.56	
Incremental Delay, d2				11.3	23.4			0.6			33.5	
Delay (s)				39.0	51.9			8.6			41.6	
Level of Service				D	D			A			D	
Approach Delay (s)		0.0			45.5			8.6			41.6	
Approach LOS		A			D			A			D	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	10	305	18	0	2	0	959	32	0	1382	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-7%			8%			0%			0%	
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		0.95			0.95	
Frpb, ped/bikes	1.00	0.98		1.00		0.97		1.00			1.00	
Flpb, ped/bikes	0.98	1.00		1.00		1.00		1.00			1.00	
Frt	1.00	0.85		1.00		0.85		1.00			1.00	
Flt Protected	0.95	1.00		0.95		1.00		1.00			1.00	
Satd. Flow (prot)	1621	1238		1528		1330		2623			2639	
Flt Permitted	0.95	1.00		0.30		1.00		1.00			1.00	
Satd. Flow (perm)	1621	1238		476		1330		2623			2639	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	5	11	332	20	0	2	0	1066	36	0	1536	0
RTOR Reduction (vph)	0	26	0	0	0	1	0	3	0	0	0	0
Lane Group Flow (vph)	5	317	0	20	0	1	0	1099	0	0	1536	0
Confl. Peds. (#/hr)	15		8	8		15			3			29
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			custom		custom						
Protected Phases		2						8			4	
Permitted Phases	2			6		6						
Actuated Green, G (s)	23.5	23.5		23.5		23.5		56.5			56.5	
Effective Green, g (s)	24.5	24.5		24.5		24.5		57.5			57.5	
Actuated g/C Ratio	0.27	0.27		0.27		0.27		0.64			0.64	
Clearance Time (s)	5.0	5.0		5.0		5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)	441	337		130		362		1676			1686	
v/s Ratio Prot		c0.26						0.42			c0.58	
v/s Ratio Perm	0.00			0.04		0.00						
v/c Ratio	0.01	0.94		0.15		0.00		0.66			0.91	
Uniform Delay, d1	23.9	32.0		24.9		23.8		10.1			14.0	
Progression Factor	1.00	1.00		0.72		0.75		0.43			0.48	
Incremental Delay, d2	0.0	33.7		0.1		0.0		0.7			6.2	
Delay (s)	23.9	65.7		18.1		17.8		5.1			12.9	
Level of Service	C	E		B		B		A			B	
Approach Delay (s)		65.1			18.1			5.1			12.9	
Approach LOS		E			B			A			B	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	50	114	109	57	11	0	905	61	0	1157	30
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-6%			11%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.97			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.99			1.00			1.00	
Frt		0.91			0.99			0.99			1.00	
Flt Protected		1.00			0.97			1.00			1.00	
Satd. Flow (prot)		1294			1278			2593			2624	
Flt Permitted		0.98			0.61			1.00			1.00	
Satd. Flow (perm)		1278			805			2593			2624	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	9	54	124	118	62	12	0	1006	68	0	1286	33
RTOR Reduction (vph)	0	43	0	0	3	0	0	5	0	0	2	0
Lane Group Flow (vph)	0	144	0	0	189	0	0	1069	0	0	1317	0
Confl. Peds. (#/hr)	32		27	27		32			35			16
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		22.7			22.7			57.3			57.3	
Effective Green, g (s)		23.7			23.7			58.3			58.3	
Actuated g/C Ratio		0.26			0.26			0.65			0.65	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		337			212			1680			1700	
v/s Ratio Prot								0.41			c0.50	
v/s Ratio Perm		0.11			c0.23							
v/c Ratio		0.43			0.89			0.64			0.77	
Uniform Delay, d1		27.5			31.9			9.5			11.2	
Progression Factor		1.00			0.85			0.33			0.61	
Incremental Delay, d2		0.9			32.1			0.6			2.4	
Delay (s)		28.4			59.2			3.7			9.2	
Level of Service		C			E			A			A	
Approach Delay (s)		28.4			59.2			3.7			9.2	
Approach LOS		C			E			A			A	

Intersection Summary			
HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.7%	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)	8	15	30	45	15	6	0	864	60	0	1111	20
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-5%			8%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.98			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.98			1.00			1.00	
Frt		0.92			0.99			0.99			1.00	
Flt Protected		0.99			0.97			1.00			1.00	
Satd. Flow (prot)		1311			1286			2409			2437	
Flt Permitted		0.96			0.80			1.00			1.00	
Satd. Flow (perm)		1274			1065			2409			2437	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	9	16	33	49	16	7	0	960	67	0	1234	22
RTOR Reduction (vph)	0	25	0	0	5	0	0	6	0	0	1	0
Lane Group Flow (vph)	0	33	0	0	67	0	0	1021	0	0	1255	0
Confl. Peds. (#/hr)	15		19	19		15			23			21
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	40	0	0	40	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		20.0			20.0			60.0			60.0	
Effective Green, g (s)		21.0			21.0			61.0			61.0	
Actuated g/C Ratio		0.23			0.23			0.68			0.68	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		297			249			1633			1652	
v/s Ratio Prot								0.42			c0.51	
v/s Ratio Perm		0.03			c0.06							
v/c Ratio		0.11			0.27			0.63			0.76	
Uniform Delay, d1		27.1			28.2			8.1			9.6	
Progression Factor		1.00			0.90			0.16			0.28	
Incremental Delay, d2		0.7			2.2			0.6			1.8	
Delay (s)		27.9			27.7			1.9			4.5	
Level of Service		C			C			A			A	
Approach Delay (s)		27.9			27.7			1.9			4.5	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	4.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.4%	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)	10	35	42	142	85	16	0	844	34	0	950	24
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-4%			7%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.97			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.98			1.00			1.00	
Frt		0.93			0.99			0.99			1.00	
Flt Protected		0.99			0.97			1.00			1.00	
Satd. Flow (prot)		1311			1291			2606			2620	
Flt Permitted		0.96			0.79			1.00			1.00	
Satd. Flow (perm)		1267			1046			2606			2620	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	38	46	154	92	17	0	938	38	0	1056	27
RTOR Reduction (vph)	0	24	0	0	2	0	0	3	0	0	2	0
Lane Group Flow (vph)	0	71	0	0	261	0	0	973	0	0	1081	0
Confl. Peds. (#/hr)	44		37	37		44			51			37
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type				Perm								
Protected Phases		2			6			8			4	
Permitted Phases				6								
Actuated Green, G (s)		33.0			33.0			47.0			47.0	
Effective Green, g (s)		34.0			34.0			48.0			48.0	
Actuated g/C Ratio		0.38			0.38			0.53			0.53	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		479			395			1390			1397	
v/s Ratio Prot								0.37			c0.41	
v/s Ratio Perm		0.06			c0.25							
v/c Ratio		0.15			0.66			0.70			0.77	
Uniform Delay, d1		18.5			23.2			15.6			16.7	
Progression Factor		1.00			0.87			1.11			0.45	
Incremental Delay, d2		0.1			3.3			1.2			3.6	
Delay (s)		18.6			23.5			18.6			11.1	
Level of Service		B			C			B			B	
Approach Delay (s)		18.6			23.5			18.6			11.1	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	65	91	83	98	13	0	804	66	0	800	33
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-7%			7%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.96			1.00			0.99			1.00	
Flpb, ped/bikes		0.99			0.98			1.00			1.00	
Frt		0.94			0.99			0.99			0.99	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1307			1383			2594			2615	
Flt Permitted		0.88			0.70			1.00			1.00	
Satd. Flow (perm)		1158			996			2594			2615	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor (vph)	100%	100%	100%	100%	100%	100%	100%	100%	100%	101%	100%	100%
Adj. Flow (vph)	54	71	99	90	107	14	0	893	73	0	889	37
RTOR Reduction (vph)	0	36	0	0	3	0	0	5	0	0	2	0
Lane Group Flow (vph)	0	188	0	0	208	0	0	961	0	0	924	0
Confl. Peds. (#/hr)	43		63	63		43			19			20
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			0			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		22.1			22.1			57.9			57.9	
Effective Green, g (s)		23.1			23.1			58.9			58.9	
Actuated g/C Ratio		0.26			0.26			0.65			0.65	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		297			256			1698			1711	
v/s Ratio Prot								c0.37			0.35	
v/s Ratio Perm		0.16			c0.21							
v/c Ratio		0.63			0.81			0.57			0.54	
Uniform Delay, d1		29.7			31.4			8.5			8.3	
Progression Factor		1.00			0.93			0.69			0.32	
Incremental Delay, d2		4.3			16.9			0.3			1.1	
Delay (s)		34.0			46.2			6.2			3.7	
Level of Service		C			D			A			A	
Approach Delay (s)		34.0			46.2			6.2			3.7	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	7	6	62	84	50	6	0	805	62	0	687	30
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-2%			6%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.94			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.97			1.00			1.00	
Frt		0.89			0.99			0.99			0.99	
Flt Protected		1.00			0.97			1.00			1.00	
Satd. Flow (prot)		1199			1272			2595			2619	
Flt Permitted		0.98			0.79			1.00			1.00	
Satd. Flow (perm)		1175			1035			2595			2619	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	8	7	67	91	54	7	0	894	69	0	763	33
RTOR Reduction (vph)	0	45	0	0	2	0	0	6	0	0	3	0
Lane Group Flow (vph)	0	37	0	0	150	0	0	957	0	0	793	0
Confl. Peds. (#/hr)	14		48	48		14			22			4
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		28.0			28.0			52.0			52.0	
Effective Green, g (s)		29.0			29.0			53.0			53.0	
Actuated g/C Ratio		0.32			0.32			0.59			0.59	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		379			334			1528			1542	
v/s Ratio Prot								c0.37			0.30	
v/s Ratio Perm		0.03			c0.14							
v/c Ratio		0.10			0.45			0.63			0.51	
Uniform Delay, d1		21.3			24.2			12.0			10.9	
Progression Factor		1.00			1.07			0.60			2.03	
Incremental Delay, d2		0.5			4.2			0.7			0.7	
Delay (s)		21.8			30.0			8.0			22.8	
Level of Service		C			C			A			C	
Approach Delay (s)		21.8			30.0			8.0			22.8	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	96	247	130	174	187	308	469	41	30	340	25
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-5%			10%			0%			0%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.90	1.00	1.00	0.89	1.00	1.00	0.90	1.00	1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1639	1553	1316	1519	1416	1212	1478	1225	1190	1478	1225	1219
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1639	1553	1316	1519	1416	1212	1478	1225	1190	1478	1225	1219
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	72	104	268	141	189	203	342	521	46	33	378	28
RTOR Reduction (vph)	0	0	234	0	0	158	0	0	9	0	0	10
Lane Group Flow (vph)	72	104	34	141	189	45	342	521	37	33	378	18
Confl. Peds. (#/hr)			30			32			29			21
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	4	0	0	4	0
Parking (#/hr)		0			0			20			20	
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	2	2		6	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	11.3	11.3	11.3	20.1	20.1	20.1	17.0	40.2	40.2	2.4	25.6	25.6
Effective Green, g (s)	11.3	11.3	11.3	20.1	20.1	20.1	17.0	40.2	40.2	2.4	25.6	25.6
Actuated g/C Ratio	0.13	0.13	0.13	0.22	0.22	0.22	0.19	0.45	0.45	0.03	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	206	195	165	339	316	271	279	547	532	39	348	347
v/s Ratio Prot	0.04	c0.07		0.09	c0.13		c0.23	0.43		0.02	c0.31	
v/s Ratio Perm			0.03			0.04			0.03			0.01
v/c Ratio	0.35	0.53	0.20	0.42	0.60	0.17	1.23	0.95	0.07	0.85	1.09	0.05
Uniform Delay, d1	36.0	36.9	35.3	29.9	31.3	28.2	36.5	24.0	14.2	43.6	32.2	23.4
Progression Factor	1.00	1.00	1.00	0.97	0.97	1.31	1.14	0.35	0.30	1.00	1.00	1.00
Incremental Delay, d2	1.0	2.8	0.6	3.6	7.8	1.3	124.2	23.0	0.0	84.9	73.3	0.1
Delay (s)	37.0	39.7	35.9	32.7	38.3	38.2	165.8	31.4	4.3	128.5	105.5	23.4
Level of Service	D	D	D	C	D	D	F	C	A	F	F	C
Approach Delay (s)		37.0			36.8			80.6			102.0	
Approach LOS		D			D			F			F	

