



Federal Transit  
Administration

---

Madison Street Corridor Bus Rapid Transit (BRT)

# Transportation Memorandum

Prepared for

**Seattle Department of Transportation  
Federal Transit Administration**

Lead Author

**Environmental Science Associates**

October 2016



*Seattle Department of Transportation*



## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Project Description</b>	<b>2</b>
2.1	Background	2
2.2	Project Location	2
2.3	Description of Proposed Work	6
<b>3</b>	<b>Methodology</b>	<b>12</b>
3.1	Data Collection	12
3.2	Traffic Analysis Modeling Methodology	13
<b>4</b>	<b>Affected Environment</b>	<b>17</b>
4.1	Roadway Network	17
4.2	Transit Service	24
4.3	Bicycle and Pedestrian Facilities	29
4.4	Parking	32
<b>5</b>	<b>Project Effects</b>	<b>32</b>
5.1	Short-term Effects	32
5.2	Long-term Effects	33
<b>6</b>	<b>Mitigation</b>	<b>51</b>
6.1	Short-term Mitigation	51
6.2	Long-term Mitigation	52
<b>7</b>	<b>References</b>	<b>53</b>

## Tables

Table 1	General Purpose Lane Removal	9
Table 2	Summary of Existing PM Peak Hour Signal Timing Plans	20
Table 3	Summary of PM Peak Hour Existing Conditions Delay and Level of Service	23
Table 4	Performance Metrics for Routes 2, 11, and 12	27
Table 5	Summary of On-Street Parking Spaces	32

Table 6	Summary of PM Peak Hour Year of Opening Average Vehicle Delay and Level of Service (Synchro Results).....	41
Table 7	Transit Travel Time Reliability.....	47
Table 8	Summary of Madison BRT Project Parking Impacts .....	50
Table 9	Madison BRT Project Parking Impacts by Segment.....	51

## Figures

Figure 1	Project Vicinity .....	4
Figure 2	Project Alignment .....	5
Figure 3	Dynameq Traffic Model Limits.....	15
Figure 4	Synchro and Vissim Study Area.....	16
Figure 5	Madison Street Example Downtown Cross-Section (4 <sup>th</sup> Avenue to 3 <sup>rd</sup> Avenue) during the PM Peak (looking east).....	19
Figure 6	Madison Street Example First Hill Cross-Section (9 <sup>th</sup> Avenue to Terry Avenue) during the PM Peak.....	19
Figure 7	Madison Street Example East End Cross-Section (18 <sup>th</sup> Avenue to 19 <sup>th</sup> Avenue) during the PM Peak.....	19
Figure 8	Existing Transit Network.....	25
Figure 9	Existing Boardings Within ¼ Mile of Madison Corridor .....	28
Figure 10	Downtown Seattle Historic Bicycle Counts.....	29
Figure 11	Bicycle Counts, Jan 2013-May 2014.....	30
Figure 12	Pedestrian Counts, Jan 2013-May 2014 .....	31
Figure 13	Downtown Channelization.....	35
Figure 14	Downtown Proposed Cross-Section of Madison Street Between 2 <sup>nd</sup> Avenue and 3 <sup>rd</sup> Avenue (looking east) .....	35
Figure 15	Downtown Proposed Cross-Section of Spring Street Between 2 <sup>nd</sup> Avenue and 3 <sup>rd</sup> Avenue (looking east) .....	35
Figure 16	First Hill Segment - Madison Street with Left Turn and Transit Channelization ..	37
Figure 17	Madison Street between 15 <sup>th</sup> Avenue and 17 <sup>th</sup> Avenue .....	37
Figure 18	Proposed Cross-Section of Madison Street between 17 <sup>th</sup> Avenue and 18 <sup>th</sup> Avenue .....	37
Figure 19	Westbound Motor Vehicle Travel Times (PM Peak Hour).....	38
Figure 20	Eastbound Motor Vehicle Travel Time (PM Peak Hour).....	39

## Transportation Memorandum

Figure 21	Westbound Transit Travel Time (PM Peak Hour) .....	45
Figure 22	Eastbound Transit Travel Time (PM Peak Hour).....	46
Figure 23	Traffic Diversion (PM Peak Hour).....	48

## Appendices

Appendix A	Madison Corridor BRT Study Traffic Analysis Report (January 2016)
Appendix B	Synchro and Vissim Modeling Results
Appendix C	Signal Warrant Analysis
Appendix D	Protected Signal Control Analysis



# 1 Introduction

The City of Seattle's Department of Transportation (SDOT) proposes to provide new Bus Rapid Transit (BRT) service on Madison Street between 1<sup>st</sup> Avenue and Martin Luther King, Jr. Way East (MLK Jr. Way), Spring Street between 1<sup>st</sup> Avenue and 9<sup>th</sup> Avenue, and 1<sup>st</sup> Avenue and 9<sup>th</sup> Avenue between Madison Street and Spring Street as part of the Madison Street Corridor Bus Rapid Transit (Madison BRT) Project. This report documents the key transportation elements of the Madison BRT Project, the tools used to evaluate traffic operations, the areas affected by transportation changes, the results of the traffic analysis, and mitigation measures to eliminate or reduce potential traffic impacts.

This Transportation Memorandum is based on earlier work completed during selection of the Locally Preferred Alternative (LPA), also referred to as the Phase I work. The *Madison Corridor BRT Study Traffic Analysis Report* (January 2016) is incorporated here by reference and found in Appendix A. The Phase I work utilized four modeling tools for the evaluation of BRT operations: dynamic traffic assignment software (Dynameq), travel demand forecasting (EMME), traffic microsimulation software (Vissim), and traffic operations analysis software (Synchro). The Dynameq model was used to capture the level of diversion from the Madison Street corridor as a result of the proposed channelization changes for each alternative. The resulting traffic volumes on Madison Street from the Dynameq analysis were used for the detailed operational analysis in Vissim and delay and level of service (LOS) in Synchro. The Dynameq model was also utilized to evaluate the overall difference in transit and auto travel times from 1<sup>st</sup> Avenue to 23<sup>rd</sup> Avenue.

This report advances the previous work with new traffic counts at locations on and off the corridor, recently modified traffic signal timing plans, and further refined geometric design and transit operations characteristics. This report considers an extended project corridor from 23<sup>rd</sup> Avenue to MLK Jr Way along Madison Street. The previously developed PM peak hour Synchro model was updated with new traffic counts and signal timing plans. The previously developed PM peak hour Vissim model was extended to include the entire route alignment. Information from the forecast travel demand and traffic assignment from the Dynameq and EMME models was used to support estimation of both on- and off-corridor traffic volumes and routing patterns.

The report addresses key project changes in the BRT roadway and station placement design and quantifies travel speed and congestion levels for both transit vehicles and automobiles. Multimodal conditions are evaluated for pedestrians, cyclists, and parking. The report also identifies potential traffic operations, parking, and construction related impacts and presents appropriate mitigation strategies.

A summary of the key elements for the Madison BRT Project as they relate to the traffic analysis is described below.

- The Madison BRT Project would operate in a business access and transit only (BAT) lane in downtown between 1<sup>st</sup> Avenue and 6<sup>th</sup> Avenue on both Madison Street (right-

side) and Spring Street (right-side). The BAT lanes would accommodate both through BRT vehicles and turning only general purpose traffic. Along 1<sup>st</sup> Avenue between Madison Street and Spring Street, BRT would operate in a median transit lane shared with the street car.

- Between 6<sup>th</sup> Avenue and 9<sup>th</sup> Avenue, BRT would operate in mixed flow on Spring Street and in a dedicated BRT-only lane on Madison Street (left side).
- The Madison BRT Project would operate in the median (one BRT lane provided for each direction) with center platforms along Madison Street between 9<sup>th</sup> Avenue and 15<sup>th</sup> Avenue. In this segment, dedicated left turn lanes off of Madison Street would be provided only at the Boren Avenue, Broadway, and 12<sup>th</sup> Avenue (eastbound only) signalized intersections.
- Between 15<sup>th</sup> Avenue and 18<sup>th</sup> Avenue, the Madison BRT Project would operate in BAT lanes and/or mixed flow lanes on the curb side of Madison Street.
- The Madison BRT Project would operate in mixed flow lanes along Madison Street from 18<sup>th</sup> Avenue to MLK Jr. Way. The terminus of the alignment at MLK Jr. Way and the turn-around would be on the south side of Madison Street at MLK Jr. Way and Harrison Street.

## 2 Project Description

### 2.1 Background

The Madison BRT Project is located in a dense and rapidly developing area that includes portions of Madison Valley, the Central District, Capitol Hill, First Hill, and Downtown Seattle. These areas are among the densest residential neighborhoods in the City and are sizable employment centers due to the presence of two major medical centers and Seattle University. Providing BRT service along this 2.4-mile corridor is identified in the Seattle Transit Master Plan and listed as a near-term action in the 2016 Move Seattle Strategic Vision. This project would improve transit capacity, travel time, reliability, and connectivity in an area that is highly urbanized and has a lower rate of automobile ownership than other parts of the city.

The Madison BRT Project would connect with dozens of bus routes, the Center City Connector Streetcar, the South Lake Union Street Car, and First Hill Streetcar, and would improve access to ferry service at the Colman Dock Ferry Terminal, First Hill medical institutions and housing, Seattle University, and Link light rail. As part of the project, pedestrian and bicycle access along the corridor would also be improved and enhancements would be made to the streetscape and public realm to increase comfort, visibility, and legibility in the Madison Street corridor.

### 2.2 Project Location

The project site is located in Seattle, Washington (Figure 1). The 4.6-mile roundtrip route would begin and end at MLK Jr. Way E in the east. Figure 2 shows that from MLK Jr. Way E the Madison BRT Project would head west on Madison Street for 2.26 miles to 1<sup>st</sup> Avenue, head north on 1<sup>st</sup> Avenue for 290 feet, head east on Spring Street for 0.43 mile, south on 9<sup>th</sup> Avenue for 290 feet, and head east on Madison Street for 1.78 miles.



## Transportation Memorandum

The project corridor traverses several Seattle neighborhoods: Downtown, First Hill, Capitol Hill, Central Area, and Madison Valley.

### **Downtown**

The Downtown neighborhood is located at the westernmost end of the project corridor from 1<sup>st</sup> Avenue to the Interstate 5 (I-5) crossing. Downtown Seattle is primarily commercial, including large office towers in the city center, and is the largest employment center in the city.

### **First Hill**

Moving east to First Hill, from I-5 to Broadway Avenue, the density decreases and there is a greater mixture of mid- and low-rise buildings with mixed residential-commercial uses. On the summit of First Hill, and heading east toward Broadway, institutional uses line the south side of Madison and commercial uses line the north. Virginia Mason Hospital and Swedish Hospital both have several large medical facility buildings adjacent to, or within, one block of the Madison Street corridor.

### **Capitol Hill**

North of the project corridor, the Capitol Hill neighborhood runs from Broadway Avenue to 26th Avenue. The Pike-Pine corridor, Madison Valley, and Broadway areas are located along the Madison Street corridor. It includes mid-rise development, transitioning into low-rise and mixed commercial and residential development.

### **The Central Area**

South of the project corridor, the Central Area neighborhood also runs from Broadway Avenue to 26th Avenue. It includes mid-rise development, transitioning into low-rise and mixed commercial and residential development. The Seattle University campus is adjacent to the Madison Street corridor.

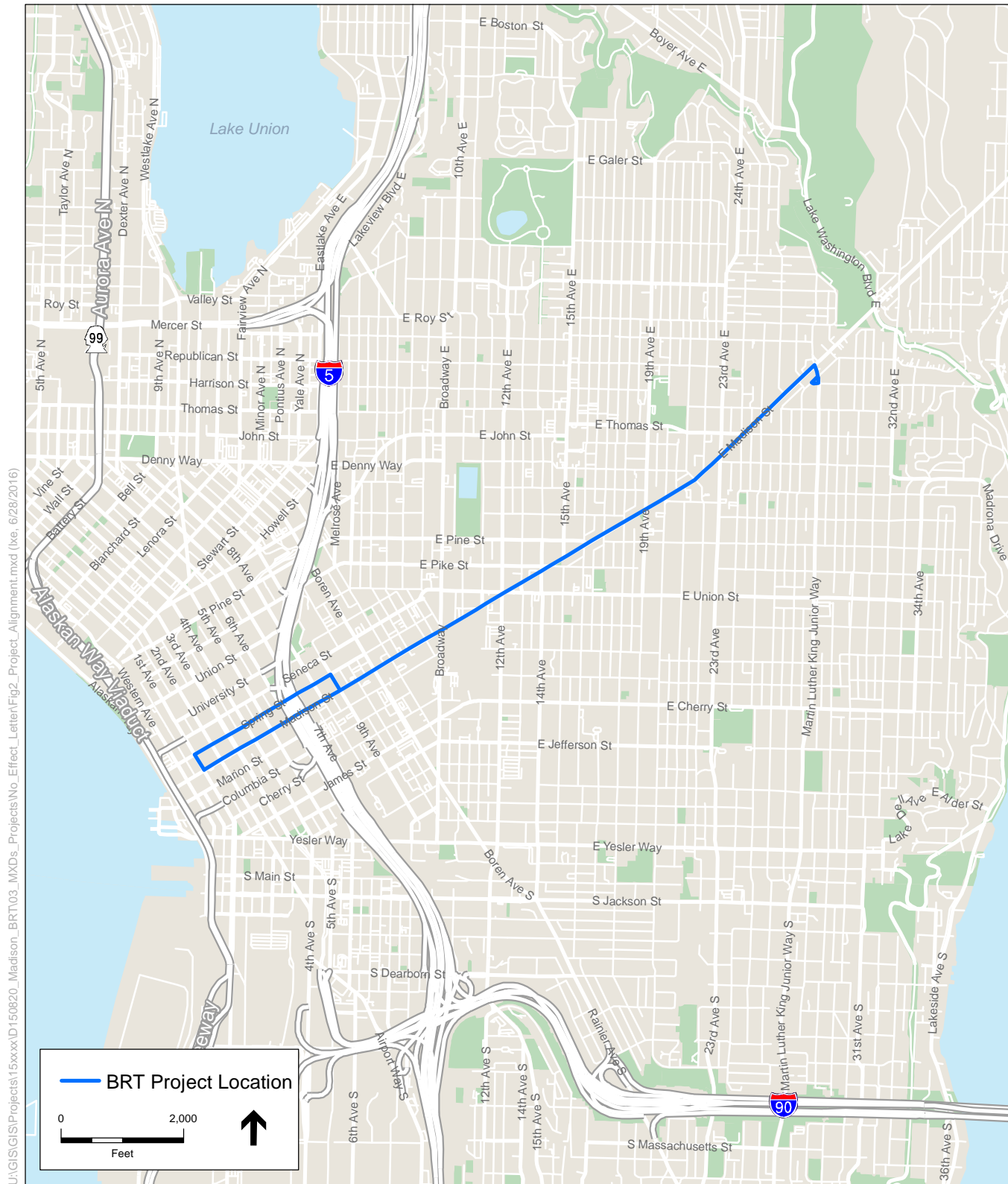
### **Madison Valley**

The Madison Valley neighborhood is located between 26th Avenue to MLK Jr. Way and east of the project corridor to Madison Park. Low-rise and mixed commercial and residential development dominates the corridor in this neighborhood.



SOURCE:  
 Wa. Dept. of Ecology 2016; ESA 2016; OSM 2015.

SDOT Madison BRT Design . 150820  
**Figure 1**  
 Project Vicinity



U:\GIS\GIS\Projects\150820\_Madison\_BRT\03\_MXD\Projects\No\_Effect\_Letter\Fig2\_Project\_Alignment.mxd (Rev. 6/28/2016)

SOURCE:  
 Wa. Dept. of Ecology 2016; ESA 2016; OSM 2015.

SDOT Madison BRT Design . 150820  
**Figure 2**  
 Project Alignment

## 2.3 Description of Proposed Work

The Project would create a new BRT line along the Madison Street corridor. It would include approximately 11 BRT station areas with 21 directional platforms along the project corridor, new Transit Only Lanes (TOLs) and Business Access & Transit (BAT) lanes, pedestrian and bicycle improvements, and signal and utility upgrades along the corridor. The Madison BRT Project would replace portions of the King County Metro Route 12 where they would otherwise overlap. Metro anticipates they will revise Route 12 to compliment the BRT and continue to serve the east Capitol Hill areas as it currently does.

The Madison BRT Project would use nine new buses, seven of which would be on the road at any one time. The buses would be 60-foot articulated low-floor vehicles with three doors on the right side and two on the left. The BRT would operate Monday through Saturday from 5 a.m. to 1 a.m. and on Sundays and holidays from 6 a.m. to 11 p.m. They would run every six minutes between 6 a.m. and 7 p.m. on weekdays and every 15 minutes during all other hours of operation.

Construction would start in 2018 and conclude in the fall of 2019.

### Stations

There would be a total of approximately 11 station areas with 21 directional platforms.

- MLK Jr. Way Station: eastbound and westbound curbside stops, shared with Metro Routes 8 and 11;
- 24th Avenue Station: eastbound and westbound curbside stops, shared with Metro Route 11;
- 22<sup>nd</sup> Avenue Station: eastbound and westbound curbside stops, shared with Metro Route 11;
- 17<sup>th</sup> Avenue Station: eastbound and westbound curbside stops, shared with Metro Route 11;
- 12<sup>th</sup> Avenue Station: eastbound and westbound stops on shared center island platform (Metro Route 2 would continue to have eastbound and westbound curbside stops in this vicinity);
- Boylston Avenue Station: eastbound and westbound stops on shared center island platform. Transfer to First Hill Streetcar;
- Terry Station: eastbound and westbound stops on shared center island platform (Metro Route 60 would continue to have eastbound and westbound curbside stops in this vicinity);

#### What is a Sidewalk Station?

A sidewalk station is a station that would be located at the curb. They are typically 60 feet long.

#### What is an Island Station?

An island station is a platform in the center median of the street. Island stations are at least 60 feet long and approximately 9 feet wide.

## Transportation Memorandum

- 8<sup>th</sup> Avenue Stations: eastbound curbside stop on Spring Street, westbound center island stop on Madison;
- 5<sup>th</sup> Avenue Stations: eastbound curbside stop on Spring Street shared with Metro Route 2, westbound curbside stop on Madison;
- 3<sup>rd</sup> Avenue Stations: eastbound curbside stop on Spring Street, westbound curbside stop on Madison; and
- 1<sup>st</sup> Avenue Station: northbound stop on center island platform, shared with the Center City Connector streetcar.

Each stop would typically have a shelter (except the 1<sup>st</sup> Avenue stop), off-board fare payment machines, and real-time arrival information. The level-boarding platforms would be approximately 13 inches in height (1<sup>st</sup> Avenue stop would have 10-inch platform to accommodate the streetcar) and ADA-accessible to the maximum extent feasible.

### *1st Avenue*

The western end would be located on 1<sup>st</sup> Avenue and would be shared with Center City Connector streetcars. It would include a northbound island station.

### *Spring Street*

On Spring Street, all of the BRT buses would be eastbound. Three stops would be provided on Spring Street, one at 3<sup>rd</sup> Avenue, one at 5<sup>th</sup> Street, and one on the nearside of 8<sup>th</sup> Avenue. The Route 2 bus would also utilize the stop at 5<sup>th</sup> Avenue.

### *Madison Street*

On Madison Street, BRT buses would be westbound only between 1<sup>st</sup> Avenue and 9<sup>th</sup> Avenue and bidirectional between 9<sup>th</sup> Avenue and MLK Jr. Way E. Ten sidewalk stops would be provided. Westbound-only sidewalk stations would be provided on the western side of 3<sup>rd</sup> Avenue and the eastern side of 5<sup>th</sup> Avenue. Sidewalk stations would be provided in both directions at the intersections with 17<sup>th</sup> Avenue, E Denny Way, 24<sup>th</sup> Avenue and the western side of MLK Jr. Way E.

There would be six island stations. One island station, on the western side of 8<sup>th</sup> Avenue would provide westbound service only. There would be two island station pairs (westbound island adjacent to eastbound island station) at Terry Avenue and the east side of Summit Avenue. One bidirectional transit island would be east of the 12<sup>th</sup> Avenue intersection.

One westbound curbside bus layover stall would be provided on Madison Street, west of the intersection with MLK Jr. Way E.

### *Layover*

On MLK Jr. Way E, two curbside bus layover stalls would be provided at the intersection with E Harrison Street, and a third curbside layover would be provided on westbound Madison Street, just west of MLK Jr. Way E.

## **Right-of-Way Improvements**

### *Reconfiguration of Lanes*

As part of the project, new TOLs and BAT lanes would be provided. TOLs can be located anywhere within the right-of-way and only allow transit use. They are typically painted red to inform all corridor users that this lane is for transit only. BAT lanes are a type of bus lane located on the curbside and permit general traffic use for accessing driveways or crossing streets (but not for through travel).

For the Madison BRT Project, 1.98 miles of new TOLs would be provided. Between 5<sup>th</sup> Avenue and 9<sup>th</sup> Avenue there would be 0.24 mile of center, unidirectional TOL. Between 9<sup>th</sup> Avenue and 15<sup>th</sup> Avenue there would be 0.80 mile of center TOLs heading in both directions (1.60 miles total). TOLs would also be provided throughout the corridor (about another 0.14 mile cumulatively) to ensure adequate transit flow. This would include TOLs being placed in front of transit stops, to keep them from being blocked, and on 9<sup>th</sup> Avenue to ensure buses can easily make the transition from Spring Street to Madison Street.

Approximately 0.82 mile of BAT lanes would be provided under the project. Unidirectional BAT lanes would be provided on Spring Street between 1<sup>st</sup> Avenue and 6<sup>th</sup> Avenue (0.3 mile heading east) and on Madison Street between 1<sup>st</sup> Avenue and 5<sup>th</sup> Avenue (0.24 mile heading west) and between 15<sup>th</sup> Avenue and 17<sup>th</sup> Avenue (0.14 heading east). BAT lanes would be provided for both directions on Madison Street between 17<sup>th</sup> Avenue and 18<sup>th</sup> Avenue (0.14 mile total).

### *Parking*

Bus lanes must be at least 10.5 feet, and preferably 12 feet wide, according to American Public Transportation Association (APTA) standards (APTA, 2010). Many of the existing rights-of-way within the corridor would not allow for the addition of a new 10.5-foot-wide bus lane without the removal of on-street parking. The Madison BRT Project would remove 222 on-street parking spaces within the corridor, 10 of which would be passenger or delivery loading spaces, 113 would be street parking spaces, and 99 would be spaces that are restricted (currently allowing parking during non-peak hours only).

#### **What is a TOL?**

A Transit Only Lane (TOL) is a lane dedicated for buses. General purpose traffic is not allowed to use TOLs.

#### **What is BAT lane?**

Business Access and Transit (BAT) lanes help move bus riders and others more efficiently and improve access to businesses and residences by reserving outside curb lanes for right-turning vehicles and buses.

***Paving***

Approximately 10 acres of roadway and sidewalk pavement would be replaced under the project. The TOL pavement would be replaced with Portland cement concrete pavement (PCCP) to increase the life of the BRT travel lanes.

***Alterations to Existing Street Corridor***

According to APTA standards, bus lanes must be at least 10.5 feet wide (APTA, 2010). Many of the existing rights-of-way within the corridor would not allow for the addition of a new 10.5-foot-wide bus lane without the narrowing of other existing lanes. In certain sections of the roadway, existing general purpose lanes may need to be converted for BRT use (Table 1). A list of the changes to the existing street corridor is provided below:

- Roadway curb widening on seven blocks of Madison Street;
- Full depth PCCP roadway restoration under proposed BRT travel lanes corridor wide;
- Sidewalk restoration and repairs impacting approximately 75 block faces;
- Storm water detention system construction underneath Madison Street (up to 72” detention pipe diameter);
- Corridor wide roadway restriping;
- Remove north/south crossing of Madison Street via Terry Avenue; and
- Remove left turn lanes on Madison Street to Minor Avenue, Summit Avenue, and Boylston Avenue.

**Table 1 General Purpose Lane Removal**

Location	Existing General Purpose Lanes (ft.)	Proposed General Purpose Lands (ft.)	Percent Reduction
1 <sup>st</sup> to 9 <sup>th</sup>	14,096	12,559	10.9%
9 <sup>th</sup> to 18 <sup>th</sup>	21,103	11,433	45.8%
18 <sup>th</sup> to MLK	11,610	9,789	15.7%
Total	46,809	33,781	27.8%

**Signal and Utility Improvements**

As part of the Madison BRT Project, Transit Signal Priority (TSP) would be provided at most signalized corridor intersections between 7<sup>th</sup> Avenue and MLK Jr Way. Signal priority would be

used to hold lights green for approaching BRT vehicles and shorten red times for BRT vehicles at intersections. Separate “queue jump” transit only phases would be employed where BRT vehicles need to go in advance of general purpose traffic. In addition, two new signals would be provided on Spring Street: one at the 8<sup>th</sup> Avenue intersection and one at the 9<sup>th</sup> Avenue intersection.

The vehicles would be electrically powered using either electric trolleybus (ETB) technology requiring overhead contact systems (OCS) or some combination of ETB/OCS and emerging battery-powered technology allowing for substantial “off wire” operation. In order to power the line, new overhead wires would need to be installed in the following areas:

- 1<sup>st</sup> Avenue from Madison Street to Spring Street (approximately 300 feet)
- Spring Street from 1<sup>st</sup> Avenue to 3<sup>rd</sup> Avenue, and from 7<sup>th</sup> Avenue to 9<sup>th</sup> Avenue (approximately 0.5 mile);
- 9<sup>th</sup> Avenue from Spring Street to Madison Street (approximately 300 feet);
- Madison Street from 19<sup>th</sup> Avenue to MLK Jr. Way (approximately 0.7 miles); and
- MLK Jr. Way from Madison Street to E Harrison Street (approximately 800 feet).

In addition, a new traction-powered substation (TPSS) would be needed somewhere near the eastern end of the project, where the existing overhead catenary system would need to be extended.

## **Pedestrian and Bicycle Improvements**

The Project would include a number of improvements for pedestrians and bicyclists.

Where the project is impacting the existing sidewalks along the corridor, repairs or replacements would be completed to restore them to ADA standards. Corner bulb-out sidewalk extensions would be provided at a number of locations, which reduce street crossing distance and increase visibility of pedestrians. At Boren Avenue, Broadway Avenue, and Union Street sidewalks would be narrowed slightly to accommodate left turn lanes.



Protected Bicycle Lanes (PBLs) would remain on Spring Street between 2<sup>nd</sup> Avenue and 4<sup>th</sup> Avenue and added on Union Street between 12<sup>th</sup> Avenue and 14<sup>th</sup> Avenue. A sharrow situation would be created in the left lane on Spring Street from 1<sup>st</sup> Avenue to 2<sup>nd</sup> Avenue.

Additional crosswalk and bicycle crossings would be provided at the intersection of 12<sup>th</sup> Avenue and Union Street, in accordance with the Seattle Bicycle Master Plan. As part of the project, a



wide crosswalk would be constructed on Madison Street on the east side of the intersection, enabling transitions between the bike facilities on Union Street, to the east across Madison Street, and 12<sup>th</sup> Avenue.

A short segment of bicycle lane would be striped through the intersection of 24<sup>th</sup> Avenue and John Street and improvements to the sidewalk on Madison Street west of the intersection would be included in the project in order to facilitate through movements on the 24<sup>th</sup> Avenue greenway.

### **Landscaping Improvements**

In order to complete construction of the stations, lane widening, utility relocations, and sidewalk and other frontage improvements, approximately 70 street trees may be removed; however, this number would be refined during final design. All trees removed would be replaced in accordance with the City of Seattle's Tree Replacement Standards (SMC 15.43) and in coordination with SDOT Urban Forestry.

As part of the project, SDOT would be installing a new 2,600 square-foot Pocket Plaza with sidewalk and landscaping at the intersection of Madison Street, E Pike Street and 14<sup>th</sup> Avenue.

### **Stormwater Improvements**

The project would replace existing stormwater infrastructure impacted by the Madison BRT Project. The majority of storm drainage impacts would be from proposed curbside bus stations.

The Project would address the City's stormwater code, improving stormwater quality and detention where required. The project passes through three basins and each would be addressed appropriately. The project is required to provide flow control for two of the five stormwater basins. The basins that require flow control are the Combined Sewer West basin and the Combined Sewer East basin. Combined Sewer West basin is in the downtown area on Spring Street and Madison Street from 1<sup>st</sup> Avenue to I-5. The Combined Sewer East basin is from 17<sup>th</sup> Avenue to the end of the project at MLK Jr. Way. The project would evaluate stormwater BMPs including rain gardens and pervious surfaces to meet requirements of the City of Seattle 2016 Stormwater Manual.

### **Utility Relocations**

Utilities are anticipated to be relocated where the roadway would be widened to accommodate BRT bus lanes and stations. There are approximately eight blocks that are proposed for widening. Utilities that would be relocated include roadway lighting, overhead contact systems, signals, storm drainage, overhead and underground power, and overhead and underground telecommunications. There are conflicts with proposed bus station amenities and existing utility systems that would require utility modifications and relocations.

## **Art**

The City has committed to contributing 1% of City funds to add public art (1% for Art Program); federal and state funds do not apply to this program. These funds are combined with other project art contributions to fund larger art installations which may or may not be located on the Madison Street corridor; this decision is made by the City's Art Council.

## **3 Methodology**

This section summarizes the overall study approach, as well as the techniques and data used to develop transportation data, perform analysis of existing and future traffic conditions, and assess bicycle and pedestrian performance for the Madison BRT Project.

### **3.1 Data Collection**

#### **Geometric Data and Traffic Operations**

Existing weekday PM peak hour vehicle turning movement counts were used from the previous Madison BRT Phase I study as well as counts provided from the Next Generation ITS – Center City Mobility Project. New PM peak hour vehicle turning movement counts were also collected at the Spring Street/8<sup>th</sup> Avenue, Spring Street/9<sup>th</sup> Avenue, Madison Street/25<sup>th</sup> Avenue, Madison Street/26<sup>th</sup> Avenue, Madison Street/27<sup>th</sup> Avenue, and Madison Street/MLK Jr. Way intersections. Peak hour traffic volumes were then post-processed and balanced to provide the basis for analyzing traffic conditions during the PM peak hour.

Existing signal timings were obtained from the City of Seattle for the study area traffic signals within the project limits. Section 4 of this document describes the signals and locations studied.

#### **Bicycles and Pedestrians**

SDOT collects quarterly bicycle and pedestrian counts at three locations on or very near the Madison corridor:

- Alaskan Way and Colman Dock
- Madison Street and 6<sup>th</sup> Avenue
- Madison Street and 12<sup>th</sup> Avenue

The count data represent bicycles counted at the intersections on a weekday between 5 p.m. and 6 p.m.

Data was also reviewed from planning documents for bicycle and pedestrian infrastructure in Seattle: the Bicycle Master Plan (BMP) and Pedestrian Master Plan (PMP)<sup>1</sup>.

## **Transit**

East-west transit service within the corridor is provided primarily by King County Metro bus routes 2, 11, and 12. Analysis of ridership and reliability was conducted for these three routes. Numerous transit routes cross the corridor, especially in the downtown area, and consist of local, express, and regional commuter bus routes. Additional ridership analysis was conducted for several routes that intersect the corridor, including Routes 3, 8, 10, 43, 48, 49, and 60. The data provided for the analysis is from King County Metro's Fall 2013 service period.

## **Parking**

A parking analysis was conducted for existing and projected on-street parking and loading spaces by segment and by designation of curb use including all-day parking, peak restricted parking, commercial load zones, and passenger load zones. Parking data was provided by SDOT for paid parking spaces on Madison Street and intersecting blocks. For unpaid areas on Madison Street, additional data was collected on weekdays every two hours from 8 a.m. to 7 p.m. in October 2014.

### **3.2 Traffic Analysis Modeling Methodology**

The traffic analysis utilized three modeling tools for the evaluation of Madison BRT Project operations: dynamic traffic assignment software (Dynameq), traffic microsimulation software (Vissim), and traffic operations analysis software (Synchro).

The Dynameq model was used to capture the level of diversion from the Madison Street corridor to the surrounding roadway network that would result from the proposed channelization changes. The resulting traffic volumes on Madison Street from the Dynameq analysis were used for the detailed operational analysis in Vissim, and delay and level of service (LOS) calculations in Synchro. Synchro cannot analyze the impact of transit signal priority (TSP) on intersection operations. Vissim, described in following sections, does account for the impact of TSP on intersection and corridor operations.

The Vissim model was developed for the entire corridor and was based on the previous Phase I Vissim model for the First Hill segment of the Madison Street corridor from 6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue. Vissim allows for detailed evaluation of traffic and transit operations resulting from the

---

<sup>1</sup> The BMP, adopted in April 2014, articulates a vision and goals for bicycling in the city and maps out a citywide network of routes with accompanying local connectors. It also identifies facility types ranging from off-street trails to cycle tracks (protected bicycle lanes) and neighborhood greenways. The Seattle Pedestrian Master Plan, adopted in 2008, includes policies, programs, design criteria, and projects to further pedestrian safety, comfort, and access. Based on data assessment, the plan identifies "High Priority along the Roadway" and "High Priority Crossing the Roadway" locations for improvement.

proposed transit lanes, turning vehicle interaction, pedestrian crossing, TSP and queue jumps. The Vissim model was used to determine transit and auto travel times and to identify the critical intersections and roadway segments for additional evaluation.

### **Dynameq Study Area**

A map of the study area for the Dynameq traffic analysis is shown in Figure 3 **Error! Reference source not found.** with a portion of the proposed BRT corridor shown in red. The modeling analysis of the Madison BRT Project corridor was conducted from 1<sup>st</sup> Avenue to 23<sup>rd</sup> Avenue, where the majority of the diversion is expected to occur. The Phase I Dynameq model did not cover the portion of the corridor between 23<sup>rd</sup> Avenue and MLK Jr. Way. The BRT would operate in mixed-flow lanes north of 18<sup>th</sup> Avenue, similar to existing, local bus operations; traffic diversion is unlikely in this area due to the maintained automobile capacity and lack of a fully developed grid network with parallel facilities.

In the westbound direction, transit operates on Madison Street for the full length of the study corridor. In the eastbound direction, transit operates on Spring Street within the downtown core before turning back onto Madison Street at 9<sup>th</sup> Avenue. The shaded area in Figure 3 is included in the current Dynameq model to capture underlying traffic diversion from Madison Street.

Dynameq models were created to represent the PM peak period. The PM peak period was modeled from 3-7 PM with focused results on the PM peak hour, 5-6 PM. The PM peak hour was determined from 24-hour traffic counts collected within the study area. All Dynameq results presented in this report reflect PM peak hour conditions (see Appendix B).

### **Synchro and Vissim Study Area**

Figure 4 shows both the Synchro Vissim model limits along the project corridor. The models include 50 existing intersections. Signalized intersections included in the Synchro and Vissim models are shown with yellow circles while unsignalized intersections included in the model are shown with orange circles. Synchro was also used to evaluate the effect of traffic diverted from the project corridor at eight off-corridor intersections along traffic diversion routes identified by the Dynameq model.

The Synchro and Vissim models were developed for the PM peak hour. All model results presented in this report reflect PM peak hour conditions (Appendix B).

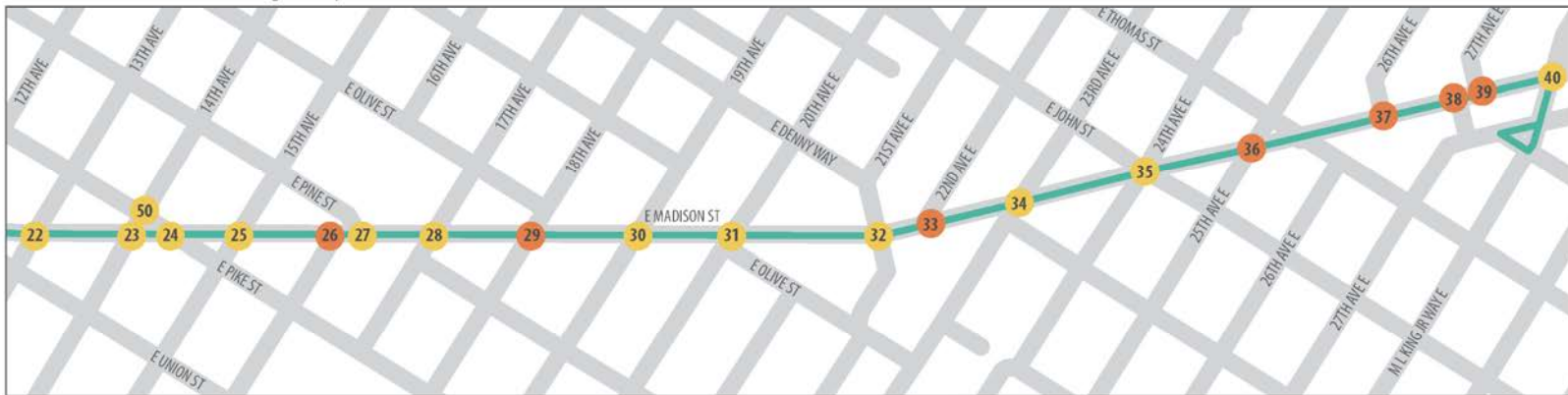


Figure 3 Dynameq Traffic Model Limits

1st Ave to 12th Ave/Union St



13th Ave to Martin Luther King Jr Way



**Legend**

**Study Intersections**

- Signalized
- Unsignalized

— Madison BRT Proposed Route

0 0.075 0.15 MILES

NORTH



Corridor Intersection Map

Figure 4 Synchro and Vissim Study Area

## Dynameq, Synchro, and Vissim Modeling Assumptions

The model developed for the No-Build Alternative in the Madison BRT LPA study was used as the baseline conditions for this analysis, for travel time comparisons. The baseline conditions reflect existing roadway channelization and funded transportation projects that will be in place by 2019 (the year of Project opening) including the followings projects: the replacement of the Alaskan Way Viaduct (AWV) with a tunnel, the Center City Connector Streetcar, and the 23<sup>rd</sup> Avenue rechannelization. Existing signal timing was utilized throughout the study area except where known and planned future signal improvements are included as a part of the projects at Broadway and 23<sup>rd</sup> Avenue. In these cases, the planned signal timing improvements are reflected within the study models. The baseline model includes lane, parking, and turn restrictions that are currently in place during the PM peak hour.

Transit service for the 2019 baseline conditions was assumed to be the same as existing conditions except for known changes related to the AWV replacement and increased light rail and streetcar lines. King County Metro provided existing dwell time data for transit stops within the study area. The dwell time at existing stop locations was assumed to be unchanged in 2019 baseline conditions. The proposed routing for the Madison Street BRT does not correspond to any singular existing route. Therefore, model results for portions of existing routes 11 and 12 were combined to establish the baseline for transit travel time along the corridor.

The proposed Madison BRT Project headways would be six minutes between 6 a.m. and 7 p.m. Dwell times were assumed to match existing dwell time data provided by King County Metro for all existing routes. Dwell times at stations for BRT service were assumed to be reduced due to enhanced stop amenities, such as level boarding, off board fare collection, and multiple transit doors for boarding and alighting. Route 12 would be altered when the Madison BRT Project is operational to eliminate redundancies in service areas. East-west service previously provided by Route 12 would be provided by the Madison BRT Project and north-south service would be provided by the First Hill-Broadway Streetcar.

### What are headways?

Headways refer to the average amount of time between bus stops at stations along the route. This corresponds to the maximum wait time between buses.

### What is Dwell Time?

Dwell refers to the amount of time a bus is stopped at a station for loading and unloading.

## 4 Affected Environment

### 4.1 Roadway Network

This section builds upon the existing conditions analysis performed in the *Madison Corridor BRT Study Traffic Analysis Report* (January 2016; Appendix A).

Madison Street is a major east-west corridor connecting downtown Seattle to Capitol Hill and the Madrona neighborhood districts (see Figure 2). The roadway is a principal arterial that changes in cross-section and function between 1<sup>st</sup> Avenue and MLK Jr. Way extending approximately 2.3 miles to the east. In the downtown area between 1<sup>st</sup> Avenue and 6<sup>th</sup> Avenue, Madison Street is one-way westbound while the remainder of the roadway out to MLK Jr. Way is two-way. Between 1<sup>st</sup> Avenue and 6<sup>th</sup> Avenue, Madison Street has two westbound travel lanes and angled on-street parking on the south side of the street. Between 6<sup>th</sup> Avenue and 7<sup>th</sup> Avenue, Madison Street has one eastbound lane and three westbound lanes. East of approximately 7<sup>th</sup> Avenue to MLK Jr. Way, Madison Street generally has two lanes in each direction with left turn lanes at the majority of intersections.

The corridor is broken up into three major segments: the Downtown segment from 1<sup>st</sup> Avenue to 6<sup>th</sup> Avenue, the First Hill segment from 6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue and the East segment from 13<sup>th</sup> Avenue to MLK Jr. Way. Interstate 5 crosses underneath Madison Street between 6<sup>th</sup> Avenue and 7<sup>th</sup> Avenue. Spring Street parallels Madison Street one block to the north and between 1<sup>st</sup> Avenue and 9<sup>th</sup> Avenue, acts as a one-way eastbound pair to Madison Street. Spring Street has two eastbound lanes between 1<sup>st</sup> Avenue and 4<sup>th</sup> Avenue, and three eastbound lanes between 4<sup>th</sup> Avenue and 9<sup>th</sup> Avenue. There is on-street parking on the north side of the street in most areas. East of I-5, there is parking on both sides of Spring Street. Spring Street is classified as a principal arterial street by the City of Seattle.

The Madison Corridor varies in width, lane channelization and directionality throughout its length. In the downtown core, Madison Street (one-way westbound) has two lanes with on-street parking on one side of the street. From 6<sup>th</sup> Avenue to Broadway, Madison Street has five lanes (two in each direction during the PM peak period; during non-peak times, there is one lane and parallel parking on the south side of the street) with a center two-way left turn lane (TWLTL). East of Broadway, the roadway transitions from five lanes down to four lanes with no TWLTL until 22<sup>nd</sup> Avenue. East of 22<sup>nd</sup> Avenue, there is an eastbound left turn lane approaching the intersection at 23<sup>rd</sup> Avenue and there are left turn lanes at MLK Jr. Way. Figure 5, Figure 6 and Figure 7 show example cross-sections and channelization for each distinct segment of the Madison Corridor.



**Figure 5 Madison Street Example Downtown Cross-Section (4<sup>th</sup> Avenue to 3<sup>rd</sup> Avenue) during the PM Peak (looking east)**



**Figure 6 Madison Street Example First Hill Cross-Section (9<sup>th</sup> Avenue to Terry Avenue) during the PM Peak**



**Figure 7 Madison Street Example East End Cross-Section (18<sup>th</sup> Avenue to 19<sup>th</sup> Avenue) during the PM Peak**



## Traffic Operations

### *Existing Signal Timings*

Existing signal timings were obtained for the study area traffic signals within the project limits. Table 2 summarizes the signal timing plans in the study area.

**Table 2 Summary of Existing PM Peak Hour Signal Timing Plans**

Intersection	Cycle Length (Seconds)	Concurrent Peds	Crosswalk Locations
1 <sup>st</sup> /Madison	90	WB, NB, SB	East, West, North, South
2 <sup>nd</sup> /Madison	90	WB, SB	East, West, North, South
3 <sup>rd</sup> /Madison	90	WB, NB, SB	East, West, North, South
4 <sup>th</sup> /Madison	90	WB, NB	East, West, North, South
5 <sup>th</sup> /Madison	90	WB, SB	East, West, North, South
6 <sup>th</sup> /Madison	90	WB, NB	West, North, South
7 <sup>th</sup> /Madison	90	EB, WB, NB, SB	East, North, South
8 <sup>th</sup> /Madison	90	EB, WB, NB, SB	East, West, North, South
9 <sup>th</sup> /Madison	90	EB, WB, NB, SB	East, West, North, South
Terry/Madison	90	EB, WB, NB, SB	East, West, North, South
Boren/Madison	90	EB, WB, NB, SB	East, West, North, South
Minor/Madison	90	EB, WB, NB, SB	East, West, North, South
Summit/Madison	90	EB, WB, NB, SB	East, West, North, South
Boylston/Madison	90	EB, WB, NB, SB	East, West, North, South
Broadway/Madison	90	EB, WB, NB, SB	East, West, North, South
11 <sup>th</sup> /Madison	100	EB, WB, SB	West, North
12 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
13 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, North, South
14 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, South
14 <sup>th</sup> /Pike	100	EB, WB, NB, SB	East, West, North
15 <sup>th</sup> /Madison	100	SB	East
Pine/Madison	100	EB, WB, SB	North, West
17 <sup>th</sup> /Madison	100	EB, WB	East, West, North, South
19 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
20 <sup>th</sup> /Madison	100	EB, WB, SB	East, West, North, South

## Transportation Memorandum

Intersection	Cycle Length (Seconds)	Concurrent Peds	Crosswalk Locations
22 <sup>nd</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
23 <sup>rd</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
John/Madison	100	EB, WB, NB, SB	East, West, North, South
28 <sup>th</sup> /MLK Jr/Madison	100	EB, WB, NB, SB	East, West, North, South
1 <sup>st</sup> /Spring	90	EB, NB, SB	East, West, North, South
2 <sup>nd</sup> /Spring	90	EB, SB	East, West, North, South
3 <sup>rd</sup> /Spring	90	EB, NB, SB	East, West, North, South
4 <sup>th</sup> /Spring	90	EB, NB	East, West, North, South
5 <sup>th</sup> /Spring	90	EB, SB	East, West, North, South
6 <sup>th</sup> /Spring	90	EB, NB	East, West, North
7 <sup>th</sup> /Spring	60	EB, NB, SB	East, West, North, South

### *Existing Traffic Operations*

Level of service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads and operating conditions. It is a qualitative measure used to describe a quantitative analysis taking into account factors such as roadway geometrics, signal phasing, speed, travel delay and average vehicle delay.

LOS provides an index to the operational qualities of a roadway segment or an intersection. For this study, LOS is used as a measure of effectiveness for intersection operation. The LOS at signalized intersections is defined by the average vehicle delay for the entire intersection, and at unsignalized intersections is defined by the average vehicle delay for the stop controlled movements. LOS is similar to a "report card" rating ranging from LOS A to F. LOS A represents free-flow conditions with little or no delay. LOS E represents conditions at intersection capacity, and LOS F represents worst case or over capacity conditions.

Signalized intersections were analyzed under PM peak hour conditions. Average intersection auto delay and intersection LOS were determined utilizing the methodology found in Chapter 18 of the *2010 Highway Capacity Manual (HCM)*, with the assistance of the Synchro (version 9.1) traffic simulation software. Wherever unusual geometries or non-standard signal timings were found, HCM 2000 methodology was used in lieu of HCM 2010.

For the purposes of this study, traffic impact thresholds were established to evaluate changes in traffic congestion levels along the corridor. The standard practice for identifying specific corridor-level traffic impacts is to measure peak-hour (morning and evening rush hour) level of service (LOS) at signalized intersections within the study area.

LOS for signalized intersections is a measure of signal control delay (seconds/vehicle) ranging from A to F, as follows<sup>[1]</sup>:

- LOS A = Free flow (intersection control delay: <10 seconds/vehicle).
- LOS B = Reasonably free flow (intersection control delay: 10-20 seconds/vehicle).
- LOS C = Stable flow (intersection control delay: 20-35 seconds/vehicle).
- LOS D = Approaching unstable flow (intersection control delay: 35-55 seconds/vehicle).
- LOS E = Unstable flow (intersection control delay: 55-80 seconds/vehicle).
- LOS F = Forced or breakdown flow (intersection control delay: > 80 seconds/vehicle).

The Federal Transit Administration (FTA) does not establish LOS standards for traffic operations analysis; however, they follow the Federal Highway Administration (FHWA) guidelines

SDOT is the agency responsible for traffic engineering within the City of Seattle. For this project, SDOT considers LOS A through D acceptable during peak hours; however, heavily used or physically constrained intersections operating at LOS E or F may be difficult to mitigate during peak hours. The project will work with SDOT's Traffic Signal Optimization Program to ensure that traffic at these intersections moves as freely and smoothly as possible.

Table 3 shows the results for the existing intersection operations analysis, including unsignalized intersections along the corridor. The delay shown below for the existing conditions is the average vehicle delay at each intersection during the PM Peak period. A review shows that all the signalized intersections operate at LOS D or better, except 18<sup>th</sup> Avenue/Madison Street, 25<sup>th</sup> Avenue/Madison Street, and 6<sup>th</sup> Avenue/Spring Street. The 18<sup>th</sup> Avenue and 25<sup>th</sup> Avenue intersections are currently unsignalized.

---

<sup>[1]</sup> Transportation Research Board, [Highway Capacity Manual 2010](#)

**Table 3 Summary of PM Peak Hour Existing Conditions Delay and Level of Service**

Study Intersection	Signalized?	Weekday PM	
		Delay (s/veh)	LOS
1st/Madison	Y	8.6	A
2nd/Madison	Y	29.8	C
3rd/Madison	Y	14.2	B
4th/Madison	Y	23.3	C
5th/Madison	Y	11.4	B
6th/Madison	Y	15.8	B
7th/Madison	Y	17.1	B
8th/Madison	Y	9.0	A
9th/Madison	Y	9.2	A
Terry/Madison	Y	5.1	A
Boren/Madison	Y	40.4	D
Minor/Madison	Y	11.3	B
Summit/Madison	Y	7.5	A
Boylston/Madison	Y	5.9	A
Broadway/Madison	Y	19.4	B
Broadway Ct/Madison	N	15.7 (SB)	C
10th/Madison	N	10.3 (SB)	B
11th/Madison	Y	8.9	A
12th/Madison	Y	35.6	D
13th/Madison	Y	8.0	A
14th/Madison	Y	13.2	B
14th/Pike	Y	9.2	A
Pike/Madison	N	7.2	A
15th/Madison	Y	1.0	A
16th/Madison	N	13.4 (NB)	B
Pine/Madison	Y	10.0	A
17th/Madison	Y	11.9	B
18th/Madison	N	<b>36.6 (NB)</b>	<b>E</b>
19th/Madison	Y	17.8	B

Study Intersection	Signalized?	Weekday PM	
		Delay (s/veh)	LOS
20th/Madison	Y	7.1	A
Denny/22nd NB/Madison	Y	5.2	A
22nd SB/Madison	N	10.0 (SB)	B
23rd/Madison	Y	36.3	D
John/Madison	Y	30.2	C
25th/Madison	N	<b>39.3 (SB)</b>	<b>E</b>
26th/Madison	N	13.2 (SB)	B
27th NB/Madison	N	14.8 (NB)	B
27th SB/Madison	N	12.2 (SB)	B
28th/MLK/Madison	Y	17.4	B
1st/Spring	Y	12.0	B
2nd/Spring	Y	23.5	C
3rd/Spring	Y	12.5	B
4th/Spring	Y	24.5	C
5th/Spring	Y	25.5	C
6th/Spring	Y	<b>94.7</b>	<b>F</b>
7th/Spring	Y	11.3	B
8th/Spring (*signalized in build)	N	13.7 (EB)	C
9th/Spring (*signalized in build)	N	15.1 (EB)	C

## 4.2 Transit Service

The existing transit network - including routes that travel along Madison Street, on parallel streets and/or via connecting streets - is shown in Figure 8. East-west transit service within the corridor is provided primarily by King Country Metro bus routes 2, 11, and 12:

- Route 2.** Route 2 operates on only a short segment of Madison Street, eastbound between 11<sup>th</sup> and 12<sup>th</sup> Avenues and westbound between 13<sup>th</sup> and 12<sup>th</sup> Avenues, in the “bowtie” area around the intersection of Madison Street and Union Street. However, it closely parallels western segments of Madison Street, operating on Seneca Street westbound and Spring Street eastbound between 3<sup>rd</sup> Avenue and Hubbell Street, just east of I-5, and on Seneca Street, then Union Street on First Hill. East of Madison Street, it continues on Union Street to 34<sup>th</sup> Avenue, then on Denny Way and Madrona Drive to Lake Washington Boulevard and Madrona Park. In the west, it continues as Route 13 from Center City to Queen Anne. Route 2’s east-of-

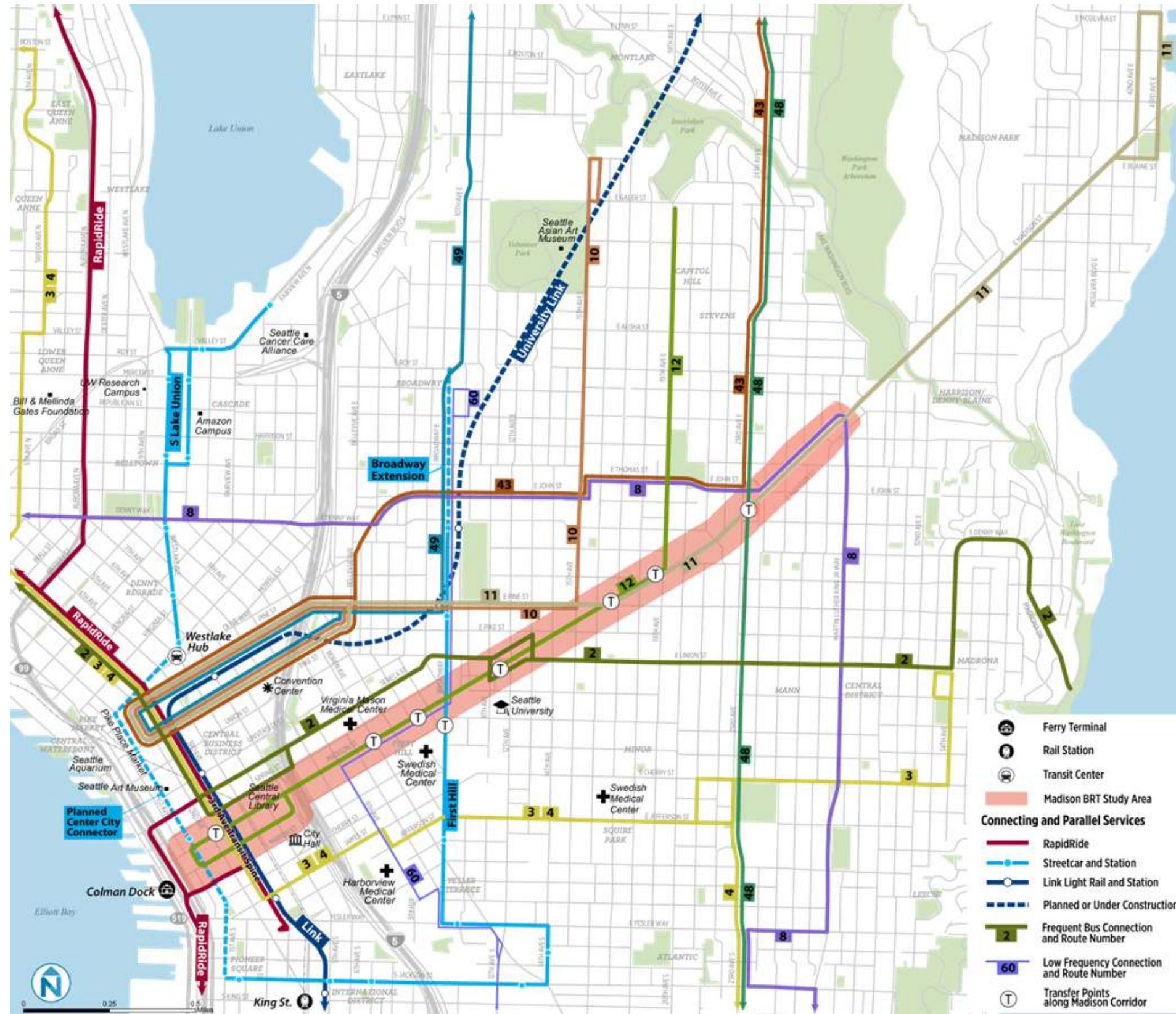


Figure 8 Existing Transit Network

- Center City segment generally operates every 15 minutes on weekdays, and the service runs until well after midnight seven days a week.
- **Route 11.** Route 11 operates on eastern segments of Madison Street. At its western end, it makes a counterclockwise loop of Pine Street, 2<sup>nd</sup> Avenue, Pike Street and Bellevue Avenue before proceeding on Pine Street to Madison Street and out Madison Street to the Madison Park neighborhood, where it makes a counterclockwise loop of Blaine Street, 43<sup>rd</sup> Avenue, McGilvra Street and 42<sup>nd</sup> Avenue. Routes 11 and 12 overlap and share stops on Madison Street between 16<sup>th</sup> Avenue and 19<sup>th</sup> Avenue. Route 11 generally operates every 15 minutes on weekdays, with 30-minute headways in the mid-day. It operates seven days a week over a longer span than Route 12, until almost 2 a.m. on weeknights.
- **Route 12.** The most frequent service operating on Madison Street, Route 12 makes a counterclockwise loop of Madison Street, 1<sup>st</sup> Avenue, Marion Street and 6<sup>th</sup> Avenue in the Center City and then traveling on Madison Street from 6<sup>th</sup> Avenue to 19<sup>th</sup> Avenue. From 19<sup>th</sup> Avenue the route continues north to Galer Street and Interlaken Park. It operates as often as every five minutes during peak periods, with a mid-day weekday base headway of 15 minutes. It operates seven days a week from approximately 6 a.m. to 11 p.m.

Other service on Madison Street includes Route 60, which serves a portion of the corridor. Route 60 operates north-south from Capitol Hill to Georgetown, and on Madison Street between 9<sup>th</sup> Avenue and Broadway. It generally operates every 20 minutes on weekdays. It also runs seven days a week, until around midnight on weekdays and 8 p.m. on weekends.

Downtown, important north-south connections can be made to regional bus service on 2<sup>nd</sup> Avenue, 4<sup>th</sup> Avenue and 5<sup>th</sup> Avenue, bus and Sound Transit Link light rail service in the Downtown Seattle Transit Tunnel (DSTT) below 3<sup>rd</sup> Avenue, and local routes on the 3<sup>rd</sup> Avenue transit spine. King County Metro Rapid Ride routes operate on 3<sup>rd</sup> Avenue and Alaskan Way, and the planned Seattle Center City Connector streetcar will operate on 1<sup>st</sup> Avenue, offering the potential for a shared BRT/streetcar stop on 1<sup>st</sup> Avenue. Outside of Downtown, north-south connections can be made to Route 60 (which shares a segment of Madison Street from Broadway to 9<sup>th</sup> Avenue), the First Hill Streetcar (Broadway), Route 9 (Broadway), Routes 2/12 (Union), Routes 12/11 (19<sup>th</sup>), Route 48 (23<sup>rd</sup>), and Route 8 (MLK Jr. Way).

Analysis of ridership and reliability was conducted for Routes 2, 11, and 12, which provide the bulk of east-west service in the Madison corridor. Additional ridership analysis was conducted for several routes that intersect the corridor, including Routes 3, 8, 10, 43, 48, 49, and 60. Route 9X was not included in this analysis as it does not stop at Madison Street, but stops instead at Union Street and Marion Street. Ridership on Route 9X is approximately 40 people per day at the Marion Street stops and 80 people per day at the Union Street stops. Route 84, which provides night owl service between Downtown Seattle and Madison Park using the Route 11 alignment, was also not included in ridership numbers. The data provided for the analysis is from King County Metro's Fall 2015 service period.



## Transportation Memorandum

There are 7,087 average total weekday boardings on existing Routes 2, 11, and 12 within ¼ mile of the corridor, which represents a typical BRT ridership-shed. Figure 9 shows total daily boardings for the routes significant to the Madison Corridor listed above. Ridership east-west through the corridor is relatively evenly split between Route 2 and Route 12, which run parallel through most of Downtown and First Hill, although ridership is slightly higher on this portion of Route 12. The greatest boarding activity on Madison Street occurs in Downtown Seattle, in First Hill at Boren Avenue and Summit Avenue, at 17<sup>th</sup> Avenue, at 23<sup>rd</sup> Avenue, and at MLK Jr. Way. The nearest First Hill Streetcar stop is just off Madison Street at Marion Street and Broadway.

As shown in Table 4, performance on Routes 2, 11, and 12 is mixed. While all three routes perform in the top 25 percent of King County Metro routes in terms of boardings per platform hour during the peak period, Routes 11 and 12 perform in the bottom 25 percent of routes for passenger miles per platform mile during some or all time periods. This is to be expected given the short length of the corridor, and resulting relatively short trips taken by most passengers.

**Table 4 Performance Metrics for Routes 2, 11, and 12**

Route	Peak		Off Peak		Night	
	Rides/ Platform Hour	Passenger Miles/ Platform Mile	Rides/ Platform Hour	Passenger Miles/ Platform Mile	Rides/ Platform Hour	Passenger Miles/ Platform Mile
Route 2	49.1*	11.4	45.7	9.8	29.8	6.8
Route 11	52.7*	10.2^	48.7	9.4^	38.4*	6.5
Route 12	50.6*	9.5^	38.0	6.3^	16.4^	2.7^

\*Denotes performance in the top 25 percent of all King County Metro Routes.

^Denotes performance in the bottom 25 percent of all King County Metro Routes.

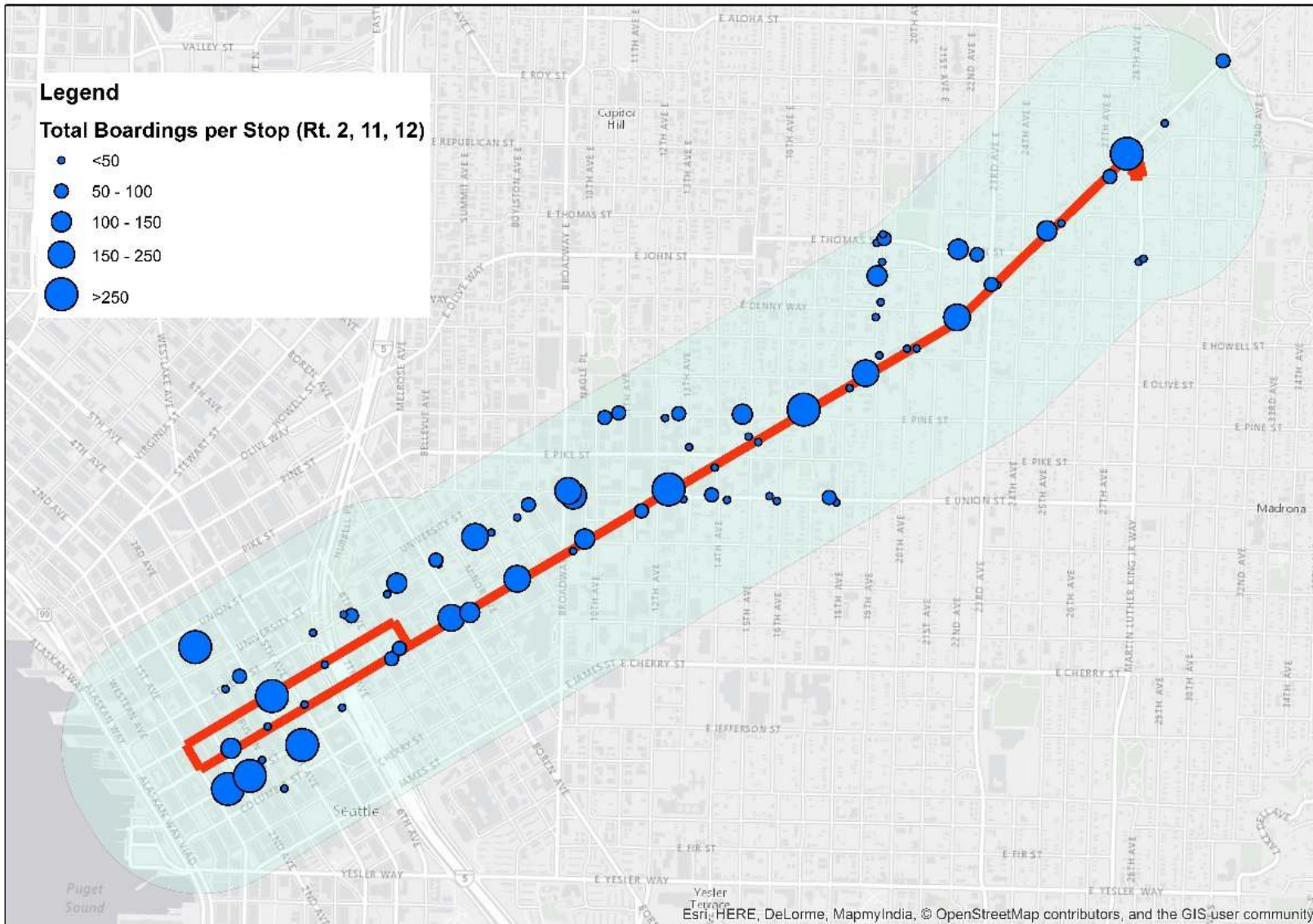
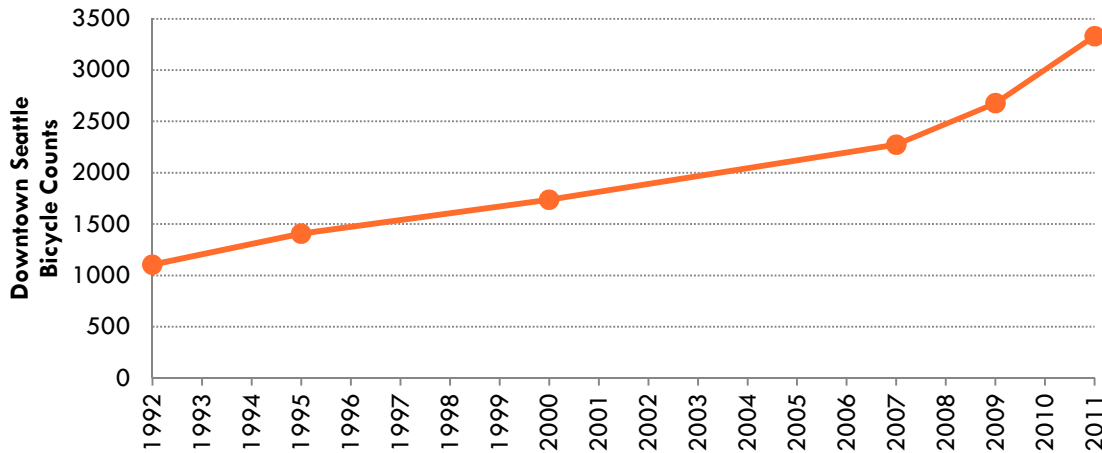


Figure 9 Existing Boardings Within ¼ Mile of Madrona Corridor

### 4.3 Bicycle and Pedestrian Facilities

As shown in Figure 10 (based on SDOT data), rates of bicycling in Downtown Seattle have been steadily increasing since 1992. While the area in which these counts were taken is limited, the data suggests it may be indicative of a larger trend toward increased rates of cycling throughout the city.

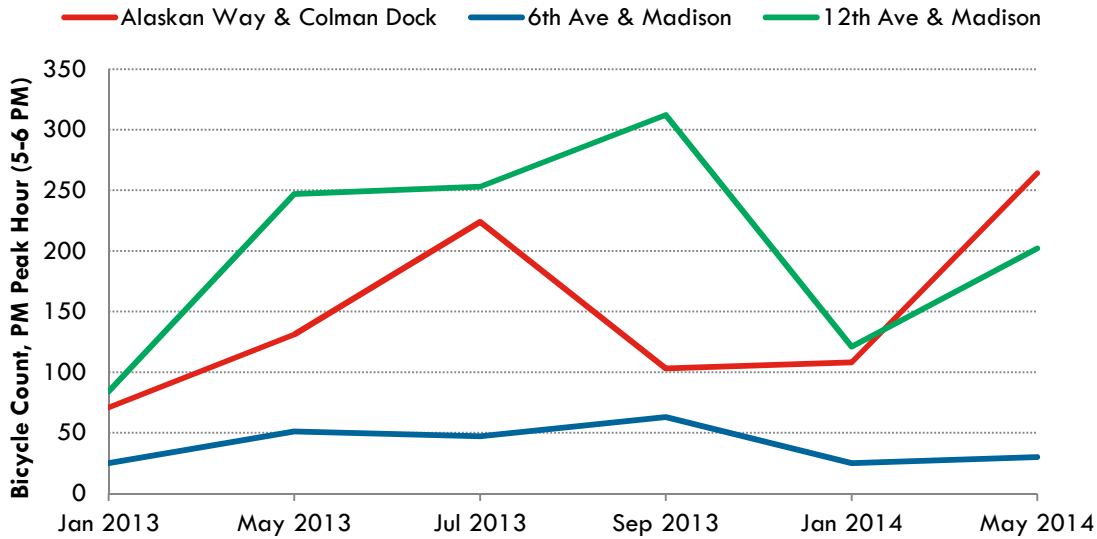


**Figure 10 Downtown Seattle Historic Bicycle Counts**

SDOT also collects quarterly bicycle and pedestrian counts at three locations on or very near the Madison corridor:

- Alaskan Way and Colman Dock
- Madison Street and 6<sup>th</sup> Avenue
- Madison Street and 12<sup>th</sup> Avenue

Figure 11 shows bicycle counts at these locations for the most recent six quarters for which data were available. The count data shown represent bicycles counted at the intersections on a weekday between 5 p.m. and 6 p.m. Of the three count locations, bicycle volumes are generally highest at Madison Street and 12<sup>th</sup> Avenue with peak-hour counts of up to 300 cyclists. Bicycle volumes at 12<sup>th</sup> and Colman Dock fluctuate significantly by season, with lows of 75-125 cyclists per hour in the fall and winter, and volumes over 200 per hour during the summer. Volumes at 6<sup>th</sup> Avenue and Madison Street are lower, around 50 cyclists per hour, with little fluctuation by season.



**Figure 11 Bicycle Counts, Jan 2013-May 2014**

Figure 12 shows pedestrian counts for the same time frame in the p.m. peak hour. Pedestrian volumes are much higher than bicycle volumes and appear to be less influenced by seasonal fluctuations. At Madison Street and 12<sup>th</sup> Avenue, pedestrian volumes generally range from 1,500 to 2,000 pedestrian crossings per hour during the p.m. peak hour. As with bicycle volumes, pedestrian volumes are both lowest and most consistent at 6<sup>th</sup> and Madison Street, with peak-hour volumes ranging from 500 to 1,000 pedestrian crossings per hour during the p.m. peak hour. Volumes at Colman Dock range from a high of nearly 1,500 pedestrians per hour in summer 2013 to a low of around 100 pedestrians per hour in May 2014, a decline that can largely be attributed to construction in the area.

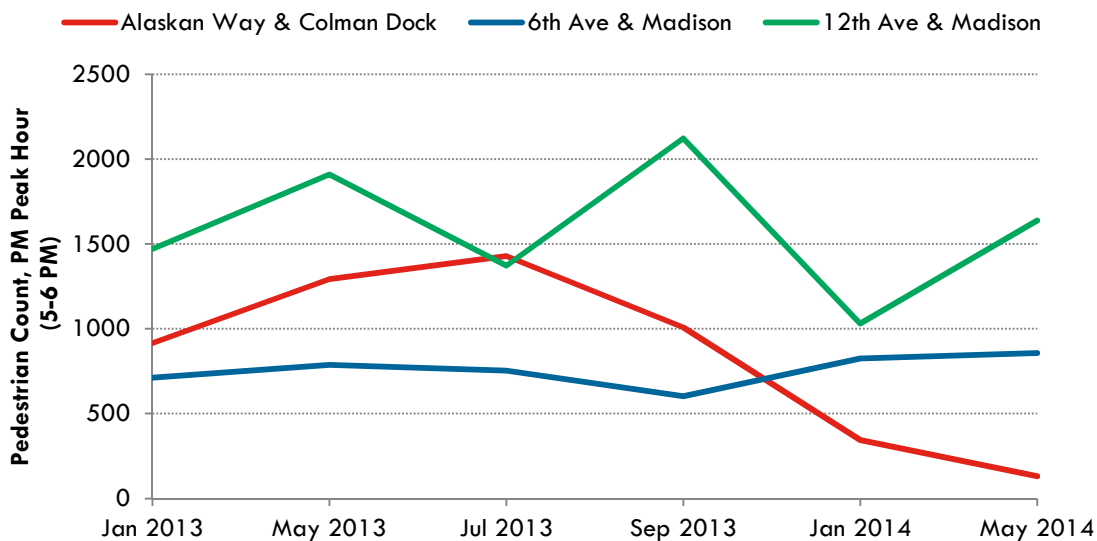


Figure 12 Pedestrian Counts, Jan 2013-May 2014

### Existing Pedestrian Facilities

Sidewalk conditions within the corridor are variable, with widths ranging from 6 to 12 feet and overall quality ranging from relatively high to very poor.

Intersection conditions are similarly variable, with irregularly configured, potentially confusing and time-consuming intersections to the east of Broadway. A number of intersections throughout the corridor have been identified as high priorities for improvement in the Pedestrian Master Plan, locations based on pedestrian demand and opportunities to improve pedestrian conditions through the addition and improvement of sidewalks, curb ramps and crosswalks

### Existing and Planned Bicycle Facilities

There is currently no direct bicycle route serving the Madison corridor. The only route with continuous bike lanes between Downtown and Capitol Hill is on Pine Street from 8<sup>th</sup> Avenue to 15<sup>th</sup> Avenue. Seneca Street has sharrows from First Avenue to Summit Avenue, at which point a bicycle lane begins and continues east on Union Street to 18<sup>th</sup> Avenue. East of where the Seneca Street sharrows end, there are bicycle lanes on Union Street between Broadway and MLK Jr. Way. East of 18<sup>th</sup> Avenue, the route includes portions with sharrows and portions with bike lanes. Spring Street alternates between sharrows and bike lanes between Alaskan Way and Boylston Avenue. To the south of Madison Street, there is a bicycle lane on Cherry Street passing under I-5 in a cycle track, where the route continues north with a block of sharrows and a block of cycle track on 7<sup>th</sup> Avenue; from there, a sharrow continues to Broadway. East-west, there are sharrows on Western Avenue, 9<sup>th</sup> Avenue east of Seneca Street, Boylston Avenue from Seneca Street to Marion Street, 14<sup>th</sup> Avenue between Pine Street and Union Street, and on 19<sup>th</sup> Avenue. East-west bicycle lanes are located on 4<sup>th</sup> Avenue south of Spring Street, and

on 12<sup>th</sup> Avenue, with cycle tracks on 2<sup>nd</sup> Avenue Downtown and on Broadway. Several bicycle improvements included in this project are described in the Pedestrian and Bicycle Improvements section of this report.

## 4.4 Parking

Parking impacts were evaluated in the *Madison Corridor BRT Study Traffic Analysis Report*, Appendix K – Madison Corridor BRT Parking and Loading Impacts Report (Appendix A of this report). The report counted the number of existing on-street parking spaces along each block face on the project corridor. There are 365 existing parking spaces, including all-day and peak-restricted spaces. There are also 25 commercial and passenger loading zones. Table 5 provides a summary of parking spaces.

**Table 5 Summary of On-Street Parking Spaces**

Category	Existing
All-Day Parking	263
Peak-Restricted Parking	102
Commercial Loading	13
Passenger Loading	12

## 5 Project Effects

### 5.1 Short-term Effects

Temporary impacts to transit, vehicular, bicycle and pedestrian traffic will occur during the project's construction phase. The majority of impacts are related to necessary work activities within the existing Madison and Spring Street right-of-ways. Construction will likely be completed in multiple segments along the corridor and, depending on the location and BRT system design, may require partial or full closure of the street. Traffic detour and access management plans will be developed for each construction segment to minimize disruption to all transportation modes, parking, and loading zones. Additionally, when possible, construction activities will be scheduled for nights, weekends, or outside of the peak travel periods. Regardless of traffic management steps taken during construction, temporary traffic diversion from the Madison Corridor onto adjacent roadways should be anticipated. The project is taking steps to minimize large pulses of diversion traffic by proactively communicating upcoming construction activities and lane closures with the public.

Existing transit service along and crossing the corridor may need to be altered during portions of the construction, including non-peak hour shutdowns of the existing trolley overhead network. Temporary short term mitigation methods may include a combination of temporary

rerouting, short term bus stop closures, and short term temporary bus stops. When the existing trolley system will be shut down, internal powered buses will be brought into the corridor to maintain transit service. SDOT will coordinate closely with King County Metro and other regional transit agencies operating in the project area to ensure transit service is maintained during construction throughout the project vicinity.

## **5.2 Long-term Effects**

### **Summary of Effects**

This updated traffic analysis examined the transit and auto travel times along the corridor, intersection delays and level of service, and traffic diversion resulting from construction and operation of the Madison BRT Project. Three PM peak hour scenarios were examined: existing conditions, year of opening (2019) for the No Build Alternative and year of opening (2019) with the Madison BRT Project in operation. The following summarizes the key findings of analysis:

- Some vehicle delay and modified circulation patterns from left turn restrictions at the following cross streets: 7<sup>th</sup> Avenue, 8<sup>th</sup> Avenue, 9<sup>th</sup> Avenue, Terry Avenue, Minor Avenue, Summit Avenue, Boylston Avenue, Broadway Court (unsignalized), 10<sup>th</sup> Avenue (unsignalized), Seneca Street (unsignalized), 12<sup>th</sup> Avenue (westbound LT prohibited), 13<sup>th</sup> Avenue, 14<sup>th</sup> Avenue, Pike Street 15<sup>th</sup> Avenue, 16<sup>th</sup> Avenue, 17<sup>th</sup> Avenue, and 18<sup>th</sup> Avenue.
- Increased auto travel time by 2.9 minutes (22%) in the westbound direction, and by 5.6 minutes (45%) in the eastbound direction.
- Diversion of PM peak hour vehicle traffic in the range of 200 to 400 vehicles from Madison Street is expected with the project (year of opening) due to left turn restrictions and the reduction in auto throughput capacity.
- Removal of 222 on-street parking spots out of a total of 390, including 10 of the 25 existing loading spots along the corridor.
- Improved transit travel time throughout the corridor. The proposed BRT system is expected to have a travel time of 16.0 minutes in the westbound direction during the PM peak hour, which is 5.6 minutes faster than existing local bus travel time in the westbound direction.
- PM peak hour travel time with the Madison BRT Project would be lower than existing auto travel time in the eastbound direction by about 1.2 minutes, but similar to existing auto travel time in the westbound direction.
- PM peak hour speeds with the Madison BRT Project would be similar to the existing auto speeds in both directions (about 18 mph for autos and 17 mph for transit in the eastbound direction, and about 16 mph for both autos and transit in the westbound direction) along the entire length of the corridor.
- The reliability of the PM peak hour BRT service is expected to be better than that of the existing transit service conditions– the standard deviation of the westbound BRT service would be 0.6 versus 1.5 for the baseline service and of the eastbound BRT

## Transportation Memorandum

service would be 0.5 (between 9<sup>th</sup> Avenue and MLK Jr. Way, since continuous transit service is available for this extent under baseline conditions) versus 0.8 for the baseline service.

- It is anticipated that 12,330 riders would utilize the new Madison BRT service each day. The Madison BRT Project would reduce future vehicle trips by providing fast, reliable, public transportation to residents businesses along the corridor. This would result in fewer vehicle miles traveled, which would reduce road congestion when compared to the baseline conditions.

### **Roadway Design and Channelization**

The Madison BRT Project extends along Madison Street, and portions of Spring Street, from 1<sup>st</sup> Avenue to MLK Jr. Way. The Madison BRT Project includes 13 stations with right door platforms on the right curb and 8 left door platforms at transit medians for the length of the corridor. A TOL is provided on Madison Street from 1<sup>st</sup> Avenue to approximately 18<sup>th</sup> Avenue through the removal of on-street parking and/or the conversion of “general purpose” (GP) lanes to bus-only lanes. Eastbound BRT service would operate on Spring Street in the downtown area from 1<sup>st</sup> Avenue to 9<sup>th</sup> Avenue.

The ability to provide exclusive bus lanes for the full length of the Madison Street corridor is constrained by the differences in the roadway widths of each segment of the corridor, along with the highly developed nature of the corridor (lack of available property to purchase for right-of-way expansion). Therefore, the cross-sections and channelization developed for the Madison BRT Project vary in relation to the underlying roadway width for the Downtown, First Hill, and East End sections identified above.

#### ***Downtown***

The downtown area would be modified to provide a BAT lane along the right curb for Madison Street and for Spring Street, along with two general purpose lanes and a parallel parking lane or bike lane where possible.

Eastbound transit would operate in a right side BAT lane on Spring Street from 1<sup>st</sup> Avenue to 6<sup>th</sup> Avenue. Westbound transit coming from First Hill would operate in a left side bus only lane on Madison east of 6<sup>th</sup> Avenue. A queue jump at 6<sup>th</sup> Avenue allows transit to traverse to a right side bus only lane for one block and becomes a BAT lane traveling westbound at Madison Street/5<sup>th</sup> Avenue. All left turns remain permitted on Madison Street and Spring Street. Figure 13 shows downtown channelization on Madison Street, Figure 14 shows a cross section of Madison Street between 2<sup>nd</sup> and 3<sup>rd</sup> avenues, and Figure 15 shows a cross section on Spring Street.



Transportation Memorandum



Figure 13 Downtown Channelization



Figure 14 Downtown Proposed Cross-Section of Madison Street Between 2<sup>nd</sup> Avenue and 3<sup>rd</sup> Avenue (looking east)



Figure 15 Downtown Proposed Cross-Section of Spring Street Between 2<sup>nd</sup> Avenue and 3<sup>rd</sup> Avenue (looking east)

### ***First Hill***

From 9<sup>th</sup> Avenue to 13<sup>th</sup> Avenue, buses operate in the center lanes with stations located in the median to allow for left side boarding/alighting. Bus station platform widths are nine to ten feet wide due to the limited 49-foot roadway. Left turns from Madison Street would be restricted for all intersections on First Hill except at Madison Street/Boren Avenue, Madison Street/Broadway, and for eastbound left turns at Madison Street/12<sup>th</sup> Avenue.

Under the Madison BRT Project, buses operate without interference from right turning vehicles. At intersections where left turns are allowed, buses operate on the left side of left turning traffic. Left turns would be protected only and not allowed to operate concurrently with through phases.

Figure 16 shows the typical channelization where left turns are allowed.

### ***Capitol Hill/Central District***

East of 13<sup>th</sup> Avenue, in the eastbound direction, buses continue to operate in the center lane until 15<sup>th</sup> Avenue. An eastbound queue jump at 15<sup>th</sup> Avenue allows the buses to traverse to the right lane and enter the BAT lane until 18<sup>th</sup> Avenue where it continues onto MLK Jr. Way with general purpose traffic. Westbound, buses travel in with general purpose traffic until 18<sup>th</sup> Avenue. Buses continue westbound in the BAT lane until the station at Madison Street and 17<sup>th</sup> Avenue. The bus traverses the next two blocks to weave over to the bus only lane just before 15<sup>th</sup> Avenue and continues onto 13<sup>th</sup> in the center bus only lane. Left turns from Madison Street are to be restricted at 15<sup>th</sup> Avenue, 16<sup>th</sup> Avenue, 17<sup>th</sup> Avenue and 18<sup>th</sup> Avenue; and are allowed at 19<sup>th</sup> Avenue and intersections to the east. Figure 17 shows the weaves that both eastbound and westbound buses need to traverse between 15<sup>th</sup> Avenue and 17<sup>th</sup> Avenue. Figure 18 shows the roadway cross-section between 17<sup>th</sup> Avenue and 18<sup>th</sup> Avenue.

Transportation Memorandum



Figure 16 First Hill Segment - Madison Street with Left Turn and Transit Channelization



Figure 17 Madison Street between 15<sup>th</sup> Avenue and 17<sup>th</sup> Avenue



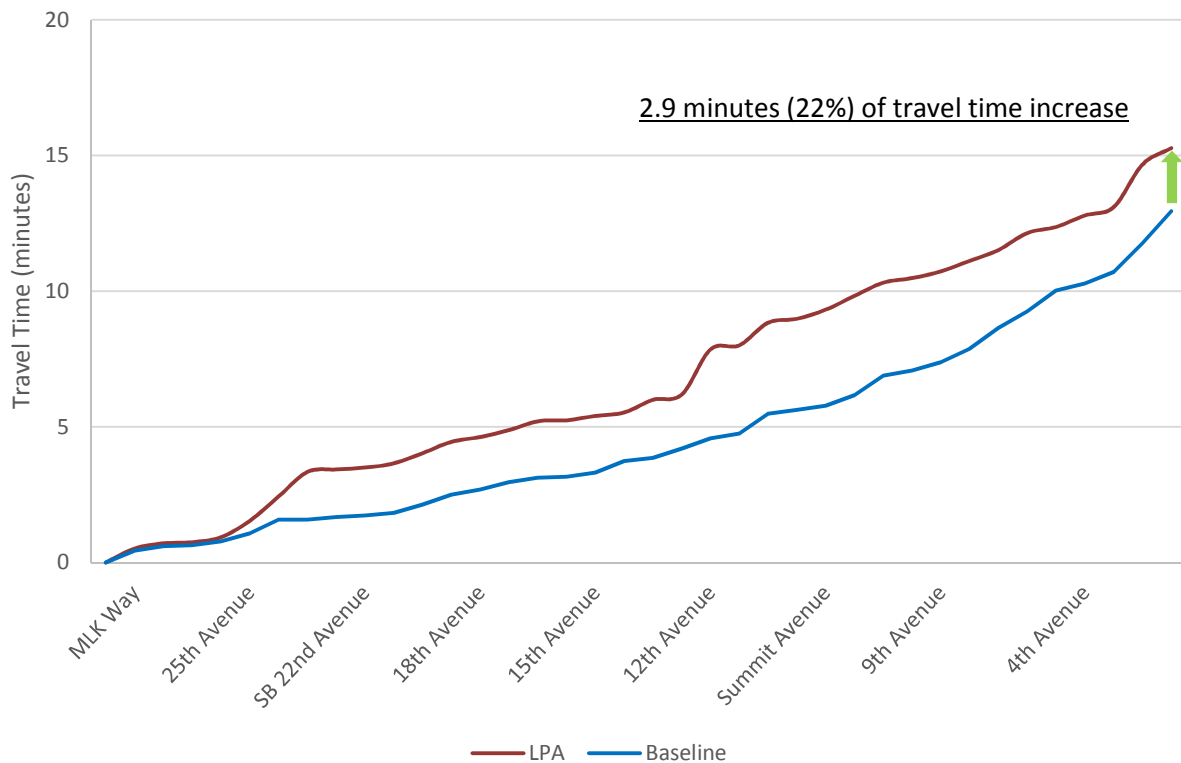
Figure 18 Proposed Cross-Section of Madison Street between 17<sup>th</sup> Avenue and 18<sup>th</sup> Avenue

## Vehicle Travel Time

The Madison BRT Project PM peak hour motor vehicle and transit travel time was evaluated along the corridor in both the eastbound and westbound directions using the Vissim traffic model. Transit travel time reliability was also measured. Transit travel time comparisons were made for the entire corridor in the westbound direction and portions of the corridor for the eastbound direction because existing buses do not operate along the entire corridor; they operate between 3<sup>rd</sup> Avenue and 7<sup>th</sup> Avenue on Spring Street and from 9<sup>th</sup> Avenue to MLK Jr. Way along Madison Street.

### *Westbound Motor Vehicle Travel Time*

Figure 19 shows the comparison between the Madison BRT Project and the baseline for westbound motor vehicle travel times. The Madison BRT Project would result in a 2.9-minute travel time increase or about 22 percent increase in travel time. Westbound motor vehicle travel times are highly dependent on the intersections of Madison/6<sup>th</sup> Avenue and Spring/6<sup>th</sup> Avenue since those provide access to I-5. Since those intersections currently operate at or near capacity, the impacts of removing a general purpose lane on corridor travel times outweigh the potential benefits of other geometric or traffic signal timing changes since motor vehicles will quickly fill any available capacity of the remaining general purpose lanes.



**Figure 19 Westbound Motor Vehicle Travel Times (PM Peak Hour)**

### Eastbound Motor Vehicle Travel Time

Figure 20 shows the eastbound motor vehicle travel time comparison between the Madison BRT Project and baseline. The Project would result in an increased travel time of about 5.6-minutes or a 45 percent increase. Project and baseline travel times are expected to be similar in the downtown area between 1<sup>st</sup> and 9<sup>th</sup> Avenues, but would vary east of 9<sup>th</sup> Avenue. This is due to the fact that eastbound travel has more capacity west of 9<sup>th</sup> Avenue than east of 9<sup>th</sup> Avenue (west of 9<sup>th</sup> Avenue, eastbound Spring Street generally has three travel lanes, while east of 9<sup>th</sup> Avenue, eastbound Madison Street generally has two travel lanes). However, the eastbound direction is the peak direction of travel during the PM peak period. As such, east of 9<sup>th</sup> Avenue, the effect of eliminating a travel lane on eastbound auto travel times is more pronounced than that on the westbound auto travel times. The removal of a travel lane causes more vehicles to shift into the remaining lane. This increases demand for that lane which leads to an increase in travel time even with the benefits of TSP and elimination of some left-turning movements.

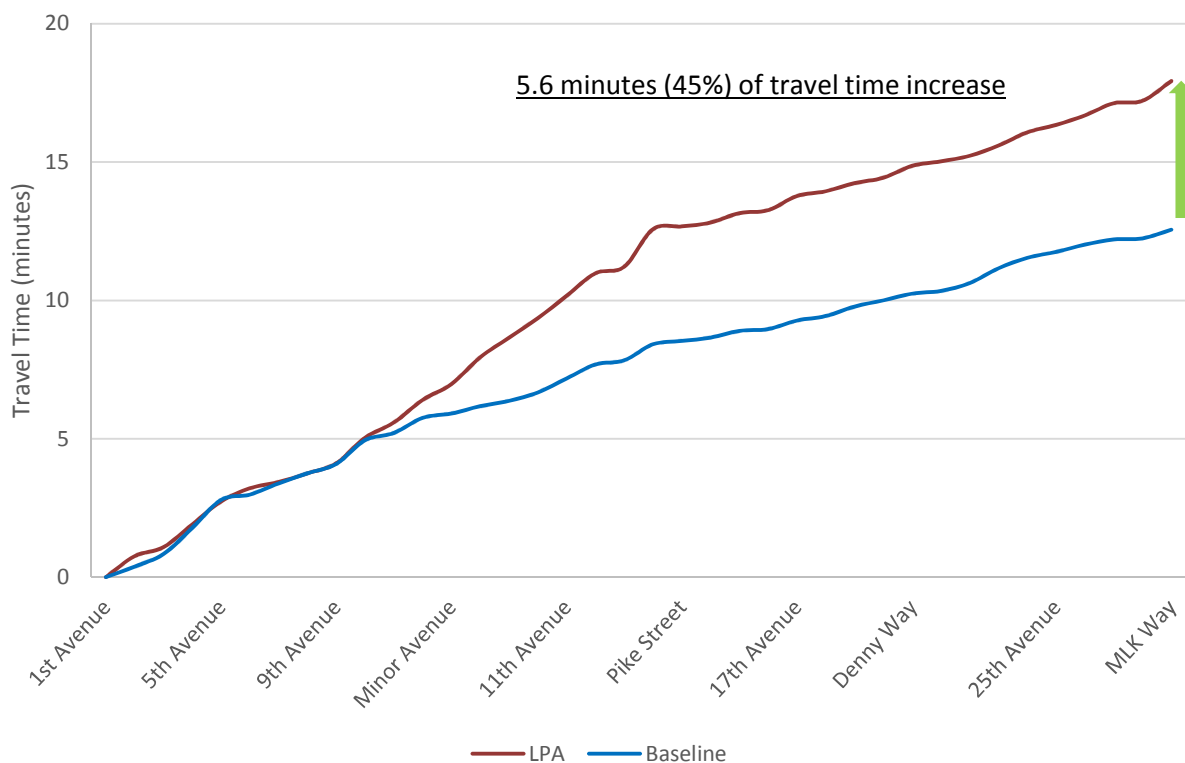


Figure 20 Eastbound Motor Vehicle Travel Time (PM Peak Hour)

### Synchro Results

Table 6 shows the results for the year of opening intersection operations analysis during the PM peak hour based on the Synchro analysis. As previously noted, Synchro cannot analyze the impact of TSP on intersection operations. Vissim, described in following sections, does account for the impact of TSP on intersection and corridor operations, which typically improves transit operations while slightly increasing automobile congestion.