Intersection Summary			
HCM Average Control Delay	66.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.0%	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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	15	0	0	15	35	8	1	25	0	0	5	13
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	0	0	16	38	9	1	27	0	0	5	14

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total (vph)	16	0	63	28	20
Volume Left (vph)	16	0	16	1	0
Volume Right (vph)	0	0	9	0	14
Hadj (s)	0.52	0.00	-0.01	0.04	-0.40
Departure Headway (s)	5.2	4.6	4.1	4.1	3.7
Degree Utilization, x	0.02	0.00	0.07	0.03	0.02
Capacity (veh/h)	686	775	862	841	944
Control Delay (s)	7.1	6.4	7.4	7.3	6.8
Approach Delay (s)	7.1		7.4	7.3	6.8
Approach LOS	A		A	A	A

Intersection Summary			
Delay	7.3		
HCM Level of Service	A		
Intersection Capacity Utilization	20.2%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection Sign configuration not allowed in HCM analysis.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	20	10	10	52	25	2	26	2	157	234	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	22	11	11	57	27	2	28	2	171	254	5

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	35	95	33	430
Volume Left (vph)	2	11	2	171
Volume Right (vph)	11	27	2	5
Hadj (s)	-0.16	-0.13	0.01	0.11
Departure Headway (s)	5.0	4.9	4.7	4.4
Degree Utilization, x	0.05	0.13	0.04	0.52
Capacity (veh/h)	651	669	718	800
Control Delay (s)	8.2	8.6	7.9	12.1
Approach Delay (s)	8.2	8.6	7.9	12.1
Approach LOS	A	A	A	B

Intersection Summary			
Delay	11.1		
HCM Level of Service	B		
Intersection Capacity Utilization	48.1%	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)	2	25	27	6	9	20	3	45	5	23	368	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			5%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	27	29	7	10	22	3	49	5	25	400	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	536	512	402	553	511	52	403			54		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	536	512	402	553	511	52	403			54		
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 %	99	94	95	98	98	98	100			98		
cM capacity (veh/h)	433	458	651	400	458	1019	1155			1551		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	59	38	58	428
Volume Left	2	7	3	25
Volume Right	29	22	5	3
cSH	536	644	1155	1551
Volume to Capacity	0.11	0.06	0.00	0.02
Queue Length 95th (ft)	9	5	0	1
Control Delay (s)	12.5	10.9	0.5	0.6
Lane LOS	B	B	A	A
Approach Delay (s)	12.5	10.9	0.5	0.6
Approach LOS	B	B		

Intersection Summary			
Average Delay	2.4		
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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	5	37	12	15	62	31	6	56	5	39	367	12
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	40	13	16	67	34	7	61	5	42	399	13

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	59	117	73	454
Volume Left (vph)	5	16	7	42
Volume Right (vph)	13	34	5	13
Hadj (s)	-0.10	-0.13	0.01	0.04
Departure Headway (s)	5.2	5.1	4.9	4.5
Degree Utilization, x	0.09	0.17	0.10	0.57
Capacity (veh/h)	610	634	682	775
Control Delay (s)	8.7	9.1	8.5	13.3
Approach Delay (s)	8.7	9.1	8.5	13.3
Approach LOS	A	A	A	B

Intersection Summary			
Delay	11.7		
HCM Level of Service	B		
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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	145	56	12	105	14	0	60	21	0	350	30
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	158	61	13	114	15	0	65	23	0	380	33

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	236	142	88	413
Volume Left (vph)	17	13	0	0
Volume Right (vph)	61	15	23	33
Hadj (s)	-0.12	-0.03	-0.12	-0.01
Departure Headway (s)	5.4	5.6	5.5	5.1
Degree Utilization, x	0.35	0.22	0.13	0.58
Capacity (veh/h)	616	572	571	676
Control Delay (s)	11.3	10.2	9.4	15.0
Approach Delay (s)	11.3	10.2	9.4	15.0
Approach LOS	B	B	A	C

Intersection Summary			
Delay	12.7		
HCM Level of Service	B		
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	15	12	15	40	34	2	74	14	46	393	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			2%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	16	13	16	43	37	2	80	15	50	427	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)											450	
pX, platoon unblocked	0.89	0.89	0.89	0.89	0.89		0.89					
vC, conflicting volume	688	637	437	651	639	88	447			96		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	585	527	302	543	530	88	313			96		
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 %	98	96	98	96	89	96	100			97		
cM capacity (veh/h)	322	392	657	371	390	973	1107			1498		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	35	97	98	497
Volume Left	5	16	2	50
Volume Right	13	37	15	20
cSH	444	500	1107	1498
Volume to Capacity	0.08	0.19	0.00	0.03
Queue Length 95th (ft)	6	18	0	3
Control Delay (s)	13.8	13.9	0.2	1.1
Lane LOS	B	B	A	A
Approach Delay (s)	13.8	13.9	0.2	1.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	48.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	26	159	80	65	270	172	23	60	30	220	312	34
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		0%			5%			0%			0%	
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99			1.00	0.95	1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	0.98	1.00			1.00	1.00	1.00	1.00		0.99	1.00	1.00
Frt	1.00	0.95			1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1571	1419			1435	1326	1578	1329		1561	1417	1380
Flt Permitted	0.50	1.00			0.90	1.00	0.47	1.00		0.69	1.00	1.00
Satd. Flow (perm)	828	1419			1303	1326	780	1329		1140	1417	1380
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	28	173	87	71	293	187	25	65	33	239	339	37
RTOR Reduction (vph)	0	41	0	0	0	101	0	22	0	0	0	24
Lane Group Flow (vph)	28	220	0	0	364	86	25	76	0	239	339	13
Confl. Peds. (#/hr)	24		18	18		24	5		13	13		5
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	0	0	0	0	0
Parking (#/hr)		0			0			10			10	
Turn Type	Perm			Perm		Perm	Perm			Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	18.4	18.4			18.4	18.4	13.6	13.6		13.6	13.6	13.6
Effective Green, g (s)	18.4	18.4			18.4	18.4	13.6	13.6		13.6	13.6	13.6
Actuated g/C Ratio	0.46	0.46			0.46	0.46	0.34	0.34		0.34	0.34	0.34
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	381	653			599	610	265	452		388	482	469
v/s Ratio Prot		0.15						0.06			c0.24	
v/s Ratio Perm	0.03				c0.28	0.06	0.03			0.21		0.01
v/c Ratio	0.07	0.34			0.61	0.14	0.09	0.17		0.62	0.70	0.03
Uniform Delay, d1	6.0	6.9			8.1	6.2	9.0	9.2		11.0	11.5	8.8
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.3			4.5	0.5	0.2	0.2		2.9	4.6	0.0
Delay (s)	6.1	7.2			12.6	6.7	9.2	9.4		13.9	16.1	8.8
Level of Service	A	A			B	A	A	A		B	B	A
Approach Delay (s)		7.1			10.6			9.4			14.8	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Intersection Sign configuration not allowed in HCM analysis.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	84	1218	37	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1700	1700
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		1.00	0.95			
Frt		0.86	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		1627	3171			
Flt Permitted		1.00	1.00			
Satd. Flow (perm)		1627	3171			
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	91	1324	40	0	0
RTOR Reduction (vph)	0	16	3	0	0	0
Lane Group Flow (vph)	0	75	1361	0	0	0
Heavy Vehicles (%)	1%	1%	2%	2%	2%	2%
Parking (#/hr)			20			
Turn Type		custom				
Protected Phases			8			
Permitted Phases		6				
Actuated Green, G (s)		5.3	29.7			
Effective Green, g (s)		6.3	30.7			
Actuated g/C Ratio		0.14	0.68			
Clearance Time (s)		5.0	5.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		228	2163			
v/s Ratio Prot			c0.43			
v/s Ratio Perm		c0.05				
v/c Ratio		0.33	0.63			
Uniform Delay, d1		17.4	4.0			
Progression Factor		1.00	1.00			
Incremental Delay, d2		0.8	1.4			
Delay (s)		18.3	5.4			
Level of Service		B	A			
Approach Delay (s)	18.3		5.4			0.0
Approach LOS	B		A			A

Intersection Summary			
HCM Average Control Delay	6.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	200	0	984	2008	99
Sign Control	Yield			Free	Free	
Grade	0%			4%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	217	0	1070	2183	108
Pedestrians	46					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	4					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					560	
pX, platoon unblocked	0.38	0.38	0.38			
vC, conflicting volume	2817	1191	2336			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2522	0	1264			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	46	100			
cM capacity (veh/h)	9	400	201			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	217	535	535	1455	835
Volume Left	0	0	0	0	0
Volume Right	217	0	0	0	108
cSH	400	1700	1700	1700	1700
Volume to Capacity	0.54	0.31	0.31	0.86	0.49
Queue Length 95th (ft)	78	0	0	0	0
Control Delay (s)	24.2	0.0	0.0	0.0	0.0
Lane LOS	C				
Approach Delay (s)	24.2	0.0		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	0	330	12	137	1061	174	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-7%			0%			0%			0%	
Total Lost time (s)					4.0			4.0				
Lane Util. Factor					1.00			0.95				
Frpb, ped/bikes					1.00			1.00				
Flpb, ped/bikes					1.00			1.00				
Frt					1.00			0.98				
Flt Protected					1.00			1.00				
Satd. Flow (prot)					1399			2767				
Flt Permitted					1.00			1.00				
Satd. Flow (perm)					1399			2767				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	0	0	0	0	365	13	151	1173	192	0	0	0
RTOR Reduction (vph)	0	0	0	0	3	0	0	42	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	375	0	0	1474	0	0	0	0
Confl. Peds. (#/hr)			4			54	5		13			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	0	0	0	0	0
Parking (#/hr)					10			20				
Turn Type							Perm					
Protected Phases					6			8				
Permitted Phases							8					
Actuated Green, G (s)					14.6			20.4				
Effective Green, g (s)					15.6			21.4				
Actuated g/C Ratio					0.35			0.48				
Clearance Time (s)					5.0			5.0				
Vehicle Extension (s)					3.0			3.0				
Lane Grp Cap (vph)					485			1316				
v/s Ratio Prot					c0.27							
v/s Ratio Perm								0.53				
v/c Ratio					0.77			1.12				
Uniform Delay, d1					13.1			11.8				
Progression Factor					1.00			0.84				
Incremental Delay, d2					7.5			63.0				
Delay (s)					20.6			72.9				
Level of Service					C			E				
Approach Delay (s)		0.0			20.6			72.9			0.0	
Approach LOS		A			C			E			A	

Intersection Summary			
HCM Average Control Delay	62.5	HCM Level of Service	E
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.8%	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)	35	0	19	1054	0	0
Sign Control	Stop			Free	Free	
Grade	-8%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	39	0	21	1165	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				450	350	
pX, platoon unblocked	0.65					
vC, conflicting volume	624	0	0			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0	0	0			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	100	99			
cM capacity (veh/h)	658	1088	1622			