## Transportation Memorandum

A review shows that 47 of the 50 intersections are projected to operate at LOS D or better except at the following locations:

- 2<sup>nd</sup> Avenue/Spring Street – this intersection changes from LOS C to LOS E. With the Madison BRT Project there is a projected volume increase due to traffic rerouting associated with the project geometric changes for southbound 2<sup>nd</sup> Avenue cross traffic. In addition, existing green time along the southbound thru 2<sup>nd</sup> Avenue movement is reduced slightly in order to accommodate a brief eastbound right turn clearance phase from the BAT lane on Spring Street to 2<sup>nd</sup> Avenue, which increases overall intersection delay. SDOT will look into opportunities to improve operations at this location through additional analysis as the project moves into final design. Measures such as updating traffic counts, additional signal coordination, revisions to traffic signal phasing, relocating pedestrian and bicycle crossings, and improvements to other modes will be analyzed as potential mitigation.
- 6<sup>th</sup> Avenue/Spring Street – LOS is maintained at LOS F, but average delay increases from 94.7 seconds to 162.0 seconds, an increase of about 1 minute. This can be accounted for in two ways. First, the eastbound Spring Street BAT lane detectors that activate the queue jump cannot be factored into the model. As a result, Synchro provides less green time along eastbound Spring and assigns them to the bus phase every signal cycle, which would not occur in reality. Secondly, Synchro reports intersection delays in isolation from surrounding intersections. Vissim, which is able to account for bus actuation, indicates that delay at the intersection would only increase by 13 seconds.

Additionally, the intersection operates closely with the nearby 5<sup>th</sup> Avenue/Spring Street intersection, which serves as the upstream feeder for vehicles heading eastbound on Spring Street to 6<sup>th</sup> Avenue. Therefore, delay changes at that intersection are also reflective of conditions in the area. Vissim indicates the delay at the 5<sup>th</sup> Avenue/Spring Street intersection would only increase by 31 seconds with the Madison BRT Project versus the existing.

Alternative geometric designs and signal modifications were evaluated at the 6<sup>th</sup> Avenue/Spring Street intersection to decrease delay and congestion around the I-5 on-ramp. If one-way, eastbound traffic is maintained, the intersection would still operate at LOS F, regardless of the Project. SDOT will continue to look into opportunities to improve operations at this location through additional analysis as the project moves into final design. Measures such as updating traffic counts, additional signal coordination, revisions to traffic signal phasing, relocating pedestrian and bicycle crossings, and improvements to other modes will be analyzed as potential mitigation.

- 25<sup>th</sup> Avenue/Madison Street – LOS E is maintained along southbound approach (the worst operating approach) of this two-way stop-controlled intersection, but average delay decreases slightly from 42.1 seconds to 41.8 seconds.

## Transportation Memorandum

The signal coordination plan used in this analysis was assumed to maintain 90-second traffic signal cycle lengths for the entire corridor, since the Downtown and First Hill portions of the corridor already use this cycle length. However, signals along the corridor could be separated into multiple coordination plans with 10-12 intersections each and different cycle lengths, especially east of 12<sup>th</sup> Avenue. SDOT will evaluate different signal timing and coordination plans along the corridor during final design to address issues at the previously mentioned intersections. These changes may also improve the Vissim-modeled motor vehicle and transit travel time results and transit reliability.

**Table 6 Summary of PM Peak Hour Year of Opening Average Vehicle Delay and Level of Service (Synchro Results)**

Study Intersection	Signalized	2019 NO BUILD CONDITIONS		2019 BUILD CONDITIONS	
		Weekday PM		Weekday PM	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
1st/Madison	Y	28.8	C	25.5	C
2nd Madison	Y	29.8	C	34.7	C
3rd/Madison	Y	14.2	B	12.5	B
4th/Madison	Y	23.3	C	26.7	C
5th/Madison	Y	11.4	B	9.7	A
6th/Madison	Y	15.8	B	19.2	B
7th/Madison	Y	17.1	B	13.7	B
8th/Madison	Y	9.0	A	16.9	B
9th/Madison	Y	9.2	A	20.0	C
Terry/Madison	Y	5.1	A	4.0	A
Boren/Madison	Y	41.1	D	39.0	D
Minor/Madison	Y	8.8	A	14.1	B
Summit/Madison	Y	4.9	A	10.2	B
Boylston/Madison	Y	6.2	A	25.5	C
Broadway/Madison	Y	25.7	C	24.5	C
Broadway Ct/Madison	N	16.0 (SB)	C	10.0 (SB)	B
10th/Madison	N	10.4 (SB)	B	10.0 (SB)	B
11th/Madison	Y	9.0	A	12.8	B

Transportation Memorandum

Study Intersection	Signalized	2019 NO BUILD CONDITIONS		2019 BUILD CONDITIONS	
		Weekday PM		Weekday PM	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
12th/Madison	Y	21.0	C	26.5	C
13th/Madison	Y	5.5	A	19.9	B
14th/Madison	Y	8.1	A	24.4	C
14th/Pike	Y	9.5	A	17.8	B
Pike/Madison	N	7.6	A	11.9 (WB)	B
15th/Madison	Y	0.9	A	5.4	A
16th/Madison	N	13.6 (NB)	B	11.9 (NB)	B
Pine/Madison	Y	10.8	B	15.9	B
17th/Madison	Y	10.5	B	12.5	B
18th/Madison	N	<b>38.4 (NB)</b>	<b>E</b>	19.8 (NB)	C
19th/Madison	Y	15.8	B	23.5	C
20th/Madison	Y	8.5	A	12.2	B
Denny/22nd NB/Madison	Y	6.4	A	20.6	C
22nd SB/Madison	N	10.1 (SB)	B	10.2 (SB)	B
23rd/Madison	Y	27.6	C	31.2	C
John/Madison	Y	22.9	C	21.8	C
25th/Madison	N	<b>42.1 (SB)</b>	<b>E</b>	<b>41.8 (SB)</b>	<b>E</b>
26th/Madison	N	13.3 (SB)	B	13.1 (SB)	B
27th NB/Madison	N	15.0 (NB)	C	14.3 (NB)	B
27th SB/Madison	N	12.3 (SB)	B	12.3 (SB)	B
28th/MLK/Madison	Y	27.2	C	35.6	D
1st/Spring	Y	24.4	C	23.1	C
2nd/Spring	Y	24.0	C	<b>60.8</b>	<b>E</b>
3rd/Spring	Y	11.9	B	6.2	A
4th/Spring	Y	24.5	C	19.0	B
5th/Spring	Y	25.5	C	15.3	B
6th/Spring	Y	<b>94.7</b>	<b>F</b>	<b>162.0</b>	<b>F</b>
7th/Spring	Y	11.3	B	6.7	A



Study Intersection	Signalized	2019 NO BUILD CONDITIONS		2019 BUILD CONDITIONS	
		Weekday PM		Weekday PM	
		Delay (s/veh)	LOS	Delay (s/veh)	LOS
8th/Spring (*signalized in build)	N	13.7 (EB)	B	10.1	B
9th/Spring (*signalized in build)	N	15.1 (WB)	C	14.8	B

**Traffic Signal Warrant Analysis**

A traffic signal warrant analysis was conducted for the unsignalized intersections on the Madison Street BRT corridor. The existing unsignalized intersections are located at:

- 8th Avenue/Spring Street
- 9th Avenue/Spring Street
- 18th Avenue/E Madison Street
- 25th Avenue/E Madison Street
- 26th Avenue/E Madison Street
- 27th Avenue/E Madison Street
- Martin Luther King Jr Way/E Harrison Street

Traffic signals are proposed to be added at the Spring Street/8<sup>th</sup> Avenue and Spring Street/9<sup>th</sup> Avenue intersections based on a traffic signal warrant analysis performed in January 2016 for the project. A traffic warrant analysis was performed for the other intersections to examine if project conditions warrant the addition of traffic signals at these locations. Twenty-four (24) hour counts for intersection turning movements and pedestrian volumes were obtained on Thursday, May 19, 2016, Thursday, June 9, 2016, and Thursday, June 30, 2016. In accordance with Chapter 4C of the Manual on Uniform Traffic Control Devices (MUTCD), it was found that none of these intersections meet warrants for the addition of a traffic control signal. Although the warrants were not met, there are benefits to transit travel time and improved pedestrian safety with the proposed traffic signals at Spring Street/8<sup>th</sup> Avenue and Spring Street/9<sup>th</sup> Avenue. It is recommended that the traffic signals are added at both locations. An additional signal is being considered at MLK Jr. Way and Harrison Street to provide sufficient gaps in traffic

on MLK Jr. Way to allow buses to make a safe and efficient eastbound left turn from Harrison Street onto MLK Jr. Way. Results of all the analyses can be found in Appendix C.<sup>2</sup>

Additional warrant analysis will be completed during the design phase for the intersection at Union Street and 19<sup>th</sup> Avenue.

### *Protected Signal Control Analysis*

An analysis for the warrant of a protected signal control at Madison Street and 19<sup>th</sup> Avenue was performed for the eastbound and westbound left turns was completed in in January 2016. Results of the analysis indicated that no protected left turn phases for the eastbound and westbound left turns are recommended for the intersection. Results of the analysis can be found in Appendix D.<sup>3</sup>

### **Transit Travel Time**

Similar to the motor vehicle travel time, the Madison BRT Project was modeled using the Vissim traffic model to analyze transit travel time.

This section shows the PM Peak results for the Project against the existing conditions with respect to transit travel time through the corridor.

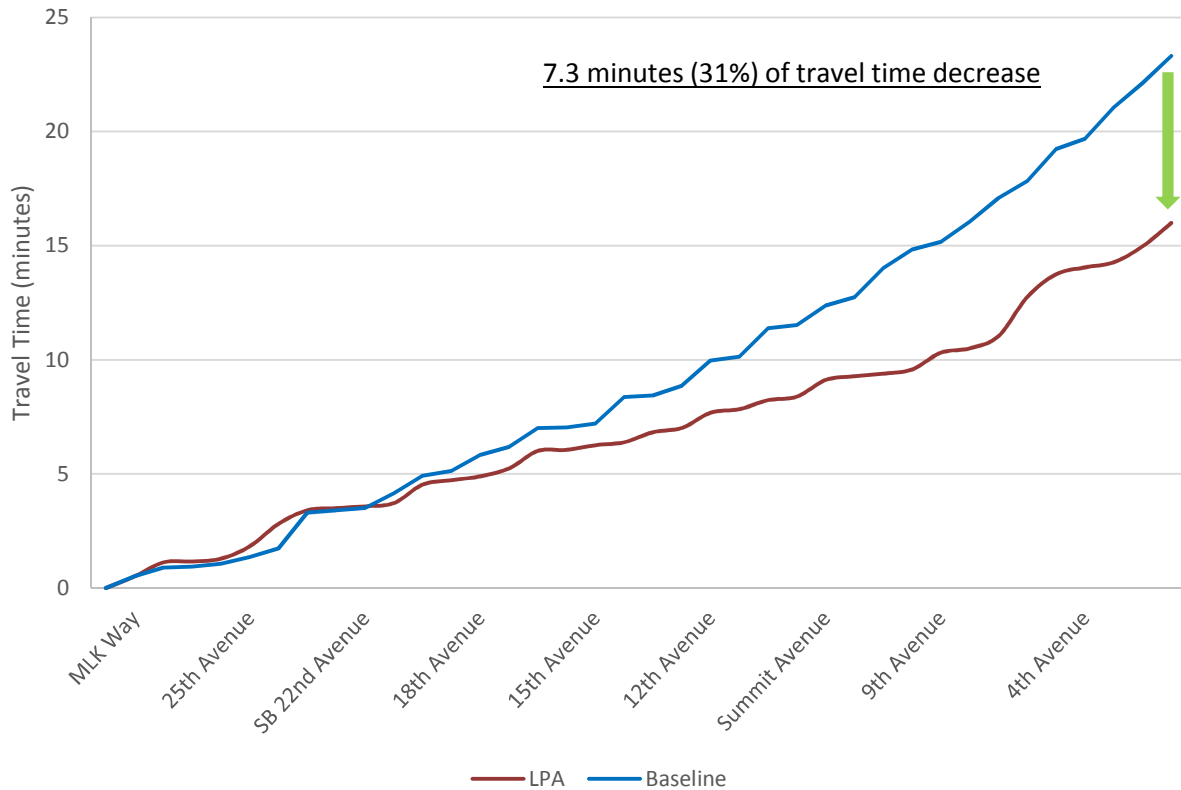
### *Westbound Transit Travel Time*

Figure 21 shows the comparison between the baseline and the Project for westbound transit. Westbound buses traveled along Madison Street for the entirety of the Vissim study area. The Project would provide an approximately 31 percent reduction in travel time which is approximately seven minutes. The transit travel times are expected to remain similar for existing and the Project between MLK Jr. Way and 22<sup>nd</sup> Avenue; the BRT service will operate in mixed-flow lanes for this segment, similar to baseline service. West of 22<sup>nd</sup> Avenue, substantial travel time benefits are expected for the Project primarily due to increased green time on Madison Street from TSP operations, removal of several left turning movements, dedicated lanes, and diversion off of the corridor.

---

<sup>2</sup> Seattle Department of Transportation. Madison Corridor BRT Study Traffic Analysis Report, Appendix E. January 2016.

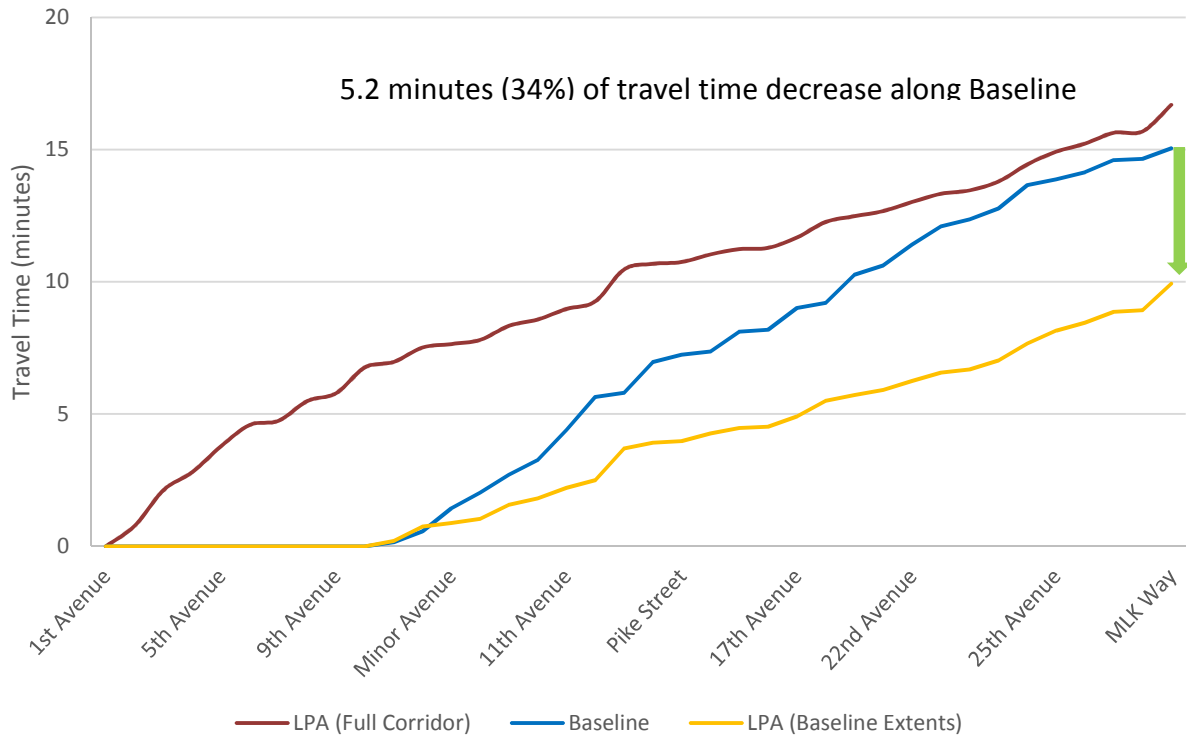
<sup>3</sup> Seattle Department of Transportation. Madison Corridor BRT Study Traffic Analysis Report, Appendix F. January 2016.



**Figure 21 Westbound Transit Travel Time (PM Peak Hour)**

***Eastbound Transit Travel Time***

Figure 22 shows the transit travel time for the eastbound Madison BRT Project compared to the baseline. Eastbound buses travel along Spring Street, turn southward onto 9th Avenue, then turn onto Madison Street and continue eastbound. As previously noted, continuous eastbound baseline transit service is only provided on a portion of the Madison corridor, between 9th Avenue and MLK Jr. Way. As such, eastbound Madison BRT Project results were calculated for the entire corridor, shown in brown, as well as the baseline extents (from 9th Avenue to MLK Jr. Way), shown in yellow. Within the baseline extents, the Project is anticipated to provide approximately 34 percent reduction in travel time or more than a five-minute travel time savings compared to baseline conditions.



**Figure 22 Eastbound Transit Travel Time (PM Peak Hour)**

***Transit Travel Time Reliability***

Table 7 shows several descriptive statistics for PM peak hour transit service over the Vissim study area for the Project and existing conditions. Reliability of transit service for the Project is expected to have a standard deviation of less than 1.0; 0.7 in the eastbound and 0.6 in the westbound direction. Compared to baseline, reliability improves with the Project in the westbound direction, as shown by the decrease in standard deviation from 1.5 in baseline to 0.6 with the Project.

As previously noted, eastbound existing transit service is only provided for a portion of the Madison/Spring corridor. As such, even though reliability metrics for eastbound with the Project were provided for the whole corridor, for an apples-to-apples comparison with the baseline, reliability metrics for eastbound with the Project were also provided between 9<sup>th</sup> Avenue and MLK Jr. Way, the portion of the study corridor where transit would run continuously under baseline conditions. Similar to westbound travel, the reliability of the Project is expected to be lower than existing in the eastbound direction; the standard deviation of the service is expected to reduce from 0.8 to 0.5.

**Table 7 Transit Travel Time Reliability**

Scenario	Direction	Transit Travel Time (minutes)				
		Segment	Min.	Max.	Avg.	Std. Dev.
Existing	Eastbound	9 <sup>th</sup> Avenue to MLK Jr. Way	14.3	16.3	15.2	0.8
	Westbound	MLK Jr, Way to 1 <sup>st</sup> Avenue	21.5	25.7	23.4	1.5
Madison BRT Project	Eastbound	9 <sup>th</sup> Avenue to MLK Jr. Way	9.5	10.6	10.1	0.5
	Eastbound	1 <sup>st</sup> Avenue to MLK Jr. Way	15.3	17.1	16.2	0.7
	Westbound	MLK Jr, Way to 1 <sup>st</sup> Avenue	15.2	16.6	16.0	0.6

**Traffic Diversion**

The Dynameq model was used to identify the amount of traffic that would divert off Madison Street as a result of the project changes and the likely alternative routes. The diversion would result from elimination of some left-turns along the corridor, decreased vehicle capacity, and changes to vehicle travel time. The behaviors of individual drivers are difficult to predict and while most drivers will reroute onto arterials or major collectors, some may use neighborhood streets. As such, this diversion analysis focuses on a limited number of viable alternative routes.

***Dynameq Results***

In the eastbound direction, traffic volumes along Madison Street would experience a decrease of approximately 400 vehicles/hour diverting onto other routes during the PM peak hour, as shown on Figure 23. Routes impacted include Broadway north of Madison Street, Pine Street eastbound until Madison Street, Union Street, 19<sup>th</sup> Avenue, 23<sup>rd</sup> Avenue, and James Street/E Cherry Street.<sup>4</sup>

The westbound direction on Madison Street experiences a reduction of approximately 200 vehicles/hour during the PM peak hour, as shown on Figure 23. Significant routes impacted within the study area include E Denny Way, 19<sup>th</sup> Avenue, James Street/E Cherry Street, and Pine Street.

---

<sup>4</sup> Seattle Department of Transportation. Madison Corridor BRT Study Traffic Analysis Report, Appendix D. January 2016.



2019 Build vs. 2019 No-Build Diversion Volumes

Figure 23 Traffic Diversion (PM Peak Hour)

### *Synchro Results*

SDOT identified eight intersections (15<sup>th</sup> Avenue/Denny Way, 19<sup>th</sup> Avenue/Denny Way, Broadway/Pine Street, Broadway/James Street/Cherry Street, 15<sup>th</sup> Avenue/Union Street, 19<sup>th</sup> Avenue/Union Street, 23<sup>rd</sup> Avenue/Union Street, and 23<sup>rd</sup> Avenue/Cherry Street intersections) that would receive diverted traffic for intersection level of service analysis, as shown on Figure 23. The diverted traffic was added to 2019 No Build traffic volumes to represent conditions with the Madison BRT Project and analyzed with optimized signal timing plans.

A review shows that most of the intersections would experience at least some increase in average delay with the greatest change at the following two intersections:

- Broadway/Pine Street – this intersection changes from LOS D (54.9 seconds of delay) to LOS F (96.3 seconds of delay). With the Project, there is a projected volume increase along north-, south-, and westbound approaches. Changing the cycle length would result in LOS E, with 78.4 seconds of delay; however, the signal timings at other intersections along Broadway would need to be considered before making any change. Construction of the Broadway Streetcar project would prohibit major geometric changes at this intersection. SDOT will continue to look into opportunities to improve operations at this location through additional analysis during final design. Measures such as updating traffic counts, additional signal coordination, revisions to traffic signal phasing, relocating pedestrian and bicycle crossings, and improvements to other modes will be analyzed as potential mitigation.
- 19<sup>th</sup> Avenue/Union Street – The current LOS F would be maintained but average delay for the stop-controlled SB 19<sup>th</sup> Avenue approach (worst operating) would greatly increase from 192.3 seconds to 1055.8 seconds. Installing a traffic signal at this intersection with signal timings similar to the 18<sup>th</sup> Avenue/Union Street intersection would result in LOS B with 11.7 seconds of delay. Additional investigation of a traffic signal warrant will be completed and the intersection will be signalized if deemed appropriate, which would result in LOS B.

### **Bicycle and Pedestrian Circulation Changes**

The project would include a number of improvements for pedestrians and bicyclists. In addition to the construction of corner bulbout sidewalk extensions at a number of locations, the following major improvements are being evaluated and may be made as part of or in relation to the Project:

- A parallel bicycle facility may be provided including:
  - A protected bicycle lane (PBL) on Spring between 1<sup>st</sup> and 4<sup>th</sup> Avenues;
  - A neighborhood greenway on 9<sup>th</sup>, University, and Union west of Broadway;
  - A neighborhood greenway on Denny and Thomas between Broadway and 24<sup>th</sup>;
  - A potential future PBL on Union between Madison and 27<sup>th</sup>; and

## Transportation Memorandum

- A potential future neighborhood greenway on 27<sup>th</sup>, Arthur and 29<sup>th</sup> from Union to Madison
- The intersection of 12<sup>th</sup> and Union would include an additional crosswalk on the north side of the intersection, in addition to new bicycle crossing striping. There would also be a wide crosswalk on Madison on the east side of the intersection enabling transitions between the bike facilities on Union to the east across Madison and 12<sup>th</sup> Avenues as well as enhance and extend pedestrian safety and crossing times.
- At 24<sup>th</sup>, a short segment of bicycle lane would be striped through the intersection of 24th and John and improvements to the sidewalk on Madison west of the intersection would be included in order to facilitate through movements on the 24<sup>th</sup> Avenue Greenway.

All of the bicycle and pedestrian circulation changes were considered during the traffic modeling effort. The changes proposed are intended to provide improved safety and access for bicycles and pedestrians in the project vicinity. The results of the traffic modeling indicate that there is no significant impact to the transportation network with these project elements.

### Parking Effects

Total existing parking and loading spaces and projected spaces along the Project alignment are shown in Table 8. Note that 1<sup>st</sup> Avenue between Madison Street and Spring Street, part of the Project alignment, has not been included in this analysis because changes to parking configuration on this street will be made as part of the Center City Connector streetcar project. Additional analysis of off-corridor parking capacity and mitigation measures will be performed in the next phase.

**Table 8 Summary of Madison BRT Project Parking Impacts**

Category	Existing	Projected	Change
All-Day Parking	263	150	-113
Peak-Restricted Parking	102	3	-99
Commercial Loading	13	5	-8
Passenger Loading	12	10	-2
<b>Total</b>	<b>390</b>	<b>168</b>	<b>-222</b>

Table 9 shows existing and projected parking and loading spaces by segment and by designation of curb use including all-day parking, peak restricted parking, commercial load zones, and passenger load zones.



**Table 9 Madison BRT Project Parking Impacts by Segment**

Segment	All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
	Existing	BRT	Existing	BRT	Existing	BRT	Existing	BRT
Downtown (1 <sup>st</sup> Ave-6 <sup>th</sup> Ave)	58	15	15	0	1	0	6	3
First Hill (6 <sup>th</sup> -Broadway)	69	46	43	0	3	1	5	1
Capitol Hill/Central District (Broadway-23 <sup>rd</sup> Ave)	34	13	38	0	3	0	1	0
Madison Park (23 <sup>rd</sup> Ave-MLK Jr. Way)	102	76	6	3	6	4	0	6

### Transit Operations Changes

The Madison BRT Project would replace portions of the King County Metro Route 12 where they would otherwise overlap. Metro anticipates they will revise Route 12 to compliment the BRT and continue to serve the east Capitol Hill areas as it currently does. All other routes will stay the same. North-south service will also be provided by the First Hill-Broadway Streetcar. All other existing transit services operating along or across the corridor will remain.

## 6 Mitigation

### 6.1 Short-term Mitigation

To mitigate for temporary traffic impacts, the contractor will be required to develop a construction management plan that will include, among other things, implementation of traffic detours and access management plans for each construction segment to minimize disruption to all transportation modes, parking, and loading zones. SDOT is reaching out to emergency service providers and the public in order to get their input on the schedule and phasing for construction. A construction traffic management plan would be developed after final design, and will incorporate the public outreach results. The plan would also identify approved routes for all construction traffic in addition to best management practices (BMPs) that would be implemented to manage traffic near active construction sites. When possible, construction activities will be scheduled for nights, weekends, or outside of the peak travel periods.

The project team is taking steps to minimize large pulses of diversion traffic from people trying to avoid construction by proactively communicating upcoming construction activities and lane closures with the public.

Temporary short term mitigation for interruptions to existing transit service may include a combination of temporary rerouting, short term bus stop closures, and short term temporary bus stops. When the existing trolley system will be shut down, internal powered buses will be

brought into the corridor to maintain transit service. SDOT will coordinate closely with King County Metro and other regional transit agencies operating in the project area to ensure transit service is maintained during construction throughout the project vicinity.

## **6.2 Long-term Mitigation**

SDOT acknowledges that implementation of the Madison BRT project will degrade operation for general purpose traffic at some intersections along the corridor. The project goal is to improve transit capacity, reliability, and connectivity since transit is the mode which carries the majority of people through the corridor. SDOT will continue to look into opportunities to improve operations at these locations through additional analysis and design workshops. Measures such as updating traffic counts, additional signal coordination, revisions to traffic signal phasing, relocating pedestrian and bicycle crossings, and improvements to other modes will be analyzed as potential mitigation.

To mitigate for the additional delay at the intersection of 19<sup>th</sup> Avenue/Union Street due to traffic diversion, an additional traffic signal warrant will be completed by SDOT and the intersection will be signalized if deemed appropriate, which would result in LOS B.

SDOT will continue to look for opportunities to create new parking and loading areas as the Madison BRT Project design progresses. SDOT will continue to coordinate with the business and property owners along the corridor that would be directly affected by parking removal. If necessary, SDOT will relocate property access points to side streets in order to maintain loading and unloading areas and access points.

Additional analysis of off-corridor parking capacity and mitigation measures will be performed in the next phase.

## 7 References

Seattle Department of Transportation. Center City Parking Program: Innovating Parking Solutions. Information obtained from City website:

<http://www.seattle.gov/transportation/centercityparking.htm>. September 2016.

Seattle Department of Transportation. Madison Corridor BRT Study, Traffic Analysis Report. January 2016.

Seattle Department of Transportation. Madison Corridor BRT Study, LPA Summary Report. December 2015.



# **Appendix A**

## **Madison Corridor BRT Study Traffic Analysis Report (January 2016)**



The Seattle Department of Transportation

# Madison Corridor BRT Study

# Traffic Analysis Report

January 2016  
DRAFT



 **SDOT**  
Seattle Department of Transportation

  
**NELSON  
NYGAARD**

DKS Associates





# Table of Contents

	Page
<b>1 Project Description/Executive Summary.....</b>	<b>1-1</b>
Project Location and Extent.....	1-1
Existing and Future Deficiencies Being Addressed.....	1-3
Project Purpose.....	1-4
Benefits, Impacts, and Tradeoffs.....	1-4
<b>2 Existing Conditions.....</b>	<b>2-6</b>
Existing Traffic Volumes.....	2-9
Existing Bicycle and Pedestrian Volumes.....	2-9
Existing Pedestrian Facilities.....	2-11
Existing and Planned Bicycle Facilities.....	2-11
Existing Signal Timings.....	2-12
Existing Traffic Operations.....	2-13
Transit Routes and Service.....	2-15
Collision Analysis.....	2-20
Parking Analysis.....	2-22
<b>3 Planned and Programmed Improvements.....</b>	<b>3-1</b>
Bicycle Master Plan and Pedestrian Master Plan.....	3-1
Transit Master Plan.....	3-3
King County Madison Street Transit Priority Corridor Improvements Conceptual Study.....	3-5
City of Seattle Madison Street BRT Corridor Study.....	3-5
<b>4 Traffic Forecast.....</b>	<b>4-1</b>
Analysis Approach and Methodology.....	4-1
Dynaemq Study Area.....	4-1
Vissim Study Area.....	4-2
Dynaemq and Vissim Modeling Assumptions.....	4-3
Synchro Study Area.....	4-4
EMME Travel Demand Modeling.....	4-4
<b>5 Traffic Operations Analysis of Alternatives.....</b>	<b>5-1</b>
Year of Opening – Locally Preferred Alternative.....	5-1
LPA Results.....	5-5
2030 No Build Alternative.....	5-15
2030 LPA Build Alternative.....	5-15
Appendix I shows the intersection operations results for the No-Build 2030 PM Peak Hour and Appendix J shows the intersection operations results for the LPA 2030 PM Peak Hour.....	5-15
<b>6 Recommended Design Program.....</b>	<b>6-1</b>
Appendix A: Role Plot – 10% LPA Plans.....	6-3
Appendix B: Traffic Volumes for Alternatives.....	6-3
Appendix C: Proposed Signal Phasing Diagrams.....	6-3
Appendix D: Diversion Graphics.....	6-3
Appendix E: Traffic Signal Warrant Analysis.....	6-3
Appendix F: Protected Signal Control Analysis.....	6-3
Appendix G: Intersection Operations Results Existing Conditions 2015 PM Peak Hour.....	6-3
Appendix H: Intersection Operations Results LPA 2015 PM Peak Hour.....	6-3

Appendix I: Intersection Operations Results No-Build 2030 PM Peak Hour .....	6-3
Appendix J: Intersection Operations Results LPA 2030 PM Peak Hour.....	6-3
Appendix K: Madison Corridor BRT Parking and Loading Impacts Report .....	6-3
Appendix L: Madison Corridor BRT Complete Streets Assessment .....	6-3

## Table of Figures & Tables

	<b>Page</b>
Figure 1 Madison BRT Corridor .....	1-2
Figure 2 Study Area Map with Existing Signalized Intersections.....	2-7
Figure 3 Madison Street Example Downtown Cross-Section (4 <sup>th</sup> Avenue to 3 <sup>rd</sup> Avenue) during the PM Peak (looking east).....	2-7
Figure 4 Madison Street Example First Hill Cross-Section (9 <sup>th</sup> Avenue to Terry Avenue) during the PM Peak .....	2-8
Figure 5 Madison Street Example East End Cross-Section (18 <sup>th</sup> Avenue to 19 <sup>th</sup> Avenue) during the PM Peak .....	2-8
Figure 6 Downtown Seattle Historic Bicycle Counts.....	2-9
Figure 7 Bicycle Counts, Jan 2013-May 2014 .....	2-10
Figure 8 Pedestrian Counts, Jan 2013-May 2014.....	2-11
Table 1 Summary of Existing PM Peak Hour Signal Timing Plans .....	2-12
Table 2 Summary of PM Peak Hour Existing Conditions Delay and Level of Service .....	2-14
Figure 9 Existing Transit Network.....	2-17
Table 3 Bus Stop Spacing .....	2-18
Figure 10 Ridership on Madison-Area Bus Routes.....	2-19
Table 4 2013 Performance Metrics for Routes 2, 11, and 12.....	2-20
Figure 11 Collision Locations by Mode.....	2-21
Table 5 On-Board Passenger Incidents in Madison Corridor .....	2-21
Table 6 Summary of LPA Parking Impacts .....	2-22
Table 7 LPA Parking Impacts by Segment .....	2-23
Figure 12 Map of Parking and Loading Impacts, LPA Downtown Segment.....	2-23
Figure 13 Map of Parking and Loading Impacts, First Hill Segment .....	2-24
Figure 14 Map of Parking and Loading Impacts, Capitol Hill/Central District Segment.....	2-24
Figure 15 Map of Parking and Loading Impacts, Madison Valley Segment .....	2-25
Figure 16 Madison Street Grades .....	3-2
Figure 17 Planned and Existing Bicycle Network .....	3-3
Figure 18 Dynameq Traffic Model Limits .....	4-2
Figure 19 Vissim Study Area .....	4-3
Figure 20 Downtown Channelization.....	5-2
Figure 21 Downtown Proposed Cross-Section of Madison Street Between 2 <sup>nd</sup> Avenue and 3 <sup>rd</sup> Avenue (looking east).....	5-2
Figure 22 Downtown Proposed Cross-Section of Spring Street Between 2 <sup>nd</sup> Avenue and 3 <sup>rd</sup> Avenue (looking east).....	5-3

Figure 23	First Hill Segment - Madison Street with Left Turn and Transit Channelization .....	5-4
Figure 24	Madison Street between 15 <sup>th</sup> Avenue and 17 <sup>th</sup> Avenue.....	5-4
Figure 25	Proposed Cross-Section of Madison Street between 17 <sup>th</sup> Avenue and 18 <sup>th</sup> Avenue .....	5-5
Figure 26	Westbound Transit Travel Time (PM Peak Hour).....	5-6
Figure 28	Westbound Motor Vehicle Time (PM Peak Hour) .....	5-7
Figure 30	Westbound Transit Travel Time (PM Peak Hour) (13 <sup>th</sup> Avenue to 6 <sup>th</sup> Avenue).....	5-9
Figure 31	Eastbound Transit Travel Time (PM Peak Hour) 9 <sup>th</sup> Avenue to 13 <sup>th</sup> Avenue).....	5-10
Table 8	Transit Travel Time Reliability (6 <sup>th</sup> Avenue to 13 <sup>th</sup> Avenue).....	5-10
Figure 32	Westbound Motor Vehicle Travel Times (PM Peak Hour) (13 <sup>th</sup> Avenue to 6 <sup>th</sup> Avenue) .....	5-11
Figure 33	Eastbound Auto Travel Time (PM Peak Hour) (9 <sup>th</sup> Avenue to 13 <sup>th</sup> Avenue).....	5-12
Table 9	Summary of PM Peak Hour Year of Opening Average Vehicle Delay and Level of Service (Synchro Results) .....	5-13
Table 10	Summary of PM Peak Hour 2030 No Build and 2030 Build Level of Service (LOS) and Average Vehicle Delay (Synchro Results).....	5-16







# 1 PROJECT DESCRIPTION/EXECUTIVE SUMMARY

## Project Location and Extent

The Madison Corridor BRT Project provides the opportunity to implement a bus rapid transit (BRT) route along a key east-west corridor in Seattle. The project extends approximately 2.3 miles along Madison Street in downtown Seattle from 1st Avenue to Martin Luther King Jr. Way (see Figure 1). In the downtown segment from 1st Avenue to 9th Avenue the project utilizes both Madison Street and Spring Street as a one-way couplet. East of 9th Avenue, the project provides two-way BRT service on Madison Street to Martin Luther King Jr. Way. The 10 percent LPA (locally preferred alternative) layout of the Madison Corridor BRT Project is provided in Appendix A. Madison Street is currently a busy street for all users across various modes along a corridor that is rapidly growing.

Madison Street is unique among Seattle streets in two key ways. First, it is the only street in the Downtown/First Hill grid to continue east without changing direction, at an angle diagonal to the grid that exists in the rest of the city from Broadway east to Lake Washington. This creates a series of uniquely configured, complex intersections. Second, Madison Street is the only roadway to extend from Elliot Bay east to Lake Washington. For both reasons, Madison Street is a major east-west route, connecting relatively low-density residential and neighborhood-oriented retail areas in the east (Madison Park and Madison Valley) to denser, more mixed-use districts in its central segments (the Central District, Capitol Hill and First Hill) and the office towers of Downtown to the west.

The objective of the traffic analysis for the Madison Street BRT study is to determine the benefits and tradeoffs of operating BRT service on the Madison Corridor with respect to transit and auto travel times within the corridor and the level of auto diversion from Madison Street to the surrounding street system. The traffic analysis includes evaluation of the Locally Preferred Alternative (LPA) BRT service concept as compared to existing transit service operation within the Madison Street corridor.

A summary of the key elements for the LPA as they relate to the traffic analysis is described below.

- BRT operates in a business access and transit only (BAT) lane in downtown between 1st Avenue and 6th Avenue on both Madison Street (right-side) and Spring Street (left-side). The BAT lanes accommodate both through BRT vehicles and turning only general purpose traffic. Along 1st Avenue between Madison Street and Spring Street BRT operates in a median transit lane shared with street car.

**Figure 1 Madison BRT Corridor**



- Between 6th Avenue and 9th Avenue, BRT operates in mixed flow on Spring Street and in a dedicated BRT only lane on Madison Street (left side).
- BRT operates in the median (one BRT lane provided for each direction) with center platforms along Madison Street between 9th Avenue and 15th Avenue.



In this segment, dedicated left turn lanes off of Madison Street are only provided at the Boren Avenue, Broadway, and 12th Avenue (eastbound only) signalized intersections.

- Between 15th Avenue and 18th Avenue, BRT operates in BAT lanes and/or mixed flow lanes on the curb side of Madison Street.
- BRT operates in mixed flow lanes along Madison Street from 18th Avenue to Martin Luther King Jr. Way. The terminus of the alignment at Martin Luther King Jr. Way and the turn-around is on the south side of Madison Street at Martin Luther King Jr. Way and Harrison Street.

The proposed project will re-channelize existing general purpose lanes and remove on street parking to accommodate BAT lanes and Transit Only lanes along the downtown, First Hill and parts of the east segments along the corridor. Proposed traffic signal phasing at the study area intersections along the Madison Corridor is shown in Appendix C. Key elements of the traffic signal operation along the corridor include:

- No transit signal priority at intersections in the downtown segment from 1st Avenue to 6th Avenue.
- A queue jump phase for westbound BRT at the Madison Street/6th Avenue intersection.
- A high level of transit signal priority for intersections along Madison Street from 7th Avenue to Martin Luther King Jr. Way.
- New traffic signals at the Spring Street/8th Avenue and Spring Street/9th Avenue intersections.

This report documents the tools used to evaluate traffic operations, the key elements of the alternatives, and the results of the traffic analysis with respect to baseline traffic conditions. The following project conditions were completed for the PM peak hour traffic analysis:

- Existing Conditions
- Year of Opening - LPA
- 2030 No Build Alternative
- 2030 LPA Build Alternative

## **Existing and Future Deficiencies Being Addressed**

The Madison BRT project is based on the following needs:

- Residents, employees, visitors, students, and shoppers all need frequent, reliable transit service. Bus service can be slow, unreliable and crowded during peak hours, and service could be more frequent.
- People using transit in the corridor need to make east-west connections to major transit hubs. Madison BRT would connect Colman Dock, RapidRide, Link, Downtown transit corridors, and the First Hill Streetcar, helping to form a network of frequent, high-capacity transit.

- Intensifying land use necessitates a robust multi-modal transportation network for the Madison corridor. The Madison corridor connects Downtown Seattle with dense and growing mixed-use neighborhoods. Large-scale infill development is occurring throughout the corridor and more is expected. The transit network and supporting non-motorized facilities are needed to accommodate this growth.
- Pedestrian and bicycle improvements are needed to support the transit network and improve safety and comfort. Pedestrian and bicycle volumes are high and growing, and the Pedestrian and Bicycle Master Plans identify needed improvements to support these modes.
- Public realm improvements would help support the transit investment, livability, and economic development. The corridor could be made a more pleasant place to spend time by adding more green space, places to sit, and more comfortable and attractive bus stops.
- Affordable access is needed to Center City jobs and the health, social services and educational facilities on First Hill. Higher-quality transit service could ensure that employees, patients, visitors, students and staff have an affordable and convenient travel option.
- **Greenhouse Gas (GhG) emissions are on the rise. Seattle’s Climate Action Plan** relies on high-capacity transit in major corridors, including Madison, to meet targets.

## Project Purpose

The Madison Street Bus Rapid Transit (BRT) corridor is one of five High Capacity Transit (HCT) corridors identified for priority implementation in the City of Seattle’s 2012 Transit Master Plan (TMP). The purpose of the Madison BRT project is to improve transit capacity, travel time, reliability, connectivity, comfort, visibility and legibility in the Madison corridor, while also making related improvements to pedestrian and bicycle access as well as the streetscape and public realm. Service is proposed to begin in 2019.

The project would improve overall mobility in a dense and rapidly developing corridor that spans diverse neighborhood districts from Center City to First Hill, Capitol Hill, the Central District, and east of the study area to the Madison Valley and Madison Park. BRT was selected as the transit mode due to the steep grades in segments of the corridor, which preclude rail service.

## Benefits, Impacts, and Tradeoffs

The key benefits, impacts and tradeoffs of the Madison Street Corridor BRT project include:

- PM peak hour transit travel time savings in both directions of approximately 33 percent, or 5.5 minutes in the eastbound direction and 5.0 minutes in the westbound direction.

- Within the Vissim study area (6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue), westbound and eastbound transit travel times vary up to approximately 7 minutes and 2 minutes respectively in the baseline conditions. With the proposed improvements, this variation decreases to approximately 18 seconds for westbound transit travel times and 36 seconds for eastbound transit travel times, providing more reliable transit service.
- Station enhancements (level boarding, off-board fare collection, multiple doors) contribute to transit travel time improvements.
- Average PM peak hour auto travel time increases by one minute in the westbound direction and three minutes in the eastbound direction.
- The 2nd Avenue/Spring Street intersection degrades from level of service D conditions (under the 2030 PM peak hour No-Build scenario) to level of service E conditions (under the 2030 PM peak hour Build (LPA) scenario). No other intersection that operates at level of service D or better condition falls below a level of service D operating condition with the project.
- PM peak hour vehicle diversion in the range of 200 to 400 vehicles from Madison Street is expected with the project (year of opening) due to left turn restrictions and the reduction in auto throughput capacity.
- Left turns from Madison Street are restricted at the following cross streets: 8th Avenue, 9th Avenue, Terry Avenue, Minor Avenue, Summit Avenue, Boylston Avenue, Broadway Court (unsignalized), 10th Avenue (unsignalized), Seneca Street (unsignalized), 12th Avenue (westbound LT prohibited), 13th Avenue, 14th Avenue, Pike Street and 15th Avenue. These left turn prohibitions restrict access and circulation.
- The following changes in on-street parking stalls along the corridor would result with the project: all-day on-street parking would reduce by 66 stalls, peak-restricted on-street parking would reduce by 96 stalls, commercial loading on-street parking would reduce by 6 stalls, and passenger loading on-street parking would reduce by 5 stalls.

## 2 EXISTING CONDITIONS

Madison Street is a major east-west corridor connecting downtown Seattle to Capitol Hill and the Madrona neighborhood districts. The roadway is a principal arterial that changes in cross-section and function between 1<sup>st</sup> Avenue and Martin Luther King Jr. Way extending approximately 2.3 miles to the east. In the downtown area between 1<sup>st</sup> Avenue and 6<sup>th</sup> Avenue, Madison Street is one-way westbound while the remainder of the roadway out to Martin Luther King Jr. Way is two-way. Between 1<sup>st</sup> Avenue and 6<sup>th</sup> Avenue, Madison Street has two westbound travel lanes and angled on-street parking on the south side of the street. Between 6<sup>th</sup> Avenue and 7<sup>th</sup> Avenue, Madison Street has one eastbound lane and three westbound lanes. East of approximately 7<sup>th</sup> Avenue to Martin Luther King Jr. Way, Madison Street generally has two lanes in each direction with left turn lanes at the majority of intersections.

The corridor is broken up into three major segments: the Downtown segment from 1<sup>st</sup> Avenue to 6<sup>th</sup> Avenue, the First Hill segment from 6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue and the East segment from 13<sup>th</sup> Avenue to Martin Luther King Jr. Way. Interstate 5 crosses underneath Madison Street between 6<sup>th</sup> Avenue and 7<sup>th</sup> Avenue. Spring Street parallels Madison Street one block to the north and between 1<sup>st</sup> Avenue and 9<sup>th</sup> Avenue acts as a one-way eastbound pair to Madison Street. Spring Street has two to three eastbound lanes between 1<sup>st</sup> Avenue and 7<sup>th</sup> Avenue with on-street parking on the north side of the street in most areas. East of Interstate 5, there is parking on both sides of Spring Street. Spring Street is classified as a principal arterial street by the City of Seattle.

A map of the study area with existing signalized intersections along the Madison Corridor is shown in Figure 2 with the proposed BRT route shown in red. The proposed BRT corridor extends from 1<sup>st</sup> Avenue to Martin Luther King Jr. Way. For this traffic analysis, the modeling study area includes the BRT corridor from 1<sup>st</sup> Avenue to 23<sup>rd</sup> Avenue.

**Figure 2 Study Area Map with Existing Signalized Intersections**



The Madison Corridor varies in width, lane channelization and directionality throughout its length from 1<sup>st</sup> Avenue to Martin Luther King Jr. Way. In the downtown core, both Madison Street (one-way westbound) and Spring Street (one-way eastbound) are typically two to three lanes in one direction with on-street parking on one side of the street. From 6<sup>th</sup> Avenue to Broadway, Madison Street has five lanes; two in each direction (during the PM peak period; at other times, there is one lane and parallel parking on the south side of the street) with a center two-way left turn lane (TWLTL). East of Broadway, the roadway transitions from five lanes down to four lanes with no TWLTL until 22<sup>nd</sup> Avenue. East of 22<sup>nd</sup> Avenue, there is an eastbound left turn lane approaching the intersection at 23<sup>rd</sup> Avenue and there are left turn lanes at Martin Luther King Jr. Way. Figure 3,

Figure 4 and Figure 5 show example cross-sections and channelization for each distinct segment of the Madison Corridor.

**Figure 3** Madison Street Example Downtown Cross-Section (4<sup>th</sup> Avenue to 3<sup>rd</sup> Avenue) during the PM Peak (looking east)



**Figure 4** Madison Street Example First Hill Cross-Section (9<sup>th</sup> Avenue to Terry Avenue) during the PM Peak



**Figure 5** Madison Street Example East End Cross-Section (18<sup>th</sup> Avenue to 19<sup>th</sup> Avenue) during the PM Peak



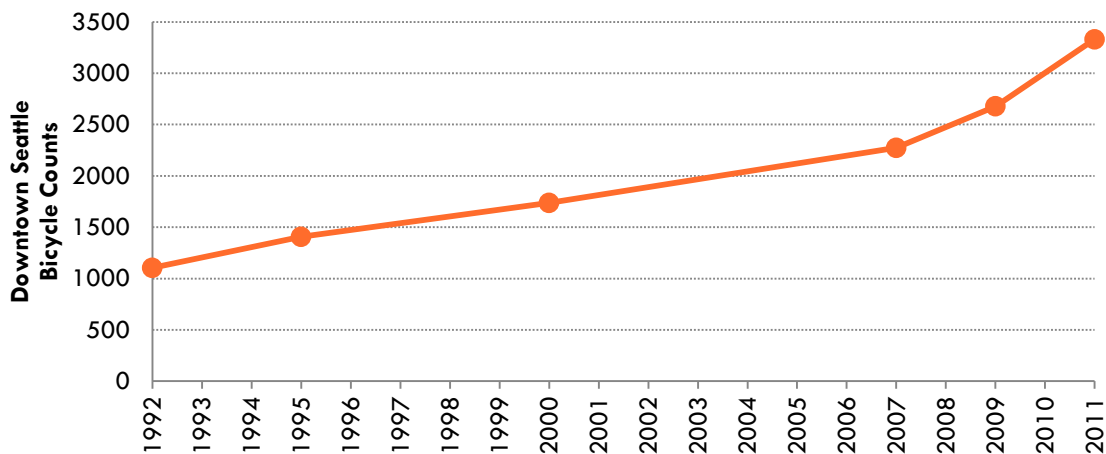
## Existing Traffic Volumes

Existing weekday PM peak hour vehicle turning movement counts were used from the previous Madison BRT Phase I study as well as counts provided from the Next Generation ITS – Center City Mobility Project. New PM peak hour vehicle turning movement counts were also collected at the Spring Street/8<sup>th</sup> Avenue and Spring Street/9<sup>th</sup> Avenue intersections. Peak hour traffic volumes were balanced to provide the basis for analyzing traffic conditions during the PM peak hour. The PM peak hour traffic volumes used in the analysis are shown in Appendix B.

## Existing Bicycle and Pedestrian Volumes

As shown in Figure 6 (based on SDOT data), rates of bicycling in Downtown Seattle have been steadily increasing since 1992. While the area in which these counts were taken is limited, the data suggests it may be indicative of a larger trend toward increased rates of cycling throughout the city.

**Figure 6** Downtown Seattle Historic Bicycle Counts



SDOT also collects quarterly bicycle and pedestrian counts at three locations on or very near the Madison corridor:

- Alaskan Way and Colman Dock
- Madison Street and 6<sup>th</sup> Avenue
- Madison Street and 12<sup>th</sup> Avenue

Figure 7 shows bicycle counts at these locations for the most recent six quarters for which data were available. The count data shown represent bicycles counted at the intersections on a weekday between 5 p.m. and 6 p.m. Of the three count locations, bicycle volumes are generally highest at Madison Street and 12<sup>th</sup> Avenue with peak-hour counts of up to 300 cyclists. Bicycle volumes at 12<sup>th</sup> and Colman Dock fluctuate significantly by season, with lows of 75-125 cyclists per hour in the fall and winter, and volumes over 200 per hour during the summer. Volumes at 6<sup>th</sup> Avenue and Madison Street are lower, around 50 cyclists per hour, with little fluctuation by season.

**Figure 7 Bicycle Counts, Jan 2013-May 2014**

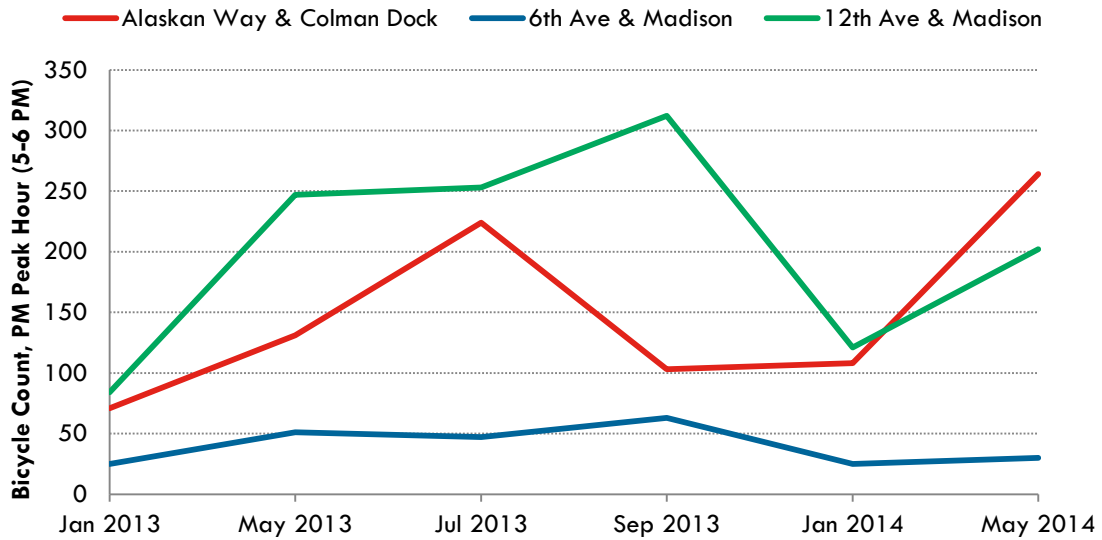
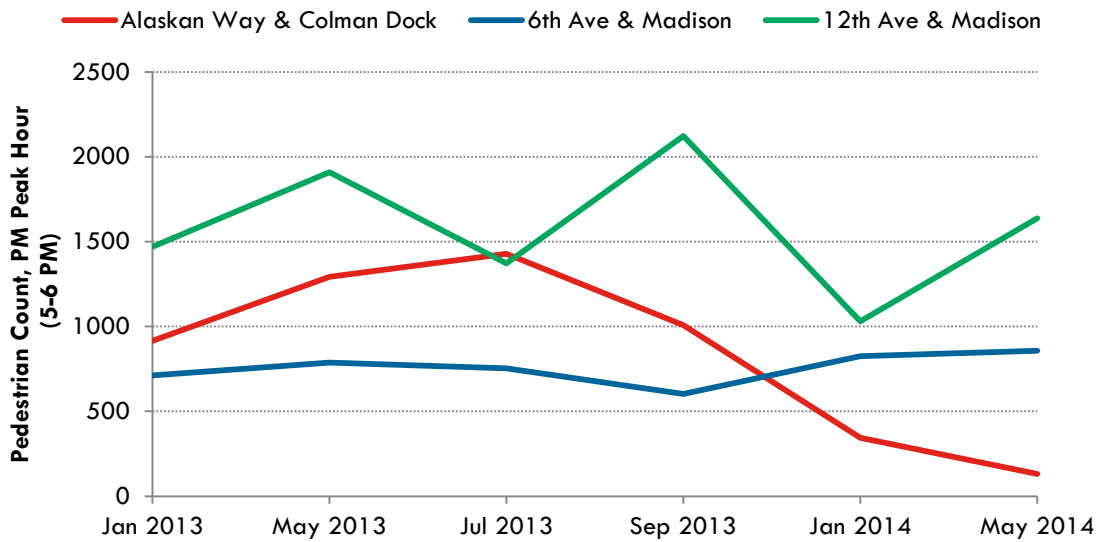


Figure 8 shows pedestrian counts for the same time frame in the p.m. peak hour. Pedestrian volumes are much higher than bicycle volumes and appear to be less influenced by seasonal fluctuations. At Madison Street and 12<sup>th</sup> Avenue, pedestrian volumes generally range from 1,500 to 2,000 pedestrian crossings per hour during the p.m. peak hour. As with bicycle volumes, pedestrian volumes are both lowest and most consistent at 6th and Madison Street, with peak-hour volumes ranging from 500 to 1,000 pedestrian crossings per hour during the p.m. peak hour. Volumes at Colman Dock range from a high of nearly 1,500 pedestrians per hour in summer 2013 to a low of around 100 pedestrians per hour in May 2014, a decline that can largely be attributed to construction in the area.



**Figure 8 Pedestrian Counts, Jan 2013-May 2014**



## Existing Pedestrian Facilities

Sidewalk conditions within the corridor are variable, with widths ranging from 6 to 12 feet and overall quality ranging from relatively high to very poor. Additional detail on sidewalks can be found in the Street Concept Plan.

Intersection conditions are similarly variable, with irregularly configured, potentially confusing and time-consuming intersections to the east of Broadway. A number of intersections throughout the corridor are identified as high priorities for improvement in the Pedestrian Master Plan, including Madison Street at Post Street, Second Avenue, Fourth Avenue, Seventh Avenue, Eighth Avenue, Ninth Avenue, Boren Avenue, Broadway Court, 10<sup>th</sup> Avenue, 11<sup>th</sup> Avenue, 12<sup>th</sup> Avenue, 19<sup>th</sup> Avenue, and 23<sup>rd</sup> Avenue. These locations were identified on the basis of pedestrian demand and opportunities to improve pedestrian conditions through the addition and improvement of sidewalks, curb ramps and crosswalks.

## Existing and Planned Bicycle Facilities

There is currently no direct bicycle route serving the Madison corridor. Figure 17 shows existing facilities as well as those planned for the future. The only route with continuous bike lanes between Downtown and Capitol Hill is on Pine Street from 8<sup>th</sup> Avenue to 15<sup>th</sup> Avenue. Seneca Street has sharrows from First Avenue to Summit Avenue, at which point a bicycle lane begins and continues east on Union Street to 18<sup>th</sup> Avenue. East of 18<sup>th</sup> Avenue, the route includes portions with sharrows and portions with bike lanes. Spring Street alternates between sharrows and bike lanes between Alaskan Way and Boylston Avenue. To the south of Madison Street, there is a bicycle lane on Cherry Street passing under Interstate 5 in a cycle track, where the route continues north with a block of sharrows and a block of cycle track on 7<sup>th</sup> Avenue; from there, a sharrow continues to

Broadway. East-west, there are sharrows on Western Avenue, 9th Avenue east of Seneca Street, Boylston Avenue from Seneca Street to Marion Street, 14<sup>th</sup> Avenue between Pine Street and Union Street, and on 19<sup>th</sup> Avenue. East-west bicycle lanes are located on 4<sup>th</sup> Avenue south of Spring Street, and on 12<sup>th</sup> Avenue, with cycle tracks on 2<sup>nd</sup> Avenue Downtown and on Broadway.

### Existing Signal Timings

Existing signal timings were obtained for the study area traffic signals within the project limits. Table 1 summarizes the signal timing plans in the study area.

**Table 1 Summary of Existing PM Peak Hour Signal Timing Plans**

Intersection	Cycle Length	Concurrent Peds	Crosswalk Locations
1 <sup>st</sup> /Madison	80	WB, NB, SB	East, West, North, South
2 <sup>nd</sup> /Madison	80	WB, SB	East, West, North, South
3 <sup>rd</sup> /Madison	80	WB, NB, SB	East, West, North, South
4 <sup>th</sup> /Madison	80	WB, NB	East, West, North, South
5 <sup>th</sup> /Madison	80	WB, SB	East, West, North, South
6 <sup>th</sup> /Madison	80	WB, NB	West, South
7 <sup>th</sup> /Madison	80	EB, WB, NB, SB	East, North, South
8 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
9 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
Terry/Madison	100	EB, WB, NB, SB	East, West, North, South
Boren/Madison	100	EB, WB, NB, SB	East, West, North, South
Minor/Madison	100	EB, WB, NB, SB	East, West, North, South
Summit/Madison	100	EB, WB, NB, SB	East, West, North, South
Boylston/Madison	100	EB, WB, NB, SB	East, West, North, South
Broadway/Madison	100	EB, WB, NB, SB	East, West, North, South
11 <sup>th</sup> /Madison	100	EB, WB, SB	West, North
12 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
13 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, North
14 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, South
14 <sup>th</sup> /Pike	100	EB, WB, NB, SB	East, West, North
15 <sup>th</sup> /Madison	100	SB	East

Intersection	Cycle Length	Concurrent Peds	Crosswalk Locations
Pine/Madison	100	EB, WB, SB	North, West
17 <sup>th</sup> /Madison	100	EB, WB	East, West, North, South
19 <sup>th</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
20 <sup>th</sup> /Madison	100	EB, WB, SB	East, West, North, South
22 <sup>nd</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
23 <sup>rd</sup> /Madison	100	EB, WB, NB, SB	East, West, North, South
1 <sup>st</sup> /Spring	80	EB, NB, SB	East, West, North, South
2 <sup>nd</sup> /Spring	80	EB, SB	East, West, North, South
3 <sup>rd</sup> /Spring	80	EB, NB, SB	East, West, North, South
4 <sup>th</sup> /Spring	80	EB, NB	East, West, North, South
5 <sup>th</sup> /Spring	80	EB, SB	East, West, North, South
6 <sup>th</sup> /Spring	80	EB, NB	East, West, North
7 <sup>th</sup> /Spring	100	EB, NB, SB	East, West, North, South

## Existing Traffic Operations

Level of service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads and operating conditions. It is a qualitative measure used to describe a quantitative analysis taking into account factors such as roadway geometrics, signal phasing, speed, travel delay and average vehicle delay. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level of service (LOS) is used as a measure of effectiveness for intersection operation. The LOS at signalized intersections is defined by the average vehicle delay for the entire intersection, and at unsignalized intersections is defined by the average vehicle delay for the stop controlled movements. LOS is similar to a "report card" rating ranging from LOS A to F. LOS A represents free-flow conditions with little or no delay. LOS E represents conditions at intersection capacity, and LOS F represents worst case or over capacity conditions.

Signalized intersections were analyzed under PM peak hour conditions. Average intersection auto delay and intersection LOS were determined utilizing the methodology found in Chapter 18 of the 2010 Highway Capacity Manual (HCM), with the assistance of the Synchro (version 9.1) traffic simulation software.

Table 2 shows the results for the existing intersection operations analysis during the PM peak. The delay shown below for the existing conditions is the average vehicle delay at each intersection during the PM Peak period. A review shows that all the signalized

intersections operate at LOS D or better except at the intersections of 2<sup>nd</sup> Avenue and Madison Street, and 6<sup>th</sup> Avenue and Spring Street.

**Table 2 Summary of PM Peak Hour Existing Conditions Delay and Level of Service**

Intersection	Average Delay Per Vehicle (sec)	Level of Service
1 <sup>st</sup> /Madison	13.7	B
2 <sup>nd</sup> /Madison	62.3	E
3 <sup>rd</sup> /Madison	9.8	A
4 <sup>th</sup> /Madison	18.5	B
5 <sup>th</sup> /Madison	11.0	B
6 <sup>th</sup> /Madison	9.8	A
7 <sup>th</sup> /Madison	16.6	B
8 <sup>th</sup> /Madison	11.4	B
9 <sup>th</sup> /Madison	16.5	B
Terry/Madison	10.7	B
Boren/Madison	42.0	D
Minor/Madison	8.3	A
Summit/Madison	4.3	A
Boylston/Madison	9.7	A
Broadway/Madison	27.0	C
11 <sup>th</sup> /Madison	8.8	A
12 <sup>th</sup> /Madison	28.9	C
13 <sup>th</sup> /Madison	8.0	A
14 <sup>th</sup> /Madison	16.9	B
14 <sup>th</sup> /Pike	7.9	A
15 <sup>th</sup> /Madison	1.8	A
Pine/Madison	10.9	B
17 <sup>th</sup> /Madison	12.5	B
19 <sup>th</sup> /Madison	19.3	B
20 <sup>th</sup> /Madison	8.6	A
22 <sup>nd</sup> /Madison	5.0	A

23 <sup>rd</sup> /Madison	33.1	C
1 <sup>st</sup> /Spring	8.5	A
2 <sup>nd</sup> /Spring	49.0	D
3 <sup>rd</sup> /Spring	18.4	B
4 <sup>th</sup> /Spring	22.7	C
5 <sup>th</sup> /Spring	23.2	C
6 <sup>th</sup> /Spring	99.5	F
7 <sup>th</sup> /Spring	19.4	B
8 <sup>th</sup> /Spring	12.1	B
9 <sup>th</sup> /Spring	12.2	B

## Transit Routes and Service

The existing transit network - including routes that travel along Madison Street, on parallel streets and/or via connecting streets - is shown in Table 3 shows distances between stops on Madison Street on Routes 11 and 12. On average, stops are every 650 feet apart eastbound and every 741 feet apart westbound. However, the distance between adjacent stops ranges from as little as 330 feet on Route 12 eastbound on Marion Street between 1<sup>st</sup> and 2<sup>nd</sup> Avenues to as much as 1,125 feet on Route 12 westbound between 9<sup>th</sup> and 5<sup>th</sup> Avenues.

Analysis of ridership and reliability was conducted for Routes 2, 11, and 12, which provide the bulk of east-west service in the Madison corridor. Additional ridership analysis was conducted for several routes that intersect the corridor, including Routes 2, 3, 8, 10, 11, 12, 43, 48, 49, and 60. Route 9X was not included in this analysis as it does not stop at Madison Street, but stops instead at Union Street and Marion Street. Ridership on Route 9X is approximately 40 people per day at the Marion Street stops and 80 people per day at the Union Street stops. Route 84, which provides night owl service between Downtown Seattle and Madison Park using the Route 11 alignment, was also not included in ridership numbers. The data provided for the analysis is from King County Metro's Fall 2013 service period.

Figure 9. East-west transit service within the corridor is provided primarily by King Country Metro bus routes 2, 12, and 11. Routes operating on Madison Street include:

- Route 12.** The most frequent service operating on Madison Street, Route 12 makes a counterclockwise loop of Madison Street, 1<sup>st</sup> Avenue, Marion Street and 6<sup>th</sup> Avenue in the Center City and then traveling on Madison Street from 6<sup>th</sup> Avenue to 19<sup>th</sup> Avenue. From 19<sup>th</sup> Avenue the route continues north to Galer Street and Interlaken Park. It operates as often as every five minutes during peak periods, with a mid-day weekday base headway of 15 minutes. It operates seven days a week from approximately 6 a.m. to 11 p.m.

- **Route 11.** While Route 12 operates on western segments of Madison Street, Route 11 operates on its eastern segments. At its western end, it makes a counterclockwise loop of Pine Street, 2<sup>nd</sup> Avenue, Pike Street and Bellevue Avenue before proceeding on Pine Street to Madison Street and out Madison Street to the Madison Park neighborhood, where it makes a counterclockwise loop of Blaine Street, 43<sup>rd</sup> Avenue, McGilvra Street and 42<sup>nd</sup> Avenue. Routes 11 and 12 overlap and share stops on Madison Street between 16<sup>th</sup> Avenue and 19<sup>th</sup> Avenue. Route 11 generally operates every 15 minutes on weekdays, with a period of 30-minute frequencies in the mid-day. It operates seven days a week over a longer span than Route 12, until almost 2 a.m. on weeknights.
- **Route 2.** Route 2 operates on only a short segment of Madison Street, eastbound between 11<sup>th</sup> and 12<sup>th</sup> Avenues and westbound between 13<sup>th</sup> and 12<sup>th</sup> Avenues, in the “bowtie” area around the intersection of Madison Street and Union Street. However, it closely parallels western segments of Madison Street, operating on Seneca Street westbound and Spring Street eastbound between 3<sup>rd</sup> Avenue and Hubbell Street, just east of Interstate 5, and on Seneca Street, then Union Street on First Hill. East of Madison Street, it continues on Union Street to 34<sup>th</sup> Avenue, then on Denny Way and Madrona Drive to Lake Washington Boulevard and Madrona Park. In the west, it continues as Route 13 from Center City to **Queen Anne.** **Route 2’s east-of-Center City** segment generally operates every 15 minutes weekdays, and the service runs until well after midnight seven days a week.

Other service on Madison Street includes Route 60, which serves a portion of the corridor. Route 60 operates north-south from Capitol Hill to Georgetown, and on Madison Street between 9<sup>th</sup> Avenue and Broadway. It generally operates every 20 minutes weekdays. It also runs seven days a week, until around midnight on weekdays and 8 p.m. on weekends.

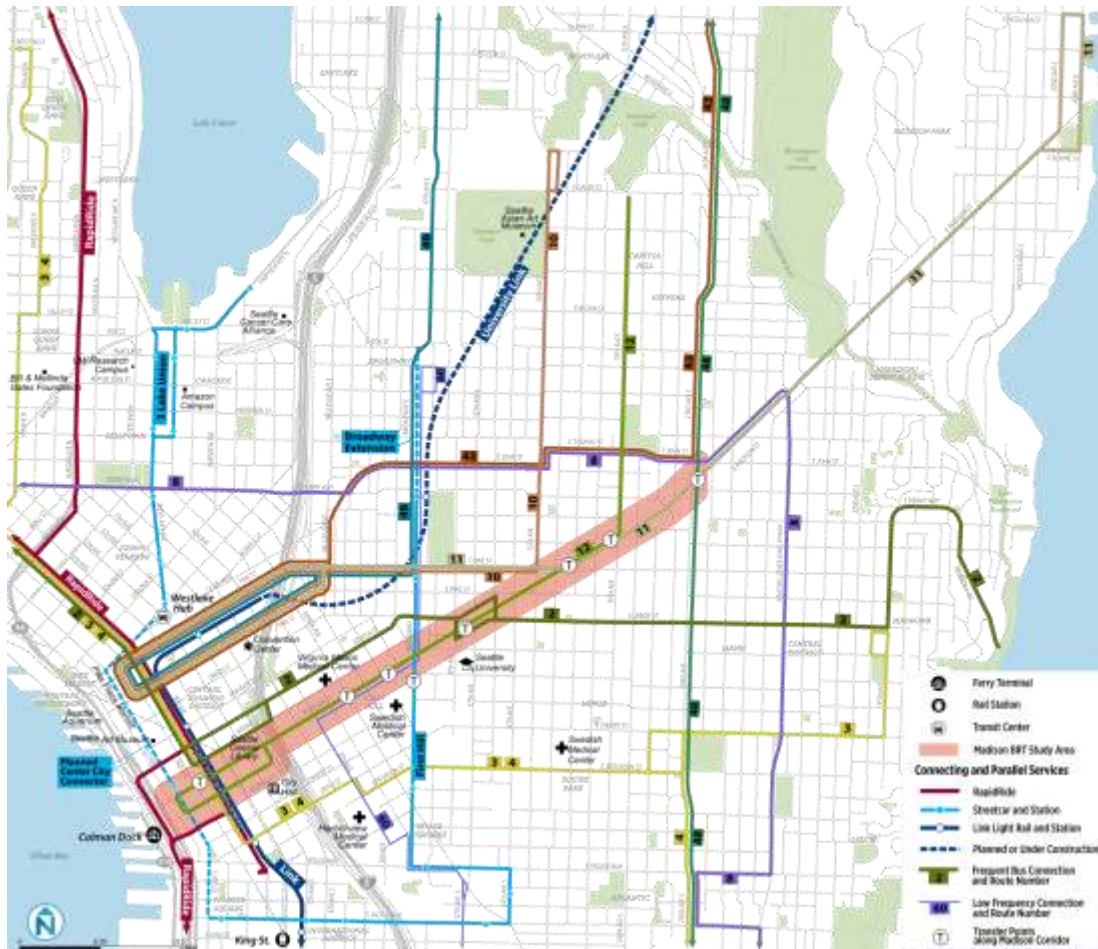
Downtown, important north-south connections can be made to regional bus service on 2<sup>nd</sup> Avenue, 4<sup>th</sup> Avenue and 5<sup>th</sup> Avenue, bus and Sound Transit Link light rail service in the Downtown Seattle Transit Tunnel (DSTT) below 3<sup>rd</sup> Avenue, and local routes on the 3<sup>rd</sup> Avenue transit spine. King Country Metro Rapid Ride routes operate on 3<sup>rd</sup> Avenue and Alaskan Way, and the planned Seattle Center City Connector streetcar would operate on 1<sup>st</sup> Avenue, offering the potential for a shared BRT/streetcar stop on 1<sup>st</sup> Avenue. Outside of Downtown, north-south connections can be made to Route 60 (which shares a segment of Madison Street from Broadway to 9<sup>th</sup> Avenue), the First Hill Streetcar (Broadway), Route 9 (Broadway), Routes 2/12 (Union), Routes 12/11 (19<sup>th</sup>), Route 48 (23<sup>rd</sup>), and Route 8 (Martin Luther King Jr. Way).

Table 3 shows distances between stops on Madison Street on Routes 11 and 12. On average, stops are every 650 feet apart eastbound and every 741 feet apart westbound. However, the distance between adjacent stops ranges from as little as 330 feet on Route 12 eastbound on Marion Street between 1<sup>st</sup> and 2<sup>nd</sup> Avenues to as much as 1,125 feet on Route 12 westbound between 9<sup>th</sup> and 5<sup>th</sup> Avenues.

Analysis of ridership and reliability was conducted for Routes 2, 11, and 12, which provide the bulk of east-west service in the Madison corridor. Additional ridership

analysis was conducted for several routes that intersect the corridor, including Routes 2, 3, 8, 10, 11, 12, 43, 48, 49, and 60. Route 9X was not included in this analysis as it does not stop at Madison Street, but stops instead at Union Street and Marion Street. Ridership on Route 9X is approximately 40 people per day at the Marion Street stops and 80 people per day at the Union Street stops. Route 84, which provides night owl service between Downtown Seattle and Madison Park using the Route 11 alignment, was also not included in ridership numbers. The data provided for the analysis is from King County Metro's Fall 2013 service period.

**Figure 9 Existing Transit Network**



The total ridership on Madison Street between the waterfront and 23<sup>rd</sup> Avenue is 2,566 boardings per day.

Figure 10 shows total daily boardings for the routes significant to the Madison Corridor listed above. Ridership east-west through the corridor is relatively evenly split between Route 2 and Route 12, which run parallel through most of Downtown and First Hill, although ridership is slightly higher on this portion of Route 12. The most boarding activity on Madison Street occurs in Downtown Seattle, in First Hill at Boren Avenue and Summit Avenue, at 17<sup>th</sup> Avenue, and at 23<sup>rd</sup> Avenue. When the First Hill Streetcar

begins operation, the nearest stop will be just off Madison Street at Marion Street and Broadway.



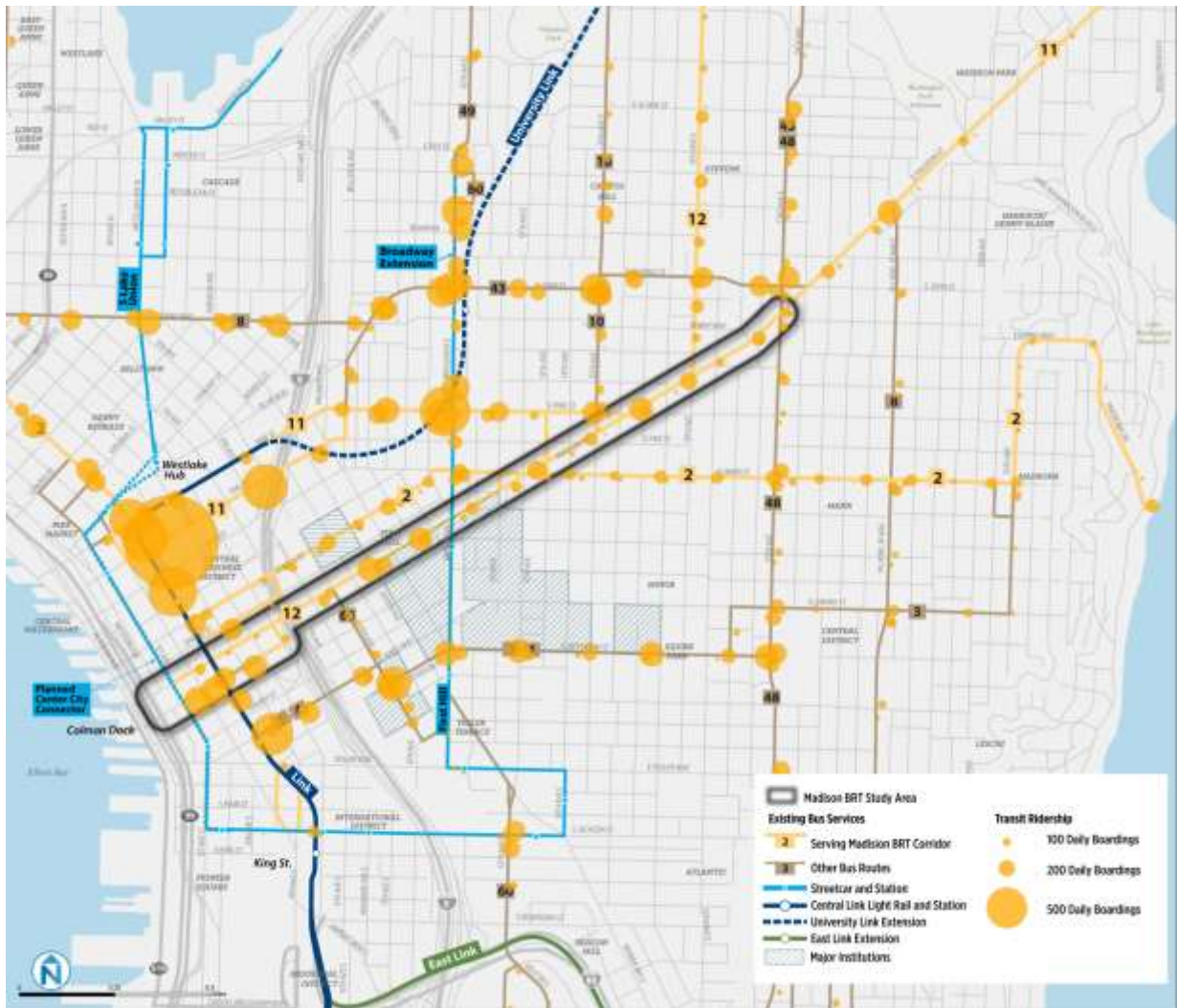
**Table 3 Bus Stop Spacing**

Eastbound			Westbound		
Route	Cross Section	Distance to next stop (ft)	Route	Cross Section	Distance to next stop (ft)
11	17th Ave	480	11	23rd Ave E	605
11	18th Ave	835	11	22nd Ave E	550
11	20th Ave	530	11	20th Ave	522
11	22nd Ave	546	11	19th Ave	790
11	23rd Ave E	934	11	17th Ave	722
Route Average		665	Route Average		638
12	1st Ave	330	12	19th Ave	789
12	2nd Ave	637	12	17th Ave	850
12	4th Ave	646	12	15th Ave	873
12	6th Ave	972	12	13th Ave	1000
12	8th Ave	694	12	Broadway Ct	862
12	Boren Ave	615	12	Summit Ave	750
12	Summit Ave	604	12	Boren Ave	675
12	Broadway	903	12	9th Ave	1125
12	12th Ave	922	12	5th Ave	463
12	14th Ave	495	12	4th Ave	471
12	15th Ave	675	12	2nd Ave	813
12	17th Ave	462			
12	18th Ave	475			
Route Average		648	Route Average		788
Overall Average		653	Overall Average		741

As shown in

Table 4, performance on Routes 2, 11, and 12 is mixed. While all three routes perform in the top 25 percent of King County Metro routes in terms of boardings per platform hour during peak period, Routes 11 and 12 perform in the bottom 25 percent of routes for passenger miles per platform mile during some or all time periods. This is to be expected given the short length of the corridor, and resulting relatively short trips taken by most passengers.

**Figure 10 Ridership on Madison-Area Bus Routes**



**Table 4 2013 Performance Metrics for Routes 2, 11, and 12**

Route	Peak		Off Peak		Night	
	Rides/ Platform Hour	Passenger Miles/ Platform Mile	Rides/ Platform Hour	Passenger Miles/ Platform Mile	Rides/ Platform Hour	Passenger Miles/ Platform Mile
Route 2	49.1*	11.4	45.7	9.8	29.8	6.8
Route 11	52.7*	10.2^	48.7	9.4^	38.4*	6.5
Route 12	50.6*	9.5^	38.0	6.3^	16.4^	2.7^

\*Denotes performance in the top 25% of all King County Metro Routes.

^Denotes performance in the bottom 25% of all King County Metro Routes.

## Collision Analysis

Figure 11 shows collisions in the Madison Street corridor by mode for the past five years, using data provided by SDOT. Overall, there have been relatively few serious collisions on Madison Street (see next paragraph), and no fatal collisions in the past five years. There were a total of 37 bicycle collisions, 64 pedestrian collisions, and 780 vehicle collisions within 100 feet of the corridor over the past five years. However, it is likely that not all bicycle and pedestrian incidents are included in available collision data.

One serious injury collision was reported on Madison Street within the last five years, at its intersection with 5th Avenue. 5th Avenue has sharrows that begin at Madison Street. There were also several pedestrian collisions resulting in serious injuries, including one on Union Street between 12th and 13th Avenues and one on Madison Street between 13th and 14th Avenues. One bicycle collision resulting in property damage was reported at the intersection of Madison Street and 12th Avenue, which was mentioned frequently in stakeholder outreach as a dangerous location.

**Figure 11 Collision Locations by Mode**



King County Metro collects records on safety incidents reported on board transit vehicles. Reports for 2012 and 2013 were reviewed for the portions of Route 2 between 3<sup>rd</sup> Avenue & Spring/Seneca streets, Route 12 between First and 23<sup>rd</sup> Avenues, and Route 11 on Madison Street. The primary types of incidents reported were unruly behavior, fare evasion, verbal abuse, and sleeping/intoxicated passengers.

Broadway.

Table 5 shows locations with more than one incident in the past two years. Incidents on vehicles traveling north-south on 3<sup>rd</sup> Avenue were not included in this summary, as these incidents were numerous but may not be specific to the route. Intersections near 3<sup>rd</sup> Avenue still had the highest number of incidents. Other locations with multiple incident reports included 23<sup>rd</sup> Avenue, Summit Avenue, and Broadway.

**Table 5 On-Board Passenger Incidents in Madison Corridor**

Routes	Cross Street	Total Incidents
2, 12	4 <sup>th</sup> /5 <sup>th</sup> avenues	12
2, 12	2 <sup>nd</sup> /3 <sup>rd</sup> avenues	8
2, 11	23 <sup>rd</sup> Avenue	7
2, 12	Summit	7

Routes	Cross Street	Total Incidents
2, 12	Broadway	6
2, 12	8 <sup>th</sup> /9 <sup>th</sup> avenues	5
2, 12	Boren	5
12	1 <sup>st</sup> Avenue	4
2, 12	6 <sup>th</sup> /7 <sup>th</sup>	3
2, 11, 12	16 <sup>th</sup> /17 <sup>th</sup>	3

## Parking Analysis

Total existing parking and loading spaces and projected spaces along the LPA alignment are shown in Table 6. Note that 1<sup>st</sup> Avenue between Madison Street and Spring Street, part of the LPA alignment, has not been included in this analysis because changes to parking configuration on this street will be made as part of the Center City Connector streetcar project.

**Table 6 Summary of LPA Parking Impacts**

Category	Existing	Projected	Change
All-Day Parking	263	197	-66
Peak-Restricted Parking	102	6	-96
Commercial Loading	13	7	-6
Passenger Loading	12	7	-5

Table 7 shows existing and projected parking and loading spaces by segment and by designation of curb use including all-day parking, peak restricted parking, commercial load zones, and passenger load zones.

Appendix K shows the existing and projected parking counts by block face and category.

### Figure 12 through

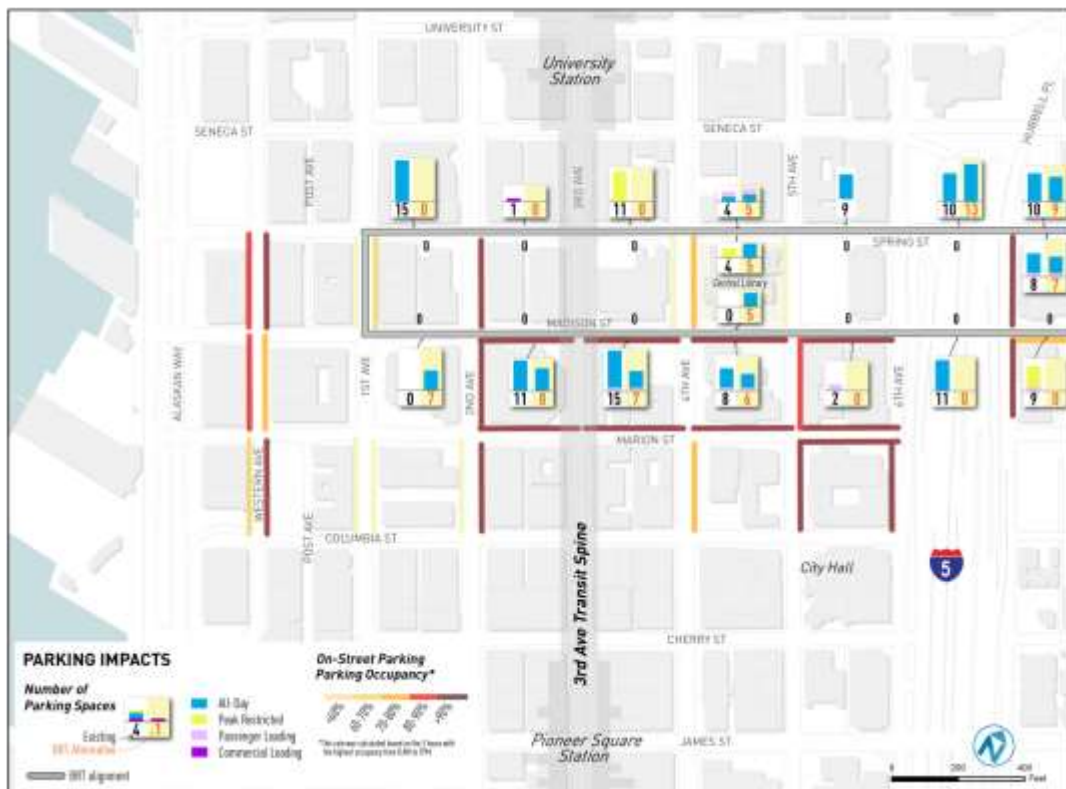
### Figure 15 Map of Parking and Loading Impacts, Madison Valley Segment

illustrate the before-and-after parking and loading counts by segment, and provide limited additional information on current peak occupancy rates, as observed during existing conditions data collection for this project.

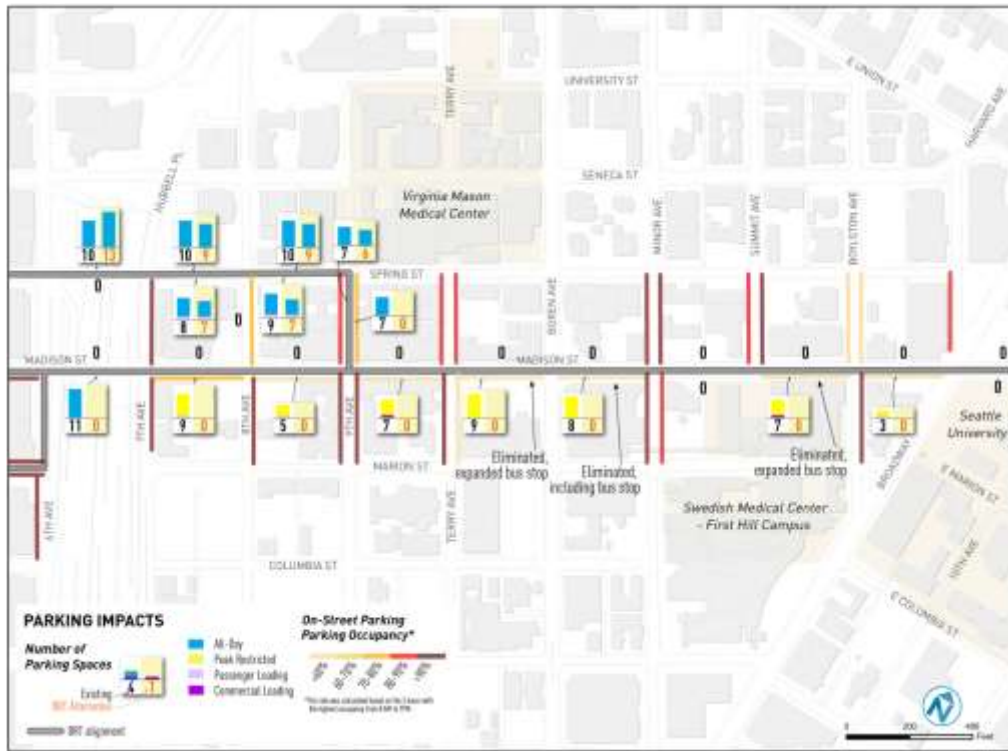
**Table 7 LPA Parking Impacts by Segment**

Segment	All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA
Downtown (1 <sup>st</sup> Ave-6 <sup>th</sup> Ave)	58	43	15	0	1	0	6	4
First Hill (6 <sup>th</sup> -Broadway)	69	48	43	0	3	1	5	2
Capitol Hill/Central District (Broadway-23 <sup>rd</sup> Ave)	34	32	38	0	3	0	1	1
Madison Park (23 <sup>rd</sup> Ave-Martin Luther King Jr. Way)	102	74	6	6	6	6	0	0

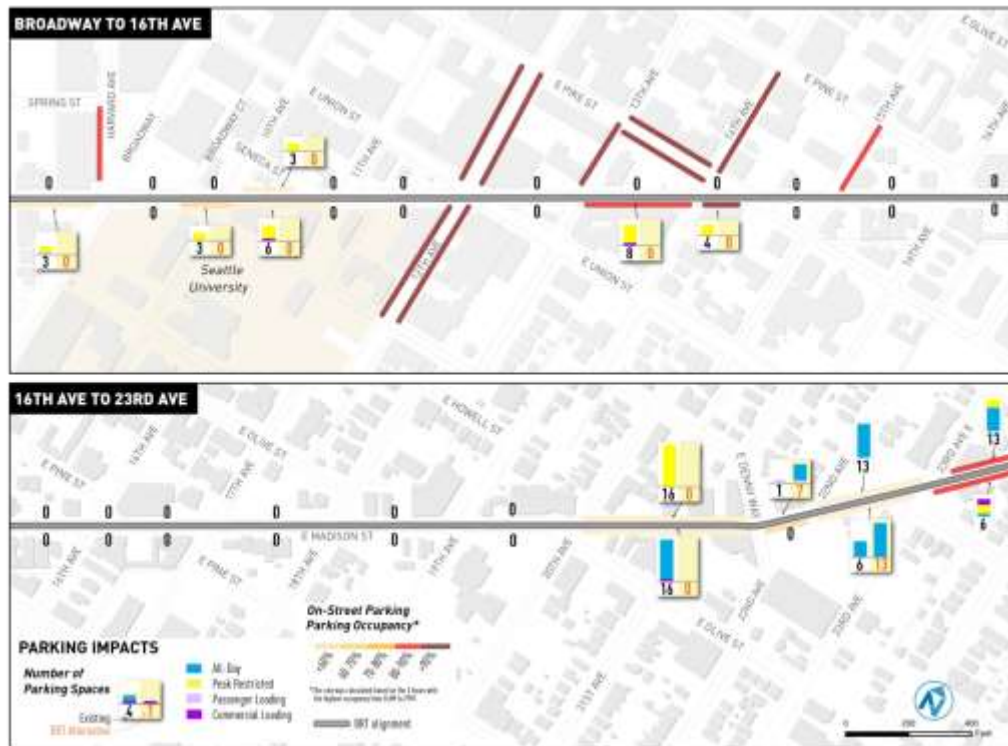
**Figure 12 Map of Parking and Loading Impacts, LPA Downtown Segment**



**Figure 13 Map of Parking and Loading Impacts, First Hill Segment**



**Figure 14 Map of Parking and Loading Impacts, Capitol Hill/Central District Segment**



**Figure 15 Map of Parking and Loading Impacts, Madison Valley Segment**





## 3 PLANNED AND PROGRAMMED IMPROVEMENTS

The Transportation Strategic Plan (TSP); Bicycle Master Plan, Pedestrian Master Plan, Transit Master Plan and Freight Mobility Action Plan all have elements that are located in the immediate vicinity of the Madison Corridor BRT Project. A description of these elements is provided below.

### **Bicycle Master Plan and Pedestrian Master Plan**

The primary planning documents for bicycle and pedestrian infrastructure in Seattle are the Bicycle Master Plan (BMP) and Pedestrian Master Plan (PMP). The BMP, adopted in April 2014, articulates a vision and goals for bicycling in the city and maps out a citywide network of routes with accompanying local connectors. It also identifies facility types ranging from off-street trails to cycle tracks (protected bicycle lanes) and neighborhood greenways. The Seattle Pedestrian Master Plan, adopted in 2008, includes policies, programs, design criteria, and projects to further pedestrian safety, comfort, and access. Based on **data assessment, the plan identifies “High Priority along the Roadway” and “High Priority Crossing the Roadway” locations for improvement.**

### **Pedestrian Conditions**

Especially in its western segments, steep grades (

Figure 16) are a defining characteristic of the corridor and a major challenge for both bicyclists and pedestrians, particularly those with limited mobility. The elevation at Madison Street and Western Avenue is 16 feet above sea level; this climbs to around 350 feet on the summit of First Hill just west of Madison Street and Broadway, then dips briefly before reaching 423 feet around 17th Avenue and Madison Street. Relatively steep grades are also present in the eastern end of the corridor, including beyond 23rd Avenue to Martin Luther King Jr. Way. Between Western and Boylston Avenue, one block west of Broadway, the average grade including intersections is approximately 7.4 percent, and grades on several blocks exceed this figure.

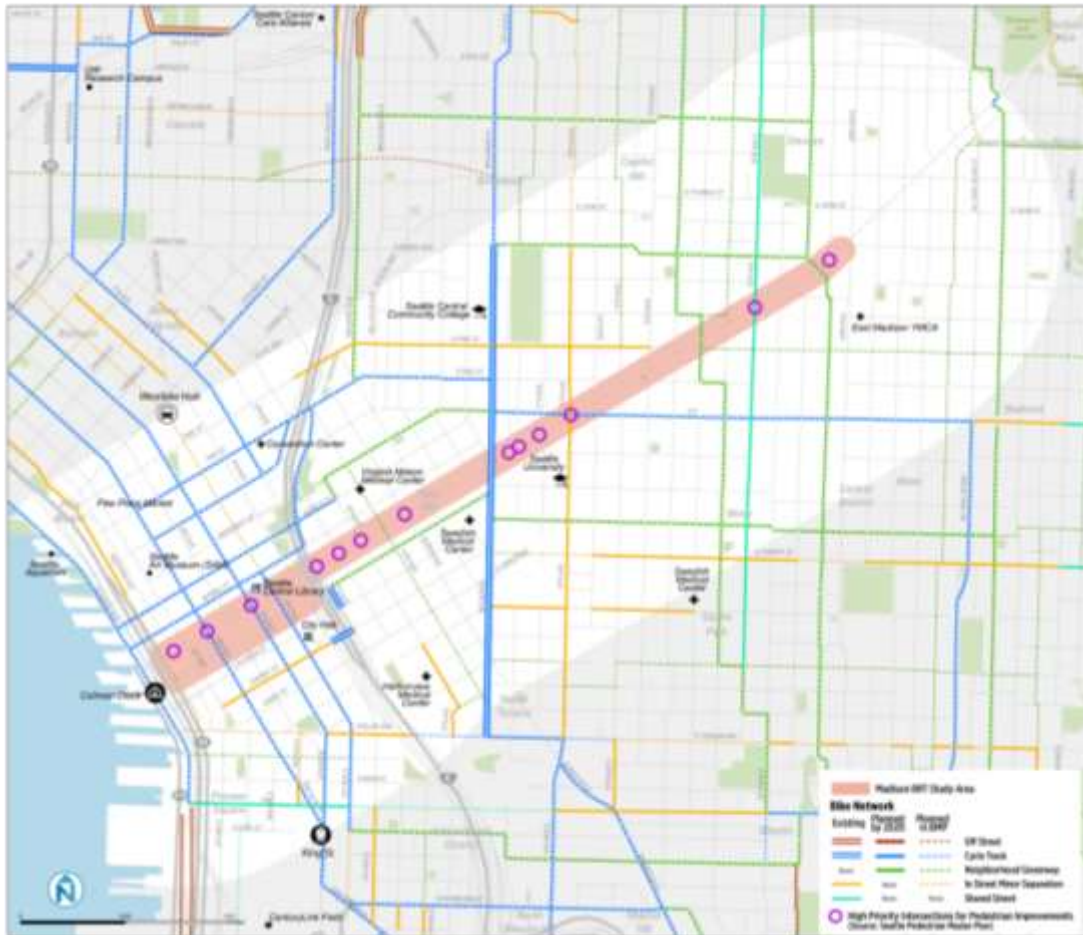
**Figure 16** Madison Street Grades



The City of Seattle Bicycle Master Plan (BMP), adopted in 2014, identifies a 20-year vision for investment in new bicycle facilities in Seattle. The BMP does not include a bicycle facility on Madison Street. Instead, the plan recommends cycle tracks on Spring Street and Seneca Street in Downtown Seattle, with cycle tracks continuing on Seneca Street east of Interstate 5 until 9th Avenue. At 9th Avenue, the cycle tracks would end and a neighborhood greenway on University Street would connect east-west to Broadway, at which point a cycle track would continue on Union Street to Martin Luther King Jr. Way. An additional route to the south of Madison Street is planned for a lower level of investment, but including existing sharrows on Cherry Street from 1<sup>st</sup> Avenue to Interstate 5, with a block of cycle track crossing over Interstate 5, a planned block of sharrows or minor separation on 7<sup>th</sup> Avenue from Cherry Street to Columbia Street, and a block of cycle track from Columbia Street to Marion Street. From Marion Street, a planned greenway would utilize Marion Street to Broadway and would then shift to Columbia Street east of Broadway.

Several existing and planned major bicycle facilities cross or would cross Madison Street, including existing cycle tracks on 2<sup>nd</sup> Avenue and Broadway and planned cycle tracks on 4<sup>th</sup> and 5<sup>th</sup> Avenues. Neighborhood greenways that are **part of the “citywide network” are planned to cross Madison Street at 17<sup>th</sup> Avenue and at 22<sup>nd</sup> Avenue. There is an existing “local connector” neighborhood greenway on 19<sup>th</sup> Avenue.** Additionally, there is an existing local connector facility with minor separation (a standard bike lane) on 12<sup>th</sup> Avenue, which crosses through the intersection of Madison Street, Union Street, and 12<sup>th</sup> Avenue. All of **the planned projects mentioned in this section are included in the City’s 2015-2019 Implementation Plan.**

**Figure 17** Planned and Existing Bicycle Network



## Transit Master Plan

In 2012 the City of Seattle completed a new TMP, which was an extensive update of the prior Transit Master Plan completed in 2005. The 2005 TMP identified a Frequent Transit Network (FTN), which built upon the 2005 Seattle Comprehensive Plan Urban Village Strategy. The Urban Village Strategy promotes job and residential growth in concentrated centers that may be easily accessed and connected by an efficient multimodal transportation system. The 2005 Transit Master Plan recommended **Madison as a corridor that “connects existing urban villages” with service stopping every four blocks.**

The 2012 TMP update expanded on the previous plan, including a revised evaluation framework for identifying high-priority transit corridors and evaluation of modes for each corridor including rail modes and rapid bus. As a 20-year planning document, the TMP identified six major transportation priorities:

- Continue Implementation of Priority Bus Corridors

- Develop Center City Transit to Support Downtown Growth and Vitality
- Plan, Fund, and Build Priority High Capacity Transit Projects
- Enhance Walk-Bike-Ride Access where Needs are Greatest
- Improve Transit Information and System Usability
- Pursue Funding to Enhance Transit Service and Facilities

The TMP articulates a long-range transportation vision for Seattle built on the backbone of high-capacity transit or HCT corridors. HCT corridors are those that deliver service with high levels of capacity, frequency, and design quality. HCT can be delivered via BRT or rail modes and can ideally bridge the gap between regional Link light rail and local bus service.

The Madison corridor (Central Area-First Hill-Downtown, via Madison Street) was identified in the TMP as one of three citywide corridors selected for full modal evaluation for implementation of HCT. In addition to HCT corridors, the TMP also included Priority Bus Corridors (where transit and infrastructure improvements are a priority, but do not warrant HCT) and Center City Corridors (focusing on circulation **in the City's core to improve connectivity of the overall** transit network) that are the subject of separate but related planning efforts.

Due in large part to steep grades, the TMP identifies BRT as the recommended mode for the Madison Corridor. The TMP alignment was 2.1 miles in length and consisted of three segments: Madison/Marion, Alaskan Way to 6<sup>th</sup> Avenue; Madison Street, Interstate 5 to Broadway; and Madison Street, Broadway to 23<sup>rd</sup> Avenue.

## **King County Madison Street Transit Priority Corridor Improvements Conceptual Study**

Following completion of the TMP in 2012, King County Metro conducted a study identifying short-term improvements to speed and reliability on the Madison Street portion of Route 12, the primary transit route currently operating within the corridor. The recommended improvements, included signal re-timing and modification, installation of Transit Signal Priority (TSP), bus stop consolidation, and installation of Business Access and Transit (BAT) lanes at select locations. These improvements were estimated to improve transit speeds by three to five minutes on Madison, depending on the route direction and time of day.

## **City of Seattle Madison Street BRT Corridor Study**

In 2013, following completion of the TMP and prior to this study, the City of Seattle conducted a study of existing conditions and an evaluation of conceptual alternatives for BRT in the Madison corridor. The study evaluated potential operating conditions for buses, bikes, and autos on Madison Street if configured for BRT. The study corridor included Madison Street from 1<sup>st</sup> Avenue to 23<sup>rd</sup> Avenue, and identified several key issues related to the Madison corridor:

- The Madison Street corridor is designated for multi-modal use with frequent, high capacity transit (BRT) with bike lanes.
- High traffic volumes and congestion exist near the Interstate 5 interchange.
- Intersection levels of service in the corridor are at reasonable levels (LOS D or better) except at the Boren Avenue intersection during the AM peak hour.
- Emergency vehicle usage and access needs on Madison Street are unknown.
- The highest parking utilization occurs in the downtown core (100%).
- Bus travel time is as much as 7 minutes longer than auto travel time in the corridor.

The alternatives studied included three design options, each of which was modeled using dynamic assignment software using the proposed configuration as well as proposed service redesign for each alternative. The design alternatives studied included:

- BRT Right Curb Lane: BAT lane with right side stops
- BRT Median Lane: Bus-only lane in median with center island stops
- Hybrid: Combination of right curb lane and median lane for different segments of the corridor

The study found that all alternatives would improve transit travel time by a similar amount, with reductions of two to five minutes over baseline conditions. Auto travel time would increase by up to two minutes in each alternative, although the alternatives performed differently by direction and time of day. The hybrid curb and median option generally had the lowest impact on auto travel times. Diversion of traffic to other streets ranged from 50-400 vehicles per hour compared to the baseline scenario. Because of lane reduction east of 15th Avenue, the median lane alternative had the highest traffic diversion impacts. The study did not identify significant differences in performance between alternatives and recommended further study of several key issues in the corridor including:

- Narrow Right-of-Way and Sidewalks
- Parking
- Bike Lanes
- Lane Widths
- Freight
- Left Turn Restrictions
- 9-Foot Median Platform Station Design
- Left-Door Boarding
- Terminal Operations
- Diversion Mitigation
- ORCA Card Readers
- Other Design Alternatives





# 4 TRAFFIC FORECAST

## Analysis Approach and Methodology

The traffic analysis utilized four modeling tools for the evaluation of BRT operations: dynamic traffic assignment software (Dynameq), travel demand forecasting (EMME), traffic microsimulation software (Vissim), and traffic operations analysis software (Synchro).

The Dynameq model was used to capture the level of diversion from the Madison Street corridor as a result of the proposed channelization changes for each alternative. The resulting traffic volumes on Madison Street from the Dynameq analysis were used for the detailed operational analysis in Vissim and delay and level of service (LOS) in Synchro. The Dynameq model was also utilized to evaluate the overall difference in transit and auto travel times from 1<sup>st</sup> Avenue to 23<sup>rd</sup> Avenue.

The Vissim model was developed for the First Hill segment of the Madison Street corridor from 6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue, which is the portion of the study corridor with the narrowest right of way and where the waterfront aligned street grid merges with the north/south aligned street grid at Broadway. Vissim allows for more detailed operational analysis than Dynameq by more accurately capturing the traffic operations resulting from transit lanes, turning vehicle interaction, pedestrian crossing, transit signal priority and queue jumps. The Vissim model was used to determine transit and auto travel times and intersection level of service for the First Hill segment of the corridor. Results from the Vissim analysis were also used to identify the critical intersections and roadway segments for additional evaluation.

**For future year analysis, the City's EMME models for travel demand modeling, developed for the Alaskan Way Viaduct project, were used to determine 2030 future year volumes for the study area. Base year and future year models were used for both the No Build and Build (LPA) scenarios to create the four PM peak hour analysis alternatives of Existing Conditions, Year of Opening LPA, 2030 No Build and 2030 LPA Build Alternative.**

## Dynameq Study Area

A map of the study area for the Dynameq traffic analysis is shown in Figure 18 with the proposed BRT corridor shown in red. The modeling analysis of the BRT corridor was conducted from 1<sup>st</sup> Avenue to 23<sup>rd</sup> Avenue. In the westbound direction transit operates on Madison Street for the full length of the study corridor. In the eastbound direction, transit operates either on Spring Street within the downtown core before turning back onto Madison Street at 9<sup>th</sup> Avenue. The area shown in orange area is included in the Dynameq model to capture underlying traffic diversion from Madison Street.

**Figure 18** Dynameq Traffic Model Limits



Dynameq models were created to represent the PM peak period. The PM peak period was modeled from 3-7 PM with focused results on the PM peak hour, 5-6 PM. The PM peak hour was determined from 24-hour counts collected within the study area. All Dynameq results presented in this report reflect PM peak hour conditions.

### **Vissim Study Area**

Figure 19 shows the Vissim model limits. The Vissim model includes intersections on Madison Street from 6th Avenue to 13th Avenue as well as the intersection of Spring Street/6th Avenue. Signalized intersections included in the Vissim model are shown with green circles while unsignalized intersections included in the model are shown with orange circles.

**Figure 19** Vissim Study Area



The Vissim model was developed for the PM peak hour. All model results presented in this report reflect PM peak hour conditions.

## **Dynameq and Vissim Modeling Assumptions**

The future baseline model developed for the Madison BRT Phase I study was used as the baseline conditions for travel time comparisons. The baseline conditions reflect existing roadway channelization and funded transportation projects that will be in place by 2017 including the followings projects: the replacement of the Alaskan Way Viaduct (AWV) with a tunnel, the First Hill Streetcar, and the 23rd Avenue rechannelization. Existing signal timing was utilized throughout the study area except where known signal improvements are included as a part of the projects at Broadway and 23rd Avenue. In these cases, the planned signal timing improvements are reflected within the study models. The baseline model includes lane, parking, and turn restrictions that are currently in place during the PM peak hour

Transit service for the 2017 baseline conditions was assumed to be the same as existing conditions except for known changes related to the AWV replacement and increased light rail and streetcar lines. King County Metro provided existing dwell time data for transit stops within the study area. The dwell time at existing stop locations was assumed to be unchanged in 2017 baseline conditions. The proposed routing for the Madison Street BRT does not correspond to any singular existing route. Therefore, model results for portions of existing routes 11

and 12 were combined to establish the baseline for transit travel time along the corridor.

The proposed Madison BRT headways are 6 minutes between 6 a.m. and 7 p.m. Dwell times were assumed to match existing dwell time data provided by King County Metro for all existing routes. Dwell times at stations for BRT service were assumed to be reduced due to enhanced stop amenities, such as level boarding, off board fare collection, and multiple transit doors for boarding and alighting.

## **Synchro Study Area**

The Synchro study area matches the area shown at the beginning of the report in Figure 2. The Synchro models captured the four alternatives and examined intersection level of service and intersection vehicle delay for the PM peak hour conditions.

## **EMME Travel Demand Modeling**

Traffic volumes for the design year 2030 were forecasted using EMME software. The 2015 and 2030 regional travel demand models developed by the City of Seattle for the Alaskan Way Viaduct project were used for this analysis. These travel demand models estimate the number of trips taken, their destinations, the time of day the trip is made, the mode that is chosen, and which route they follow. For the 2030 model, estimates of household, population and employment are applied to an updated roadway network that includes funded projects such as the replacement of the Alaskan Way Viaduct with a tunnel. Both models were run to determine traffic volume trends in the study area.

The volume trends showed little vehicle traffic growth along Madison Street but substantial growth on north-south streets like 4<sup>th</sup> Avenue. Raw model forecasts were post processed against existing traffic volume counts and year of opening volumes to develop the forecasted 2030 turning movement volumes for the 2030 Future No Build alternative and the 2030 LPA Future Build alternative, respectively.

# 5 TRAFFIC OPERATIONS ANALYSIS OF ALTERNATIVES

## Year of Opening – Locally Preferred Alternative

Appendix A provides a layout of the 10 percent design LPA alternatives that extends along Madison Street, and portions of Spring Street, from 1<sup>st</sup> Avenue to Martin Luther King Jr. Way. The LPA includes right door stops on the right curb or left door stops at transit medians for most of the length of the corridor. A dedicated bus-only lane is provided on Madison Street from 1<sup>st</sup> Avenue to approximately 18<sup>th</sup> Avenue through the removal of on-street parking and/or the conversion of “**general purpose**” (GP) lanes to bus-only lanes. Eastbound BRT service would operate on Spring Street in the downtown area from 1<sup>st</sup> Avenue to 9<sup>th</sup> Avenue.

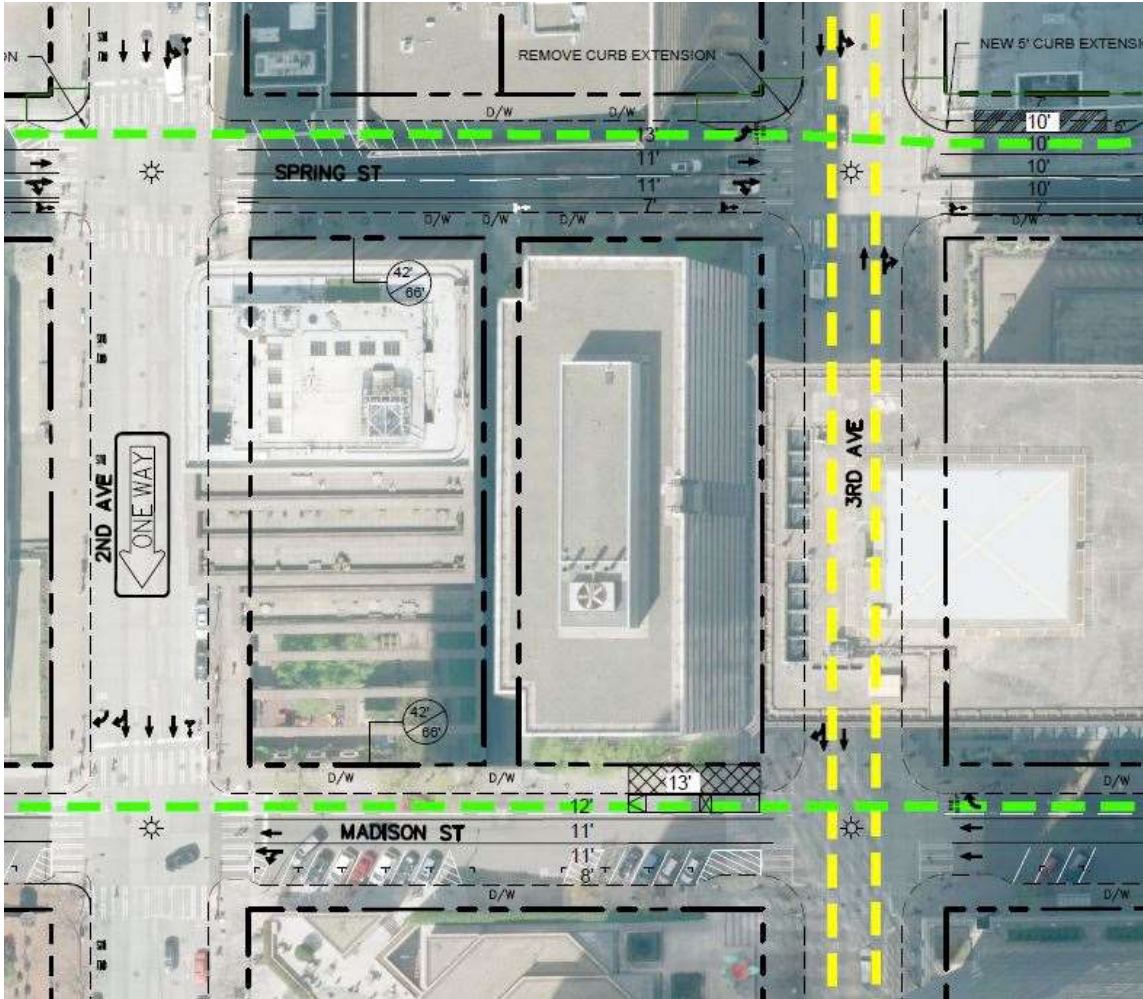
The ability to provide exclusive bus lanes for the full length of the Madison Street corridor is constrained by the differences in the roadway widths of each segment of the corridor. Therefore, the cross-sections and channelization developed for the LPA vary in relation to the underlying roadway width for the Downtown, First Hill, and East End sections identified above.

### Downtown

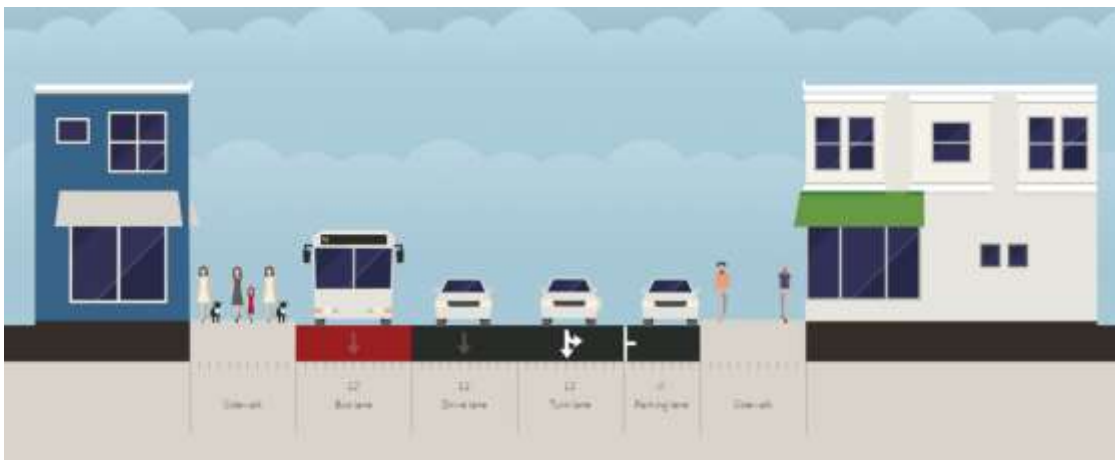
The downtown area would be modified to provide a BAT lane along the right curb for Madison Street and along the left curb for Spring Street, along with two general purpose lanes and a parallel parking lane or bike lane where possible. Figure 20 shows the downtown channelization on both Madison Street and Spring Street between 2<sup>nd</sup> Avenue and 3<sup>rd</sup> Avenue.

Eastbound transit would operate in a left side BAT lane on Spring Street from 1<sup>st</sup> Avenue to 6<sup>th</sup> Avenue. Westbound transit coming from First Hill would operate in a left side bus only lane on Madison east of 6<sup>th</sup> Avenue. A queue jump at 6<sup>th</sup> Avenue allows transit to traverse to a right side bus only lane for one block and becomes a BAT lane traveling westbound at Madison Street/5<sup>th</sup> Avenue. All left turns remain permitted on Madison Street and Spring Street. Figure 21 shows a roadway cross section on Madison Street and Figure 22 shows a cross section on Spring Street.

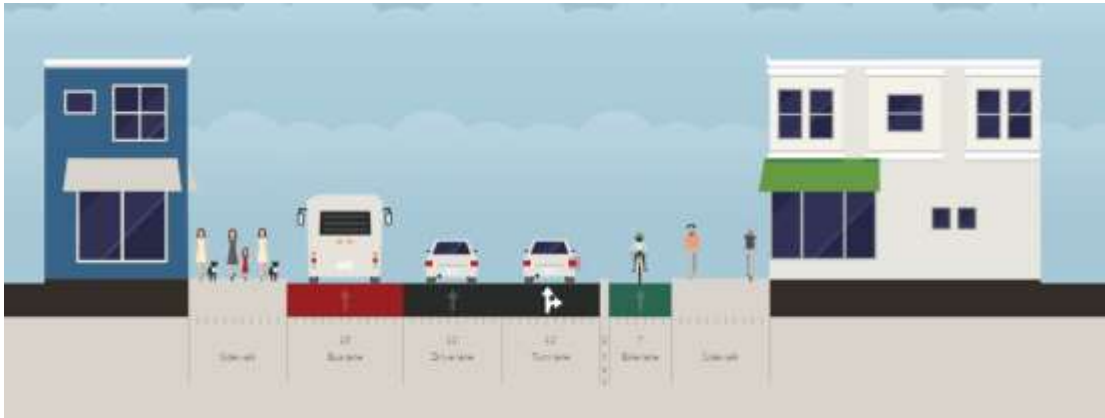
**Figure 20 Downtown Channelization**



**Figure 21 Downtown Proposed Cross-Section of Madison Street Between 2<sup>nd</sup> Avenue and 3<sup>rd</sup> Avenue (looking east)**



**Figure 22** Downtown Proposed Cross-Section of Spring Street Between 2<sup>nd</sup> Avenue and 3<sup>rd</sup> Avenue (looking east)



## First Hill

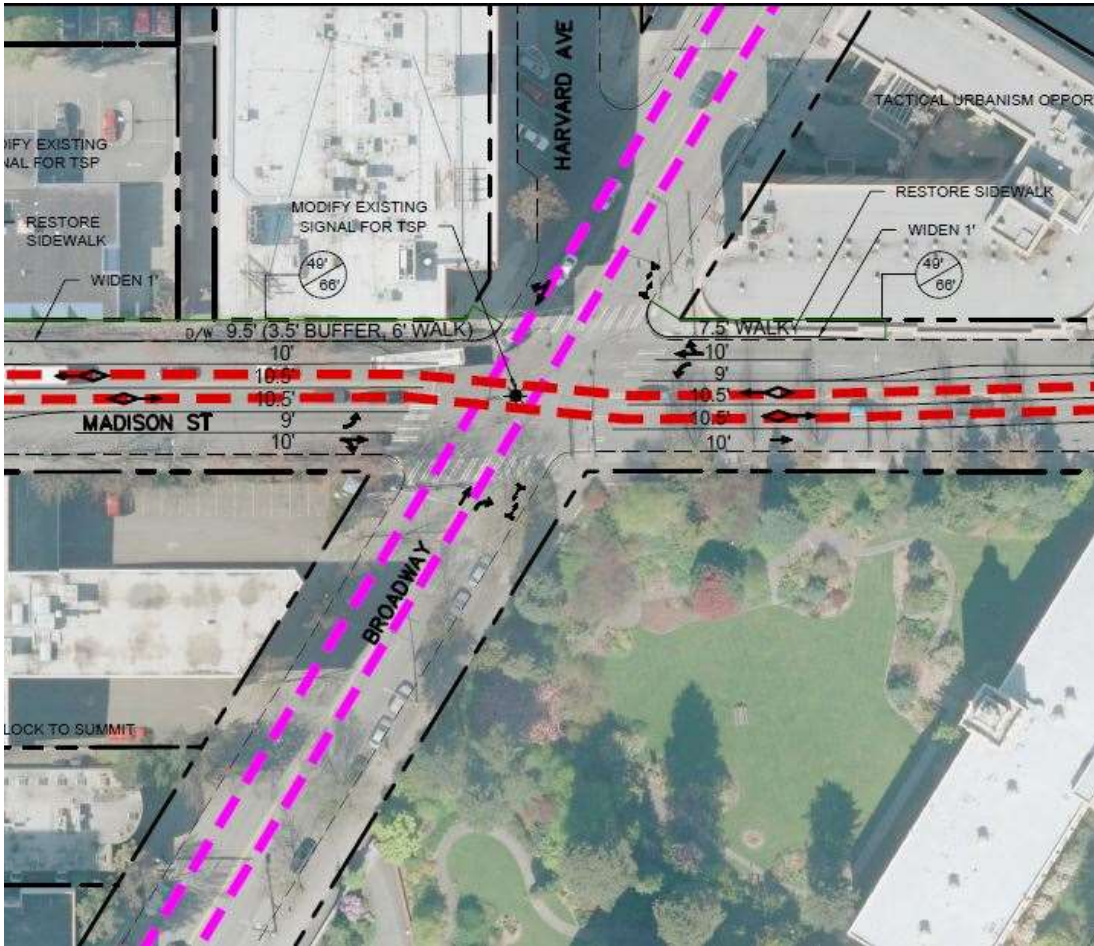
From 9<sup>th</sup> Avenue to 13<sup>th</sup> Avenue, buses operate in the center lanes with stations located in the median to allow for left side boarding/alighting. For this analysis, bus station platform widths were assumed to be ten feet wide due to the limited 49-foot roadway. Left turns from Madison Street would be restricted for all intersections on First Hill except at Madison Street/Boren Avenue, Madison Street/Broadway, and for eastbound left turns at Madison Street/12<sup>th</sup> Avenue.

Under this alternative, buses operate without interference from right turning vehicles. At intersections where left turns are allowed, buses operate on the left side of left turning traffic. Left turns would be protected only and not allowed to operate concurrently with through phases. Figure 23 shows the typical channelization where left turns are allowed.

## Capitol Hill/Central District

East of 13<sup>th</sup> Avenue, in the eastbound direction, buses continue to operate in the center lane until 15<sup>th</sup> Avenue. An eastbound queue jump at 15<sup>th</sup> Avenue allows the buses to traverse to the right lane and enter the BAT lane until 18<sup>th</sup> Avenue where it continues onto 23<sup>rd</sup> with general purpose traffic. Westbound, buses travel in with general purpose traffic until 18<sup>th</sup> Avenue. Buses continue westbound in the BAT lane until the station at Madison Street and 17<sup>th</sup> Avenue. The bus traverses the next two blocks to weave over to the bus only lane just before 15<sup>th</sup> Avenue and continues onto 13<sup>th</sup> in the center bus only lane. Left turns from Madison Street are to be restricted at 15<sup>th</sup> Avenue, 16<sup>th</sup> Avenue, 17<sup>th</sup> Avenue and 18<sup>th</sup> Avenue; and are allowed at 19<sup>th</sup> Avenue and intersections to the east. Figure 24 shows the weaves that both eastbound and westbound buses need to traverse between 15<sup>th</sup> Avenue and 17<sup>th</sup> Avenue. Figure 25 shows the roadway cross-section between 17<sup>th</sup> Avenue and 18<sup>th</sup> Avenue.

**Figure 23 First Hill Segment - Madison Street with Left Turn and Transit Channelization**

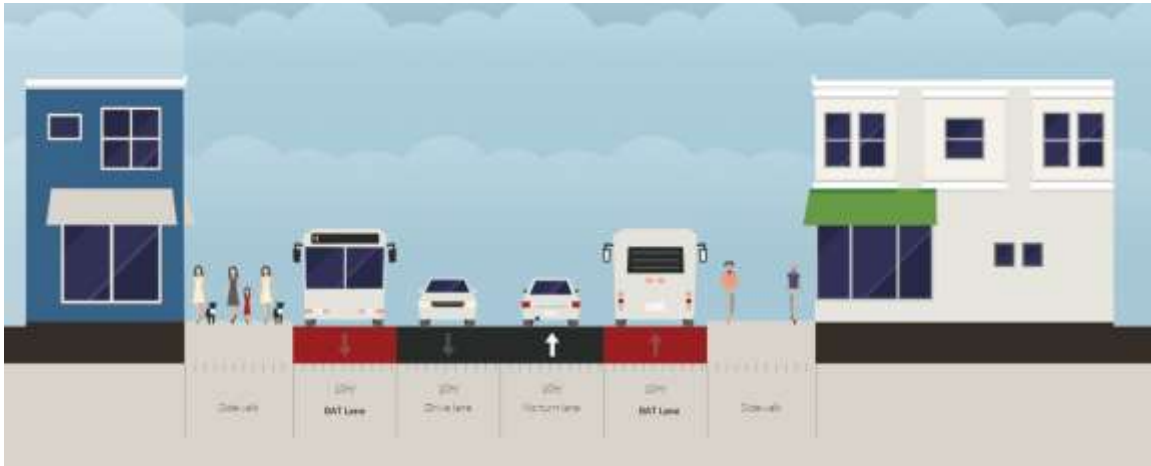


**Figure 24 Madison Street between 15<sup>th</sup> Avenue and 17<sup>th</sup> Avenue**





**Figure 25 Proposed Cross-Section of Madison Street between 17<sup>th</sup> Avenue and 18<sup>th</sup> Avenue**



## LPA Results

The LPA was modeled using the Dynameq, and Vissim traffic models. The Dynameq model results are presented first, followed by the Vissim model results. The Dynameq model provides results for the corridor from 1<sup>st</sup> Avenue to 23<sup>rd</sup> Avenue. The Vissim model provides more detailed results but these results are only available for the section of the corridor from 6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue. Each model produces a different and unique set of performance metrics. These performance metrics are used to compare the impacts and benefits of the LPA and to isolate issues that need more evaluation and resolution.

This section shows the PM Peak results for the LPA against the baseline conditions with respect to transit and auto travel time through the corridor.

## Dynameq Results

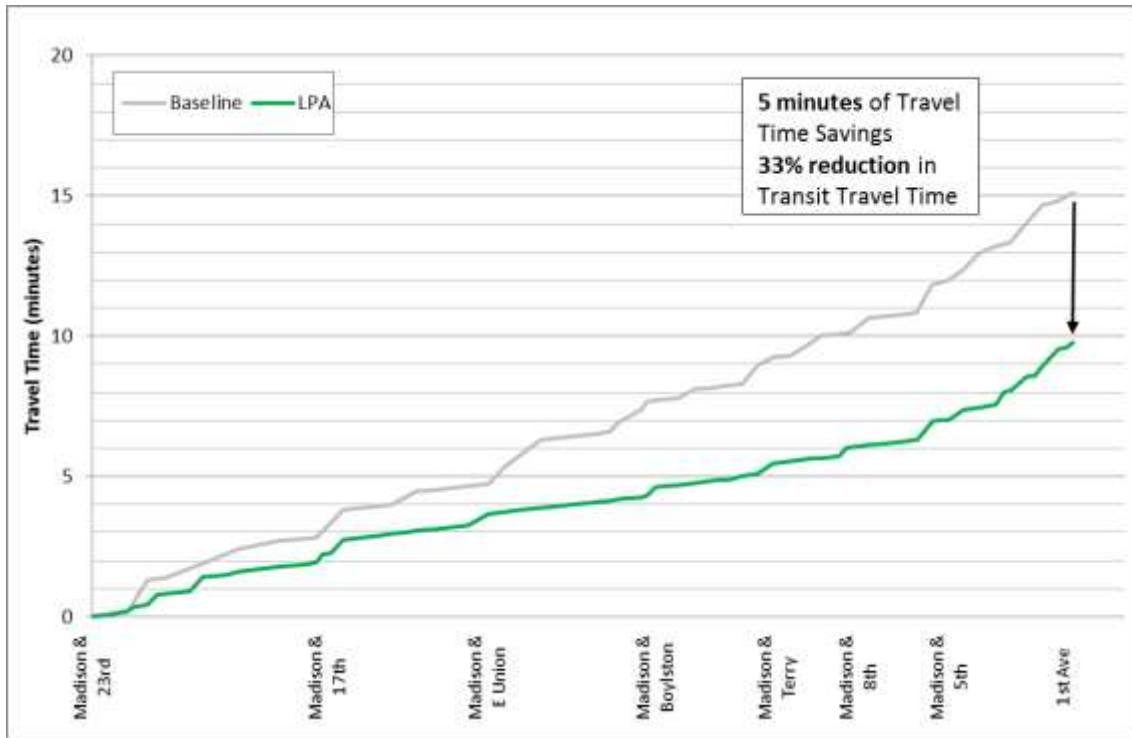
### Westbound Transit Travel Time

Figure 2 shows the westbound transit travel time for the LPA along the corridor. The LPA provides approximately 5 minutes of travel time savings or about 33% reduction in the overall transit travel time compared to the baseline conditions.

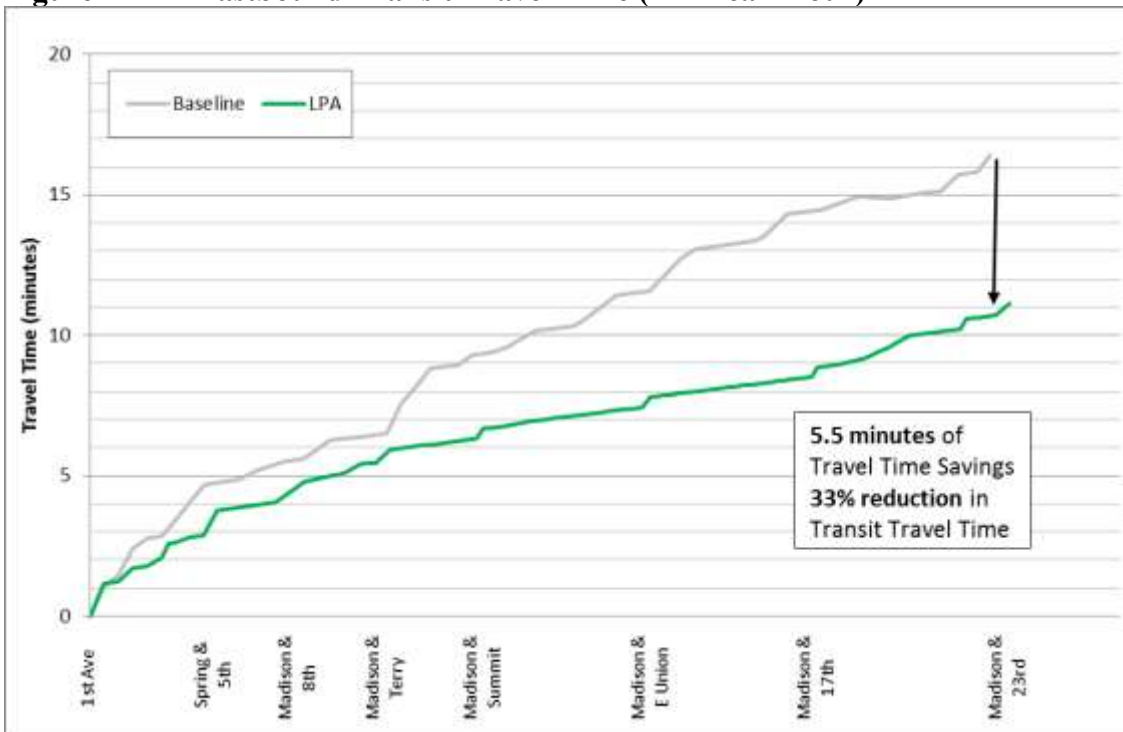
### Eastbound Transit Travel Time

Figure 27 shows the eastbound transit travel time for the LPA along the corridor. The LPA provides approximately 5.5 minutes of travel time savings or about 33% reduction in the overall transit travel time compared to the baseline conditions.

**Figure 26 Westbound Transit Travel Time (PM Peak Hour)**



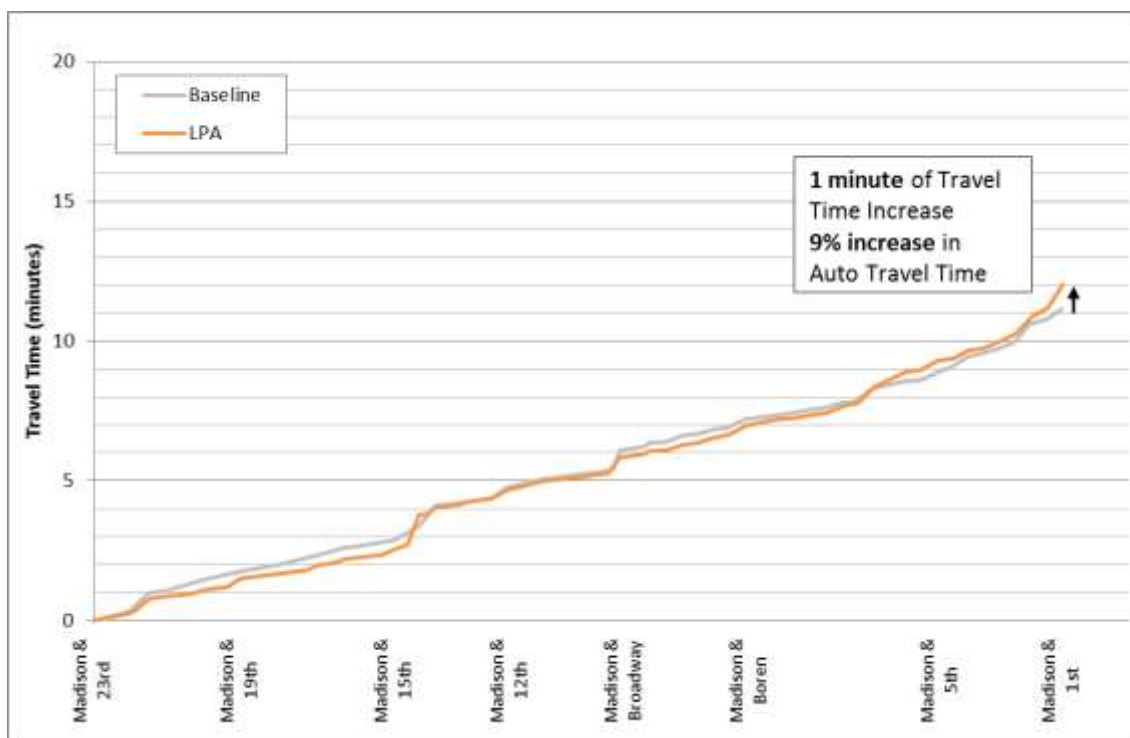
**Figure 27 Eastbound Transit Travel Time (PM Peak Hour)**



## Westbound Motor Vehicle Travel Time

Figure 28 shows the motor vehicle travel time for the westbound LPA along Madison Street. The LPA provides an increase of approximately 1 minute of overall auto travel time across the corridor.

**Figure 28 Westbound Motor Vehicle Time (PM Peak Hour)**



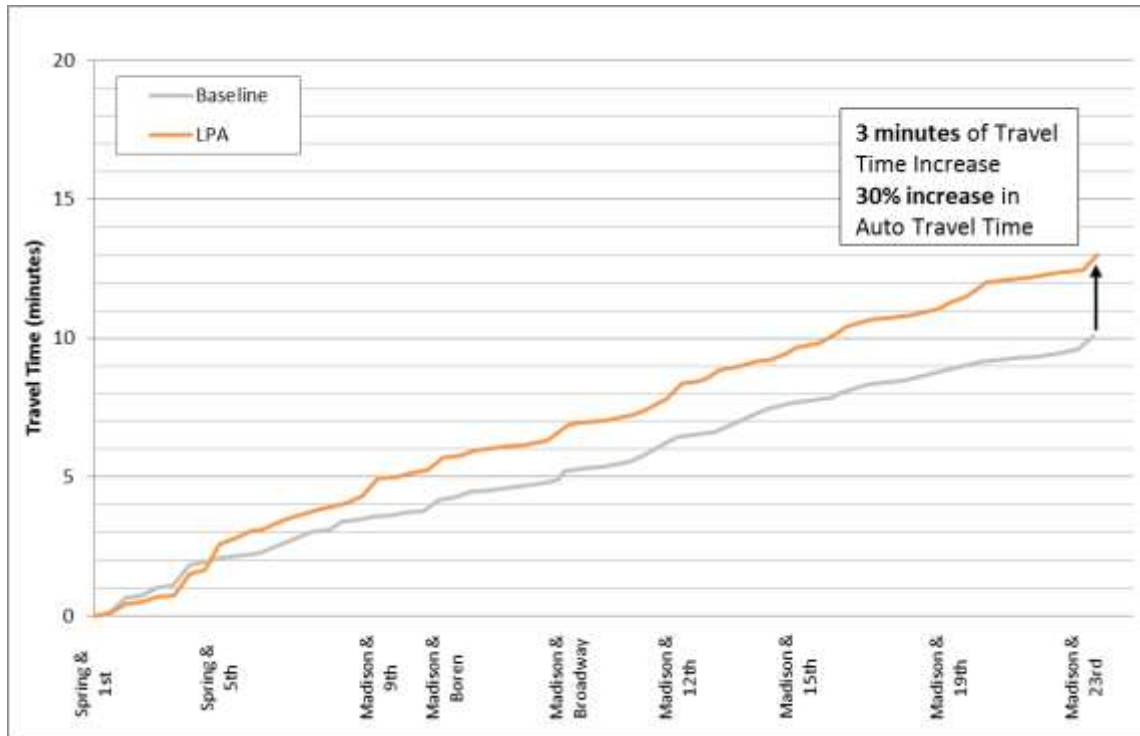
## Eastbound Motor Vehicle Travel Time

For the eastbound direction, Figure 29 shows the motor vehicle travel time for the corridor. The LPA provides an increase of approximately 3 minutes or approximately 9% of overall auto travel time across the corridor.

## Diversion

Appendix D shows the estimated motor vehicle diversion off of Madison Street with the LPA configuration. In the eastbound direction, Madison Street experiences a decrease of approximately 400 vehicles/hour diverting onto other routes during the PM peak hour. Routes impacted include Broadway north of Madison Street, Pine Street eastbound until Madison Street, Union Street, 19<sup>th</sup> Avenue, 23<sup>rd</sup> Avenue and James Street/E Cherry Street.

**Figure 29 Eastbound Motor Vehicle Travel Time (PM Peak Hour)**



The westbound direction on Madison Street experiences a reduction of approximately 200 vehicles/hour during the PM peak hour. Significant routes impacted within the study area include E Denny Way, 19<sup>th</sup> Avenue, James Street/E Cherry Street, and Pine Street.

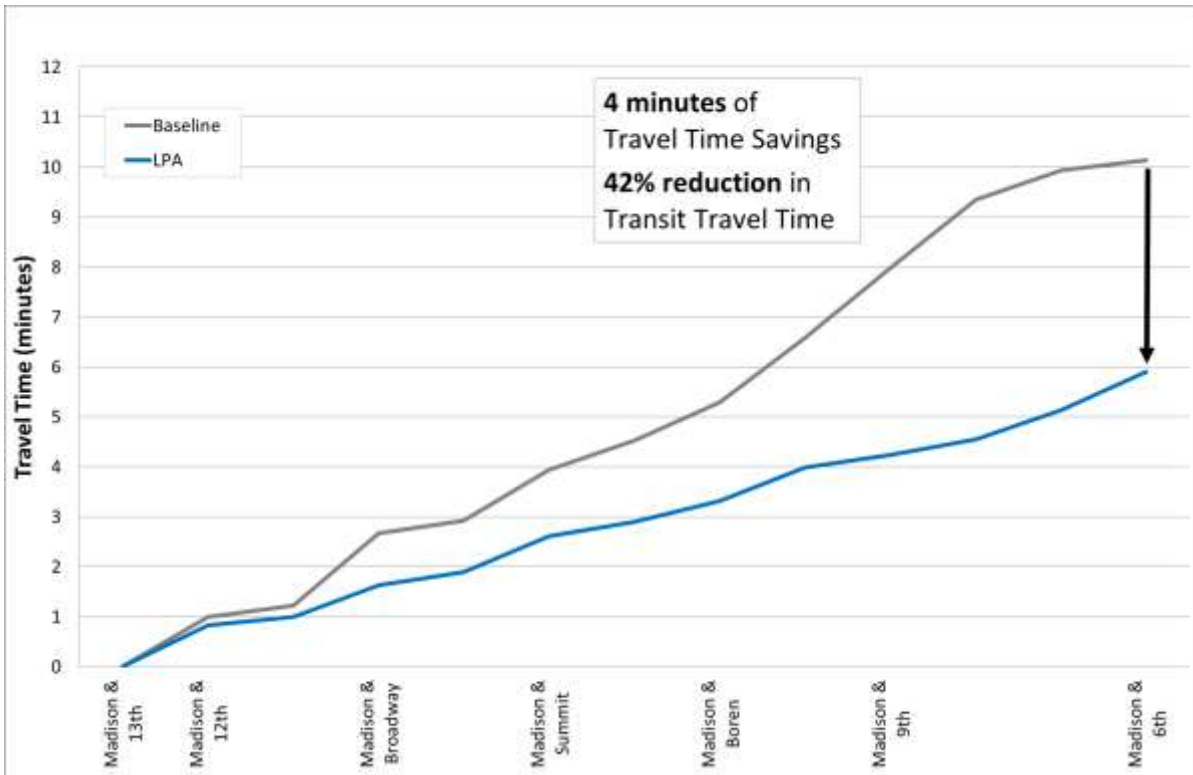
## Vissim Results

Travel time was evaluated along Madison Street from 9<sup>th</sup> Avenue to 13<sup>th</sup> Avenue in the eastbound direction for transit and motor vehicles. In the westbound direction, transit and motor vehicle travel time was evaluated from 13<sup>th</sup> Avenue to 6<sup>th</sup> Avenue. Transit travel time reliability was measured for the same segments.

### Westbound Transit Travel Time

Figure 30 shows the comparison between the baseline and the LPA for westbound transit. Westbound buses traveled along Madison Street for the entirety of the Vissim study area. The LPA provides an approximately 42% reduction in travel time which translates into about four minutes of savings.

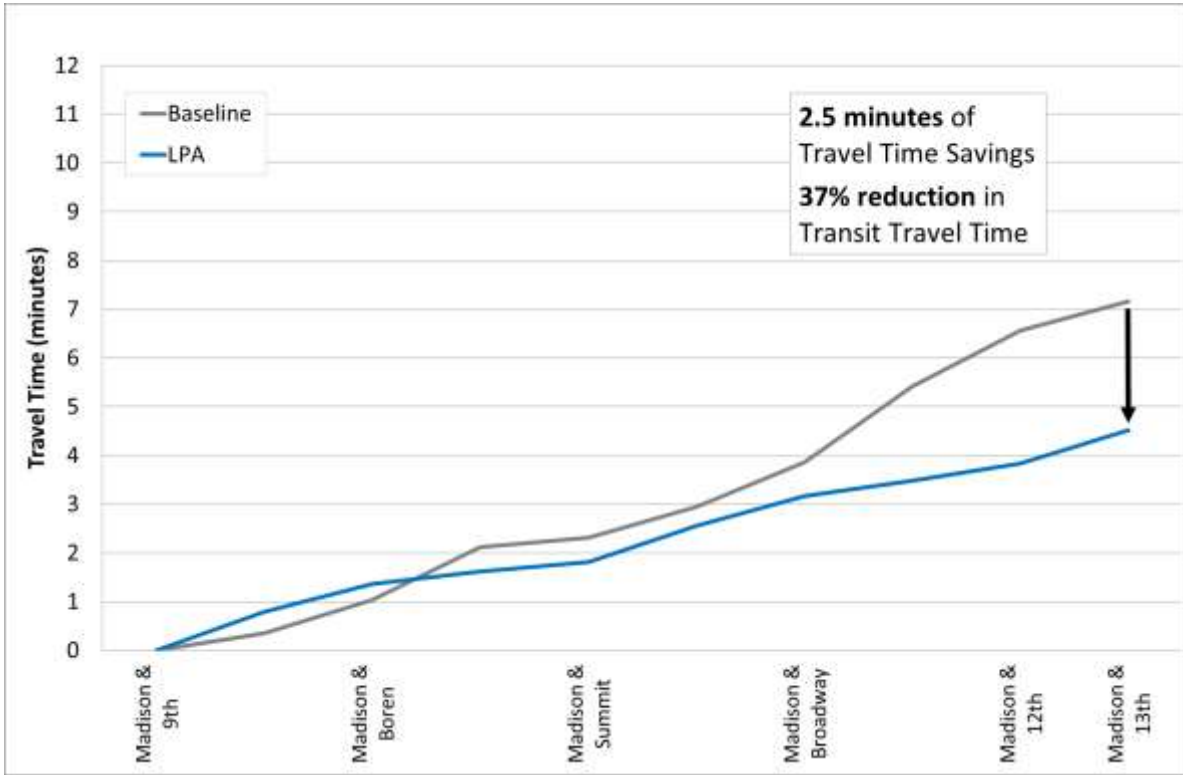
**Figure 30 Westbound Transit Travel Time (PM Peak Hour) (13<sup>th</sup> Avenue to 6<sup>th</sup> Avenue)**



### Eastbound Transit Travel Time

Figure 31 shows the transit travel time for the eastbound LPA compared to the baseline. Eastbound buses traveled along Spring Street and turn southward onto 9<sup>th</sup> Avenue. Buses then turn onto Madison Street and continues eastbound on Madison Street. The LPA provides approximately a 37% reduction or a two and a half minute travel time savings compared to baseline conditions.

**Figure 31 Eastbound Transit Travel Time (PM Peak Hour) 9<sup>th</sup> Avenue to 13<sup>th</sup> Avenue)**



### Transit Travel Time Reliability

Table 8 shows several descriptive statistics for transit service over the Vissim study area for the LPA and baseline conditions. Reliability of transit service improves for the LPA compared to the baseline as shown by the decrease in standard deviation.

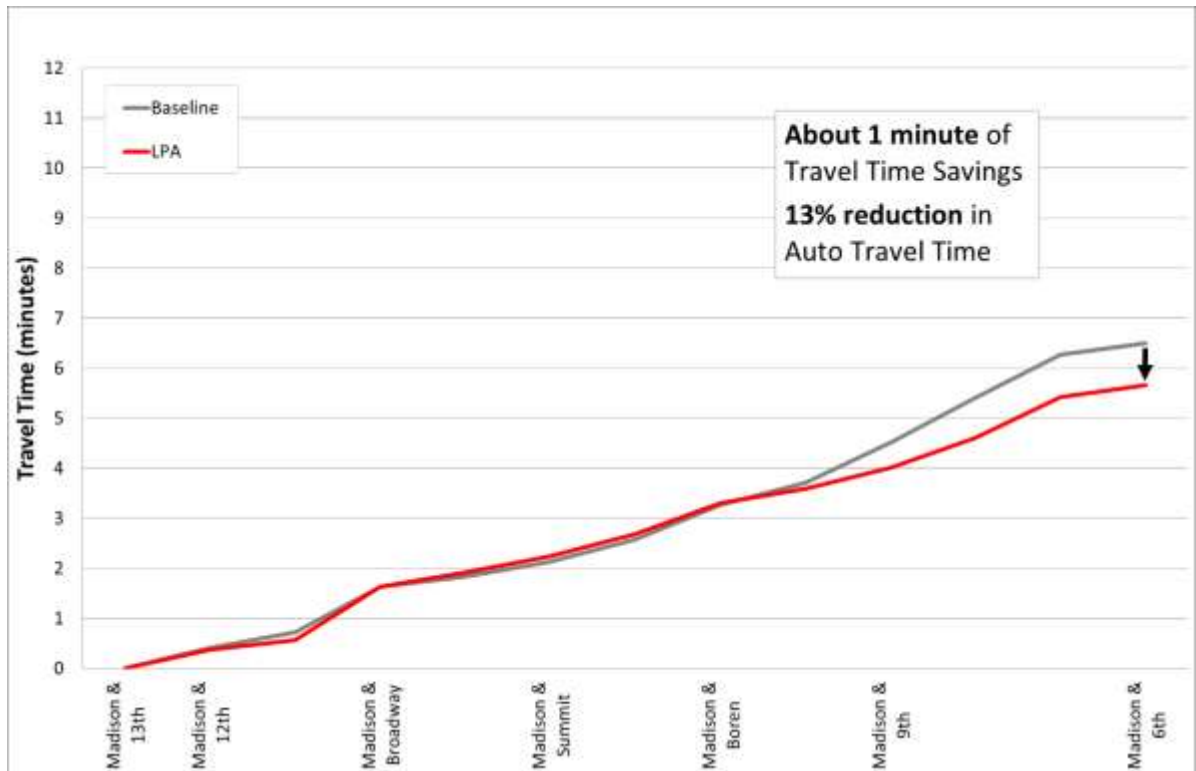
**Table 8 Transit Travel Time Reliability (6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue)**

Scenario	Transit Travel Time (min)				
	Direction	Min	Max	Avg	Stnd Dev
Baseline	EB	6.5	8.2	7.2	0.6
	WB	7.3	14.3	10.1	2.5
LPA	EB	4.2	4.8	4.5	0.2
	WB	5.7	6.0	5.9	0.1

## Westbound Motor Vehicle Travel Time

Figure 32 shows the comparison between the LPA and the baseline for westbound motor vehicle travel times. The LPA provides about a one minute travel time savings or a 13% reduction in travel time. Westbound motor vehicle travel times are highly dependent on the intersections of Madison/6<sup>th</sup> and Spring/6<sup>th</sup> since those provide access to Interstate 5. Since those intersections operate at or near capacity, the impacts of removing a general purpose lane on corridor travel times are outweighed by other benefits since additional demand cannot be shifted to the remaining lane. The benefits come from a variety of factors but are primarily due to increased green time on Madison Street from TSP operations, removal of several left turning movements, and diversion off of the corridor.

**Figure 32 Westbound Motor Vehicle Travel Times (PM Peak Hour) (13<sup>th</sup> Avenue to 6<sup>th</sup> Avenue)**

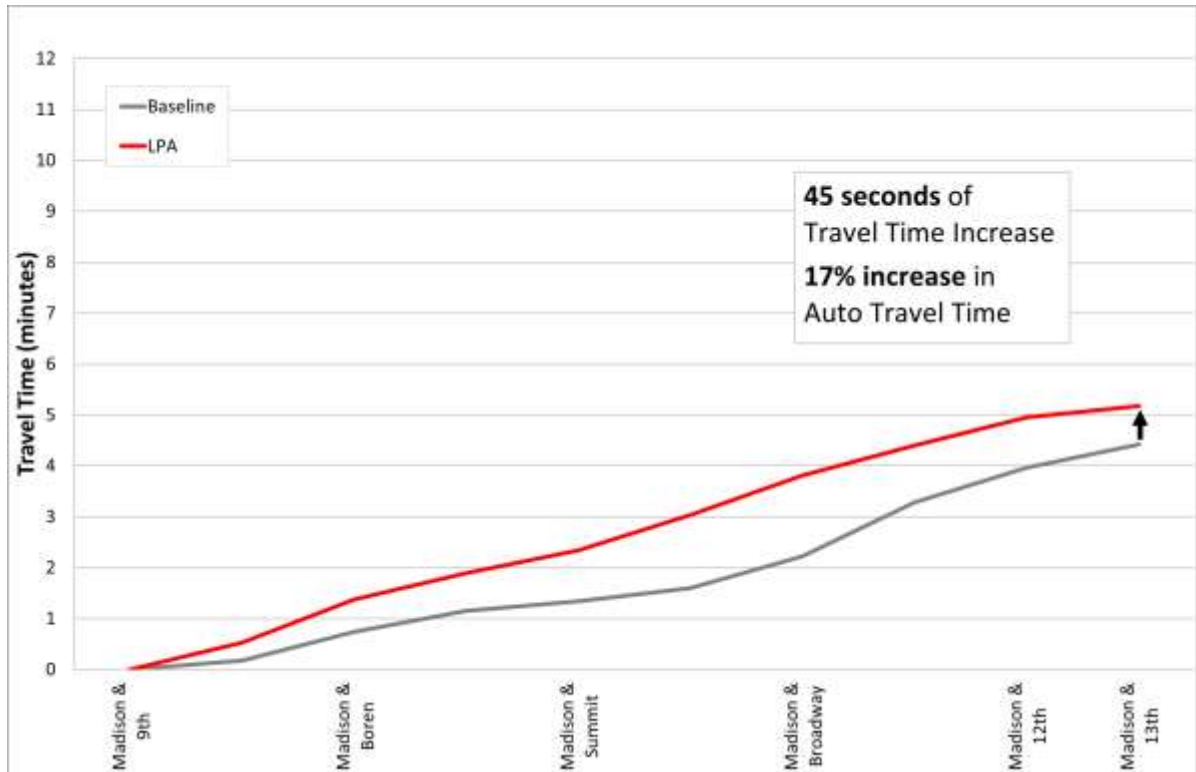


## Eastbound Auto Travel Time

Figure 33 shows the eastbound motor vehicle travel time comparison between the LPA and baseline. The LPA results in an increased travel time of about forty five seconds or a 17% increase. Eastbound operations on the corridor differ from westbound in that eastbound does not currently operate at capacity. Since the corridor does not operate at capacity, removal of a general purpose lane allows more vehicles to shift into the remaining lane. This increases demand for that

lane which leads to an increase in travel time even with the benefits of TSP and removal of left turning movements.

**Figure 33 Eastbound Auto Travel Time (PM Peak Hour) (9<sup>th</sup> Avenue to 13<sup>th</sup> Avenue)**



## Synchro Results

The year of opening volumes are shown in Appendix B. Table 9 shows the results for the year of opening intersection operations analysis during the PM peak hour based on Synchro analysis. A review shows that all the signalized intersections are projected to operate at LOS D or better except at the intersections of 2<sup>nd</sup> Avenue and Spring Street, 2<sup>nd</sup> Avenue and Madison Street, and 6<sup>th</sup> Avenue and Spring Street. These intersections experience an increase in average vehicle delay although 2<sup>nd</sup> Avenue and Madison Street, and 6<sup>th</sup> Avenue and Spring Street operate at the same level of service as in existing conditions. 2<sup>nd</sup> Avenue currently experiences a high volume of traffic in the PM peak period and this volume increases slightly with the LPA. Mitigation approaches included optimizing signal timing and changing of offsets to allow for progression but intersection level of service did not change.

Appendix G shows the intersection operations results for the Existing Conditions 2015 PM Peak Hour and Appendix H shows the intersection operations results for the LPA Year of Opening PM Peak Hour.



**Table 9 Summary of PM Peak Hour Year of Opening Average Vehicle Delay and Level of Service (Synchro Results)**

<b>Intersection</b>	<b>Average Delay Per Vehicle (sec)</b>	<b>Level of Service</b>
1 <sup>st</sup> /Madison	23.4	C
2 <sup>nd</sup> /Madison	56.6	E
3 <sup>rd</sup> /Madison	7.0	A
4 <sup>th</sup> /Madison	18.8	B
5 <sup>th</sup> /Madison	10.1	B
6 <sup>th</sup> /Madison	21.7	C
7 <sup>th</sup> /Madison	21.5	C
8 <sup>th</sup> /Madison	18.1	B
9 <sup>th</sup> /Madison	33.2	C
Terry/Madison	11.7	B
Boren/Madison	47.6	D
Minor/Madison	18.9	B
Summit/Madison	5.5	A
Boylston/Madison	26.2	C
Broadway/Madison	36.4	D
11 <sup>th</sup> /Madison	12.7	B
12 <sup>th</sup> /Madison	41.7	D
13 <sup>th</sup> /Madison	25.4	C
14 <sup>th</sup> /Madison	29.5	C
14 <sup>th</sup> /Pike	14.0	B
15 <sup>th</sup> /Madison	2.3	A
Pine/Madison	19.6	B
17 <sup>th</sup> /Madison	22.2	C
19 <sup>th</sup> /Madison	31.3	C
20 <sup>th</sup> /Madison	8.0	A

Intersection	Average Delay Per Vehicle (sec)	Level of Service
22 <sup>nd</sup> /Madison	22.0	C
23 <sup>rd</sup> /Madison	31.9	C
1 <sup>st</sup> /Spring	40.8	D
2 <sup>nd</sup> /Spring	63.4	E
3 <sup>rd</sup> /Spring	24.2	C
4 <sup>th</sup> /Spring	16.2	B
5 <sup>th</sup> /Spring	40.6	D
6 <sup>th</sup> /Spring	172.6	F
7 <sup>th</sup> /Spring	16.9	B
8 <sup>th</sup> /Spring	11.3	B
9 <sup>th</sup> /Spring	9.1	A

### Traffic Signal Warrant Analysis

A traffic signal is proposed to be added at the Spring Street/8<sup>th</sup> Avenue and Spring Street/9<sup>th</sup> Avenue intersections. A traffic signal warrant analysis was performed to examine if conditions warrant the addition of traffic signals at the two locations. 24 hour counts were obtained Tuesday, January 19, 2016. In accordance with Chapter 4C of the Manual on Uniform Traffic Control Devices (MUTCD), it was found that both intersections do not meet warrants for the addition of a traffic control signal at either location. The analyses for both intersections can be found in Appendix E. Although the warrants were not met, there are benefits to transit travel time and improved pedestrian safety at both locations with a proposed traffic signal. It is recommended that the traffic signals are added at both locations.

### Protected Signal Control Analysis

An analysis for the warrant of a protected signal control at Madison Street and 19<sup>th</sup> Avenue was performed for the eastbound and westbound left turns. Per the SDOT Cross-Product Guideline for protected signal control, projected volumes for the Year of Opening condition at the intersection warrant protected left turn signals for the left turns in both directions. From the operations analysis at the intersection, the two movements, and the resulting eastbound and westbound approaches, do not experience a high delay due to the left turn volume, given the proposed signal timing. As such, no protected left turn phases for the eastbound

and westbound left turns are recommended for the intersection. Analysis for this intersection can be found in Appendix F.

## **2030 No Build Alternative**

The 2030 No Build intersection turn movement volumes are shown in Appendix A. Table 10 shows the results for the 2030 No Build intersection operations analysis during the PM peak based on Synchro. A review shows that all the signalized intersections are projected to operate at level of service D or better conditions except at the intersections of 2<sup>nd</sup> Avenue and Madison Street, 4<sup>th</sup> Avenue and Spring Street, and 6<sup>th</sup> Avenue and Spring Street. These intersections experience an increase in delay although 2<sup>nd</sup> Avenue and Madison Street, and 6<sup>th</sup> Avenue and Spring Street operate at the same level of service as in existing conditions. Mitigation approaches included optimizing signal timing and changing of offsets to allow for better progression for coordinated phases.

## **2030 LPA Build Alternative**

The 2030 LPA Build volumes are shown in Appendix B. Table 10 shows the results for the year of opening intersection operations analysis during the PM peak. A review shows that all the signalized intersections are projected to operate at level of service D or better except at the intersections of 2<sup>nd</sup> Avenue and Madison Street, 2<sup>nd</sup> Avenue and Spring Street, and 6<sup>th</sup> Avenue and Spring Street. These intersections experience an increase in delay although 2<sup>nd</sup> Avenue and Madison Street, and 6<sup>th</sup> Avenue and Spring Street operate at the same level of service as in existing conditions.

Mitigation approaches included optimizing signal timing and changing of offsets to allow for better progression for coordinated phases. At the intersection of 19<sup>th</sup> Avenue and Madison Street, the northbound approach had a LOS E. The addition of a left turn pocket of 100 feet and the removal of parking on the curb side, in conjunction with a protected and permitted left turn phase, allowed for the northbound approach to perform at LOS C. At the intersection of E Denny Way and Madison Street, the southbound approach had a LOS F. The addition of a left turn pocket of 100 feet and the removal of parking on the curb side, in conjunction with a protected and permitted left turn phase and signal timing optimization, allowed for the southbound approach to reduce to LOS D.

Appendix I shows the intersection operations results for the No-Build 2030 PM Peak Hour and Appendix J shows the intersection operations results for the LPA 2030 PM Peak Hour.

**Table 10 Summary of PM Peak Hour 2030 No Build and 2030 Build Level of Service (LOS) and Average Vehicle Delay (Synchro Results)**

<b>Intersection</b>	<b>2030 No Build Avg Delay (sec)</b>	<b>2030 No Build LOS</b>	<b>2030 Build Avg Delay (sec)</b>	<b>2030 Build LOS</b>
1 <sup>st</sup> /Madison	27.1	C	25.2	C
2 <sup>nd</sup> /Madison	69.4	E	57.7	E
3 <sup>rd</sup> /Madison	11.6	B	7.4	A
4 <sup>th</sup> /Madison	52.1	D	25.4	C
5 <sup>th</sup> /Madison	13.4	B	14.9	B
6 <sup>th</sup> /Madison	11.7	B	29.8	C
7 <sup>th</sup> /Madison	17.0	B	24.6	C
8 <sup>th</sup> /Madison	11.9	B	21.6	C
9 <sup>th</sup> /Madison	16.9	B	30.9	C
Terry/Madison	12.8	B	20.0	C
Boren/Madison	43.7	D	44.7	D
Minor/Madison	7.6	A	20.1	C
Summit/Madison	4.0	A	9.0	A
Boylston/Madison	8.8	A	26.0	C
Broadway/Madison	28.4	C	33.1	C
11 <sup>th</sup> /Madison	8.5	A	16.3	B
12 <sup>th</sup> /Madison	30.3	C	44.1	D
13 <sup>th</sup> /Madison	8.6	A	28.4	C
14 <sup>th</sup> /Madison	18.2	B	27.0	C
14 <sup>th</sup> /Pike	8.0	A	14.1	B
15 <sup>th</sup> /Madison	1.9	A	2.0	A
Pine/Madison	10.4	B	19.0	B
17 <sup>th</sup> /Madison	12.0	B	22.0	C
19 <sup>th</sup> /Madison	19.3	B	27.3	C
20 <sup>th</sup> /Madison	9.9	A	14.3	B
22 <sup>nd</sup> /Madison	5.4	A	26.6	C

<b>Intersection</b>	<b>2030 No Build Avg Delay (sec)</b>	<b>2030 No Build LOS</b>	<b>2030 Build Avg Delay (sec)</b>	<b>2030 Build LOS</b>
23 <sup>rd</sup> /Madison	35.0	D	35.9	D
1 <sup>st</sup> /Spring	26.6	C	41.7	D
2 <sup>nd</sup> /Spring	53.3	D	64.0	E
3 <sup>rd</sup> /Spring	21.2	C	23.7	C
4 <sup>th</sup> /Spring	65.5	E	19.7	B
5 <sup>th</sup> /Spring	27.1	C	12.8	B
6 <sup>th</sup> /Spring	106.7	F	165.5	F
7 <sup>th</sup> /Spring	19.7	B	18.0	B
8 <sup>th</sup> /Spring	12.5	B	11.4	B
9 <sup>th</sup> /Spring	11.8	B	8.9	A



## 6 RECOMMENDED DESIGN PROGRAM

The proposed project will create a BRT corridor along Madison Street that will connect downtown and the Capitol Hill and Madrona neighborhoods. Appendix A shows the 10 percent design layout for the Madison BRT Project which extends along the Madison Corridor from 1<sup>st</sup> Avenue to Martin Luther King Jr. Way. The traffic analysis examined the transit and auto travel times, and the intersection delays and level of service for the following four PM peak hour scenarios: existing conditions, year of opening LPA, 2030 No Build and 2030 LPA Build alternative. The following summarizes the key findings of analysis:

- Average PM peak hour transit travel times in both directions experience a travel time savings of approximately 33 percent, or 5.5 minutes in the eastbound direction and 5.0 minutes in the westbound direction compared to the baseline conditions.
- Within the Vissim study area (6<sup>th</sup> Avenue to 13<sup>th</sup> Avenue), westbound and eastbound transit travel times vary up to approximately 7 minutes and 2 minutes respectively in the baseline conditions. With the proposed improvements, this variation decreases to approximately 18 seconds for westbound transit travel times and 36 seconds for eastbound transit travel times, providing more reliable transit service.
- Station enhancements (level boarding, off-board fare collection, multiple doors) contribute to transit travel time improvements.
- Average PM peak hour auto travel times in the westbound direction has a small increase of approximately one minute along the corridor while the eastbound direction experiences an increase of approximately three minutes.
- **The City's EMME2 travel** demand model shows little growth in PM peak hour traffic volumes along Madison Street between 2015 and 2030 alternatives.
- Based on the year 2030 PM peak hour No-Build and Build (LPA) analysis, all study area intersections operate at level of service D or better conditions except for the following: 1) the 2<sup>nd</sup> Avenue/Madison Street intersection operates at level of service E under both the 2030 PM peak hour No-Build and Build (LPA) scenarios; 2) the 2<sup>nd</sup> Avenue/Spring Street intersection operates at level of service D conditions under the 2030 PM peak hour No-Build scenario and degrades to level of service E under the 2030 PM peak hour Build (LPA) scenario; 3) the 6<sup>th</sup> Avenue/Spring Street intersection operates at level of service F under both the 2030 PM peak hour No-Build and Build (LPA) scenarios.

- PM peak hour vehicle diversion in the range of 200 to 400 vehicles from Madison Street is expected with the project (year of opening) due to left turn restrictions and the reduction in auto throughput capacity.
- Left turns from Madison Street are restricted at the following cross streets: 8th Avenue, 9th Avenue, Terry Avenue, Minor Avenue, Summit Avenue, Boylston Avenue, Broadway Court (unsignalized), 10th Avenue (unsignalized), Seneca Street (unsignalized), 12th Avenue (westbound LT prohibited), 13th Avenue, 14th Avenue, Pike Street and 15th Avenue. These left turn prohibitions restrict access and circulation.
- The following changes in on-street parking stalls along the corridor would result with the project: all-day on-street parking would reduce by 66 stalls, peak-restricted on-street parking would reduce by 96 stalls, commercial loading on-street parking would reduce by 6 stalls, and passenger loading on-street parking would reduce by 5 stalls. In summary, of the existing 390 parking spots within the LPA alignment, 217 parking spots will remain, with 173 being removed. Mitigation measures can be found in the Parking and Loading Impacts Report (see Appendix K).

The Madison BRT Project adds BRT on a priority bus corridor that has, in large part, steep grades. It also includes many of the improvements recommended in the King County Madison Street Transit Priority Corridor Improvements Conceptual Study to benefit transit service along Madison Street. It would provide quick and reliable transit service to help connect existing urban villages as a key corridor within the city. The expected improvements conform to the SDOT Complete Streets Checklist.

A summary of the public involvement process and activities for the Madison Corridor BRT Project can be found in the Outreach Summary Report.

An evaluation of the Complete Streets Criteria for the Madison Corridor BRT Project is provided in Appendix L.

Based on the traffic analysis completed to date and described in this report, it is recommended that the Madison Corridor BRT Project be moved forward for additional design beyond the 10 percent level based on the benefits to transit operations and minimal impact to traffic operations.



# APPENDICES

---

**Appendix A: Role Plot – 10% LPA Plans**

**Appendix B: Traffic Volumes for Alternatives**

**Appendix C: Proposed Signal Phasing Diagrams**

**Appendix D: Diversion Graphics**

**Appendix E: Traffic Signal Warrant Analysis**

**Appendix F: Protected Signal Control Analysis**

**Appendix G: Intersection Operations Results Existing  
Conditions 2015 PM Peak Hour**

**Appendix H: Intersection Operations Results LPA 2015 PM  
Peak Hour**

**Appendix I: Intersection Operations Results No-Build 2030  
PM Peak Hour**

**Appendix J: Intersection Operations Results LPA 2030 PM  
Peak Hour**

**Appendix K: Madison Corridor BRT Parking and Loading  
Impacts Report**

**Appendix L: Madison Corridor BRT Complete Streets  
Assessment**

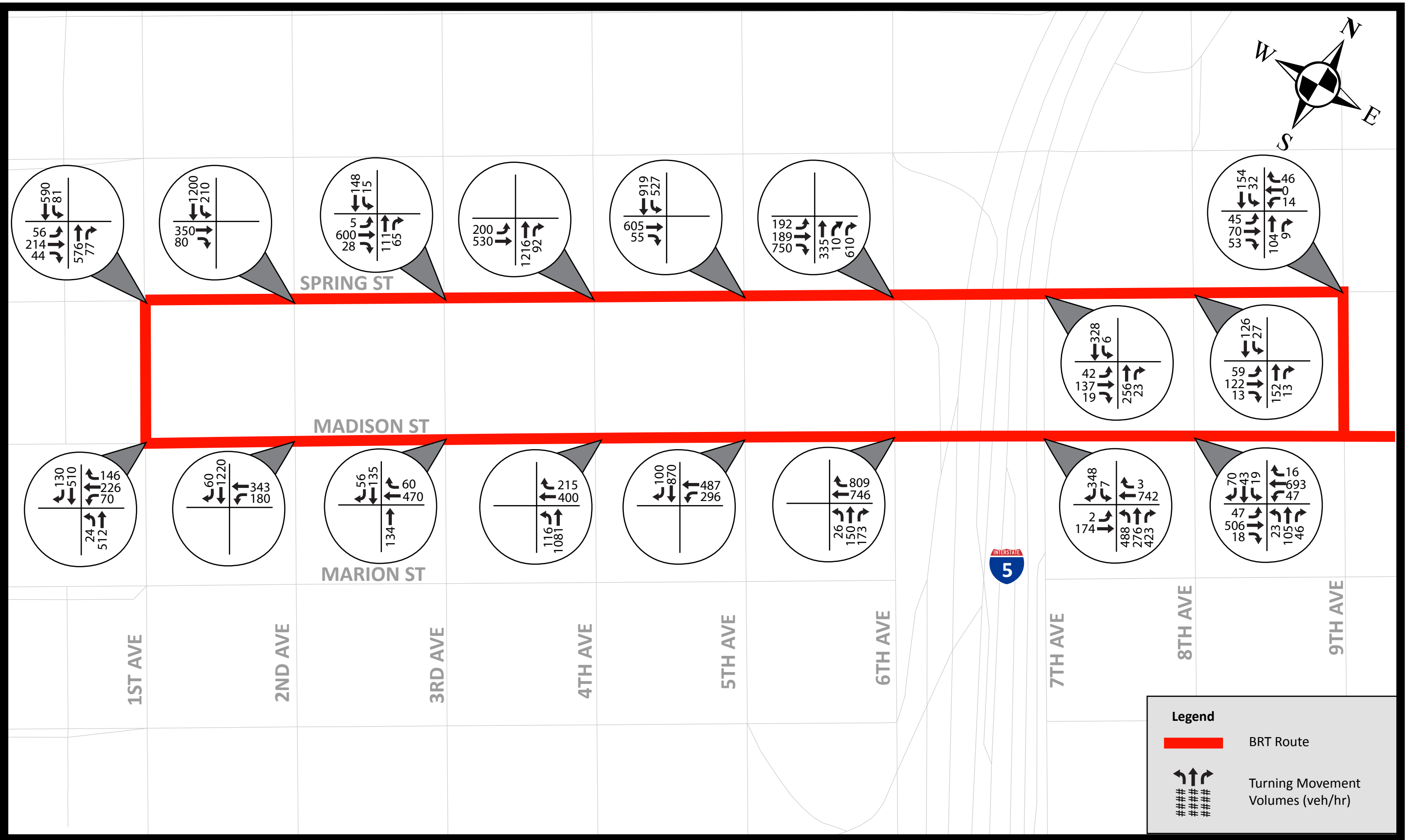
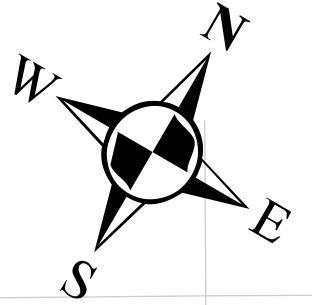


## **Appendix A: See 30% Design**

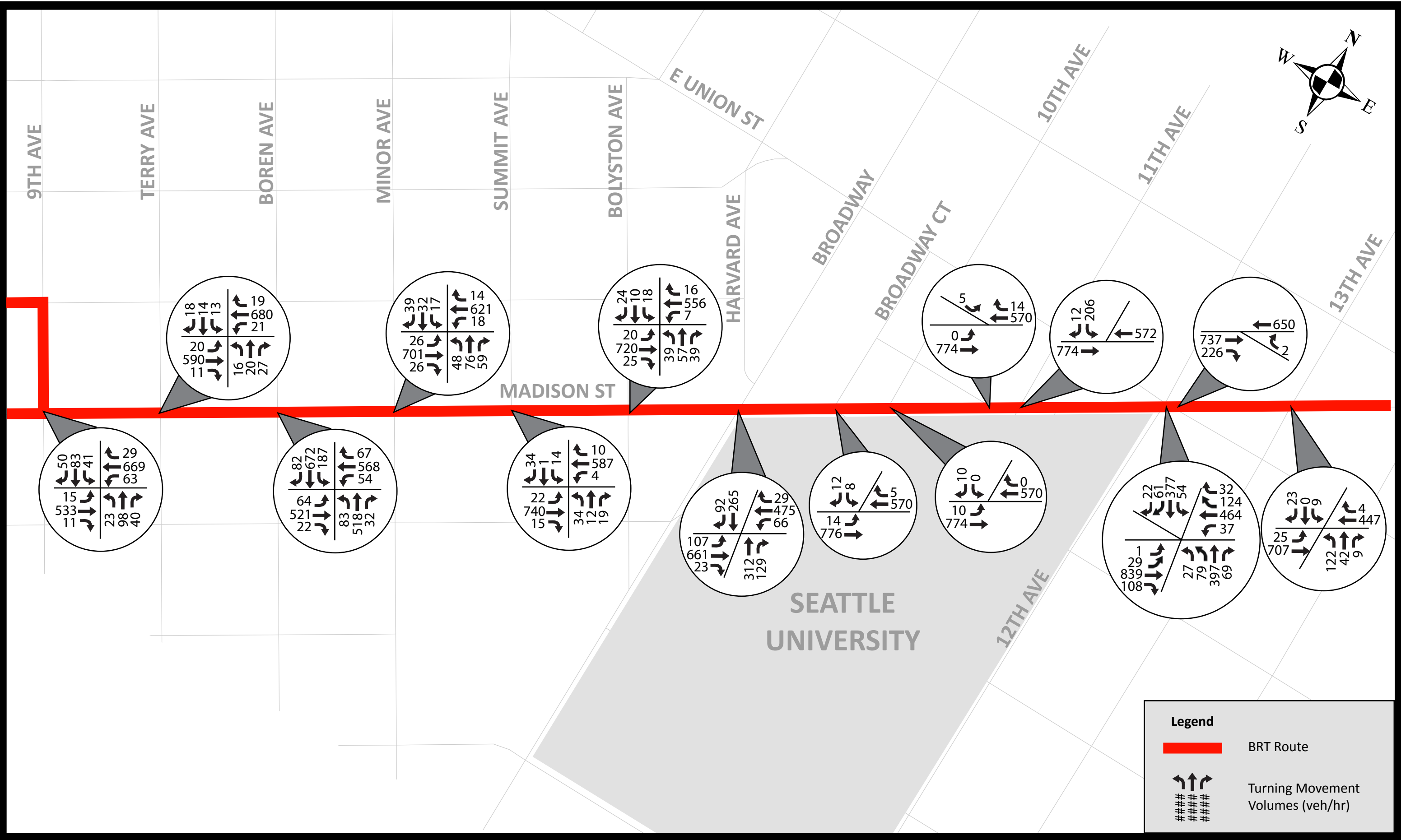
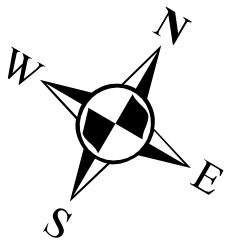


## **Appendix B: Traffic Volumes for Alternatives**

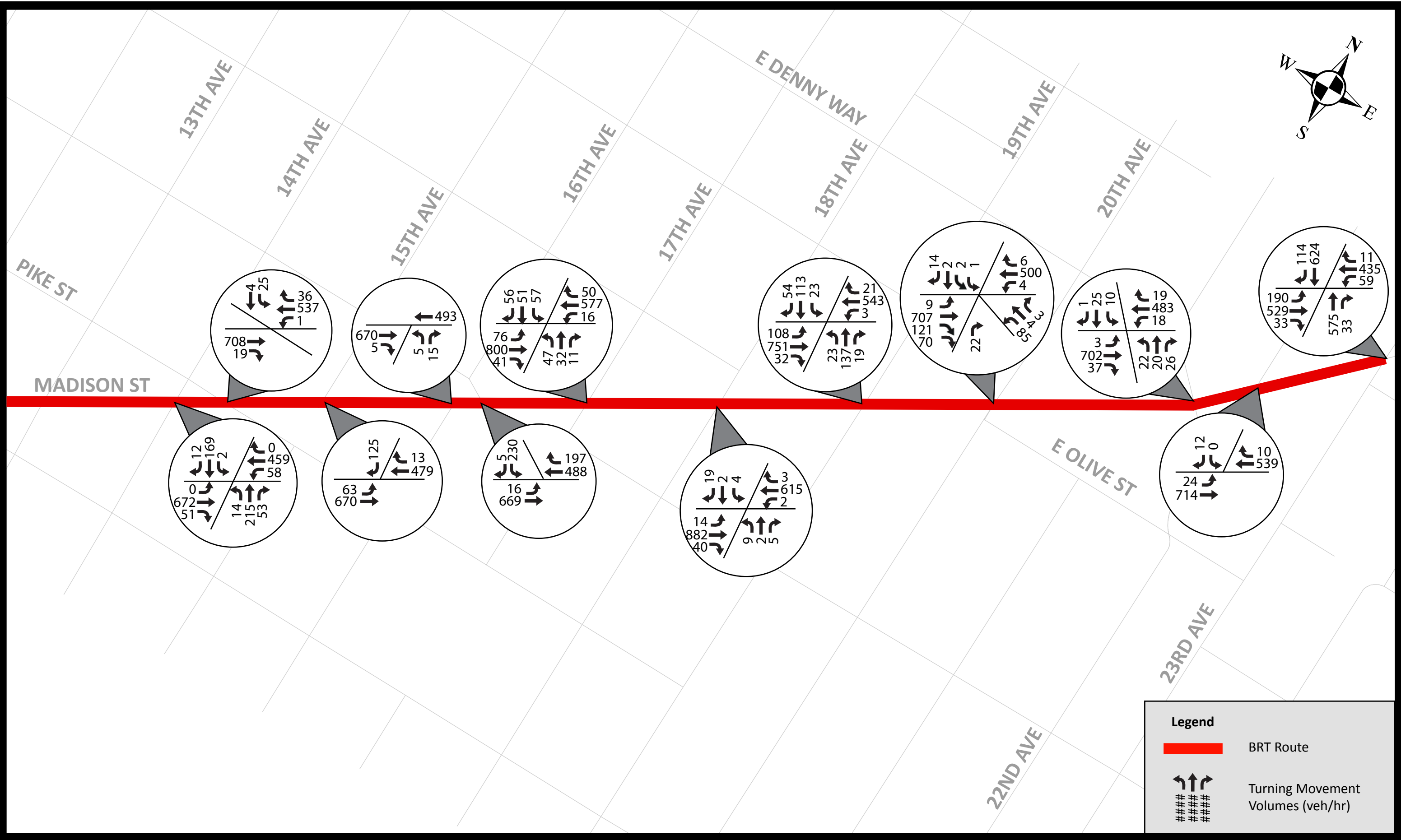
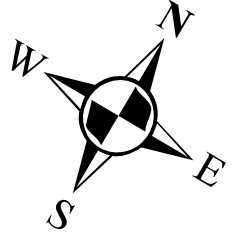
# EXISTING CONDITIONS



# EXISTING CONDITIONS

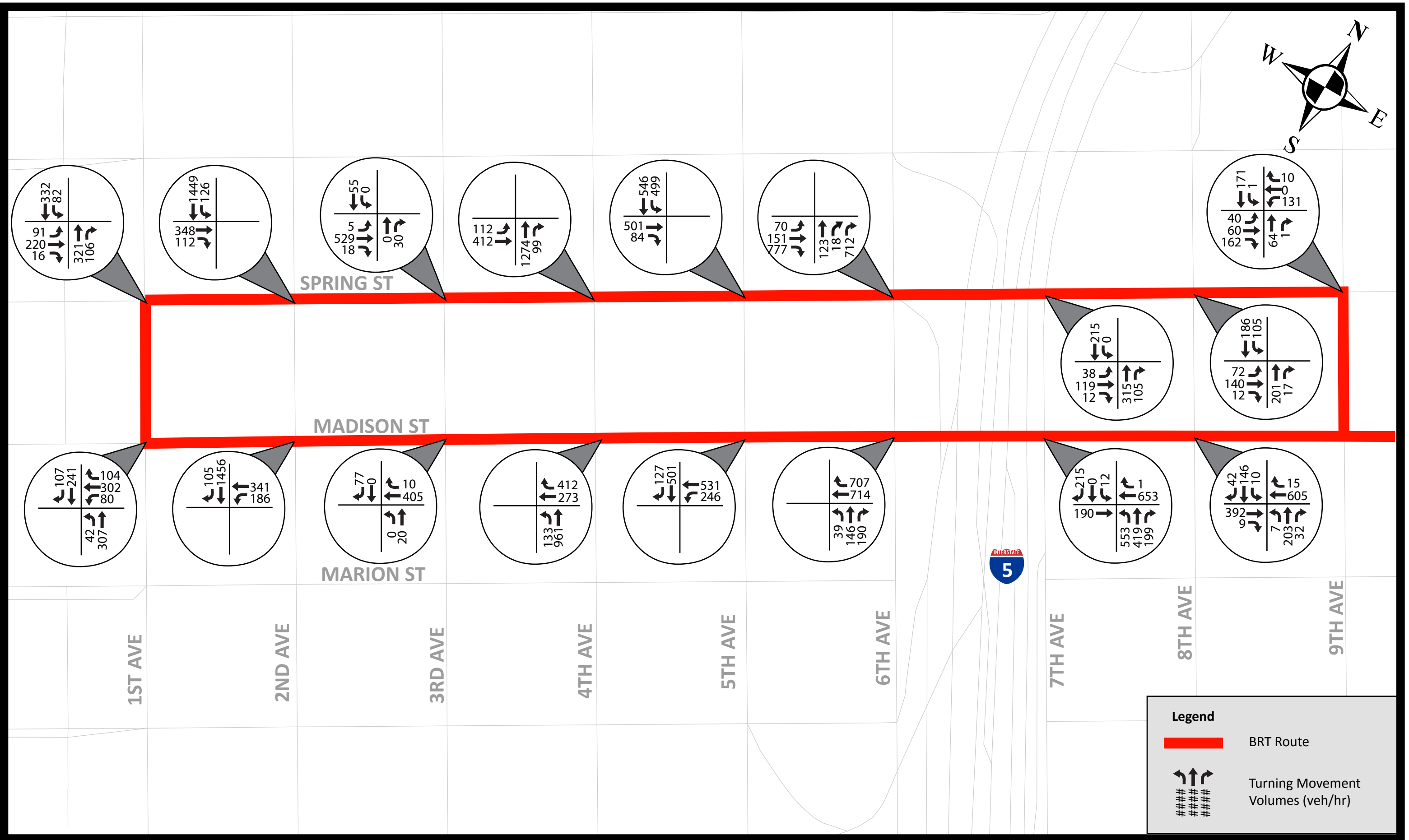
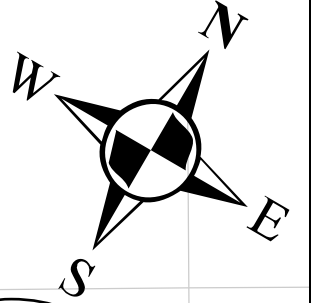