Direction, Lane #	EB 1	NB 1	NB 2
Volume Total	39	409	777
Volume Left	39	21	0
Volume Right	0	0	0
cSH	658	1622	1700
Volume to Capacity	0.06	0.01	0.46
Queue Length 95th (ft)	5	1	0
Control Delay (s)	10.8	0.5	0.0
Lane LOS	B	A	
Approach Delay (s)	10.8	0.2	
Approach LOS	B		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	44.8%	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 (vph)	35	70	0	0	105	15	75	903	111	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-11%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			1.00			1.00				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.98				
Flt Protected		0.98			1.00			1.00				
Satd. Flow (prot)		1484			1401			2782				
Flt Permitted		0.86			1.00			1.00				
Satd. Flow (perm)		1294			1401			2782				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	39	77	0	0	116	17	83	998	123	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	14	0	0	0	0
Lane Group Flow (vph)	0	116	0	0	120	0	0	1190	0	0	0	0
Confl. Peds. (#/hr)			53			21	14		11			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		10			10			20				
Turn Type	Perm						Perm					
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		9.2			9.2			25.8				
Effective Green, g (s)		10.2			10.2			26.8				
Actuated g/C Ratio		0.23			0.23			0.60				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		293			318			1657				
v/s Ratio Prot					0.09							
v/s Ratio Perm		c0.09						0.43				
v/c Ratio		0.40			0.38			0.72				
Uniform Delay, d1		14.8			14.7			6.4				
Progression Factor		0.82			1.00			2.10				
Incremental Delay, d2		0.7			0.8			0.2				
Delay (s)		12.9			15.5			13.8				
Level of Service		B			B			B				
Approach Delay (s)		12.9			15.5			13.8			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	50	0	0	7	9	59	875	19	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		-8%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	28	55	0	0	8	10	65	967	21	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								460			460	
pX, platoon unblocked	0.85	0.85		0.85	0.85	0.85				0.85		
vC, conflicting volume	628	1119	0	1136	1108	494	0			988		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	215	791	0	811	778	58	0			638		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	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	79	100	100	97	99	96			100		
cM capacity (veh/h)	580	265	1088	189	268	851	1622			802		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2
Volume Total	83	18	549	505
Volume Left	28	0	65	0
Volume Right	0	10	0	21
cSH	323	436	1622	1700
Volume to Capacity	0.26	0.04	0.04	0.30
Queue Length 95th (ft)	25	3	3	0
Control Delay (s)	19.9	13.6	1.2	0.0
Lane LOS	C	B	A	
Approach Delay (s)	19.9	13.6	0.6	
Approach LOS	C	B		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	49.1%	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 (vph)	42	27	0	0	158	78	95	759	50	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-7%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			0.98			1.00				
Flpb, ped/bikes		1.00			1.00			0.99				
Frt		1.00			0.96			0.99				
Flt Protected		0.97			1.00			0.99				
Satd. Flow (prot)		1437			1343			2773				
Flt Permitted		0.73			1.00			0.99				
Satd. Flow (perm)		1084			1343			2773				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	46	30	0	0	175	86	105	839	55	0	0	0
RTOR Reduction (vph)	0	0	0	0	45	0	0	8	0	0	0	0
Lane Group Flow (vph)	0	76	0	0	216	0	0	991	0	0	0	0
Confl. Peds. (#/hr)			48			50	60		50			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		10			10			20				
Turn Type	Perm						Perm					
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		11.6			11.6			23.4				
Effective Green, g (s)		12.6			12.6			24.4				
Actuated g/C Ratio		0.28			0.28			0.54				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		304			376			1504				
v/s Ratio Prot					c0.16							
v/s Ratio Perm		0.07						0.36				
v/c Ratio		0.25			0.57			0.66				
Uniform Delay, d1		12.5			13.9			7.3				
Progression Factor		1.07			1.00			1.51				
Incremental Delay, d2		0.4			2.1			1.7				
Delay (s)		13.9			16.0			12.7				
Level of Service		B			B			B				
Approach Delay (s)		13.9			16.0			12.7			0.0	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	13.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.1%	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)	55	70	0	0	84	11	123	579	49	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-7%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			0.99			1.00				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.98			0.99				
Flt Protected		0.98			1.00			0.99				
Satd. Flow (prot)		1449			1647			2781				
Flt Permitted		0.82			1.00			0.99				
Satd. Flow (perm)		1220			1647			2781				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	61	77	0	0	93	12	136	640	54	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	9	0	0	0	0
Lane Group Flow (vph)	0	138	0	0	96	0	0	821	0	0	0	0
Confl. Peds. (#/hr)			94			49	18		13			
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		10						20				
Turn Type	Perm						Perm					
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		10.2			10.2			24.8				
Effective Green, g (s)		11.2			11.2			25.8				
Actuated g/C Ratio		0.25			0.25			0.57				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		304			410			1594				
v/s Ratio Prot					0.06							
v/s Ratio Perm		c0.11						0.30				
v/c Ratio		0.45			0.23			0.52				
Uniform Delay, d1		14.3			13.5			5.8				
Progression Factor		0.88			1.00			1.15				
Incremental Delay, d2		0.9			0.3			0.9				
Delay (s)		13.5			13.8			7.6				
Level of Service		B			B			A				
Approach Delay (s)		13.5			13.8			7.6			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	9.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	45	0	0	48	15	86	502	55	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		-6%			0%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0				
Lane Util. Factor		1.00			1.00			0.95				
Frpb, ped/bikes		1.00			0.99			1.00				
Flpb, ped/bikes		1.00			1.00			1.00				
Frt		1.00			0.97			0.99				
Flt Protected		0.99			1.00			0.99				
Satd. Flow (prot)		1432			1610			2774				
Flt Permitted		0.91			1.00			0.99				
Satd. Flow (perm)		1320			1610			2774				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	17	50	0	0	53	17	95	555	61	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	10	0	0	0	0
Lane Group Flow (vph)	0	67	0	0	56	0	0	701	0	0	0	0
Confl. Peds. (#/hr)			44			30	17		21			17
Heavy Vehicles (%)	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	4	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		10						20				
Turn Type	Perm						Perm					
Protected Phases		2			6			8				
Permitted Phases	2						8					
Actuated Green, G (s)		7.7			7.7			27.3				
Effective Green, g (s)		8.7			8.7			28.3				
Actuated g/C Ratio		0.19			0.19			0.63				
Clearance Time (s)		5.0			5.0			5.0				
Vehicle Extension (s)		3.0			3.0			3.0				
Lane Grp Cap (vph)		255			311			1745				
v/s Ratio Prot					0.03							
v/s Ratio Perm		c0.05						0.25				
v/c Ratio		0.26			0.18			0.40				
Uniform Delay, d1		15.4			15.2			4.1				
Progression Factor		1.02			1.00			1.26				
Incremental Delay, d2		0.4			0.3			0.6				
Delay (s)		16.1			15.5			5.8				
Level of Service		B			B			A				
Approach Delay (s)		16.1			15.5			5.8			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	167	0	0	190	336	193
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Grade (%)	-10%			0%	0%	
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	1.00			0.95	1.00	1.00
Frpb, ped/bikes	1.00			1.00	1.00	0.93
Flpb, ped/bikes	1.00			1.00	1.00	1.00
Frt	1.00			1.00	1.00	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	1750			3167	1267	1029
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	1750			3167	1267	1029
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	185	0	0	210	371	213
RTOR Reduction (vph)	0	0	0	0	0	90
Lane Group Flow (vph)	185	0	0	210	371	123
Confl. Peds. (#/hr)		51				36
Bus Blockages (#/hr)	0	0	0	0	0	6
Parking (#/hr)					20	20
Turn Type						Perm
Protected Phases	2			6	8	
Permitted Phases						8
Actuated Green, G (s)	10.0			10.0	25.0	25.0
Effective Green, g (s)	11.0			11.0	26.0	26.0
Actuated g/C Ratio	0.24			0.24	0.58	0.58
Clearance Time (s)	5.0			5.0	5.0	5.0
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Lane Grp Cap (vph)	428			774	732	595
v/s Ratio Prot	c0.11			0.07	c0.29	
v/s Ratio Perm						0.12
v/c Ratio	0.43			0.27	0.51	0.21
Uniform Delay, d1	14.4			13.8	5.7	4.6
Progression Factor	0.91			1.00	0.92	1.95
Incremental Delay, d2	0.7			0.2	2.3	0.7
Delay (s)	13.7			13.9	7.6	9.6
Level of Service	B			B	A	A
Approach Delay (s)	13.7			13.9	8.3	
Approach LOS	B			B	A	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	41.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	410	50	7	0	1069	0	0	1853	8
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	11	11	12	10	10	10	10	10	10
Grade (%)		0%			7%			0%			0%	
Total Lost time (s)				4.0	4.0			4.0			4.0	
Lane Util. Factor				0.95	0.95			0.95			0.95	
Frpb, ped/bikes				1.00	1.00			1.00			1.00	
Flpb, ped/bikes				0.99	0.99			1.00			1.00	
Frt				1.00	1.00			1.00			1.00	
Flt Protected				0.95	0.96			1.00			1.00	
Satd. Flow (prot)				1368	1193			2639			2635	
Flt Permitted				0.95	0.96			1.00			1.00	
Satd. Flow (perm)				1368	1193			2639			2635	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	0	0	0	453	55	8	0	1182	0	0	2048	9
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	258	256	0	0	1182	0	0	2057	0
Confl. Peds. (#/hr)				7		49			6			58
Bus Blockages (#/hr)	0	0	0	4	0	0	0	4	0	0	4	0
Parking (#/hr)					10			20			20	
Turn Type				Perm								
Protected Phases					6			8			4	
Permitted Phases				6								
Actuated Green, G (s)				20.0	20.0			60.0			60.0	
Effective Green, g (s)				21.0	21.0			61.0			61.0	
Actuated g/C Ratio				0.23	0.23			0.68			0.68	
Clearance Time (s)				5.0	5.0			5.0			5.0	
Vehicle Extension (s)				3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)				319	278			1789			1786	
v/s Ratio Prot								0.45			c0.78	
v/s Ratio Perm				0.19	0.22							
v/c Ratio				0.81	0.92			0.66			1.15	
Uniform Delay, d1				32.6	33.7			8.5			14.5	
Progression Factor				0.86	0.85			1.00			0.48	
Incremental Delay, d2				11.1	24.1			0.9			69.9	
Delay (s)				39.1	52.6			9.4			76.9	
Level of Service				D	D			A			E	
Approach Delay (s)		0.0			45.8			9.4			76.9	
Approach LOS		A			D			A			E	

Intersection Summary			
HCM Average Control Delay	51.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	10	305	18	0	2	0	1044	32	0	1538	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-7%			8%			0%			0%	
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		0.95			0.95	
Frpb, ped/bikes	1.00	0.98		1.00		0.97		1.00			1.00	
Flpb, ped/bikes	0.98	1.00		1.00		1.00		1.00			1.00	
Frt	1.00	0.85		1.00		0.85		1.00			1.00	
Flt Protected	0.95	1.00		0.95		1.00		1.00			1.00	
Satd. Flow (prot)	1621	1238		1528		1330		2625			2639	
Flt Permitted	0.95	1.00		0.30		1.00		1.00			1.00	
Satd. Flow (perm)	1621	1238		477		1330		2625			2639	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	6	11	337	20	0	2	0	1154	35	0	1700	0
RTOR Reduction (vph)	0	18	0	0	0	1	0	2	0	0	0	0
Lane Group Flow (vph)	6	330	0	20	0	1	0	1187	0	0	1700	0
Confl. Peds. (#/hr)	15		8	8		15			3			29
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			custom		custom						
Protected Phases		2						8			4	
Permitted Phases	2			6		6						
Actuated Green, G (s)	24.0	24.0		24.0		24.0		56.0			56.0	
Effective Green, g (s)	25.0	25.0		25.0		25.0		57.0			57.0	
Actuated g/C Ratio	0.28	0.28		0.28		0.28		0.63			0.63	
Clearance Time (s)	5.0	5.0		5.0		5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0		3.0		3.0			3.0	
Lane Grp Cap (vph)	450	344		133		369		1663			1671	
v/s Ratio Prot		c0.27						0.45			c0.64	
v/s Ratio Perm	0.00			0.04		0.00						
v/c Ratio	0.01	0.96		0.15		0.00		0.71			1.02	
Uniform Delay, d1	23.6	32.0		24.5		23.5		11.0			16.5	
Progression Factor	1.00	1.00		0.73		0.75		0.41			0.44	
Incremental Delay, d2	0.0	37.3		0.0		0.0		1.1			20.4	
Delay (s)	23.6	69.3		17.8		17.5		5.6			27.6	
Level of Service	C	E		B		B		A			C	
Approach Delay (s)		68.5			17.8			5.6			27.6	
Approach LOS		E			B			A			C	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.1%	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)	8	50	114	109	57	11	0	990	61	0	1313	30
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-6%			11%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.97			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.99			1.00			1.00	
Frt		0.91			0.99			0.99			1.00	
Flt Protected		1.00			0.97			1.00			1.00	
Satd. Flow (prot)		1295			1278			2597			2626	
Flt Permitted		0.98			0.61			1.00			1.00	
Satd. Flow (perm)		1278			801			2597			2626	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	9	55	126	120	63	12	0	1094	67	0	1451	33
RTOR Reduction (vph)	0	29	0	0	3	0	0	4	0	0	1	0
Lane Group Flow (vph)	0	161	0	0	192	0	0	1157	0	0	1483	0
Confl. Peds. (#/hr)	32		27	27		32			35			16
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		23.0			23.0			57.0			57.0	
Effective Green, g (s)		24.0			24.0			58.0			58.0	
Actuated g/C Ratio		0.27			0.27			0.64			0.64	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		341			214			1674			1692	
v/s Ratio Prot								0.45			c0.56	
v/s Ratio Perm		0.13			c0.24							
v/c Ratio		0.47			0.90			0.69			0.88	
Uniform Delay, d1		27.7			31.8			10.3			13.1	
Progression Factor		1.00			0.85			0.31			0.70	
Incremental Delay, d2		1.0			32.5			0.9			3.8	
Delay (s)		28.7			59.4			4.1			12.9	
Level of Service		C			E			A			B	
Approach Delay (s)		28.7			59.4			4.1			12.9	
Approach LOS		C			E			A			B	