# EXISTING CONDITIONS





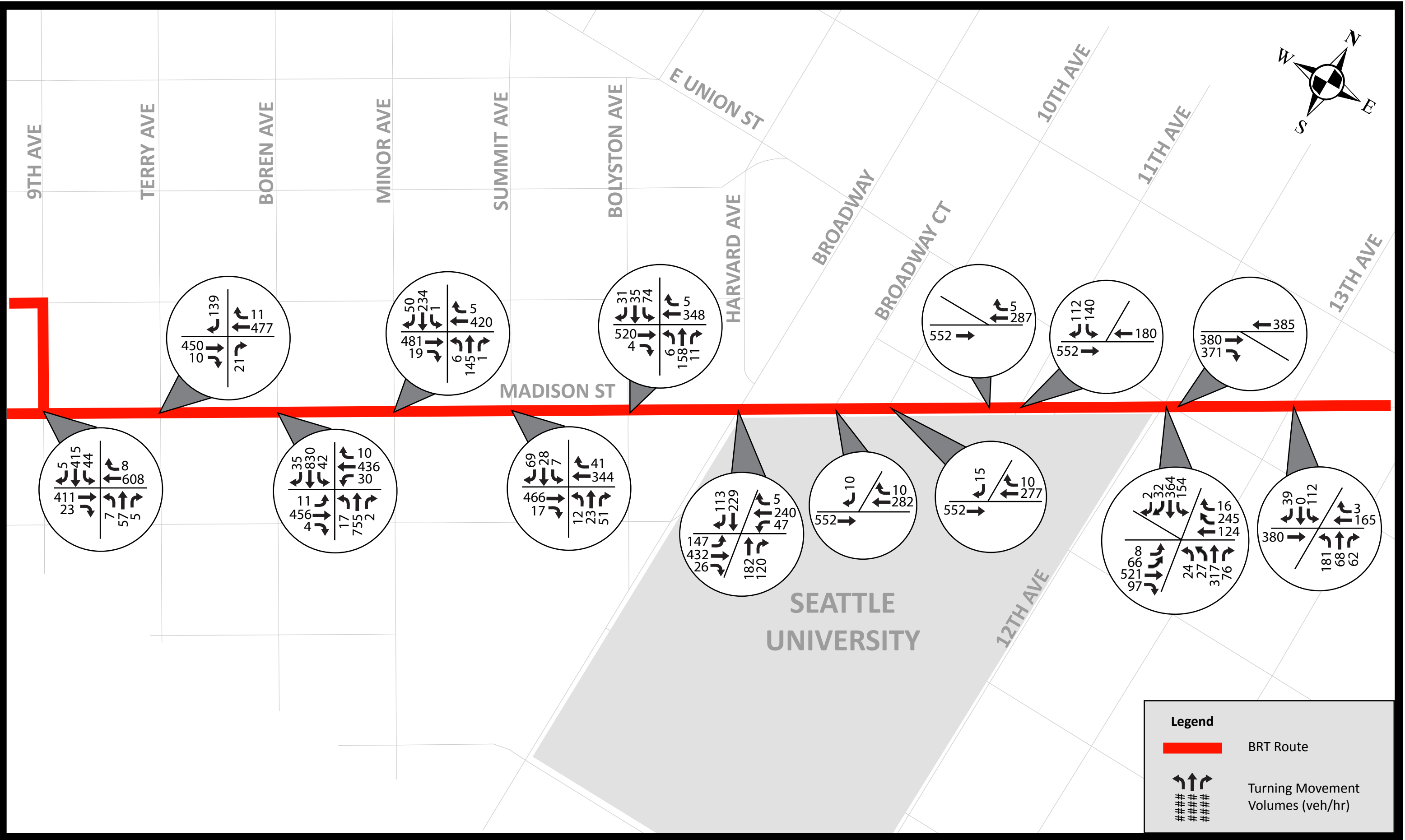
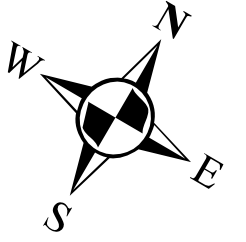
# YEAR OF OPENING



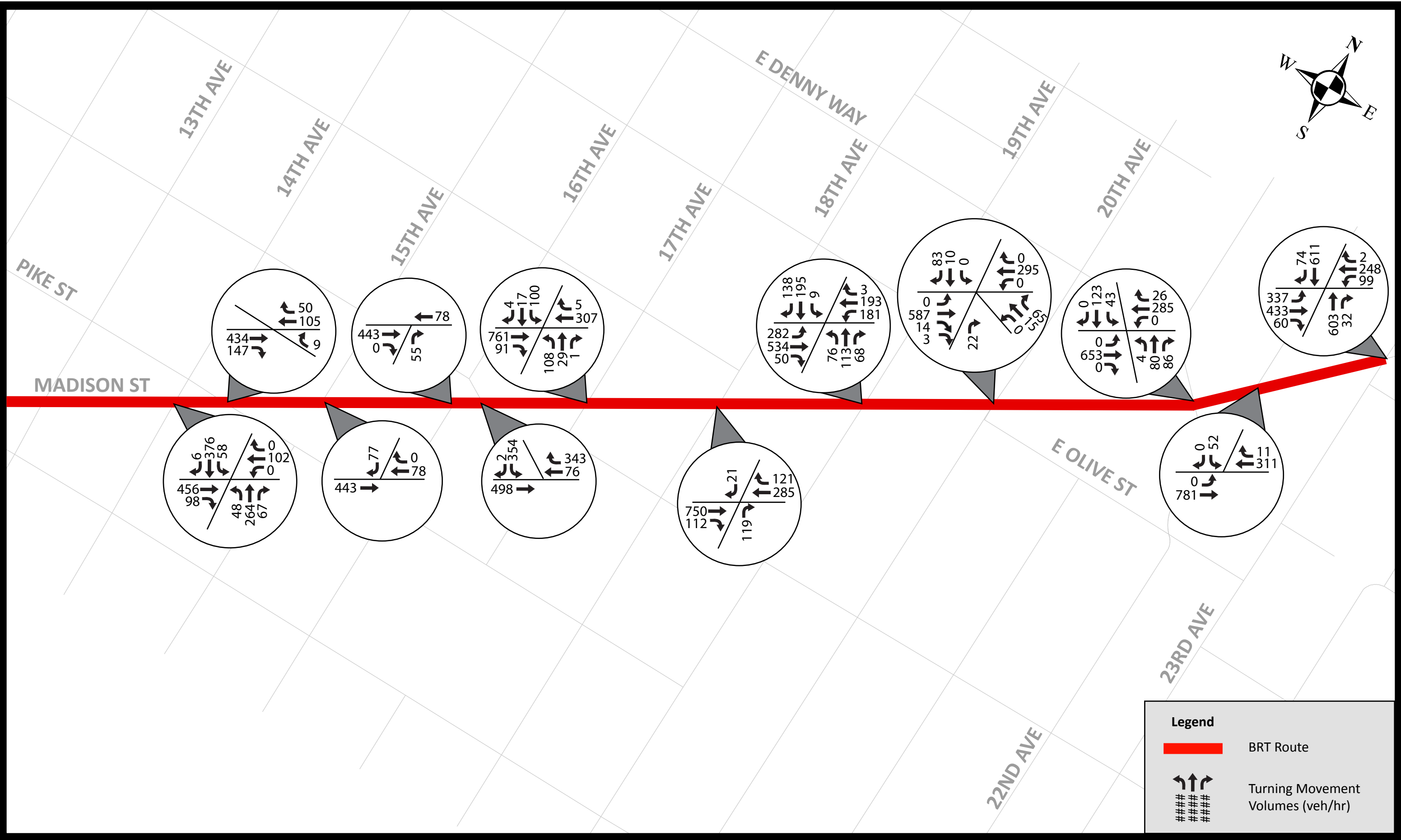
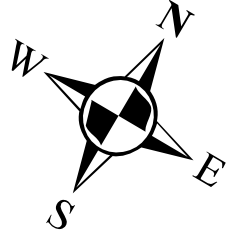
**Legend**

- BRT Route
- Turning Movement Volumes (veh/hr)


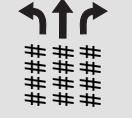
# YEAR OF OPENING



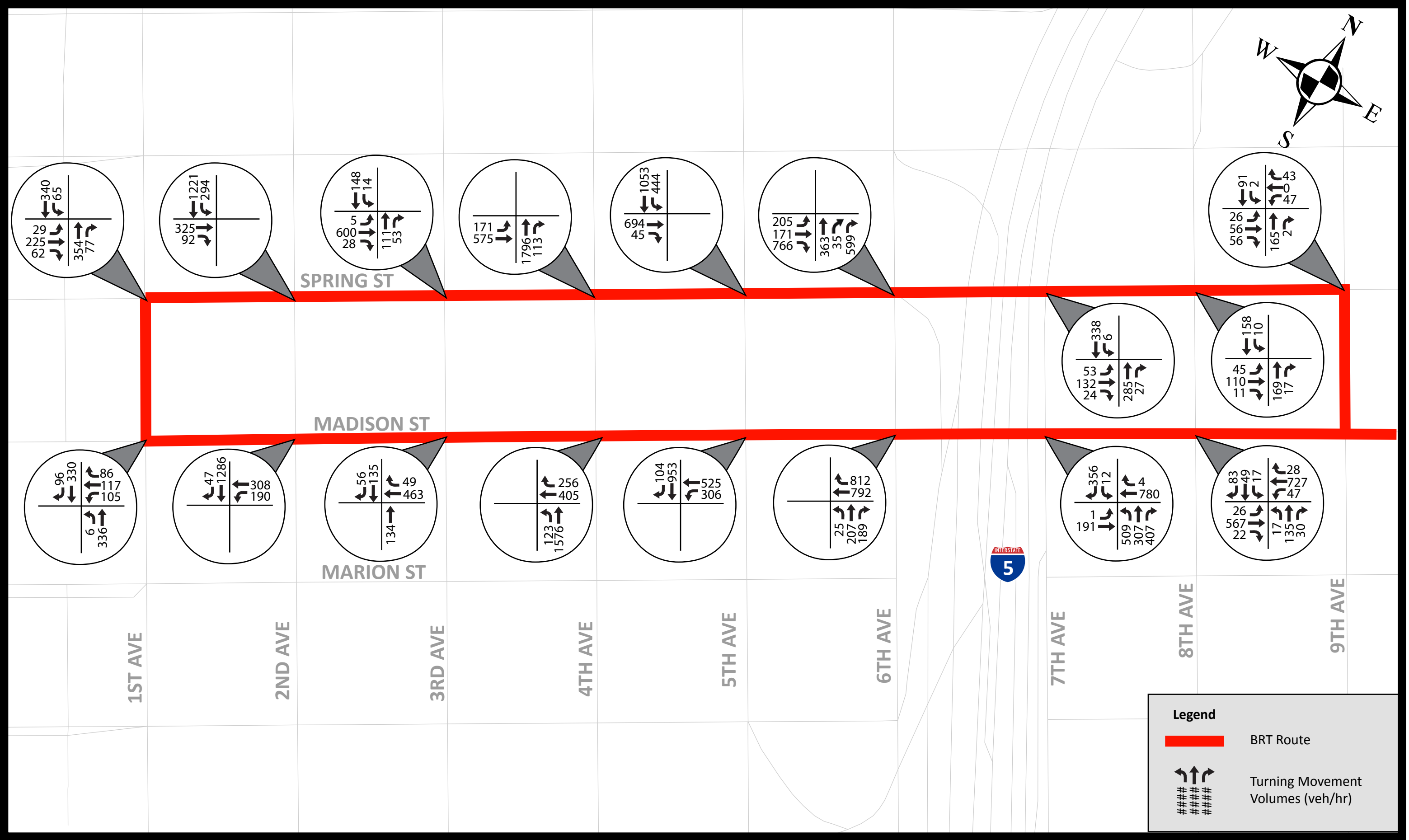
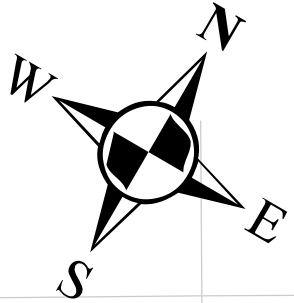
# YEAR OF OPENING



**Legend**

-  BRT Route
-  Turning Movement Volumes (veh/hr)

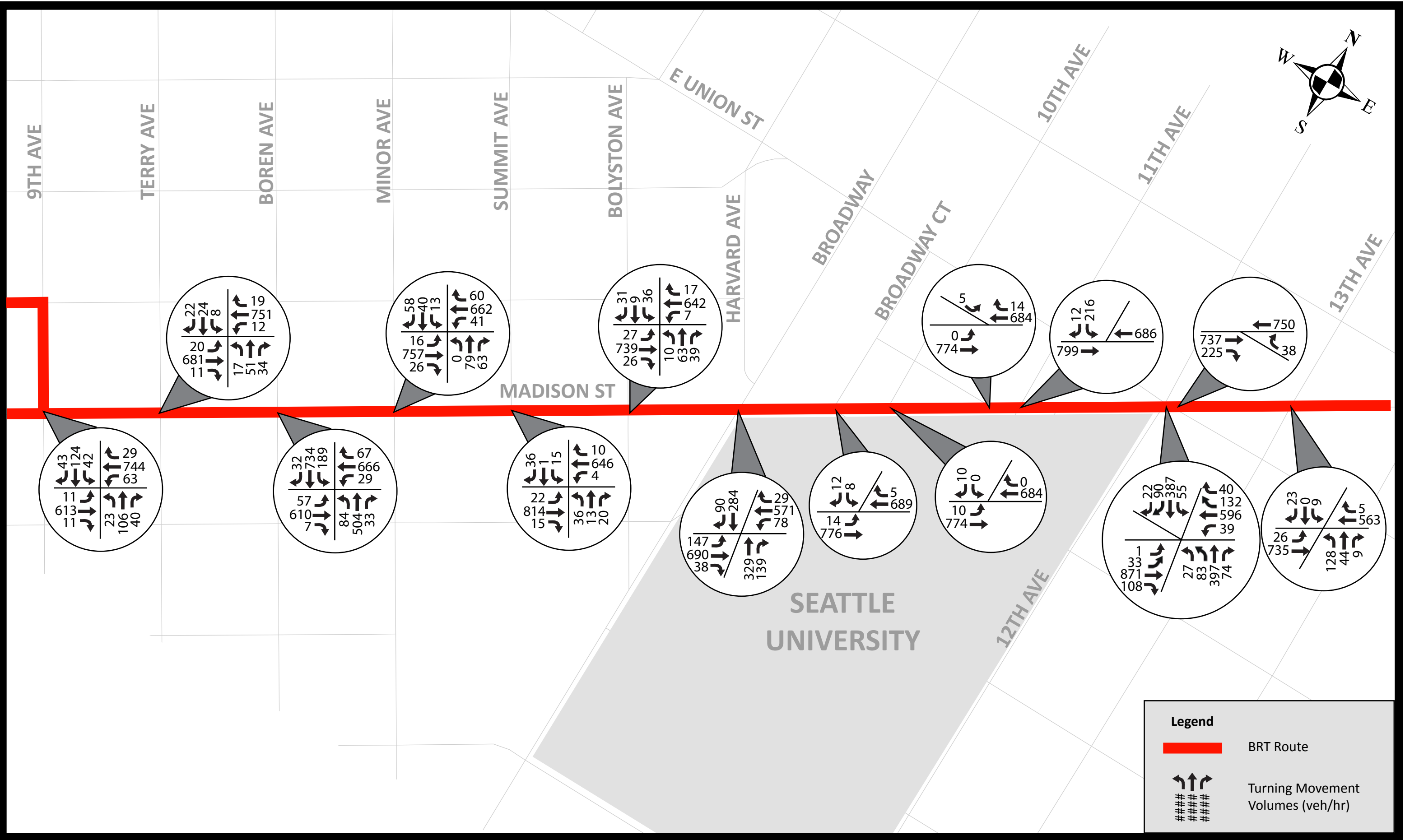
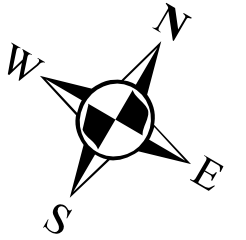
# 2030 NO BUILD



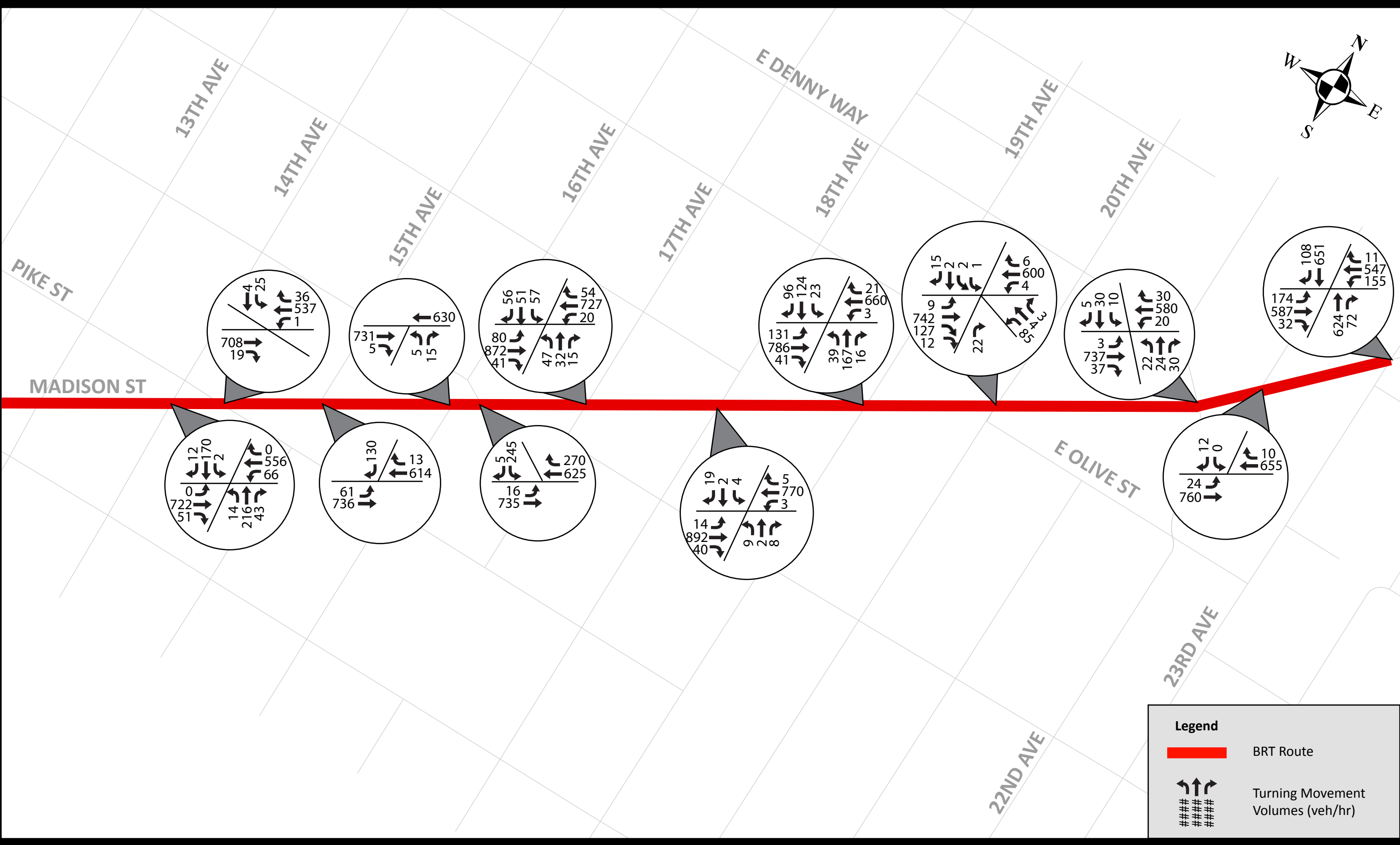
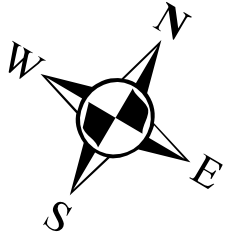
**Legend**

- BRT Route
- Turning Movement Volumes (veh/hr)

# 2030 NO BUILD



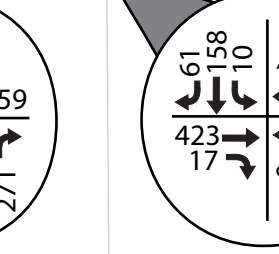
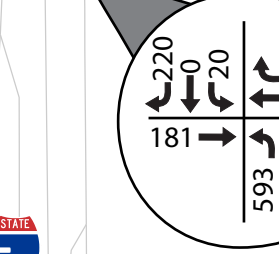
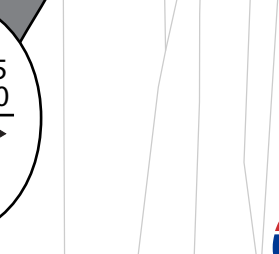
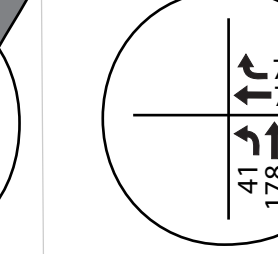
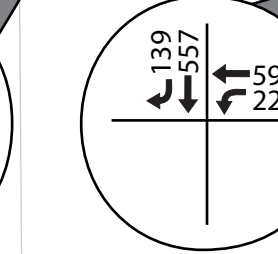
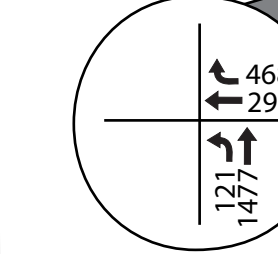
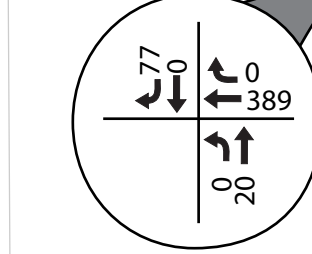
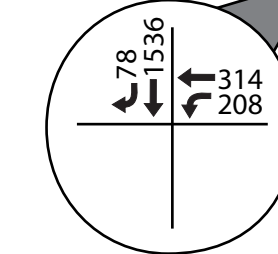
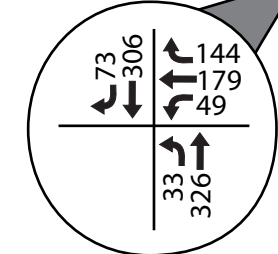
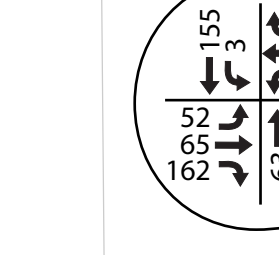
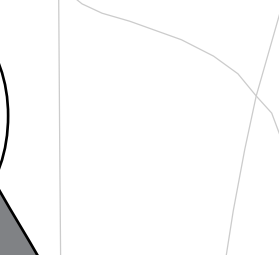
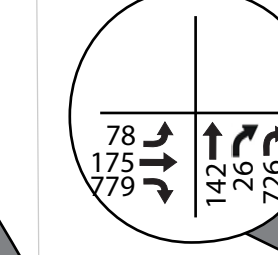
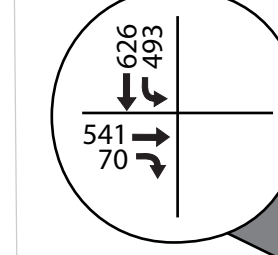
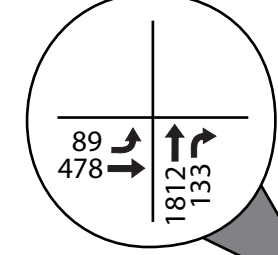
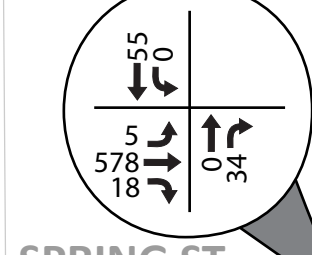
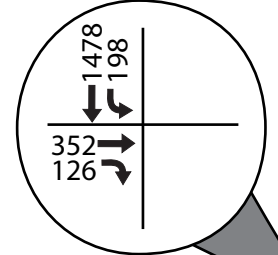
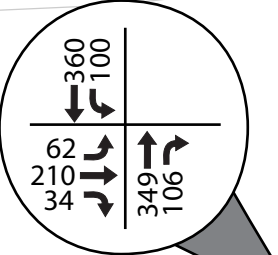
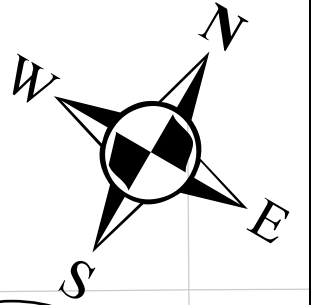
# 2030 NO BUILD



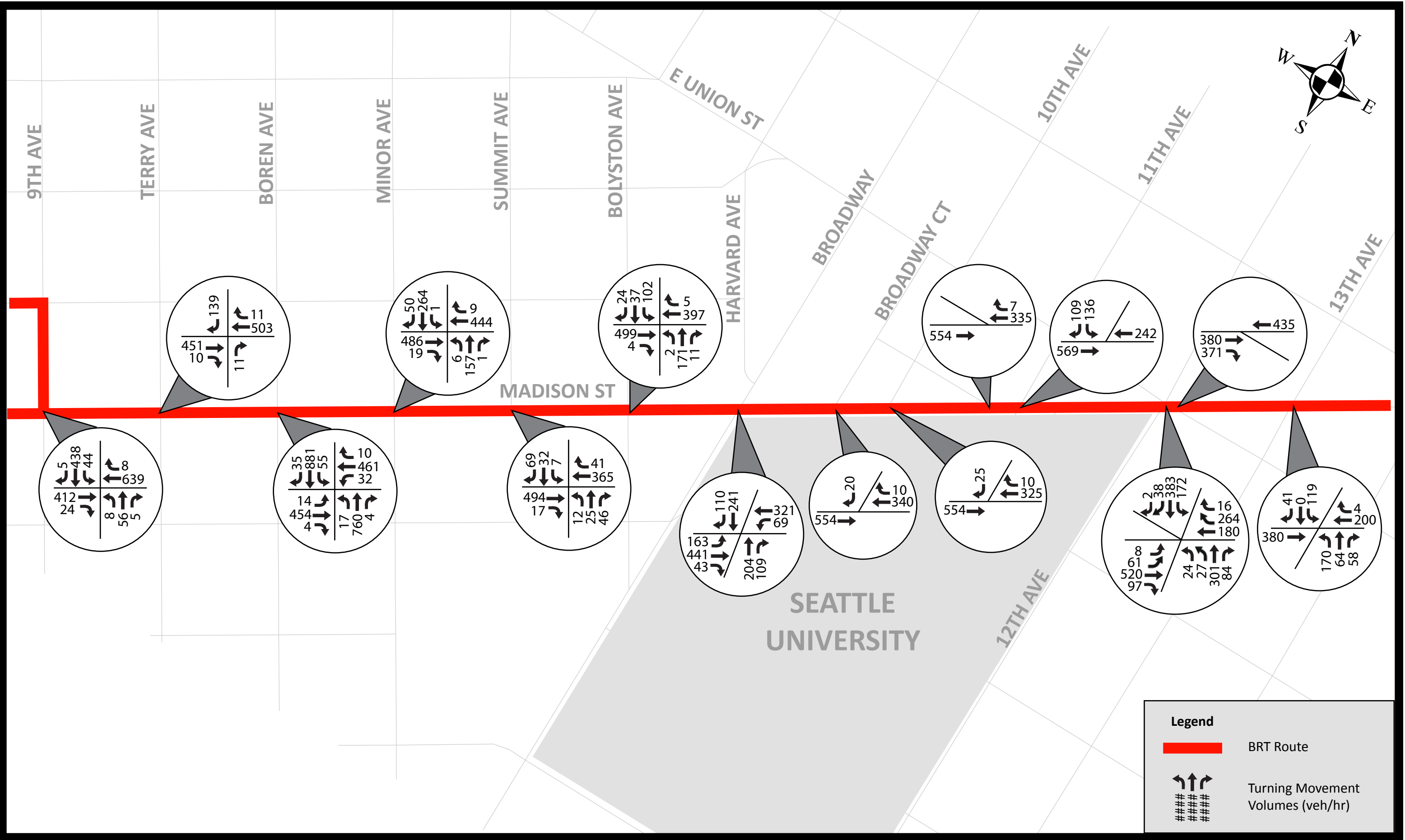
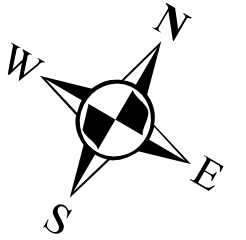
**Legend**

- BRT Route
- Turning Movement Volumes (veh/hr)

# 2030 BUILD

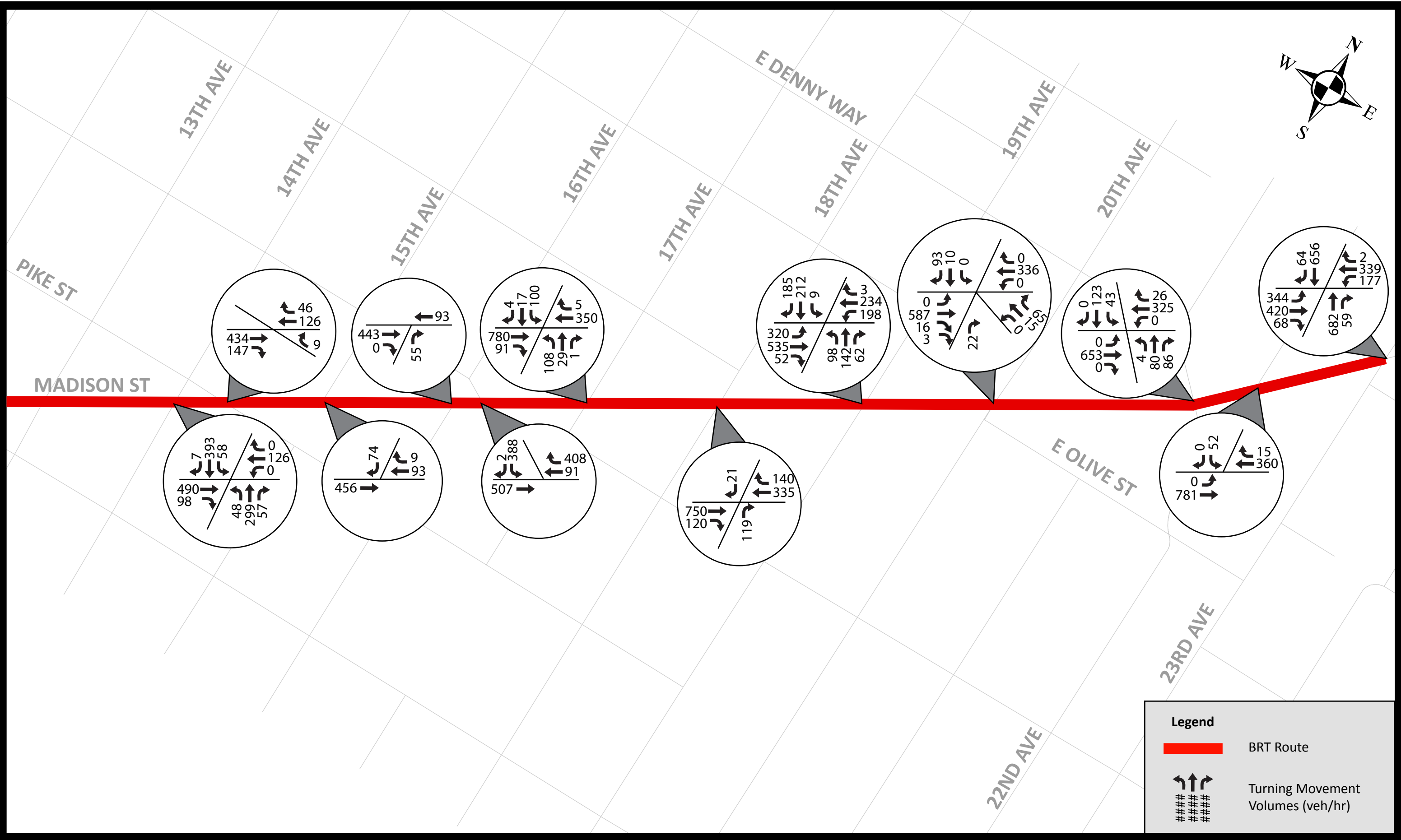
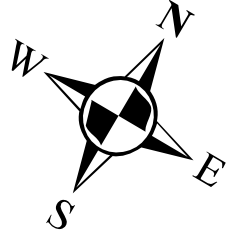


# 2030 BUILD



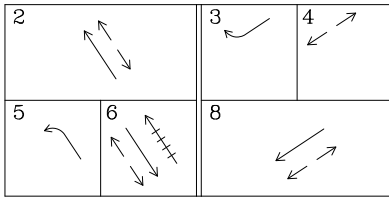


# 2030 BUILD



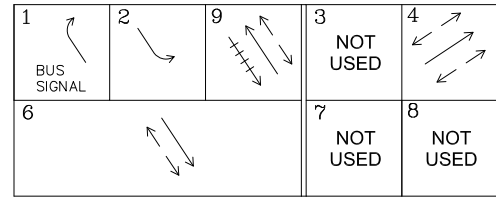
## **Appendix C: Proposed Signal Phasing Diagrams**

1ST AVE/MADISON ST



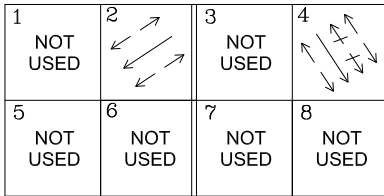
NOTE: SB STREETCAR WILL RUN WITH VEH Φ6.

1ST AVE/SPRING ST

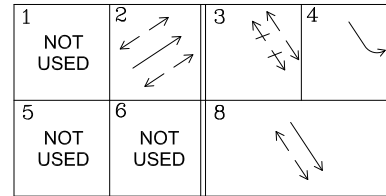


NOTE: NB STREETCAR WILL RUN WITH VEH Φ9.

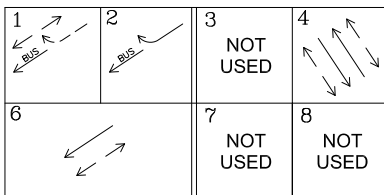
2ND AVE/MADISON ST



2ND AVE/SPRING ST

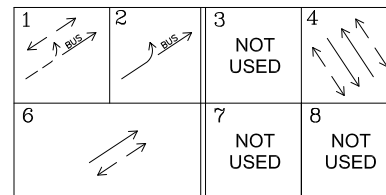


3RD AVE/MADISON ST



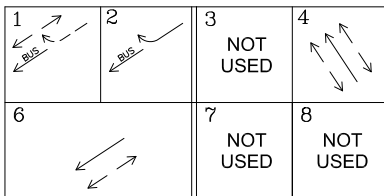
NOTE: RIGHT TURN ONLY EXCEPT TRANSIT FOR VEH Φ1 AND Φ2.

3RD AVE/SPRING ST



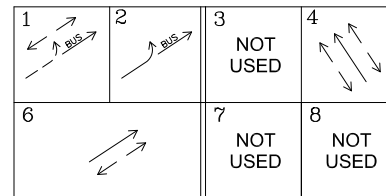
NOTE: LEFT TURN ONLY EXCEPT TRANSIT FOR VEH Φ1 AND Φ2.

4TH AVE/MADISON ST



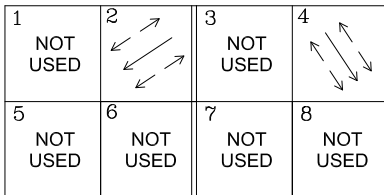
NOTE: RIGHT TURN ONLY EXCEPT TRANSIT FOR VEH Φ1 AND Φ2.

4TH AVE/SPRING ST

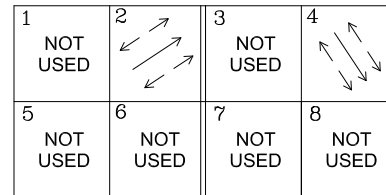


NOTE: LEFT TURN ONLY EXCEPT TRANSIT FOR VEH Φ1 AND Φ2.

5TH AVE/MADISON ST



5TH AVE/SPRING ST



LEGEND

- BUS
- PROTECTED VEHICLE
- PERMITTED VEHICLE
- PEDESTRIAN
- PROTECTED BIKE LANE
- STREETCAR



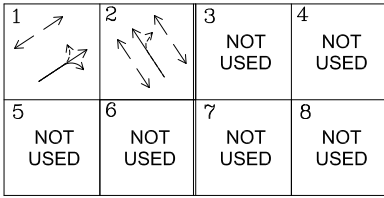
719 Second Ave., Suite 1250  
Seattle, Washington 98104  
(206) 382-9800  
www.dksassociates.com

MADISON BRT  
LOCALLY PREFERRED ALTERNATIVE  
SIGNAL PHASING DIAGRAMS

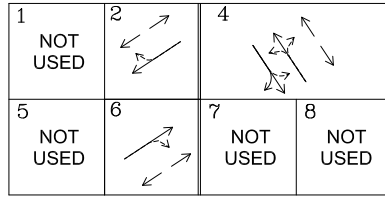
FINAL

01/28/2016

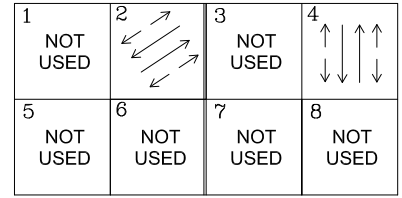
6TH AVE/SPRING ST



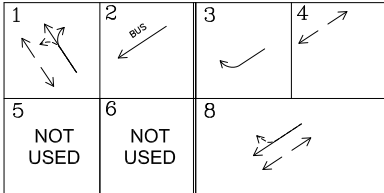
7TH AVE/MADISON ST



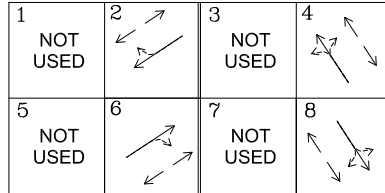
19TH AVE/MADISON ST



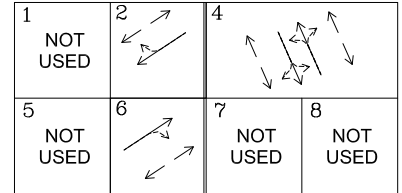
6TH AVE/MADISON ST



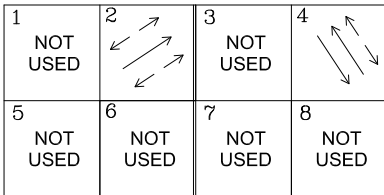
8TH AVE/MADISON ST



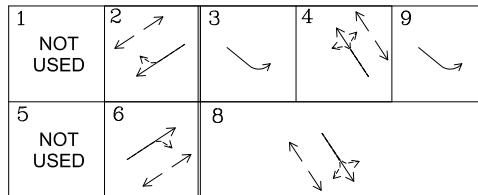
MINOR AVE/MADISON ST



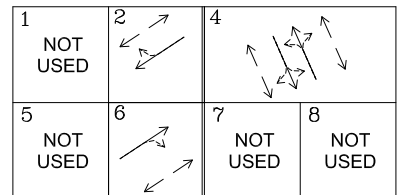
7TH AVE/SPRING ST



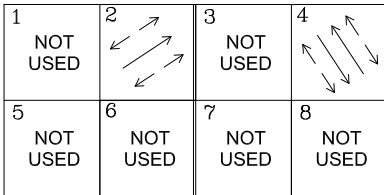
9TH AVE/MADISON ST



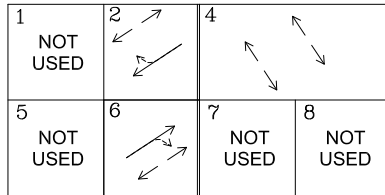
SUMMIT AVE/MADISON ST



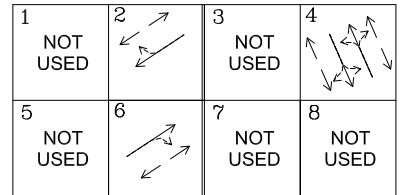
8TH AVE/SPRING ST



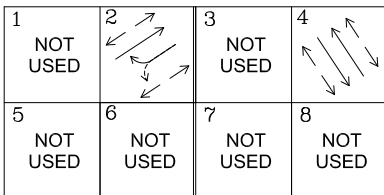
TERRY AVE/MADISON ST



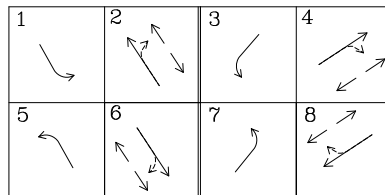
BOYLSTON AVE/MADISON ST



9TH AVE/SPRING ST



BOREN AVE/MADISON ST

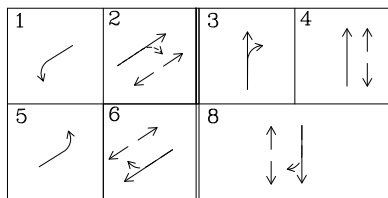


LEGEND

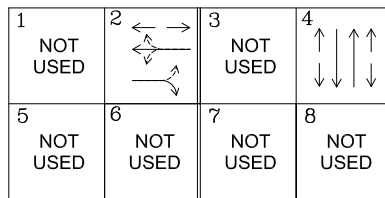
- BUS
- PROTECTED VEHICLE
- PERMITTED VEHICLE
- PEDESTRIAN
- PROTECTED BIKE LANE
- STREETCAR



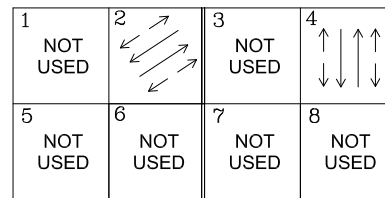
BROADWAY/MADISON ST



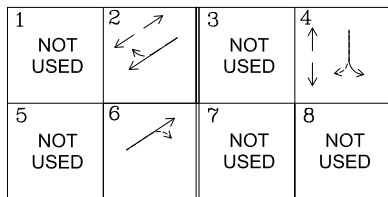
14TH AVE/E PIKE ST



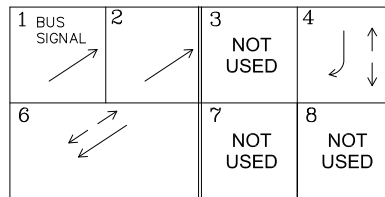
20TH AVE/MADISON ST



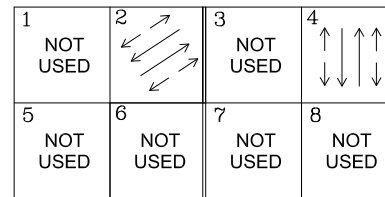
11TH AVE/MADISON ST



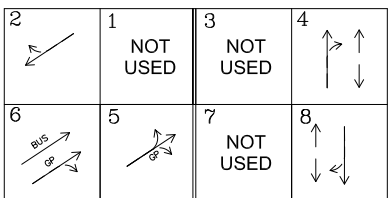
15TH AVE/MADISON ST



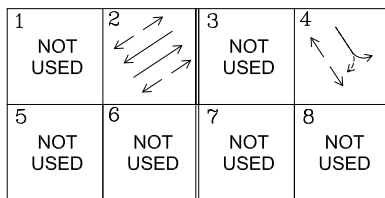
22ND AVE/MADISON ST/  
E DENNY WAY



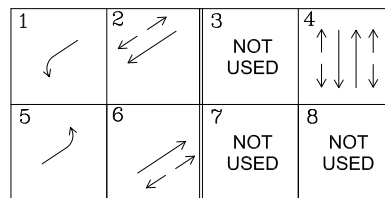
12TH AVE/MADISON ST



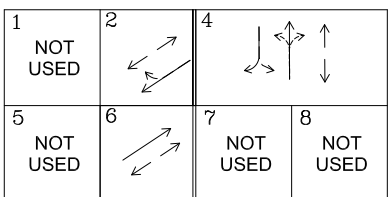
E PINE ST/MADISON ST



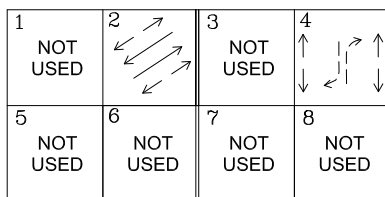
23RD AVE/MADISON ST



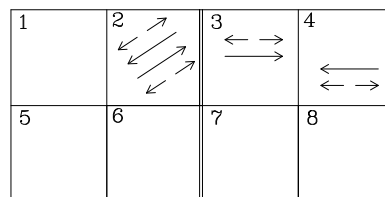
13TH AVE/MADISON ST



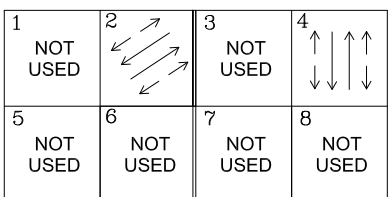
17TH AVE/MADISON ST



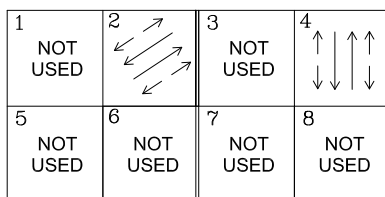
E JOHN ST/MADISON ST



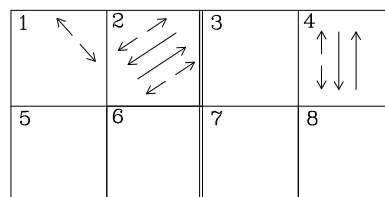
14TH AVE/MADISON ST



19TH AVE/MADISON ST



MLK JR. WAY/MADISON ST



LEGEND

- BUS
- PROTECTED VEHICLE
- PERMITTED VEHICLE
- PEDESTRIAN
- PROTECTED BIKE LANE
- STREETCAR



719 Second Ave., Suite 1250  
Seattle, Washington 98104  
(206) 382-9800  
www.dksassociates.com

MADISON BRT  
LOCALLY PREFERRED ALTERNATIVE  
SIGNAL PHASING DIAGRAMS

FINAL

01/28/2016

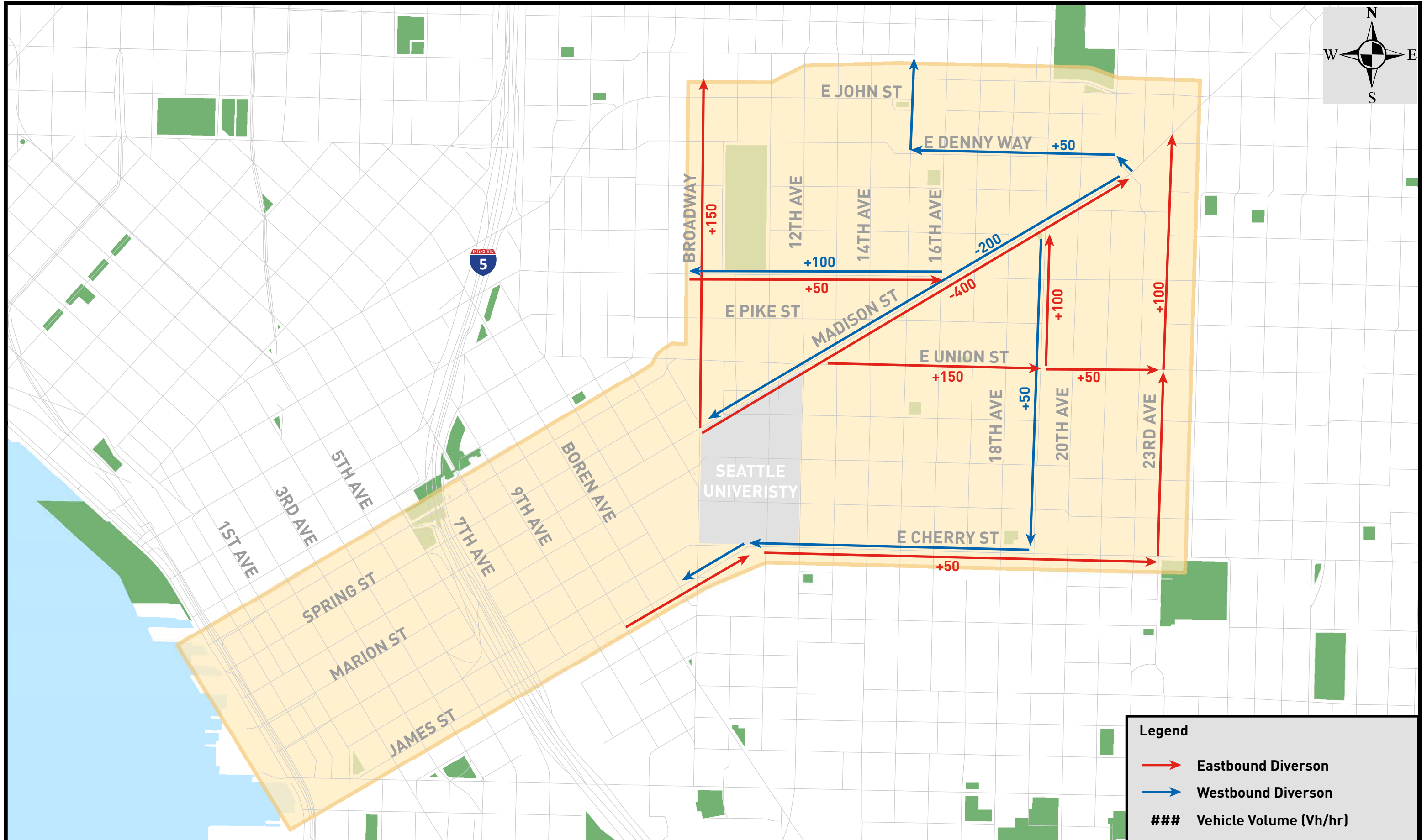


## **Appendix D: Diversion Graphics**





# Locally Preferred Alternative Vs. Baseline



## **Appendix E: Traffic Signal Warrant Analysis**

## Traffic Signal Warrant Analysis 8th Avenue and Spring Street

### Existing Volumes

Hour	Vehicles per hour on major street (total of both approaches)	Vehicles per hour on Minor Street (One Direction Only)	Warrant		
	8th Ave	Spring St	Condition A	Condition B	Combination A & B
12:00 AM	32	11	No	No	No
01:00 AM	9	12	No	No	No
02:00 AM	10	8	No	No	No
03:00 AM	10	3	No	No	No
04:00 AM	10	8	No	No	No
05:00 AM	53	38	No	No	No
06:00 AM	113	87	No	No	No
07:00 AM	201	94	No	No	No
08:00 AM	263	121	No	No	No
09:00 AM	218	141	No	No	No
10:00 AM	202	147	No	No	No
11:00 AM	188	114	No	No	No
12:00 PM	210	153	No	No	No
01:00 PM	169	152	No	No	No
02:00 PM	170	119	No	No	No
03:00 PM	276	144	No	No	No
04:00 PM	312	130	No	No	No
05:00 PM	349	166	No	No	No
06:00 PM	355	160	No	No	No
07:00 PM	263	109	No	No	No
08:00 PM	113	70	No	No	No
09:00 PM	83	48	No	No	No
10:00 PM	62	34	No	No	No
11:00 PM	51	18	No	No	No
<b>Number of Hours Warranted</b>			<b>0</b>	<b>0</b>	<b>0</b>

# Traffic Signal Warrant Analysis

## 9th Avenue and Spring Street

### Existing Volumes

Hour	Vehicles per hour on major street (total of both approaches)	Vehicles per hour on Minor Street (One Direction Only)	Warrant		
	9th Ave	Spring St	Condition A	Condition B	Combination A & B
12:00 AM	32	11	No	No	No
01:00 AM	21	12	No	No	No
02:00 AM	15	8	No	No	No
03:00 AM	11	3	No	No	No
04:00 AM	28	8	No	No	No
05:00 AM	39	38	No	No	No
06:00 AM	151	87	No	No	No
07:00 AM	245	94	No	No	No
08:00 AM	267	121	No	No	No
09:00 AM	311	141	No	No	No
10:00 AM	288	147	No	No	No
11:00 AM	280	114	No	No	No
12:00 PM	312	153	No	No	No
01:00 PM	245	152	No	No	No
02:00 PM	264	119	No	No	No
03:00 PM	312	144	No	No	No
04:00 PM	321	130	No	No	No
05:00 PM	299	166	No	No	No
06:00 PM	333	160	No	No	No
07:00 PM	191	109	No	No	No
08:00 PM	140	70	No	No	No
09:00 PM	86	48	No	No	No
10:00 PM	76	34	No	No	No
11:00 PM	61	18	No	No	No
<b>Number of Hours Warranted</b>			<b>0</b>	<b>0</b>	<b>0</b>

## Traffic Signal Warrant Analysis 8th Avenue and Spring Street

### Existing Volumes

Hour	Vehicles per hour on major street (total of both approaches)	Vehicles per hour on Minor Street (One Direction Only)	Warrant
	8th Avenue	Spring Street	
12:00 AM	32	11	No
01:00 AM	9	12	No
02:00 AM	10	8	No
03:00 AM	10	3	No
04:00 AM	10	8	No
05:00 AM	53	38	No
06:00 AM	113	87	No
07:00 AM	201	94	No
08:00 AM	263	121	No
09:00 AM	218	141	No
10:00 AM	202	147	No
11:00 AM	188	114	No
12:00 PM	210	153	No
01:00 PM	169	152	No
02:00 PM	170	119	No
03:00 PM	276	144	No
04:00 PM	312	130	No
05:00 PM	349	166	No
06:00 PM	355	160	No
07:00 PM	263	109	No
08:00 PM	113	70	No
09:00 PM	83	48	No
10:00 PM	62	34	No
11:00 PM	51	18	No
<b>Number of Hours Warranted</b>			<b>0</b>

## Traffic Signal Warrant Analysis 9th Avenue and Spring Street

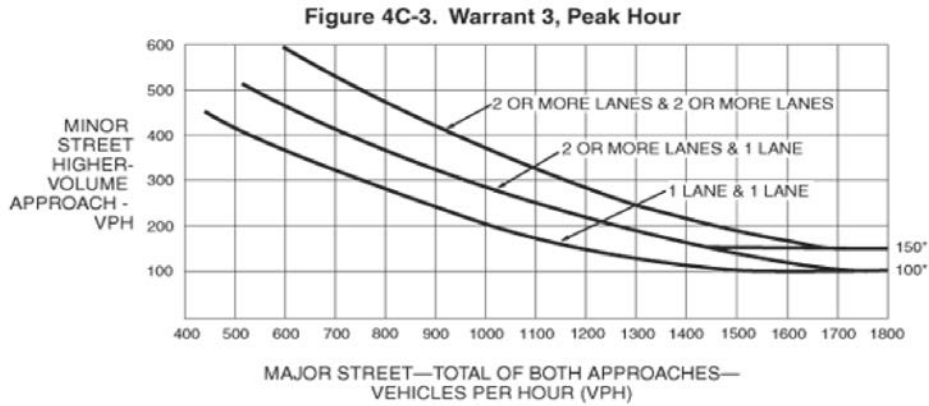
2016 Existing Volumes

Hour	Vehicles per hour on major street (total of both approaches)	Vehicles per hour on Minor Street (One Direction Only)	Warrant
	9th Avenue	Spring Street	
12:00 AM	32	11	No
01:00 AM	21	12	No
02:00 AM	15	8	No
03:00 AM	11	3	No
04:00 AM	28	8	No
05:00 AM	39	38	No
06:00 AM	151	87	No
07:00 AM	245	94	No
08:00 AM	267	121	No
09:00 AM	311	141	No
10:00 AM	288	147	No
11:00 AM	280	114	No
12:00 PM	312	153	No
01:00 PM	245	152	No
02:00 PM	264	119	No
03:00 PM	312	144	No
04:00 PM	321	130	No
05:00 PM	299	166	No
06:00 PM	333	160	No
07:00 PM	191	109	No
08:00 PM	140	70	No
09:00 PM	86	48	No
10:00 PM	76	34	No
11:00 PM	61	18	No
<b>Number of Hours Warranted</b>			<b>0</b>

## Traffic Signal Warrant Analysis 8th Avenue and Spring Street

Hour	Vehicles per hour on major street (total of both approaches)	Vehicles per hour on Minor Street (One Direction Only)	Warrant
	8th Avenue	Spring St	
AM Peak Hour Vol.	263	121	No
PM Peak Hour Vol.	355	160	No

### 2009 Edition Part 4 Figure 4C-3. Warrant 3, Peak Hour



\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Table for Figure 4C-3

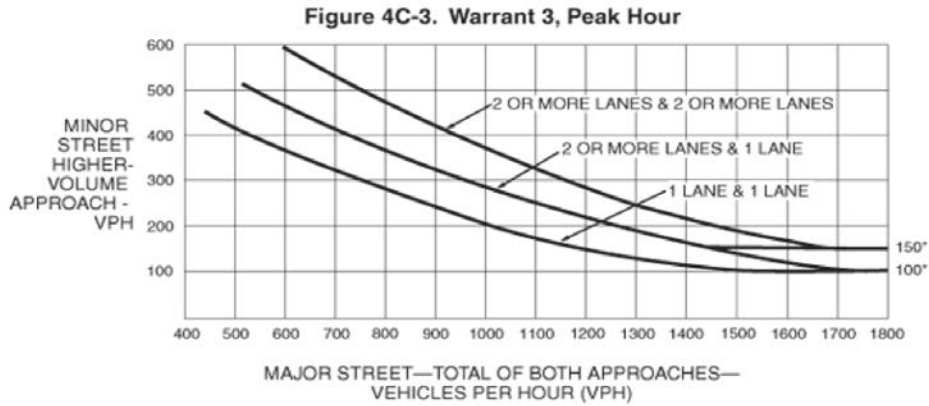
One lane and one lane		Two or more lanes and one lane		Two or more lanes and two or more lanes	
VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)
1800	100	1800	100 or 150*	1800	150
1700	100	1700	100 or 150*	1700	150
1600	100	1600	120 or 150*	1600	170
1500	100	1500	145 or 150*	1500	180
1400	120	1400	155	1400	220
1300	130	1300	190	1300	250
1200	150	1200	220	1200	285
1100	175	1100	250	1100	340
1000	200	1000	285	1000	370
900	245	900	325	900	425
800	285	800	360	800	475
700	325	700	420	700	540
600	360	600	460	600	590
500	420	500	Not available	500	Not available

\* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

## Traffic Signal Warrant Analysis 9th Avenue and Spring Street

Hour	Vehicles per hour on major street (total of both approaches)	Vehicles per hour on Minor Street (One Direction Only)	Warrant
	9th Avenue	Spring St	
AM Peak Hour Vol.	311	141	No
PM Peak Hour Vol.	333	160	No

### 2009 Edition Part 4 Figure 4C-3. Warrant 3, Peak Hour



\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Table for Figure 4C-3

One lane and one lane		Two or more lanes and one lane		Two or more lanes and two or more lanes	
VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)
1800	100	1800	100 or 150*	1800	150
1700	100	1700	100 or 150*	1700	150
1600	100	1600	120 or 150*	1600	170
1500	100	1500	145 or 150*	1500	180
1400	120	1400	155	1400	220
1300	130	1300	190	1300	250
1200	150	1200	220	1200	285
1100	175	1100	250	1100	340
1000	200	1000	285	1000	370
900	245	900	325	900	425
800	285	800	360	800	475
700	325	700	420	700	540
600	360	600	460	600	590
500	420	500	Not available	500	Not available

\* Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.



# Appendix F: Protected Signal Control Analysis

Location Madison Street/19th Avenue  
 Date of Counts Year of Opening - LPA  
 By DKS  
 Date 1/28/2016

Existing LT Phase? Y/N Y/N  
 Number of Lanes 0 2 0 0 2 0

Period/Movement	EBLT	EBT	EBRT	WBLT	WBT	WBRT	EBLT x WB	WBLT x EB
AM							0	0
Off							0	0
PM	282	534	50	181	193	3	106314	156746

Meet Vol Warrant? Y/N Y/N

Existing LT Phase? Y/N Y/N  
 Number of Lanes 0 1 0 0 1 0

Period/Movement	NBLT	NBT	NBRT	SBLT	SBT	SBRT	NBLT x SB	SBLT x NB
AM							0	0
Off							0	0
PM							0	0

Meet Vol Warrant? Y/N Y/N

Volume Warrant met if  $LT \times Opp\ T > 50000$  when there is only 1 Opp T lane  
 Volume Warrant met if  $LT \times Opp\ T > 100000$  when there are 2 or more Opp T lanes  
 Include Opp LT and Opp RT volumes in Opp T volume if they do not have own lanes

Product formulas assume no left turn or right turn lanes for all approaches  
 Please adjust formulas if the above does not apply

**Appendix G: Intersection Operations Results Existing  
Conditions 2015 PM Peak Hour**

Lanes, Volumes, Timings  
3: 9th Ave & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗		↔			↖			↖	
Traffic Volume (vph)	45	70	53	14	0	46	0	104	9	32	154	0
Future Volume (vph)	45	70	53	14	0	46	0	104	9	32	154	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		1	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1827	1583	0	1651	0	0	1842	0	0	1846	0
Flt Permitted		0.981			0.989						0.991	
Satd. Flow (perm)	0	1827	1583	0	1651	0	0	1842	0	0	1846	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		317			322			149			162	
Travel Time (s)		8.6			8.8			4.1			4.4	
Confl. Peds. (#/hr)				15								
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	125	58	0	65	0	0	123	0	0	202	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	33.6%
ICU Level of Service	A
Analysis Period (min)	15

Lanes, Volumes, Timings  
6: 8th Ave & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↑			↔	
Traffic Volume (vph)	59	122	13	0	0	0	0	152	13	27	126	0
Future Volume (vph)	59	122	13	0	0	0	0	152	13	27	126	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3451	0	0	0	0	0	1842	0	0	1846	0
Flt Permitted		0.985									0.991	
Satd. Flow (perm)	0	3451	0	0	0	0	0	1842	0	0	1846	0
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		329			317			149			143	
Travel Time (s)		7.5			7.2			3.4			3.9	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	211	0	0	0	0	0	179	0	0	166	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	32.4%
Analysis Period (min)	15
	ICU Level of Service A

Lanes, Volumes, Timings  
220: 1st Ave & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↑						↑↑↑			↔↑	
Traffic Volume (vph)	56	214	44	0	0	0	0	576	77	81	590	0
Future Volume (vph)	56	214	44	0	0	0	0	576	77	81	590	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	12	10	12	12	12	10	10	10	10	10	10
Grade (%)		9%			0%			3%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2857	0	0	0	0	0	3970	0	0	2984	0
Flt Permitted		0.991									0.784	
Satd. Flow (perm)	0	2788	0	0	0	0	0	3970	0	0	2309	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21						5				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		170			339			321			307	
Travel Time (s)		4.6			9.2			8.8			8.4	
Confl. Peds. (#/hr)	90		309	309		90	502		488	488		502
Confl. Bikes (#/hr)			1			5			12			28
Peak Hour Factor	0.88	0.88	0.88	0.25	0.25	0.25	0.95	0.95	0.95	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	357	0	0	0	0	0	687	0	0	721	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		2						1			1	
Permitted Phases	2	2								1		
Total Split (s)	22.0	22.0						58.0		58.0	58.0	
Total Lost Time (s)		4.5						4.5			4.5	
Act Effct Green (s)		17.5						53.5			53.5	
Actuated g/C Ratio		0.22						0.67			0.67	
v/c Ratio		0.57						0.26			0.47	
Control Delay		30.3						2.0			3.8	
Queue Delay		0.0						0.0			0.2	
Total Delay		30.3						2.0			4.0	
LOS		C						A			A	
Approach Delay		30.3						2.0			4.0	
Approach LOS		C						A			A	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 49 (61%), Referenced to phase 1:NBSB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.57

# Lanes, Volumes, Timings

## 220: 1st Ave & Spring St

1/29/2016

Intersection Signal Delay: 8.5

Intersection LOS: A

Intersection Capacity Utilization 61.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 220: 1st Ave & Spring St



Lanes, Volumes, Timings  
221: 1st Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	70	226	146	24	512	0	0	510	130
Future Volume (vph)	0	0	0	70	226	146	24	512	0	0	510	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		6%			-8%			0%				0%
Storage Length (ft)	0		0	50		0	0		0	0		0
Storage Lanes	0		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	1531	2602	0	0	4307	0	0	2717	0
Flt Permitted				0.950				0.896				
Satd. Flow (perm)	0	0	0	1173	2602	0	0	3849	0	0	2717	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					26							35
Link Speed (mph)		25			25			25				25
Link Distance (ft)		169			338			287				321
Travel Time (s)		4.6			9.2			7.8				8.8
Confl. Peds. (#/hr)	226		156	156		226	276		553	553		276
Confl. Bikes (#/hr)												
Peak Hour Factor	0.25	0.25	0.25	0.85	0.85	0.85	0.92	0.92	0.92	0.89	0.89	0.89
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	3%	0%	0%	0%	1%	0%	0%	1%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	82	438	0	0	583	0	0	719	0
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			1				1
Permitted Phases				2			1					
Total Split (s)				27.0	27.0		53.0	53.0				53.0
Total Lost Time (s)				4.5	4.5			4.5				4.5
Act Effect Green (s)				22.5	22.5			48.5				48.5
Actuated g/C Ratio				0.28	0.28			0.61				0.61
v/c Ratio				0.25	0.58			0.25				0.43
Control Delay				33.9	33.7			2.7				7.2
Queue Delay				0.0	0.0			0.0				0.9
Total Delay				33.9	33.7			2.7				8.2
LOS				C	C			A				A
Approach Delay					33.8			2.7				8.2
Approach LOS					C			A				A

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 2 (3%), Referenced to phase 1:NBSB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.58



# Lanes, Volumes, Timings

## 221: 1st Ave & Madison St

1/29/2016

Intersection Signal Delay: 13.7

Intersection LOS: B

Intersection Capacity Utilization 53.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 221: 1st Ave & Madison St



Lanes, Volumes, Timings  
 2036: Swedish/Summit Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	740	15	4	587	10	34	12	19	14	1	34
Future Volume (vph)	22	740	15	4	587	10	34	12	19	14	1	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1516	2938	0	1516	2950	0	0	1508	0	0	1380	0
Flt Permitted	0.395			0.327				0.836			0.921	
Satd. Flow (perm)	546	2938	0	456	2950	0	0	1219	0	0	1236	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			4			20			44	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		318			325			139			185	
Travel Time (s)		8.7			8.9			3.8			5.0	
Confl. Peds. (#/hr)	101		132	132		101	69		102	102		69
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.96	0.96	0.96	0.63	0.63	0.63	0.77	0.77	0.77
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	778	0	4	621	0	0	103	0	0	63	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases	2			6			4			4		
Total Split (s)	72.0	72.0		72.0	72.0		28.0	28.0		28.0	28.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	68.5	68.5		68.5	68.5			24.5			24.5	
Actuated g/C Ratio	0.68	0.68		0.68	0.68			0.24			0.24	
v/c Ratio	0.06	0.39		0.01	0.31			0.33			0.19	
Control Delay	2.2	2.3		1.0	1.5			28.3			14.9	
Queue Delay	0.0	0.1		0.0	0.2			0.0			0.0	
Total Delay	2.2	2.4		1.0	1.7			28.3			14.9	
LOS	A	A		A	A			C			B	
Approach Delay		2.4			1.7			28.3			14.9	
Approach LOS		A			A			C			B	

Intersection Summary




Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 97 (97%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.39

Lanes, Volumes, Timings  
2036: Swedish/Summit Ave & Madison St

1/29/2016

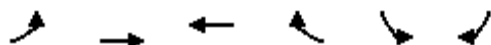
Intersection Signal Delay: 4.3                                  Intersection LOS: A  
Intersection Capacity Utilization 43.4%                                  ICU Level of Service A  
Analysis Period (min) 15

Splits and Phases:    2036: Swedish/Summit Ave & Madison St

 Ø2 (R)	 Ø4
72 s	28 s
 Ø6	
72 s	

Lanes, Volumes, Timings  
2064: E Madison St & 11th Ave

1/29/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↓↓↓	
Traffic Volume (vph)	0	774	572	0	206	12
Future Volume (vph)	0	774	572	0	206	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	13	12	10	12
Grade (%)		0%	-4%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	0			0	2	0
Taper Length (ft)	25				25	
Satd. Flow (prot)	0	3693	3694	0	3094	0
Flt Permitted					0.955	
Satd. Flow (perm)	0	3693	3694	0	3094	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)					6	
Link Speed (mph)		30	30		25	
Link Distance (ft)		110	373		234	
Travel Time (s)		2.5	8.5		6.4	
Confl. Peds. (#/hr)	23			38		61
Confl. Bikes (#/hr)				3		17
Peak Hour Factor	0.90	0.90	0.88	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						0
Mid-Block Traffic (%)		0%	0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	860	650	0	248	0
Turn Type		NA	NA		Prot	
Protected Phases		6	2		4	
Permitted Phases						
Total Split (s)		65.0	65.0		35.0	
Total Lost Time (s)		5.5	5.5		4.5	
Act Effect Green (s)		79.3	79.3		10.7	
Actuated g/C Ratio		0.79	0.79		0.11	
v/c Ratio		0.29	0.22		0.74	
Control Delay		1.3	0.9		55.2	
Queue Delay		0.0	0.1		0.0	
Total Delay		1.3	1.1		55.2	
LOS		A	A		E	
Approach Delay		1.3	1.1		55.2	
Approach LOS		A	A		E	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 98 (98%), Referenced to phase 2:WBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.74

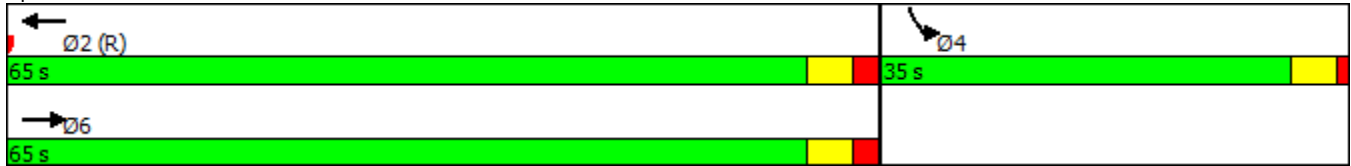
Lanes, Volumes, Timings  
 2064: E Madison St & 11th Ave

1/29/2016

Intersection Signal Delay: 8.8  
 Intersection Capacity Utilization 42.2%  
 Analysis Period (min) 15

Intersection LOS: A  
 ICU Level of Service A

Splits and Phases: 2064: E Madison St & 11th Ave



Lanes, Volumes, Timings  
2066: 13th Ave & E Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕			↕	
Traffic Volume (vph)	25	707	0	0	447	4	122	42	9	9	0	23
Future Volume (vph)	25	707	0	0	447	4	122	42	9	9	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	11	12	16	16	12	12	13	12
Grade (%)		8%			-7%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	1		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3196	0	0	3533	0	1869	1876	0	0	1706	0
Flt Permitted		0.927					0.734	0.881			0.937	
Satd. Flow (perm)	0	2963	0	0	3533	0	1441	1687	0	0	1583	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					2			6				26
Link Speed (mph)		30			30			30				30
Link Distance (ft)		213			358			154				283
Travel Time (s)		4.8			8.1			3.5				6.4
Confl. Peds. (#/hr)	28		29	29		28	1		52	52		1
Confl. Bikes (#/hr)												6
Peak Hour Factor	0.90	0.90	0.90	0.95	0.95	0.95	0.87	0.87	0.87	0.89	0.89	0.89
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)									0			0
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)							30%					
Lane Group Flow (vph)	0	814	0	0	475	0	98	100	0	0	36	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4				4
Permitted Phases	6						4			4		
Total Split (s)	68.0	68.0			68.0		32.0	32.0		32.0	32.0	
Total Lost Time (s)		4.5			4.5		4.5	4.5			4.5	
Act Effct Green (s)		63.5			63.5		27.5	27.5			27.5	
Actuated g/C Ratio		0.64			0.64		0.28	0.28			0.28	
v/c Ratio		0.43			0.21		0.25	0.21			0.08	
Control Delay		3.8			9.5		21.1	18.9			13.8	
Queue Delay		0.2			0.0		0.0	0.0			0.0	
Total Delay		4.0			9.5		21.1	18.9			13.8	
LOS		A			A		C	B			B	
Approach Delay		4.0			9.5			20.0			13.8	
Approach LOS		A			A			C			B	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 5 (5%), Referenced to phase 2:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.43

Lanes, Volumes, Timings  
 2066: 13th Ave & E Madison St

1/29/2016

Intersection Signal Delay: 8.0                      Intersection LOS: A  
 Intersection Capacity Utilization 57.4%              ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases:    2066: 13th Ave & E Madison St

← Ø2 (R)	↕ Ø4
68 s	32 s
↑ Ø6	
68 s	

Lanes, Volumes, Timings  
2067: 14th Ave & Pike St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	25	85	0	31	5	140	69	0	4	98	10
Future Volume (vph)	5	25	85	0	31	5	140	69	0	4	98	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	16	12	12	16	12	12	16	12
Grade (%)		6%			-6%			0%				0%
Storage Length (ft)	80		0	0		0	0		0	0		0
Storage Lanes	1		1	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1717	1342	0	0	2137	0	0	2044	0	0	1873	0
Flt Permitted	0.732							0.730			0.990	
Satd. Flow (perm)	1323	1342	0	0	2137	0	0	1541	0	0	1858	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		92			5							6
Link Speed (mph)		30			30			25				25
Link Distance (ft)		317			140			100				416
Travel Time (s)		7.2			3.2			2.7				11.3
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
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
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		0									0	
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	119	0	0	39	0	0	227	0	0	122	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		4			4			6			3	
Permitted Phases	4						6			3		
Total Split (s)	51.0	51.0			51.0		49.0	49.0		49.0	49.0	
Total Lost Time (s)	4.5	4.5			4.5			4.5			8.5	
Act Effect Green (s)	46.5	46.5			46.5			44.5			40.5	
Actuated g/C Ratio	0.46	0.46			0.46			0.44			0.40	
v/c Ratio	0.01	0.18			0.04			0.33			0.16	
Control Delay	14.6	5.7			8.8			1.9			18.7	
Queue Delay	0.0	2.0			0.0			0.0			0.0	
Total Delay	14.6	7.8			8.8			1.9			18.7	
LOS	B	A			A			A			B	
Approach Delay		8.0			8.8			1.9			18.7	
Approach LOS		A			A			A			B	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 42 (42%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.51



Lane Group	Ø1
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	1
Permitted Phases	
Total Split (s)	51.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

# Lanes, Volumes, Timings

## 2067: 14th Ave & Pike St

1/29/2016

Intersection Signal Delay: 7.9

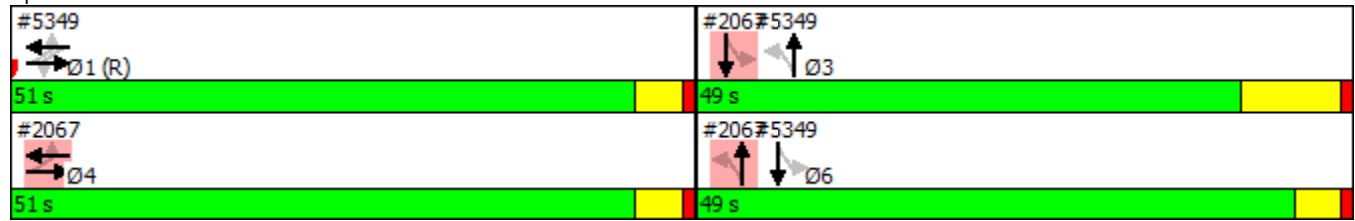
Intersection LOS: A

Intersection Capacity Utilization 32.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2067: 14th Ave & Pike St



Lanes, Volumes, Timings  
2070: 17th Ave & E Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕			↕			↕	
Traffic Volume (vph)	76	800	41	16	577	50	47	32	11	57	51	56
Future Volume (vph)	76	800	41	16	577	50	47	32	11	57	51	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	10	12	10	12	12	16	12
Grade (%)		4%			4%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3328	0	0	3242	0	0	1649	0	0	1879	0
Flt Permitted		0.822			0.920			0.632			0.830	
Satd. Flow (perm)	0	2727	0	0	2984	0	0	1012	0	0	1523	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11			20			7			24	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		270			381			117			303	
Travel Time (s)		6.1			8.7			2.7			8.3	
Confl. Peds. (#/hr)	95		44	44		95	120		113	113		120
Confl. Bikes (#/hr)			17			23			3			11
Peak Hour Factor	0.92	0.92	0.92	0.96	0.96	0.96	0.80	0.80	0.80	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	998	0	0	670	0	0	113	0	0	176	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Total Split (s)	73.0	73.0		73.0	73.0		27.0	27.0		27.0	27.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effect Green (s)		76.1			76.1			14.9			14.9	
Actuated g/C Ratio		0.76			0.76			0.15			0.15	
v/c Ratio		0.48			0.29			0.72			0.71	
Control Delay		4.8			5.2			62.3			50.1	
Queue Delay		0.4			0.0			0.0			0.0	
Total Delay		5.1			5.2			62.3			50.1	
LOS		A			A			E			D	
Approach Delay		5.1			5.2			62.3			50.1	
Approach LOS		A			A			E			D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 49 (49%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.72

Lanes, Volumes, Timings  
 2070: 17th Ave & E Madison St

1/29/2016

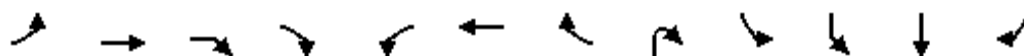
Intersection Signal Delay: 12.5	Intersection LOS: B
Intersection Capacity Utilization 68.0%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 2070: 17th Ave & E Madison St



Lanes, Volumes, Timings  
 2071: 20th Ave & E Olive St & E Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBR2	SBL2	SBL	SBT	SBR
Lane Configurations		↕↕				↕		↗			↕	
Traffic Volume (vph)	9	707	121	10	4	500	6	22	1	2	2	14
Future Volume (vph)	9	707	121	10	4	500	6	22	1	2	2	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	10	12	12	12	12	13	12
Grade (%)		-8%				3%						0%
Storage Length (ft)	0		0		0		0			0		0
Storage Lanes	0		0		0		0			0		0
Taper Length (ft)	25				25					25		
Satd. Flow (prot)	0	3597	0	0	0	1726	0	1465	0	0	1706	0
Flt Permitted		0.950				0.995					0.992	
Satd. Flow (perm)	0	3420	0	0	0	1717	0	1465	0	0	1692	0
Right Turn on Red				Yes			Yes	Yes				Yes
Satd. Flow (RTOR)		2				1		913				24
Link Speed (mph)		30				30						25
Link Distance (ft)		361				397						452
Travel Time (s)		8.2				9.0						12.3
Confl. Peds. (#/hr)	29		10	2	2		29		12	10		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.79	0.59	0.59	0.59	0.59
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)			0					0				0
Mid-Block Traffic (%)		0%				0%						0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	873	0	0	0	542	0	28	0	0	32	0
Turn Type	Perm	NA			Perm	NA		Free	Perm	Perm	NA	
Protected Phases		2				2						4
Permitted Phases	2				2			Free	4	4		
Total Split (s)	57.0	57.0			57.0	57.0			27.0	27.0	27.0	
Total Lost Time (s)		4.5				4.5						4.5
Act Effct Green (s)		75.9				75.9		100.0				7.1
Actuated g/C Ratio		0.76				0.76		1.00				0.07
v/c Ratio		0.34				0.42		0.02				0.23
Control Delay		3.0				12.3		0.0				25.6
Queue Delay		0.2				0.1		0.0				0.0
Total Delay		3.2				12.4		0.0				25.6
LOS		A				B		A				C
Approach Delay		3.2				12.4						25.6
Approach LOS		A				B						C

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 56 (56%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.51

Lanes, Volumes, Timings  
 2071: 20th Ave & E Olive St & E Madison St

1/29/2016



Lane Group	NWL	NWR	NWR2
Lane Configurations			
Traffic Volume (vph)	85	4	3
Future Volume (vph)	85	4	3
Ideal Flow (vphpl)	1900	1900	1900
Lane Width (ft)	16	12	12
Grade (%)	0%		
Storage Length (ft)	0	0	
Storage Lanes	1	0	
Taper Length (ft)	25		
Satd. Flow (prot)	1997	0	0
Flt Permitted	0.956		
Satd. Flow (perm)	1997	0	0
Right Turn on Red			Yes
Satd. Flow (RTOR)	65		
Link Speed (mph)	25		
Link Distance (ft)	330		
Travel Time (s)	9.0		
Confl. Peds. (#/hr)		29	12
Confl. Bikes (#/hr)			
Peak Hour Factor	0.82	0.82	0.82
Growth Factor	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%
Bus Blockages (#/hr)	0	0	0
Parking (#/hr)		0	0
Mid-Block Traffic (%)	0%		
Shared Lane Traffic (%)			
Lane Group Flow (vph)	113	0	0
Turn Type	Prot		
Protected Phases	1		
Permitted Phases			
Total Split (s)	16.0		
Total Lost Time (s)	4.5		
Act Effect Green (s)	8.1		
Actuated g/C Ratio	0.08		
v/c Ratio	0.51		
Control Delay	29.0		
Queue Delay	0.0		
Total Delay	29.0		
LOS	C		
Approach Delay	29.0		
Approach LOS	C		

Intersection Summary

# Lanes, Volumes, Timings

## 2071: 20th Ave & E Olive St & E Madison St

1/29/2016

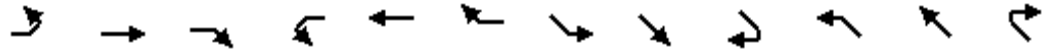
Intersection Signal Delay: 8.6	Intersection LOS: A
Intersection Capacity Utilization 55.4%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 2071: 20th Ave & E Olive St & E Madison St



Lanes, Volumes, Timings  
 2073: 22nd Ave/E Denny Way & E Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕↕			↕↕			↕				↕
Traffic Volume (vph)	3	702	37	18	483	19	10	25	1	22	20	26
Future Volume (vph)	3	702	37	18	483	19	10	25	1	22	20	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	12	12	10	12	12	12	12	12	11	12
Grade (%)		-3%			1%			0%				0%
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3702	0	0	3293	0	0	1862	0	0	1634	0
Flt Permitted		0.954			0.915			0.834			0.906	
Satd. Flow (perm)	0	3532	0	0	3017	0	0	1554	0	0	1502	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			7			2				31
Link Speed (mph)		30			30			30				25
Link Distance (ft)		175			200			207				403
Travel Time (s)		4.0			4.5			4.7				11.0
Confl. Peds. (#/hr)	2		25	25		2	39		4	4		39
Confl. Bikes (#/hr)			1						10			2
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.64	0.64	0.64	0.77	0.77	0.77
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)			0			0			0			
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	834	0	0	584	0	0	57	0	0	89	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2			4			4		
Total Split (s)	67.0	67.0		67.0	67.0		33.0	33.0		33.0	33.0	
Total Lost Time (s)		4.5			4.5			4.5				4.5
Act Effect Green (s)		85.6			85.6			8.6				8.6
Actuated g/C Ratio		0.86			0.86			0.09				0.09
v/c Ratio		0.28			0.23			0.42				0.57
Control Delay		0.4			1.3			50.9				43.5
Queue Delay		0.0			0.0			0.0				0.0
Total Delay		0.4			1.3			50.9				43.5
LOS		A			A			D				D
Approach Delay		0.4			1.3			50.9				43.5
Approach LOS		A			A			D				D

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 60 (60%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.57



# Lanes, Volumes, Timings

## 2073: 22nd Ave/E Denny Way & E Madison St

1/29/2016

Intersection Signal Delay: 5.0

Intersection LOS: A

Intersection Capacity Utilization 48.6%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2073: 22nd Ave/E Denny Way & E Madison St



Lanes, Volumes, Timings  
2846: 8th Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	47	506	18	47	693	16	23	105	46	19	43	70
Future Volume (vph)	47	506	18	47	693	16	23	105	46	19	43	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	65		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	60			25			25			25		
Satd. Flow (prot)	1516	2897	0	1516	2925	0	0	1544	0	0	1507	0
Flt Permitted	0.338			0.398				0.951			0.945	
Satd. Flow (perm)	462	2897	0	512	2925	0	0	1463	0	0	1412	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			4			19			59	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		329			326			156			163	
Travel Time (s)		9.0			8.9			4.3			4.4	
Confl. Peds. (#/hr)	165		269	169		165	69		96	96		36
Confl. Bikes (#/hr)												
Peak Hour Factor	0.89	0.89	0.89	0.99	0.99	0.99	0.93	0.93	0.93	0.80	0.80	0.80
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	2%	6%	4%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	53	589	0	47	716	0	0	187	0	0	166	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases	2			6			4			4		
Total Split (s)	65.0	65.0		65.0	65.0		35.0	35.0		35.0	35.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	61.5	61.5		61.5	61.5			31.5			31.5	
Actuated g/C Ratio	0.62	0.62		0.62	0.62			0.32			0.32	
v/c Ratio	0.19	0.33		0.15	0.40			0.40			0.34	
Control Delay	10.4	9.8		9.5	8.2			27.0			9.8	
Queue Delay	0.0	1.0		0.0	0.2			0.0			0.0	
Total Delay	10.4	10.8		9.5	8.4			27.0			9.8	
LOS	B	B		A	A			C			A	
Approach Delay		10.7			8.5			27.0			9.8	
Approach LOS		B			A			C			A	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 10 (10%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.40

Lanes, Volumes, Timings  
 2846: 8th Ave & Madison St

1/29/2016

Intersection Signal Delay: 11.4                                  Intersection LOS: B  
 Intersection Capacity Utilization 57.5%                          ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases:    2846: 8th Ave & Madison St



Lanes, Volumes, Timings  
2865: 9th Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	533	11	63	669	29	23	98	40	41	83	50
Future Volume (vph)	15	533	11	63	669	29	23	98	40	41	83	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1516	2929	0	1430	2898	0	0	1475	0	0	1515	0
Flt Permitted	0.326			0.375				0.935			0.824	
Satd. Flow (perm)	455	2929	0	456	2898	0	0	1355	0	0	1264	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			7			15			22	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		326			325			144			151	
Travel Time (s)		8.9			8.9			3.9			4.1	
Confl. Peds. (#/hr)	132		249	249		132	128		63	63		128
Confl. Bikes (#/hr)												
Peak Hour Factor	0.88	0.88	0.88	0.97	0.97	0.97	0.81	0.81	0.81	0.87	0.87	0.87
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	6%	2%	0%	0%	9%	10%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	17	619	0	65	720	0	0	198	0	0	199	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Total Split (s)	61.0	61.0		61.0	61.0		23.0	23.0		39.0	39.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	57.5	57.5		57.5	57.5			19.5			35.5	
Actuated g/C Ratio	0.58	0.58		0.58	0.58			0.20			0.36	
v/c Ratio	0.07	0.37		0.25	0.43			0.72			0.43	
Control Delay	6.0	8.6		11.6	12.9			50.8			21.6	
Queue Delay	0.0	0.3		0.0	0.4			0.0			0.0	
Total Delay	6.0	8.9		11.6	13.3			50.8			21.6	
LOS	A	A		B	B			D			C	
Approach Delay		8.8			13.1			50.8			21.6	
Approach LOS		A			B			D			C	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 27 (27%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.72

Lane Group	Ø3	Ø5
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Growth Factor		
Heavy Vehicles (%)		
Bus Blockages (#/hr)		
Parking (#/hr)		
Mid-Block Traffic (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	3	5
Permitted Phases		
Total Split (s)	8.0	8.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
 2865: 9th Ave & Madison St

1/29/2016

Intersection Signal Delay: 16.7 Intersection LOS: B  
 Intersection Capacity Utilization 62.9% ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 2865: 9th Ave & Madison St



Lanes, Volumes, Timings  
2893: Terry Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	590	11	21	680	19	16	20	27	13	14	18
Future Volume (vph)	20	590	11	21	680	19	16	20	27	13	14	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1444	2938	0	1516	2941	0	0	1479	0	0	1526	0
Flt Permitted	0.325			0.388				0.940			0.932	
Satd. Flow (perm)	456	2938	0	529	2941	0	0	1377	0	0	1392	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			6			33			24	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		325			319			146			164	
Travel Time (s)		8.9			8.7			4.0			4.5	
Confl. Peds. (#/hr)	152		226	226		152	59		91	91		59
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.90	0.90	0.90	0.83	0.83	0.83	0.75	0.75	0.75
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	5%	2%	9%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	21	633	0	23	777	0	0	76	0	0	60	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Total Split (s)	71.0	71.0		71.0	71.0		29.0	29.0		29.0	29.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.0			3.0	
Act Effect Green (s)	67.5	67.5		67.5	67.5			26.0			26.0	
Actuated g/C Ratio	0.68	0.68		0.68	0.68			0.26			0.26	
v/c Ratio	0.07	0.32		0.06	0.39			0.20			0.16	
Control Delay	5.0	7.9		10.2	10.2			19.5			20.5	
Queue Delay	0.0	0.4		0.0	1.0			0.0			0.0	
Total Delay	5.0	8.3		10.2	11.2			19.5			20.5	
LOS	A	A		B	B			B			C	
Approach Delay		8.2			11.2			19.5			20.5	
Approach LOS		A			B			B			C	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 47 (47%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.39

Lanes, Volumes, Timings  
 2893: Terry Ave & Madison St

1/29/2016

Intersection Signal Delay: 10.7  
 Intersection Capacity Utilization 46.7%  
 Analysis Period (min) 15

Intersection LOS: B  
 ICU Level of Service A

Splits and Phases: 2893: Terry Ave & Madison St





Lanes, Volumes, Timings  
2896: Madison St & Minor Ave

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	26	701	26	18	621	14	48	76	59	17	32	39
Future Volume (vph)	26	701	26	18	621	14	48	76	59	17	32	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1516	2901	0	1516	2931	0	0	1532	0	0	1442	0
Flt Permitted	0.355			0.290				0.898			0.927	
Satd. Flow (perm)	478	2901	0	408	2931	0	0	1338	0	0	1328	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			4			26			43	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		324			318			151			149	
Travel Time (s)		8.8			8.7			4.1			4.1	
Confl. Peds. (#/hr)	157		212	212		157	110		81	81		110
Confl. Bikes (#/hr)												
Peak Hour Factor	0.89	0.89	0.89	0.95	0.95	0.95	0.83	0.83	0.83	0.76	0.76	0.76
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	29	817	0	19	669	0	0	221	0	0	115	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases	2			6			4			4		
Total Split (s)	63.0	63.0		63.0	63.0		37.0	37.0		37.0	37.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	59.5	59.5		59.5	59.5			33.5			33.5	
Actuated g/C Ratio	0.60	0.60		0.60	0.60			0.34			0.34	
v/c Ratio	0.10	0.47		0.08	0.38			0.48			0.24	
Control Delay	1.7	2.6		6.2	6.6			27.1			16.8	
Queue Delay	0.0	0.7		0.0	0.3			0.0			0.0	
Total Delay	1.7	3.4		6.2	6.9			27.1			16.8	
LOS	A	A		A	A			C			B	
Approach Delay		3.3			6.9			27.1			16.8	
Approach LOS		A			A			C			B	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 92 (92%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.48

# Lanes, Volumes, Timings

## 2896: Madison St & Minor Ave

1/29/2016

Intersection Signal Delay: 8.3

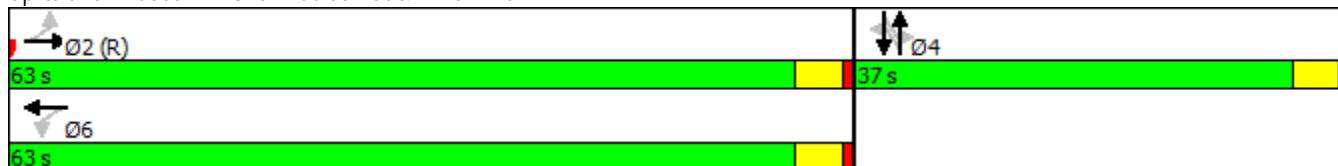
Intersection LOS: A

Intersection Capacity Utilization 50.6%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2896: Madison St & Minor Ave



Lanes, Volumes, Timings  
 4018: E Madison St & 12th Ave & Union St

1/29/2016



Lane Group	NBL2	NBL	NBT	NBR	SBL	SBT	SBR	SBR2	NEL2	NEL	NET	NER
Lane Configurations												
Traffic Volume (vph)	27	79	397	69	54	377	61	22	1	29	839	108
Future Volume (vph)	27	79	397	69	54	377	61	22	1	29	839	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	11	12	10	10	12	12	12	12	15	12
Grade (%)			0%			0%						4%
Storage Length (ft)		145		0	160		0			0		0
Storage Lanes		1		1	1		0			0		0
Taper Length (ft)		25			25					25		
Satd. Flow (prot)	0	1668	1818	1599	1652	2866	0	0	0	0	3747	0
Flt Permitted		0.392			0.358						0.912	
Satd. Flow (perm)	0	597	1818	1599	606	2866	0	0	0	0	3420	0
Right Turn on Red				Yes				Yes				Yes
Satd. Flow (RTOR)				72		6					19	
Link Speed (mph)			30			30					30	
Link Distance (ft)			172			489					373	
Travel Time (s)			3.9			11.1					8.5	
Confl. Peds. (#/hr)	96	34		41	41		96	34	34	27		45
Confl. Bikes (#/hr)												
Peak Hour Factor	0.96	0.96	0.96	0.96	0.86	0.86	0.86	0.86	0.96	0.96	0.96	0.96
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%	2%	2%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)						0						
Mid-Block Traffic (%)			0%			0%					0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	110	414	72	63	535	0	0	0	0	1018	0
Turn Type	Perm	Perm	NA	Prot	Perm	NA			Perm	Perm	NA	
Protected Phases			4	4		8					6	
Permitted Phases	4	4			8				6	6		
Total Split (s)	46.0	46.0	46.0	46.0	46.0	46.0			54.0	54.0	54.0	
Total Lost Time (s)		5.0	5.0	5.0	5.5	5.5					5.5	
Act Effect Green (s)		41.0	41.0	41.0	40.5	40.5					48.5	
Actuated g/C Ratio		0.41	0.41	0.41	0.40	0.40					0.48	
v/c Ratio		0.45	0.56	0.10	0.26	0.46					0.61	
Control Delay		28.8	26.1	4.9	40.2	40.7					19.8	
Queue Delay		0.0	0.0	0.0	0.0	0.0					0.9	
Total Delay		28.8	26.1	4.9	40.2	40.7					20.7	
LOS		C	C	A	D	D					C	
Approach Delay			24.0			40.7					20.7	
Approach LOS			C			D					C	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 7 (7%), Referenced to phase 2:SWTL and 6:NETL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.61

Lanes, Volumes, Timings  
 4018: E Madison St & 12th Ave & Union St

1/29/2016



Lane Group	SWL	SWT	SWR	SWR2
Lane Configurations		↕↕		
Traffic Volume (vph)	37	464	124	32
Future Volume (vph)	37	464	124	32
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12
Grade (%)		-8%		
Storage Length (ft)	0		0	
Storage Lanes	0		0	
Taper Length (ft)	25			
Satd. Flow (prot)	0	3282	0	0
Flt Permitted		0.815		
Satd. Flow (perm)	0	2681	0	0
Right Turn on Red				Yes
Satd. Flow (RTOR)		7		
Link Speed (mph)		30		
Link Distance (ft)		165		
Travel Time (s)		3.8		
Confl. Peds. (#/hr)	45		34	27
Confl. Bikes (#/hr)				
Peak Hour Factor	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0
Parking (#/hr)				
Mid-Block Traffic (%)		0%		
Shared Lane Traffic (%)				
Lane Group Flow (vph)	0	714	0	0
Turn Type	Perm	NA		
Protected Phases		2		
Permitted Phases	2			
Total Split (s)	54.0	54.0		
Total Lost Time (s)		5.5		
Act Effct Green (s)		48.5		
Actuated g/C Ratio		0.48		
v/c Ratio		0.55		
Control Delay		34.2		
Queue Delay		0.4		
Total Delay		34.7		
LOS		C		
Approach Delay		34.7		
Approach LOS		C		

Intersection Summary

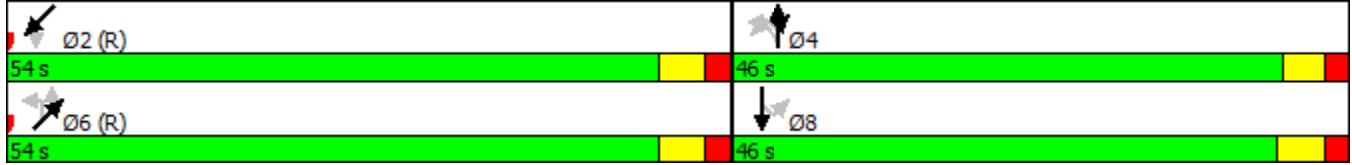
# Lanes, Volumes, Timings

## 4018: E Madison St & 12th Ave & Union St

1/29/2016

Intersection Signal Delay: 28.9 Intersection LOS: C  
Intersection Capacity Utilization 89.2% ICU Level of Service E  
Analysis Period (min) 15

Splits and Phases: 4018: E Madison St & 12th Ave & Union St



Lanes, Volumes, Timings  
4031: 3rd Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	0	470	60	0	134	0	0	135	56
Future Volume (vph)	0	0	0	0	470	60	0	134	0	0	135	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	10	12	12	11	12
Grade (%)		10%			-15%			0%				-5%
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	2900	0	0	1468	0	0	1556	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	2900	0	0	1468	0	0	1556	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					24							63
Link Speed (mph)		25			25			25				25
Link Distance (ft)		309			297			298				321
Travel Time (s)		8.4			8.1			8.1				8.8
Confl. Peds. (#/hr)	244		457	457		244	588		499	499		588
Confl. Bikes (#/hr)												
Peak Hour Factor	0.25	0.25	0.25	0.91	0.91	0.91	0.93	0.93	0.93	0.87	0.87	0.87
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	9%	2%	2%	0%	81%	0%	0%	82%	11%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	62	0	0	29	0
Parking (#/hr)					15							
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	582	0	0	144	0	0	219	0
Turn Type					NA			NA			NA	
Protected Phases					6			4				4
Permitted Phases												
Total Split (s)					42.0			38.0				38.0
Total Lost Time (s)					4.0			4.0				4.0
Act Effect Green (s)					38.0			34.0				34.0
Actuated g/C Ratio					0.48			0.42				0.42
v/c Ratio					0.42			0.23				0.31
Control Delay					8.5			18.8				6.2
Queue Delay					0.5			0.0				0.0
Total Delay					9.0			18.8				6.2
LOS					A			B				A
Approach Delay					9.0			18.8				6.2
Approach LOS					A			B				A

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	2 (3%), Referenced to phase 6:WBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.42

# Lanes, Volumes, Timings

## 4031: 3rd Ave & Madison St

1/29/2016

Intersection Signal Delay: 9.8

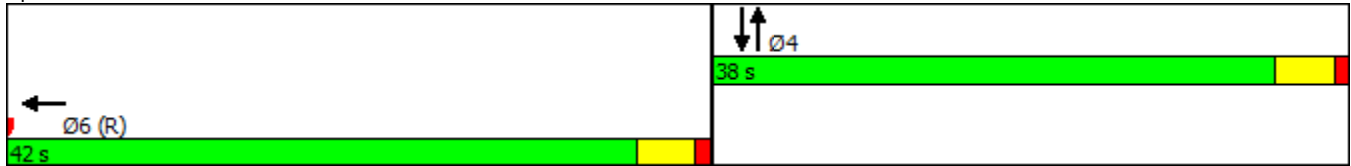
Intersection LOS: A

Intersection Capacity Utilization 35.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4031: 3rd Ave & Madison St



Lanes, Volumes, Timings  
4032: 6th Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑				
Traffic Volume (vph)	0	0	0	0	746	809	26	150	173	0	0	0
Future Volume (vph)	0	0	0	0	746	809	26	150	173	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	10	9	12	12	12	12	12	12
Grade (%)		10%			-10%			5%				-5%
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		1	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	2645	1238	0	2538	0	0	0	0
Flt Permitted								0.996				
Satd. Flow (perm)	0	0	0	0	2645	1238	0	2480	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)					139	492		214				
Link Speed (mph)		25			25			25				25
Link Distance (ft)		287			328			296				323
Travel Time (s)		7.8			8.9			8.1				8.8
Confl. Peds. (#/hr)	137		316	316		137	178			1		178
Confl. Bikes (#/hr)			3			26			2			3
Peak Hour Factor	0.25	0.25	0.25	0.97	0.97	0.97	0.85	0.85	0.85	0.25	0.25	0.25
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	12%	1%	5%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)								15				
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)						41%						
Lane Group Flow (vph)	0	0	0	0	1111	492	0	411	0	0	0	0
Turn Type					NA	custom	Perm	NA				
Protected Phases					8	3		1				
Permitted Phases							1					
Total Split (s)					51.0	25.0	21.0	21.0				
Total Lost Time (s)					4.0	4.0		4.0				
Act Effect Green (s)					47.0	21.0		17.0				
Actuated g/C Ratio					0.59	0.26		0.21				
v/c Ratio					0.69	0.72		0.59				
Control Delay					8.6	9.6		10.5				
Queue Delay					0.4	1.5		0.2				
Total Delay					9.0	11.1		10.7				
LOS					A	B		B				
Approach Delay					9.6			10.7				
Approach LOS					A			B				

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	0 (0%), Referenced to phase 1:NBTL, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.72



Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Growth Factor		
Heavy Vehicles (%)		
Bus Blockages (#/hr)		
Parking (#/hr)		
Mid-Block Traffic (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	4
Permitted Phases		
Total Split (s)	8.0	26.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
 4032: 6th Ave & Madison St

1/29/2016

Intersection Signal Delay: 9.8

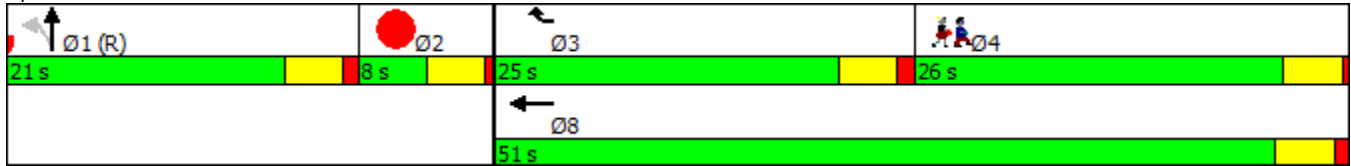
Intersection LOS: A

Intersection Capacity Utilization 62.3%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 4032: 6th Ave & Madison St



Lanes, Volumes, Timings

4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖			↖↖↖		↖	↖	↖	↖		↖
Traffic Volume (vph)	2	174	0	0	742	3	488	276	423	7	0	348
Future Volume (vph)	2	174	0	0	742	3	488	276	423	7	0	348
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			5%				-5%
Storage Length (ft)	0		0	130		0	0		180	0		10
Storage Lanes	0		0	1		0	1		2	1		1
Taper Length (ft)	25			60			0			25		
Satd. Flow (prot)	0	1255	0	0	4263	0	1505	1562	1403	1665	0	1475
Flt Permitted		0.994					0.950	0.986		0.441		
Satd. Flow (perm)	0	1246	0	0	4263	0	1503	1561	1288	749	0	1475
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					1				20			20
Link Speed (mph)		25			25			25				25
Link Distance (ft)		328			329			522				325
Travel Time (s)		8.9			9.0			14.2				8.9
Confl. Peds. (#/hr)	114		364	364		114	1		56	56		
Confl. Bikes (#/hr)			2			9			22			
Peak Hour Factor	0.81	0.81	0.81	0.94	0.94	0.94	0.94	0.94	0.94	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	5%	0%	0%	2%	0%	0%	0%	1%	0%	0%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		15										
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)							23%					
Lane Group Flow (vph)	0	217	0	0	792	0	400	413	450	8	0	387
Turn Type	Perm	NA			NA		Perm	NA	Perm	D.Pm		Perm
Protected Phases		2			6			4				
Permitted Phases	2						4		4	4		4
Total Split (s)	28.0	28.0			28.0		52.0	52.0	52.0	52.0		52.0
Total Lost Time (s)		3.5			3.5		3.5	3.5	3.5	3.5		4.5
Act Effct Green (s)		24.5			24.5		48.5	48.5	48.5	48.5		47.5
Actuated g/C Ratio		0.31			0.31		0.61	0.61	0.61	0.61		0.59
v/c Ratio		0.57			0.61		0.44	0.44	0.57	0.02		0.44
Control Delay		22.3			26.0		10.3	10.2	12.6	6.4		10.3
Queue Delay		0.0			0.0		0.0	0.0	0.0	0.0		1.7
Total Delay		22.3			26.0		10.3	10.2	12.6	6.4		12.1
LOS		C			C		B	B	B	A		B
Approach Delay		22.3			26.0			11.1				
Approach LOS		C			C			B				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 16 (20%), Referenced to phase 6:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.61

# Lanes, Volumes, Timings

## 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/29/2016

Intersection Signal Delay: 16.6

Intersection LOS: B

Intersection Capacity Utilization 73.5%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St



Lanes, Volumes, Timings  
4034: Boren Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	64	521	22	54	568	67	83	518	32	187	672	82
Future Volume (vph)	64	521	22	54	568	67	83	518	32	187	672	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	12	9	9	12	9	9	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	85		0	85		0	150		0	200		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			50		
Satd. Flow (prot)	1486	2849	0	1516	2799	0	1433	2778	0	1462	2695	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1318	2849	0	1272	2799	0	1313	2778	0	1305	2695	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			13			6			15	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		319			324			309			308	
Travel Time (s)		8.7			8.8			7.0			7.0	
Confl. Peds. (#/hr)	183		335	335		183	144		160	160		144
Confl. Bikes (#/hr)												
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	4%	0%	2%	0%	2%	2%	6%	0%	2%	1%
Bus Blockages (#/hr)	0	10	0	0	6	0	0	2	0	0	8	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	74	624	0	62	730	0	99	655	0	208	838	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	12.0	32.0		12.0	32.0		14.0	34.0		22.0	42.0	
Total Lost Time (s)	4.0	3.5		4.0	3.5		4.0	3.5		4.0	3.5	
Act Effect Green (s)	7.9	28.0		7.9	28.0		12.9	30.5		20.9	38.5	
Actuated g/C Ratio	0.08	0.28		0.08	0.28		0.13	0.30		0.21	0.38	
v/c Ratio	0.63	0.78		0.52	0.92		0.54	0.77		0.68	0.80	
Control Delay	53.8	38.5		63.3	59.5		54.0	28.8		41.9	27.4	
Queue Delay	0.0	1.4		0.0	3.9		0.0	2.2		0.0	2.2	
Total Delay	53.8	39.9		63.3	63.4		54.0	30.9		41.9	29.6	
LOS	D	D		E	E		D	C		D	C	
Approach Delay		41.4			63.4			34.0			32.1	
Approach LOS		D			E			C			C	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	34 (34%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.92

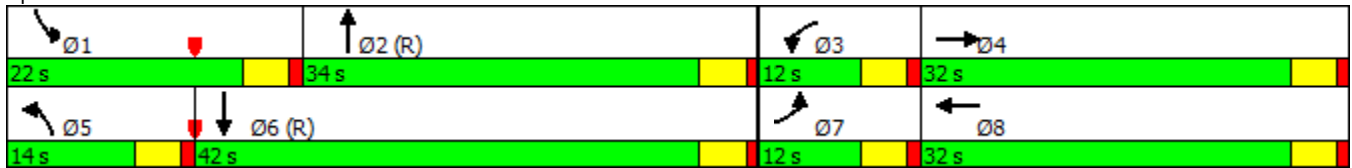
Lanes, Volumes, Timings  
 4034: Boren Ave & Madison St

1/29/2016

Intersection Signal Delay: 42.0  
 Intersection Capacity Utilization 69.2%  
 Analysis Period (min) 15

Intersection LOS: D  
 ICU Level of Service C

Splits and Phases: 4034: Boren Ave & Madison St



Lanes, Volumes, Timings  
 4035: Broadway & Madison St/E Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↗			↗	
Traffic Volume (vph)	107	661	23	66	475	29	0	312	129	0	265	92
Future Volume (vph)	107	661	23	66	475	29	0	312	129	0	265	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	10	12	10	10	12	12	13	12	12	13	12
Grade (%)		-9%			8%			0%			0%	
Storage Length (ft)	50		0	50		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	50			25			59			25		
Satd. Flow (prot)	1770	3424	0	1526	3114	0	0	3381	0	0	3386	0
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	1640	3424	0	1467	3114	0	0	3381	0	0	3386	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			6			87			67	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		306			247			363			184	
Travel Time (s)		7.0			5.6			8.3			4.2	
Confl. Peds. (#/hr)	98		62	62		62	62		62	62		62
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.94	0.94	0.94	0.94	0.94	0.94	0.88	0.88	0.88
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	2%	0%	6%	2%	7%	0%	2%	2%	0%	2%	5%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	110	705	0	70	536	0	0	469	0	0	406	0
Turn Type	Prot	NA		Prot	NA			NA			NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases								3				
Total Split (s)	18.0	30.0		18.0	30.0			25.0			52.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	11.3	56.5		11.0	56.5			21.7			21.7	
Actuated g/C Ratio	0.11	0.56		0.11	0.56			0.22			0.22	
v/c Ratio	0.55	0.36		0.42	0.30			0.58			0.52	
Control Delay	41.3	20.1		33.0	25.7			26.8			34.9	
Queue Delay	0.0	0.5		0.0	0.0			0.0			0.0	
Total Delay	41.3	20.6		33.0	25.7			26.8			34.9	
LOS	D	C		C	C			C			C	
Approach Delay		23.4			26.5			26.8			34.9	
Approach LOS		C			C			C			C	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 2 (2%), Referenced to phase 2:EBT and 6:WBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.58

Lane Group	Ø3
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	3
Permitted Phases	
Total Split (s)	27.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

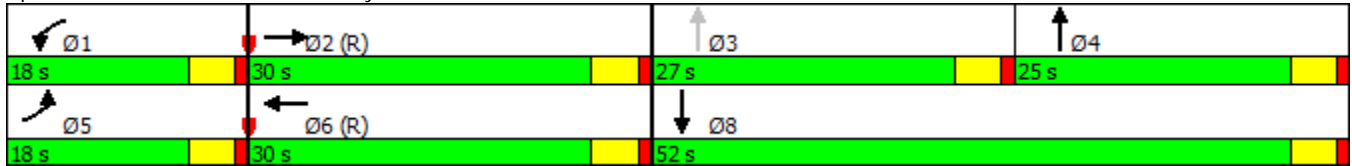


Lanes, Volumes, Timings  
 4035: Broadway & Madison St/E Madison St

1/29/2016

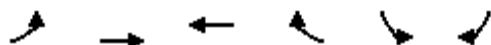
Intersection Signal Delay: 27.0 Intersection LOS: C  
 Intersection Capacity Utilization 48.2% ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4035: Broadway & Madison St/E Madison St



Lanes, Volumes, Timings  
4039: E Madison St & 15th Ave

1/29/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø1	Ø4
Lane Configurations		↑↑	↑↑			↓		
Traffic Volume (vph)	63	670	479	13	0	125		
Future Volume (vph)	63	670	479	13	0	125		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	12	11	11	12	12	16		
Grade (%)		10%	-9%		0%			
Storage Length (ft)	0			0	0	0		
Storage Lanes	0			0	0	1		
Taper Length (ft)	25				25			
Satd. Flow (prot)	0	3269	3590	0	0	1774		
Flt Permitted		0.845						
Satd. Flow (perm)	0	2769	3590	0	0	1752		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)			7			497		
Link Speed (mph)		30	30		30			
Link Distance (ft)		260	400		288			
Travel Time (s)		5.9	9.1		6.5			
Confl. Peds. (#/hr)	59			59	47	1		
Confl. Bikes (#/hr)				2				
Peak Hour Factor	0.93	0.93	0.85	0.85	0.85	0.85		
Growth Factor	100%	100%	100%	100%	100%	100%		
Heavy Vehicles (%)	1%	1%	1%	1%	5%	5%		
Bus Blockages (#/hr)	0	0	0	0	0	0		
Parking (#/hr)				0				
Mid-Block Traffic (%)		0%	0%		0%			
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	788	579	0	0	147		
Turn Type	Perm	NA	NA			Free		
Protected Phases		2	6				1	4
Permitted Phases	2					Free		
Total Split (s)	68.0	68.0	76.0				8.0	24.0
Total Lost Time (s)		4.5	4.5					
Act Effect Green (s)		83.2	83.2			100.0		
Actuated g/C Ratio		0.83	0.83			1.00		
v/c Ratio		0.34	0.19			0.08		
Control Delay		1.8	2.0			0.1		
Queue Delay		0.0	0.0			0.0		
Total Delay		1.9	2.0			0.1		
LOS		A	A			A		
Approach Delay		1.9	2.0					
Approach LOS		A	A					

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 37 (37%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.34

# Lanes, Volumes, Timings

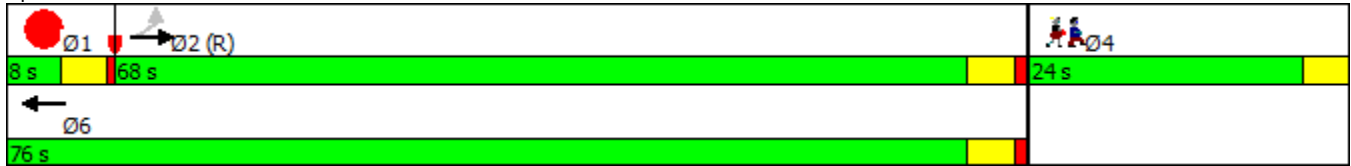
## 4039: E Madison St & 15th Ave

1/29/2016

Intersection Signal Delay: 1.8  
 Intersection Capacity Utilization 48.6%  
 Analysis Period (min) 15

Intersection LOS: A  
 ICU Level of Service A

Splits and Phases: 4039: E Madison St & 15th Ave



Lanes, Volumes, Timings  
4040: E Madison St & 23rd Ave E

1/29/2016



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↑↑			↑↑		↗	↑↑		↗	↑↑	
Traffic Volume (vph)	0	575	33	0	624	114	190	529	33	59	435	11
Future Volume (vph)	0	575	33	0	624	114	190	529	33	59	435	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	9	9	10	10	10	10	16	10	9	10	10
Grade (%)		0%			0%			-5%			10%	
Storage Length (ft)	0		0	0		0	167		0	50		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3181	0	0	3254	0	1693	4074	0	1528	3115	0
Flt Permitted							0.950			0.950		
Satd. Flow (perm)	0	3181	0	0	3254	0	1693	4074	0	1528	3115	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			25			7			5	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		758			380			361			501	
Travel Time (s)		17.2			8.6			8.2			11.4	
Confl. Peds. (#/hr)			2	2								3
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.87	0.69	0.25	0.91	0.92	0.92	0.92	0.92	0.64	0.92	0.46
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	1%	1%	1%	1%	2%	2%	2%	2%	1%	2%	1%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)			0									0
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	709	0	0	810	0	207	611	0	92	497	0
Turn Type		NA			NA		Prot	NA		Prot	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases												
Total Split (s)		45.0			45.0		30.0	39.0		16.0	25.0	
Total Lost Time (s)		3.0			3.0		3.0	3.0		3.0	4.5	
Act Effect Green (s)		42.0			42.0		19.0	39.2		12.1	28.5	
Actuated g/C Ratio		0.42			0.42		0.19	0.39		0.12	0.28	
v/c Ratio		0.53			0.59		0.65	0.38		0.50	0.56	
Control Delay		20.1			44.0		57.8	21.8		46.6	30.5	
Queue Delay		0.0			2.7		0.0	0.0		0.0	0.0	
Total Delay		20.1			46.6		57.8	21.8		46.6	30.5	
LOS		C			D		E	C		D	C	
Approach Delay		20.1			46.6			30.9			33.0	
Approach LOS		C			D			C			C	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 72 (72%), Referenced to phase 2:NET and 6:SWT, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.65

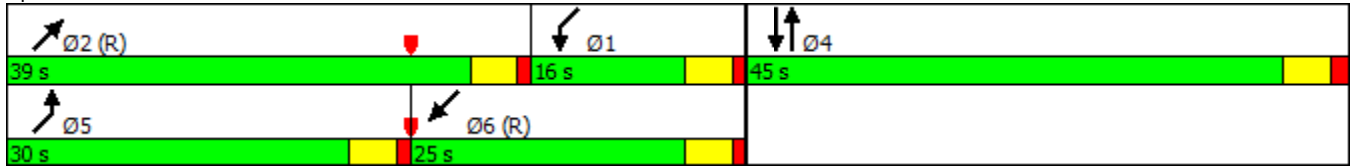
Lanes, Volumes, Timings  
 4040: E Madison St & 23rd Ave E

1/29/2016

Intersection Signal Delay: 33.1  
 Intersection Capacity Utilization 56.8%  
 Analysis Period (min) 15

Intersection LOS: C  
 ICU Level of Service B

Splits and Phases: 4040: E Madison St & 23rd Ave E



Lanes, Volumes, Timings  
4041: 3rd Ave & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕↕			↕↕	
Traffic Volume (vph)	5	600	28	0	0	0	0	111	65	15	148	0
Future Volume (vph)	5	600	28	0	0	0	0	111	65	15	148	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	11	12	12	11	12
Grade (%)		10%			-10%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2550	0	0	0	0	0	1448	0	0	1771	0
Flt Permitted											0.927	
Satd. Flow (perm)	0	2543	0	0	0	0	0	1448	0	0	1608	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7						39				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		306			298			321			281	
Travel Time (s)		8.3			8.1			8.8			7.7	
Confl. Peds. (#/hr)	396		213	213		396	650		405	405		650
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.25	0.25	0.25	0.80	0.80	0.80	0.91	0.91	0.91
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	87%	0%	40%	67%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	60	0	0	34	0
Parking (#/hr)		15										
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	653	0	0	0	0	0	220	0	0	179	0
Turn Type	custom	NA						NA		Perm	NA	
Protected Phases	1	6						4			4	
Permitted Phases	2									4		
Total Split (s)	10.0	38.0						42.0		42.0	42.0	
Total Lost Time (s)		4.0						4.0			4.0	
Act Effct Green (s)		34.0						38.0			38.0	
Actuated g/C Ratio		0.42						0.48			0.48	
v/c Ratio		0.60						0.31			0.23	
Control Delay		19.8						11.3			19.9	
Queue Delay		0.5						0.2			0.1	
Total Delay		20.4						11.4			20.0	
LOS		C						B			C	
Approach Delay		20.4						11.4			20.0	
Approach LOS		C						B			C	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 22 (28%), Referenced to phase 1:EBL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.60

Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	28.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

# Lanes, Volumes, Timings

## 4041: 3rd Ave & Spring St

1/29/2016

Intersection Signal Delay: 18.4

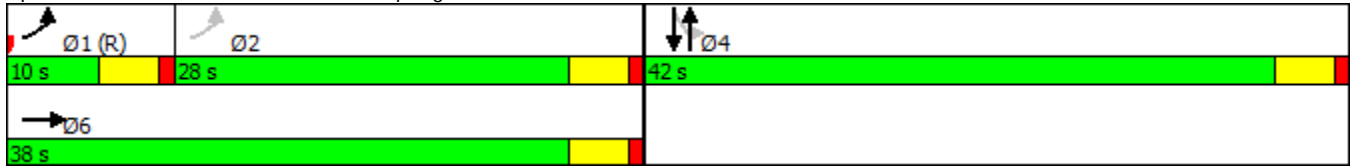
Intersection LOS: B

Intersection Capacity Utilization 47.4%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4041: 3rd Ave & Spring St





Lanes, Volumes, Timings  
4058: 6th Ave & I-5 CD SB On-Ramp & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	NBT	NBR	NBR2
Lane Configurations		↕↑	↗	↑↑	↗	
Traffic Volume (vph)	192	189	750	335	10	610
Future Volume (vph)	192	189	750	335	10	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	11	10	11	12
Grade (%)		10%		5%		
Storage Length (ft)	0		0		0	
Storage Lanes	0		1		1	
Taper Length (ft)	25					
Satd. Flow (prot)	0	2512	1322	2927	1357	0
Flt Permitted		0.975				
Satd. Flow (perm)	0	2216	1322	2927	1357	0
Right Turn on Red	Yes					No
Satd. Flow (RTOR)		164				
Link Speed (mph)		25		25		
Link Distance (ft)		295		323		
Travel Time (s)		8.0		8.8		
Confl. Peds. (#/hr)	224					
Confl. Bikes (#/hr)						
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	0%	1%
Bus Blockages (#/hr)	0	5	0	0	0	0
Parking (#/hr)		15				
Mid-Block Traffic (%)		0%		0%		
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	409	806	360	667	0
Turn Type	Perm	NA	Perm	NA	Perm	
Protected Phases		1		2		
Permitted Phases	1		1		2	
Total Split (s)	41.0	41.0	41.0	39.0	39.0	
Total Lost Time (s)		4.5	4.5	4.5	4.5	
Act Effect Green (s)		36.5	36.5	34.5	34.5	
Actuated g/C Ratio		0.46	0.46	0.43	0.43	
v/c Ratio		0.37	1.34	0.29	1.14	
Control Delay		1.3	184.1	14.8	101.8	
Queue Delay		0.0	0.9	0.0	0.3	
Total Delay		1.3	185.0	14.8	102.1	
LOS		A	F	B	F	
Approach Delay		123.2		71.5		
Approach LOS		F		E		

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 66 (83%), Referenced to phase 1:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.34

# Lanes, Volumes, Timings

## 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St

1/29/2016

Intersection Signal Delay: 99.5

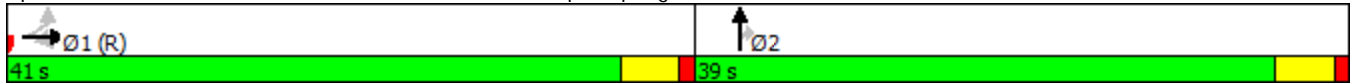
Intersection LOS: F

Intersection Capacity Utilization 101.8%

ICU Level of Service G

Analysis Period (min) 15

Splits and Phases: 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St



Lanes, Volumes, Timings  
4059: Madison St & Boylston Ave

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	720	25	7	556	16	39	57	39	18	10	24
Future Volume (vph)	20	720	25	7	556	16	39	57	39	18	10	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	9	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%				0%
Storage Length (ft)	85		0	70		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			50			25			25		
Satd. Flow (prot)	1516	2908	0	1516	2826	0	0	1589	0	0	1496	0
Flt Permitted	0.413			0.323				0.900			0.892	
Satd. Flow (perm)	568	2908	0	462	2826	0	0	1415	0	0	1341	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			6			19				30
Link Speed (mph)		25			25			25				25
Link Distance (ft)		325			306			184				179
Travel Time (s)		8.9			8.3			5.0				4.9
Confl. Peds. (#/hr)	88		106	106		88	52		30	30		52
Confl. Bikes (#/hr)												
Peak Hour Factor	0.91	0.91	0.91	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	8%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	22	818	0	7	602	0	0	152	0	0	64	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2			4			4		
Total Split (s)	72.0	72.0		72.0	72.0		28.0	28.0		28.0		28.0
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5				3.5
Act Effect Green (s)	74.7	74.7		74.7	74.7			18.3				18.3
Actuated g/C Ratio	0.75	0.75		0.75	0.75			0.18				0.18
v/c Ratio	0.05	0.38		0.02	0.29			0.55				0.24
Control Delay	1.2	1.5		4.7	11.6			40.2				23.0
Queue Delay	0.0	0.1		0.0	0.4			0.0				0.0
Total Delay	1.2	1.6		4.7	12.0			40.2				23.0
LOS	A	A		A	B			D				C
Approach Delay		1.6			11.9			40.2				23.0
Approach LOS		A			B			D				C

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 3 (3%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.55

Lanes, Volumes, Timings  
4059: Madison St & Boylston Ave

1/29/2016

Intersection Signal Delay: 9.7

Intersection LOS: A

Intersection Capacity Utilization 43.2%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4059: Madison St & Boylston Ave



Lanes, Volumes, Timings  
4411: 4th Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑			↑↑↑				
Traffic Volume (vph)	0	0	0	0	400	215	116	1081	0	0	0	0
Future Volume (vph)	0	0	0	0	400	215	116	1081	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	13	12	12	10	12	12	12	12
Grade (%)		15%			-10%			5%				0%
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	2593	0	0	3678	0	0	0	0
Flt Permitted								0.995				
Satd. Flow (perm)	0	0	0	0	2593	0	0	3532	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)					1			20				
Link Speed (mph)		25			25			25				25
Link Distance (ft)		297			362			160				323
Travel Time (s)		8.1			9.9			4.4				8.8
Confl. Peds. (#/hr)	361		494	494		361	487		575	575		487
Confl. Bikes (#/hr)												
Peak Hour Factor	0.25	0.25	0.25	0.84	0.84	0.84	0.97	0.97	0.97	0.25	0.25	0.25
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	1%	9%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)					15			15				
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	732	0	0	1234	0	0	0	0
Turn Type					NA		Perm	NA				
Protected Phases					6			4				
Permitted Phases							4					
Total Split (s)					39.0		41.0	41.0				
Total Lost Time (s)					2.5			3.5				
Act Effect Green (s)					36.5			37.5				
Actuated g/C Ratio					0.46			0.47				
v/c Ratio					0.62			0.74				
Control Delay					14.6			20.4				
Queue Delay					0.6			0.1				
Total Delay					15.2			20.5				
LOS					B			C				
Approach Delay					15.2			20.5				
Approach LOS					B			C				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 69 (86%), Referenced to phase 2: and 6:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.74

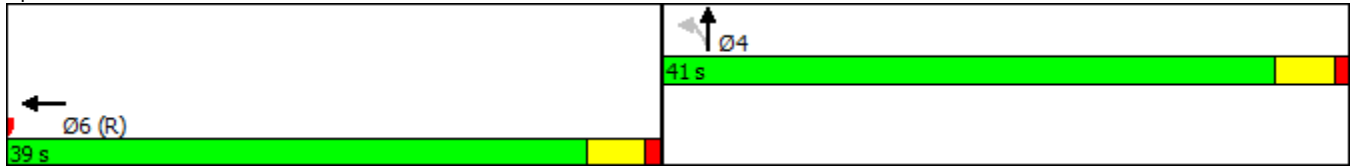
Lanes, Volumes, Timings  
4411: 4th Ave & Madison St

1/29/2016

Intersection Signal Delay: 18.5  
Intersection Capacity Utilization 57.8%  
Analysis Period (min) 15

Intersection LOS: B  
ICU Level of Service B

Splits and Phases: 4411: 4th Ave & Madison St



Lanes, Volumes, Timings  
4412: 4th Ave & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕↕↕	↗			
Traffic Volume (vph)	200	530	0	0	0	0	0	1216	92	0	0	0
Future Volume (vph)	200	530	0	0	0	0	0	1216	92	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	10	12	12	12	12
Grade (%)		15%			-5%			5%				0%
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2508	0	0	0	0	0	3704	1389	0	0	0
Flt Permitted		0.987										
Satd. Flow (perm)	0	2282	0	0	0	0	0	3704	829	0	0	0
Right Turn on Red	Yes		Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20							27			
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		298			362			323			130	
Travel Time (s)		8.1			9.9			8.8			3.5	
Confl. Peds. (#/hr)	315		294	294		315	452		497	497		452
Confl. Bikes (#/hr)												
Peak Hour Factor	0.96	0.96	0.96	0.25	0.25	0.25	0.95	0.95	0.95	0.25	0.25	0.25
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	8%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		15						15				
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	760	0	0	0	0	0	1280	97	0	0	0
Turn Type	custom	NA						NA	Perm			
Protected Phases		2						4				
Permitted Phases	6								4			
Total Split (s)	38.0	38.0						42.0	42.0			
Total Lost Time (s)		4.5						5.5	5.5			
Act Effct Green (s)		33.5						36.5	36.5			
Actuated g/C Ratio		0.42						0.46	0.46			
v/c Ratio		0.79						0.76	0.25			
Control Delay		39.2						12.0	1.0			
Queue Delay		3.7						0.4	0.0			
Total Delay		42.9						12.4	1.0			
LOS		D						B	A			
Approach Delay		42.9						11.6				
Approach LOS		D						B				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 0 (0%), Referenced to phase 2:EBT and 6:EBL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.79

# Lanes, Volumes, Timings

## 4412: 4th Ave & Spring St

1/29/2016

Intersection Signal Delay: 22.7

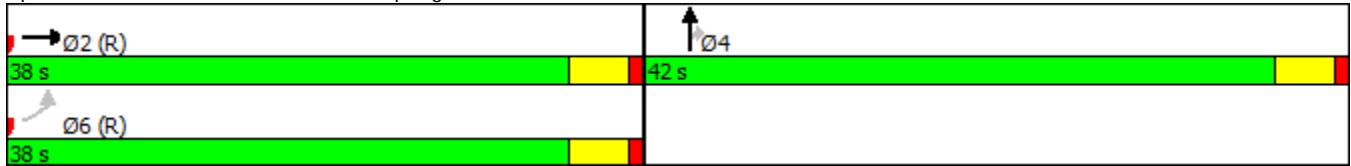
Intersection LOS: C

Intersection Capacity Utilization 60.5%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 4412: 4th Ave & Spring St





Lanes, Volumes, Timings  
4455: 2nd Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑	↑
Traffic Volume (vph)	0	0	0	180	343	0	0	0	0	0	1220	60
Future Volume (vph)	0	0	0	180	343	0	0	0	0	0	1220	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	12	12	10	10	11
Grade (%)		12%			-8%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	2950	0	0	0	0	0	2281	548
Flt Permitted					0.983							
Satd. Flow (perm)	0	0	0	0	2626	0	0	0	0	0	2281	328
Right Turn on Red			Yes	No		No			Yes			Yes
Satd. Flow (RTOR)												48
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		338			309			302			313	
Travel Time (s)		9.2			8.4			8.2			8.5	
Confl. Peds. (#/hr)	140		263	263		140	395		417	417		395
Confl. Bikes (#/hr)												
Peak Hour Factor	0.25	0.25	0.25	0.94	0.94	0.94	0.25	0.25	0.25	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	0%	0%	0%	9%	9%	9%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)				10		0					52	95
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	556	0	0	0	0	0	1284	63
Turn Type				Perm	NA						NA	Perm
Protected Phases					4						2	
Permitted Phases				4	4							2
Total Split (s)				27.0	27.0						53.0	53.0
Total Lost Time (s)					5.0						5.0	6.5
Act Effct Green (s)					22.0						48.0	46.5
Actuated g/C Ratio					0.28						0.60	0.58
v/c Ratio					0.77						0.94	0.30
Control Delay					53.5						24.2	4.2
Queue Delay					0.0						44.8	0.0
Total Delay					53.5						68.9	4.2
LOS					D						E	A
Approach Delay					53.5						65.9	
Approach LOS					D						E	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	9 (11%), Referenced to phase 2:SBT and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.94

# Lanes, Volumes, Timings

## 4455: 2nd Ave & Madison St

1/29/2016

Intersection Signal Delay: 62.3  
Intersection Capacity Utilization 62.1%  
Analysis Period (min) 15

Intersection LOS: E  
ICU Level of Service B

Splits and Phases: 4455: 2nd Ave & Madison St



Lanes, Volumes, Timings  
4456: 2nd Ave & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑								↘	↑↑	
Traffic Volume (vph)	0	350	80	0	0	0	0	0	0	210	1200	0
Future Volume (vph)	0	350	80	0	0	0	0	0	0	210	1200	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		12%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	250		0
Storage Lanes	0		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2569	0	0	0	0	0	0	0	1204	2203	0
Flt Permitted										0.950		
Satd. Flow (perm)	0	2569	0	0	0	0	0	0	0	790	2203	0
Right Turn on Red			Yes			No			Yes	No		Yes
Satd. Flow (RTOR)		23										
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		339			306			313			293	
Travel Time (s)		9.2			8.3			8.5			8.0	
Confl. Peds. (#/hr)	200		178	178		200	340		348	348		340
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.25	0.25	0.25	0.25	0.25	0.25	0.97	0.97	0.97
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)										10	69	69
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	467	0	0	0	0	0	0	0	216	1237	0
Turn Type		NA								Prot	NA	
Protected Phases		2								3	14	
Permitted Phases												
Total Split (s)		22.0								20.0		
Total Lost Time (s)		4.0								4.0		
Act Effct Green (s)		18.0								16.0	54.0	
Actuated g/C Ratio		0.22								0.20	0.68	
v/c Ratio		0.78								0.90	0.83	
Control Delay		30.1								48.0	7.9	
Queue Delay		0.1								0.0	48.3	
Total Delay		30.2								48.0	56.2	
LOS		C								D	E	
Approach Delay		30.2									55.0	
Approach LOS		C									E	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 65 (81%), Referenced to phase 1:SBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.90

Lane Group	Ø1	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Growth Factor		
Heavy Vehicles (%)		
Bus Blockages (#/hr)		
Parking (#/hr)		
Mid-Block Traffic (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	1	4
Permitted Phases		
Total Split (s)	58.0	38.0
Total Lost Time (s)		
Act Effect Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

# Lanes, Volumes, Timings

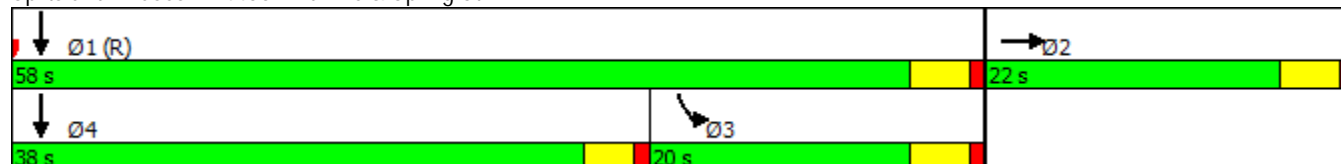
## 4456: 2nd Ave & Spring St

1/29/2016

Intersection Signal Delay: 49.0  
 Intersection Capacity Utilization 58.5%  
 Analysis Period (min) 15

Intersection LOS: D  
 ICU Level of Service B

Splits and Phases: 4456: 2nd Ave & Spring St



Lanes, Volumes, Timings  
4477: 5th Ave & Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑↑	
Traffic Volume (vph)	0	0	0	296	487	0	0	0	0	0	870	100
Future Volume (vph)	0	0	0	296	487	0	0	0	0	0	870	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	9	12
Grade (%)		10%			-10%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	3005	0	0	0	0	0	3653	0
Flt Permitted					0.981							
Satd. Flow (perm)	0	0	0	0	2645	0	0	0	0	0	3653	0
Right Turn on Red			Yes	Yes		Yes			Yes			Yes
Satd. Flow (RTOR)					20							31
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		362			287			292			323	
Travel Time (s)		9.9			7.8			8.0			8.8	
Confl. Peds. (#/hr)	228		242	242		228	311		184	184		311
Confl. Bikes (#/hr)												
Peak Hour Factor	0.25	0.25	0.25	0.96	0.96	0.96	0.25	0.25	0.25	0.97	0.97	0.97
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	0%	0%	0%	3%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)					15						15	
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	815	0	0	0	0	0	1000	0
Turn Type				Perm	NA						NA	
Protected Phases					2						4	
Permitted Phases				2								
Total Split (s)				41.0	41.0						39.0	
Total Lost Time (s)					4.5						4.5	
Act Effct Green (s)					36.5						34.5	
Actuated g/C Ratio					0.46						0.43	
v/c Ratio					0.67						0.63	
Control Delay					13.6						6.4	
Queue Delay					2.7						0.2	
Total Delay					16.4						6.6	
LOS					B						A	
Approach Delay					16.4						6.6	
Approach LOS					B						A	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 54 (68%), Referenced to phase 2:WBTL and 6:, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.67

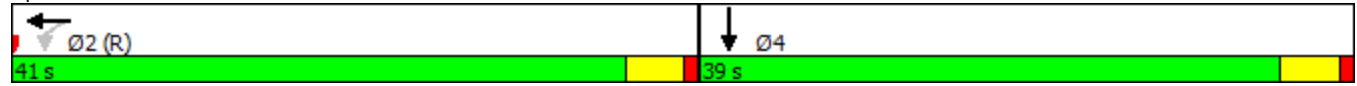
# Lanes, Volumes, Timings

## 4477: 5th Ave & Madison St

1/29/2016

Intersection Signal Delay: 11.0 Intersection LOS: B  
Intersection Capacity Utilization 57.3% ICU Level of Service B  
Analysis Period (min) 15

Splits and Phases: 4477: 5th Ave & Madison St



Lanes, Volumes, Timings  
 4485: 7th Ave/Hubbell Pl & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↔			↔	
Traffic Volume (vph)	42	137	19	0	0	0	0	256	23	6	328	0
Future Volume (vph)	42	137	19	0	0	0	0	256	23	6	328	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2989	0	0	0	0	0	1688	0	0	1675	0
Flt Permitted		0.989									0.995	
Satd. Flow (perm)	0	2687	0	0	0	0	0	1688	0	0	1668	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13						8				
Link Speed (mph)		25			30			25			25	
Link Distance (ft)		173			329			325			300	
Travel Time (s)		4.7			7.5			8.9			8.2	
Confl. Peds. (#/hr)	166		20				4					4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.87	0.92	0.87	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	17%	2%	0%	2%	2%	2%	0%	0%	2%	2%	2%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	219	0	0	0	0	0	303	0	0	393	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			2	
Permitted Phases	4									2		
Total Split (s)	38.0	38.0						62.0		62.0	62.0	
Total Lost Time (s)		4.5						4.5			4.5	
Act Effct Green (s)		33.5						57.5			57.5	
Actuated g/C Ratio		0.34						0.58			0.58	
v/c Ratio		0.24						0.31			0.41	
Control Delay		23.4						11.8			19.9	
Queue Delay		0.0						2.0			1.6	
Total Delay		23.4						13.7			21.4	
LOS		C						B			C	
Approach Delay		23.4						13.7			21.4	
Approach LOS		C						B			C	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 98 (98%), Referenced to phase 4:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.41



# Lanes, Volumes, Timings

## 4485: 7th Ave/Hubbell Pl & Spring St

1/29/2016

Intersection Signal Delay: 19.4

Intersection LOS: B

Intersection Capacity Utilization 47.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 4485: 7th Ave/Hubbell Pl & Spring St



Lanes, Volumes, Timings  
4568: 5th Ave & Spring St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑									↑↑↑	
Traffic Volume (vph)	0	605	55	0	0	0	0	0	0	527	919	0
Future Volume (vph)	0	605	55	0	0	0	0	0	0	527	919	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	12	12	10	10	12
Grade (%)		15%			-5%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3508	0	0	0	0	0	0	0	0	4184	0
Flt Permitted											0.982	
Satd. Flow (perm)	0	3508	0	0	0	0	0	0	0	0	3709	0
Right Turn on Red			Yes			Yes			Yes	Yes		Yes
Satd. Flow (RTOR)		19										27
Link Speed (mph)		25			25			25				25
Link Distance (ft)		362			295			323				278
Travel Time (s)		9.9			8.0			8.8				7.6
Confl. Peds. (#/hr)	210		133	133		210	392		208	208		392
Confl. Bikes (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.25	0.25	0.25	0.25	0.25	0.25	0.93	0.93	0.93
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%	0%	0%	0%	1%	3%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)		30										
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	733	0	0	0	0	0	0	0	0	1555	0
Turn Type		NA								Perm	NA	
Protected Phases		2										4
Permitted Phases										4		
Total Split (s)		28.0								52.0	52.0	
Total Lost Time (s)		3.5									3.5	
Act Effct Green (s)		24.5									48.5	
Actuated g/C Ratio		0.31									0.61	
v/c Ratio		0.67									0.69	
Control Delay		37.8									11.8	
Queue Delay		6.9									1.2	
Total Delay		44.7									13.0	
LOS		D									B	
Approach Delay		44.7									13.0	
Approach LOS		D									B	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 59 (74%), Referenced to phase 2:EBT and 6:, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.69

# Lanes, Volumes, Timings

## 4568: 5th Ave & Spring St

1/29/2016

Intersection Signal Delay: 23.2

Intersection LOS: C

Intersection Capacity Utilization 60.7%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 4568: 5th Ave & Spring St



Lanes, Volumes, Timings  
5005: 19th Ave & E Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕			↕			↕	
Traffic Volume (vph)	108	751	32	3	543	21	23	137	19	23	113	54
Future Volume (vph)	108	751	32	3	543	21	23	137	19	23	113	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		-11%			8%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3587	0	0	3289	0	0	2086	0	0	1962	0
Flt Permitted		0.783			0.952			0.848			0.866	
Satd. Flow (perm)	0	2815	0	0	3130	0	0	1778	0	0	1709	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			6			7			22	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		419			361			534			317	
Travel Time (s)		9.5			8.2			12.1			7.2	
Confl. Peds. (#/hr)	26		40	40		26	7		2	2		7
Confl. Bikes (#/hr)			8			4			1			12
Peak Hour Factor	0.99	0.99	0.99	0.98	0.98	0.98	0.86	0.86	0.86	0.91	0.91	0.91
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)									0			0
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	900	0	0	578	0	0	208	0	0	208	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Total Split (s)	58.0	58.0		58.0	58.0		42.0	42.0		42.0	42.0	
Total Lost Time (s)		6.0			6.0			6.0			6.0	
Act Effct Green (s)		72.3			72.3			15.7			15.7	
Actuated g/C Ratio		0.72			0.72			0.16			0.16	
v/c Ratio		0.44			0.26			0.73			0.73	
Control Delay		11.1			8.6			53.4			50.0	
Queue Delay		0.0			0.2			0.0			0.0	
Total Delay		11.1			8.7			53.4			50.0	
LOS		B			A			D			D	
Approach Delay		11.1			8.7			53.4			50.0	
Approach LOS		B			A			D			D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 40 (40%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.73

# Lanes, Volumes, Timings

## 5005: 19th Ave & E Madison St

1/29/2016

Intersection Signal Delay: 19.3  
Intersection Capacity Utilization 69.9%  
Analysis Period (min) 15

Intersection LOS: B  
ICU Level of Service C

Splits and Phases: 5005: 19th Ave & E Madison St



Lanes, Volumes, Timings  
5349: 14th Ave & E Madison St

1/29/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕			↕			↕	
Traffic Volume (vph)	0	672	51	58	459	0	14	215	53	2	169	12
Future Volume (vph)	0	672	51	58	459	0	14	215	53	2	169	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		7%			-10%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3273	0	0	3606	0	0	2063	0	0	2062	0
Flt Permitted					0.756			0.979			0.998	
Satd. Flow (perm)	0	3273	0	0	2737	0	0	2020	0	0	2058	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10						14			5	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		358			166			347			100	
Travel Time (s)		8.1			3.8			7.9			2.7	
Confl. Peds. (#/hr)	3		31	31		3	37		10	10		37
Confl. Bikes (#/hr)			7			3			1			1
Peak Hour Factor	0.92	0.92	0.92	0.91	0.91	0.91	0.85	0.85	0.85	0.86	0.86	0.86
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)									0			0
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	785	0	0	568	0	0	331	0	0	213	0
Turn Type		NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		1			1			3			6	
Permitted Phases	1			1			3			6		
Total Split (s)	51.0	51.0		51.0	51.0		49.0	49.0		49.0	49.0	
Total Lost Time (s)		4.5			4.5			8.5			4.5	
Act Effct Green (s)		46.5			46.5			40.5			44.5	
Actuated g/C Ratio		0.46			0.46			0.40			0.44	
v/c Ratio		0.51			0.45			0.40			0.23	
Control Delay		17.9			13.2			19.5			12.3	
Queue Delay		1.1			0.0			1.6			0.0	
Total Delay		19.0			13.2			21.1			12.3	
LOS		B			B			C			B	
Approach Delay		19.0			13.2			21.1			12.3	
Approach LOS		B			B			C			B	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 42 (42%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.51

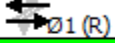



Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Total Split (s)	51.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
 5349: 14th Ave & E Madison St

1/29/2016

Intersection Signal Delay: 16.9 Intersection LOS: B  
 Intersection Capacity Utilization 74.5% ICU Level of Service D  
 Analysis Period (min) 15

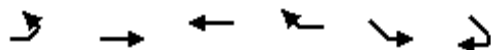
Splits and Phases: 5349: 14th Ave & E Madison St

#5349  Ø1 (R)	#206 #5349  Ø3
51 s	49 s
#2067  Ø4	#206 #5349  Ø6
51 s	49 s



Lanes, Volumes, Timings  
5355: E Madison St & Pine St

1/29/2016



Lane Group	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↕↕	↕↔		↕	↕
Traffic Volume (vph)	16	669	488	197	230	5
Future Volume (vph)	16	669	488	197	230	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	10	12	11	11
Grade (%)		9%	-4%		0%	
Storage Length (ft)	0			0	0	0
Storage Lanes	0			0	1	1
Taper Length (ft)	25				25	
Satd. Flow (prot)	0	3183	3128	0	1678	1351
Flt Permitted		0.932			0.950	
Satd. Flow (perm)	0	2967	3128	0	1674	1197
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			102			6
Link Speed (mph)		30	30		30	
Link Distance (ft)		96	270		127	
Travel Time (s)		2.2	6.1		2.9	
Confl. Peds. (#/hr)	62			62	1	43
Confl. Bikes (#/hr)				3		8
Peak Hour Factor	0.95	0.95	0.94	0.94	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	1%	1%	2%	2%	4%	4%
Bus Blockages (#/hr)	0	0	0	0	0	0
Parking (#/hr)						0
Mid-Block Traffic (%)		0%	0%		0%	
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	721	729	0	256	6
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	2		4	
Permitted Phases	2					4
Total Split (s)	62.0	62.0	62.0		38.0	38.0
Total Lost Time (s)		4.5	4.5		4.5	4.5
Act Effect Green (s)		72.6	72.6		18.4	18.4
Actuated g/C Ratio		0.73	0.73		0.18	0.18
v/c Ratio		0.33	0.32		0.83	0.03
Control Delay		1.0	2.7		60.9	17.6
Queue Delay		0.0	0.3		0.0	0.0
Total Delay		1.0	3.0		60.9	17.6
LOS		A	A		E	B
Approach Delay		1.0	3.0		59.9	
Approach LOS		A	A		E	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 43 (43%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.83

Lanes, Volumes, Timings  
5355: E Madison St & Pine St

1/29/2016

Intersection Signal Delay: 10.9      Intersection LOS: B  
Intersection Capacity Utilization 50.2%      ICU Level of Service A  
Analysis Period (min) 15

Splits and Phases: 5355: E Madison St & Pine St



## **Appendix H: Intersection Operations Results LPA 2015 PM Peak Hour**

# Lanes, Volumes, Timings

## 3: 9th Ave & Spring St

1/22/2016

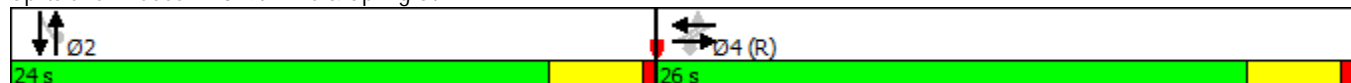


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗		↔			↖			↖	
Traffic Volume (vph)	40	60	162	131	0	10	0	64	1	1	171	0
Future Volume (vph)	40	60	162	131	0	10	0	64	1	1	171	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1643	1425	0	1587	0	0	1673	0	0	1676	0
Flt Permitted		0.873			0.694						0.999	
Satd. Flow (perm)	0	1464	1425	0	1152	0	0	1673	0	0	1675	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			176		22			1				
Link Speed (mph)		25			25			25				25
Link Distance (ft)		317			322			299				155
Travel Time (s)		8.6			8.8			8.2				4.2
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	108	176	0	153	0	0	71	0	0	187	0
Turn Type	Perm	NA	Perm	Perm	NA			NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4		4	4						2		
Total Split (s)	26.0	26.0	26.0	26.0	26.0			24.0		24.0	24.0	
Total Lost Time (s)		4.0	4.0		4.0			4.0			4.0	
Act Effct Green (s)		22.0	22.0		22.0			20.0			20.0	
Actuated g/C Ratio		0.44	0.44		0.44			0.40			0.40	
v/c Ratio		0.17	0.24		0.29			0.11			0.28	
Control Delay		6.7	2.5		9.6			18.3			11.6	
Queue Delay		0.0	0.1		0.1			0.0			1.1	
Total Delay		6.7	2.6		9.8			18.3			12.7	
LOS		A	A		A			B			B	
Approach Delay		4.1			9.8			18.3			12.7	
Approach LOS		A			A			B			B	

### Intersection Summary

Area Type: CBD  
 Cycle Length: 50  
 Actuated Cycle Length: 50  
 Offset: 0 (0%), Referenced to phase 4:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.29  
 Intersection Signal Delay: 9.1  
 Intersection Capacity Utilization 39.9%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service A

Splits and Phases: 3: 9th Ave & Spring St



Lanes, Volumes, Timings  
6: 8th Ave & Spring St

1/22/2016

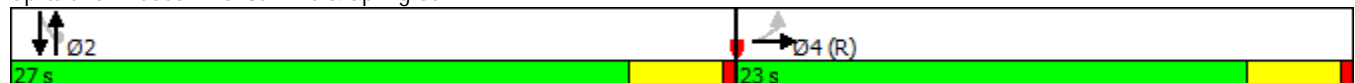


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↔			↕	
Traffic Volume (vph)	72	140	12	0	0	0	0	201	17	105	186	0
Future Volume (vph)	72	140	12	0	0	0	0	201	17	105	186	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	3109	0	0	0	0	0	1660	0	0	1646	0
Flt Permitted		0.984									0.815	
Satd. Flow (perm)	0	3109	0	0	0	0	0	1660	0	0	1366	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13						11				
Link Speed (mph)		30			30			30				25
Link Distance (ft)		301			317			312				149
Travel Time (s)		6.8			7.2			7.1				4.1
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	243	0	0	0	0	0	236	0	0	316	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2				2
Permitted Phases	4									2		
Total Split (s)	23.0	23.0						27.0		27.0	27.0	
Total Lost Time (s)		4.0						4.0			4.0	
Act Effct Green (s)		19.0						23.0			23.0	
Actuated g/C Ratio		0.38						0.46			0.46	
v/c Ratio		0.20						0.31			0.50	
Control Delay		10.4						10.0			13.0	
Queue Delay		0.0						0.0			0.0	
Total Delay		10.4						10.0			13.0	
LOS		B						B			B	
Approach Delay		10.4						10.0			13.0	
Approach LOS		B						B			B	

Intersection Summary

Area Type: CBD  
 Cycle Length: 50  
 Actuated Cycle Length: 50  
 Offset: 0 (0%), Referenced to phase 4:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.50  
 Intersection Signal Delay: 11.3      Intersection LOS: B  
 Intersection Capacity Utilization 47.3%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 6: 8th Ave & Spring St



Lanes, Volumes, Timings  
 2036: Swedish Medical Cntr/Summit Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↶			↶			↷			↷	
Traffic Volume (vph)	0	466	17	0	344	41	12	23	51	7	28	69
Future Volume (vph)	0	466	17	0	344	41	12	23	51	7	28	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	16	12	12	16	12
Grade (%)		3%			-2%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1506	0	0	1475	0	0	1352	0	0	1603	0
Flt Permitted								0.958			0.984	
Satd. Flow (perm)	0	1506	0	0	1475	0	0	1290	0	0	1552	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			14			59			91	
Link Speed (mph)		30			30			15			30	
Link Distance (ft)		318			325			139			185	
Travel Time (s)		7.2			7.4			6.3			4.2	
Confl. Peds. (#/hr)	19		150	150		114	37		123	123		37
Peak Hour Factor	0.89	0.89	0.89	0.97	0.97	0.97	0.87	0.87	0.87	0.76	0.76	0.76
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	543	0	0	397	0	0	99	0	0	137	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases							4			4		
Total Split (s)		72.0			72.0		28.0	28.0		28.0	28.0	
Total Lost Time (s)		3.5			3.5			3.5			3.5	
Act Effect Green (s)		68.5			68.5			24.5			24.5	
Actuated g/C Ratio		0.68			0.68			0.24			0.24	
v/c Ratio		0.53			0.39			0.28			0.31	
Control Delay		2.1			3.9			16.6			14.0	
Queue Delay		0.2			0.3			0.0			0.0	
Total Delay		2.3			4.2			16.6			14.0	
LOS		A			A			B			B	
Approach Delay		2.3			4.2			16.6			14.0	
Approach LOS		A			A			B			B	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	97 (97%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.53
Intersection Signal Delay:	5.5
Intersection LOS:	A
Intersection Capacity Utilization:	48.6%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
2036: Swedish Medical Cntr/Summit Ave & Madison St

1/22/2016

Splits and Phases: 2036: Swedish Medical Cntr/Summit Ave & Madison St

→ Ø2 (R) 72 s	↕ Ø4 28 s
← Ø6 72 s	

Lanes, Volumes, Timings  
 2064: E Madison St & 11th Ave

1/22/2016

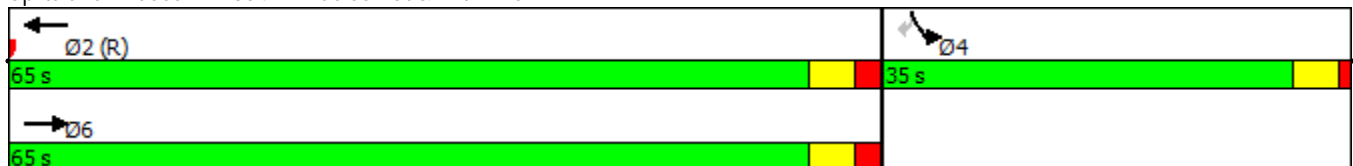


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↘	↗
Traffic Volume (vph)	0	552	180	0	140	112
Future Volume (vph)	0	552	180	0	140	112
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	13	12	10	12
Grade (%)		0%	-4%		0%	
Satd. Flow (prot)	0	1944	1944	0	1620	1398
Flt Permitted					0.950	
Satd. Flow (perm)	0	1944	1944	0	1620	1085
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)						127
Link Speed (mph)		30	30		25	
Link Distance (ft)		110	373		220	
Travel Time (s)		2.5	8.5		6.0	
Confl. Peds. (#/hr)	23			38		61
Confl. Bikes (#/hr)				3		17
Peak Hour Factor	0.90	0.90	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Parking (#/hr)						0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	613	205	0	159	127
Turn Type		NA	NA		Prot	Perm
Protected Phases		6	2		4	
Permitted Phases						4
Total Split (s)		65.0	65.0		35.0	35.0
Total Lost Time (s)		5.5	5.5		4.5	4.5
Act Effect Green (s)		77.2	77.2		12.8	12.8
Actuated g/C Ratio		0.77	0.77		0.13	0.13
v/c Ratio		0.41	0.14		0.77	0.51
Control Delay		1.6	3.6		65.2	14.3
Queue Delay		0.1	0.0		0.3	0.0
Total Delay		1.6	3.6		65.5	14.3
LOS		A	A		E	B
Approach Delay		1.6	3.6		42.8	
Approach LOS		A	A		D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 98 (98%), Referenced to phase 2:WBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.77  
 Intersection Signal Delay: 12.7  
 Intersection LOS: B  
 Intersection Capacity Utilization 50.0%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2064: E Madison St & 11th Ave





Lanes, Volumes, Timings  
2066: 13th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↕			↕	
Traffic Volume (vph)	0	380	0	0	165	3	181	68	62	112	0	39
Future Volume (vph)	0	380	0	0	165	3	181	68	62	112	0	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	11	12	16	16	12	12	13	12
Grade (%)		8%			-7%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1686	0	0	1856	0	0	1903	0	0	1689	0
Flt Permitted								0.748			0.615	
Satd. Flow (perm)	0	1686	0	0	1856	0	0	1337	0	0	1044	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					1			13			19	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		213			358			154			225	
Travel Time (s)		4.8			8.1			3.5			5.1	
Confl. Peds. (#/hr)	28		29	29		28	75		40	40		75
Confl. Bikes (#/hr)												6
Peak Hour Factor	0.90	0.90	0.90	0.95	0.95	0.95	0.87	0.87	0.87	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	422	0	0	177	0	0	357	0	0	170	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4			4	
Permitted Phases							4			4		
Total Split (s)		63.0			63.0		37.0	37.0		37.0	37.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effct Green (s)		58.5			58.5			32.5			32.5	
Actuated g/C Ratio		0.58			0.58			0.32			0.32	
v/c Ratio		0.43			0.16			0.81			0.48	
Control Delay		8.9			7.5			45.9			29.4	
Queue Delay		2.4			0.0			2.9			0.4	
Total Delay		11.4			7.5			48.8			29.8	
LOS		B			A			D			C	
Approach Delay		11.4			7.5			48.8			29.8	
Approach LOS		B			A			D			C	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	5 (5%), Referenced to phase 2:WBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.81
Intersection Signal Delay:	25.4
Intersection LOS:	C
Intersection Capacity Utilization	46.4%
ICU Level of Service	A
Analysis Period (min)	15

Lanes, Volumes, Timings  
2066: 13th Ave & E Madison St

1/22/2016

Splits and Phases: 2066: 13th Ave & E Madison St



Lanes, Volumes, Timings  
2067: 14th Ave & Pike St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	36	45	3	2	2	264	0	0	359	1
Future Volume (vph)	4	0	36	45	3	2	2	264	0	0	359	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	16	12	12	16	12	12	16	12
Grade (%)		6%			-6%			0%				0%
Storage Length (ft)	80		0	0		0	0		0	0		0
Storage Lanes	1		1	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1717	0	1536	0	2071	0	0	2111	0	0	1900	0
Flt Permitted	0.722				0.957			0.998				
Satd. Flow (perm)	1305	0	1536	0	2071	0	0	2107	0	0	1900	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			60		2							
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		214			140			100			208	
Travel Time (s)		4.9			3.2			2.7			5.7	
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
Parking (#/hr)		0									0	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	4	0	39	0	54	0	0	289	0	0	391	0
Turn Type	D.Pm		Perm	Perm	NA		Perm	NA			NA	
Protected Phases					4			6			3	
Permitted Phases	4		4	4			6					
Total Split (s)	51.0		51.0	51.0	51.0		49.0	49.0			49.0	
Total Lost Time (s)	4.5		4.5		4.5			4.5			8.5	
Act Effect Green (s)	46.5		46.5		46.5			44.5			40.5	
Actuated g/C Ratio	0.46		0.46		0.46			0.44			0.40	
v/c Ratio	0.01		0.05		0.06			0.31			0.51	
Control Delay	14.5		2.1		11.3			1.0			25.2	
Queue Delay	0.0		0.1		0.1			0.0			0.0	
Total Delay	14.5		2.1		11.3			1.0			25.2	
LOS	B		A		B			A			C	
Approach Delay					11.3			1.0			25.2	
Approach LOS					B			A			C	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 42 (42%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.77  
 Intersection Signal Delay: 14.0      Intersection LOS: B  
 Intersection Capacity Utilization 45.2%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2067: 14th Ave & Pike St

#5349  Ø1 (R) 51 s	#206#5349  Ø3 49 s
#2067  Ø4 51 s	#206#5349  Ø6 49 s

Lane Group	Ø1
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	1
Permitted Phases	
Total Split (s)	51.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
2070: 17th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↕			↕	
Traffic Volume (vph)	0	761	91	0	307	5	108	29	1	100	17	4
Future Volume (vph)	0	761	91	0	307	5	108	29	1	100	17	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	10	12	10	12	12	16	12
Grade (%)		4%			4%			0%			0%	
Satd. Flow (prot)	0	1732	0	0	1754	0	0	1686	0	0	2028	0
Flt Permitted								0.744			0.724	
Satd. Flow (perm)	0	1732	0	0	1754	0	0	1188	0	0	1409	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			2						1	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		270			381			261			305	
Travel Time (s)		6.1			8.7			5.9			8.3	
Confl. Peds. (#/hr)	95		44	44		95	120		113	113		120
Confl. Bikes (#/hr)			17			23			3			11
Peak Hour Factor	0.92	0.92	0.92	0.96	0.96	0.96	0.80	0.80	0.80	0.93	0.93	0.93
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	926	0	0	325	0	0	172	0	0	130	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases							4			4		
Total Split (s)		72.0			72.0		28.0	28.0		28.0	28.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effct Green (s)		72.1			72.1			18.9			18.9	
Actuated g/C Ratio		0.72			0.72			0.19			0.19	
v/c Ratio		0.74			0.26			0.77			0.49	
Control Delay		15.2			12.0			59.7			41.2	
Queue Delay		1.0			0.0			0.0			0.0	
Total Delay		16.1			12.0			59.7			41.2	
LOS		B			B			E			D	
Approach Delay		16.1			12.0			59.7			41.2	
Approach LOS		B			B			E			D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 49 (49%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.77  
 Intersection Signal Delay: 22.2  
 Intersection LOS: C  
 Intersection Capacity Utilization 61.5%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 2070: 17th Ave & E Madison St



Lanes, Volumes, Timings  
 2071: 20th Ave & E Olive St & E Madison St

1/22/2016



Lane Group	EBT	EBR	EBR2	WBT	NBR2	SBT	SBR	NWL	NWR	NWR2
Lane Configurations	↔			↔	↔	↔		↔		
Traffic Volume (vph)	587	14	3	295	22	10	83	0	15	65
Future Volume (vph)	587	14	3	295	22	10	83	0	15	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	10	12	13	12	16	12	12
Grade (%)	-8%			3%		0%		0%		
Satd. Flow (prot)	3697	0	0	3286	1465	1678	0	1629	0	0
Flt Permitted										
Satd. Flow (perm)	3697	0	0	3286	1465	1678	0	1629	0	0
Right Turn on Red			Yes		Yes		Yes			Yes
Satd. Flow (RTOR)	1				1069	141		79		
Link Speed (mph)	30			30		25		25		
Link Distance (ft)	361			397		423		330		
Travel Time (s)	8.2			9.0		11.5		9.0		
Confl. Peds. (#/hr)		10	2				7		29	12
Peak Hour Factor	0.97	0.97	0.97	0.94	0.79	0.59	0.59	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)		0			0		0		0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	622	0	0	314	28	158	0	97	0	0
Turn Type	NA			NA	Free	NA		Prot		
Protected Phases	2			2		4		1		
Permitted Phases					Free					
Total Split (s)	57.0			57.0		27.0		16.0		
Total Lost Time (s)	4.5			4.5		4.5		4.5		
Act Effect Green (s)	72.8			72.8	100.0	8.2		7.8		
Actuated g/C Ratio	0.73			0.73	1.00	0.08		0.08		
v/c Ratio	0.23			0.13	0.02	0.59		0.49		
Control Delay	2.6			8.5	0.0	19.6		22.6		
Queue Delay	0.2			0.0	0.0	0.0		0.0		
Total Delay	2.8			8.5	0.0	19.6		22.6		
LOS	A			A	A	B		C		
Approach Delay	2.8			8.5		19.6		22.6		
Approach LOS	A			A		B		C		

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 56 (56%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.59  
 Intersection Signal Delay: 8.0  
 Intersection LOS: A  
 Intersection Capacity Utilization 44.4%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2071: 20th Ave & E Olive St & E Madison St



Lanes, Volumes, Timings  
 2073: 22nd Ave/E Denny Way & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	0	653	0	0	285	26	4	80	86	43	123	0
Future Volume (vph)	0	653	0	0	285	26	4	80	86	43	123	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	12	12	10	12	12	11	12	12	12	12
Grade (%)		-3%			1%			0%			0%	
Satd. Flow (prot)	0	3749	0	0	1724	0	0	1616	0	0	1875	0
Flt Permitted								0.994			0.691	
Satd. Flow (perm)	0	3749	0	0	1724	0	0	1608	0	0	1302	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					9			52				
Link Speed (mph)		30			30			25			30	
Link Distance (ft)		175			200			197			246	
Travel Time (s)		4.0			4.5			5.4			5.6	
Confl. Peds. (#/hr)	2		25	25		2	4		39	39		4
Confl. Bikes (#/hr)			1						2			10
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.77	0.77	0.77	0.64	0.64	0.64
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	0%	0%	0%
Parking (#/hr)			0			0						0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	734	0	0	349	0	0	221	0	0	259	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Total Split (s)	67.0	67.0		67.0	67.0		33.0	33.0		33.0	33.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effct Green (s)		70.7			70.7			20.3			20.3	
Actuated g/C Ratio		0.71			0.71			0.20			0.20	
v/c Ratio		0.28			0.29			0.60			0.98	
Control Delay		2.6			5.0			33.4			90.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		2.6			5.0			33.4			90.2	
LOS		A			A			C			F	
Approach Delay		2.6			5.0			33.4			90.2	
Approach LOS		A			A			C			F	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 60 (60%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.98  
 Intersection Signal Delay: 22.0 Intersection LOS: C  
 Intersection Capacity Utilization 54.4% ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2073: 22nd Ave/E Denny Way & E Madison St



Lanes, Volumes, Timings  
2846: 8th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↶			↶↷			↶↷			↶↷	
Traffic Volume (vph)	0	392	9	0	605	15	7	203	32	10	146	42
Future Volume (vph)	0	392	9	0	605	15	7	203	32	10	146	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	10	12	12	12	12
Grade (%)		5%			-10%			0%			0%	
Storage Length (ft)	50		0	0		50	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	60			25			25			25		
Satd. Flow (prot)	0	1504	0	0	3091	0	0	1441	0	0	1578	0
Flt Permitted								0.991			0.979	
Satd. Flow (perm)	0	1504	0	0	3091	0	0	1426	0	0	1540	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		2			5			8			14	
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		329			326			156			312	
Travel Time (s)		7.5			7.4			4.3			8.5	
Confl. Peds. (#/hr)	54		132	132		54	85		92	92		85
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.75	0.75	0.75	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	422	0	0	653	0	0	323	0	0	220	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases							4			4		
Total Split (s)		65.0			65.0		35.0	35.0		35.0	35.0	
Total Lost Time (s)		3.5			3.5			3.5			3.5	
Act Effect Green (s)		61.5			61.5			31.5			31.5	
Actuated g/C Ratio		0.62			0.62			0.32			0.32	
v/c Ratio		0.46			0.34			0.71			0.45	
Control Delay		12.2			6.7			39.6			22.1	
Queue Delay		4.1			0.4			0.0			0.7	
Total Delay		16.3			7.0			39.6			22.8	
LOS		B			A			D			C	
Approach Delay		16.3			7.0			39.6			22.8	
Approach LOS		B			A			D			C	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	10 (10%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.71
Intersection Signal Delay:	18.1
Intersection LOS:	B
Intersection Capacity Utilization:	48.0%
ICU Level of Service:	A
Analysis Period (min):	15



Lanes, Volumes, Timings  
2846: 8th Ave & Madison St

1/22/2016

Splits and Phases: 2846: 8th Ave & Madison St



Lanes, Volumes, Timings  
2865: 9th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↻			↻			↕		↻	↻	
Traffic Volume (vph)	0	411	23	0	608	8	7	57	5	44	415	5
Future Volume (vph)	0	411	23	0	608	8	7	57	5	44	415	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	16	12	12	16	12
Grade (%)		10%			-12%			0%				0%
Storage Length (ft)	0		125	125		0	0		0	75		0
Storage Lanes	0		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1432	0	0	1630	0	0	1732	0	1608	1911	0
Flt Permitted								0.854		0.557		
Satd. Flow (perm)	0	1432	0	0	1630	0	0	1480	0	855	1911	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			1			3			1	
Link Speed (mph)		30			25			25			25	
Link Distance (ft)		326			325			144			299	
Travel Time (s)		7.4			8.9			3.9			8.2	
Confl. Peds. (#/hr)	121		209	209		121	79		52	52		79
Peak Hour Factor	0.83	0.83	0.83	0.88	0.88	0.88	0.95	0.95	0.95	0.87	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	9%	9%	9%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	523	0	0	700	0	0	72	0	51	483	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases							4			8		
Total Split (s)		61.0			61.0		23.0	23.0		39.0	39.0	
Total Lost Time (s)		3.5			3.5			3.5		3.5	3.5	
Act Effct Green (s)		57.5			57.5			19.5		35.5	35.5	
Actuated g/C Ratio		0.58			0.58			0.20		0.36	0.36	
v/c Ratio		0.63			0.75			0.25		0.17	0.71	
Control Delay		15.9			29.8			35.3		22.6	33.2	
Queue Delay		1.3			1.5			0.0		0.0	21.0	
Total Delay		17.2			31.2			35.3		22.6	54.3	
LOS		B			C			D		C	D	
Approach Delay		17.2			31.2			35.3			51.2	
Approach LOS		B			C			D			D	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	27 (27%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	33.2
Intersection LOS:	C
Intersection Capacity Utilization:	67.5%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 2865: 9th Ave & Madison St

1/22/2016

Splits and Phases: 2865: 9th Ave & Madison St



Lane Group	Ø3	Ø5
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	3	5
Permitted Phases		
Total Split (s)	8.0	8.0
Total Lost Time (s)		
Act Effect Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Intersection Summary		

Lanes, Volumes, Timings  
2893: Madison St & Terry Ave

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗			↖				↗			↖
Traffic Volume (vph)	0	450	10	0	477	11	0	0	21	0	0	139
Future Volume (vph)	0	450	10	0	477	11	0	0	21	0	0	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	10	12	12	16	12
Grade (%)		12%			-5%			0%				0%
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		1	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1459	0	0	1560	0	0	0	1465	0	0	1436
Flt Permitted												
Satd. Flow (perm)	0	1459	0	0	1560	0	0	0	1192	0	0	1200
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			3				257			245
Link Speed (mph)		25			30			25				25
Link Distance (ft)		325			319			146				164
Travel Time (s)		8.9			7.3			4.0				4.5
Confl. Peds. (#/hr)	134		117	117		134	53		61	61		53
Peak Hour Factor	0.86	0.86	0.86	0.93	0.93	0.93	0.70	0.70	0.70	0.82	0.82	0.82
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	1%	1%	1%	3%	3%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	535	0	0	525	0	0	0	30	0	0	170
Turn Type		NA			NA				Perm			Perm
Protected Phases		2			6							
Permitted Phases									8			4
Total Split (s)		72.0			72.0				28.0			28.0
Total Lost Time (s)		3.5			3.5				4.0			4.0
Act Effect Green (s)		68.5			68.5				24.0			24.0
Actuated g/C Ratio		0.68			0.68				0.24			0.24
v/c Ratio		0.54			0.49				0.06			0.36
Control Delay		10.0			7.7				0.2			3.0
Queue Delay		6.1			0.8				0.0			6.6
Total Delay		16.1			8.5				0.3			9.6
LOS		B			A				A			A
Approach Delay		16.1			8.5							
Approach LOS		B			A							

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	47 (47%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.54
Intersection Signal Delay:	11.7
Intersection LOS:	B
Intersection Capacity Utilization:	50.2%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
2893: Madison St & Terry Ave

1/22/2016

Splits and Phases: 2893: Madison St & Terry Ave

→ Ø2 (R) 72 s	↶ Ø4 28 s
← Ø6 72 s	↷ Ø8 28 s

Lanes, Volumes, Timings  
2896: Madison St & Minor Ave

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖			↖			↕			↕	
Traffic Volume (vph)	0	481	19	0	420	5	6	145	1	1	234	50
Future Volume (vph)	0	481	19	0	420	5	6	145	1	1	234	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	16	12	12	16	12
Grade (%)		2%			-3%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1506	0	0	1561	0	0	1892	0	0	1711	0
Flt Permitted								0.984				
Satd. Flow (perm)	0	1506	0	0	1561	0	0	1854	0	0	1710	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			1							12
Link Speed (mph)		30			30			30				30
Link Distance (ft)		324			318			151				149
Travel Time (s)		7.4			7.2			3.4				3.4
Confl. Peds. (#/hr)	127		267	267		127	137		87	87		137
Peak Hour Factor	0.97	0.97	0.97	0.95	0.95	0.95	0.77	0.77	0.77	0.81	0.81	0.81
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	516	0	0	447	0	0	197	0	0	352	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases							4			4		
Total Split (s)		63.0			63.0		37.0	37.0		37.0		37.0
Total Lost Time (s)		3.5			3.5			3.5				3.5
Act Effect Green (s)		59.5			59.5			33.5				33.5
Actuated g/C Ratio		0.60			0.60			0.34				0.34
v/c Ratio		0.58			0.48			0.32				0.61
Control Delay		6.1			10.2			26.5				32.1
Queue Delay		5.9			0.6			0.4				2.8
Total Delay		12.0			10.9			26.9				34.9
LOS		B			B			C				C
Approach Delay		12.0			10.9			26.9				34.9
Approach LOS		B			B			C				C

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	92 (92%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.61
Intersection Signal Delay:	18.9
Intersection LOS:	B
Intersection Capacity Utilization:	55.1%
ICU Level of Service:	B
Analysis Period (min):	15

Lanes, Volumes, Timings  
2896: Madison St & Minor Ave

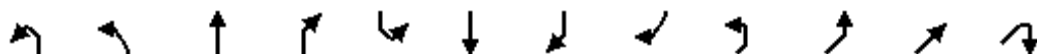
1/22/2016

Splits and Phases: 2896: Madison St & Minor Ave



Lanes, Volumes, Timings  
4018: E Madison St & 12th Ave & Union St

1/22/2016



Lane Group	NBL2	NBL	NBT	NBR	SBL	SBT	SBR	SBR2	NEL2	NEL	NET	NER
Lane Configurations												
Traffic Volume (vph)	24	27	317	76	154	364	32	2	8	66	521	97
Future Volume (vph)	24	27	317	76	154	364	32	2	8	66	521	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	11	12	10	10	12	12	12	12	15	12
Grade (%)			0%			0%						4%
Storage Length (ft)		145		0	160		0			175		0
Storage Lanes		1		1	1		0			1		0
Taper Length (ft)		25			25					25		
Satd. Flow (prot)	0	1668	1818	1599	1652	1500	0	0	0	1751	1967	0
Flt Permitted		0.229			0.388					0.950		
Satd. Flow (perm)	0	364	1818	1599	637	1500	0	0	0	1602	1967	0
Right Turn on Red				Yes				Yes				Yes
Satd. Flow (RTOR)				131								13
Link Speed (mph)			30			30						30
Link Distance (ft)			172			409						373
Travel Time (s)			3.9			9.3						8.5
Confl. Peds. (#/hr)	96	34		41	41		96	34	34	27		45
Peak Hour Factor	0.96	0.96	0.96	0.96	0.86	0.86	0.86	0.86	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%	2%	2%	1%	1%	1%	1%
Parking (#/hr)						0						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	53	330	79	179	462	0	0	0	77	644	0
Turn Type	Perm	Perm	NA	Prot	Perm	NA			Prot	Prot	NA	
Protected Phases			4	4		8			1	1	5 6	
Permitted Phases	4	4			8							
Total Split (s)	38.0	38.0	38.0	38.0	38.0	38.0			11.0	11.0		
Total Lost Time (s)		5.0	5.0	5.0	5.5	5.5				5.5		
Act Effect Green (s)		33.0	33.0	33.0	32.5	32.5				5.5	47.5	
Actuated g/C Ratio		0.33	0.33	0.33	0.32	0.32				0.06	0.48	
v/c Ratio		0.44	0.55	0.13	0.86	0.95				0.80	0.68	
Control Delay		40.4	31.7	1.4	69.7	64.3				91.5	21.3	
Queue Delay		0.0	0.0	0.0	0.0	0.0				0.0	2.1	
Total Delay		40.4	31.7	1.4	69.7	64.3				91.5	23.4	
LOS		D	C	A	E	E				F	C	
Approach Delay			27.5			65.8					30.7	
Approach LOS			C			E					C	

Intersection Summary

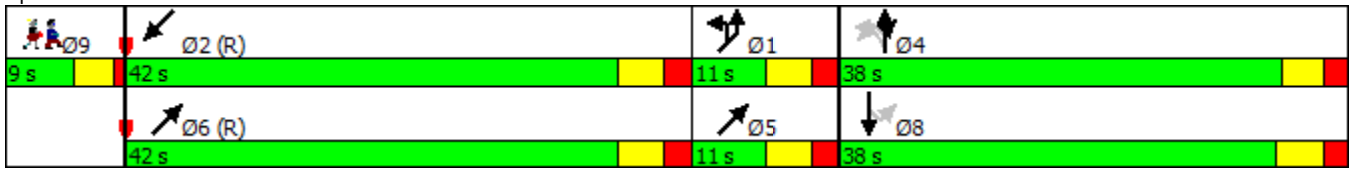
Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	98 (98%), Referenced to phase 2:SWT and 6:NET, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.95
Intersection Signal Delay:	41.7
Intersection LOS:	D
Intersection Capacity Utilization:	74.8%
ICU Level of Service:	D
Analysis Period (min):	15



Lanes, Volumes, Timings  
4018: E Madison St & 12th Ave & Union St

1/22/2016

Splits and Phases: 4018: E Madison St & 12th Ave & Union St



Lane Group	SWT	SWR	SWR2	Ø5	Ø6	Ø9
Lane Configurations	↶					
Traffic Volume (vph)	124	245	16			
Future Volume (vph)	124	245	16			
Ideal Flow (vphpl)	1900	1900	1900			
Lane Width (ft)	11	12	12			
Grade (%)	-8%					
Storage Length (ft)	0					
Storage Lanes	0					
Taper Length (ft)						
Satd. Flow (prot)	1507	0	0			
Flt Permitted						
Satd. Flow (perm)	1507	0	0			
Right Turn on Red	Yes					
Satd. Flow (RTOR)	2					
Link Speed (mph)	30					
Link Distance (ft)	165					
Travel Time (s)	3.8					
Confl. Peds. (#/hr)	34		27			
Peak Hour Factor	0.92	0.92	0.92			
Heavy Vehicles (%)	2%	2%	2%			
Parking (#/hr)						
Shared Lane Traffic (%)						
Lane Group Flow (vph)	418	0	0			
Turn Type	NA					
Protected Phases	2			5	6	9
Permitted Phases						
Total Split (s)	42.0			11.0	42.0	9.0
Total Lost Time (s)	5.5					
Act Effect Green (s)	36.5					
Actuated g/C Ratio	0.36					
v/c Ratio	0.76					
Control Delay	32.4					
Queue Delay	7.0					
Total Delay	39.4					
LOS	D					
Approach Delay	39.4					
Approach LOS	D					

Intersection Summary

Lanes, Volumes, Timings  
4030: 1st Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑	↑	↑			↑	
Traffic Volume (vph)	0	0	0	80	302	104	42	307	0	0	241	107
Future Volume (vph)	0	0	0	80	302	104	42	307	0	0	241	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	13	13	10	10	10	10	9	11	13
Grade (%)		8%			-15%			0%				0%
Storage Length (ft)	0		0	25		0	0		0	0		0
Storage Lanes	0		0	0		1	1		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	3275	1384	1458	1455	0	0	1298	0
Flt Permitted					0.990		0.950					
Satd. Flow (perm)	0	0	0	0	3074	1180	1042	1455	0	0	1298	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						113						30
Link Speed (mph)		25			25			25				25
Link Distance (ft)		271			338			254				321
Travel Time (s)		7.4			9.2			6.9				8.8
Confl. Peds. (#/hr)	52		117	117		52	707		177	177		707
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	4%	4%	4%
Bus Blockages (#/hr)	0	0	0	0	8	8	0	13	0	0	0	0
Parking (#/hr)			0		0							
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	415	113	46	334	0	0	378	0
Turn Type				Perm	NA	custom	Prot	NA				NA
Protected Phases					8	3	5	2				6
Permitted Phases				8		8						
Total Split (s)				34.0	34.0	19.0	15.0	46.0				31.0
Total Lost Time (s)					4.0	4.5	3.5	4.0				4.0
Act Effct Green (s)					30.0	29.5	11.5	42.0				27.0
Actuated g/C Ratio					0.38	0.37	0.14	0.52				0.34
v/c Ratio					0.36	0.21	0.22	0.44				0.83
Control Delay					22.6	11.8	33.3	14.0				33.5
Queue Delay					0.0	0.0	0.0	0.7				0.6
Total Delay					22.6	11.8	33.3	14.7				34.1
LOS					C	B	C	B				C
Approach Delay					20.3			17.0				34.1
Approach LOS					C			B				C

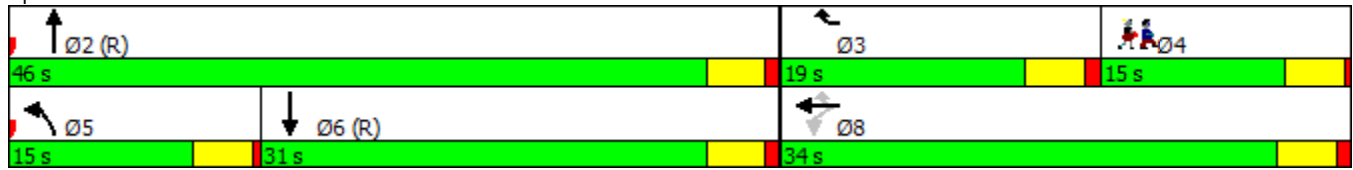
Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	56 (70%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.83
Intersection Signal Delay:	23.4
Intersection LOS:	C
Intersection Capacity Utilization:	53.2%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4030: 1st Ave & Madison St

1/22/2016

Splits and Phases: 4030: 1st Ave & Madison St



Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Total Split (s)	15.0
Total Lost Time (s)	
Act Effect Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
4031: 3rd Ave & Madison St