Intersection Summary			
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	8	15	30	45	15	6	0	949	60	0	1267	20
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-5%			8%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.98			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.98			1.00			1.00	
Frt		0.92			0.99			0.99			1.00	
Flt Protected		0.99			0.97			1.00			1.00	
Satd. Flow (prot)		1314			1287			2413			2438	
Flt Permitted		0.96			0.80			1.00			1.00	
Satd. Flow (perm)		1277			1065			2413			2438	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	9	17	33	50	17	7	0	1049	66	0	1400	22
RTOR Reduction (vph)	0	25	0	0	4	0	0	5	0	0	1	0
Lane Group Flow (vph)	0	34	0	0	70	0	0	1110	0	0	1421	0
Confl. Peds. (#/hr)	15		19	19		15			23			21
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	40	0	0	40	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		20.0			20.0			60.0			60.0	
Effective Green, g (s)		21.0			21.0			61.0			61.0	
Actuated g/C Ratio		0.23			0.23			0.68			0.68	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		298			249			1635			1652	
v/s Ratio Prot								0.46			c0.58	
v/s Ratio Perm		0.03			c0.07							
v/c Ratio		0.11			0.28			0.68			0.86	
Uniform Delay, d1		27.2			28.3			8.7			11.2	
Progression Factor		1.00			0.89			0.18			0.37	
Incremental Delay, d2		0.8			2.2			0.8			4.0	
Delay (s)		27.9			27.5			2.4			8.1	
Level of Service		C			C			A			A	
Approach Delay (s)		27.9			27.5			2.4			8.1	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	35	42	142	85	16	0	929	34	0	1106	24
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-4%			7%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.97			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.98			1.00			1.00	
Frt		0.94			0.99			0.99			1.00	
Flt Protected		0.99			0.97			1.00			1.00	
Satd. Flow (prot)		1313			1291			2609			2623	
Flt Permitted		0.96			0.78			1.00			1.00	
Satd. Flow (perm)		1265			1032			2609			2623	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	11	39	46	157	94	18	0	1027	38	0	1222	27
RTOR Reduction (vph)	0	28	0	0	3	0	0	2	0	0	2	0
Lane Group Flow (vph)	0	68	0	0	266	0	0	1063	0	0	1247	0
Confl. Peds. (#/hr)	44		37	37		44			51			37
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		26.9			26.9			53.1			53.1	
Effective Green, g (s)		27.9			27.9			54.1			54.1	
Actuated g/C Ratio		0.31			0.31			0.60			0.60	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		392			320			1568			1577	
v/s Ratio Prot								0.41			c0.48	
v/s Ratio Perm		0.05			c0.26							
v/c Ratio		0.17			0.83			0.68			0.79	
Uniform Delay, d1		22.6			28.8			12.1			13.7	
Progression Factor		1.00			0.90			1.18			0.59	
Incremental Delay, d2		0.2			14.0			0.9			3.2	
Delay (s)		22.8			39.8			15.1			11.3	
Level of Service		C			D			B			B	
Approach Delay (s)		22.8			39.8			15.1			11.3	
Approach LOS		C			D			B			B	

Intersection Summary			
HCM Average Control Delay	16.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.0%	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)	50	65	91	83	98	13	0	889	66	0	956	33
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-7%			7%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.96			1.00			0.99			1.00	
Flpb, ped/bikes		0.99			0.98			1.00			1.00	
Frt		0.94			0.99			0.99			1.00	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1307			1383			2598			2619	
Flt Permitted		0.87			0.70			1.00			1.00	
Satd. Flow (perm)		1156			989			2598			2619	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	55	72	101	92	108	14	0	983	73	0	1057	36
RTOR Reduction (vph)	0	36	0	0	3	0	0	5	0	0	2	0
Lane Group Flow (vph)	0	192	0	0	211	0	0	1051	0	0	1091	0
Confl. Peds. (#/hr)	43		63	63		43			19			20
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	4	0	0	4	0
Parking (#/hr)		10			0			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		22.4			22.4			57.6			57.6	
Effective Green, g (s)		23.4			23.4			58.6			58.6	
Actuated g/C Ratio		0.26			0.26			0.65			0.65	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		301			257			1692			1705	
v/s Ratio Prot								0.40			c0.42	
v/s Ratio Perm		0.17			c0.21							
v/c Ratio		0.64			0.82			0.62			0.64	
Uniform Delay, d1		29.5			31.3			9.2			9.4	
Progression Factor		1.00			0.94			0.64			0.27	
Incremental Delay, d2		4.4			17.7			0.5			1.5	
Delay (s)		33.9			47.1			6.4			4.1	
Level of Service		C			D			A			A	
Approach Delay (s)		33.9			47.1			6.4			4.1	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	11.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.6%	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)	7	6	62	84	50	6	0	890	62	0	843	30
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-2%			6%			0%			0%	
Total Lost time (s)		4.0			4.0			4.0			4.0	
Lane Util. Factor		1.00			1.00			0.95			0.95	
Frpb, ped/bikes		0.94			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			0.97			1.00			1.00	
Frt		0.89			0.99			0.99			0.99	
Flt Protected		1.00			0.97			1.00			1.00	
Satd. Flow (prot)		1198			1272			2598			2622	
Flt Permitted		0.98			0.79			1.00			1.00	
Satd. Flow (perm)		1175			1032			2598			2622	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	8	7	69	93	55	7	0	984	69	0	932	33
RTOR Reduction (vph)	0	47	0	0	2	0	0	6	0	0	3	0
Lane Group Flow (vph)	0	37	0	0	153	0	0	1047	0	0	962	0
Confl. Peds. (#/hr)	14		48	48		14			22			4
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	4	0	0	4	0
Parking (#/hr)		10			10			20			20	
Turn Type	Perm			Perm								
Protected Phases		2			6			8			4	
Permitted Phases	2			6								
Actuated Green, G (s)		28.0			28.0			52.0			52.0	
Effective Green, g (s)		29.0			29.0			53.0			53.0	
Actuated g/C Ratio		0.32			0.32			0.59			0.59	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		379			333			1530			1544	
v/s Ratio Prot								c0.40			0.37	
v/s Ratio Perm		0.03			c0.15							
v/c Ratio		0.10			0.46			0.68			0.62	
Uniform Delay, d1		21.3			24.3			12.7			12.0	
Progression Factor		1.00			1.04			0.57			2.18	
Incremental Delay, d2		0.5			4.4			1.0			0.2	
Delay (s)		21.9			29.7			8.3			26.4	
Level of Service		C			C			A			C	
Approach Delay (s)		21.9			29.7			8.3			26.4	
Approach LOS		C			C			A			C	

Intersection Summary			
HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	66	96	247	130	174	222	308	554	41	30	481	25
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	12	12	12	12	12	12	10	10	10	10	10	10
Grade (%)		-5%			10%			0%			0%	
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.90	1.00	1.00	0.89	1.00	1.00	0.90	1.00	1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1639	1553	1316	1519	1416	1212	1478	1225	1190	1478	1225	1219
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1639	1553	1316	1519	1416	1212	1478	1225	1190	1478	1225	1219
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	73	106	273	144	192	245	340	612	45	33	532	28
RTOR Reduction (vph)	0	0	238	0	0	191	0	0	7	0	0	7
Lane Group Flow (vph)	73	106	35	144	192	54	340	612	38	33	532	21
Confl. Peds. (#/hr)			30			32			29			21
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	4	0	0	4	0
Parking (#/hr)		0			0			20			20	
Turn Type	Split		Perm	Split		Perm	Prot		Perm	Prot		Perm
Protected Phases	2	2		6	6		3	8		7	4	
Permitted Phases			2			6			8			4
Actuated Green, G (s)	11.4	11.4	11.4	20.0	20.0	20.0	17.0	40.2	40.2	2.4	25.6	25.6
Effective Green, g (s)	11.4	11.4	11.4	20.0	20.0	20.0	17.0	40.2	40.2	2.4	25.6	25.6
Actuated g/C Ratio	0.13	0.13	0.13	0.22	0.22	0.22	0.19	0.45	0.45	0.03	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	208	197	167	338	315	269	279	547	532	39	348	347
v/s Ratio Prot	0.04	c0.07		0.09	c0.14		c0.23	0.50		0.02	c0.43	
v/s Ratio Perm			0.03			0.04			0.03			0.02
v/c Ratio	0.35	0.54	0.21	0.43	0.61	0.20	1.22	1.12	0.07	0.85	1.53	0.06
Uniform Delay, d1	35.9	36.8	35.2	30.1	31.5	28.5	36.5	24.9	14.2	43.6	32.2	23.4
Progression Factor	1.00	1.00	1.00	0.97	0.97	1.37	1.01	0.40	0.28	1.00	1.00	1.00
Incremental Delay, d2	1.0	2.8	0.6	3.7	8.0	1.6	119.9	70.6	0.0	84.9	252.0	0.1
Delay (s)	36.9	39.6	35.9	32.9	38.5	40.6	156.8	80.4	4.1	128.5	284.2	23.5
Level of Service	D	D	D	C	D	D	F	F	A	F	F	C
Approach Delay (s)		36.9			38.0			103.0			263.3	
Approach LOS		D			D			F			F	