1/22/2016

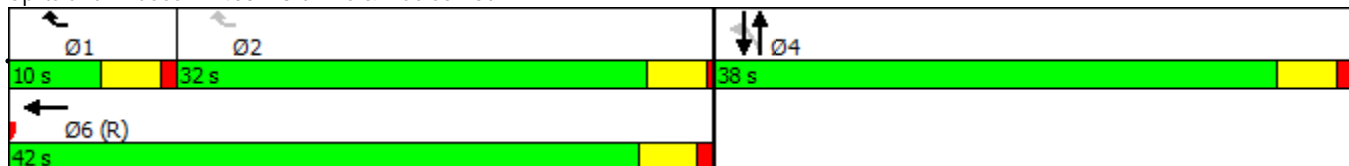


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑			↑↑	
Traffic Volume (vph)	0	0	0	0	405	10	0	20	0	0	0	77
Future Volume (vph)	0	0	0	0	405	10	0	20	0	0	0	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	10	13	12	12	13	12	12	12	12
Grade (%)		13%			-14%			5%			-5%	
Satd. Flow (prot)	0	0	0	0	3149	1372	0	1447	0	0	1305	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3149	933	0	1447	0	0	1305	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						20						82
Link Speed (mph)		30			25			25				25
Link Distance (ft)		309			297			231				321
Travel Time (s)		7.0			8.1			6.3				8.8
Confl. Peds. (#/hr)	279		221	221		279	463		239	239		463
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	100%	90%	4%	12%	90%	12%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	58	0	0	59	0
Parking (#/hr)					15	0		0	0			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	440	11	0	22	0	0	84	0
Turn Type					NA	custom		NA			NA	
Protected Phases					6	1		4				4
Permitted Phases						2	4					
Total Split (s)					42.0	10.0	38.0	38.0				38.0
Total Lost Time (s)					4.0	4.5		4.0				4.0
Act Effect Green (s)					38.0	33.0		34.0				34.0
Actuated g/C Ratio					0.48	0.41		0.42				0.42
v/c Ratio					0.29	0.03		0.04				0.14
Control Delay					7.8	1.1		13.8				2.0
Queue Delay					0.0	0.0		0.0				0.0
Total Delay					7.8	1.1		13.8				2.0
LOS					A	A		B				A
Approach Delay					7.7			13.8				2.0
Approach LOS					A			B				A

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 2 (3%), Referenced to phase 6:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.29  
 Intersection Signal Delay: 7.0      Intersection LOS: A  
 Intersection Capacity Utilization 31.6%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4031: 3rd Ave & Madison St



Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	32.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
4032: 6th Ave & Madison St

1/22/2016

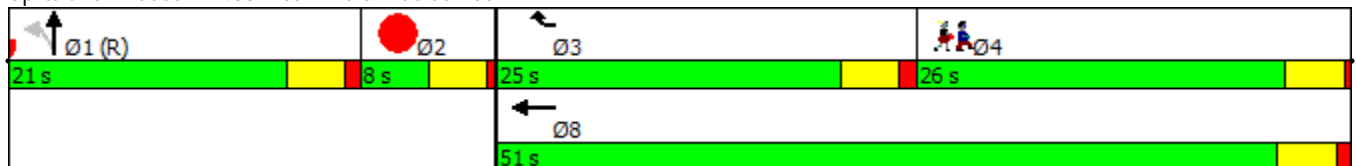


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑	↑↑		↑↑				
Traffic Volume (vph)	0	0	0	0	714	707	39	146	190	0	0	0
Future Volume (vph)	0	0	0	0	714	707	39	146	190	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	10	10	12	12	12	12	12	12
Grade (%)		13%			-5%			5%			-5%	
Satd. Flow (prot)	0	0	0	0	1604	2399	0	2463	0	0	0	0
Flt Permitted								0.995				
Satd. Flow (perm)	0	0	0	0	1604	2399	0	2386	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)						664		221				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		287			328			245			323	
Travel Time (s)		7.8			8.9			6.7			8.8	
Confl. Peds. (#/hr)	117		343	343		117	186		4	4		186
Confl. Bikes (#/hr)			3			26			2			3
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	6%	6%	6%	2%	2%	2%
Parking (#/hr)								15				
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	776	768	0	408	0	0	0	0
Turn Type					NA	custom	Perm	NA				
Protected Phases					8	3		1				
Permitted Phases							1					
Total Split (s)					51.0	25.0	21.0	21.0				
Total Lost Time (s)					4.0	4.0		4.0				
Act Effect Green (s)					47.0	21.0		17.0				
Actuated g/C Ratio					0.59	0.26		0.21				
v/c Ratio					0.82	0.69		0.60				
Control Delay					19.3	7.1		16.8				
Queue Delay					18.5	0.8		0.1				
Total Delay					37.8	7.9		16.9				
LOS					D	A		B				
Approach Delay					22.9			16.9				
Approach LOS					C			B				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 0 (0%), Referenced to phase 1:NBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.82  
 Intersection Signal Delay: 21.7  
 Intersection LOS: C  
 Intersection Capacity Utilization 64.5%  
 ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 4032: 6th Ave & Madison St



Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Parking (#/hr)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	4
Permitted Phases		
Total Split (s)	8.0	26.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑↑↑		↖	↗	↗		↕	
Traffic Volume (vph)	0	190	0	0	653	1	553	419	199	12	0	215
Future Volume (vph)	0	190	0	0	653	1	553	419	199	12	0	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	10	12	12	12	12	12	14	12
Grade (%)		5%			-5%			5%			-5%	
Storage Length (ft)	0		0	0		0	0		180	0		0
Storage Lanes	0		0	1		0	1		2	0		0
Taper Length (ft)	25			60			0			25		
Satd. Flow (prot)	0	1513	0	0	4377	0	1475	1540	1389	0	1570	0
Flt Permitted							0.607	0.913			0.971	
Satd. Flow (perm)	0	1513	0	0	4377	0	941	1417	1235	0	1527	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)									65			20
Link Speed (mph)		30			30			25				25
Link Distance (ft)		328			329			522				327
Travel Time (s)		7.5			7.5			14.2				8.9
Confl. Peds. (#/hr)	119		211	211		119	2		42	42		2
Confl. Bikes (#/hr)			2			9			22			4
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
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)	0	15										
Shared Lane Traffic (%)							14%					
Lane Group Flow (vph)	0	207	0	0	711	0	517	539	216	0	247	0
Turn Type		NA			NA		Perm	NA	Perm	D.Pm	NA	
Protected Phases		2			6			4				
Permitted Phases							4		4	4		4
Total Split (s)		28.0			28.0		52.0	52.0	52.0	52.0		52.0
Total Lost Time (s)		3.5			3.5		3.5	3.5	3.5			3.5
Act Effct Green (s)		24.5			24.5		48.5	48.5	48.5			48.5
Actuated g/C Ratio		0.31			0.31		0.61	0.61	0.61			0.61
v/c Ratio		0.45			0.53		0.91	0.63	0.28			0.26
Control Delay		19.1			24.7		37.4	14.1	6.2			7.6
Queue Delay		0.0			0.7		0.0	0.0	0.0			0.8
Total Delay		19.1			25.5		37.4	14.1	6.2			8.4
LOS		B			C		D	B	A			A
Approach Delay		19.1			25.5			22.2				8.4
Approach LOS		B			C			C				A

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	16 (20%), Referenced to phase 6:WBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.91
Intersection Signal Delay:	21.5
Intersection LOS:	C
Intersection Capacity Utilization:	71.8%
ICU Level of Service:	C
Analysis Period (min):	15



Lanes, Volumes, Timings

4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/22/2016

Splits and Phases: 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St



Lanes, Volumes, Timings  
4034: Boren Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↕		↖	↗	
Traffic Volume (vph)	11	456	4	30	436	10	17	755	2	42	830	35
Future Volume (vph)	11	456	4	30	436	10	17	755	2	42	830	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	9	11	12	10	10	12	9	10	12	9	10	12
Grade (%)		5%			-2%			0%				5%
Storage Length (ft)	50		125	75		125	0		0	200		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1384	1511	0	1487	1499	0	1433	2940	0	1398	2823	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1161	1511	0	1342	1499	0	1319	2940	0	1222	2823	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					1							5
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		319			324			361			293	
Travel Time (s)		7.3			7.4			8.2			6.7	
Confl. Peds. (#/hr)	189		91	91		189	94		142	142		94
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	8	0	0	8	0	0	5	0	0	4	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	12	500	0	33	485	0	18	823	0	46	940	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	12.0	38.0		12.0	38.0		12.0	38.0		12.0	38.0	
Total Lost Time (s)	4.0	3.5		4.0	3.5		4.0	3.5		4.0	3.5	
Act Effct Green (s)	7.6	35.2		7.8	40.0		12.1	34.5		12.1	34.5	
Actuated g/C Ratio	0.08	0.35		0.08	0.40		0.12	0.34		0.12	0.34	
v/c Ratio	0.11	0.94		0.29	0.81		0.10	0.81		0.27	0.96	
Control Delay	41.4	49.3		53.4	38.7		44.3	37.4		47.9	53.9	
Queue Delay	0.0	7.0		0.0	4.9		0.0	0.0		0.0	0.0	
Total Delay	41.4	56.4		53.4	43.6		44.3	37.4		47.9	53.9	
LOS	D	E		D	D		D	D		D	D	
Approach Delay		56.0			44.2			37.6			53.6	
Approach LOS		E			D			D			D	











Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	34 (34%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.96
Intersection Signal Delay:	47.6
Intersection LOS:	D
Intersection Capacity Utilization	68.8%
ICU Level of Service	C
Analysis Period (min)	15

Lanes, Volumes, Timings  
 4034: Boren Ave & Madison St

1/22/2016

Splits and Phases: 4034: Boren Ave & Madison St

 Ø1 12 s		 Ø2 (R) 38 s	 Ø3 12 s	 Ø4 38 s
 Ø5 12 s		 Ø6 (R) 38 s	 Ø7 12 s	 Ø8 38 s

Lanes, Volumes, Timings  
4035: Broadway & Madison St/E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	147	432	26	47	240	5	0	182	120	0	229	113
Future Volume (vph)	147	432	26	47	240	5	0	182	120	0	229	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	10	12	10	10	12	12	13	12	12	13	12
Grade (%)		-9%			8%			0%				0%
Storage Length (ft)	75		125	50		125	0		0	0		0
Storage Lanes	1		0	1		0	0		1	0		0
Taper Length (ft)	50			25			25			25		
Satd. Flow (prot)	1788	1753	0	1586	1488	0	0	1732	1425	0	1414	0
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	1539	1753	0	1312	1488	0	0	1732	1425	0	1414	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			1				126			45
Link Speed (mph)		30			30			30				30
Link Distance (ft)		306			247			367				184
Travel Time (s)		7.0			5.6			8.3				4.2
Confl. Peds. (#/hr)	130		130	130		130	130		130	130		130
Peak Hour Factor	0.84	0.87	0.73	0.80	0.88	0.68	0.25	0.88	0.95	0.25	0.94	0.72
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Parking (#/hr)					0	0		0	0		0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	175	533	0	59	280	0	0	207	126	0	401	0
Turn Type	Prot	NA		Prot	NA			NA	custom		NA	
Protected Phases	5	2		1	6			4	3		8	
Permitted Phases								3				
Total Split (s)	18.0	30.0		18.0	30.0			25.0	27.0		52.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5	4.5		3.5	
Act Effect Green (s)	13.2	43.6		12.5	43.6			32.7	7.8		32.7	
Actuated g/C Ratio	0.13	0.44		0.12	0.44			0.33	0.08		0.33	
v/c Ratio	0.74	0.70		0.30	0.43			0.37	0.56		0.82	
Control Delay	62.1	33.1		45.1	29.6			25.8	17.7		39.8	
Queue Delay	0.0	3.4		0.0	0.0			0.0	0.0		0.0	
Total Delay	62.1	36.5		45.1	29.6			25.8	17.7		39.8	
LOS	E	D		D	C			C	B		D	
Approach Delay		42.8			32.3			22.7			39.8	
Approach LOS		D			C			C			D	

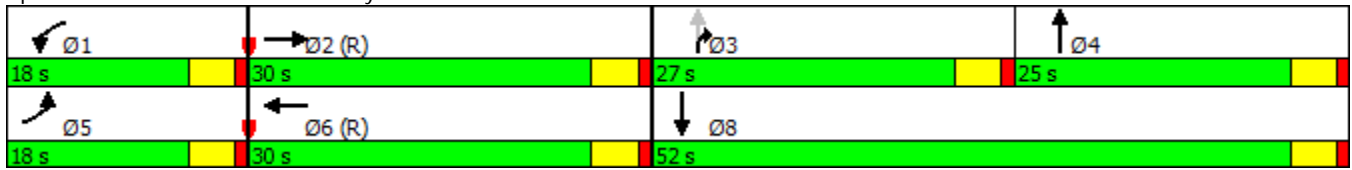
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	2 (2%), Referenced to phase 2:EBT and 6:WBT, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.82
Intersection Signal Delay:	36.4
Intersection LOS:	D
Intersection Capacity Utilization:	60.0%
ICU Level of Service:	B
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4035: Broadway & Madison St/E Madison St

1/22/2016

Splits and Phases: 4035: Broadway & Madison St/E Madison St



# Lanes, Volumes, Timings

## 4039: E Madison St & 15th Ave

1/22/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø1	Ø4
Lane Configurations		↑	↔			↗		
Traffic Volume (vph)	0	443	78	0	0	77		
Future Volume (vph)	0	443	78	0	0	77		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	12	11	11	12	12	16		
Grade (%)		10%	-9%		0%			
Satd. Flow (prot)	0	1728	1900	0	0	1774		
Flt Permitted								
Satd. Flow (perm)	0	1728	1900	0	0	1738		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)						829		
Link Speed (mph)		30	30		30			
Link Distance (ft)		260	156		233			
Travel Time (s)		5.9	3.5		5.3			
Confl. Peds. (#/hr)	59			59	47	1		
Confl. Bikes (#/hr)				2				
Peak Hour Factor	0.93	0.93	0.85	0.85	0.85	0.85		
Heavy Vehicles (%)	1%	1%	1%	1%	5%	5%		
Parking (#/hr)				0				
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	476	92	0	0	91		
Turn Type		NA	NA			Free		
Protected Phases		2	6				1	4
Permitted Phases						Free		
Total Split (s)		68.0	76.0				8.0	24.0
Total Lost Time (s)		4.5	4.5					
Act Effect Green (s)		83.2	83.2			100.0		
Actuated g/C Ratio		0.83	0.83			1.00		
v/c Ratio		0.33	0.06			0.05		
Control Delay		2.7	1.6			0.1		
Queue Delay		0.2	0.0			0.0		
Total Delay		2.9	1.6			0.1		
LOS		A	A			A		
Approach Delay		2.9	1.6					
Approach LOS		A	A					

### Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 37 (37%), Referenced to phase 2:EBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.33  
 Intersection Signal Delay: 2.3  
 Intersection Capacity Utilization 34.1%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service A

Splits and Phases: 4039: E Madison St & 15th Ave



Lanes, Volumes, Timings  
4040: E Madison St & 23rd Ave E

1/22/2016



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↑↑			↑↑		↑	↑↑		↑	↑↑	
Traffic Volume (vph)	0	603	32	0	611	74	337	433	60	99	248	2
Future Volume (vph)	0	603	32	0	611	74	337	433	60	99	248	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	9	9	10	10	10	10	16	10	9	10	10
Grade (%)		0%			0%			-5%			10%	
Storage Length (ft)	0		0	0		0	167		0	50		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3185	0	0	3279	0	1693	4037	0	1528	3132	0
Flt Permitted							0.950			0.950		
Satd. Flow (perm)	0	3185	0	0	3279	0	1693	4037	0	1528	3132	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			16			17			1	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		379			190			361			250	
Travel Time (s)		8.6			4.3			8.2			5.7	
Confl. Peds. (#/hr)			2	2								3
Peak Hour Factor	0.92	0.87	0.69	0.25	0.91	0.92	0.92	0.92	0.92	0.64	0.92	0.46
Heavy Vehicles (%)	2%	1%	1%	1%	1%	2%	2%	2%	2%	1%	2%	1%
Parking (#/hr)			0									0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	739	0	0	751	0	366	536	0	155	274	0
Turn Type		NA			NA		Prot	NA		Prot	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases												
Total Split (s)		45.0			45.0		30.0	39.0		16.0	25.0	
Total Lost Time (s)		3.0			3.0		3.0	3.0		3.0	4.5	
Act Effct Green (s)		42.0			42.0		25.4	36.0		13.0	22.1	
Actuated g/C Ratio		0.42			0.42		0.25	0.36		0.13	0.22	
v/c Ratio		0.55			0.54		0.85	0.37		0.78	0.40	
Control Delay		23.5			23.1		61.3	22.8		69.5	35.8	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		23.5			23.1		61.3	22.8		69.5	35.8	
LOS		C			C		E	C		E	D	
Approach Delay		23.5			23.1			38.4			47.9	
Approach LOS		C			C			D			D	

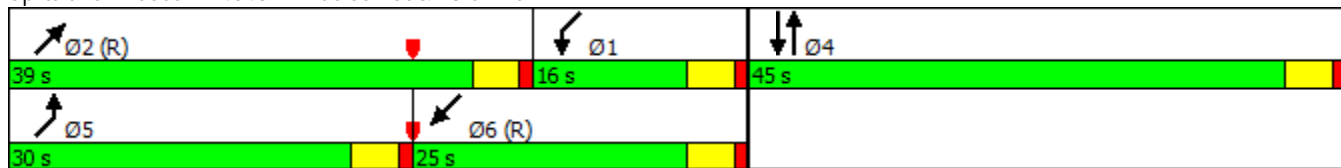
Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 72 (72%), Referenced to phase 2:NET and 6:SWT, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.85  
 Intersection Signal Delay: 31.9  
 Intersection LOS: C  
 Intersection Capacity Utilization 63.3%  
 ICU Level of Service B  
 Analysis Period (min) 15

Lanes, Volumes, Timings  
 4040: E Madison St & 23rd Ave E

1/22/2016

Splits and Phases: 4040: E Madison St & 23rd Ave E





Lanes, Volumes, Timings  
4041: 3rd Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	529	18	0	0	0	0	0	30	0	55	0
Future Volume (vph)	5	529	18	0	0	0	0	0	30	0	55	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	11	12	12	11	12
Grade (%)		10%			-10%			5%			0%	
Satd. Flow (prot)	1513	2781	0	0	0	0	0	1254	0	0	1438	0
Flt Permitted	0.950											
Satd. Flow (perm)	1055	2781	0	0	0	0	0	1254	0	0	1438	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5						82				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		306			298			321			283	
Travel Time (s)		8.3			8.1			8.8			7.7	
Confl. Peds. (#/hr)	197		184	184		197	473		302	302		473
Confl. Bikes (#/hr)			22			13			2			7
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	14%	90%	14%	15%	90%	15%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	56	0	0	65	0
Parking (#/hr)								0	0			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	595	0	0	0	0	0	33	0	0	60	0
Turn Type	custom	NA						NA			NA	
Protected Phases	1	6						4			4	
Permitted Phases	2									4		
Total Split (s)	10.0	38.0						42.0		42.0	42.0	
Total Lost Time (s)	4.0	4.0						4.0			4.0	
Act Effect Green (s)	30.0	34.0						38.0			38.0	
Actuated g/C Ratio	0.38	0.42						0.48			0.48	
v/c Ratio	0.01	0.50						0.05			0.09	
Control Delay	22.4	26.2						2.6			12.0	
Queue Delay	0.0	0.4						0.0			0.0	
Total Delay	22.4	26.6						2.6			12.0	
LOS	C	C						A			B	
Approach Delay		26.6						2.6			12.0	
Approach LOS		C						A			B	

Intersection Summary





Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	22 (28%), Referenced to phase 1:EBL, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.50
Intersection Signal Delay:	24.2
Intersection LOS:	C
Intersection Capacity Utilization	35.5%
ICU Level of Service	A
Analysis Period (min)	15

# Lanes, Volumes, Timings

## 4041: 3rd Ave & Spring St

1/22/2016

Splits and Phases: 4041: 3rd Ave & Spring St

 Ø1 (R)	 Ø2	 Ø4
10 s	28 s	42 s
 Ø6		
38 s		

Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	28.0
Total Lost Time (s)	
Act Effect Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

# Lanes, Volumes, Timings

## 4042: 1st Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↔		↕	↕	
Traffic Volume (vph)	91	220	16	0	0	0	0	321	106	82	332	0
Future Volume (vph)	91	220	16	0	0	0	0	321	106	82	332	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	12	12	12	10	10	10	10	10	10
Grade (%)		9%			0%			3%			0%	
Satd. Flow (prot)	0	2509	0	0	0	0	0	1031	0	1430	1280	0
Flt Permitted		0.986								0.950		
Satd. Flow (perm)	0	2158	0	0	0	0	0	1031	0	1174	1280	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6						26				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		280			339			321			346	
Travel Time (s)		7.6			9.2			8.8			9.4	
Confl. Peds. (#/hr)	189		101	101		189	419		295	295		419
Confl. Bikes (#/hr)			2			4			14			24
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	6%	6%	6%
Parking (#/hr)	14	14	14					24	24		10	40
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	355	0	0	0	0	0	464	0	89	361	0
Turn Type	Perm	NA						NA	custom	NA		
Protected Phases		4						9		2	6	
Permitted Phases	4	4								2		
Total Split (s)	23.0	23.0						38.0		11.0	57.0	
Total Lost Time (s)		4.0						4.0		3.5	4.0	
Act Effct Green (s)		19.0						34.0		7.5	53.0	
Actuated g/C Ratio		0.24						0.42		0.09	0.66	
v/c Ratio		0.69						1.02		0.66	0.43	
Control Delay		35.2						66.8		60.5	8.2	
Queue Delay		0.0						0.0		0.0	0.0	
Total Delay		35.2						66.8		60.5	8.2	
LOS		D						E		E	A	
Approach Delay		35.2						66.8			18.6	
Approach LOS		D						E			B	

### Intersection Summary

Area Type: CBD

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 49 (61%), Referenced to phase 2:SBL and 6:SBT, Start of 1st Green

Control Type: Pretimed

Maximum v/c Ratio: 1.02

Intersection Signal Delay: 40.8

Intersection LOS: D

Intersection Capacity Utilization 57.0%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 4042: 1st Ave & Spring St



Lane Group	Ø1
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	1
Permitted Phases	
Total Split (s)	8.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Lanes, Volumes, Timings  
 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St

1/22/2016

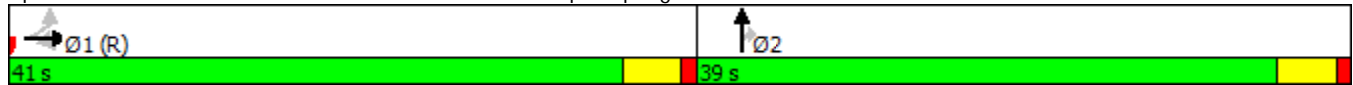


Lane Group	EBL	EBT	EBR	NBT	NBR	NBR2
Lane Configurations						
Traffic Volume (vph)	70	151	777	123	18	712
Future Volume (vph)	70	151	777	123	18	712
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	10	11	12
Grade (%)		10%		5%		
Satd. Flow (prot)	1513	1202	1354	2899	1343	0
Flt Permitted	0.950					
Satd. Flow (perm)	1327	1202	1324	2899	1308	0
Right Turn on Red	Yes					No
Satd. Flow (RTOR)	76					
Link Speed (mph)		25		25		
Link Distance (ft)		295		323		
Travel Time (s)		8.0		8.8		
Confl. Peds. (#/hr)	118		1		11	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Bus Blockages (#/hr)	0	5	0	0	0	0
Parking (#/hr)		15				
Shared Lane Traffic (%)						
Lane Group Flow (vph)	76	164	845	134	794	0
Turn Type	Perm	NA	Perm	NA	Perm	
Protected Phases		1		2		
Permitted Phases	1		1		2	
Total Split (s)	41.0	41.0	41.0	39.0	39.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	
Act Effect Green (s)	36.5	36.5	36.5	34.5	34.5	
Actuated g/C Ratio	0.46	0.46	0.46	0.43	0.43	
v/c Ratio	0.12	0.30	1.40	0.11	1.41	
Control Delay	2.8	12.4	208.1	9.0	210.7	
Queue Delay	0.0	0.0	0.8	0.0	0.3	
Total Delay	2.8	12.4	208.9	9.0	211.0	
LOS	A	B	F	A	F	
Approach Delay		164.7		181.8		
Approach LOS		F		F		

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 66 (83%), Referenced to phase 1:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.41  
 Intersection Signal Delay: 172.6  
 Intersection Capacity Utilization 112.4%  
 Analysis Period (min) 15  
 Intersection LOS: F  
 ICU Level of Service H

Splits and Phases: 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St



Lanes, Volumes, Timings  
4059: Boylston Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↶			↶			↷			↷	
Traffic Volume (vph)	0	520	4	0	348	5	6	158	11	74	35	31
Future Volume (vph)	0	520	4	0	348	5	6	158	11	74	35	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	15	12	12	15	12
Grade (%)		2%			9%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			70			25			25		
Satd. Flow (prot)	0	1544	0	0	1488	0	0	1846	0	0	1669	0
Flt Permitted								0.990			0.535	
Satd. Flow (perm)	0	1544	0	0	1488	0	0	1825	0	0	892	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			2			3			14	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		325			306			184			179	
Travel Time (s)		7.4			7.0			4.2			4.1	
Confl. Peds. (#/hr)	35		62	62		35	56		33	33		56
Peak Hour Factor	0.82	0.82	0.82	0.88	0.88	0.88	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	2%	2%	2%
Parking (#/hr)			0									
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	639	0	0	401	0	0	216	0	0	172	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases							4			4		
Total Split (s)		72.0			72.0		28.0	28.0		28.0	28.0	
Total Lost Time (s)		3.5			3.5			3.5			3.5	
Act Effct Green (s)		71.6			71.6			21.4			21.4	
Actuated g/C Ratio		0.72			0.72			0.21			0.21	
v/c Ratio		0.58			0.38			0.55			0.85	
Control Delay		4.8			4.4			39.6			69.6	
Queue Delay		0.3			0.9			3.3			62.9	
Total Delay		5.1			5.3			42.9			132.5	
LOS		A			A			D			F	
Approach Delay		5.1			5.3			42.9			132.5	
Approach LOS		A			A			D			F	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	3 (3%), Referenced to phase 2:EBWB, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.85
Intersection Signal Delay:	26.2
Intersection LOS:	C
Intersection Capacity Utilization:	67.4%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
4059: Boylston Ave & Madison St

1/22/2016

Splits and Phases: 4059: Boylston Ave & Madison St



Lanes, Volumes, Timings  
4411: 4th Ave & Madison St

1/22/2016

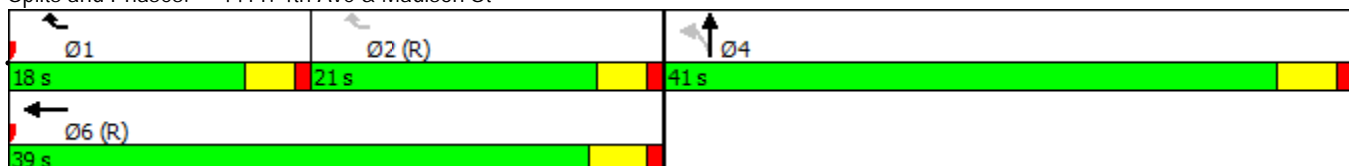


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑	↑	↑↑↑				
Traffic Volume (vph)	0	0	0	0	273	412	133	961	0	0	0	0
Future Volume (vph)	0	0	0	0	273	412	133	961	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	13	12	13	11	10	12	12	12
Grade (%)		14%			-10%			5%			0%	
Satd. Flow (prot)	0	0	0	0	3061	1482	1637	4400	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	3061	1041	1249	4400	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)						25	145					
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		297			362			249			323	
Travel Time (s)		8.1			9.9			6.8			8.8	
Confl. Peds. (#/hr)	194		81	81		194	138		129	129		138
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
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)					15							
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	297	448	145	1045	0	0	0	0
Turn Type					NA	custom	Perm	NA				
Protected Phases					6	1		4				
Permitted Phases						2	4					
Total Split (s)					39.0	18.0	41.0	41.0				
Total Lost Time (s)					2.5	4.0	3.5	3.5				
Act Effect Green (s)					36.5	31.0	37.5	37.5				
Actuated g/C Ratio					0.46	0.39	0.47	0.47				
v/c Ratio					0.21	0.91	0.22	0.51				
Control Delay					8.2	37.8	3.2	15.9				
Queue Delay					0.0	0.0	0.0	0.0				
Total Delay					8.2	37.8	3.2	15.9				
LOS					A	D	A	B				
Approach Delay					26.0			14.3				
Approach LOS					C			B				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 69 (86%), Referenced to phase 2:WBR and 6:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.91  
 Intersection Signal Delay: 18.8  
 Intersection LOS: B  
 Intersection Capacity Utilization 63.3%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 4411: 4th Ave & Madison St





Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	21.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Lanes, Volumes, Timings  
4412: 4th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑						↑↑↑	↘			
Traffic Volume (vph)	112	412	0	0	0	0	0	1274	99	0	0	0
Future Volume (vph)	112	412	0	0	0	0	0	1274	99	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	10	12	12	12	12
Grade (%)		15%			-5%			5%			0%	
Satd. Flow (prot)	1473	2509	0	0	0	0	0	3772	1219	0	0	0
Flt Permitted	0.950											
Satd. Flow (perm)	1176	2509	0	0	0	0	0	3772	1038	0	0	0
Right Turn on Red	Yes		Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	20							2	75			
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		298			362			323			239	
Travel Time (s)		8.1			9.9			8.8			6.5	
Confl. Peds. (#/hr)	143		93	93		143	180		87	87		180
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	2%	2%	2%
Parking (#/hr)		15						15				
Shared Lane Traffic (%)									10%			
Lane Group Flow (vph)	122	448	0	0	0	0	0	1396	97	0	0	0
Turn Type	custom	NA						NA	Perm			
Protected Phases	1	6						4				
Permitted Phases	2								4			
Total Split (s)	8.0	29.0						51.0	51.0			
Total Lost Time (s)	4.0	4.5						5.5	5.5			
Act Effct Green (s)	21.0	24.5						45.5	45.5			
Actuated g/C Ratio	0.26	0.31						0.57	0.57			
v/c Ratio	0.36	0.58						0.65	0.16			
Control Delay	33.8	38.5						8.5	1.4			
Queue Delay	0.0	0.2						0.0	0.0			
Total Delay	33.8	38.7						8.5	1.4			
LOS	C	D						A	A			
Approach Delay		37.6						8.0				
Approach LOS		D						A				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 72 (90%), Referenced to phase 2:EBL and 6:EBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.65  
 Intersection Signal Delay: 16.2  
 Intersection LOS: B  
 Intersection Capacity Utilization 50.8%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4412: 4th Ave & Spring St



Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	21.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
4455: 2nd Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑	↑
Traffic Volume (vph)	0	0	0	186	341	0	0	0	0	0	1456	105
Future Volume (vph)	0	0	0	186	341	0	0	0	0	0	1456	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	16	10	10	12	12	10	12	12
Grade (%)		15%			-13%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	3451	0	0	0	0	0	2664	1454
Flt Permitted					0.983							
Satd. Flow (perm)	0	0	0	0	3056	0	0	0	0	0	2664	1168
Right Turn on Red			Yes	Yes		Yes			Yes			Yes
Satd. Flow (RTOR)					48							48
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		338			309			274			313	
Travel Time (s)		9.2			8.4			7.5			8.5	
Confl. Peds. (#/hr)	270		283	283		270	94		216	216		94
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
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)					0					0	52	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	573	0	0	0	0	0	1583	114
Turn Type				Perm	NA						NA	Perm
Protected Phases					4						2	
Permitted Phases				4	4							2
Total Split (s)				25.0	25.0						55.0	55.0
Total Lost Time (s)					5.0						5.0	6.5
Act Effct Green (s)					20.0						50.0	48.5
Actuated g/C Ratio					0.25						0.62	0.61
v/c Ratio					0.72						0.95	0.16
Control Delay					48.3						19.2	2.0
Queue Delay					0.0						44.2	0.0
Total Delay					48.3						63.5	2.0
LOS					D						E	A
Approach Delay					48.3						59.3	
Approach LOS					D						E	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	9 (11%), Referenced to phase 2:SBT and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.95
Intersection Signal Delay:	56.6
Intersection LOS:	E
Intersection Capacity Utilization:	72.8%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
4455: 2nd Ave & Madison St

1/22/2016

Splits and Phases: 4455: 2nd Ave & Madison St



# Lanes, Volumes, Timings

## 4456: 2nd Ave & Spring St

1/22/2016

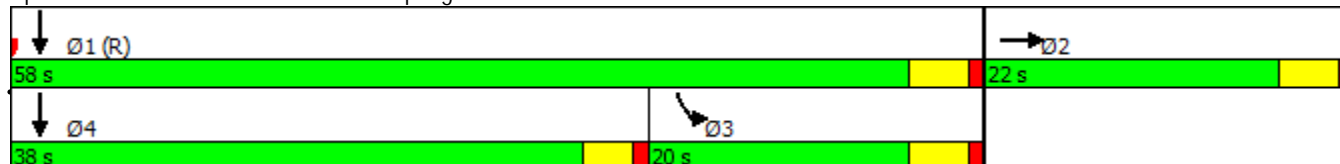


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑								↘	↑↑	
Traffic Volume (vph)	0	348	112	0	0	0	0	0	0	126	1449	0
Future Volume (vph)	0	348	112	0	0	0	0	0	0	126	1449	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		12%			0%			0%			0%	
Satd. Flow (prot)	0	2446	0	0	0	0	0	0	0	1289	2358	0
Flt Permitted										0.950		
Satd. Flow (perm)	0	2446	0	0	0	0	0	0	0	825	2358	0
Right Turn on Red			Yes			Yes			Yes	Yes		Yes
Satd. Flow (RTOR)		8								102		
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		339			306			313			314	
Travel Time (s)		9.2			8.3			8.5			8.6	
Confl. Peds. (#/hr)	400		400	400		400	400		400	400		400
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	0%	0%	0%
Parking (#/hr)										10	69	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	500	0	0	0	0	0	0	0	137	1575	0
Turn Type		NA								Prot	NA	
Protected Phases		2								3	14	
Permitted Phases												
Total Split (s)		22.0								20.0		
Total Lost Time (s)		4.0								4.0		
Act Effct Green (s)		18.0								16.0	54.0	
Actuated g/C Ratio		0.22								0.20	0.68	
v/c Ratio		0.90								0.40	0.99	
Control Delay		44.6								13.7	34.9	
Queue Delay		0.0								0.0	38.9	
Total Delay		44.6								13.7	73.8	
LOS		D								B	E	
Approach Delay		44.6									69.0	
Approach LOS		D									E	

### Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	65 (81%), Referenced to phase 1:SBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.99
Intersection Signal Delay:	63.4
Intersection LOS:	E
Intersection Capacity Utilization:	68.1%
ICU Level of Service:	C
Analysis Period (min):	15

### Splits and Phases: 4456: 2nd Ave & Spring St



Lane Group	Ø1	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Parking (#/hr)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	1	4
Permitted Phases		
Total Split (s)	58.0	38.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
4477: 5th Ave & Madison St

1/22/2016

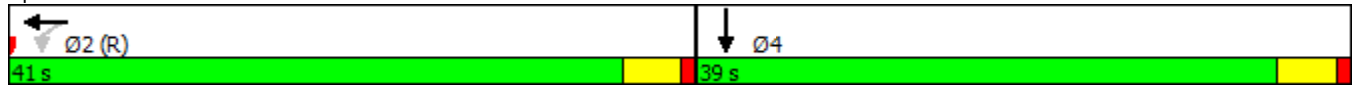


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑↑	
Traffic Volume (vph)	0	0	0	246	531	0	0	0	0	0	501	127
Future Volume (vph)	0	0	0	246	531	0	0	0	0	0	501	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	16	12	12	12	12	12	15	12
Grade (%)		10%			-13%			0%			0%	
Satd. Flow (prot)	0	0	0	0	3783	0	0	0	0	0	4387	0
Flt Permitted					0.984							
Satd. Flow (perm)	0	0	0	0	3343	0	0	0	0	0	4387	0
Right Turn on Red			Yes	Yes		Yes			Yes			Yes
Satd. Flow (RTOR)					20						18	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		362			287			226			323	
Travel Time (s)		9.9			7.8			6.2			8.8	
Confl. Peds. (#/hr)	400		400	400		400	400		400	400		400
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	5%	5%	5%
Parking (#/hr)				15								15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	844	0	0	0	0	0	683	0
Turn Type				Perm	NA						NA	
Protected Phases					2						4	
Permitted Phases				2								
Total Split (s)				41.0	41.0						39.0	
Total Lost Time (s)					4.5						4.5	
Act Effct Green (s)					36.5						34.5	
Actuated g/C Ratio					0.46						0.43	
v/c Ratio					0.55						0.36	
Control Delay					8.4						9.3	
Queue Delay					2.4						0.0	
Total Delay					10.7						9.3	
LOS					B						A	
Approach Delay					10.7						9.3	
Approach LOS					B						A	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	54 (68%), Referenced to phase 2:WBTL and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.55
Intersection Signal Delay:	10.1
Intersection LOS:	B
Intersection Capacity Utilization:	50.8%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 4477: 5th Ave & Madison St





Lanes, Volumes, Timings  
 4485: 7th Ave/Hubbell Pl & Spring st

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↑↔			↔↔	
Traffic Volume (vph)	38	119	12	0	0	0	0	315	105	0	215	0
Future Volume (vph)	38	119	12	0	0	0	0	315	105	0	215	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	3462	0	0	0	0	0	1799	0	0	1863	0
Flt Permitted		0.989										
Satd. Flow (perm)	0	3462	0	0	0	0	0	1799	0	0	1863	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8						28				
Link Speed (mph)		30			25			25			30	
Link Distance (ft)		201			301			327			679	
Travel Time (s)		4.6			8.2			8.9			15.4	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	183	0	0	0	0	0	456	0	0	234	0
Turn Type	Perm	NA						NA			NA	
Protected Phases		4						2			2	
Permitted Phases	4									2		
Total Split (s)	38.0	38.0						62.0		62.0	62.0	
Total Lost Time (s)		4.5						4.5		4.5	4.5	
Act Effct Green (s)		33.5						57.5		57.5	57.5	
Actuated g/C Ratio		0.34						0.58		0.58	0.58	
v/c Ratio		0.16						0.44		0.44	0.22	
Control Delay		22.8						12.8		12.8	11.0	
Queue Delay		0.0						4.8		4.8	0.0	
Total Delay		22.8						17.6		17.6	11.0	
LOS		C						B		B	B	
Approach Delay		22.8						17.6		17.6	11.0	
Approach LOS		C						B		B	B	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	34 (34%), Referenced to phase 4:EBTL, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.44
Intersection Signal Delay:	16.9
Intersection LOS:	B
Intersection Capacity Utilization:	38.8%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 4485: 7th Ave/Hubbell Pl & Spring st



Lanes, Volumes, Timings  
4568: 5th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑									↑↑↑	
Traffic Volume (vph)	0	501	84	0	0	0	0	0	0	499	546	0
Future Volume (vph)	0	501	84	0	0	0	0	0	0	499	546	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	12	12	12	10	12
Grade (%)		15%			-5%			0%			0%	
Satd. Flow (prot)	0	2521	0	0	0	0	0	0	0	0	4173	0
Flt Permitted											0.977	
Satd. Flow (perm)	0	2521	0	0	0	0	0	0	0	0	3422	0
Right Turn on Red			Yes			Yes			Yes	Yes		Yes
Satd. Flow (RTOR)		24										27
Link Speed (mph)		25			25			25				25
Link Distance (ft)		362			295			323				224
Travel Time (s)		9.9			8.0			8.8				6.1
Confl. Peds. (#/hr)	400		400	400		400	400		400	400		400
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
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	636	0	0	0	0	0	0	0	0	1135	0
Turn Type		NA								Perm	NA	
Protected Phases		2										4
Permitted Phases										4		
Total Split (s)		28.0								52.0	52.0	
Total Lost Time (s)		3.5									3.5	
Act Effct Green (s)		24.5									48.5	
Actuated g/C Ratio		0.31									0.61	
v/c Ratio		0.81									0.54	
Control Delay		50.6									10.2	
Queue Delay		44.3									0.0	
Total Delay		94.9									10.2	
LOS		F									B	
Approach Delay		94.9									10.2	
Approach LOS		F									B	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 59 (74%), Referenced to phase 2:EBT and 6:, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.81  
 Intersection Signal Delay: 40.6  
 Intersection LOS: D  
 Intersection Capacity Utilization 63.8%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 4568: 5th Ave & Spring St



Lanes, Volumes, Timings  
5005: 19th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕			↕			↕	
Traffic Volume (vph)	282	534	50	181	193	3	76	113	68	9	195	138
Future Volume (vph)	282	534	50	181	193	3	76	113	68	9	195	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		-11%			8%			0%			0%	
Satd. Flow (prot)	0	3525	0	0	3235	0	0	2016	0	0	1930	0
Flt Permitted		0.704			0.531			0.522			0.988	
Satd. Flow (perm)	0	2486	0	0	1738	0	0	1067	0	0	1909	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			1			20			38	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		419			361			267			345	
Travel Time (s)		9.5			8.2			6.1			7.8	
Confl. Peds. (#/hr)	26		40	40		26	7		2	2		7
Confl. Bikes (#/hr)			8			4			1			12
Peak Hour Factor	0.99	0.99	0.99	0.98	0.98	0.98	0.86	0.86	0.86	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	875	0	0	385	0	0	298	0	0	376	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Total Split (s)	58.0	58.0		58.0	58.0		42.0	42.0		42.0	42.0	
Total Lost Time (s)		6.0			6.0			6.0			6.0	
Act Effect Green (s)		62.1			62.1			25.9			25.9	
Actuated g/C Ratio		0.62			0.62			0.26			0.26	
v/c Ratio		0.57			0.36			1.03			0.72	
Control Delay		15.2			14.1			93.3			37.4	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		15.2			14.1			93.3			37.4	
LOS		B			B			F			D	
Approach Delay		15.2			14.1			93.3			37.4	
Approach LOS		B			B			F			D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 40 (40%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 1.03  
 Intersection Signal Delay: 31.3      Intersection LOS: C  
 Intersection Capacity Utilization 92.7%      ICU Level of Service F  
 Analysis Period (min) 15

Splits and Phases: 5005: 19th Ave & E Madison St



Lanes, Volumes, Timings  
5349: 14th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗			↖			↕		↗	↖	
Traffic Volume (vph)	0	456	98	0	102	0	48	264	67	58	376	6
Future Volume (vph)	0	456	98	0	102	0	48	264	67	58	376	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		7%			-10%			0%			0%	
Satd. Flow (prot)	0	1681	0	0	1909	0	0	2051	0	1752	2082	0
Flt Permitted								0.689		0.440		
Satd. Flow (perm)	0	1681	0	0	1909	0	0	1415	0	803	2082	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15						13			1	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		358			166			257			100	
Travel Time (s)		8.1			3.8			5.8			2.7	
Confl. Peds. (#/hr)	3		31	31		3	37		10	10		37
Confl. Bikes (#/hr)			7			3			1			1
Peak Hour Factor	0.92	0.92	0.92	0.91	0.91	0.91	0.85	0.85	0.85	0.86	0.86	0.86
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	603	0	0	112	0	0	446	0	67	444	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		1			1			3			6	
Permitted Phases							3			6		
Total Split (s)		51.0			51.0		49.0	49.0		49.0	49.0	
Total Lost Time (s)		4.5			4.5			8.5		4.5	4.5	
Act Effct Green (s)		46.5			46.5			40.5		44.5	44.5	
Actuated g/C Ratio		0.46			0.46			0.40		0.44	0.44	
v/c Ratio		0.76			0.13			0.77		0.19	0.48	
Control Delay		30.2			12.3			35.5		6.9	7.6	
Queue Delay		16.7			0.0			0.0		0.0	0.0	
Total Delay		46.9			12.3			35.5		6.9	7.6	
LOS		D			B			D		A	A	
Approach Delay		46.9			12.3			35.5			7.5	
Approach LOS		D			B			D			A	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 42 (42%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.77  
 Intersection Signal Delay: 29.5  
 Intersection LOS: C  
 Intersection Capacity Utilization 86.0%  
 ICU Level of Service E  
 Analysis Period (min) 15

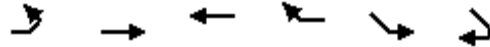
Splits and Phases: 5349: 14th Ave & E Madison St

#5349 ← Ø1 (R)	#206#5349 ↓ Ø3
51 s	49 s
#2067 ← Ø4	#206#5349 ↑ Ø6
51 s	49 s

Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Total Split (s)	51.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
 5355: E Madison St & Pine St

1/22/2016

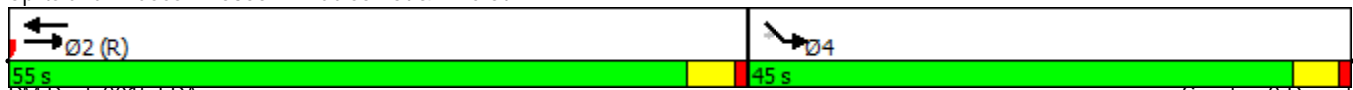


Lane Group	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑	↑↑		↑	↑
Traffic Volume (vph)	0	498	76	343	354	2
Future Volume (vph)	0	498	76	343	354	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	10	12	11	11
Grade (%)		9%	-4%		0%	
Satd. Flow (prot)	0	1677	2535	0	1678	1351
Flt Permitted					0.950	
Satd. Flow (perm)	0	1677	2535	0	1671	1198
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			365			2
Link Speed (mph)		30	30		30	
Link Distance (ft)		96	270		182	
Travel Time (s)		2.2	6.1		4.1	
Confl. Peds. (#/hr)	62			62	1	43
Confl. Bikes (#/hr)				3		8
Peak Hour Factor	0.95	0.95	0.94	0.94	0.90	0.90
Heavy Vehicles (%)	1%	1%	2%	2%	4%	4%
Parking (#/hr)						0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	524	446	0	393	2
Turn Type		NA	NA		Prot	Perm
Protected Phases		2	2		4	
Permitted Phases						4
Total Split (s)		55.0	55.0		45.0	45.0
Total Lost Time (s)		4.5	4.5		4.5	4.5
Act Effct Green (s)		63.8	63.8		27.2	27.2
Actuated g/C Ratio		0.64	0.64		0.27	0.27
v/c Ratio		0.49	0.26		0.86	0.01
Control Delay		9.6	0.7		52.6	15.5
Queue Delay		0.2	0.3		1.1	0.0
Total Delay		9.8	1.0		53.7	15.5
LOS		A	A		D	B
Approach Delay		9.8	1.0		53.5	
Approach LOS		A	A		D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 43 (43%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.86  
 Intersection Signal Delay: 19.6  
 Intersection LOS: B  
 Intersection Capacity Utilization 53.3%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 5355: E Madison St & Pine St



# MADISON CORRIDOR BRT STUDY

## Appendix I: Intersection Operations Results No-Build 2030 PM Peak Hour

Lanes, Volumes, Timings  
3: 9th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗		↔			↑			↖	
Traffic Volume (vph)	26	56	56	47	0	43	0	165	2	2	91	0
Future Volume (vph)	26	56	56	47	0	43	0	165	2	2	91	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1651	1425	0	1528	0	0	1675	0	0	1675	0
Flt Permitted		0.985			0.975							0.999
Satd. Flow (perm)	0	1651	1425	0	1528	0	0	1675	0	0	1675	0
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		317			322			149			162	
Travel Time (s)		8.6			8.8			4.1			4.4	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	89	61	0	98	0	0	181	0	0	101	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type:	CBD
Control Type:	Unsignalized
Intersection Capacity Utilization	28.9%
Analysis Period (min)	15
	ICU Level of Service A



Lanes, Volumes, Timings  
6: 8th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↔			↔	
Traffic Volume (vph)	45	110	11	0	0	0	0	169	17	10	158	0
Future Volume (vph)	45	110	11	0	0	0	0	169	17	10	158	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	3112	0	0	0	0	0	1656	0	0	1671	0
Flt Permitted		0.987									0.997	
Satd. Flow (perm)	0	3112	0	0	0	0	0	1656	0	0	1671	0
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		329			317			149			143	
Travel Time (s)		7.5			7.2			3.4			3.9	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	181	0	0	0	0	0	202	0	0	183	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Area Type:	CBD
Control Type:	Unsignalized
Intersection Capacity Utilization	30.2%
Analysis Period (min)	15
	ICU Level of Service A

Lanes, Volumes, Timings  
220: 1st Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↔		↕	↕	
Traffic Volume (vph)	29	225	62	0	0	0	0	354	77	65	340	0
Future Volume (vph)	29	225	62	0	0	0	0	354	77	65	340	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	12	10	12	12	12	10	10	10	10	10	10
Grade (%)		9%			0%			3%			0%	
Storage Length (ft)	0		0	0		0	0		0	100		0
Storage Lanes	0		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2657	0	0	0	0	0	1417	0	1501	1580	0
Flt Permitted		0.995								0.950		
Satd. Flow (perm)	0	2599	0	0	0	0	0	1417	0	1205	1580	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		34						17				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		170			339			321			307	
Travel Time (s)		4.6			9.2			8.8			8.4	
Confl. Peds. (#/hr)	90		309	309		90	502		488	488		502
Confl. Bikes (#/hr)			1			5			12			28
Peak Hour Factor	0.88	0.88	0.88	0.25	0.25	0.25	0.95	0.95	0.95	0.93	0.93	0.93
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	359	0	0	0	0	0	454	0	70	366	0
Turn Type	Perm	NA						NA		Prot	NA	
Protected Phases		6						8		7	4	
Permitted Phases	6	6										
Total Split (s)	23.0	23.0						38.0		11.0	49.0	
Total Lost Time (s)		4.5						4.5		4.0	4.5	
Act Effct Green (s)		18.5						41.5		7.0	52.5	
Actuated g/C Ratio		0.23						0.52		0.09	0.66	
v/c Ratio		0.57						0.61		0.53	0.35	
Control Delay		28.7						30.8		60.1	3.8	
Queue Delay		1.5						5.8		0.0	0.5	
Total Delay		30.2						36.5		60.1	4.3	
LOS		C						D		E	A	
Approach Delay		30.2						36.5			13.3	
Approach LOS		C						D			B	

Intersection Summary

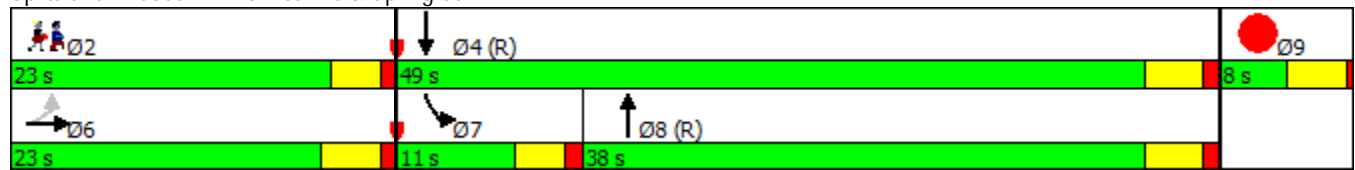
Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	56 (70%), Referenced to phase 4:SBT and 8:NBT, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.61
Intersection Signal Delay:	26.6
Intersection LOS:	C
Intersection Capacity Utilization	58.6%
ICU Level of Service	B
Analysis Period (min)	15

# Lanes, Volumes, Timings

## 220: 1st Ave & Spring St

1/22/2016

Splits and Phases: 220: 1st Ave & Spring St



Lane Group	Ø2	Ø9
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	9
Permitted Phases		
Total Split (s)	23.0	8.0
Total Lost Time (s)		
Act Effect Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
221: 1st Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	105	117	86	6	336	0	0	330	96
Future Volume (vph)	0	0	0	105	117	86	6	336	0	0	330	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		6%			-8%			0%				0%
Storage Length (ft)	0		0	50		0	100		0	0		0
Storage Lanes	0		0	1		0	1		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	1531	2302	0	1516	1580	0	0	1418	0
Flt Permitted				0.950			0.950					
Satd. Flow (perm)	0	0	0	934	2302	0	1255	1580	0	0	1418	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					51							24
Link Speed (mph)		25			25			25				25
Link Distance (ft)		169			338			287				321
Travel Time (s)		4.6			9.2			7.8				8.8
Confl. Peds. (#/hr)	226		156	156		226	276		553	553		276
Peak Hour Factor	0.25	0.25	0.25	0.85	0.85	0.85	0.92	0.92	0.92	0.89	0.89	0.89
Heavy Vehicles (%)	0%	0%	0%	3%	0%	0%	0%	1%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	124	239	0	7	365	0	0	479	0
Turn Type				Perm	NA		Prot	NA			NA	
Protected Phases					2		3	8				4
Permitted Phases				2								
Total Split (s)				25.0	25.0		15.0	55.0				40.0
Total Lost Time (s)				4.5	4.5		3.5	3.5				4.5
Act Effect Green (s)				39.7	39.7		6.0	32.3				29.2
Actuated g/C Ratio				0.50	0.50		0.08	0.40				0.36
v/c Ratio				0.27	0.20		0.06	0.57				0.90
Control Delay				9.3	5.2		37.5	16.3				45.3
Queue Delay				0.8	0.0		0.0	0.6				4.6
Total Delay				10.1	5.3		37.5	16.9				49.9
LOS				B	A		D	B				D
Approach Delay					6.9			17.3				49.9
Approach LOS					A			B				D


Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	0 (0%), Referenced to phase 2:WBTL and 6:, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	27.1
Intersection LOS:	C
Intersection Capacity Utilization:	55.2%
ICU Level of Service:	B
Analysis Period (min):	15

Lanes, Volumes, Timings  
 221: 1st Ave & Madison St

1/22/2016

Splits and Phases: 221: 1st Ave & Madison St

 Ø2 (R)	 Ø4	 Ø3
25 s	40 s	15 s
	 Ø8	
	55 s	

Lanes, Volumes, Timings  
 2036: Swedish/Summit Ave & Madison St

1/22/2016

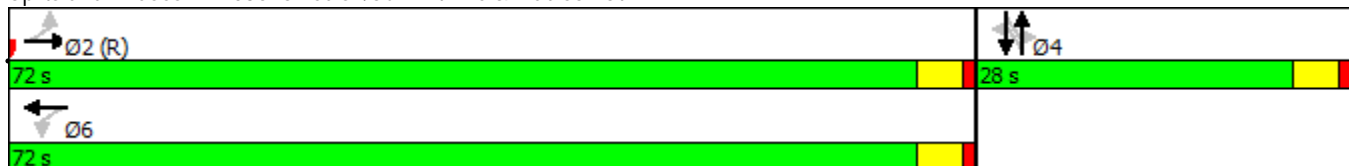


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	814	15	4	646	10	36	13	20	15	1	36
Future Volume (vph)	22	814	15	4	646	10	36	13	20	15	1	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	12	12	12	12	12	12	12
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1516	2940	0	1516	2952	0	0	1509	0	0	1377	0
Flt Permitted	0.367			0.297				0.834			0.919	
Satd. Flow (perm)	517	2940	0	423	2952	0	0	1218	0	0	1233	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			3			20				47
Link Speed (mph)		25			25			25				25
Link Distance (ft)		318			325			139				185
Travel Time (s)		8.7			8.9			3.8				5.0
Confl. Peds. (#/hr)	101		132	132		101	69		102	102		69
Peak Hour Factor	0.97	0.97	0.97	0.96	0.96	0.96	0.63	0.63	0.63	0.77	0.77	0.77
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	854	0	4	683	0	0	110	0	0	67	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4				4
Permitted Phases	2			6			4			4		
Total Split (s)	72.0	72.0		72.0	72.0		28.0	28.0		28.0		28.0
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5				3.5
Act Effect Green (s)	68.5	68.5		68.5	68.5			24.5				24.5
Actuated g/C Ratio	0.68	0.68		0.68	0.68			0.24				0.24
v/c Ratio	0.06	0.42		0.01	0.34			0.35				0.20
Control Delay	2.0	2.0		0.8	1.2			29.1				14.7
Queue Delay	0.0	0.1		0.0	0.2			0.0				0.0
Total Delay	2.0	2.1		0.8	1.4			29.1				14.7
LOS	A	A		A	A			C				B
Approach Delay		2.1			1.3			29.1				14.7
Approach LOS		A			A			C				B

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 97 (97%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.42  
 Intersection Signal Delay: 4.0  
 Intersection LOS: A  
 Intersection Capacity Utilization 45.7%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2036: Swedish/Summit Ave & Madison St



Lanes, Volumes, Timings  
 2064: E Madison St & 11th Ave

1/22/2016

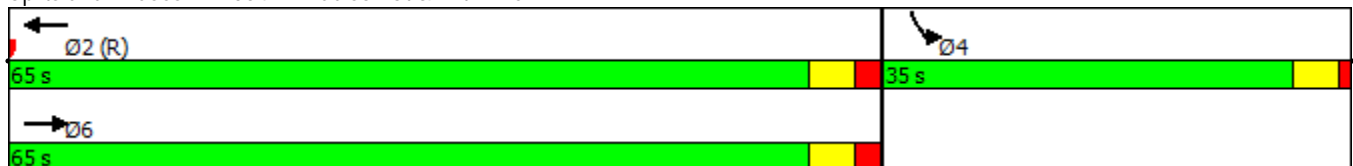


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↓↓↓	
Traffic Volume (vph)	0	799	686	0	216	12
Future Volume (vph)	0	799	686	0	216	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	13	12	10	12
Grade (%)		0%	-4%		0%	
Satd. Flow (prot)	0	3693	3694	0	3096	0
Flt Permitted					0.955	
Satd. Flow (perm)	0	3693	3694	0	3096	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)					6	
Link Speed (mph)		30	30		25	
Link Distance (ft)		110	373		234	
Travel Time (s)		2.5	8.5		6.4	
Confl. Peds. (#/hr)	23			38		61
Confl. Bikes (#/hr)				3		17
Peak Hour Factor	0.90	0.90	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Parking (#/hr)						0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	888	780	0	259	0
Turn Type		NA	NA		Prot	
Protected Phases		6	2		4	
Permitted Phases						
Total Split (s)		65.0	65.0		35.0	
Total Lost Time (s)		5.5	5.5		4.5	
Act Effct Green (s)		79.0	79.0		11.0	
Actuated g/C Ratio		0.79	0.79		0.11	
v/c Ratio		0.30	0.27		0.75	
Control Delay		1.4	0.8		55.4	
Queue Delay		0.0	0.2		0.0	
Total Delay		1.4	0.9		55.4	
LOS		A	A		E	
Approach Delay		1.4	0.9		55.4	
Approach LOS		A	A		E	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 98 (98%), Referenced to phase 2:WBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.75  
 Intersection Signal Delay: 8.5  
 Intersection Capacity Utilization 42.9%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service A

Splits and Phases: 2064: E Madison St & 11th Ave



Lanes, Volumes, Timings  
 2066: 13th Ave & E Madison St

1/22/2016

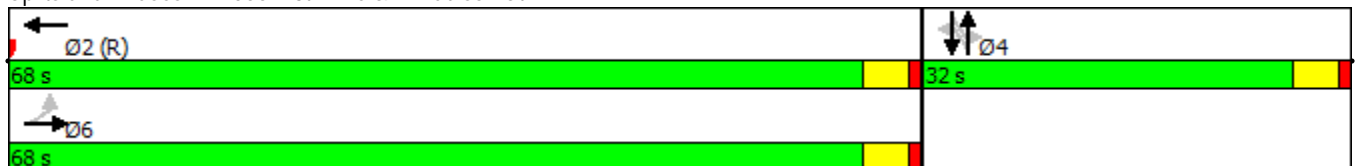


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕			↕↕	
Traffic Volume (vph)	26	735	0	0	563	5	128	44	9	9	0	23
Future Volume (vph)	26	735	0	0	563	5	128	44	9	9	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	11	12	16	16	12	12	13	12
Grade (%)		8%			-7%			0%			0%	
Satd. Flow (prot)	0	3196	0	0	3533	0	1869	1879	0	0	1706	0
Flt Permitted		0.919					0.734	0.880			0.936	
Satd. Flow (perm)	0	2939	0	0	3533	0	1441	1688	0	0	1581	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					2			5				26
Link Speed (mph)		30			30			30				30
Link Distance (ft)		213			358			154				283
Travel Time (s)		4.8			8.1			3.5				6.4
Confl. Peds. (#/hr)	28		29	29		28	1		52	52		1
Confl. Bikes (#/hr)												6
Peak Hour Factor	0.90	0.90	0.90	0.95	0.95	0.95	0.87	0.87	0.87	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)									0			0
Shared Lane Traffic (%)							30%					
Lane Group Flow (vph)	0	846	0	0	598	0	103	105	0	0	36	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4				4
Permitted Phases	6						4			4		
Total Split (s)	68.0	68.0			68.0		32.0	32.0		32.0		32.0
Total Lost Time (s)		4.5			4.5		4.5	4.5				4.5
Act Effct Green (s)		63.5			63.5		27.5	27.5				27.5
Actuated g/C Ratio		0.64			0.64		0.28	0.28				0.28
v/c Ratio		0.45			0.27		0.26	0.22				0.08
Control Delay		3.9			10.0		21.7	19.7				13.8
Queue Delay		0.2			0.3		0.0	0.0				0.0
Total Delay		4.1			10.3		21.7	19.7				13.8
LOS		A			B		C	B				B
Approach Delay		4.1			10.3			20.7				13.8
Approach LOS		A			B			C				B

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 5 (5%), Referenced to phase 2:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.45  
 Intersection Signal Delay: 8.6  
 Intersection Capacity Utilization 60.1%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service B

Splits and Phases: 2066: 13th Ave & E Madison St





# Lanes, Volumes, Timings

## 2067: 14th Ave & Pike St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	25	85	0	31	5	140	69	0	4	98	10
Future Volume (vph)	5	25	85	0	31	5	140	69	0	4	98	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	16	12	12	16	12	12	16	12
Grade (%)		6%			-6%			0%				0%
Storage Length (ft)	80		0	0		0	0		0	0		0
Storage Lanes	1		1	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1717	1342	0	0	2137	0	0	2044	0	0	1873	0
Flt Permitted	0.732							0.730			0.990	
Satd. Flow (perm)	1323	1342	0	0	2137	0	0	1541	0	0	1858	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		92			5							6
Link Speed (mph)		30			30			25				25
Link Distance (ft)		317			140			100				416
Travel Time (s)		7.2			3.2			2.7				11.3
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
Parking (#/hr)		0										0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	119	0	0	39	0	0	227	0	0	122	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		4			4			6			3	
Permitted Phases	4						6			3		
Total Split (s)	51.0	51.0			51.0		49.0	49.0		49.0	49.0	
Total Lost Time (s)	4.5	4.5			4.5			4.5			8.5	
Act Effct Green (s)	46.5	46.5			46.5			44.5			40.5	
Actuated g/C Ratio	0.46	0.46			0.46			0.44			0.40	
v/c Ratio	0.01	0.18			0.04			0.33			0.16	
Control Delay	14.6	5.7			9.9			1.8			18.7	
Queue Delay	0.0	2.1			0.0			0.0			0.0	
Total Delay	14.6	7.8			9.9			1.8			18.7	
LOS	B	A			A			A			B	
Approach Delay		8.1			9.9			1.8			18.7	
Approach LOS		A			A			A			B	

### Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 42 (42%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.56  
 Intersection Signal Delay: 8.0  
 Intersection LOS: A  
 Intersection Capacity Utilization 32.1%  
 ICU Level of Service A  
 Analysis Period (min) 15

### Splits and Phases: 2067: 14th Ave & Pike St

#5349  Ø1 (R) 51 s	#2067  Ø4 51 s	#206#5349  Ø3 49 s	#206#5349  Ø6 49 s
-----------------------------	-------------------------	-----------------------------	-----------------------------

Lane Group	Ø1
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	1
Permitted Phases	
Total Split (s)	51.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
 2070: 17th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕			↕			↕	
Traffic Volume (vph)	80	872	41	20	727	54	47	32	15	57	51	56
Future Volume (vph)	80	872	41	20	727	54	47	32	15	57	51	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	10	12	10	12	12	16	12
Grade (%)		4%			4%			0%			0%	
Satd. Flow (prot)	0	3333	0	0	3258	0	0	1632	0	0	1879	0
Flt Permitted		0.791			0.912			0.642			0.822	
Satd. Flow (perm)	0	2634	0	0	2973	0	0	1019	0	0	1509	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			17			9			24	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		270			381			117			303	
Travel Time (s)		6.1			8.7			2.7			8.3	
Confl. Peds. (#/hr)	95		44	44		95	120		113	113		120
Confl. Bikes (#/hr)			17			23			3			11
Peak Hour Factor	0.92	0.92	0.92	0.96	0.96	0.96	0.80	0.80	0.80	0.93	0.93	0.93
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1080	0	0	834	0	0	118	0	0	176	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Total Split (s)	73.0	73.0		73.0	73.0		27.0	27.0		27.0	27.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effct Green (s)		76.1			76.1			14.9			14.9	
Actuated g/C Ratio		0.76			0.76			0.15			0.15	
v/c Ratio		0.54			0.37			0.74			0.72	
Control Delay		5.2			5.1			63.0			50.5	
Queue Delay		0.3			0.0			0.0			0.0	
Total Delay		5.5			5.1			63.0			50.5	
LOS		A			A			E			D	
Approach Delay		5.5			5.1			63.0			50.5	
Approach LOS		A			A			E			D	

Intersection Summary

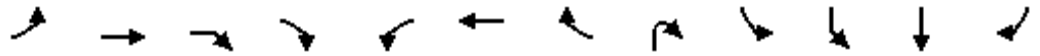
Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 49 (49%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.74  
 Intersection Signal Delay: 12.0  
 Intersection LOS: B  
 Intersection Capacity Utilization 74.6%  
 ICU Level of Service D  
 Analysis Period (min) 15

Splits and Phases: 2070: 17th Ave & E Madison St



Lanes, Volumes, Timings  
 2071: 20th Ave & E Olive St & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBR2	SBL2	SBL	SBT	SBR
Lane Configurations		↕↕				↕		↗			↕	
Traffic Volume (vph)	9	742	127	12	4	600	6	22	1	2	2	15
Future Volume (vph)	9	742	127	12	4	600	6	22	1	2	2	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	10	12	12	12	12	13	12
Grade (%)		-8%				3%					0%	
Satd. Flow (prot)	0	3601	0	0	0	1726	0	1465	0	0	1704	0
Flt Permitted		0.949				0.996					0.992	
Satd. Flow (perm)	0	3417	0	0	0	1719	0	1465	0	0	1691	0
Right Turn on Red				Yes			Yes	Yes				Yes
Satd. Flow (RTOR)		2				1		906			25	
Link Speed (mph)		30				30					25	
Link Distance (ft)		361				397					452	
Travel Time (s)		8.2				9.0					12.3	
Confl. Peds. (#/hr)	29		10	2	2		29		12	10		7
Peak Hour Factor	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.79	0.59	0.59	0.59	0.59
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)			0					0				0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	917	0	0	0	648	0	28	0	0	33	0
Turn Type	Perm	NA			Perm	NA		Free	Perm	Perm	NA	
Protected Phases		2				2						4
Permitted Phases	2				2			Free	4	4		
Total Split (s)	57.0	57.0			57.0	57.0			27.0	27.0	27.0	
Total Lost Time (s)		4.5				4.5					4.5	
Act Effct Green (s)		75.9				75.9		100.0			7.1	
Actuated g/C Ratio		0.76				0.76		1.00			0.07	
v/c Ratio		0.35				0.50		0.02			0.23	
Control Delay		2.1				17.0		0.0			25.3	
Queue Delay		0.2				0.1		0.0			0.0	
Total Delay		2.3				17.0		0.0			25.3	
LOS		A				B		A			C	
Approach Delay		2.3				17.0					25.3	
Approach LOS		A				B					C	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 56 (56%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.51  
 Intersection Signal Delay: 9.9  
 Intersection Capacity Utilization 60.7%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service B

Splits and Phases: 2071: 20th Ave & E Olive St & E Madison St



Lanes, Volumes, Timings  
 2071: 20th Ave & E Olive St & E Madison St

1/22/2016

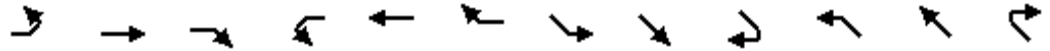


Lane Group	NWL	NWR	NWR2
Lane Configurations			
Traffic Volume (vph)	85	4	3
Future Volume (vph)	85	4	3
Ideal Flow (vphpl)	1900	1900	1900
Lane Width (ft)	16	12	12
Grade (%)	0%		
Satd. Flow (prot)	1997	0	0
Flt Permitted	0.956		
Satd. Flow (perm)	1997	0	0
Right Turn on Red			Yes
Satd. Flow (RTOR)	65		
Link Speed (mph)	25		
Link Distance (ft)	330		
Travel Time (s)	9.0		
Confl. Peds. (#/hr)		29	12
Peak Hour Factor	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	1%
Parking (#/hr)		0	0
Shared Lane Traffic (%)			
Lane Group Flow (vph)	113	0	0
Turn Type	Prot		
Protected Phases	1		
Permitted Phases			
Total Split (s)	16.0		
Total Lost Time (s)	4.5		
Act Effct Green (s)	8.1		
Actuated g/C Ratio	0.08		
v/c Ratio	0.51		
Control Delay	29.0		
Queue Delay	0.0		
Total Delay	29.0		
LOS	C		
Approach Delay	29.0		
Approach LOS	C		

Intersection Summary

Lanes, Volumes, Timings  
2073: 22nd Ave/E Denny Way & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↕↕			↕↕			↕				↕
Traffic Volume (vph)	3	737	37	20	580	30	10	30	5	22	24	30
Future Volume (vph)	3	737	37	20	580	30	10	30	5	22	24	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	12	12	10	12	12	12	12	12	11	12
Grade (%)		-3%			1%			0%				0%
Satd. Flow (prot)	0	3707	0	0	3285	0	0	1846	0	0	1634	0
Flt Permitted		0.954			0.914			0.882			0.881	
Satd. Flow (perm)	0	3536	0	0	3007	0	0	1628	0	0	1458	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			10			6				33
Link Speed (mph)		30			30			30				25
Link Distance (ft)		175			200			207				403
Travel Time (s)		4.0			4.5			4.7				11.0
Confl. Peds. (#/hr)	2		25	25		2	39		4	4		39
Confl. Bikes (#/hr)			1						10			2
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.64	0.64	0.64	0.77	0.77	0.77
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	2%	2%	2%
Parking (#/hr)			0			0			0			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	873	0	0	708	0	0	71	0	0	99	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2			4			4		
Total Split (s)	67.0	67.0		67.0	67.0		33.0	33.0		33.0	33.0	
Total Lost Time (s)		4.5			4.5			4.5				4.5
Act Effct Green (s)		82.0			82.0			9.0				9.0
Actuated g/C Ratio		0.82			0.82			0.09				0.09
v/c Ratio		0.30			0.29			0.47				0.61
Control Delay		0.5			1.5			48.9				46.0
Queue Delay		0.0			0.0			0.0				0.0
Total Delay		0.5			1.5			48.9				46.0
LOS		A			A			D				D
Approach Delay		0.5			1.5			48.9				46.0
Approach LOS		A			A			D				D

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 60 (60%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.61  
 Intersection Signal Delay: 5.4      Intersection LOS: A  
 Intersection Capacity Utilization 53.3%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2073: 22nd Ave/E Denny Way & E Madison St



Lanes, Volumes, Timings  
 2846: 8th Ave & Madison St

1/22/2016

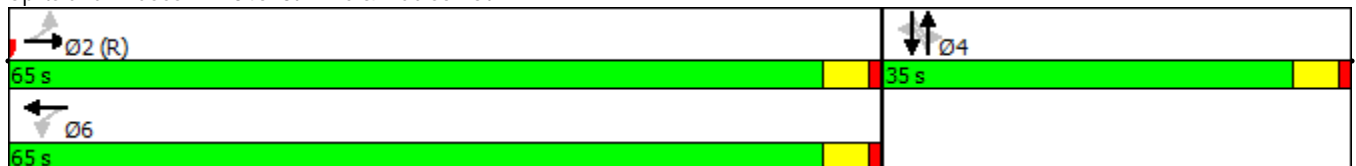


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	26	567	22	47	727	17	17	135	30	17	49	83
Future Volume (vph)	26	567	22	47	727	17	17	135	30	17	49	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Storage Length (ft)	65		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	60			25			25			25		
Satd. Flow (prot)	1516	2887	0	1516	2925	0	0	1603	0	0	1500	0
Flt Permitted	0.323			0.363				0.967			0.958	
Satd. Flow (perm)	448	2887	0	484	2925	0	0	1547	0	0	1428	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			4			10			67	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		329			326			156			163	
Travel Time (s)		9.0			8.9			4.3			4.4	
Confl. Peds. (#/hr)	165		269	169		165	69		96	96		36
Peak Hour Factor	0.89	0.89	0.89	0.99	0.99	0.99	0.93	0.93	0.93	0.80	0.80	0.80
Heavy Vehicles (%)	0%	2%	0%	0%	2%	6%	4%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	29	662	0	47	751	0	0	195	0	0	186	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases	2			6			4			4		
Total Split (s)	65.0	65.0		65.0	65.0		35.0	35.0		35.0	35.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	61.5	61.5		61.5	61.5			31.5			31.5	
Actuated g/C Ratio	0.62	0.62		0.62	0.62			0.32			0.32	
v/c Ratio	0.11	0.37		0.16	0.42			0.39			0.38	
Control Delay	9.2	10.2		10.0	8.7			28.3			9.3	
Queue Delay	0.0	1.2		0.0	0.1			0.0			0.0	
Total Delay	9.2	11.5		10.0	8.8			28.3			9.3	
LOS	A	B		B	A			C			A	
Approach Delay		11.4			8.9			28.3			9.3	
Approach LOS		B			A			C			A	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 10 (10%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.42  
 Intersection Signal Delay: 11.9  
 Intersection LOS: B  
 Intersection Capacity Utilization 58.2%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 2846: 8th Ave & Madison St



Lanes, Volumes, Timings  
 2865: 9th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	613	11	63	744	29	23	106	40	42	124	43
Future Volume (vph)	11	613	11	63	744	29	23	106	40	42	124	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1516	2933	0	1430	2904	0	0	1478	0	0	1567	0
Flt Permitted	0.293			0.331				0.932			0.832	
Satd. Flow (perm)	419	2933	0	420	2904	0	0	1381	0	0	1317	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			7			14			14	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		326			325			144			151	
Travel Time (s)		8.9			8.9			3.9			4.1	
Confl. Peds. (#/hr)	132		249	249		132	30		63	63		128
Peak Hour Factor	0.88	0.88	0.88	0.97	0.97	0.97	0.81	0.81	0.81	0.87	0.87	0.87
Heavy Vehicles (%)	0%	2%	0%	6%	2%	0%	0%	9%	10%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	13	710	0	65	797	0	0	208	0	0	240	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4				8
Permitted Phases	2			6			4			8		
Total Split (s)	61.0	61.0		61.0	61.0		23.0	23.0		39.0	39.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	57.5	57.5		57.5	57.5			19.5			35.5	
Actuated g/C Ratio	0.58	0.58		0.58	0.58			0.20			0.36	
v/c Ratio	0.05	0.42		0.27	0.48			0.74			0.50	
Control Delay	4.7	8.2		12.1	13.0			52.8			23.9	
Queue Delay	0.0	0.3		0.0	0.4			0.0			0.0	
Total Delay	4.7	8.5		12.1	13.4			52.8			23.9	
LOS	A	A		B	B			D			C	
Approach Delay		8.4			13.3			52.8			23.9	
Approach LOS		A			B			D			C	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 27 (27%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.74  
 Intersection Signal Delay: 16.9  
 Intersection LOS: B  
 Intersection Capacity Utilization 66.8%  
 ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 2865: 9th Ave & Madison St





Lane Group	Ø3	Ø5
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	3	5
Permitted Phases		
Total Split (s)	8.0	8.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
 2893: Terry Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	681	11	12	751	19	17	51	34	8	24	22
Future Volume (vph)	20	681	11	12	751	19	17	51	34	8	24	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1444	2945	0	1516	2943	0	0	1533	0	0	1535	0
Flt Permitted	0.295			0.345				0.957			0.962	
Satd. Flow (perm)	418	2945	0	482	2943	0	0	1459	0	0	1464	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			5			25				29
Link Speed (mph)		25			25			25				25
Link Distance (ft)		325			319			146				164
Travel Time (s)		8.9			8.7			4.0				4.5
Confl. Peds. (#/hr)	152		226	226		152	59		91	91		59
Peak Hour Factor	0.95	0.95	0.95	0.90	0.90	0.90	0.83	0.83	0.83	0.75	0.75	0.75
Heavy Vehicles (%)	5%	2%	9%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	21	729	0	13	855	0	0	122	0	0	72	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8				4
Permitted Phases	2			6			8			4		
Total Split (s)	71.0	71.0		71.0	71.0		29.0	29.0		29.0		29.0
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.0				3.0
Act Effect Green (s)	67.5	67.5		67.5	67.5			26.0				26.0
Actuated g/C Ratio	0.68	0.68		0.68	0.68			0.26				0.26
v/c Ratio	0.07	0.37		0.04	0.43			0.31				0.18
Control Delay	4.7	8.3		11.2	12.6			26.0				20.0
Queue Delay	0.0	0.4		0.0	1.5			0.0				0.0
Total Delay	4.7	8.7		11.2	14.1			26.0				20.0
LOS	A	A		B	B			C				C
Approach Delay		8.6			14.1			26.0				20.0
Approach LOS		A			B			C				C

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 47 (47%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.43  
 Intersection Signal Delay: 12.8  
 Intersection LOS: B  
 Intersection Capacity Utilization 46.7%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2893: Terry Ave & Madison St



Lanes, Volumes, Timings  
2896: Madison St & Minor Ave

1/22/2016

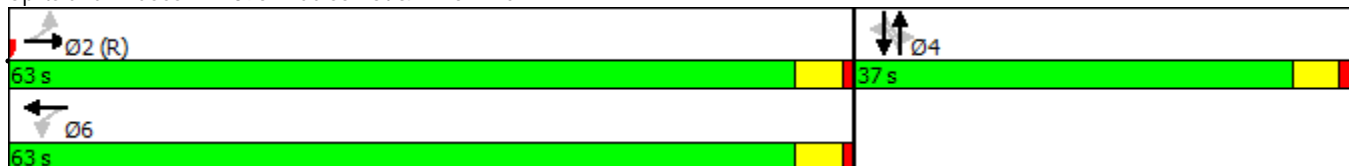


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	757	26	41	662	60	0	79	63	13	40	58
Future Volume (vph)	16	757	26	41	662	60	0	79	63	13	40	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	12	12	12	12	12
Storage Length (ft)	85		0	85		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1516	2905	0	1516	2815	0	0	1492	0	0	1405	0
Flt Permitted	0.314			0.266							0.962	
Satd. Flow (perm)	438	2905	0	382	2815	0	0	1492	0	0	1342	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			17			43				59
Link Speed (mph)		25			25			25				25
Link Distance (ft)		324			318			151				149
Travel Time (s)		8.8			8.7			4.1				4.1
Confl. Peds. (#/hr)	157		212	212		157	110		81	81		110
Peak Hour Factor	0.89	0.89	0.89	0.95	0.95	0.95	0.83	0.83	0.83	0.76	0.76	0.76
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	18	880	0	43	760	0	0	171	0	0	146	0
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		2			6			4				4
Permitted Phases	2			6			4			4		
Total Split (s)	63.0	63.0		63.0	63.0		37.0	37.0		37.0		37.0
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5				3.5
Act Effect Green (s)	59.5	59.5		59.5	59.5			33.5				33.5
Actuated g/C Ratio	0.60	0.60		0.60	0.60			0.34				0.34
v/c Ratio	0.07	0.51		0.19	0.45			0.32				0.30
Control Delay	1.5	3.5		7.3	6.5			20.3				16.5
Queue Delay	0.0	1.1		0.0	0.3			0.0				0.5
Total Delay	1.5	4.5		7.3	6.7			20.3				16.9
LOS	A	A		A	A			C				B
Approach Delay		4.5			6.8			20.3				16.9
Approach LOS		A			A			C				B

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 92 (92%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.51  
 Intersection Signal Delay: 7.6      Intersection LOS: A  
 Intersection Capacity Utilization 67.2%      ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 2896: Madison St & Minor Ave



Lanes, Volumes, Timings  
 4018: E Madison St & 12th Ave & Union St

1/22/2016



Lane Group	NBL2	NBL	NBT	NBR	SBL	SBT	SBR	SBR2	NEL2	NEL	NET	NER
Lane Configurations												
Traffic Volume (vph)	27	83	397	74	55	387	90	22	1	33	871	108
Future Volume (vph)	27	83	397	74	55	387	90	22	1	33	871	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	11	12	10	10	12	12	12	12	15	12
Grade (%)			0%			0%						4%
Storage Length (ft)		145		0	160		0			0		0
Storage Lanes		1		1	1		0			0		0
Taper Length (ft)		25			25					25		
Satd. Flow (prot)	0	1668	1818	1599	1652	2800	0	0	0	0	3752	0
Flt Permitted		0.359			0.350						0.893	
Satd. Flow (perm)	0	555	1818	1599	593	2800	0	0	0	0	3354	0
Right Turn on Red				Yes				Yes				Yes
Satd. Flow (RTOR)				74		6					18	
Link Speed (mph)			30			30					30	
Link Distance (ft)			172			489					373	
Travel Time (s)			3.9			11.1					8.5	
Confl. Peds. (#/hr)	96	34		41	41		96	34	34	27		45
Peak Hour Factor	0.96	0.96	0.96	0.96	0.86	0.86	0.86	0.86	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%	2%	2%	1%	1%	1%	1%
Parking (#/hr)						0						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	114	414	77	64	581	0	0	0	0	1055	0
Turn Type	Perm	Perm	NA	Prot	Perm	NA			Perm	Perm	NA	
Protected Phases			4	4		8					6	
Permitted Phases	4	4			8				6	6		
Total Split (s)	45.0	45.0	45.0	45.0	45.0	45.0			55.0	55.0	55.0	
Total Lost Time (s)		5.0	5.0	5.0	5.5	5.5					5.5	
Act Effect Green (s)		40.0	40.0	40.0	39.5	39.5					49.5	
Actuated g/C Ratio		0.40	0.40	0.40	0.40	0.40					0.50	
v/c Ratio		0.51	0.57	0.11	0.27	0.52					0.63	
Control Delay		32.7	27.1	5.4	40.4	41.7					19.9	
Queue Delay		0.0	0.0	0.0	0.0	0.0					0.9	
Total Delay		32.7	27.1	5.4	40.4	41.7					20.8	
LOS		C	C	A	D	D					C	
Approach Delay			25.4			41.5					20.8	
Approach LOS			C			D					C	

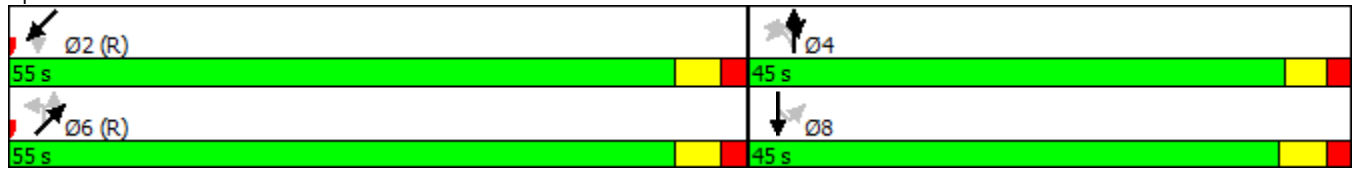
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	7 (7%), Referenced to phase 2:SWTL and 6:NETL, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.65
Intersection Signal Delay:	30.3
Intersection LOS:	C
Intersection Capacity Utilization:	93.1%
ICU Level of Service:	F
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4018: E Madison St & 12th Ave & Union St

1/22/2016

Splits and Phases: 4018: E Madison St & 12th Ave & Union St



Lane Group	SWL	SWT	SWR	SWR2
Lane Configurations		↕↕		
Traffic Volume (vph)	39	596	132	40
Future Volume (vph)	39	596	132	40
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12
Grade (%)		-8%		
Storage Length (ft)	0		0	
Storage Lanes	0		0	
Taper Length (ft)	25			
Satd. Flow (prot)	0	3314	0	0
Flt Permitted		0.813		
Satd. Flow (perm)	0	2698	0	0
Right Turn on Red				Yes
Satd. Flow (RTOR)		7		
Link Speed (mph)		30		
Link Distance (ft)		165		
Travel Time (s)		3.8		
Confl. Peds. (#/hr)	45		34	27
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	2%	2%	2%
Parking (#/hr)				
Shared Lane Traffic (%)				
Lane Group Flow (vph)	0	876	0	0
Turn Type	Perm	NA		
Protected Phases		2		
Permitted Phases	2			
Total Split (s)	55.0	55.0		
Total Lost Time (s)		5.5		
Act Effect Green (s)		49.5		
Actuated g/C Ratio		0.50		
v/c Ratio		0.65		
Control Delay		36.2		
Queue Delay		0.5		
Total Delay		36.7		
LOS		D		
Approach Delay		36.7		
Approach LOS		D		

Intersection Summary

Lanes, Volumes, Timings  
4031: 3rd Ave & Madison St

1/22/2016

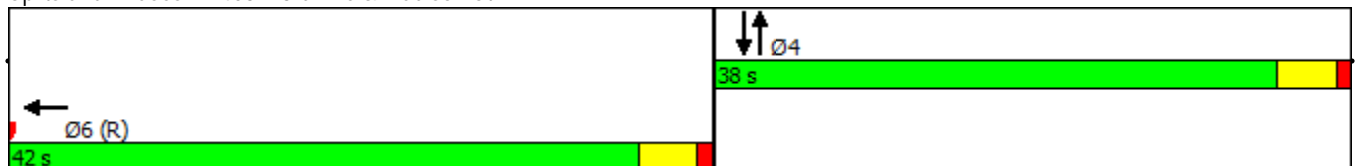


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	0	463	49	0	134	0	0	135	56
Future Volume (vph)	0	0	0	0	463	49	0	134	0	0	135	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	10	12	12	11	12
Grade (%)		10%			-15%			0%			-5%	
Satd. Flow (prot)	0	0	0	0	2925	0	0	1468	0	0	1556	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	2925	0	0	1468	0	0	1556	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					19						64	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		309			297			298			321	
Travel Time (s)		8.4			8.1			8.1			8.8	
Confl. Peds. (#/hr)	244		457	457		244	588		499	499		588
Peak Hour Factor	0.25	0.25	0.25	0.91	0.91	0.91	0.93	0.93	0.93	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	0%	9%	2%	2%	0%	81%	0%	0%	82%	11%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	62	0	0	29	0
Parking (#/hr)					15							
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	563	0	0	144	0	0	219	0
Turn Type					NA			NA			NA	
Protected Phases					6			4			4	
Permitted Phases												
Total Split (s)					42.0			38.0			38.0	
Total Lost Time (s)					4.0			4.0			4.0	
Act Effct Green (s)					38.0			34.0			34.0	
Actuated g/C Ratio					0.48			0.42			0.42	
v/c Ratio					0.40			0.23			0.31	
Control Delay					10.5			18.8			6.2	
Queue Delay					1.5			0.0			0.0	
Total Delay					12.0			18.8			6.2	
LOS					B			B			A	
Approach Delay					12.0			18.8			6.2	
Approach LOS					B			B			A	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 2 (3%), Referenced to phase 6:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.40  
 Intersection Signal Delay: 11.6      Intersection LOS: B  
 Intersection Capacity Utilization 34.2%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4031: 3rd Ave & Madison St



Lanes, Volumes, Timings  
4032: 6th Ave & Madison St

1/22/2016

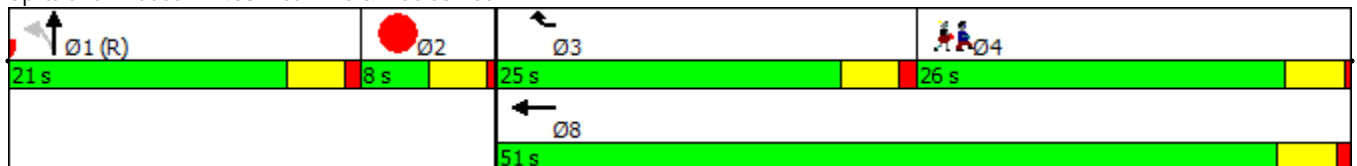


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑				
Traffic Volume (vph)	0	0	0	0	792	812	25	207	189	0	0	0
Future Volume (vph)	0	0	0	0	792	812	25	207	189	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	10	9	12	12	12	12	12	12
Grade (%)		10%			-10%			5%			-5%	
Satd. Flow (prot)	0	0	0	0	2671	1238	0	2572	0	0	0	0
Flt Permitted								0.997				
Satd. Flow (perm)	0	0	0	0	2671	1238	0	2527	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)					118	511		229				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		287			328			296			323	
Travel Time (s)		7.8			8.9			8.1			8.8	
Confl. Peds. (#/hr)	137		316	316		137	178			1		178
Confl. Bikes (#/hr)			3			26			2			3
Peak Hour Factor	0.25	0.25	0.25	0.97	0.97	0.97	0.85	0.85	0.85	0.25	0.25	0.25
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	12%	1%	5%	0%	0%	0%
Parking (#/hr)								15				
Shared Lane Traffic (%)						39%						
Lane Group Flow (vph)	0	0	0	0	1142	511	0	495	0	0	0	0
Turn Type					NA	custom	Perm	NA				
Protected Phases					8	3		1				
Permitted Phases							1					
Total Split (s)					51.0	25.0	21.0	21.0				
Total Lost Time (s)					4.0	4.0		4.0				
Act Effect Green (s)					47.0	21.0		17.0				
Actuated g/C Ratio					0.59	0.26		0.21				
v/c Ratio					0.71	0.73		0.69				
Control Delay					8.9	9.8		14.8				
Queue Delay					0.9	2.4		0.6				
Total Delay					9.9	12.2		15.5				
LOS					A	B		B				
Approach Delay					10.6			15.5				
Approach LOS					B			B				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 0 (0%), Referenced to phase 1:NBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.73  
 Intersection Signal Delay: 11.7  
 Intersection LOS: B  
 Intersection Capacity Utilization 64.7%  
 ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 4032: 6th Ave & Madison St



Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Parking (#/hr)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	4
Permitted Phases		
Total Split (s)	8.0	26.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		



Lanes, Volumes, Timings  
 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↖			↖↖↖		↖	↖	↖	↖		↖
Traffic Volume (vph)	1	191	0	0	780	4	509	307	407	12	0	356
Future Volume (vph)	1	191	0	0	780	4	509	307	407	12	0	356
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			5%				-5%
Storage Length (ft)	0		0	130		0	0		180	0		10
Storage Lanes	0		0	1		0	1		2	1		1
Taper Length (ft)	25			60			0			25		
Satd. Flow (prot)	0	1254	0	0	4262	0	1505	1563	1403	1665	0	1475
Flt Permitted		0.997					0.950	0.987		0.420		
Satd. Flow (perm)	0	1250	0	0	4262	0	1503	1563	1288	715	0	1475
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					1				20			20
Link Speed (mph)		25			25			25				25
Link Distance (ft)		328			329			522				325
Travel Time (s)		8.9			9.0			14.2				8.9
Confl. Peds. (#/hr)	114		364	364		114	1		56	56		
Confl. Bikes (#/hr)			2			9			22			
Peak Hour Factor	0.81	0.81	0.81	0.94	0.94	0.94	0.94	0.94	0.94	0.90	0.90	0.90
Heavy Vehicles (%)	0%	5%	0%	0%	2%	0%	0%	0%	1%	0%	0%	1%
Parking (#/hr)		15										
Shared Lane Traffic (%)							21%					
Lane Group Flow (vph)	0	237	0	0	834	0	427	441	433	13	0	396
Turn Type	Perm	NA			NA		Perm	NA	Perm	D.Pm		Perm
Protected Phases		2			6			4				
Permitted Phases	2						4		4	4		4
Total Split (s)	28.0	28.0			28.0		52.0	52.0	52.0	52.0		52.0
Total Lost Time (s)		3.5			3.5		3.5	3.5	3.5	3.5		4.5
Act Effct Green (s)		24.5			24.5		48.5	48.5	48.5	48.5		47.5
Actuated g/C Ratio		0.31			0.31		0.61	0.61	0.61	0.61		0.59
v/c Ratio		0.62			0.64		0.47	0.47	0.55	0.03		0.45
Control Delay		22.4			26.6		10.8	10.7	12.1	6.6		10.5
Queue Delay		0.0			0.2		0.0	0.0	0.0	0.0		1.8
Total Delay		22.4			26.8		10.8	10.7	12.1	6.6		12.3
LOS		C			C		B	B	B	A		B
Approach Delay		22.4			26.8			11.2				
Approach LOS		C			C			B				