Intersection Summary			
HCM Average Control Delay	113.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	15	0	0	15	35	8	1	25	0	0	5	13
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	17	0	0	17	39	9	1	28	0	0	6	14

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total (vph)	17	0	64	29	20
Volume Left (vph)	17	0	17	1	0
Volume Right (vph)	0	0	9	0	14
Hadj (s)	0.52	0.00	-0.01	0.04	-0.40
Departure Headway (s)	5.2	4.6	4.1	4.1	3.7
Degree Utilization, x	0.02	0.00	0.07	0.03	0.02
Capacity (veh/h)	685	774	862	841	943
Control Delay (s)	7.1	6.4	7.4	7.3	6.8
Approach Delay (s)	7.1		7.4	7.3	6.8
Approach LOS	A		A	A	A

Intersection Summary			
Delay	7.3		
HCM Level of Service	A		
Intersection Capacity Utilization	20.4%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection Sign configuration not allowed in HCM analysis.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	2	20	10	10	52	25	2	26	2	157	234	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	22	11	11	57	28	2	29	2	174	259	6

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	35	96	33	438
Volume Left (vph)	2	11	2	174
Volume Right (vph)	11	28	2	6
Hadj (s)	-0.16	-0.13	0.01	0.11
Departure Headway (s)	5.0	4.9	4.7	4.4
Degree Utilization, x	0.05	0.13	0.04	0.53
Capacity (veh/h)	647	665	715	798
Control Delay (s)	8.2	8.7	7.9	12.3
Approach Delay (s)	8.2	8.7	7.9	12.3
Approach LOS	A	A	A	B

Intersection Summary			
Delay	11.2		
HCM Level of Service	B		
Intersection Capacity Utilization	49.5%	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)	2	25	27	6	9	20	3	45	5	23	368	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			5%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	28	30	7	10	22	3	50	6	25	407	3
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	545	521	408	562	520	52	410			55		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	545	521	408	562	520	52	410			55		
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 %	99	94	95	98	98	98	100			98		
cM capacity (veh/h)	427	452	645	393	452	1018	1149			1550		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	60	39	59	435
Volume Left	2	7	3	25
Volume Right	30	22	6	3
cSH	530	638	1149	1550
Volume to Capacity	0.11	0.06	0.00	0.02
Queue Length 95th (ft)	9	5	0	1
Control Delay (s)	12.6	11.0	0.5	0.6
Lane LOS	B	B	A	A
Approach Delay (s)	12.6	11.0	0.5	0.6
Approach LOS	B	B		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	5	37	12	15	62	31	6	56	5	39	367	12
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	41	13	17	69	34	7	62	6	43	406	13

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	60	119	74	462
Volume Left (vph)	6	17	7	43
Volume Right (vph)	13	34	6	13
Hadj (s)	-0.10	-0.13	0.01	0.04
Departure Headway (s)	5.3	5.1	4.9	4.5
Degree Utilization, x	0.09	0.17	0.10	0.58
Capacity (veh/h)	606	630	678	773
Control Delay (s)	8.8	9.2	8.5	13.5
Approach Delay (s)	8.8	9.2	8.5	13.5
Approach LOS	A	A	A	B

Intersection Summary			
Delay	11.9		
HCM Level of Service	B		
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	16	145	56	12	105	14	0	60	21	0	350	30
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	18	160	62	13	116	15	0	66	23	0	387	33

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	240	145	90	420
Volume Left (vph)	18	13	0	0
Volume Right (vph)	62	15	23	33
Hadj (s)	-0.12	-0.03	-0.12	-0.01
Departure Headway (s)	5.4	5.7	5.6	5.1
Degree Utilization, x	0.36	0.23	0.14	0.60
Capacity (veh/h)	611	567	565	671
Control Delay (s)	11.4	10.3	9.4	15.5
Approach Delay (s)	11.4	10.3	9.4	15.5
Approach LOS	B	B	A	C

Intersection Summary			
Delay	12.9		
HCM Level of Service	B		
Intersection Capacity Utilization	48.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	15	12	15	40	34	2	74	14	46	393	18
Sign Control		Stop			Stop			Free			Free	
Grade		0%			2%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	17	13	17	44	38	2	82	15	51	434	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)											450	
pX, platoon unblocked	0.88	0.88	0.88	0.88	0.88		0.88					
vC, conflicting volume	700	648	444	662	650	90	454			97		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	593	534	303	549	536	90	314			97		
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 %	98	96	98	95	88	96	100			97		
cM capacity (veh/h)	315	386	652	364	384	971	1099			1496		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	35	98	99	505
Volume Left	6	17	2	51
Volume Right	13	38	15	20
cSH	437	494	1099	1496
Volume to Capacity	0.08	0.20	0.00	0.03
Queue Length 95th (ft)	7	18	0	3
Control Delay (s)	14.0	14.1	0.2	1.1
Lane LOS	B	B	A	A
Approach Delay (s)	14.0	14.1	0.2	1.1
Approach LOS	B	B		

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	49.9%	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 (vph)	26	159	80	65	270	172	23	60	30	220	312	34
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Grade (%)		0%			5%			0%			0%	
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.99			1.00	0.95	1.00	0.99		1.00	1.00	0.97
Flpb, ped/bikes	0.98	1.00			1.00	1.00	1.00	1.00		0.99	1.00	1.00
Frt	1.00	0.95			1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00			0.99	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1572	1419			1435	1326	1578	1330		1561	1417	1380
Flt Permitted	0.49	1.00			0.90	1.00	0.46	1.00		0.69	1.00	1.00
Satd. Flow (perm)	816	1419			1301	1326	769	1330		1139	1417	1380
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	29	176	88	72	298	190	25	66	33	243	345	38
RTOR Reduction (vph)	0	41	0	0	0	103	0	22	0	0	0	25
Lane Group Flow (vph)	29	223	0	0	370	87	25	77	0	243	345	13
Confl. Peds. (#/hr)	24		18	18		24	5		13	13		5
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	4	0	0	0	0	0	0	0
Parking (#/hr)		0			0			10			10	
Turn Type	Perm			Perm		Perm	Perm			Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6		6	8			4		4
Actuated Green, G (s)	18.3	18.3			18.3	18.3	13.7	13.7		13.7	13.7	13.7
Effective Green, g (s)	18.3	18.3			18.3	18.3	13.7	13.7		13.7	13.7	13.7
Actuated g/C Ratio	0.46	0.46			0.46	0.46	0.34	0.34		0.34	0.34	0.34
Clearance Time (s)	4.0	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	3.0
Lane Grp Cap (vph)	373	649			595	607	263	456		390	485	473
v/s Ratio Prot		0.16						0.06			c0.24	
v/s Ratio Perm	0.04				c0.28	0.07	0.03			0.21		0.01
v/c Ratio	0.08	0.34			0.62	0.14	0.10	0.17		0.62	0.71	0.03
Uniform Delay, d1	6.1	7.0			8.2	6.3	8.9	9.2		11.0	11.4	8.7
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	0.1	0.3			4.8	0.5	0.2	0.2		3.1	4.9	0.0
Delay (s)	6.2	7.3			13.1	6.8	9.1	9.4		14.1	16.3	8.8
Level of Service	A	A			B	A	A	A		B	B	A
Approach Delay (s)		7.2			10.9			9.3			15.0	
Approach LOS		A			B			A			B	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Intersection Sign configuration not allowed in HCM analysis.