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	16 (20%), Referenced to phase 6:WBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.64
Intersection Signal Delay:	17.0
Intersection LOS:	B
Intersection Capacity Utilization:	76.4%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings

4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/22/2016

Splits and Phases: 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St



Lanes, Volumes, Timings  
4034: Boren Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	610	7	29	666	67	84	504	33	189	734	32
Future Volume (vph)	57	610	7	29	666	67	84	504	33	189	734	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	12	9	9	12	9	9	12
Storage Length (ft)	85		0	85		0	150		0	200		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			50		
Satd. Flow (prot)	1486	2894	0	1516	2817	0	1433	2776	0	1462	2772	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1342	2894	0	1299	2817	0	1315	2776	0	1302	2772	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			11			7			5	
Link Speed (mph)		25			25			30			30	
Link Distance (ft)		319			324			309			308	
Travel Time (s)		8.7			8.8			7.0			7.0	
Confl. Peds. (#/hr)	183		335	335		183	144		160	160		144
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	4%	0%	2%	0%	2%	2%	6%	0%	2%	1%
Bus Blockages (#/hr)	0	10	0	0	6	0	0	2	0	0	8	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	66	709	0	33	843	0	100	639	0	210	852	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	12.0	32.0		12.0	32.0		14.0	34.0		22.0	42.0	
Total Lost Time (s)	4.0	3.5		4.0	3.5		4.0	3.5		4.0	3.5	
Act Effect Green (s)	7.9	33.2		7.8	30.8		10.1	30.5		18.1	38.5	
Actuated g/C Ratio	0.08	0.33		0.08	0.31		0.10	0.30		0.18	0.38	
v/c Ratio	0.56	0.74		0.28	0.96		0.69	0.75		0.80	0.80	
Control Delay	45.6	34.4		53.6	65.3		67.1	27.7		52.2	27.5	
Queue Delay	0.0	0.6		0.0	5.0		0.0	1.8		0.0	2.3	
Total Delay	45.6	34.9		53.6	70.3		67.1	29.5		52.2	29.8	
LOS	D	C		D	E		E	C		D	C	
Approach Delay		35.8			69.7			34.6			34.2	
Approach LOS		D			E			C			C	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	34 (34%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.96
Intersection Signal Delay:	43.7
Intersection LOS:	D
Intersection Capacity Utilization:	71.8%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4034: Boren Ave & Madison St

1/22/2016

Splits and Phases: 4034: Boren Ave & Madison St



Lanes, Volumes, Timings  
4035: Broadway & Madison St/E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↕		↖	↕			↕			↕	↖
Traffic Volume (vph)	147	690	38	78	571	29	0	329	139	0	284	90
Future Volume (vph)	147	690	38	78	571	29	0	329	139	0	284	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	10	12	10	10	12	12	13	12	12	13	12
Grade (%)		-9%			8%			0%				0%
Storage Length (ft)	50		0	50		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	50			25			59			25		
Satd. Flow (prot)	1770	3408	0	1526	3125	0	0	3375	0	0	3406	0
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	1657	3408	0	1470	3125	0	0	3375	0	0	3406	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			5			91				58
Link Speed (mph)		30			30			30				30
Link Distance (ft)		306			247			363				184
Travel Time (s)		7.0			5.6			8.3				4.2
Confl. Peds. (#/hr)	98		62	62		62	62		62	62		62
Peak Hour Factor	0.97	0.97	0.97	0.94	0.94	0.94	0.94	0.94	0.94	0.88	0.88	0.88
Heavy Vehicles (%)	3%	2%	0%	6%	2%	7%	0%	2%	2%	0%	2%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	152	750	0	83	638	0	0	498	0	0	425	0
Turn Type	Prot	NA		Prot	NA			NA			NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases								3				
Total Split (s)	18.0	30.0		18.0	30.0			25.0			52.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	12.6	54.5		12.2	54.5			22.3			22.3	
Actuated g/C Ratio	0.13	0.54		0.12	0.54			0.22			0.22	
v/c Ratio	0.68	0.40		0.45	0.37			0.60			0.53	
Control Delay	47.8	21.6		30.6	27.4			26.4			36.0	
Queue Delay	0.0	0.5		0.0	0.0			0.0			0.0	
Total Delay	47.8	22.0		30.6	27.4			26.4			36.0	
LOS	D	C		C	C			C			D	
Approach Delay		26.4			27.8			26.4			36.0	
Approach LOS		C			C			C			D	

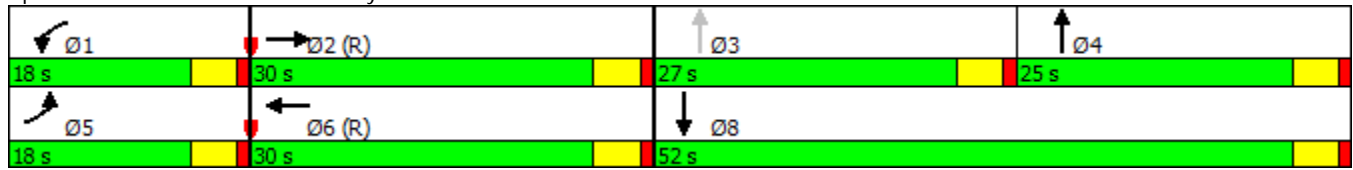
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	2 (2%), Referenced to phase 2:EBT and 6:WBT, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.68
Intersection Signal Delay:	28.4
Intersection LOS:	C
Intersection Capacity Utilization:	50.1%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4035: Broadway & Madison St/E Madison St

1/22/2016

Splits and Phases: 4035: Broadway & Madison St/E Madison St

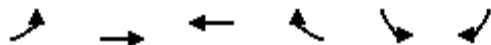


Lane Group	Ø3
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	3
Permitted Phases	
Total Split (s)	27.0
Total Lost Time (s)	
Act Effect Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

# Lanes, Volumes, Timings

## 4039: E Madison St & 15th Ave

1/22/2016



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø1	Ø4
Lane Configurations		↕↕	↕↔			↗		
Traffic Volume (vph)	61	736	614	13	0	130		
Future Volume (vph)	61	736	614	13	0	130		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	12	11	11	12	12	16		
Grade (%)		10%	-9%		0%			
Satd. Flow (prot)	0	3269	3595	0	0	1774		
Flt Permitted		0.830						
Satd. Flow (perm)	0	2721	3595	0	0	1752		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)			5			435		
Link Speed (mph)		30	30		30			
Link Distance (ft)		260	400		288			
Travel Time (s)		5.9	9.1		6.5			
Confl. Peds. (#/hr)	59			59	47	1		
Confl. Bikes (#/hr)				2				
Peak Hour Factor	0.93	0.93	0.85	0.85	0.85	0.85		
Heavy Vehicles (%)	1%	1%	1%	1%	5%	5%		
Parking (#/hr)				0				
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	857	737	0	0	153		
Turn Type	Perm	NA	NA			Free		
Protected Phases		2	6				1	4
Permitted Phases	2					Free		
Total Split (s)	68.0	68.0	76.0				8.0	24.0
Total Lost Time (s)		4.5	4.5					
Act Effect Green (s)		83.2	83.2			100.0		
Actuated g/C Ratio		0.83	0.83			1.00		
v/c Ratio		0.38	0.25			0.09		
Control Delay		2.0	2.2			0.1		
Queue Delay		0.0	0.0			0.0		
Total Delay		2.0	2.2			0.1		
LOS		A	A			A		
Approach Delay		2.0	2.2					
Approach LOS		A	A					

### Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 37 (37%), Referenced to phase 2:EBTL, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.38  
 Intersection Signal Delay: 1.9  
 Intersection Capacity Utilization 54.1%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service A

Splits and Phases: 4039: E Madison St & 15th Ave



Lanes, Volumes, Timings  
4040: E Madison St & 23rd Ave E

1/22/2016



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↑↑			↑↑		↖	↑↑		↖	↑↑	
Traffic Volume (vph)	0	624	72	0	651	108	174	587	32	155	547	11
Future Volume (vph)	0	624	72	0	651	108	174	587	32	155	547	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	9	9	10	10	10	10	16	10	9	10	10
Grade (%)		0%			0%			-5%			10%	
Storage Length (ft)	0		0	0		0	167		0	50		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3150	0	0	3261	0	1693	4078	0	1528	3118	0
Flt Permitted							0.950			0.950		
Satd. Flow (perm)	0	3150	0	0	3261	0	1693	4078	0	1528	3118	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		18			21			5			4	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		758			380			361			501	
Travel Time (s)		17.2			8.6			8.2			11.4	
Confl. Peds. (#/hr)			2	2								3
Peak Hour Factor	0.92	0.87	0.69	0.25	0.91	0.92	0.92	0.92	0.92	0.64	0.92	0.46
Heavy Vehicles (%)	2%	1%	1%	1%	1%	2%	2%	2%	2%	1%	2%	1%
Parking (#/hr)			0									0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	821	0	0	832	0	189	673	0	242	619	0
Turn Type		NA			NA		Prot	NA		Prot	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases												
Total Split (s)		39.0			39.0		24.0	30.0		31.0	37.0	
Total Lost Time (s)		3.0			3.0		3.0	3.0		3.0	4.5	
Act Effct Green (s)		36.0			36.0		17.2	27.0		28.0	36.3	
Actuated g/C Ratio		0.36			0.36		0.17	0.27		0.28	0.36	
v/c Ratio		0.72			0.70		0.65	0.61		0.57	0.55	
Control Delay		28.0			44.2		55.4	33.3		34.6	25.8	
Queue Delay		0.0			1.3		0.0	0.0		0.0	0.0	
Total Delay		28.0			45.5		55.4	33.3		34.6	25.8	
LOS		C			D		E	C		C	C	
Approach Delay		28.0			45.5			38.1			28.3	
Approach LOS		C			D			D			C	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	72 (72%), Referenced to phase 2:NET and 6:SWT, Start of Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.72
Intersection Signal Delay:	35.0
Intersection LOS:	C
Intersection Capacity Utilization:	57.3%
ICU Level of Service:	B
Analysis Period (min):	15



Lanes, Volumes, Timings  
 4040: E Madison St & 23rd Ave E

1/22/2016

Splits and Phases: 4040: E Madison St & 23rd Ave E



# Lanes, Volumes, Timings

## 4041: 3rd Ave & Spring St

1/22/2016

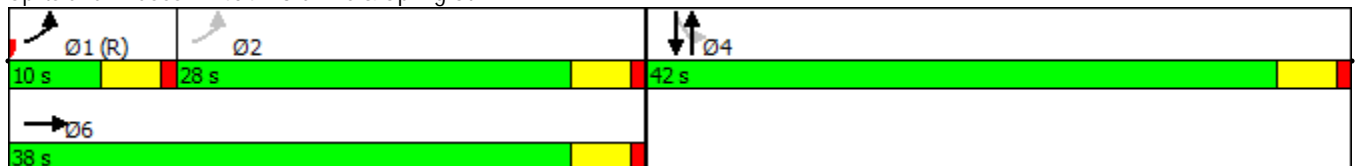


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕↕			↕↕	
Traffic Volume (vph)	5	600	28	0	0	0	0	111	53	14	148	0
Future Volume (vph)	5	600	28	0	0	0	0	111	53	14	148	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	11	12	12	11	12
Grade (%)		10%			-10%			0%			0%	
Satd. Flow (prot)	0	2550	0	0	0	0	0	1451	0	0	1770	0
Flt Permitted											0.930	
Satd. Flow (perm)	0	2543	0	0	0	0	0	1451	0	0	1613	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7						39				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		306			298			321			281	
Travel Time (s)		8.3			8.1			8.8			7.7	
Confl. Peds. (#/hr)	396		213	213		396	650		405	405		650
Peak Hour Factor	0.97	0.97	0.97	0.25	0.25	0.25	0.80	0.80	0.80	0.91	0.91	0.91
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	87%	0%	40%	67%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	60	0	0	34	0
Parking (#/hr)		15										
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	653	0	0	0	0	0	205	0	0	178	0
Turn Type	custom	NA						NA		Perm	NA	
Protected Phases	1	6						4			4	
Permitted Phases	2									4		
Total Split (s)	10.0	38.0						42.0		42.0	42.0	
Total Lost Time (s)		4.0						4.0			4.0	
Act Effct Green (s)		34.0						38.0			38.0	
Actuated g/C Ratio		0.42						0.48			0.48	
v/c Ratio		0.60						0.29			0.23	
Control Delay		22.9						10.0			19.9	
Queue Delay		1.9						0.6			0.4	
Total Delay		24.8						10.6			20.2	
LOS		C						B			C	
Approach Delay		24.8						10.6			20.2	
Approach LOS		C						B			C	

### Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 22 (28%), Referenced to phase 1:EBL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.60  
 Intersection Signal Delay: 21.2      Intersection LOS: C  
 Intersection Capacity Utilization 46.5%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4041: 3rd Ave & Spring St



Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	28.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St

1/22/2016

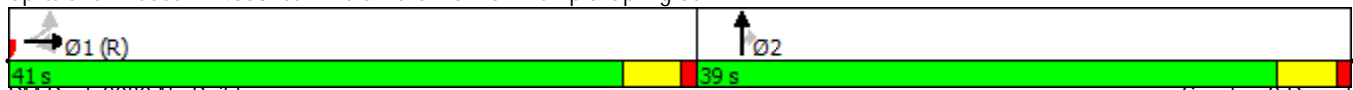


Lane Group	EBL	EBT	EBR	NBT	NBR	NBR2
Lane Configurations		↕↑	↗	↑↑	↖	
Traffic Volume (vph)	205	171	766	363	35	599
Future Volume (vph)	205	171	766	363	35	599
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	11	10	11	12
Grade (%)		10%		5%		
Satd. Flow (prot)	0	2507	1322	2927	1357	0
Flt Permitted		0.973				
Satd. Flow (perm)	0	2188	1322	2927	1357	0
Right Turn on Red	Yes					No
Satd. Flow (RTOR)		149				
Link Speed (mph)		25		25		
Link Distance (ft)		295		323		
Travel Time (s)		8.0		8.8		
Confl. Peds. (#/hr)	224					
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	1%	1%	1%	1%	0%	1%
Bus Blockages (#/hr)	0	5	0	0	0	0
Parking (#/hr)		15				
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	404	824	390	682	0
Turn Type	Perm	NA	Perm	NA	Perm	
Protected Phases		1		2		
Permitted Phases	1		1		2	
Total Split (s)	41.0	41.0	41.0	39.0	39.0	
Total Lost Time (s)		4.5	4.5	4.5	4.5	
Act Effect Green (s)		36.5	36.5	34.5	34.5	
Actuated g/C Ratio		0.46	0.46	0.43	0.43	
v/c Ratio		0.37	1.37	0.31	1.17	
Control Delay		0.8	196.6	14.8	111.9	
Queue Delay		0.0	0.9	0.0	0.4	
Total Delay		0.8	197.5	14.8	112.3	
LOS		A	F	B	F	
Approach Delay		132.8		76.8		
Approach LOS		F		E		

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 66 (83%), Referenced to phase 1:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.37  
 Intersection Signal Delay: 106.7  
 Intersection LOS: F  
 Intersection Capacity Utilization 103.8%  
 ICU Level of Service G  
 Analysis Period (min) 15

Splits and Phases: 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St



Lanes, Volumes, Timings  
4059: Madison St & Boylston Ave

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	27	739	26	7	642	17	10	63	39	36	9	31
Future Volume (vph)	27	739	26	7	642	17	10	63	39	36	9	31
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	9	12	12	12	12	12	12	12
Storage Length (ft)	85		0	70		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			50			25			25		
Satd. Flow (prot)	1516	2906	0	1516	2829	0	0	1585	0	0	1509	0
Flt Permitted	0.374			0.316				0.975			0.789	
Satd. Flow (perm)	529	2906	0	455	2829	0	0	1542	0	0	1197	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			6			26			33	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		325			306			184			179	
Travel Time (s)		8.9			8.3			5.0			4.9	
Confl. Peds. (#/hr)	88		106	106		88	52		30	30		52
Peak Hour Factor	0.91	0.91	0.91	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81
Heavy Vehicles (%)	0%	2%	8%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	30	841	0	7	694	0	0	126	0	0	93	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Total Split (s)	72.0	72.0		72.0	72.0		28.0	28.0		28.0	28.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Act Effect Green (s)	75.7	75.7		75.7	75.7			17.3			17.3	
Actuated g/C Ratio	0.76	0.76		0.76	0.76			0.17			0.17	
v/c Ratio	0.07	0.38		0.02	0.32			0.44			0.40	
Control Delay	1.2	1.3		2.0	10.1			34.4			30.0	
Queue Delay	0.0	0.1		0.0	0.4			0.0			0.0	
Total Delay	1.2	1.4		2.0	10.6			34.4			30.0	
LOS	A	A		A	B			C			C	
Approach Delay		1.4			10.5			34.4			30.0	
Approach LOS		A			B			C			C	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 3 (3%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.44  
 Intersection Signal Delay: 8.8      Intersection LOS: A  
 Intersection Capacity Utilization 44.9%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4059: Madison St & Boylston Ave



Lanes, Volumes, Timings  
4411: 4th Ave & Madison St

1/22/2016

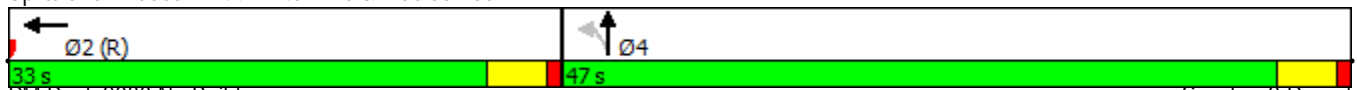


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑			↑↑↑				
Traffic Volume (vph)	0	0	0	0	405	256	123	1576	0	0	0	0
Future Volume (vph)	0	0	0	0	405	256	123	1576	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	13	12	12	10	12	12	12	12
Grade (%)		15%			-10%			5%			0%	
Satd. Flow (prot)	0	0	0	0	2538	0	0	3675	0	0	0	0
Flt Permitted								0.996				
Satd. Flow (perm)	0	0	0	0	2538	0	0	3566	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)					1			20				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		297			362			160			323	
Travel Time (s)		8.1			9.9			4.4			8.8	
Confl. Peds. (#/hr)	361		494	494		361	487		575	575		487
Peak Hour Factor	0.25	0.25	0.25	0.84	0.84	0.84	0.97	0.97	0.97	0.25	0.25	0.25
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	1%	9%	0%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)					15			15				
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	787	0	0	1752	0	0	0	0
Turn Type					NA		Perm	NA				
Protected Phases					2			4				
Permitted Phases							4					
Total Split (s)					33.0		47.0	47.0				
Total Lost Time (s)					2.5			3.5				
Act Effect Green (s)					30.5			43.5				
Actuated g/C Ratio					0.38			0.54				
v/c Ratio					0.81			0.90				
Control Delay					18.4			21.1				
Queue Delay					0.0			46.1				
Total Delay					18.4			67.2				
LOS					B			E				
Approach Delay					18.4			67.2				
Approach LOS					B			E				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 61 (76%), Referenced to phase 2:WBT and 6:, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.90  
 Intersection Signal Delay: 52.1 Intersection LOS: D  
 Intersection Capacity Utilization 70.5% ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 4411: 4th Ave & Madison St



Lanes, Volumes, Timings  
4412: 4th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕↕↕	↗			
Traffic Volume (vph)	171	575	0	0	0	0	0	1796	113	0	0	0
Future Volume (vph)	171	575	0	0	0	0	0	1796	113	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	10	12	12	12	12
Grade (%)		15%			-5%			5%				0%
Storage Length (ft)	0		0	0		0	0		100	0		0
Storage Lanes	0		0	0		0	0		1	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2512	0	0	0	0	0	3704	1389	0	0	0
Flt Permitted		0.989										
Satd. Flow (perm)	0	2323	0	0	0	0	0	3704	829	0	0	0
Right Turn on Red	Yes		Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20							20			
Link Speed (mph)		25			25			25				25
Link Distance (ft)		298			362			323				130
Travel Time (s)		8.1			9.9			8.8				3.5
Confl. Peds. (#/hr)	315		294	294		315	452		497	497		452
Peak Hour Factor	0.96	0.96	0.96	0.25	0.25	0.25	0.95	0.95	0.95	0.25	0.25	0.25
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	8%	2%	0%	0%	0%
Parking (#/hr)		15						15				
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	777	0	0	0	0	0	1891	119	0	0	0
Turn Type	Perm	NA						NA	Perm			
Protected Phases		2						4				
Permitted Phases	2								4			
Total Split (s)	33.0	33.0						47.0	47.0			
Total Lost Time (s)		4.5						5.5	5.5			
Act Effct Green (s)		28.5						41.5	41.5			
Actuated g/C Ratio		0.36						0.52	0.52			
v/c Ratio		0.93						0.98	0.27			
Control Delay		56.9						24.6	1.1			
Queue Delay		20.6						40.1	0.0			
Total Delay		77.5						64.6	1.1			
LOS		E						E	A			
Approach Delay		77.5						60.9				
Approach LOS		E						E				

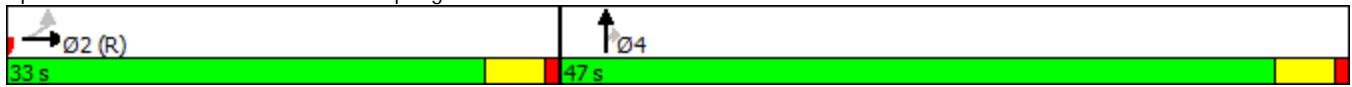
Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	74 (93%), Referenced to phase 2:EBTL, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.98
Intersection Signal Delay:	65.5
Intersection LOS:	E
Intersection Capacity Utilization:	73.4%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
4412: 4th Ave & Spring St

1/22/2016

Splits and Phases: 4412: 4th Ave & Spring St





Lanes, Volumes, Timings  
4455: 2nd Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑	↑
Traffic Volume (vph)	0	0	0	190	308	0	0	0	0	0	1286	47
Future Volume (vph)	0	0	0	190	308	0	0	0	0	0	1286	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	12	12	10	10	11
Grade (%)		12%			-8%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	2944	0	0	0	0	0	2281	548
Flt Permitted					0.981							
Satd. Flow (perm)	0	0	0	0	2586	0	0	0	0	0	2281	328
Right Turn on Red			Yes	No		No			Yes			Yes
Satd. Flow (RTOR)												48
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		338			309			302			313	
Travel Time (s)		9.2			8.4			8.2			8.5	
Confl. Peds. (#/hr)	140		263	263		140	395		417	417		395
Peak Hour Factor	0.25	0.25	0.25	0.94	0.94	0.94	0.25	0.25	0.25	0.95	0.95	0.95
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	0%	0%	0%	9%	9%	9%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)				10		0					52	95
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	530	0	0	0	0	0	1354	49
Turn Type				Perm	NA						NA	Perm
Protected Phases					4						2	
Permitted Phases				4	4							2
Total Split (s)				27.0	27.0						53.0	53.0
Total Lost Time (s)					5.0						5.0	6.5
Act Effct Green (s)					22.0						48.0	46.5
Actuated g/C Ratio					0.28						0.60	0.58
v/c Ratio					0.75						0.99	0.23
Control Delay					41.7						42.2	8.0
Queue Delay					0.0						40.3	0.0
Total Delay					41.7						82.4	8.0
LOS					D						F	A
Approach Delay					41.7						79.8	
Approach LOS					D						E	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	73 (91%), Referenced to phase 2:SBT and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.99
Intersection Signal Delay:	69.4
Intersection LOS:	E
Intersection Capacity Utilization:	63.4%
ICU Level of Service:	B
Analysis Period (min):	15

Lanes, Volumes, Timings  
4455: 2nd Ave & Madison St

1/22/2016

Splits and Phases: 4455: 2nd Ave & Madison St



Lanes, Volumes, Timings  
4456: 2nd Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑								↘	↑↑	
Traffic Volume (vph)	0	325	92	0	0	0	0	0	0	294	1221	0
Future Volume (vph)	0	325	92	0	0	0	0	0	0	294	1221	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		12%			0%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	250		0
Storage Lanes	0		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	2529	0	0	0	0	0	0	0	1204	2203	0
Flt Permitted										0.950		
Satd. Flow (perm)	0	2529	0	0	0	0	0	0	0	890	2203	0
Right Turn on Red			Yes			No			Yes	No		Yes
Satd. Flow (RTOR)		22										
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		339			306			313			293	
Travel Time (s)		9.2			8.3			8.5			8.0	
Confl. Peds. (#/hr)	200		178	178		200	340		348	348		340
Peak Hour Factor	0.92	0.92	0.92	0.25	0.25	0.25	0.25	0.25	0.25	0.97	0.97	0.97
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)										10	69	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	453	0	0	0	0	0	0	0	303	1259	0
Turn Type		NA								Prot	NA	
Protected Phases		2								3	14	
Permitted Phases												
Total Split (s)		22.0								36.0		
Total Lost Time (s)		4.0								4.0		
Act Effct Green (s)		18.0								32.0	54.0	
Actuated g/C Ratio		0.22								0.40	0.68	
v/c Ratio		0.77								0.63	0.85	
Control Delay		43.6								22.2	14.8	
Queue Delay		1.9								1.7	48.4	
Total Delay		45.5								23.9	63.2	
LOS		D								C	E	
Approach Delay		45.5									55.6	
Approach LOS		D									E	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	32 (40%), Referenced to phase 1:SBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.85
Intersection Signal Delay:	53.3
Intersection LOS:	D
Intersection Capacity Utilization:	59.1%
ICU Level of Service:	B
Analysis Period (min):	15

Lanes, Volumes, Timings  
4456: 2nd Ave & Spring St

1/22/2016

Splits and Phases: 4456: 2nd Ave & Spring St



Lane Group	Ø1	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Parking (#/hr)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	1	4
Permitted Phases		
Total Split (s)	58.0	22.0
Total Lost Time (s)		
Act Effect Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
4477: 5th Ave & Madison St

1/22/2016

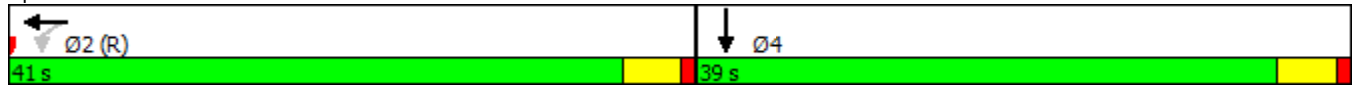


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑↑	
Traffic Volume (vph)	0	0	0	306	525	0	0	0	0	0	953	104
Future Volume (vph)	0	0	0	306	525	0	0	0	0	0	953	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	9	12
Grade (%)		10%			-10%			0%			0%	
Satd. Flow (prot)	0	0	0	0	3008	0	0	0	0	0	3659	0
Flt Permitted					0.982							
Satd. Flow (perm)	0	0	0	0	2656	0	0	0	0	0	3659	0
Right Turn on Red			Yes	Yes		Yes			Yes			Yes
Satd. Flow (RTOR)					20						29	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		362			287			292			323	
Travel Time (s)		9.9			7.8			8.0			8.8	
Confl. Peds. (#/hr)	228		242	242		228	311		184	184		311
Peak Hour Factor	0.25	0.25	0.25	0.96	0.96	0.96	0.25	0.25	0.25	0.97	0.97	0.97
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	0%	0%	0%	3%	2%
Parking (#/hr)					15						15	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	866	0	0	0	0	0	1089	0
Turn Type				Perm	NA						NA	
Protected Phases					2						4	
Permitted Phases				2								
Total Split (s)				41.0	41.0						39.0	
Total Lost Time (s)					4.5						4.5	
Act Effct Green (s)					36.5						34.5	
Actuated g/C Ratio					0.46						0.43	
v/c Ratio					0.71						0.68	
Control Delay					14.5						8.8	
Queue Delay					4.5						0.3	
Total Delay					18.9						9.1	
LOS					B						A	
Approach Delay					18.9						9.1	
Approach LOS					B						A	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	54 (68%), Referenced to phase 2:WBTL and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.71
Intersection Signal Delay:	13.4
Intersection LOS:	B
Intersection Capacity Utilization:	60.7%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 4477: 5th Ave & Madison St



Lanes, Volumes, Timings  
 4485: 7th Ave/Hubbell Pl & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕			↕	
Traffic Volume (vph)	53	132	24	0	0	0	0	285	27	6	338	0
Future Volume (vph)	53	132	24	0	0	0	0	285	27	6	338	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	2952	0	0	0	0	0	1687	0	0	1675	0
Flt Permitted		0.987									0.994	
Satd. Flow (perm)	0	2594	0	0	0	0	0	1687	0	0	1666	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16						8				
Link Speed (mph)		25			30			25			25	
Link Distance (ft)		173			329			325			300	
Travel Time (s)		4.7			7.5			8.9			8.2	
Confl. Peds. (#/hr)	166		20				4					4
Peak Hour Factor	0.87	0.92	0.87	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85
Heavy Vehicles (%)	17%	2%	0%	2%	2%	2%	0%	0%	2%	2%	2%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	232	0	0	0	0	0	339	0	0	405	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			2	
Permitted Phases	4									2		
Total Split (s)	38.0	38.0						62.0		62.0	62.0	
Total Lost Time (s)		4.5						4.5			4.5	
Act Effct Green (s)		33.5						57.5			57.5	
Actuated g/C Ratio		0.34						0.58			0.58	
v/c Ratio		0.26						0.35			0.42	
Control Delay		23.5						12.2			20.0	
Queue Delay		0.0						2.5			1.7	
Total Delay		23.5						14.7			21.7	
LOS		C						B			C	
Approach Delay		23.5						14.7			21.7	
Approach LOS		C						B			C	

Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 98 (98%), Referenced to phase 4:EBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.42  
 Intersection Signal Delay: 19.7      Intersection LOS: B  
 Intersection Capacity Utilization 47.6%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4485: 7th Ave/Hubbell Pl & Spring St



Lanes, Volumes, Timings  
4568: 5th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑									↑↑↑	
Traffic Volume (vph)	0	694	45	0	0	0	0	0	0	444	1053	0
Future Volume (vph)	0	694	45	0	0	0	0	0	0	444	1053	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	12	12	10	10	12
Grade (%)		15%			-5%			0%			0%	
Satd. Flow (prot)	0	3538	0	0	0	0	0	0	0	0	4191	0
Flt Permitted											0.985	
Satd. Flow (perm)	0	3538	0	0	0	0	0	0	0	0	3804	0
Right Turn on Red			Yes			Yes			Yes	Yes		Yes
Satd. Flow (RTOR)		9										27
Link Speed (mph)		25			25			25				25
Link Distance (ft)		362			295			323				278
Travel Time (s)		9.9			8.0			8.8				7.6
Confl. Peds. (#/hr)	210		133	133		210	392		208	208		392
Peak Hour Factor	0.90	0.90	0.90	0.25	0.25	0.25	0.25	0.25	0.25	0.93	0.93	0.93
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%	0%	0%	0%	1%	3%	0%
Parking (#/hr)		30										
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	821	0	0	0	0	0	0	0	0	1609	0
Turn Type		NA								Perm	NA	
Protected Phases		2										4
Permitted Phases										4		
Total Split (s)		32.0								48.0	48.0	
Total Lost Time (s)		3.5									3.5	
Act Effct Green (s)		28.5									44.5	
Actuated g/C Ratio		0.36									0.56	
v/c Ratio		0.65									0.76	
Control Delay		36.6									16.3	
Queue Delay		2.4									4.8	
Total Delay		39.0									21.0	
LOS		D									C	
Approach Delay		39.0									21.0	
Approach LOS		D									C	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	59 (74%), Referenced to phase 2:EBT and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.76
Intersection Signal Delay:	27.1
Intersection LOS:	C
Intersection Capacity Utilization:	57.9%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 4568: 5th Ave & Spring St



Lanes, Volumes, Timings  
5005: 19th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕			↕↕	
Traffic Volume (vph)	131	786	41	3	660	21	39	167	16	23	124	96
Future Volume (vph)	131	786	41	3	660	21	39	167	16	23	124	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		-11%			8%			0%			0%	
Storage Length (ft)	0		0	0		0	100		0	0		0
Storage Lanes	0		0	0		0	1		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3577	0	0	3291	0	1787	2101	0	0	1927	0
Flt Permitted		0.726			0.952		0.332				0.855	
Satd. Flow (perm)	0	2606	0	0	3132	0	620	2101	0	0	1655	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			5			6				37
Link Speed (mph)		30			30			30				30
Link Distance (ft)		419			361			534				317
Travel Time (s)		9.5			8.2			12.1				7.2
Confl. Peds. (#/hr)	26		40	40		26	7		2	2		7
Confl. Bikes (#/hr)			8			4			1			12
Peak Hour Factor	0.99	0.99	0.99	0.98	0.98	0.98	0.86	0.86	0.86	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	967	0	0	697	0	45	213	0	0	266	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2			4			4		
Total Split (s)	58.0	58.0		58.0	58.0		42.0	42.0		42.0		42.0
Total Lost Time (s)		6.0			6.0		6.0	6.0				6.0
Act Effct Green (s)		69.8			69.8		18.2	18.2				18.2
Actuated g/C Ratio		0.70			0.70		0.18	0.18				0.18
v/c Ratio		0.53			0.32		0.40	0.55				0.80
Control Delay		13.7			6.7		44.8	40.5				51.1
Queue Delay		0.0			0.2		0.0	0.0				0.0
Total Delay		13.7			6.8		44.8	40.5				51.1
LOS		B			A		D	D				D
Approach Delay		13.7			6.8			41.3				51.1
Approach LOS		B			A			D				D

Intersection Summary

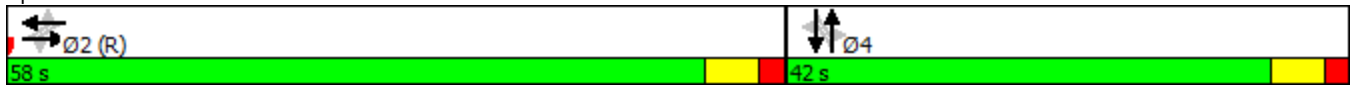
Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	40 (40%), Referenced to phase 2:EBWB, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.80
Intersection Signal Delay:	19.3
Intersection LOS:	B
Intersection Capacity Utilization:	90.1%
ICU Level of Service:	E
Analysis Period (min):	15



Lanes, Volumes, Timings  
5005: 19th Ave & E Madison St

1/22/2016

Splits and Phases: 5005: 19th Ave & E Madison St



# Lanes, Volumes, Timings

## 5349: 14th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	722	51	66	556	0	14	216	43	2	170	12
Future Volume (vph)	0	722	51	66	556	0	14	216	43	2	170	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		7%			-10%			0%			0%	
Satd. Flow (prot)	0	3278	0	0	3610	0	0	2074	0	0	2062	0
Flt Permitted					0.721			0.979			0.998	
Satd. Flow (perm)	0	3278	0	0	2611	0	0	2030	0	0	2058	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10						11			5	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		358			166			347			100	
Travel Time (s)		8.1			3.8			7.9			2.7	
Confl. Peds. (#/hr)	3		31	31		3	37		10	10		37
Confl. Bikes (#/hr)			7			3			1			1
Peak Hour Factor	0.92	0.92	0.92	0.91	0.91	0.91	0.85	0.85	0.85	0.86	0.86	0.86
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	840	0	0	684	0	0	321	0	0	214	0
Turn Type		NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		1			1			3			6	
Permitted Phases	1			1			3			6		
Total Split (s)	51.0	51.0		51.0	51.0		49.0	49.0		49.0	49.0	
Total Lost Time (s)		4.5			4.5			8.5			4.5	
Act Effct Green (s)		46.5			46.5			40.5			44.5	
Actuated g/C Ratio		0.46			0.46			0.40			0.44	
v/c Ratio		0.55			0.56			0.39			0.23	
Control Delay		18.7			16.2			19.5			12.3	
Queue Delay		1.3			0.2			1.6			0.0	
Total Delay		20.0			16.4			21.1			12.3	
LOS		C			B			C			B	
Approach Delay		20.0			16.4			21.1			12.3	
Approach LOS		C			B			C			B	

### Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 42 (42%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.56  
 Intersection Signal Delay: 18.2      Intersection LOS: B  
 Intersection Capacity Utilization 76.7%      ICU Level of Service D  
 Analysis Period (min) 15

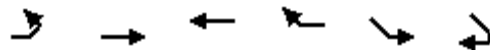
### Splits and Phases: 5349: 14th Ave & E Madison St

#5349  Ø1 (R) 51 s	#206#5349  Ø3 49 s
#2067  Ø4 51 s	#206#5349  Ø6 49 s

Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Total Split (s)	51.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
5355: E Madison St & Pine St

1/22/2016



Lane Group	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↕↕	↕↔		↕	↕
Traffic Volume (vph)	16	735	625	270	245	5
Future Volume (vph)	16	735	625	270	245	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	10	12	11	11
Grade (%)		9%	-4%		0%	
Satd. Flow (prot)	0	3183	3117	0	1678	1351
Flt Permitted		0.926			0.950	
Satd. Flow (perm)	0	2949	3117	0	1674	1197
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			114			6
Link Speed (mph)		30	30		30	
Link Distance (ft)		96	270		127	
Travel Time (s)		2.2	6.1		2.9	
Confl. Peds. (#/hr)	62			62	1	43
Confl. Bikes (#/hr)				3		8
Peak Hour Factor	0.95	0.95	0.94	0.94	0.90	0.90
Heavy Vehicles (%)	1%	1%	2%	2%	4%	4%
Parking (#/hr)						0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	791	952	0	272	6
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	2		4	
Permitted Phases	2					4
Total Split (s)	62.0	62.0	62.0		38.0	38.0
Total Lost Time (s)		4.5	4.5		4.5	4.5
Act Effct Green (s)		71.7	71.7		19.3	19.3
Actuated g/C Ratio		0.72	0.72		0.19	0.19
v/c Ratio		0.37	0.42		0.84	0.03
Control Delay		1.2	3.6		60.1	17.0
Queue Delay		0.0	0.2		0.0	0.0
Total Delay		1.2	3.9		60.1	17.0
LOS		A	A		E	B
Approach Delay		1.2	3.9		59.2	
Approach LOS		A	A		E	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	43 (43%), Referenced to phase 2:EBWB, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.84
Intersection Signal Delay:	10.4
Intersection LOS:	B
Intersection Capacity Utilization:	52.8%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 5355: E Madison St & Pine St



## **Appendix J: Intersection Operations Results LPA 2030 PM Peak Hour**

# Lanes, Volumes, Timings

## 3: 9th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗		↔			↖			↕	↘
Traffic Volume (vph)	52	65	162	174	0	17	0	63	1	3	155	0
Future Volume (vph)	52	65	162	174	0	17	0	63	1	3	155	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1822	1583	0	1759	0	0	1859	0	0	1861	0
Flt Permitted		0.830			0.664						0.997	
Satd. Flow (perm)	0	1546	1583	0	1222	0	0	1859	0	0	1857	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			176		22			1				
Link Speed (mph)		25			25			25				25
Link Distance (ft)		317			322			299				155
Travel Time (s)		8.6			8.8			8.2				4.2
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	128	176	0	207	0	0	69	0	0	171	0
Turn Type	Perm	NA	Perm	Perm	NA			NA		Perm	NA	
Protected Phases		4			4			2				2
Permitted Phases	4		4	4						2		
Total Split (s)	26.0	26.0	26.0	26.0	26.0			24.0		24.0	24.0	
Total Lost Time (s)		4.0	4.0		4.0			4.0			4.0	
Act Effect Green (s)		22.0	22.0		22.0			20.0			20.0	
Actuated g/C Ratio		0.44	0.44		0.44			0.40			0.40	
v/c Ratio		0.19	0.22		0.38			0.09			0.23	
Control Delay		6.4	2.0		10.8			17.8			11.0	
Queue Delay		0.0	0.1		0.2			0.0			0.8	
Total Delay		6.4	2.1		11.0			17.8			11.8	
LOS		A	A		B			B			B	
Approach Delay		3.9			11.0			17.8			11.8	
Approach LOS		A			B			B			B	

### Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 4:EBWB, Start of 1st Green

Control Type: Pre timed

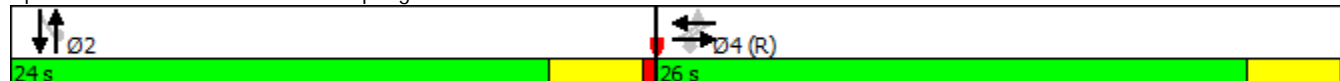
Maximum v/c Ratio: 0.38

Intersection Signal Delay: 8.9      Intersection LOS: A

Intersection Capacity Utilization 39.0%      ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: 9th Ave & Spring St



Lanes, Volumes, Timings  
6: 8th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↔			↕	
Traffic Volume (vph)	58	162	9	0	0	0	0	254	17	105	218	0
Future Volume (vph)	58	162	9	0	0	0	0	254	17	105	218	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	3476	0	0	0	0	0	1848	0	0	1833	0
Flt Permitted		0.988									0.811	
Satd. Flow (perm)	0	3476	0	0	0	0	0	1848	0	0	1511	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10						9				
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		301			317			312			149	
Travel Time (s)		6.8			7.2			7.1			4.1	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	249	0	0	0	0	0	294	0	0	351	0
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			2	
Permitted Phases	4									2		
Total Split (s)	23.0	23.0						27.0		27.0	27.0	
Total Lost Time (s)		4.0						4.0		4.0	4.0	
Act Effect Green (s)		19.0						23.0		23.0	23.0	
Actuated g/C Ratio		0.38						0.46		0.46	0.46	
v/c Ratio		0.19						0.34		0.51	0.51	
Control Delay		9.8						11.2		12.7	12.7	
Queue Delay		0.0						0.0		0.0	0.0	
Total Delay		9.8						11.2		12.7	12.7	
LOS		A						B		B	B	
Approach Delay		9.8						11.2		12.7	12.7	
Approach LOS		A						B		B	B	

Intersection Summary

Area Type: Other

Cycle Length: 50

Actuated Cycle Length: 50

Offset: 0 (0%), Referenced to phase 4:EBTL, Start of 1st Green

Control Type: Pretimed

Maximum v/c Ratio: 0.51

Intersection Signal Delay: 11.4

Intersection LOS: B

Intersection Capacity Utilization 48.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 6: 8th Ave & Spring St



Lanes, Volumes, Timings  
 2036: Swedish Medical Cntr/Summit Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↶			↷			↕			↕	
Traffic Volume (vph)	0	494	17	0	365	41	12	25	46	7	32	69
Future Volume (vph)	0	494	17	0	365	41	12	25	46	7	32	69
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	16	12	12	16	12
Grade (%)		3%			-2%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1509	0	0	1478	0	0	1390	0	0	1613	0
Flt Permitted								0.956			0.985	
Satd. Flow (perm)	0	1509	0	0	1478	0	0	1324	0	0	1564	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			13			53			85	
Link Speed (mph)		30			30			15			30	
Link Distance (ft)		318			325			139			185	
Travel Time (s)		7.2			7.4			6.3			4.2	
Confl. Peds. (#/hr)	19		150	150		114	37		123	123		37
Peak Hour Factor	0.89	0.89	0.89	0.97	0.97	0.97	0.87	0.87	0.87	0.76	0.76	0.76
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	574	0	0	418	0	0	96	0	0	142	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases							4			4		
Total Split (s)		72.0			72.0		28.0	28.0		28.0	28.0	
Total Lost Time (s)		3.5			3.5			3.5			3.5	
Act Effect Green (s)		68.5			68.5			24.5			24.5	
Actuated g/C Ratio		0.68			0.68			0.24			0.24	
v/c Ratio		0.56			0.41			0.26			0.32	
Control Delay		2.6			11.4			17.5			15.7	
Queue Delay		0.9			0.5			0.4			0.4	
Total Delay		3.5			11.9			17.9			16.2	
LOS		A			B			B			B	
Approach Delay		3.5			11.9			17.9			16.2	
Approach LOS		A			B			B			B	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	97 (97%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.56
Intersection Signal Delay:	9.0
Intersection LOS:	A
Intersection Capacity Utilization:	50.3%
ICU Level of Service:	A
Analysis Period (min):	15



Lanes, Volumes, Timings  
2036: Swedish Medical Cntr/Summit Ave & Madison St

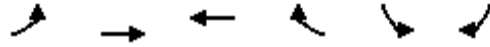
1/22/2016

Splits and Phases: 2036: Swedish Medical Cntr/Summit Ave & Madison St



Lanes, Volumes, Timings  
 2064: E Madison St & 11th Ave

1/22/2016

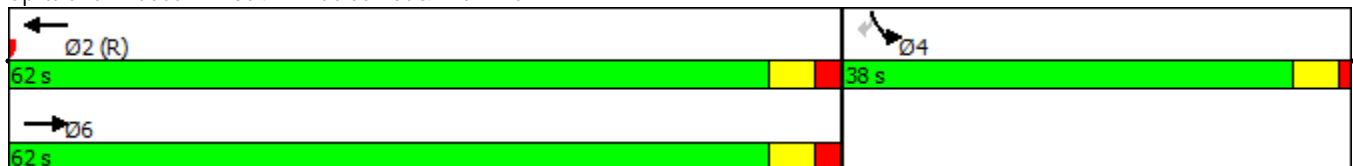


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑		↘	↗
Traffic Volume (vph)	0	569	242	0	136	109
Future Volume (vph)	0	569	242	0	136	109
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	13	12	10	12
Grade (%)		0%	-4%		0%	
Satd. Flow (prot)	0	1944	1944	0	1620	1398
Flt Permitted					0.950	
Satd. Flow (perm)	0	1944	1944	0	1620	1087
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)						124
Link Speed (mph)		30	30		25	
Link Distance (ft)		110	373		220	
Travel Time (s)		2.5	8.5		6.0	
Confl. Peds. (#/hr)	23			38		61
Confl. Bikes (#/hr)				3		17
Peak Hour Factor	0.90	0.90	0.88	0.88	0.88	0.88
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Parking (#/hr)						0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	632	275	0	155	124
Turn Type		NA	NA		Prot	Perm
Protected Phases		6	2		4	
Permitted Phases						4
Total Split (s)		62.0	62.0		38.0	38.0
Total Lost Time (s)		5.5	5.5		4.5	4.5
Act Effect Green (s)		77.4	77.4		12.6	12.6
Actuated g/C Ratio		0.77	0.77		0.13	0.13
v/c Ratio		0.42	0.18		0.76	0.51
Control Delay		11.2	0.5		64.7	14.5
Queue Delay		0.2	0.4		0.0	0.0
Total Delay		11.4	0.9		64.7	14.5
LOS		B	A		E	B
Approach Delay		11.4	0.9		42.4	
Approach LOS		B	A		D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 98 (98%), Referenced to phase 2:WBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.76  
 Intersection Signal Delay: 16.3  
 Intersection LOS: B  
 Intersection Capacity Utilization 50.9%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2064: E Madison St & 11th Ave



Lanes, Volumes, Timings  
 2066: 13th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↕			↕	
Traffic Volume (vph)	0	380	0	0	200	4	170	64	58	119	0	41
Future Volume (vph)	0	380	0	0	200	4	170	64	58	119	0	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	11	12	16	16	12	12	13	12
Grade (%)		8%			-7%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1686	0	0	1853	0	0	1903	0	0	1690	0
Flt Permitted								0.753			0.621	
Satd. Flow (perm)	0	1686	0	0	1853	0	0	1354	0	0	1055	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					2			12			17	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		213			358			154			225	
Travel Time (s)		4.8			8.1			3.5			5.1	
Confl. Peds. (#/hr)	28		29	29		28	75		40	40		75
Confl. Bikes (#/hr)												6
Peak Hour Factor	0.90	0.90	0.90	0.95	0.95	0.95	0.87	0.87	0.87	0.89	0.89	0.89
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	422	0	0	215	0	0	336	0	0	180	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4			4	
Permitted Phases							4			4		
Total Split (s)		68.0			68.0		32.0	32.0		32.0	32.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effct Green (s)		63.5			63.5			27.5			27.5	
Actuated g/C Ratio		0.64			0.64			0.28			0.28	
v/c Ratio		0.39			0.18			0.88			0.60	
Control Delay		6.9			5.8			59.5			37.8	
Queue Delay		0.6			0.1			4.2			0.5	
Total Delay		7.6			5.9			63.7			38.3	
LOS		A			A			E			D	
Approach Delay		7.6			5.9			63.7			38.3	
Approach LOS		A			A			E			D	

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	5 (5%), Referenced to phase 2:WBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.88
Intersection Signal Delay:	28.4
Intersection LOS:	C
Intersection Capacity Utilization:	45.3%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
2066: 13th Ave & E Madison St

1/22/2016

Splits and Phases: 2066: 13th Ave & E Madison St

← Ø2 (R)	↕ Ø4
68 s	32 s
→ Ø6	
68 s	

# Lanes, Volumes, Timings

## 2067: 14th Ave & Pike St

1/22/2016

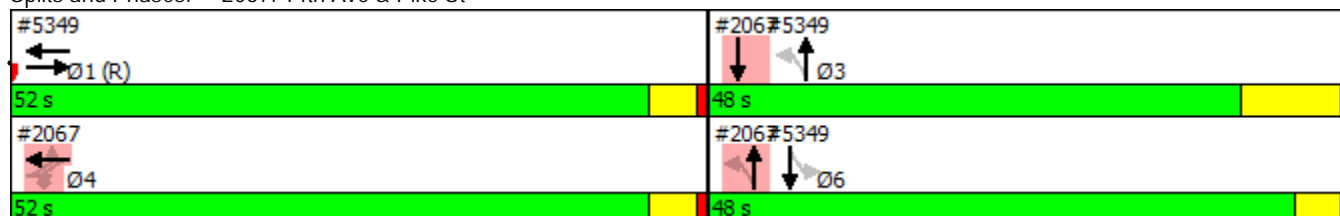


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	36	41	3	2	2	294	0	0	359	1
Future Volume (vph)	4	0	36	41	3	2	2	294	0	0	359	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	16	12	12	16	12	12	16	12
Grade (%)		6%			-6%			0%			0%	
Storage Length (ft)	80		0	0		0	0		0	0		0
Storage Lanes	1		1	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1717	0	1536	0	2071	0	0	2111	0	0	1900	0
Flt Permitted	0.724				0.957			0.998				
Satd. Flow (perm)	1308	0	1536	0	2071	0	0	2107	0	0	1900	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			60		2							
Link Speed (mph)		30			30			25			25	
Link Distance (ft)		214			140			100			208	
Travel Time (s)		4.9			3.2			2.7			5.7	
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
Parking (#/hr)		0									0	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	4	0	39	0	50	0	0	322	0	0	391	0
Turn Type	D.Pm		Perm	Perm	NA		Perm	NA			NA	
Protected Phases					4			6			3	
Permitted Phases	4		4	4			6					
Total Split (s)	52.0		52.0	52.0	52.0		48.0	48.0			48.0	
Total Lost Time (s)	4.5		4.5	4.5	4.5		4.5	4.5			8.5	
Act Effect Green (s)	47.5		47.5	47.5	47.5		43.5	43.5			39.5	
Actuated g/C Ratio	0.48		0.48	0.48	0.48		0.44	0.44			0.40	
v/c Ratio	0.01		0.05	0.05	0.05		0.35	0.35			0.52	
Control Delay	14.0		2.0	14.9	14.9		0.8	0.8			26.1	
Queue Delay	0.0		0.1	0.1	0.1		0.0	0.0			0.0	
Total Delay	14.0		2.1	14.9	14.9		0.8	0.8			26.1	
LOS	B		A	B	B		A	A			C	
Approach Delay					14.9			0.8			26.1	
Approach LOS					B			A			C	

### Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 18 (18%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.89  
 Intersection Signal Delay: 14.1      Intersection LOS: B  
 Intersection Capacity Utilization 45.2%      ICU Level of Service A  
 Analysis Period (min) 15

### Splits and Phases: 2067: 14th Ave & Pike St



Lane Group	Ø1
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	1
Permitted Phases	
Total Split (s)	52.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
2070: 17th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑			↑↓			↑↓	
Traffic Volume (vph)	0	780	91	0	350	5	108	29	1	100	17	4
Future Volume (vph)	0	780	91	0	350	5	108	29	1	100	17	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	10	12	10	12	12	16	12
Grade (%)		4%			4%			0%			0%	
Satd. Flow (prot)	0	1732	0	0	1755	0	0	1686	0	0	2027	0
Flt Permitted								0.745			0.726	
Satd. Flow (perm)	0	1732	0	0	1755	0	0	1185	0	0	1409	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			2						1	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		270			381			261			305	
Travel Time (s)		6.1			8.7			5.9			8.3	
Confl. Peds. (#/hr)	95		44	44		95	120		113	113		120
Confl. Bikes (#/hr)			17			23			3			11
Peak Hour Factor	0.92	0.92	0.92	0.96	0.96	0.96	0.80	0.80	0.80	0.93	0.93	0.93
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	947	0	0	370	0	0	172	0	0	130	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases							4			4		
Total Split (s)		73.0			73.0		27.0	27.0		27.0	27.0	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effct Green (s)		72.3			72.3			18.7			18.7	
Actuated g/C Ratio		0.72			0.72			0.19			0.19	
v/c Ratio		0.75			0.29			0.78			0.49	
Control Delay		16.6			6.8			61.6			41.8	
Queue Delay		1.3			0.0			0.0			0.0	
Total Delay		17.9			6.8			61.6			41.8	
LOS		B			A			E			D	
Approach Delay		17.9			6.8			61.6			41.8	
Approach LOS		B			A			E			D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 49 (49%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.78  
 Intersection Signal Delay: 22.0  
 Intersection LOS: C  
 Intersection Capacity Utilization 62.4%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 2070: 17th Ave & E Madison St



Lanes, Volumes, Timings  
 2071: 20th Ave & E Olive St & E Madison St

1/22/2016



Lane Group	EBT	EBR	EBR2	WBT	NBR2	SBT	SBR	NWL	NWR	NWR2
Lane Configurations	↔			↔	↔	↔		↔		
Traffic Volume (vph)	587	16	3	336	22	10	93	0	15	65
Future Volume (vph)	587	16	3	336	22	10	93	0	15	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	10	12	13	12	16	12	12
Grade (%)	-8%			3%		0%		0%		
Satd. Flow (prot)	3692	0	0	3286	1465	1674	0	1629	0	0
Flt Permitted										
Satd. Flow (perm)	3692	0	0	3286	1465	1674	0	1629	0	0
Right Turn on Red			Yes		Yes		Yes			Yes
Satd. Flow (RTOR)	1				1066	158		79		
Link Speed (mph)	30			30		25		25		
Link Distance (ft)	361			397		423		330		
Travel Time (s)	8.2			9.0		11.5		9.0		
Confl. Peds. (#/hr)		10	2				7		29	12
Peak Hour Factor	0.97	0.97	0.97	0.94	0.79	0.59	0.59	0.82	0.82	0.82
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)		0			0		0		0	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	624	0	0	357	28	175	0	97	0	0
Turn Type	NA			NA	Free	NA		Prot		
Protected Phases	2			2		4		1		
Permitted Phases					Free					
Total Split (s)	57.0			57.0		27.0		16.0		
Total Lost Time (s)	4.5			4.5		4.5		4.5		
Act Effect Green (s)	72.7			72.7	100.0	8.3		7.8		
Actuated g/C Ratio	0.73			0.73	1.00	0.08		0.08		
v/c Ratio	0.23			0.15	0.02	0.62		0.49		
Control Delay	12.6			12.7	0.0	19.2		22.6		
Queue Delay	0.6			0.0	0.0	0.0		0.0		
Total Delay	13.2			12.7	0.0	19.2		22.6		
LOS	B			B	A	B		C		
Approach Delay	13.2			12.7		19.2		22.6		
Approach LOS	B			B		B		C		

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 56 (56%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.62  
 Intersection Signal Delay: 14.3  
 Intersection LOS: B  
 Intersection Capacity Utilization 45.0%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2071: 20th Ave & E Olive St & E Madison St





Lanes, Volumes, Timings  
 2073: 22nd Ave/E Denny Way & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔			↔↔		↔	↔	
Traffic Volume (vph)	0	653	0	0	325	26	4	80	86	43	123	0
Future Volume (vph)	0	653	0	0	325	26	4	80	86	43	123	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	13	12	12	10	12	12	11	12	12	12	12
Grade (%)		-3%			1%			0%			0%	
Satd. Flow (prot)	0	3749	0	0	1726	0	0	1617	0	1805	1900	0
Flt Permitted								0.992		0.274		
Satd. Flow (perm)	0	3749	0	0	1726	0	0	1605	0	503	1900	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					6			53				
Link Speed (mph)		30			30			25			30	
Link Distance (ft)		175			200			197			246	
Travel Time (s)		4.0			4.5			5.4			5.6	
Confl. Peds. (#/hr)	2		25	25		2	4		39	39		4
Confl. Bikes (#/hr)			1						2			10
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.77	0.77	0.77	0.64	0.64	0.64
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	0%	0%	0%
Parking (#/hr)			0			0						0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	734	0	0	394	0	0	221	0	67	192	0
Turn Type		NA			NA		Perm	NA		pm+pt	NA	
Protected Phases		2			2			4		3	4	
Permitted Phases	2			2			4			4		
Total Split (s)	54.0	54.0		54.0	54.0		35.0	35.0		11.0	35.0	
Total Lost Time (s)		4.5			4.5			4.5		4.0	4.5	
Act Effct Green (s)		67.6			67.6			14.6		20.7	14.6	
Actuated g/C Ratio		0.68			0.68			0.15		0.21	0.15	
v/c Ratio		0.29			0.34			0.79		0.35	0.69	
Control Delay		22.5			7.1			50.5		31.7	52.8	
Queue Delay		0.0			0.0			0.0		0.0	0.0	
Total Delay		22.5			7.1			50.5		31.7	52.8	
LOS		C			A			D		C	D	
Approach Delay		22.5			7.1			50.5			47.4	
Approach LOS		C			A			D			D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 0 (0%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 26.6      Intersection LOS: C  
 Intersection Capacity Utilization 52.6%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2073: 22nd Ave/E Denny Way & E Madison St



Lanes, Volumes, Timings  
2846: 8th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗			↖			↕			↘	↙
Traffic Volume (vph)	0	423	17	0	627	16	0	255	32	10	158	61
Future Volume (vph)	0	423	17	0	627	16	0	255	32	10	158	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	10	12	12	12	12
Grade (%)		5%			-10%			0%				0%
Storage Length (ft)	50		0	0		50	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	60			25			25			25		
Satd. Flow (prot)	0	1487	0	0	3090	0	0	1457	0	0	1551	0
Flt Permitted												0.980
Satd. Flow (perm)	0	1487	0	0	3090	0	0	1457	0	0	1523	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			5			7				19
Link Speed (mph)		30			30			25				25
Link Distance (ft)		329			326			156				312
Travel Time (s)		7.5			7.4			4.3				8.5
Confl. Peds. (#/hr)	54		132	132		54	85		92	92		85
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.75	0.75	0.75	0.90	0.90	0.90
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	463	0	0	677	0	0	383	0	0	255	0
Turn Type		NA			NA			NA		Perm		NA
Protected Phases		2			6			4				4
Permitted Phases							4			4		
Total Split (s)		65.0			65.0		35.0	35.0		35.0		35.0
Total Lost Time (s)		3.5			3.5			3.5				3.5
Act Effect Green (s)		61.5			61.5			31.5				31.5
Actuated g/C Ratio		0.62			0.62			0.32				0.32
v/c Ratio		0.51			0.36			0.83				0.52
Control Delay		13.1			7.6			48.0				23.0
Queue Delay		5.6			0.4			0.0				0.8
Total Delay		18.6			8.0			48.0				23.7
LOS		B			A			D				C
Approach Delay		18.6			8.0			48.0				23.7
Approach LOS		B			A			D				C

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	10 (10%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.83
Intersection Signal Delay:	21.6
Intersection LOS:	C
Intersection Capacity Utilization:	57.0%
ICU Level of Service:	B
Analysis Period (min):	15

Lanes, Volumes, Timings  
2846: 8th Ave & Madison St

1/22/2016

Splits and Phases: 2846: 8th Ave & Madison St



Lanes, Volumes, Timings  
2865: 9th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↗			↖			↕		↗	↖	
Traffic Volume (vph)	0	412	24	0	639	8	8	56	5	44	438	5
Future Volume (vph)	0	412	24	0	639	8	8	56	5	44	438	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	16	12	12	16	12
Grade (%)		10%			-12%			0%				0%
Storage Length (ft)	0		125	125		0	0		0	75		0
Storage Lanes	0		0	0		0	0		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1431	0	0	1630	0	0	1731	0	1608	1912	0
Flt Permitted								0.749		0.559		
Satd. Flow (perm)	0	1431	0	0	1630	0	0	1298	0	858	1912	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			1			3			1	
Link Speed (mph)		30			25			25			25	
Link Distance (ft)		326			325			144			299	
Travel Time (s)		7.4			8.9			3.9			8.2	
Confl. Peds. (#/hr)	121		209	209		121	79		52	52		79
Peak Hour Factor	0.83	0.83	0.83	0.88	0.88	0.88	0.95	0.95	0.95	0.87	0.87	0.87
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	9%	9%	9%	1%	1%	1%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	525	0	0	735	0	0	72	0	51	509	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases							4			8		
Total Split (s)		61.0			61.0		23.0	23.0		39.0	39.0	
Total Lost Time (s)		3.5			3.5			3.5		3.5	3.5	
Act Effct Green (s)		57.5			57.5			19.5		35.5	35.5	
Actuated g/C Ratio		0.58			0.58			0.20		0.36	0.36	
v/c Ratio		0.64			0.78			0.28		0.17	0.75	
Control Delay		15.1			24.0			36.3		22.1	34.2	
Queue Delay		1.4			2.1			0.0		0.0	18.6	
Total Delay		16.4			26.2			36.3		22.1	52.8	
LOS		B			C			D		C	D	
Approach Delay		16.4			26.2			36.3			50.0	
Approach LOS		B			C			D			D	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	27 (27%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.78
Intersection Signal Delay:	30.9
Intersection LOS:	C
Intersection Capacity Utilization:	70.7%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 2865: 9th Ave & Madison St

1/22/2016

Splits and Phases: 2865: 9th Ave & Madison St



Lane Group	Ø3	Ø5
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Storage Length (ft)		
Storage Lanes		
Taper Length (ft)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	3	5
Permitted Phases		
Total Split (s)	8.0	8.0
Total Lost Time (s)		
Act Effect Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
Intersection Summary		

Lanes, Volumes, Timings  
2893: Madison St & Terry Ave

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↻			↻				↻			↻
Traffic Volume (vph)	0	451	10	0	503	11	0	0	11	0	0	139
Future Volume (vph)	0	451	10	0	503	11	0	0	11	0	0	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	10	12	12	16	12
Grade (%)		12%			-5%			0%				0%
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		1	0		1
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1459	0	0	1560	0	0	0	1465	0	0	1436
Flt Permitted												
Satd. Flow (perm)	0	1459	0	0	1560	0	0	0	1192	0	0	1200
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			3				257			231
Link Speed (mph)		25			30			25				25
Link Distance (ft)		325			319			146				164
Travel Time (s)		8.9			7.3			4.0				4.5
Confl. Peds. (#/hr)	134		117	117		134	53		61	61		53
Peak Hour Factor	0.86	0.86	0.86	0.93	0.93	0.93	0.70	0.70	0.70	0.82	0.82	0.82
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	1%	1%	1%	3%	3%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	536	0	0	553	0	0	0	16	0	0	170
Turn Type		NA			NA				Perm			Perm
Protected Phases		2			6							
Permitted Phases									8			4
Total Split (s)		72.0			72.0				28.0			28.0
Total Lost Time (s)		3.5			3.5				4.0			4.0
Act Effect Green (s)		68.5			68.5				24.0			24.0
Actuated g/C Ratio		0.68			0.68				0.24			0.24
v/c Ratio		0.54			0.52				0.03			0.37
Control Delay		10.1			13.7				0.1			3.6
Queue Delay		18.1			1.5				0.0			8.0
Total Delay		28.1			15.1				0.1			11.6
LOS		C			B				A			B
Approach Delay		28.1			15.1							
Approach LOS		C			B							

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	47 (47%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.54
Intersection Signal Delay:	20.0
Intersection LOS:	B
Intersection Capacity Utilization:	51.7%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
2893: Madison St & Terry Ave

1/22/2016

Splits and Phases: 2893: Madison St & Terry Ave

→ Ø2 (R) 72 s	↶ Ø4 28 s
← Ø6 72 s	↷ Ø8 28 s

Lanes, Volumes, Timings  
2896: Madison St & Minor Ave

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↶			↶			↷			↷	
Traffic Volume (vph)	0	486	19	0	444	9	6	157	1	1	264	50
Future Volume (vph)	0	486	19	0	444	9	6	157	1	1	264	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	16	12	12	16	12
Grade (%)		2%			-3%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	1506	0	0	1554	0	0	1892	0	0	1728	0
Flt Permitted								0.985				
Satd. Flow (perm)	0	1506	0	0	1554	0	0	1858	0	0	1727	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			2							11
Link Speed (mph)		30			30			30				30
Link Distance (ft)		324			318			151				149
Travel Time (s)		7.4			7.2			3.4				3.4
Confl. Peds. (#/hr)	127		267	267		127	137		87	87		137
Peak Hour Factor	0.97	0.97	0.97	0.95	0.95	0.95	0.77	0.77	0.77	0.81	0.81	0.81
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	521	0	0	476	0	0	213	0	0	389	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			4	
Permitted Phases							4			4		
Total Split (s)		59.0			59.0		41.0	41.0		41.0	41.0	
Total Lost Time (s)		3.5			3.5			3.5			3.5	
Act Effct Green (s)		55.5			55.5			37.5			37.5	
Actuated g/C Ratio		0.56			0.56			0.38			0.38	
v/c Ratio		0.62			0.55			0.31			0.59	
Control Delay		5.8			15.3			23.6			29.0	
Queue Delay		4.8			0.8			0.6			6.4	
Total Delay		10.7			16.1			24.2			35.3	
LOS		B			B			C			D	
Approach Delay		10.7			16.1			24.2			35.3	
Approach LOS		B			B			C			D	

Intersection Summary

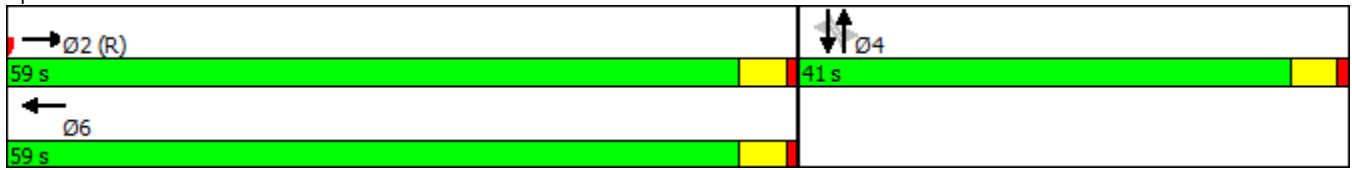
Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	92 (92%), Referenced to phase 2:EBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.62
Intersection Signal Delay:	20.1
Intersection LOS:	C
Intersection Capacity Utilization:	57.0%
ICU Level of Service:	B
Analysis Period (min):	15



Lanes, Volumes, Timings  
2896: Madison St & Minor Ave

1/22/2016

Splits and Phases: 2896: Madison St & Minor Ave



Lanes, Volumes, Timings  
 4018: E Madison St & 12th Ave & Union St

1/22/2016



Lane Group	NBL2	NBL	NBT	NBR	SBL	SBT	SBR	SBR2	NEL2	NEL	NET	NER
Lane Configurations												
Traffic Volume (vph)	24	27	301	84	172	383	38	2	8	61	520	97
Future Volume (vph)	24	27	301	84	172	383	38	2	8	61	520	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	11	12	10	10	12	12	12	12	15	12
Grade (%)			0%			0%						4%
Storage Length (ft)		145		0	160		0			175		0
Storage Lanes		1		1	1		0			1		0
Taper Length (ft)		25			25					25		
Satd. Flow (prot)	0	1668	1818	1599	1652	1494	0	0	0	1751	1968	0
Flt Permitted		0.220			0.425					0.950		
Satd. Flow (perm)	0	353	1818	1599	694	1494	0	0	0	1618	1968	0
Right Turn on Red				Yes				Yes				Yes
Satd. Flow (RTOR)				88								15
Link Speed (mph)			30			30						30
Link Distance (ft)			172			409						373
Travel Time (s)			3.9			9.3						8.5
Confl. Peds. (#/hr)	96	34		41	41		96	34	34	27		45
Peak Hour Factor	0.96	0.96	0.96	0.96	0.86	0.86	0.86	0.86	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%	2%	2%	1%	1%	1%	1%
Parking (#/hr)						0						
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	53	314	88	200	491	0	0	0	72	643	0
Turn Type	Perm	Perm	NA	Prot	Perm	NA			Prot	Prot	NA	
Protected Phases			4	4		8			1	1	5 6	
Permitted Phases	4	4			8							
Total Split (s)	40.0	40.0	40.0	40.0	40.0	40.0			15.0	15.0		
Total Lost Time (s)		5.0	5.0	5.0	5.5	5.5				5.5		
Act Effct Green (s)		35.0	35.0	35.0	34.5	34.5				9.5	54.5	
Actuated g/C Ratio		0.35	0.35	0.35	0.34	0.34				0.10	0.54	
v/c Ratio		0.43	0.49	0.14	0.84	0.95				0.43	0.60	
Control Delay		38.2	28.8	5.6	60.7	63.1				61.2	25.4	
Queue Delay		0.0	0.0	0.0	0.0	0.0				0.0	1.0	
Total Delay		38.2	28.8	5.6	60.7	63.1				61.2	26.4	
LOS		D	C	A	E	E				E	C	
Approach Delay			25.4			62.4					29.9	
Approach LOS			C			E					C	

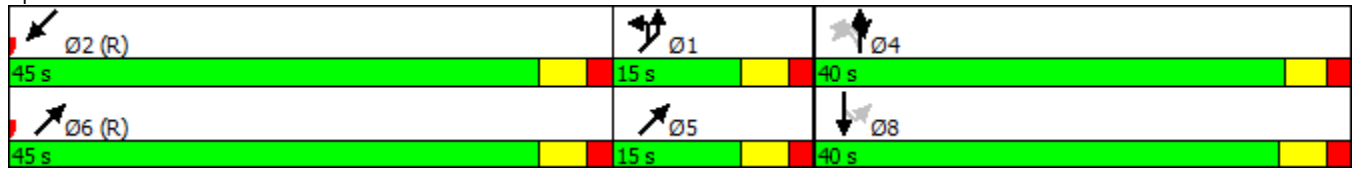
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	7 (7%), Referenced to phase 2:SWT and 6:NET, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.95
Intersection Signal Delay:	44.1
Intersection LOS:	D
Intersection Capacity Utilization:	79.5%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4018: E Madison St & 12th Ave & Union St

1/22/2016

Splits and Phases: 4018: E Madison St & 12th Ave & Union St



Lane Group	SWT	SWR	SWR2	Ø5	Ø6
Lane Configurations	↕				
Traffic Volume (vph)	180	264	16		
Future Volume (vph)	180	264	16		
Ideal Flow (vphpl)	1900	1900	1900		
Lane Width (ft)	11	12	12		
Grade (%)	-8%				
Storage Length (ft)		0			
Storage Lanes		0			
Taper Length (ft)					
Satd. Flow (prot)	1542	0	0		
Flt Permitted					
Satd. Flow (perm)	1542	0	0		
Right Turn on Red			Yes		
Satd. Flow (RTOR)	2				
Link Speed (mph)	30				
Link Distance (ft)	165				
Travel Time (s)	3.8				
Confl. Peds. (#/hr)		34	27		
Peak Hour Factor	0.92	0.92	0.92		
Heavy Vehicles (%)	2%	2%	2%		
Parking (#/hr)					
Shared Lane Traffic (%)					
Lane Group Flow (vph)	500	0	0		
Turn Type	NA				
Protected Phases	2			5	6
Permitted Phases					
Total Split (s)	45.0			15.0	45.0
Total Lost Time (s)	5.5				
Act Effect Green (s)	39.5				
Actuated g/C Ratio	0.40				
v/c Ratio	0.82				
Control Delay	34.5				
Queue Delay	21.4				
Total Delay	55.9				
LOS	E				
Approach Delay	55.9				
Approach LOS	E				

Intersection Summary

Lanes, Volumes, Timings  
4030: 1st Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑	↑	↑			↑	
Traffic Volume (vph)	0	0	0	49	179	144	33	326	0	0	306	73
Future Volume (vph)	0	0	0	49	179	144	33	326	0	0	306	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	13	13	10	10	10	10	9	11	13
Grade (%)		8%			-15%			0%				0%
Storage Length (ft)	0		0	25		0	0		0	0		0
Storage Lanes	0		0	0		1	1		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	3271	1384	1458	1455	0	0	1404	0
Flt Permitted					0.989		0.950					
Satd. Flow (perm)	0	0	0	0	3067	1180	1061	1455	0	0	1404	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						157						16
Link Speed (mph)		25			25			25				25
Link Distance (ft)		271			338			254				321
Travel Time (s)		7.4			9.2			6.9				8.8
Confl. Peds. (#/hr)	52		117	117		52	707		177	177		707
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	4%	4%	4%
Bus Blockages (#/hr)	0	0	0	0	8	8	0	13	0	0	0	0
Parking (#/hr)			0		0							
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	248	157	36	354	0	0	412	0
Turn Type				Perm	NA	custom	Prot	NA			NA	
Protected Phases					8	3	5	2				6
Permitted Phases				8		8						
Total Split (s)				34.0	34.0	19.0	15.0	46.0				31.0
Total Lost Time (s)					4.0	4.5	3.5	4.0				4.0
Act Effct Green (s)					30.0	29.5	11.5	42.0				27.0
Actuated g/C Ratio					0.38	0.37	0.14	0.52				0.34
v/c Ratio					0.22	0.27	0.17	0.46				0.85
Control Delay					21.3	13.8	32.5	14.4				37.5
Queue Delay					0.0	0.0	0.0	1.2				1.8
Total Delay					21.3	13.8	32.5	15.7				39.4
LOS					C	B	C	B				D
Approach Delay					18.4			17.2				39.4
Approach LOS					B			B				D

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	56 (70%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.85
Intersection Signal Delay:	25.2
Intersection LOS:	C
Intersection Capacity Utilization:	50.5%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4030: 1st Ave & Madison St

1/22/2016

Splits and Phases: 4030: 1st Ave & Madison St

↑ Ø2 (R) 46 s	↙ Ø3 19 s	⚣ Ø4 15 s
↙ Ø5 15 s	↓ Ø6 (R) 31 s	↙ Ø8 34 s

Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Total Split (s)	15.0
Total Lost Time (s)	
Act Effect Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
4031: 3rd Ave & Madison St

1/22/2016

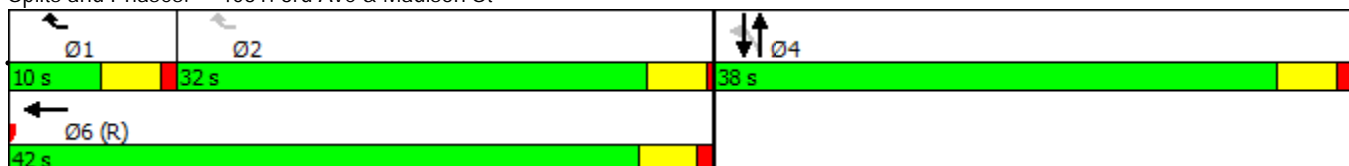


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑			↑↑	
Traffic Volume (vph)	0	0	0	0	389	0	0	20	0	0	0	77
Future Volume (vph)	0	0	0	0	389	0	0	20	0	0	0	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	10	13	12	12	13	12	12	12	12
Grade (%)		13%			-14%			5%			-5%	
Satd. Flow (prot)	0	0	0	0	3149	1614	0	1447	0	0	1305	0
Flt Permitted												
Satd. Flow (perm)	0	0	0	0	3149	1614	0	1447	0	0	1305	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												82
Link Speed (mph)		30			25			25				25
Link Distance (ft)		309			297			231				321
Travel Time (s)		7.0			8.1			6.3				8.8
Confl. Peds. (#/hr)	279		221	221		279	463		239	239		463
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	100%	90%	4%	12%	90%	12%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	58	0	0	59	0
Parking (#/hr)					15	0		0	0			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	423	0	0	22	0	0	84	0
Turn Type					NA	custom		NA			NA	
Protected Phases					6	1		4				4
Permitted Phases						2	4					
Total Split (s)					42.0	10.0	38.0	38.0				38.0
Total Lost Time (s)					4.0	4.5		4.0				4.0
Act Effct Green (s)					38.0			34.0				34.0
Actuated g/C Ratio					0.48			0.42				0.42
v/c Ratio					0.28			0.04				0.14
Control Delay					8.1			13.8				1.9
Queue Delay					0.0			0.0				0.0
Total Delay					8.1			13.8				1.9
LOS					A			B				A
Approach Delay					8.1			13.8				1.9
Approach LOS					A			B				A

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 2 (3%), Referenced to phase 6:WBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.28  
 Intersection Signal Delay: 7.4      Intersection LOS: A  
 Intersection Capacity Utilization 31.6%      ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 4031: 3rd Ave & Madison St



Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	32.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Lanes, Volumes, Timings  
4032: 6th Ave & Madison St

1/22/2016

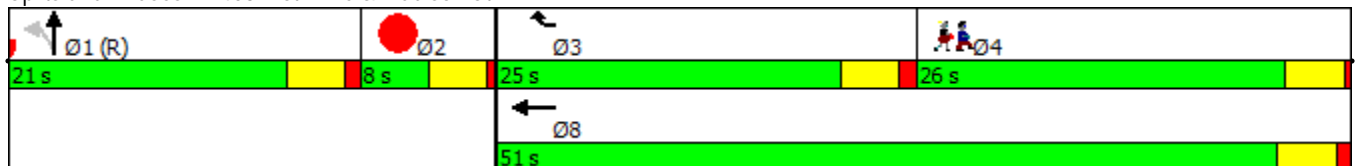


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑	↑↑		↑↑				
Traffic Volume (vph)	0	0	0	0	750	725	41	178	181	0	0	0
Future Volume (vph)	0	0	0	0	750	725	41	178	181	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	10	10	12	12	12	12	12	12
Grade (%)		13%			-5%			5%			-5%	
Satd. Flow (prot)	0	0	0	0	1604	2399	0	2489	0	0	0	0
Flt Permitted								0.995				
Satd. Flow (perm)	0	0	0	0	1604	2399	0	2411	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)						649		211				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		287			328			245			323	
Travel Time (s)		7.8			8.9			6.7			8.8	
Confl. Peds. (#/hr)	117		343	343		117	186		4	4		186
Confl. Bikes (#/hr)			3			26			2			3
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	6%	6%	6%	2%	2%	2%
Parking (#/hr)								15				
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	815	788	0	435	0	0	0	0
Turn Type					NA	custom	Perm	NA				
Protected Phases					8	3		1				
Permitted Phases							1					
Total Split (s)					51.0	25.0	21.0	21.0				
Total Lost Time (s)					4.0	4.0		4.0				
Act Effect Green (s)					47.0	21.0		17.0				
Actuated g/C Ratio					0.59	0.26		0.21				
v/c Ratio					0.87	0.71		0.64				
Control Delay					21.3	7.7		19.4				
Queue Delay					34.3	1.1		0.2				
Total Delay					55.6	8.8		19.6				
LOS					E	A		B				
Approach Delay					32.6			19.6				
Approach LOS					C			B				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 0 (0%), Referenced to phase 1:NBTL, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.87  
 Intersection Signal Delay: 29.8  
 Intersection LOS: C  
 Intersection Capacity Utilization 67.3%  
 ICU Level of Service C  
 Analysis Period (min) 15

Splits and Phases: 4032: 6th Ave & Madison St





Lane Group	Ø2	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Confl. Bikes (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Parking (#/hr)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	2	4
Permitted Phases		
Total Split (s)	8.0	26.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑↑↑		↑	↑	↑		↑	
Traffic Volume (vph)	0	181	0	0	659	1	593	433	271	20	0	220
Future Volume (vph)	0	181	0	0	659	1	593	433	271	20	0	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	10	12	12	12	12	12	14	12
Grade (%)		5%			-5%			5%			-5%	
Storage Length (ft)	0		0	0		0	0		180	0		0
Storage Lanes	0		0	1		0	1		2	0		0
Taper Length (ft)	25			60			0			25		
Satd. Flow (prot)	0	1513	0	0	4377	0	1475	1540	1389	0	1576	0
Flt Permitted							0.597	0.899			0.942	
Satd. Flow (perm)	0	1513	0	0	4377	0	926	1396	1235	0	1488	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)									68			20
Link Speed (mph)		30			30			25				25
Link Distance (ft)		328			329			522				327
Travel Time (s)		7.5			7.5			14.2				8.9
Confl. Peds. (#/hr)	119		211	211		119	2		42	42		2
Confl. Bikes (#/hr)			2			9			22			4
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
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)	0	15										
Shared Lane Traffic (%)							15%					
Lane Group Flow (vph)	0	197	0	0	717	0	548	568	295	0	261	0
Turn Type		NA			NA		Perm	NA	Perm	D.Pm	NA	
Protected Phases		2			6			4				
Permitted Phases							4		4	4		4
Total Split (s)		28.0			28.0		52.0	52.0	52.0	52.0		52.0
Total Lost Time (s)		3.5			3.5		3.5	3.5	3.5			3.5
Act Effct Green (s)		24.5			24.5		48.5	48.5	48.5			48.5
Actuated g/C Ratio		0.31			0.31		0.61	0.61	0.61			0.61
v/c Ratio		0.43			0.54		0.98	0.67	0.38			0.29
Control Delay		17.6			24.8		51.2	15.5	7.7			7.9
Queue Delay		0.0			1.0		0.7	0.0	0.0			0.8
Total Delay		17.6			25.8		51.9	15.5	7.7			8.7
LOS		B			C		D	B	A			A
Approach Delay		17.6			25.8			28.0				8.7
Approach LOS		B			C			C				A

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	16 (20%), Referenced to phase 6:WBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.98
Intersection Signal Delay:	24.6
Intersection LOS:	C
Intersection Capacity Utilization:	73.4%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings

4033: I-5 CD NB Off-Ramp/7th Ave & Madison St

1/22/2016

Splits and Phases: 4033: I-5 CD NB Off-Ramp/7th Ave & Madison St



Lanes, Volumes, Timings  
4034: Boren Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↖	↕		↖	↗	
Traffic Volume (vph)	14	454	4	32	461	10	17	760	4	55	881	35
Future Volume (vph)	14	454	4	32	461	10	17	760	4	55	881	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	9	11	12	10	10	12	9	10	12	9	10	12
Grade (%)		5%			-2%			0%			5%	
Storage Length (ft)	50		125	75		125	0		0	200		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	1384	1511	0	1487	1500	0	1433	2935	0	1398	2825	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1169	1511	0	1341	1500	0	1328	2935	0	1223	2825	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					1			1				5
Link Speed (mph)		30			30			30				30
Link Distance (ft)		319			324			361				293
Travel Time (s)		7.3			7.4			8.2				6.7
Confl. Peds. (#/hr)	189		91	91		189	94		142	142		94
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
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	8	0	0	8	0	0	5	0	0	4	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	497	0	35	512	0	18	830	0	60	996	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Total Split (s)	12.0	34.0		12.0	34.0		12.0	42.0		12.0	42.0	
Total Lost Time (s)	4.0	3.5		4.0	3.5		4.0	3.5		4.0	3.5	
Act Effct Green (s)	7.7	35.3		7.8	37.7		8.0	38.5		8.0	38.5	
Actuated g/C Ratio	0.08	0.35		0.08	0.38		0.08	0.38		0.08	0.38	
v/c Ratio	0.14	0.93		0.30	0.90		0.16	0.73		0.54	0.91	
Control Delay	36.1	52.0		57.4	49.0		46.4	31.1		63.0	42.9	
Queue Delay	0.0	3.8		0.0	4.7		1.3	0.0		0.0	1.4	
Total Delay	36.1	55.9		57.4	53.7		47.6	31.1		63.0	44.3	
LOS	D	E		E	D		D	C		E	D	
Approach Delay		55.3			53.9			31.4			45.4	
Approach LOS		E			D			C			D	

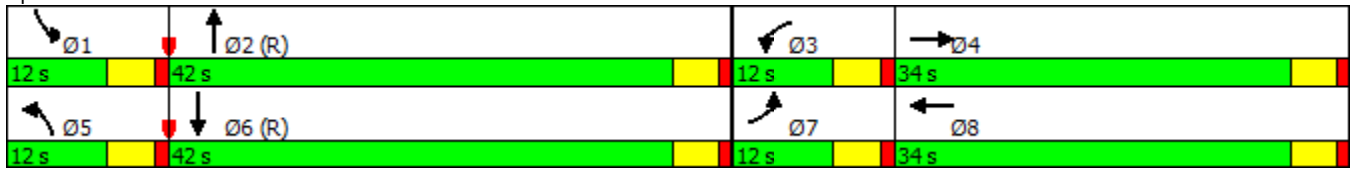
Intersection Summary

Area Type: CBD  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 34 (34%), Referenced to phase 2:NBT and 6:SBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.93  
 Intersection Signal Delay: 44.7  
 Intersection LOS: D  
 Intersection Capacity Utilization 72.2%  
 ICU Level of Service C  
 Analysis Period (min) 15

Lanes, Volumes, Timings  
4034: Boren Ave & Madison St

1/22/2016

Splits and Phases: 4034: Boren Ave & Madison St



Lanes, Volumes, Timings  
4035: Broadway & Madison St/E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	163	441	43	69	321	5	0	204	109	0	241	110
Future Volume (vph)	163	441	43	69	321	5	0	204	109	0	241	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	10	12	10	10	12	12	13	12	12	13	12
Grade (%)		-9%			8%			0%				0%
Storage Length (ft)	120		125	50		125	0		0	0		0
Storage Lanes	1		0	1		0	0		1	0		0
Taper Length (ft)	50			25			25			25		
Satd. Flow (prot)	1788	1718	0	1586	1492	0	0	1732	1425	0	1428	0
Flt Permitted	0.950			0.950								
Satd. Flow (perm)	1569	1718	0	1325	1492	0	0	1732	1425	0	1428	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			1				164			37
Link Speed (mph)		30			30			30				30
Link Distance (ft)		306			247			367				184
Travel Time (s)		7.0			5.6			8.3				4.2
Confl. Peds. (#/hr)	130		130	130		130	114		130	130		130
Peak Hour Factor	0.84	0.87	0.73	0.80	0.88	0.68	0.25	0.88	0.95	0.25	0.94	0.72
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%	1%	1%
Parking (#/hr)					0	0		0	0		0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	194	566	0	86	372	0	0	232	115	0	409	0
Turn Type	Prot	NA		Prot	NA			NA	custom		NA	
Protected Phases	5	2		1	6			4	3		8	
Permitted Phases								3				
Total Split (s)	26.0	36.0		18.0	28.0			25.0	21.0		46.0	
Total Lost Time (s)	3.5	3.5		3.5	3.5			3.5	4.5		3.5	
Act Effct Green (s)	16.2	48.3		10.7	40.9			32.5	7.0		32.5	
Actuated g/C Ratio	0.16	0.48		0.11	0.41			0.32	0.07		0.32	
v/c Ratio	0.67	0.68		0.51	0.61			0.41	0.46		0.84	
Control Delay	48.4	23.9		56.0	30.8			27.1	8.4		43.0	
Queue Delay	0.2	1.6		0.0	0.0			0.0	0.0		0.9	
Total Delay	48.5	25.5		56.0	30.8			27.1	8.4		43.9	
LOS	D	C		E	C			C	A		D	
Approach Delay		31.4			35.6			20.9			43.9	
Approach LOS		C			D			C			D	

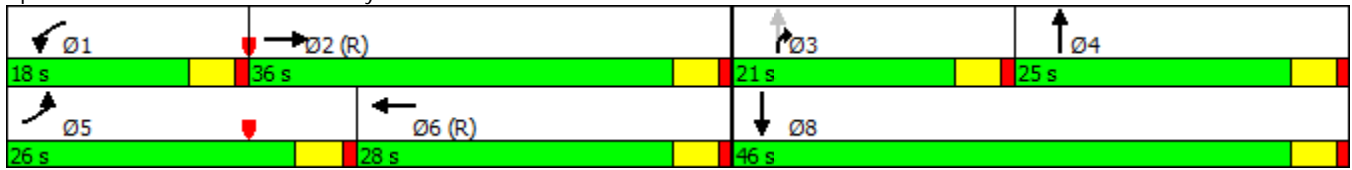
Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 56 (56%), Referenced to phase 2:EBT and 6:WBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.84  
 Intersection Signal Delay: 33.1      Intersection LOS: C  
 Intersection Capacity Utilization 62.1%      ICU Level of Service B  
 Analysis Period (min) 15

Lanes, Volumes, Timings  
4035: Broadway & Madison St/E Madison St

1/22/2016

Splits and Phases: 4035: Broadway & Madison St/E Madison St



Lanes, Volumes, Timings  
4039: E Madison St & 15th Ave

1/22/2016

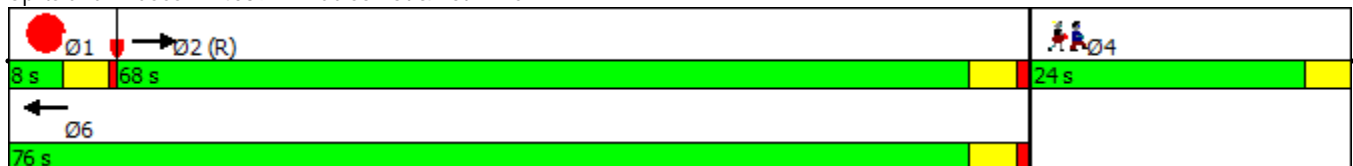


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø1	Ø4
Lane Configurations		↑	↔			↗		
Traffic Volume (vph)	0	456	93	9	0	74		
Future Volume (vph)	0	456	93	9	0	74		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	12	11	11	12	12	16		
Grade (%)		10%	-9%		0%			
Satd. Flow (prot)	0	1728	1867	0	0	1774		
Flt Permitted								
Satd. Flow (perm)	0	1728	1867	0	0	1738		
Right Turn on Red				Yes		Yes		
Satd. Flow (RTOR)			11			811		
Link Speed (mph)		30	30		30			
Link Distance (ft)		260	156		233			
Travel Time (s)		5.9	3.5		5.3			
Confl. Peds. (#/hr)	59			59	47	1		
Confl. Bikes (#/hr)				2				
Peak Hour Factor	0.93	0.93	0.85	0.85	0.85	0.85		
Heavy Vehicles (%)	1%	1%	1%	1%	5%	5%		
Parking (#/hr)				0				
Shared Lane Traffic (%)								
Lane Group Flow (vph)	0	490	120	0	0	87		
Turn Type		NA	NA			Free		
Protected Phases		2	6				1	4
Permitted Phases						Free		
Total Split (s)		68.0	76.0				8.0	24.0
Total Lost Time (s)		4.5	4.5					
Act Effect Green (s)		83.2	83.2			100.0		
Actuated g/C Ratio		0.83	0.83			1.00		
v/c Ratio		0.34	0.08			0.05		
Control Delay		1.8	2.8			0.1		
Queue Delay		0.4	0.0			0.0		
Total Delay		2.2	2.8			0.1		
LOS		A	A			A		
Approach Delay		2.2	2.8					
Approach LOS		A	A					