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	84	1288	37	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1700	1700
Total Lost time (s)		4.0	4.0			
Lane Util. Factor		1.00	0.95			
Frt		0.86	1.00			
Flt Protected		1.00	1.00			
Satd. Flow (prot)		1627	3172			
Flt Permitted		1.00	1.00			
Satd. Flow (perm)		1627	3172			
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor (vph)	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	0	93	1424	41	0	0
RTOR Reduction (vph)	0	12	3	0	0	0
Lane Group Flow (vph)	0	81	1462	0	0	0
Heavy Vehicles (%)	1%	1%	2%	2%	2%	2%
Parking (#/hr)			20			
Turn Type		custom				
Protected Phases			8			
Permitted Phases		6				
Actuated Green, G (s)		5.3	29.7			
Effective Green, g (s)		6.3	30.7			
Actuated g/C Ratio		0.14	0.68			
Clearance Time (s)		5.0	5.0			
Vehicle Extension (s)		3.0	3.0			
Lane Grp Cap (vph)		228	2164			
v/s Ratio Prot			c0.46			
v/s Ratio Perm		c0.05				
v/c Ratio		0.36	0.68			
Uniform Delay, d1		17.5	4.2			
Progression Factor		1.00	1.00			
Incremental Delay, d2		1.0	1.7			
Delay (s)		18.5	5.9			
Level of Service		B	A			
Approach Delay (s)	18.5		5.9			0.0
Approach LOS	B		A			A

Intersection Summary			
HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	210	0	1069	2164	99
Sign Control	Yield			Free	Free	
Grade	0%			4%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	232	0	1182	2392	109
Pedestrians	46					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	4					
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					560	
pX, platoon unblocked	0.38	0.38	0.38			
vC, conflicting volume	3083	1297	2547			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3218	0	1816			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	42	100			
cM capacity (veh/h)	3	400	123			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	232	591	591	1595	907
Volume Left	0	0	0	0	0
Volume Right	232	0	0	0	109
cSH	400	1700	1700	1700	1700
Volume to Capacity	0.58	0.35	0.35	0.94	0.53
Queue Length 95th (ft)	89	0	0	0	0
Control Delay (s)	25.7	0.0	0.0	0.0	0.0
Lane LOS	D				
Approach Delay (s)	25.7	0.0		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	86.6%	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)	48	964	42	95	586	92	82	189	117	97	86	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00		0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1770	3539	1554	1770	3539	1530	1756	1863	1547		3380	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.61	1.00	1.00		0.75	
Satd. Flow (perm)	1770	3539	1554	1770	3539	1530	1133	1863	1547		2608	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	52	1048	46	103	637	100	89	205	127	105	93	24
RTOR Reduction (vph)	0	0	29	0	0	55	0	0	82	0	14	0
Lane Group Flow (vph)	52	1048	17	103	637	45	89	205	45	0	208	0
Confl. Peds. (#/hr)	6		6	6		6	11		12	12		11
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2			6	4		4	4		
Actuated Green, G (s)	3.0	23.0	23.0	4.8	24.8	24.8	22.2	22.2	22.2		22.2	
Effective Green, g (s)	4.0	24.0	24.0	5.8	25.8	25.8	23.2	23.2	23.2		23.2	
Actuated g/C Ratio	0.06	0.37	0.37	0.09	0.40	0.40	0.36	0.36	0.36		0.36	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	109	1307	574	158	1405	607	404	665	552		931	
v/s Ratio Prot	0.03	c0.30		c0.06	0.18			c0.11				
v/s Ratio Perm			0.01			0.03	0.08		0.03		0.08	
v/c Ratio	0.48	0.80	0.03	0.65	0.45	0.07	0.22	0.31	0.08		0.22	
Uniform Delay, d1	29.5	18.4	13.1	28.6	14.4	12.2	14.6	15.1	13.8		14.6	
Progression Factor	1.00	1.00	1.00	0.89	1.49	2.93	1.00	1.00	1.00		1.00	
Incremental Delay, d2	3.3	5.3	0.1	8.9	1.0	0.2	1.3	1.2	0.3		0.6	
Delay (s)	32.8	23.6	13.2	34.5	22.5	35.9	15.8	16.3	14.1		15.2	
Level of Service	C	C	B	C	C	D	B	B	B		B	
Approach Delay (s)		23.6			25.6			15.6			15.2	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.2%	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)	64	1006	61	109	665	29	68	33	194	57	10	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1770	3539	1546	1770	3511			1793	1583		1739	
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.79	1.00		0.75	
Satd. Flow (perm)	1770	3539	1546	1770	3511			1455	1583		1345	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	1093	66	118	723	32	74	36	211	62	11	22
RTOR Reduction (vph)	0	0	27	0	4	0	0	0	170	0	18	0
Lane Group Flow (vph)	70	1093	39	118	751	0	0	110	41	0	77	0
Confl. Peds. (#/hr)	9		2	2		9	10					10
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2				4		4	4		
Actuated Green, G (s)	4.4	31.4	31.4	7.1	34.1			11.5	11.5		11.5	
Effective Green, g (s)	5.4	32.4	32.4	8.1	35.1			12.5	12.5		12.5	
Actuated g/C Ratio	0.08	0.50	0.50	0.12	0.54			0.19	0.19		0.19	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0			5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	147	1764	771	221	1896			280	304		259	
v/s Ratio Prot	0.04	c0.31		c0.07	c0.21							
v/s Ratio Perm			0.03					c0.08	0.03		0.06	
v/c Ratio	0.48	0.62	0.05	0.53	0.40			0.39	0.14		0.30	
Uniform Delay, d1	28.4	11.8	8.4	26.7	8.7			22.9	21.8		22.5	
Progression Factor	0.69	1.89	2.97	1.18	0.84			1.00	1.00		1.00	
Incremental Delay, d2	1.8	1.2	0.1	2.4	0.6			0.9	0.2		0.6	
Delay (s)	21.5	23.6	25.0	33.9	8.0			23.8	22.0		23.1	
Level of Service	C	C	C	C	A			C	C		C	
Approach Delay (s)		23.6			11.5			22.6			23.1	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	1122	24	65	749	65	21	25	117	39	10	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.95		1.00	0.98		0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.98	
Satd. Flow (prot)	1770	3539	1535	1770	3539	1508		1815	1552		1707	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.85	1.00		0.83	
Satd. Flow (perm)	1770	3539	1535	1770	3539	1508		1573	1552		1455	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	67	1220	26	71	814	71	23	27	127	42	11	32
RTOR Reduction (vph)	0	0	6	0	0	23	0	0	106	0	27	0
Lane Group Flow (vph)	67	1220	20	71	814	48	0	50	21	0	58	0
Confl. Peds. (#/hr)	12		6	6		12	10		10	10		10
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2			6	4		4	4		
Actuated Green, G (s)	4.2	34.4	34.4	5.6	35.8	35.8		10.0	10.0		10.0	
Effective Green, g (s)	5.2	35.4	35.4	6.6	36.8	36.8		11.0	11.0		11.0	
Actuated g/C Ratio	0.08	0.54	0.54	0.10	0.57	0.57		0.17	0.17		0.17	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	142	1927	836	180	2004	854		266	263		246	
v/s Ratio Prot	0.04	c0.34		c0.04	0.23							
v/s Ratio Perm			0.01			0.03		0.03	0.01		c0.04	
v/c Ratio	0.47	0.63	0.02	0.39	0.41	0.06		0.19	0.08		0.24	
Uniform Delay, d1	28.6	10.3	6.8	27.3	7.9	6.3		23.2	22.7		23.4	
Progression Factor	0.90	1.03	1.64	1.07	1.04	1.42		1.00	1.00		1.00	
Incremental Delay, d2	2.1	1.4	0.0	1.4	0.6	0.1		0.3	0.1		0.5	
Delay (s)	27.8	12.0	11.2	30.5	8.8	9.1		23.5	22.9		23.9	
Level of Service	C	B	B	C	A	A		C	C		C	
Approach Delay (s)		12.8			10.5			23.1			23.9	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	11	1137	79	127	706	38	130	29	188	100	37	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.96	1.00	1.00	0.97		1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1763	3539	1516	1770	3539	1534		1786	1535	1755	1841	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.74	1.00	0.59	1.00	
Satd. Flow (perm)	1763	3539	1516	1770	3539	1534		1369	1535	1092	1841	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	12	1236	86	138	767	41	141	32	204	109	40	3
RTOR Reduction (vph)	0	0	33	0	0	18	0	0	126	0	2	0
Lane Group Flow (vph)	12	1236	53	138	767	23	0	173	78	109	41	0
Confl. Peds. (#/hr)	6		17	17		6	3		8	8		3
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2			6	4		4	4		
Actuated Green, G (s)	0.8	27.6	27.6	10.4	37.2	37.2		15.0	15.0	15.0	15.0	
Effective Green, g (s)	0.8	27.6	27.6	10.4	37.2	37.2		15.0	15.0	15.0	15.0	
Actuated g/C Ratio	0.01	0.42	0.42	0.16	0.57	0.57		0.23	0.23	0.23	0.23	
Clearance Time (s)	4.0	4.0	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	3.0	3.0	
Lane Grp Cap (vph)	22	1503	644	283	2025	878		316	354	252	425	
v/s Ratio Prot	0.01	c0.35		c0.08	0.22						0.02	
v/s Ratio Perm			0.03			0.02		c0.13	0.05	0.10		
v/c Ratio	0.55	0.82	0.08	0.49	0.38	0.03		0.55	0.22	0.43	0.10	
Uniform Delay, d1	31.9	16.5	11.1	24.9	7.6	6.0		22.0	20.3	21.4	19.7	
Progression Factor	0.96	1.17	1.86	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	21.5	4.5	0.2	1.3	0.5	0.1		1.9	0.3	1.2	0.1	
Delay (s)	52.0	23.9	20.9	26.2	8.1	6.1		24.0	20.6	22.6	19.8	
Level of Service	D	C	C	C	A	A		C	C	C	B	
Approach Delay (s)		23.9			10.7			22.1			21.8	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.1%	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)	48	1316	42	95	878	92	82	189	117	97	86	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00		0.95	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98		1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1770	3539	1553	1770	3539	1528	1756	1863	1546		3380	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.61	1.00	1.00		0.71	
Satd. Flow (perm)	1770	3539	1553	1770	3539	1528	1120	1863	1546		2459	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	55	1502	48	108	1002	105	94	216	134	111	98	25
RTOR Reduction (vph)	0	0	20	0	0	33	0	0	92	0	13	0
Lane Group Flow (vph)	55	1502	28	108	1002	72	94	216	42	0	221	0
Confl. Peds. (#/hr)	6		6	6		6	11		12	12		11
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2			6	4		4	4		
Actuated Green, G (s)	3.0	30.0	30.0	4.0	31.0	31.0	21.0	21.0	21.0		21.0	
Effective Green, g (s)	4.0	31.0	31.0	5.0	32.0	32.0	22.0	22.0	22.0		22.0	
Actuated g/C Ratio	0.06	0.44	0.44	0.07	0.46	0.46	0.31	0.31	0.31		0.31	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	101	1567	688	126	1618	699	352	586	486		773	
v/s Ratio Prot	0.03	c0.42		c0.06	0.28			c0.12				
v/s Ratio Perm			0.02			0.05	0.08		0.03		0.09	
v/c Ratio	0.54	0.96	0.04	0.86	0.62	0.10	0.27	0.37	0.09		0.29	
Uniform Delay, d1	32.1	18.9	11.1	32.1	14.4	10.8	18.0	18.6	16.9		18.1	
Progression Factor	1.00	1.00	1.00	0.88	1.34	2.07	1.00	1.00	1.00		1.00	
Incremental Delay, d2	5.9	14.8	0.1	34.7	1.5	0.2	1.9	1.8	0.4		0.9	
Delay (s)	38.0	33.7	11.2	63.0	20.7	22.6	19.8	20.4	17.3		19.0	
Level of Service	D	C	B	E	C	C	B	C	B		B	
Approach Delay (s)		33.2			24.6			19.3			19.0	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	64	1358	61	109	1017	29	68	33	194	57	10	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95			1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.99	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1770	3539	1546	1770	3520			1792	1583		1738	
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.77	1.00		0.74	
Satd. Flow (perm)	1770	3539	1546	1770	3520			1432	1583		1334	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	73	1550	70	124	1161	33	78	38	221	65	11	23
RTOR Reduction (vph)	0	0	22	0	2	0	0	0	110	0	19	0
Lane Group Flow (vph)	73	1550	48	124	1192	0	0	116	111	0	80	0
Confl. Peds. (#/hr)	9		2	2		9	10					10
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2				4		4	4		
Actuated Green, G (s)	5.9	33.1	33.1	9.7	36.9			12.2	12.2		12.2	
Effective Green, g (s)	6.9	34.1	34.1	10.7	37.9			13.2	13.2		13.2	
Actuated g/C Ratio	0.10	0.49	0.49	0.15	0.54			0.19	0.19		0.19	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0			5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	174	1724	753	271	1906			270	299		252	
v/s Ratio Prot	0.04	c0.44		c0.07	c0.34							
v/s Ratio Perm			0.03					c0.08	0.07		0.06	
v/c Ratio	0.42	0.90	0.06	0.46	0.63			0.43	0.37		0.32	
Uniform Delay, d1	29.7	16.4	9.5	27.0	11.1			25.1	24.8		24.5	
Progression Factor	0.74	1.28	2.19	1.28	0.64			1.00	1.00		1.00	
Incremental Delay, d2	0.9	4.4	0.1	1.0	1.3			1.1	0.8		0.7	
Delay (s)	22.8	25.5	20.8	35.5	8.4			26.2	25.5		25.3	
Level of Service	C	C	C	D	A			C	C		C	
Approach Delay (s)		25.2			11.0			25.8			25.3	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.8%	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)	62	1474	24	65	1101	65	21	25	117	39	10	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00		1.00	
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.95		1.00	0.98		0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85		0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98	1.00		0.98	
Satd. Flow (prot)	1770	3539	1534	1770	3539	1505		1816	1551		1706	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.87	1.00		0.82	
Satd. Flow (perm)	1770	3539	1534	1770	3539	1505		1608	1551		1439	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	71	1682	27	74	1257	74	24	29	134	45	11	33
RTOR Reduction (vph)	0	0	4	0	0	15	0	0	113	0	28	0
Lane Group Flow (vph)	71	1682	23	74	1257	59	0	53	21	0	61	0
Confl. Peds. (#/hr)	12		6	6		12	10		10	10		10
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2			6	4		4	4		
Actuated Green, G (s)	5.8	39.0	39.0	5.9	39.1	39.1		10.1	10.1		10.1	
Effective Green, g (s)	6.8	40.0	40.0	6.9	40.1	40.1		11.1	11.1		11.1	
Actuated g/C Ratio	0.10	0.57	0.57	0.10	0.57	0.57		0.16	0.16		0.16	
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	172	2022	877	174	2027	862		255	246		228	
v/s Ratio Prot	0.04	c0.48		c0.04	0.36							
v/s Ratio Perm			0.01			0.04		0.03	0.01		c0.04	
v/c Ratio	0.41	0.83	0.03	0.43	0.62	0.07		0.21	0.09		0.27	
Uniform Delay, d1	29.7	12.3	6.5	29.7	9.9	6.6		25.6	25.1		25.9	
Progression Factor	0.77	1.18	1.63	1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	0.9	2.4	0.0	1.7	1.4	0.2		0.4	0.2		0.6	
Delay (s)	23.8	16.9	10.7	31.4	11.3	6.8		26.0	25.3		26.5	
Level of Service	C	B	B	C	B	A		C	C		C	
Approach Delay (s)		17.0			12.2			25.5			26.5	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.6%	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)	11	1489	79	127	1058	38	130	29	188	100	37	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.95	1.00	1.00	0.96		1.00	0.97	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.96	1.00	0.95	1.00	
Satd. Flow (prot)	1765	3539	1502	1770	3539	1527		1785	1528	1751	1842	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00		0.73	1.00	0.49	1.00	
Satd. Flow (perm)	1765	3539	1502	1770	3539	1527		1364	1528	903	1842	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Adj. Flow (vph)	13	1699	90	145	1208	43	148	33	215	114	42	3
RTOR Reduction (vph)	0	0	19	0	0	13	0	0	78	0	2	0
Lane Group Flow (vph)	13	1699	71	145	1208	30	0	181	137	114	43	0
Confl. Peds. (#/hr)	6		17	17		6	3		8	8		3
Turn Type	Prot		Perm	Prot		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			4			4	
Permitted Phases			2			6	4		4	4		
Actuated Green, G (s)	0.8	49.2	49.2	11.5	59.9	59.9		17.3	17.3	17.3	17.3	
Effective Green, g (s)	0.8	49.2	49.2	11.5	59.9	59.9		17.3	17.3	17.3	17.3	
Actuated g/C Ratio	0.01	0.55	0.55	0.13	0.67	0.67		0.19	0.19	0.19	0.19	
Clearance Time (s)	4.0	4.0	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	3.0	3.0	
Lane Grp Cap (vph)	16	1935	821	226	2355	1016		262	294	174	354	
v/s Ratio Prot	0.01	c0.48		c0.08	0.34						0.02	
v/s Ratio Perm			0.05			0.02		c0.13	0.09	0.13		
v/c Ratio	0.81	0.88	0.09	0.64	0.51	0.03		0.69	0.46	0.66	0.12	
Uniform Delay, d1	44.5	17.8	9.7	37.3	7.6	5.1		33.9	32.2	33.6	30.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	132.2	6.0	0.2	6.1	0.8	0.1		7.6	1.2	8.6	0.2	
Delay (s)	176.7	23.8	9.9	43.4	8.4	5.2		41.5	33.4	42.2	30.2	
Level of Service	F	C	A	D	A	A		D	C	D	C	
Approach Delay (s)		24.2			12.0			37.1			38.8	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

FEHR & PEERS

MEMORANDUM

Date: May 28, 2012

To: Kimberly Cole, Elizabeth Caraker, Rich Deal, City of Monterey

From: Monica Altmaier, Fehr & Peers

Subject: Monterey Citywide Transportation Study- Traffic Data

SJ10-1219

The traffic count data evaluated for the operational analysis was provided by Hatch Mott MacDonald in August 2011. The traffic volumes reflect the typical summertime seasonal peak for Monterey, thus providing "worst- case" conditions for intersection conditions. The intersection counts occurred during the Friday peak period (4:00 – 6:00 pm) and Saturday peak period (2:00 – 4:00 pm) within the Downtown, Lighthouse, and North Fremont neighborhoods. Discrepancies were found in the data, so the traffic volumes were reviewed with City staff and balanced between intersections to provide a more comprehensive representation of the existing traffic conditions. Several counts collected internally from City staff supplemented the inconsistent intersection data.

The balanced traffic volumes were imported into the Synchro models for each study area for further analysis. The existing traffic models were used as a base to develop the future growth conditions. The intersection output results are included in Appendix D for the existing and future conditions.