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 37 (37%), Referenced to phase 2:EBT, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.34  
 Intersection Signal Delay: 2.0  
 Intersection Capacity Utilization 34.7%  
 Analysis Period (min) 15  
 Intersection LOS: A  
 ICU Level of Service A

Splits and Phases: 4039: E Madison St & 15th Ave





Lanes, Volumes, Timings  
4040: E Madison St & 23rd Ave E

1/22/2016



Lane Group	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↑↑			↑↑		↑	↑↑		↑	↑↑	
Traffic Volume (vph)	0	682	59	0	656	64	344	420	68	177	339	2
Future Volume (vph)	0	682	59	0	656	64	344	420	68	177	339	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	9	9	10	10	10	10	16	10	9	10	10
Grade (%)		0%			0%			-5%			10%	
Storage Length (ft)	0		0	0		0	167		0	50		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3164	0	0	3290	0	1693	4025	0	1528	3132	0
Flt Permitted							0.950			0.950		
Satd. Flow (perm)	0	3164	0	0	3290	0	1693	4025	0	1528	3132	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			11			18			1	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		379			190			361			250	
Travel Time (s)		8.6			4.3			8.2			5.7	
Confl. Peds. (#/hr)			2	2								3
Peak Hour Factor	0.92	0.87	0.69	0.25	0.91	0.92	0.92	0.92	0.92	0.64	0.92	0.46
Heavy Vehicles (%)	2%	1%	1%	1%	1%	2%	2%	2%	2%	1%	2%	1%
Parking (#/hr)			0									0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	870	0	0	791	0	374	531	0	277	372	0
Turn Type		NA			NA		Prot	NA		Prot	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases												
Total Split (s)		38.0			38.0		37.0	29.0		33.0	25.0	
Total Lost Time (s)		3.0			3.0		3.0	3.0		3.0	4.5	
Act Effct Green (s)		35.0			35.0		28.1	26.0		30.0	26.4	
Actuated g/C Ratio		0.35			0.35		0.28	0.26		0.30	0.26	
v/c Ratio		0.78			0.68		0.79	0.50		0.60	0.45	
Control Delay		34.5			31.0		51.1	36.0		36.5	34.1	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		34.5			31.0		51.1	36.0		36.5	34.1	
LOS		C			C		D	D		D	C	
Approach Delay		34.5			31.0			42.3			35.1	
Approach LOS		C			C			D			D	

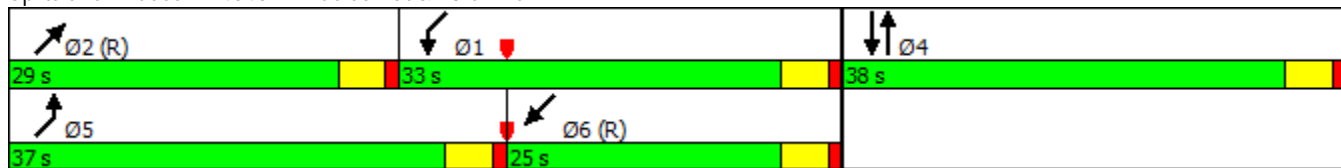
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	72 (72%), Referenced to phase 2:NET and 6:SWT, Start of Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.79
Intersection Signal Delay:	35.9
Intersection LOS:	D
Intersection Capacity Utilization:	65.2%
ICU Level of Service:	C
Analysis Period (min):	15

Lanes, Volumes, Timings  
 4040: E Madison St & 23rd Ave E

1/22/2016

Splits and Phases: 4040: E Madison St & 23rd Ave E



Lanes, Volumes, Timings  
4041: 3rd Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	578	18	0	0	0	0	0	34	0	55	0
Future Volume (vph)	5	578	18	0	0	0	0	0	34	0	55	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	11	12	12	11	12
Grade (%)		10%			-10%			5%			0%	
Satd. Flow (prot)	1513	2784	0	0	0	0	0	1254	0	0	1438	0
Flt Permitted	0.950											
Satd. Flow (perm)	1055	2784	0	0	0	0	0	1254	0	0	1438	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5						82				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		306			298			321			283	
Travel Time (s)		8.3			8.1			8.8			7.7	
Confl. Peds. (#/hr)	197		184	184		197	473		302	302		473
Confl. Bikes (#/hr)			22			13			2			7
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	14%	90%	14%	15%	90%	15%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	56	0	0	65	0
Parking (#/hr)								0	0			
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	648	0	0	0	0	0	37	0	0	60	0
Turn Type	custom	NA						NA			NA	
Protected Phases	1	6						4			4	
Permitted Phases	2									4		
Total Split (s)	10.0	38.0						42.0		42.0	42.0	
Total Lost Time (s)	4.0	4.0						4.0			4.0	
Act Effct Green (s)	30.0	34.0						38.0			38.0	
Actuated g/C Ratio	0.38	0.42						0.48			0.48	
v/c Ratio	0.01	0.55						0.06			0.09	
Control Delay	21.2	25.5						2.4			12.0	
Queue Delay	0.0	0.6						0.0			0.0	
Total Delay	21.2	26.0						2.4			12.0	
LOS	C	C						A			B	
Approach Delay		26.0						2.4			12.0	
Approach LOS		C						A			B	

Intersection Summary

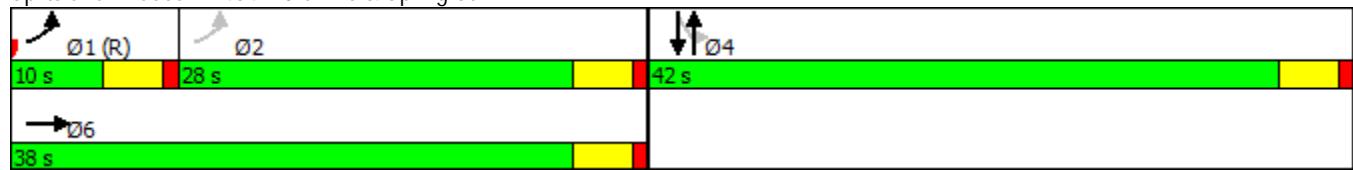
Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	22 (28%), Referenced to phase 1:EBL, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.55
Intersection Signal Delay:	23.7
Intersection LOS:	C
Intersection Capacity Utilization:	37.0%
ICU Level of Service:	A
Analysis Period (min):	15

# Lanes, Volumes, Timings

## 4041: 3rd Ave & Spring St

1/22/2016

Splits and Phases: 4041: 3rd Ave & Spring St



Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	28.0
Total Lost Time (s)	
Act Effect Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

# Lanes, Volumes, Timings

## 4042: 1st Ave & Spring St

1/22/2016

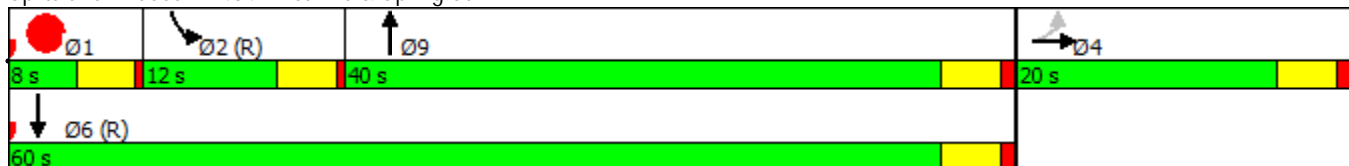


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕						↕		↕	↕	
Traffic Volume (vph)	62	210	34	0	0	0	0	349	106	100	360	0
Future Volume (vph)	62	210	34	0	0	0	0	349	106	100	360	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	12	12	12	10	10	10	10	10	10
Grade (%)		9%			0%			3%			0%	
Satd. Flow (prot)	0	2447	0	0	0	0	0	1040	0	1430	1280	0
Flt Permitted		0.990								0.950		
Satd. Flow (perm)	0	2200	0	0	0	0	0	1040	0	1185	1280	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15						25				
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		280			339			321			346	
Travel Time (s)		7.6			9.2			8.8			9.4	
Confl. Peds. (#/hr)	189		101	101		189	419		295	295		419
Confl. Bikes (#/hr)			2			4			14			24
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	5%	5%	5%	6%	6%	6%
Parking (#/hr)	14	14	14					24	24		10	40
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	332	0	0	0	0	0	494	0	109	391	0
Turn Type	Perm	NA						NA	custom	NA		
Protected Phases		4						9		2	6	
Permitted Phases	4	4								2		
Total Split (s)	20.0	20.0						40.0		12.0	60.0	
Total Lost Time (s)		4.0						4.0		3.5	4.0	
Act Effct Green (s)		16.0						36.0		8.5	56.0	
Actuated g/C Ratio		0.20						0.45		0.11	0.70	
v/c Ratio		0.73						1.03		0.72	0.44	
Control Delay		39.8						65.8		62.9	7.0	
Queue Delay		0.0						0.0		0.0	0.0	
Total Delay		39.8						65.8		62.9	7.0	
LOS		D						E		E	A	
Approach Delay		39.8						65.8			19.2	
Approach LOS		D						E			B	

### Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 49 (61%), Referenced to phase 2:SBL and 6:SBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 1.03  
 Intersection Signal Delay: 41.7  
 Intersection LOS: D  
 Intersection Capacity Utilization 59.4%  
 ICU Level of Service B  
 Analysis Period (min) 15

### Splits and Phases: 4042: 1st Ave & Spring St



Lane Group	Ø1
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	1
Permitted Phases	
Total Split (s)	8.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St

1/22/2016

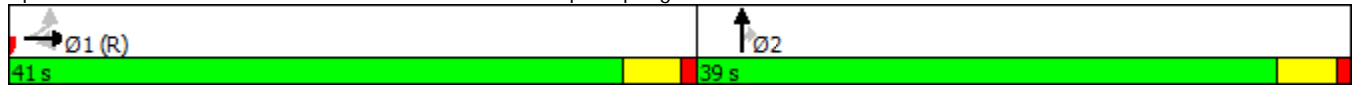


Lane Group	EBL	EBT	EBR	NBT	NBR	NBR2
Lane Configurations						
Traffic Volume (vph)	78	175	779	142	26	726
Future Volume (vph)	78	175	779	142	26	726
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	10	11	12
Grade (%)		10%		5%		
Satd. Flow (prot)	1513	1202	1354	2899	1343	0
Flt Permitted	0.950					
Satd. Flow (perm)	1327	1202	1354	2899	1343	0
Right Turn on Red	Yes					No
Satd. Flow (RTOR)	85					
Link Speed (mph)		25		25		
Link Distance (ft)		295		323		
Travel Time (s)		8.0		8.8		
Confl. Peds. (#/hr)	118					
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Bus Blockages (#/hr)	0	5	0	0	0	0
Parking (#/hr)		15				
Shared Lane Traffic (%)						
Lane Group Flow (vph)	85	190	847	154	817	0
Turn Type	Perm	NA	Perm	NA	Perm	
Protected Phases		1		2		
Permitted Phases	1		1		2	
Total Split (s)	41.0	41.0	41.0	39.0	39.0	
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	
Act Effect Green (s)	36.5	36.5	36.5	34.5	34.5	
Actuated g/C Ratio	0.46	0.46	0.46	0.43	0.43	
v/c Ratio	0.13	0.35	1.37	0.12	1.41	
Control Delay	5.8	17.3	197.9	9.2	211.8	
Queue Delay	0.0	0.0	0.3	0.0	0.3	
Total Delay	5.8	17.3	198.2	9.2	212.1	
LOS	A	B	F	A	F	
Approach Delay		153.0		179.9		
Approach LOS		F		F		

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	66 (83%), Referenced to phase 1:EBTL, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	1.41
Intersection Signal Delay:	165.5
Intersection LOS:	F
Intersection Capacity Utilization:	112.8%
ICU Level of Service:	H
Analysis Period (min):	15

Splits and Phases: 4058: 6th Ave & I-5 CD SB On-Ramp & Spring St



Lanes, Volumes, Timings  
4059: Boylston Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↶			↶			↷			↷	
Traffic Volume (vph)	0	499	4	0	397	5	2	171	11	102	37	24
Future Volume (vph)	0	499	4	0	397	5	2	171	11	102	37	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	12	10	10	12	12	15	12	12	15	12
Grade (%)		2%			9%			0%			0%	
Storage Length (ft)	0		125	0		125	0		0	0		0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			70			25			25		
Satd. Flow (prot)	0	1544	0	0	1488	0	0	1852	0	0	1703	0
Flt Permitted								0.998			0.498	
Satd. Flow (perm)	0	1544	0	0	1488	0	0	1847	0	0	845	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			1			4			10	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		325			306			184			179	
Travel Time (s)		7.4			7.0			4.2			4.1	
Confl. Peds. (#/hr)	35		62	62		35	56		33	33		56
Peak Hour Factor	0.82	0.82	0.82	0.88	0.88	0.88	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	2%	2%	2%
Parking (#/hr)			0									
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	614	0	0	457	0	0	227	0	0	202	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases							4			4		
Total Split (s)		62.0			62.0		38.0	38.0		38.0	38.0	
Total Lost Time (s)		3.5			3.5			3.5			3.5	
Act Effct Green (s)		67.9			67.9			25.1			25.1	
Actuated g/C Ratio		0.68			0.68			0.25			0.25	
v/c Ratio		0.59			0.45			0.49			0.92	
Control Delay		14.6			10.8			33.7			77.4	
Queue Delay		2.3			0.9			0.0			0.0	
Total Delay		16.9			11.6			33.7			77.5	
LOS		B			B			C			E	
Approach Delay		16.9			11.6			33.7			77.5	
Approach LOS		B			B			C			E	

Intersection Summary

Area Type:	CBD
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	29 (29%), Referenced to phase 2:EBWB, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.92
Intersection Signal Delay:	26.0
Intersection LOS:	C
Intersection Capacity Utilization:	66.2%
ICU Level of Service:	C
Analysis Period (min):	15



Lanes, Volumes, Timings  
4059: Boylston Ave & Madison St

1/22/2016

Splits and Phases: 4059: Boylston Ave & Madison St



Lanes, Volumes, Timings  
4411: 4th Ave & Madison St

1/22/2016

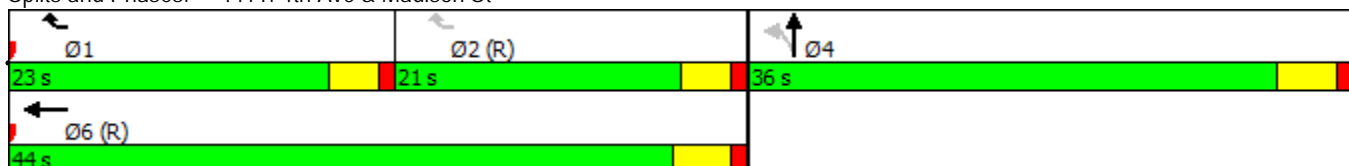


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑	↑	↑↑↑				
Traffic Volume (vph)	0	0	0	0	291	468	121	1477	0	0	0	0
Future Volume (vph)	0	0	0	0	291	468	121	1477	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	13	12	13	11	10	12	12	12
Grade (%)		14%			-10%			5%			0%	
Satd. Flow (prot)	0	0	0	0	3061	1482	1637	4400	0	0	0	0
Flt Permitted							0.950					
Satd. Flow (perm)	0	0	0	0	3061	1041	1249	4400	0	0	0	0
Right Turn on Red			Yes			Yes	Yes		Yes			Yes
Satd. Flow (RTOR)						20	132					
Link Speed (mph)		25			25			25				25
Link Distance (ft)		297			362			249				323
Travel Time (s)		8.1			9.9			6.8				8.8
Confl. Peds. (#/hr)	194		81	81		194	138		129	129		138
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
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	0%	0%	0%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)					15							
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	316	509	132	1605	0	0	0	0
Turn Type					NA	custom	Perm	NA				
Protected Phases					6	1		4				
Permitted Phases						2	4					
Total Split (s)					44.0	23.0	36.0	36.0				
Total Lost Time (s)					2.5	4.0	3.5	3.5				
Act Effct Green (s)					41.5	36.0	32.5	32.5				
Actuated g/C Ratio					0.52	0.45	0.41	0.41				
v/c Ratio					0.20	0.87	0.23	0.90				
Control Delay					4.4	27.5	4.1	30.6				
Queue Delay					0.0	0.0	0.0	0.0				
Total Delay					4.4	27.5	4.1	30.6				
LOS					A	C	A	C				
Approach Delay					18.6			28.6				
Approach LOS					B			C				

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	69 (86%), Referenced to phase 2:WBR and 6:WBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.90
Intersection Signal Delay:	25.4
Intersection LOS:	C
Intersection Capacity Utilization:	78.3%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 4411: 4th Ave & Madison St



Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	21.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Intersection Summary	

Lanes, Volumes, Timings  
4412: 4th Ave & Spring St

1/22/2016

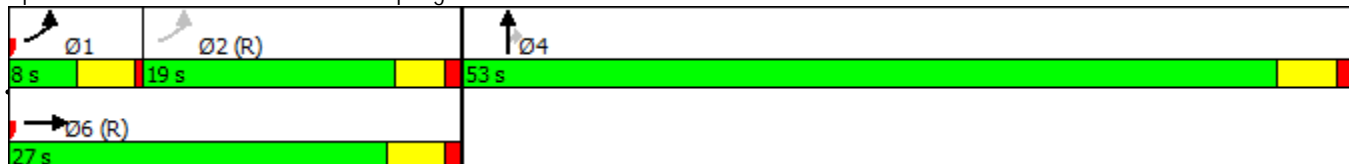


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↘	↑↑						↑↑↑	↗			
Traffic Volume (vph)	89	478	0	0	0	0	0	1812	133	0	0	0
Future Volume (vph)	89	478	0	0	0	0	0	1812	133	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	10	12	12	12	12
Grade (%)		15%			-5%			5%			0%	
Satd. Flow (prot)	1473	2509	0	0	0	0	0	3773	1219	0	0	0
Flt Permitted	0.950											
Satd. Flow (perm)	1176	2509	0	0	0	0	0	3773	1038	0	0	0
Right Turn on Red	Yes		Yes			Yes			Yes			Yes
Satd. Flow (RTOR)	20							2	75			
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		298			362			323			239	
Travel Time (s)		8.1			9.9			8.8			6.5	
Confl. Peds. (#/hr)	143		93	93		143	180		87	87		180
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	0%	0%	0%	2%	2%	2%
Parking (#/hr)		15						15				
Shared Lane Traffic (%)									10%			
Lane Group Flow (vph)	97	520	0	0	0	0	0	1985	130	0	0	0
Turn Type	custom	NA						NA	Perm			
Protected Phases	1	6						4				
Permitted Phases	2								4			
Total Split (s)	8.0	27.0						53.0	53.0			
Total Lost Time (s)	4.0	4.5						5.5	5.5			
Act Effct Green (s)	19.0	22.5						47.5	47.5			
Actuated g/C Ratio	0.24	0.28						0.59	0.59			
v/c Ratio	0.31	0.74						0.89	0.20			
Control Delay	31.7	42.4						14.3	3.4			
Queue Delay	0.0	0.0						0.0	0.0			
Total Delay	31.7	42.4						14.3	3.4			
LOS	C	D						B	A			
Approach Delay		40.7						13.6				
Approach LOS		D						B				

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 72 (90%), Referenced to phase 2:EBL and 6:EBT, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.89  
 Intersection Signal Delay: 19.7  
 Intersection Capacity Utilization 63.1%  
 Analysis Period (min) 15  
 Intersection LOS: B  
 ICU Level of Service B

Splits and Phases: 4412: 4th Ave & Spring St



Lane Group	Ø2
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	2
Permitted Phases	
Total Split (s)	19.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	

Lanes, Volumes, Timings  
4455: 2nd Ave & Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑	↑
Traffic Volume (vph)	0	0	0	208	314	0	0	0	0	0	1536	78
Future Volume (vph)	0	0	0	208	314	0	0	0	0	0	1536	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	16	10	10	12	12	10	12	12
Grade (%)		15%			-13%			0%			0%	
Storage Length (ft)	0		0	0		0	0		0	0		50
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	0	0	0	3440	0	0	0	0	0	2664	1454
Flt Permitted					0.980							
Satd. Flow (perm)	0	0	0	0	2995	0	0	0	0	0	2664	1168
Right Turn on Red			Yes	Yes		Yes			Yes			Yes
Satd. Flow (RTOR)					48							48
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		338			309			274			313	
Travel Time (s)		9.2			8.4			7.5			8.5	
Confl. Peds. (#/hr)	270		283	283		270	94		216	216		94
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
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	0%	0%	0%
Bus Blockages (#/hr)	0	0	0	0	10	0	0	0	0	0	0	0
Parking (#/hr)					0					0	52	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	567	0	0	0	0	0	1670	85
Turn Type				Perm	NA						NA	Perm
Protected Phases					4						2	
Permitted Phases				4	4							2
Total Split (s)				25.0	25.0						55.0	55.0
Total Lost Time (s)					5.0						5.0	6.5
Act Effct Green (s)					20.0						50.0	48.5
Actuated g/C Ratio					0.25						0.62	0.61
v/c Ratio					0.72						1.00	0.12
Control Delay					47.9						27.4	1.6
Queue Delay					0.0						36.5	0.0
Total Delay					47.9						63.9	1.6
LOS					D						E	A
Approach Delay					47.9						60.9	
Approach LOS					D						E	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	9 (11%), Referenced to phase 2:SBT and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	1.00
Intersection Signal Delay:	57.7
Intersection LOS:	E
Intersection Capacity Utilization:	75.1%
ICU Level of Service:	D
Analysis Period (min):	15

Lanes, Volumes, Timings  
4455: 2nd Ave & Madison St

1/22/2016

Splits and Phases: 4455: 2nd Ave & Madison St



Lanes, Volumes, Timings  
4456: 2nd Ave & Spring St

1/22/2016

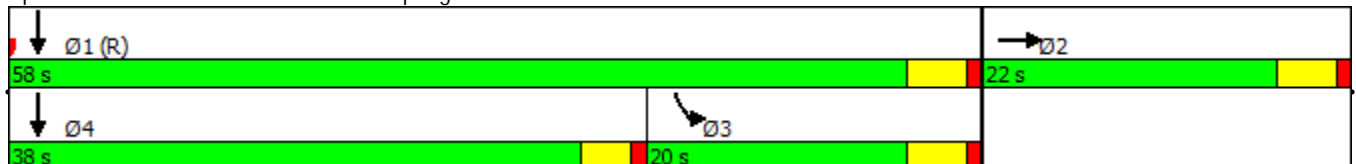


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑								↘	↑↑	
Traffic Volume (vph)	0	352	126	0	0	0	0	0	0	198	1478	0
Future Volume (vph)	0	352	126	0	0	0	0	0	0	198	1478	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		12%			0%			0%			0%	
Satd. Flow (prot)	0	2419	0	0	0	0	0	0	0	1289	2358	0
Flt Permitted										0.950		
Satd. Flow (perm)	0	2419	0	0	0	0	0	0	0	825	2358	0
Right Turn on Red			Yes			Yes			Yes	Yes		Yes
Satd. Flow (RTOR)		8								157		
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		339			306			313			314	
Travel Time (s)		9.2			8.3			8.5			8.6	
Confl. Peds. (#/hr)	400		400	400		400	400		400	400		400
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	0%	0%	0%
Parking (#/hr)										10	69	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	520	0	0	0	0	0	0	0	215	1607	0
Turn Type		NA								Prot	NA	
Protected Phases		2								3	14	
Permitted Phases												
Total Split (s)		22.0								20.0		
Total Lost Time (s)		4.0								4.0		
Act Effct Green (s)		18.0								16.0	54.0	
Actuated g/C Ratio		0.22								0.20	0.68	
v/c Ratio		0.95								0.56	1.01	
Control Delay		51.8								15.6	40.1	
Queue Delay		0.0								0.0	34.3	
Total Delay		51.8								15.6	74.4	
LOS		D								B	E	
Approach Delay		51.8									67.5	
Approach LOS		D									E	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	65 (81%), Referenced to phase 1:SBT, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	1.01
Intersection Signal Delay:	64.0
Intersection LOS:	E
Intersection Capacity Utilization:	69.8%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 4456: 2nd Ave & Spring St





Lane Group	Ø1	Ø4
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Grade (%)		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Confl. Peds. (#/hr)		
Peak Hour Factor		
Heavy Vehicles (%)		
Parking (#/hr)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Turn Type		
Protected Phases	1	4
Permitted Phases		
Total Split (s)	58.0	38.0
Total Lost Time (s)		
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
<b>Intersection Summary</b>		

Lanes, Volumes, Timings  
4477: 5th Ave & Madison St

1/22/2016

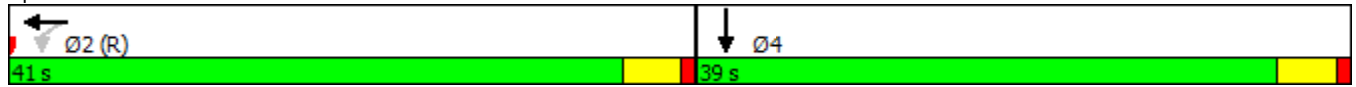


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑↑	
Traffic Volume (vph)	0	0	0	226	597	0	0	0	0	0	557	139
Future Volume (vph)	0	0	0	226	597	0	0	0	0	0	557	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	16	12	12	12	12	12	15	12
Grade (%)		10%			-13%			0%			0%	
Satd. Flow (prot)	0	0	0	0	3791	0	0	0	0	0	4391	0
Flt Permitted					0.986							
Satd. Flow (perm)	0	0	0	0	3407	0	0	0	0	0	4391	0
Right Turn on Red			Yes	Yes		Yes			Yes			Yes
Satd. Flow (RTOR)					20						14	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		362			287			226			323	
Travel Time (s)		9.9			7.8			6.2			8.8	
Confl. Peds. (#/hr)	400		400	400		400	400		400	400		400
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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	5%	5%	5%
Parking (#/hr)				15								15
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	895	0	0	0	0	0	756	0
Turn Type				Perm	NA						NA	
Protected Phases					2						4	
Permitted Phases				2								
Total Split (s)				41.0	41.0						39.0	
Total Lost Time (s)					4.5						4.5	
Act Effct Green (s)					36.5						34.5	
Actuated g/C Ratio					0.46						0.43	
v/c Ratio					0.57						0.40	
Control Delay					8.5						18.4	
Queue Delay					3.4						0.0	
Total Delay					11.9						18.4	
LOS					B						B	
Approach Delay					11.9						18.4	
Approach LOS					B						B	

Intersection Summary

Area Type:	CBD
Cycle Length:	80
Actuated Cycle Length:	80
Offset:	54 (68%), Referenced to phase 2:WBTL and 6:, Start of 1st Green
Control Type:	Pretimed
Maximum v/c Ratio:	0.57
Intersection Signal Delay:	14.9
Intersection LOS:	B
Intersection Capacity Utilization:	53.7%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 4477: 5th Ave & Madison St





Lanes, Volumes, Timings  
4568: 5th Ave & Spring St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑									↑↑↑	
Traffic Volume (vph)	0	541	70	0	0	0	0	0	0	493	626	0
Future Volume (vph)	0	541	70	0	0	0	0	0	0	493	626	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	12	12	12	12	12	12	12	12	10	12
Grade (%)		15%			-5%			0%			0%	
Satd. Flow (prot)	0	2560	0	0	0	0	0	0	0	0	4178	0
Flt Permitted											0.978	
Satd. Flow (perm)	0	2560	0	0	0	0	0	0	0	0	3483	0
Right Turn on Red			Yes			Yes			Yes	Yes		Yes
Satd. Flow (RTOR)		18									27	
Link Speed (mph)		25			25			25			25	
Link Distance (ft)		362			295			323			224	
Travel Time (s)		9.9			8.0			8.8			6.1	
Confl. Peds. (#/hr)	400		400	400		400	400		400	400		400
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
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	664	0	0	0	0	0	0	0	0	1216	0
Turn Type		NA								Perm	NA	
Protected Phases		2									4	
Permitted Phases										4		
Total Split (s)		28.0								52.0	52.0	
Total Lost Time (s)		3.5									3.5	
Act Effct Green (s)		24.5									48.5	
Actuated g/C Ratio		0.31									0.61	
v/c Ratio		0.83									0.57	
Control Delay		15.5									10.6	
Queue Delay		0.1									0.7	
Total Delay		15.6									11.3	
LOS		B									B	
Approach Delay		15.6									11.3	
Approach LOS		B									B	

Intersection Summary

Area Type: CBD  
 Cycle Length: 80  
 Actuated Cycle Length: 80  
 Offset: 1 (1%), Referenced to phase 2:EBT and 6:, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.83  
 Intersection Signal Delay: 12.8  
 Intersection LOS: B  
 Intersection Capacity Utilization 63.8%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 4568: 5th Ave & Spring St



Lanes, Volumes, Timings  
5005: 19th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↗	↕			↕	
Traffic Volume (vph)	320	535	52	198	234	3	98	142	62	9	212	185
Future Volume (vph)	320	535	52	198	234	3	98	142	62	9	212	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		-11%			8%			0%			0%	
Storage Length (ft)	0		0	0		0	100		0	0		0
Storage Lanes	0		0	0		0	1		0	0		0
Taper Length (ft)	25			25			25			25		
Satd. Flow (prot)	0	3522	0	0	3239	0	1698	1923	0	0	1913	0
Flt Permitted		0.673			0.521		0.229	0.973			0.990	
Satd. Flow (perm)	0	2378	0	0	1709	0	409	1875	0	0	1896	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			1			22			43	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		419			361			267			345	
Travel Time (s)		9.5			8.2			6.1			7.8	
Confl. Peds. (#/hr)	26		40	40		26	7		2	2		7
Confl. Bikes (#/hr)			8			4			1			12
Peak Hour Factor	0.99	0.99	0.99	0.98	0.98	0.98	0.86	0.86	0.86	0.91	0.91	0.91
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Parking (#/hr)									0			0
Shared Lane Traffic (%)							10%					
Lane Group Flow (vph)	0	916	0	0	444	0	103	248	0	0	446	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		2			2		3	4			4	
Permitted Phases	2			2			4			4		
Total Split (s)	56.0	56.0		56.0	56.0		8.0	36.0		36.0	36.0	
Total Lost Time (s)		6.0			6.0		4.0	6.0			6.0	
Act Effct Green (s)		55.7			55.7		31.1	27.5			25.9	
Actuated g/C Ratio		0.56			0.56		0.31	0.28			0.26	
v/c Ratio		0.69			0.47		0.58	0.47			0.85	
Control Delay		19.6			20.2		36.0	28.6			47.6	
Queue Delay		0.0			0.0		0.0	0.0			0.0	
Total Delay		19.6			20.2		36.0	28.6			47.6	
LOS		B			C		D	C			D	
Approach Delay		19.6			20.2			30.8			47.6	
Approach LOS		B			C			C			D	

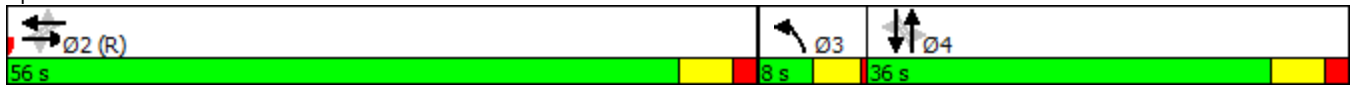
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	100
Offset:	0 (0%), Referenced to phase 2:EBWB, Start of 1st Green
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.85
Intersection Signal Delay:	27.3
Intersection LOS:	C
Intersection Capacity Utilization:	90.5%
ICU Level of Service:	E
Analysis Period (min):	15

Lanes, Volumes, Timings  
5005: 19th Ave & E Madison St

1/22/2016

Splits and Phases: 5005: 19th Ave & E Madison St



Lanes, Volumes, Timings  
5349: 14th Ave & E Madison St

1/22/2016



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↻			↻			↕		↻	↻	
Traffic Volume (vph)	0	490	98	0	126	0	48	299	57	58	393	7
Future Volume (vph)	0	490	98	0	126	0	48	299	57	58	393	7
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		7%			-10%			0%			0%	
Satd. Flow (prot)	0	1684	0	0	1909	0	0	2065	0	1752	2080	0
Flt Permitted								0.644		0.415		
Satd. Flow (perm)	0	1684	0	0	1909	0	0	1333	0	758	2080	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14						10			1	
Link Speed (mph)		30			30			30			25	
Link Distance (ft)		358			166			257			100	
Travel Time (s)		8.1			3.8			5.8			2.7	
Confl. Peds. (#/hr)	3		31	31		3	37		10	10		37
Confl. Bikes (#/hr)			7			3			1			1
Peak Hour Factor	0.92	0.92	0.92	0.91	0.91	0.91	0.85	0.85	0.85	0.86	0.86	0.86
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%
Parking (#/hr)									0			0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	640	0	0	138	0	0	475	0	67	465	0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		1			1			3			6	
Permitted Phases							3			6		
Total Split (s)		52.0			52.0		48.0	48.0		48.0	48.0	
Total Lost Time (s)		4.5			4.5			8.5		4.5	4.5	
Act Effct Green (s)		47.5			47.5			39.5		43.5	43.5	
Actuated g/C Ratio		0.48			0.48			0.40		0.44	0.44	
v/c Ratio		0.79			0.15			0.89		0.20	0.51	
Control Delay		25.8			16.1			49.2		7.6	8.6	
Queue Delay		2.6			0.0			0.0		0.0	0.0	
Total Delay		28.4			16.1			49.2		7.6	8.6	
LOS		C			B			D		A	A	
Approach Delay		28.4			16.1			49.2			8.4	
Approach LOS		C			B			D			A	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 18 (18%), Referenced to phase 1:EBWB, Start of 1st Green  
 Control Type: Pretimed  
 Maximum v/c Ratio: 0.89  
 Intersection Signal Delay: 27.0      Intersection LOS: C  
 Intersection Capacity Utilization 89.9%      ICU Level of Service E  
 Analysis Period (min) 15

Splits and Phases: 5349: 14th Ave & E Madison St

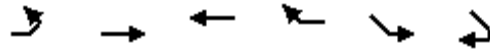
#5349 ← Ø1 (R) 52 s	#2067 #5349 ↓ Ø3 48 s
#2067 ← Ø4 52 s	#2067 #5349 ↑ Ø6 48 s

Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Total Split (s)	52.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
<b>Intersection Summary</b>	



Lanes, Volumes, Timings  
 5355: E Madison St & Pine St

1/22/2016



Lane Group	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑	↑↑		↓	↓
Traffic Volume (vph)	0	507	91	408	388	2
Future Volume (vph)	0	507	91	408	388	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	10	10	12	11	11
Grade (%)		9%	-4%		0%	
Satd. Flow (prot)	0	1677	2535	0	1678	1351
Flt Permitted					0.950	
Satd. Flow (perm)	0	1677	2535	0	1671	1198
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			434			2
Link Speed (mph)		30	30		30	
Link Distance (ft)		96	270		182	
Travel Time (s)		2.2	6.1		4.1	
Confl. Peds. (#/hr)	62			62	1	43
Confl. Bikes (#/hr)				3		8
Peak Hour Factor	0.95	0.95	0.94	0.94	0.90	0.90
Heavy Vehicles (%)	1%	1%	2%	2%	4%	4%
Parking (#/hr)						0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	534	531	0	431	2
Turn Type		NA	NA		Prot	Perm
Protected Phases		2	2		4	
Permitted Phases						4
Total Split (s)		55.0	55.0		45.0	45.0
Total Lost Time (s)		4.5	4.5		4.5	4.5
Act Effect Green (s)		61.6	61.6		29.4	29.4
Actuated g/C Ratio		0.62	0.62		0.29	0.29
v/c Ratio		0.52	0.31		0.87	0.01
Control Delay		7.7	2.6		51.6	14.0
Queue Delay		0.3	0.3		1.1	0.0
Total Delay		8.0	2.9		52.6	14.0
LOS		A	A		D	B
Approach Delay		8.0	2.9		52.5	
Approach LOS		A	A		D	

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 43 (43%), Referenced to phase 2:EBWB, Start of 1st Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.87  
 Intersection Signal Delay: 19.0  
 Intersection LOS: B  
 Intersection Capacity Utilization 55.7%  
 ICU Level of Service B  
 Analysis Period (min) 15

Splits and Phases: 5355: E Madison St & Pine St



**MADISON CORRIDOR BRT STUDY**

**Appendix K: Madison Corridor BRT Parking and  
Loading Impacts Report**

Seattle Department of Transportation

# Madison Street Corridor Bus Rapid Transit Study Parking and Loading Impacts Report

January 2016  
Draft



 **SDOT**  
Seattle Department of Transportation

  
NELSON  
NYGAARD

in association with:

PB  
DKS  
LTK  
VIA  
SASAKI



## Table of Contents

	<b>Page</b>
<b>1 Introduction</b> .....	<b>1-1</b>
<b>2 Methodology</b> .....	<b>2-1</b>
<b>3 Alternatives Impacts</b> .....	<b>3-1</b>
<b>4 LPA Impacts</b> .....	<b>4-1</b>
<b>5 Parking Mitigation</b> .....	<b>5-1</b>
Approach/Methodology .....	5-1
Parking Mitigation Opportunities .....	5-3
Key Finding and Considerations .....	5-6

## Table of Figures

	<b>Page</b>
Figure 4-1 Summary of LPA Parking Impacts .....	4-1
Figure 4-2 LPA Parking Impacts by Segment .....	4-1
Figure 4-3 LPA Parking Impacts by Block Face .....	4-2
Figure 4-4 Map of Parking and Loading Impacts, LPA Downtown Segment .....	4-7
Figure 4-5 Map of Parking and Loading Impacts, First Hill Segment.....	4-8
Figure 4-6 Map of Parking and Loading Impacts, Capitol Hill/Central District Segment .....	4-9
Figure 4-7 Map of Parking and Loading Impacts, Madison Valley Segment.....	4-10
Figure 5-1 Parking Mitigation Opportunities .....	5-4
Figure 5-2 Parking Mitigation Evaluation Detail.....	5-5



# 1 INTRODUCTION

This report describes on-street parking and loading impacts of the Madison Corridor BRT Locally Preferred Alternative (LPA) and of the previous project alternatives used to develop it. It also evaluates potential mitigation approaches to address the loss of on-street parking.





## 2 METHODOLOGY

This chapter describes the methodology used to assess impacts to on-street parking and passenger and commercial loading supply from the Madison BRT project.

Counts of existing numbers of spaces in different regulatory categories (parking, peak period-restricted parking, commercial loading, passenger loading and carpool) on each block face along the project alignment were developed primarily using a database provided by SDOT. In some cases, the database was supplemented by manual field surveys, visual surveys using Google Street View, and with information from the SDOT Seattle Parking Map.

Future projections are based on the 10 percent plan-view drawings developed in support of the project alternatives and of the LPA. In assigning future spaces to different categories, loading spaces were replaced with loading spaces on the same block wherever possible.

Parking spaces include both paid (metered) and free spaces. Peak-restricted parking spaces are spaces in which parking is prohibited during the AM peak period, PM peak period, or both. In some cases, loading zones are available for general parking outside of designated hours. Carpool spaces were included in counts of all-day spaces.

Note that the analysis is limited to on-street parking and loading, and does not include off-street parking spaces in the corridor, public or private.



### 3 ALTERNATIVES IMPACTS

During alternatives analysis, both the primary project alternatives – Side and Center Running BRT – and terminal variants were evaluated.

Both the Side and Center Running alternatives were found to require the removal of all on-street parking from Madison between 8<sup>th</sup> and 20<sup>th</sup> Avenues, with both center transit-only lanes and side-running business, access and transit (BAT) lanes requiring replacement of existing lanes used for travel during peak periods and parking during off-peak periods. Each alternative was found to result in the removal of 94 on-street spaces between 8<sup>th</sup> and 20<sup>th</sup> Avenues, of which 57 would be peak period-restricted spaces (note that these figures were updated for the final analysis found in the following section).

Impacts of the terminal variants were also evaluated. The Madison westbound, Spring eastbound alignment in the downtown was found, based on the design developed up to that point, to require the removal of 73 parking and loading spaces west of 8<sup>th</sup> Avenue, compared to just 36 for the Madison westbound and Marion eastbound variant (both assumed a turnaround at Western Avenue, with minor differences if it were 1<sup>st</sup> Avenue or Alaskan Way). The Martin Luther King, Jr. Way eastern terminal variant was found to require the removal of 32 spaces, while the 23<sup>rd</sup> Avenue variant was found to require the removal of just four spaces (if it used Olive Way to return to Madison).



## 4 LPA IMPACTS

Total existing parking and loading spaces and projected spaces along the LPA alignment are shown in Figure 4-1. Note that First Avenue between Madison and Spring, part of the LPA alignment, has not been included in this analysis because changes to parking configuration on this street will be made as part of the Center City Connector streetcar project.

**Figure 4-1 Summary of LPA Parking Impacts**

Category	Existing	Projected	Change
All-Day Parking	263	197	-66
Peak-Restricted Parking	102	6	-96
Commercial Loading	13	7	-6
Passenger Loading	12	7	-5

Figure 4-2 shows existing and projected parking and loading spaces by segment and by designation of curb use including all-day parking, peak restricted parking, commercial load zones, and passenger load zones.

**Figure 4-2 LPA Parking Impacts by Segment**

Segment	All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA
Downtown (1 <sup>st</sup> Ave-6 <sup>th</sup> Ave)	58	43	15	0	1	0	6	4
First Hill (6 <sup>th</sup> -Broadway)	69	48	43	0	3	1	5	2
Capitol Hill/Central District (Broadway-23 <sup>rd</sup> Ave)	34	32	38	0	3	0	1	1
Madison Park (23 <sup>rd</sup> Ave-MLK Jr. Way)	102	74	6	6	6	6	0	0

Figure 4-3 shows existing and projected counts by block face and category.

**Figure 4-3 LPA Parking Impacts by Block Face**

Block		All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
		Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA
<b>SPRING ST</b>									
1ST AVE to 2ND AVE	SE	0	0	0	0	0	0	0	0
1ST AVE to 2ND AVE	NW	15	0	0	0	0	0	0	0
2ND AVE to 3RD AVE	SE	0	0	0	0	0	0	0	0
2ND AVE to 3RD AVE	NW	0	0	0	0	1	0	0	0
3RD AVE to 4TH AVE	SE	0	0	0	0	0	0	0	0
3RD AVE to 4TH AVE	NW	0	0	11	0	0	0	0	0
4TH AVE to 5TH AVE	SE	0	5	4	0	0	0	0	0
4TH AVE to 5TH AVE	NW	2	3	0	0	0	0	2	2
5TH AVE to 6TH AVE	SE	0	0	0	0	0	0	0	0
5TH AVE to 6TH AVE	NW	9	9	0	0	0	0	0	0
6TH AVE to 7TH AVE	SE	0	0	0	0	0	0	0	0
6TH AVE to 7TH AVE	NW	10	13	0	0	0	0	0	0
7TH AVE to 8TH AVE	SE	6	5	0	0	0	0	2	2
7TH AVE to 8TH AVE	NW	10	9	0	0	0	0	0	0
8TH AVE to 9TH AVE	SE	8	6	0	0	1	1	0	0
8TH AVE to 9TH AVE	NW	10	9	0	0	0	0	0	0
<b>9TH AVE</b>									
SPRING ST to MADISON ST	SW	7	6	0	0	0	0	0	0
SPRING ST to MADISON ST	NE	7	0	0	0	0	0	0	0
<b>MADISON ST</b>									
1ST AVE to 2ND AVE	SE	0	7	0	0	0	0	0	0
1ST AVE to 2ND AVE	NW	0	0	0	0	0	0	0	0

Block		All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
		Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA
2ND AVE to 3RD AVE	SE	11	8	0	0	0	0	0	0
2ND AVE to 3RD AVE	NW	0	0	0	0	0	0	0	0
3RD AVE to 4TH AVE	SE	14	6	0	0	0	0	1	1
3RD AVE to 4TH AVE	NW	0	0	0	0	0	0	0	0
4TH AVE to 5TH AVE	SE	7	5	0	0	0	0	1	1
4TH AVE to 5TH AVE	NW	0	0	0	0	0	0	0	0
5TH AVE to 6TH AVE	SE	0	0	0	0	0	0	2	0
5TH AVE to 6TH AVE	NW	0	0	0	0	0	0	0	0
6TH AVE to 7TH AVE	SE	11	0	0	0	0	0	0	0
6TH AVE to 7TH AVE	NW	0	0	0	0	0	0	0	0
7TH AVE to 8TH AVE	SE	0	0	8	0	0	0	1	0
7TH AVE to 8TH AVE	NW	0	0	0	0	0	0	0	0
8TH AVE to 9TH AVE	SE	0	0	4	0	0	0	1	0
8TH AVE to 9TH AVE	NW	0	0	0	0	0	0	0	0
9TH AVE to TERRY AVE	SE	0	0	6	0	1	0	0	0
9TH AVE to TERRY AVE	NW	0	0	0	0	0	0	0	0
TERRY AVE to BOREN AVE	SE	0	0	9	0	0	0	0	0
TERRY AVE to BOREN AVE	NW	0	0	0	0	0	0	0	0
BOREN AVE to MINOR AVE	SE	0	0	8	0	0	0	0	0
BOREN AVE to MINOR AVE	NW	0	0	0	0	0	0	0	0
MINOR AVE to SUMMIT AVE	SE	0	0	0	0	0	0	0	0
MINOR AVE to SUMMIT AVE	NW	0	0	0	0	0	0	0	0
SUMMIT AVE to BOYLSTON AVE	SE	0	0	6	0	1	0	0	0

Block		All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
		Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA
SUMMIT AVE to BOYLSTON AVE	NW	0	0	0	0	0	0	0	0
BOYLSTON AVE to BROADWAY	SE	0	0	2	0	0	0	1	0
BOYLSTON AVE to BROADWAY	NW	0	0	0	0	0	0	0	0
BROADWAY to BROADWAY CT	SE	0	0	0	0	0	0	0	0
BROADWAY to BROADWAY CT	NW	0	0	0	0	0	0	0	0
BROADWAY CT to 10TH AVE	SE	0	0	3	0	0	0	0	0
BROADWAY CT to 10TH AVE	NW	0	0	0	0	0	0	0	0
10TH AVE to E SENECA ST	SE	0	0	5	0	1	0	0	0
10TH AVE to E SENECA ST	NW	0	0	3	0	0	0	0	0
E SENECA ST to 11TH AVE	SE	0	0	0	0	0	0	0	0
E SENECA ST to 11TH AVE	NW	0	0	0	0	0	0	0	0
11TH AVE to 12TH AVE	SE	0	0	0	0	0	0	0	0
11TH AVE to 12TH AVE	NW	0	0	0	0	0	0	0	0
12TH AVE to 13TH AVE	SE	0	0	0	0	0	0	0	0
12TH AVE to 13TH AVE	NW	0	0	0	0	0	0	0	0
13TH AVE to 14TH AVE	SE	0	0	7	0	1	0	0	0
13TH AVE to 14TH AVE	NW	0	0	0	0	0	0	0	0
14TH AVE to E PIKE ST	SE	0	0	4	0	0	0	0	0
14TH AVE to E PIKE ST	NW	0	0	0	0	0	0	0	0
E PIKE ST to 15TH AVE	SE	0	0	0	0	0	0	0	0
E PIKE ST to 15TH AVE	NW	0	0	0	0	0	0	0	0

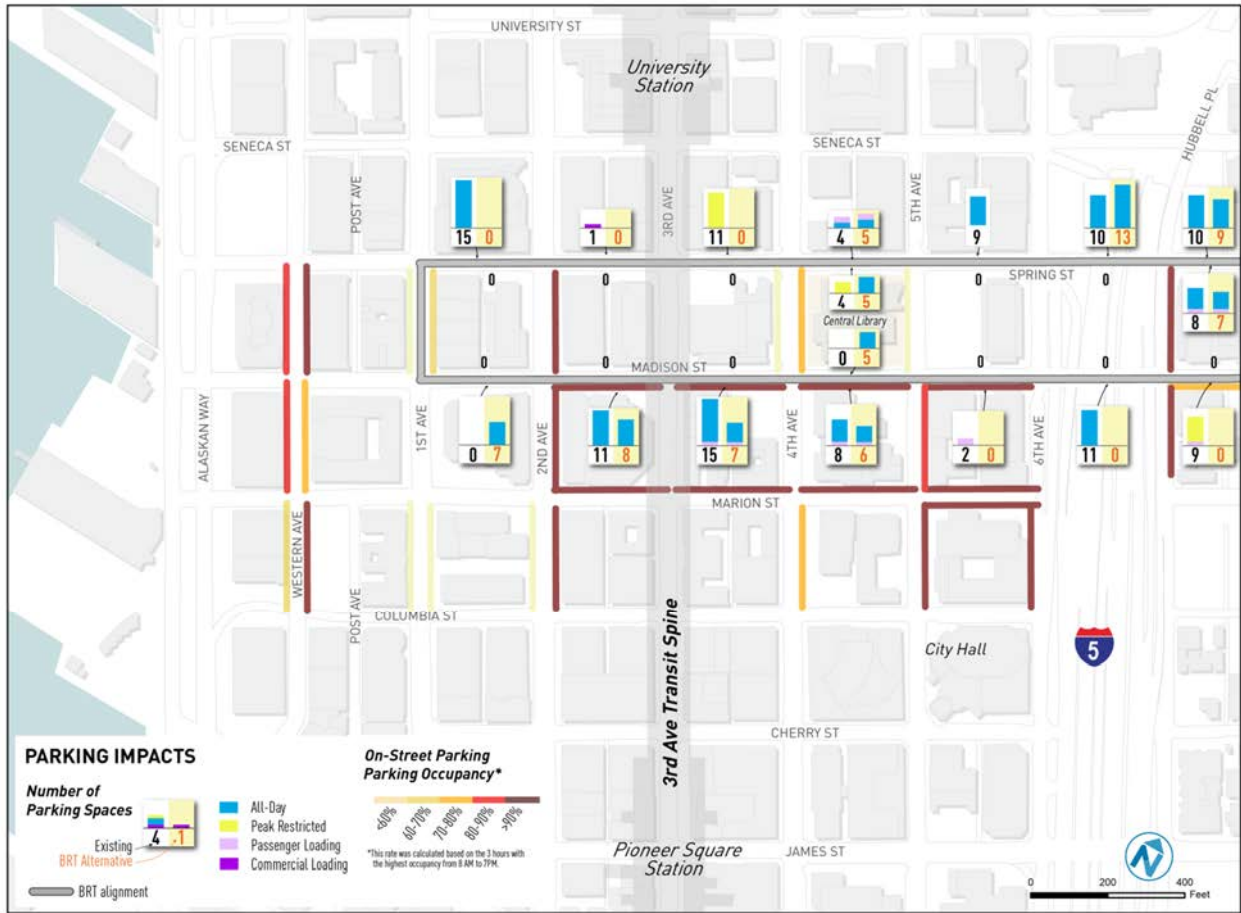


Block		All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
		Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA
15TH AVE to 16TH AVE	SE	0	0	0	0	0	0	0	0
15TH AVE to 16TH AVE	NW	0	0	0	0	0	0	0	0
16TH AVE to E PINE ST	SE	0	0	0	0	0	0	0	0
16TH AVE to E PINE ST	NW	0	0	0	0	0	0	0	0
E PINE ST to 17TH AVE	SE	0	0	0	0	0	0	0	0
E PINE ST to 17TH AVE	NW	0	0	0	0	0	0	0	0
17TH AVE to 18TH AVE	SE	0	0	0	0	0	0	0	0
17TH AVE to 18TH AVE	NW	0	0	0	0	0	0	0	0
18TH AVE to 19TH AVE	SE	0	0	0	0	0	0	0	0
18TH AVE to 19TH AVE	NW	0	0	0	0	0	0	0	0
19TH AVE to 20TH AVE	SE	0	0	0	0	0	0	0	0
19TH AVE to 20TH AVE	NW	0	0	0	0	0	0	0	0
20TH AVE to E DENNY WAY	SE	15	0	0	0	1	0	0	0
20TH AVE to E DENNY WAY	NW	0	0	15	0	0	0	0	0
E DENNY WAY to 22ND AVE	SE	0	0	0	0	0	0	0	0
E DENNY WAY to 22ND AVE	NW	0	6	0	0	0	0	1	1
22ND AVE to 23RD AVE	SE	6	13	0	0	0	0	0	0
22ND AVE to 23RD AVE	NW	13	13	0	0	0	0	0	0
23RD AVE to 24TH AVE	SE	1	1	3	3	2	2	0	0
23RD AVE to 24TH AVE	NW	10	10	3	3	0	0	0	0
24TH AVE to 25TH AVE	SE	8	3	0	0	0	0	0	0
24TH AVE to 25TH AVE	NW	2	2	0	0	1	1	0	0
25TH AVE to 26TH AVE	SE	14	14	0	0	0	0	0	0

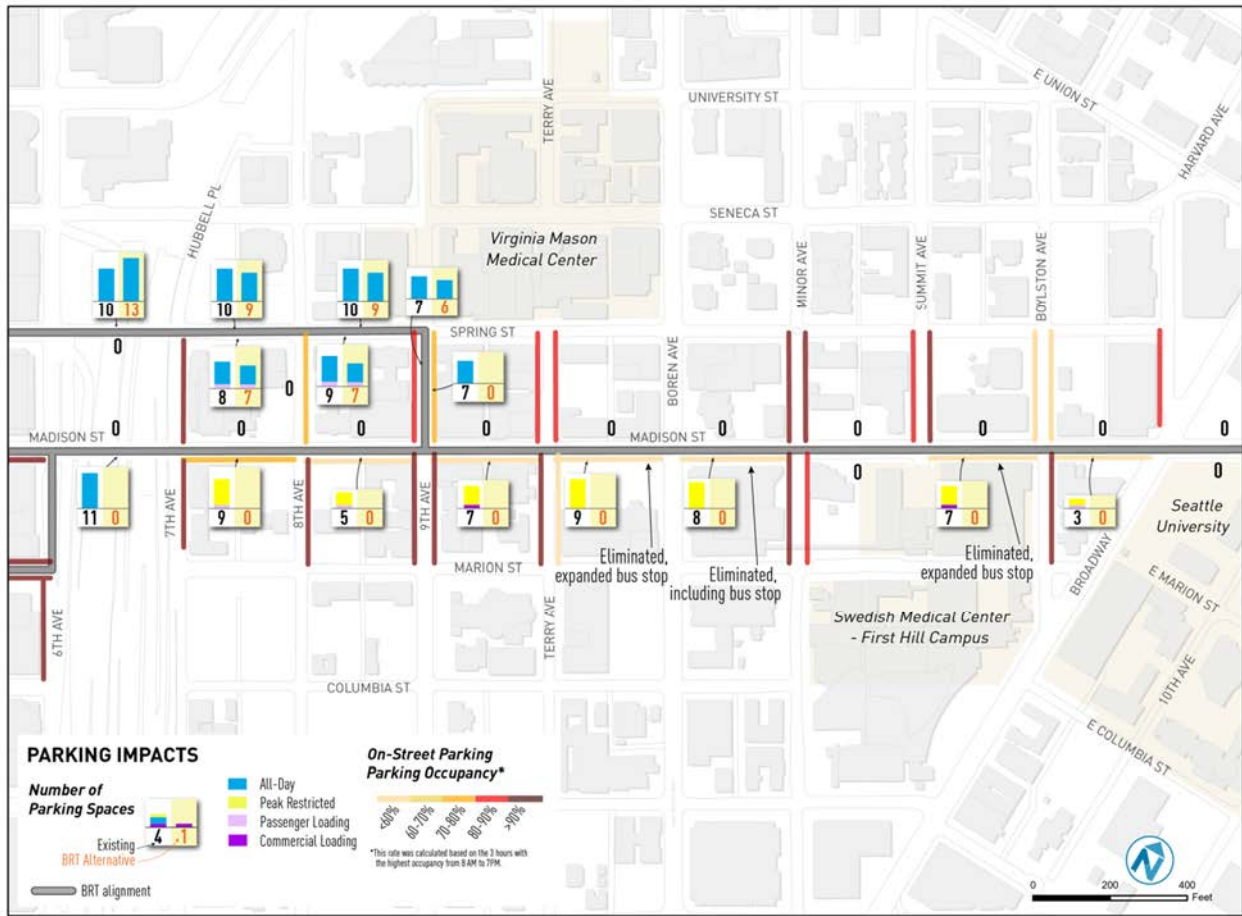
Block		All Day Parking		Peak Restrict		Comm Loading		Psgr Loading	
		Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA	Existing	BRT LPA
25TH AVE to 26TH AVE	NW	20	20	0	0	0	0	0	0
26TH AVE to 27TH AVE	SE	6	6	0	0	0	0	0	0
26TH AVE to 27TH AVE	NW	10	5	0	0	1	1	0	0
27TH AVE to 27TH AVE	SE	1	1	0	0	1	1	0	0
27TH AVE to 27TH AVE	NW	2	2	0	0	0	0	0	0
27TH AVE to MLK JR WAY	SE	10	5	0	0	1	1	0	0
27TH AVE to MLK JR WAY	NW	11	5	0	0	0	0	0	0
<b>MARTIN LUTHER KING, JR. WAY</b>									
MADISON to ARTHUR PL	E	0	0	0	0	0	0	0	0
MADISON to ARTHUR PL	W	0	0	0	0	0	0	0	0
AT ARTHUR PL/HARRISON (TRAFFIC CIRCLE)	--	7	0	0	0	0	0	0	0

Figures 4-4 through 4-7 on the following pages illustrate the before-and-after parking and loading counts by segment, and provide limited additional information on current peak occupancy rates, as observed during existing conditions data collection for this project.

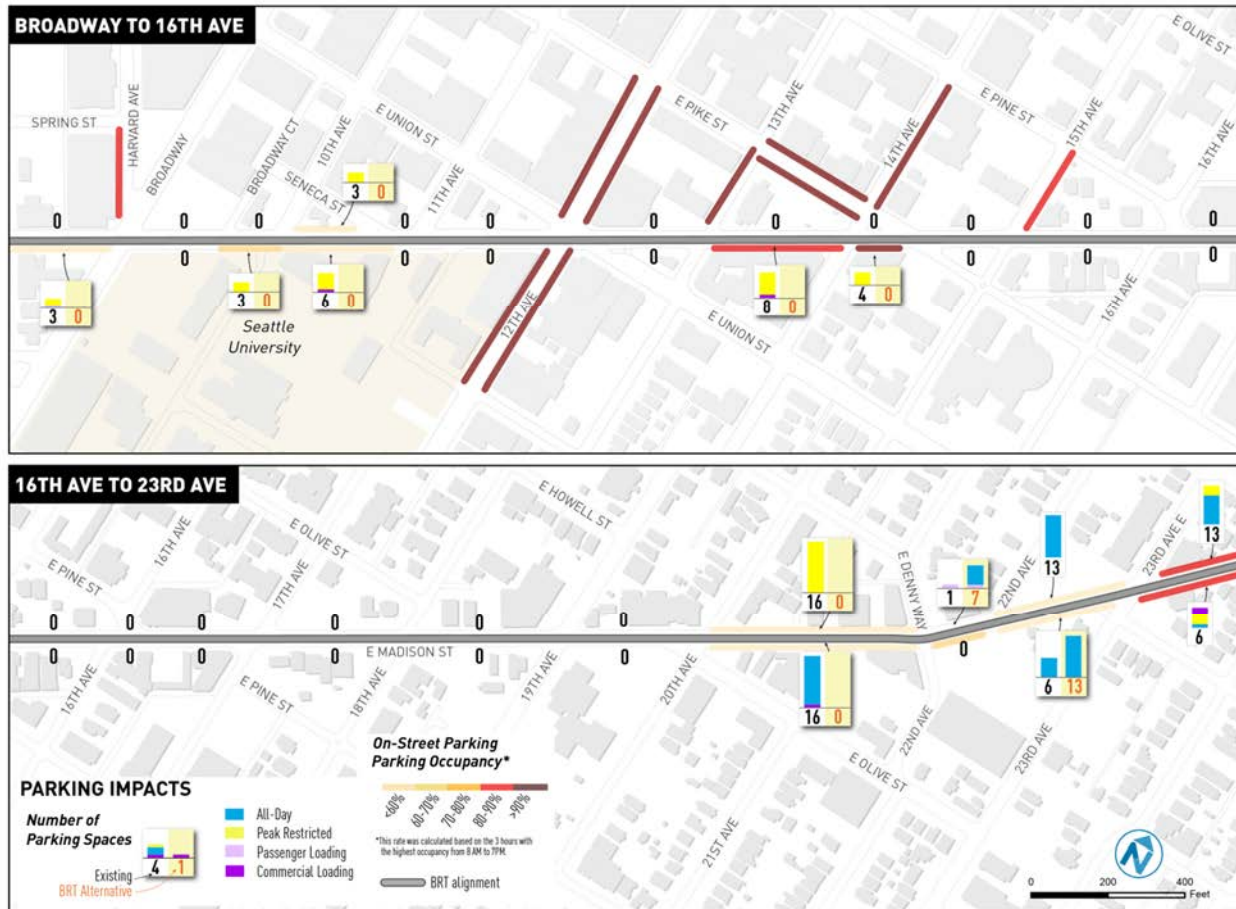
**Figure 4-4 Map of Parking and Loading Impacts, LPA Downtown Segment**



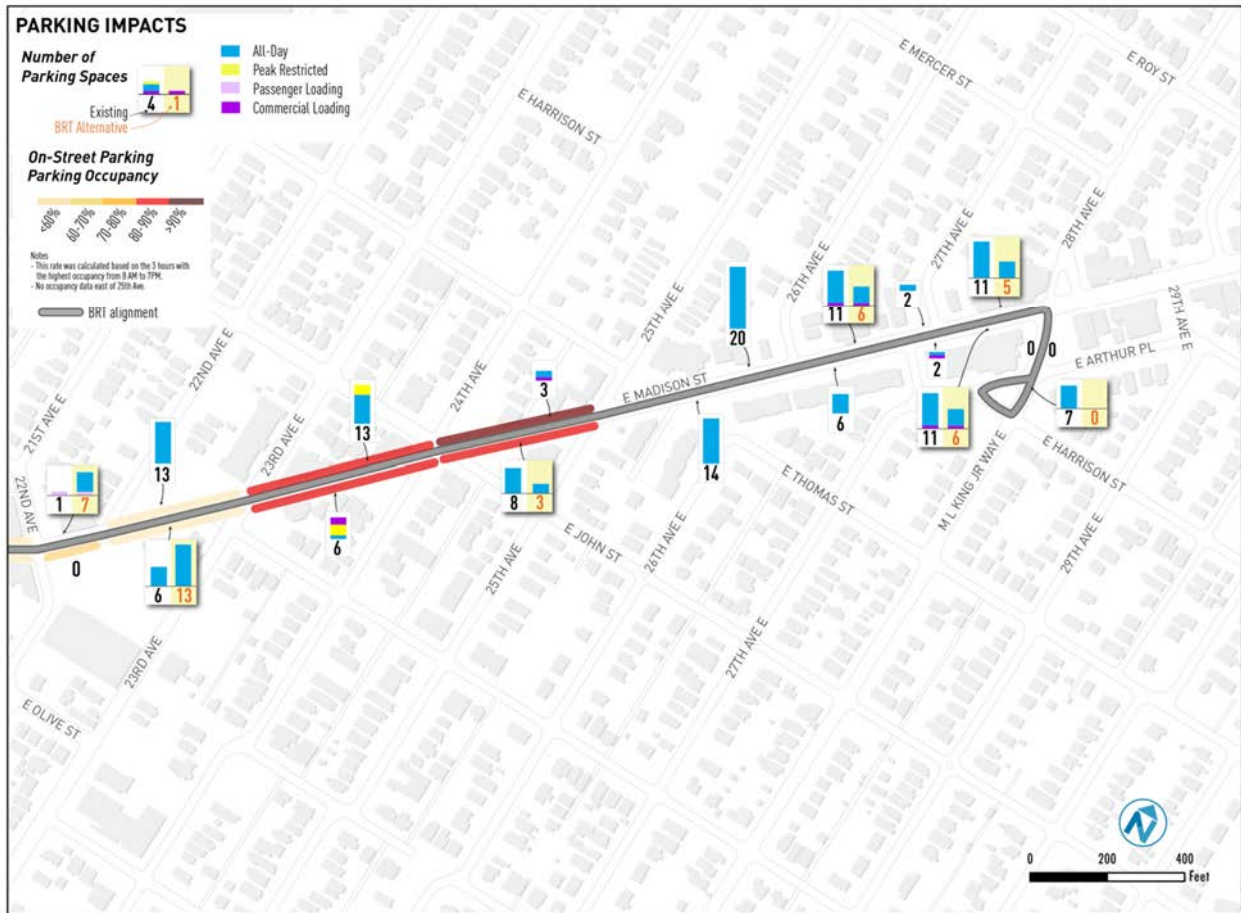
**Figure 4-5 Map of Parking and Loading Impacts, First Hill Segment**



**Figure 4-6 Map of Parking and Loading Impacts, Capitol Hill/Central District Segment**



**Figure 4-7 Map of Parking and Loading Impacts, Madison Valley Segment**



# 5 PARKING MITIGATION

As part of the parking and loading impacts analysis, an evaluation of potential mitigation measures was conducted. Opportunities to add on-street parking supply on blocks adjacent to the Madison BRT alignment west of 23<sup>rd</sup> Avenue, where most of the impacts would occur, were evaluated.

## Approach/Methodology

The analysis assessed the potential feasibility and impacts of two parking mitigation strategies: conversion of two-way streets to one-way operation in order to allow for angled parking; and closure of connecting streets at Madison in order to provide additional space for parking.

The evaluation was based on GIS mapping of street dimensions (with spot checks conducted using Google Earth) and automobile turning movements counts collected through previous traffic modeling efforts. Detailed analysis of impacts to traffic flow, business access, and transit operations was not conducted.<sup>1</sup> Any changes to streets to optimize parking supply would require a more detailed traffic and parking study.

The following sections explain the approach used for each parking mitigation strategy, including basic parking design parameters used to calculate the net new parking supply on each street that could be eligible for mitigation.

## One-way streets

Opportunities to convert two-way streets that intersect with the Madison corridor to one-way operation to allow for angled parking on one side of the street were identified. The assessment focused on streets east of I-5, since downtown Avenues already operate primarily as one-way for vehicular traffic. Exceptions such as 1<sup>st</sup> Avenue and 3<sup>rd</sup> Avenue have features, special designations, and planned transit projects that will preclude operational changes.

All streets intersecting Madison were evaluated for parking mitigation opportunities including at a minimum the street segment one block northwest and one block southwest of Madison. A review of each block was conducted using peak-hour turning counts to identify low-volume candidate streets. A field check of existing right-of-way and parking supply was conducted through Google Maps. Streets with relatively low volumes of cars traveling across Madison or turning on and off of Madison were analyzed in greater detail, including GIS-based measurement of the street length and width to determine whether angled parking would be feasible. The analysis found that very few, if any, streets could accommodate additional parking if converted to one-way operations. In most cases, parking is already available on one or both sides of the street and the additional depth of angled parking would restrict the travel lane to below a

---

<sup>1</sup> Street closure locations or one-way conversion opportunities where transit operate in both directions would require re-routing. Route 2 is an example of this condition. This is a sub optimal condition, but remains in the analysis result in order to demonstrate the potential range of mitigations.

minimum threshold. The analysis assumed a minimum width of 28-29' total for one way streets, based on a 10-11' travel lane and 18' of angled parking.

## Street Closures

The same street blocks that were assessed as candidates for one-way street conversion were evaluated for possible street closure to accommodate additional parking. The street closure evaluation considered the following:

- Additional curb space that could be gained at the end of the intersecting street
- The number of spaces created along Madison Street by developing recessed parking bays (typically up to two spaces available depending on the width of the intersecting street)
- How this mitigation could potentially accommodate additional angled parking near the street end

The minimum street width used was the same as for one-way streets (28-29'), but with the additional need for a turnaround space at the end of the street.



Street closures at intersections can provide the dual benefit of adding limited amounts of new parking stalls, while developing great pedestrian plaza spaces that enable people to enjoy the street environment. This pedestrian plaza in Philadelphia was developed to create a more pedestrian-friendly environment and optimize parking supply.

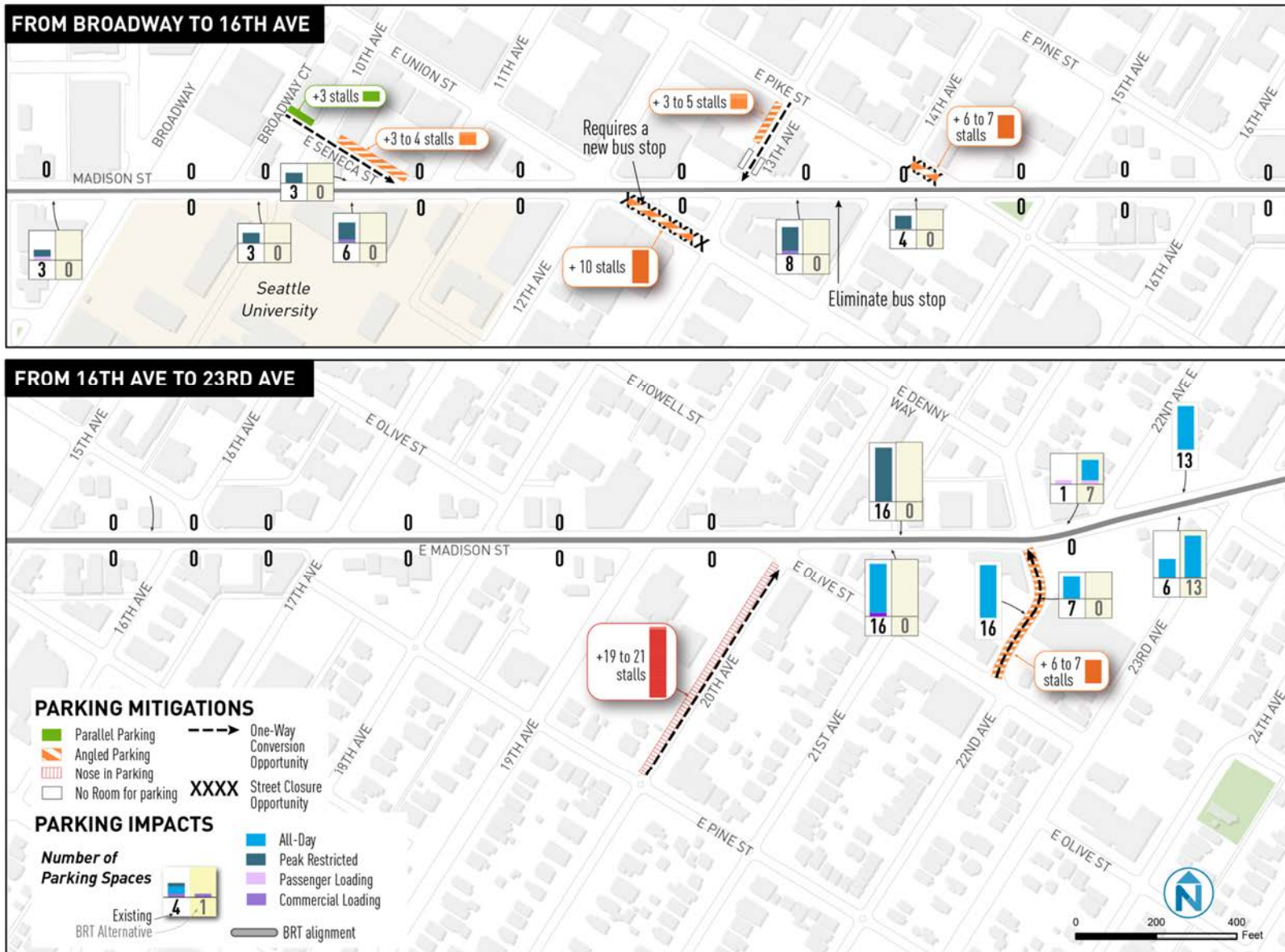
Image from Nelson\Nygaard



## Parking Mitigation Opportunities

Figure 5-1 shows the findings of the parking mitigation evaluation. Opportunities for one-way street conversions or street closures are very limited in the corridor. In locations where both a one-way street conversion and a street closure would be feasible, it should be noted that the analysis assumes only one of these options could be pursued, so the net parking gain is not additive between the two options.

Figure 5-1 Parking Mitigation Opportunities



Using the methodology described previously, a number of blocks were identified for potential conversion to one-way streets. Of these, however, very few were wide enough to allow for conversion to angled parking, even if traffic was reduced to one-way only. Potential locations for one-way conversion locations included the following:

- *20<sup>th</sup> Avenue between Pine and Olive.* This location could accommodate 19-21 additional stalls.
- *Denny Way/22<sup>nd</sup> Avenue between Madison and Olive.* This location could accommodate 6-7 additional stalls south of Madison. This location is adjacent to a large private parking garage.
- *Seneca between Broadway and Madison.* This location could accommodate 6-7 additional stalls.
- *13<sup>th</sup> Avenue between Pike and Madison.* This location could accommodate 3-5 stalls.
- *Pike between 14<sup>th</sup> Avenue and Madison.* This location could accommodate 6-7 additional stalls by converting parallel parking to angled parking. No conversion to one-way operations would be necessary.

Opportunities for street closures were also extremely limited. As shown in Figure 5-1, only one location would provide a net gain – and it is a location at which other changes are planned as part of the LPA.

- Union between Madison and 13<sup>th</sup> Avenue. This location could accommodate 10 additional stalls. However, the block is planned to be reconfigured as part of the BRT LPA. Additionally, Route 2 operates on this block.

Figure 5-2 includes the full set of locations that were considered in the detailed feasibility analysis.

**Figure 5-2 Parking Mitigation Evaluation Detail**

Street Segment	Possible configuration	Comments	Net Parking Supply Added
Terry Ave b/w Marion St and Madison St	One-way (direction TBD)	Not feasible	None
Terry Ave b/w Madison and Spring	One-way (direction TBD)	Not feasible	None
Minor Ave b/w Madison and Spring	One-way NB	Not feasible	None
Summit Ave b/w Madison and Spring	One-way SB	Not feasible	None
Boylston Ave b/w Madison and Spring	One-way NB	Not feasible	None
Boylston Ave b/w Marion St and Madison St	One-way NB	Not feasible	None
E Seneca St b/w Madison and Broadway Ct	One-way WB	Angled spots could be added on the north side of street	6-7

Street Segment	Possible configuration	Comments	Net Parking Supply Added
10 <sup>th</sup> Ave b/w E Seneca St and Madison St	One-way SB	Not feasible	None
E Union St b/w Madison and 13 <sup>th</sup> Ave	Street closure	Would require reroute of Route 2	10
13 <sup>th</sup> Ave b/w Madison and E Pine St	One-way SB	Angled parking for 6-7 spaces	3-5
E Pike St b/w Madison and 14 <sup>th</sup> Ave	No change	Convert parallel parking to angled	6-7
E Pike St b/w Madison and 16 <sup>th</sup> Ave	One-way EB	Not feasible	None
16 <sup>th</sup> Ave b/w Madison and E Pike St	One-way SB	Not feasible	None
17 <sup>th</sup> Ave b/w Madison and E Pike St	One-way NB	Not feasible	None
E Pine St b/w 17 <sup>th</sup> Ave and 18 <sup>th</sup> Ave	One-way (direction TBD)	Not feasible	None
18 <sup>th</sup> Ave b/w Madison and E Pine St	One-way SB	Not feasible	None
20 <sup>th</sup> Ave b/w E Olive St and E Pine St	One-way NB	Keep existing angled parking and close north driveway	19-21 spaces, additional curb cut reduction could produce more
20 <sup>th</sup> Ave b/w Madison and E Denny Way	One-way NB	Not feasible	None
E Denny Way/E 22 <sup>nd</sup> Ave b/w 21 <sup>st</sup> Ave E and E Olive St	One-way SB	Angled parking on west side of street	6-7

## Key Finding and Considerations

Based on the analysis above, an estimated 50-57 additional on-street parking spaces could be provided in the corridor using the proposed mitigation strategies. Further study would be needed to determine the precise impact of these mitigations. Other key considerations should also be taken into account:

- **Curb management.** SDOT should study the need for passenger and commercial loading stalls in the blocks that can accommodate the parking mitigation strategies.
- **Pedestrian Benefits of Mitigation Measures.** While the proposed mitigation measures are designed to reduce the impact of parking supply reduction as a result of the Madison BRT project, other benefits may be realized, including enhanced walkability and placemaking. Narrow one-way side streets with greater buffering between pedestrians and motorists will serve as calmed environments. Likewise, street closures offer unique opportunities to connect BRT with new public spaces such as pocket parks and small plazas.

- **Potential traffic impacts.** Adding parking on a street can reduce vehicle lane capacity by 3-30 percent on the adjacent travel lane. Further study is needed to assess the potential level of impact on each affected street.

**Appendix L: Madison Corridor BRT Complete Streets  
Assessment**

## **COMPLETE STREETS ASSESSMENT**

### **INTENT**

This assessment was developed to ensure that SDOT projects comply with the City's Complete Streets Ordinance requiring SDOT to plan for, design and construct all new City transportation improvement projects to provide appropriate accommodation for pedestrian, bicyclists, transit riders, freight, and persons of all abilities, while promoting safe operation for all users (*see page 18 for full ordinance*).

The assessment will help to ensure that projects are consistent with relevant City plans (including SDOT modal plans), help to recognize and make recommendations regarding potentially conflicting right-of-way priorities, explore opportunities for streetscape and place-making enhancements, and ensure that projects are consistent with urban design and multi-modal best practices.

### **COMPLETE STREETS REVIEW PROCESS**

For projects going through the Project Definition process, a Complete Streets checklist is required as part of the Project Definition stage of the design process in order to provide recommendations on Complete Streets elements to be incorporated into the project's scope. The Project Definition Steering Committee will make all final decisions regarding project scope, based on these preliminary Complete Streets recommendations.

In addition to these preliminary scope recommendations, ongoing urban design review is required at all major design milestones (30%, 60%, and 90%) to review ongoing design details and urban design opportunities. To the greatest extent possible, all major scope recommendations will be made during the Project Definition phase.

**ASSESSMENT**

**Project Name:** Madison Street Corridor Bus Rapid Transit

**Project Manager/Project Owner:** Maria Koengeter

**Description of Scope:**

Implementation of Bus Rapid Transit service in Madison corridor (1st Avenue to Martin Luther King, Jr. Way).

**Complete Streets  
Comments/Recommendations**

**1. Traffic Data**

a. **Average Daily Traffic:** 14,700-27,400 (existing)

*\* If ADT is less than 25K AND lane configuration includes 4 or more through lanes, contact traffic management for review for potential rechannelization.*

b. **Pedestrian Counts:** up to 2,100/day (@ 12th Ave)

c. **Bicycle Counts:** up to 310/day (@ 12th Ave)

d. **Truck Volumes:** u/k

**2. Classifications/Street Type**

e. **Traffic Classification:** What is the Traffic Classification? (click here to see map)

- Principal Arterial
- Minor Arterial
- Collector Arterial
- Non-Arterial

f. **Transit Classification:** What is the Transit Classification? (click here to see map)

- Transit Way
- Principal
- Major
- Minor
- Local



**Complete Streets**  
**Comments/Recommendations**

g. **Other Street Classifications:** Is this project located on a route with one of the following classifications? (click on classifications to see maps)

- Major Truck Street
- Boulevard
- SFD Non-Arterial Route

h. **Street Type:** What is the Street Type(s)? (click here to see map) Check all that apply

- Regional Connector
- Commercial Connector
- Local Connector
- Neighborhood Green Street
- Main Street
- Mixed Use Street
- Industrial Access Street
- Green Street

i. **Priority Elements Matrix:** Based on the above, review the design elements recommended for each street type within the priority elements matrix (see page 21).

Describe the priority elements included/not included in this project below:

Street trees and landscaping -- recommended as part of Street Design Concept Plan  
 Weather protection -- recommended as part of Street Design Concept Plan  
 Pedestrian scaled lighting -- recommended as part of Street Design Concept Plan  
 Street furniture -- recommended as part of Street Design Concept Plan  
 Short-term, on-street parking -- limited removal  
 Curb bulbs -- some added at bus stops; some removed due to constrained ROW

### 3. Planning / Project Context

a. **Completed SDOT Plans/Studies:** Was an SDOT plan or study completed within the project area?  Yes  No

If "yes," are there recommendations that fall within the project area?  Yes  No

Complete Streets  
Comments/Recommendations

Describe relevant plan(s) and recommendations:

Transit Master Plan was predecessor to current Madison Street  
Corridor Bus Rapid Transit Study

Are recommended Plan elements included  Yes  No  
within the project scope? If no, please  
describe reason for deferral below:

[Redacted area for describing reason for deferral]

b. **Pending SDOT Plans/Studies:** Are there  Yes  No  
pending SDOT plans/studies/projects that  
fall within the project area? If "Yes,"  
coordinate with the project manager to  
ensure consistency.

Describe relevant plan recommendations below:

Future phases of Madison BRT project development

Are recommended Plan elements included  Yes  No  
within the project scope? If no, please  
describe reason for deferral below:

[Redacted area for describing reason for deferral]

Complete Streets  
Comments/Recommendations

- c. **Streetscape Concept Plans:** Is there a Streetscape Concept Plan for the project area? (Click here to view Right-of-Way Improvements Manual, chapter 6)  Yes  No

Describe relevant plan recommendations below:

Establish activity nodes  
At other locations, apply design standards related to: planting strips and street trees; buffer seatwalls; pedestrian lighting; seating; bike racks; tree beds.  
Plan includes interim and ideal sections based on available sidewalk widths.

Are recommended Plan elements included within the project scope? If no, please describe reason for deferral below:  Yes  No

[Empty text box for describing reasons for deferral]

- d. **Other Plans:** Have other significant plan(s) been completed within the project area (e.g., Neighborhood Plans, Station Area Plans, Urban Design Frameworks, other DPD plans/projects, etc.)  Yes  No

Describe relevant plan recommendations

Transit Master Plan  
Bicycle Master Plan  
Pedestrian Master Plan

Are recommended Plan elements included within the project scope? If no, please describe reason for deferral below:  Yes  No

To extent possible -- project includes parallel bikeway, pedestrian and bicycle improvements at key intersections of 12th/Union, 24th

## 4. Project Coordination

SDOT's Right-of-Way Management map (<http://sdotapp2/rowm/>) allows the user to explore various conditions, types, categories, and statuses of permits for right-of-way management. Furthermore, the ROWM map allows the user to utilize the Planning Analysis Coordination Tool (PACT) to track projects in the rights-of-way within the City of Seattle.

- a. **Right-of-Way Management Map.** Are there any opportunities to coordinate with relevant City projects/initiatives or with active private development within the project area?  Yes  No

If "Yes," describe below:

MAP UNAVAILABLE USING ABOVE LINK

## 5. ROW Elements

### a. Pedestrian Infrastructure

- i. **Pedestrian Master Plan (click here to view plan).**

(Refer to Seattle Tools Layer Explorer in ArcGIS: "Ped Master Plan - Along the Roadway Score" & "Ped Master Plan - Crossing the Roadway")

What is the ATR Score(s)?

30-42

What is the CTR Score(s)?

30-42

Are there specific Pedestrian Master Plan Recommendations within the Project Area? If "Yes," describe Plan recommendations below:  Yes  No

Tier I CTR locations: Madison/2nd, Madison/4th, Spring/5th, Madison/Boren, Madison/Broadway Ct, Madison/12th. Segment west of 15th within Tier 1 High Priority Area.

**Complete Streets  
Comments/Recommendations**

Are recommended Plan elements included within the project scope? If no, please describe reason for deferral below:

Yes  No

Major improvements at 12th/Union intersection

ii. **Sidewalk Maintenance.** Are existing sidewalks within the project area in good condition and up to standard?

Yes  No

If “No,” will they be repaired/improved as part of this project?

Yes  No

**Trees and Sidewalks.** Has an initial assessment of trees and sidewalk conditions been conducted, with an engineer and arborist/landscape architect per the SDOT Trees and Sidewalks Operations Plan?

Yes  No

Please note impacts to project scope based on this initial assessment:

Sidewalk and landscaping improvements recommended as part of Street Design Concept Plan. (Note that only limited improvements to public realm would be made as part of BRT project; other improvements would be made by property owners over time.)

iii. **Pedestrian-Scale Lighting.** Is the project within a Tier 1 or Tier 2 priority area for pedestrian lighting, as defined within the Pedestrian Master Plan?

Yes  No

Complete Streets  
Comments/Recommendations

If "Yes," are pedestrian lighting improvements included within project scope? Describe reason for deferral if not:  Yes  No

Lighting improvements recommended as part of Street Design Concept Plan. (Note that only limited improvements to public realm would be made as part of BRT project; other improvements would be made by property owners over time.)

**b. Bicycle Master Plan (click here to view plan)**

Are there Bicycle Master Plan recommendations within the project area?  Yes  No  
If "Yes," describe recommendations below.

PBLs recommended on Spring, Union

Are recommended Plan elements included within the project scope? If no, please describe reason for deferral below:  Yes  No

Parallel bikeway included in project. Includes Union, Spring segments.

**c. Transit Facilities**

**i. Transit Master Plan (click here to view plan).**  Yes  No

Are there Seattle Transit Master Plan recommendations for bus stop or transit improvements within the project area?

Are recommended elements included within the project scope? If no, please describe reason for deferral below:

Madison corridor recommended for Bus Rapid Transit service as part of Transit Master Plan.

Complete Streets  
Comments/Recommendations

ii. **Bus Stops.** Are there bus stops within the project area?  Yes  No

What is the average distance between bus stops in/adjacent to the project area?

653' EB, 741' WB

If bus stops are less than 0.2 miles apart (1,056 ft.), can stops be consolidated?  Yes  No

Describe below:

Stops to be consolidated/relocated as part of BRT project.

**d. Freight Mobility Action Plan**

*Note: Freight is important to the basic economy of the city and has unique right-of-way needs to support that role. Complete Street improvements that are consistent with freight mobility and support other modes should be considered.*

Is this a Major Truck Street?  Yes  No

Describe any elements included in this project pursuant to freight needs in the project area:

On-street loading spaces maintained to extent possible given other project imperatives.

Complete Streets  
Comments/Recommendations

Describe any elements NOT included in this project and reason for deferral:

**e. Intelligent Transportation Systems (ITS) Strategic Plan (click here to view plan)**

Are there ITS Strategic Plan recommendations within the project area?  Yes  No

Are recommended Plan elements included within the project scope? If "Yes," please describe; if "No," please describe reason for deferral below:

ITS elements not addressed as part of project LPA.

**f. Urban Forestry**

Are there opportunities to add canopy coverage and/or better protect the health of existing trees with this project?  Yes  No

Describe any Urban Forestry elements currently included within the project:

Landscaping improvements recommended as part of Street Design Concept Plan. (Note that only limited improvements to public realm would be made as part of BRT project; other improvements would be made by property owners over time.)

Describe any elements NOT included in this project and reason for deferral:



Complete Streets  
Comments/Recommendations

**g. Green Stormwater Infrastructure (GSI)**

Does the project trigger the requirement for GSI in the 2016 stormwater code?  Yes  No

If "No," explain why not:

Refer to upcoming drainage memorandum

If "Yes," describe any GSI elements or techniques included in this project, including any permeable pavement options:

Is this project in an area identified as potentially suitable for infiltrating GSI approaches (per SPU GIS data), including permeable pavement options?  Yes  No

Is there an opportunity to provide a minimum of 500 sf of GSI within the ROW?  Yes  No

Is there an opportunity to remove impervious surface as part of this project in accordance with the 2013 Executive Order which urges all City departments to incorporate natural drainage features into capital projects?  Yes  No

Is this project on a street identified as potentially eligible for SPU partnership opportunities (per SPU GIS data)?  Yes  No

Are there existing GSI facilities within or near the project area that must be protected from compaction and sedimentation?  Yes  No

Complete Streets  
Comments/Recommendations

Describe any GSI recommendations NOT included in this project and reason for deferral:

**h. Pavement Condition**

Is existing street pavement within the project area in good condition?  Yes  No

If "No," will it be repaired as part of this project? Describe reason for deferral below:  Yes  No

Madison and segment of Spring Street to be repaved as part of BRT project.

**i. Parking Restrictions at Crosswalks and Intersections**

*Note: curb side parking shall be restricted 20' from the back of any crosswalk (marked or implied), and 30' from the back of any intersection.*

Does the project area include curb side parking?  Yes  No

If "Yes," describe how the restriction will be addressed (curb bulbs/signs):

LPA does not preclude described restrictions.

Complete Streets  
Comments/Recommendations

**j. SDOT Art Plan (click here to view page)**

Is there an opportunity to utilize 1% for the Arts funding to implement Art Plan Toolbox elements (e.g. signal box art, special inlays or materials) with this project?

Yes  No

Describe any art elements currently included within the project scope:

None currently planned.

Based on the initial project information provided, the above noted Complete Streets elements are recommended to be incorporated into the project scope. The Project Definition Steering Committee will make all final decisions regarding project scope, based on these preliminary Complete Streets recommendations.

In addition to these broad preliminary scope recommendations, ongoing urban design review is required for 30%, 60%, and 90% design drawings to review consistency with these preliminary recommendations, as well as ongoing design details and urban design opportunities. To the greatest extent possible, all major scope recommendations will be made during the Project Definition phase.

Complete Streets  
Coordinator:

\_\_\_\_\_

*name (please print)*

\_\_\_\_\_

*date*

\_\_\_\_\_

*signature*

Project Manager

\_\_\_\_\_

*name (please print)*

\_\_\_\_\_

*date*

\_\_\_\_\_

*signature*

**Exceptions**

In the following unusual or extraordinary circumstances, Complete Streets principles will not apply (*Note: the Complete Streets Ordinance requires the SDOT Director to issue a documented exception concluding that the application of Complete Streets principles is unnecessary or inappropriate because it would be contrary to public safety; or where other available means or factors indicate an absence of need, including future need*):

- Does the project wholly consist of simple repairs made pursuant to the Pavement Opening and Restoration Rule (SDOT Director’s Rule 2004-02)?
- Does the project wholly consist of standard maintenance activities designed to keep assets in serviceable condition (e.g. mowing, sweeping, spot repair, and surface treatments such as chip seal)?
- Is there a plan to implement Complete Streets principles incrementally through a series of smaller improvements or maintenance activities over time?
- Does the Project Team recommend an exception to Complete Streets for this project?

Additional Comments:

Project Manager: \_\_\_\_\_  
*name (please print)* *date*

\_\_\_\_\_  
*signature*

Complete Streets  
Coordinator: \_\_\_\_\_  
*name (please print)* *date*

\_\_\_\_\_  
*signature*

Project Engineer: \_\_\_\_\_  
*name (please print)* *date*

\_\_\_\_\_  
*signature*

Owning Division  
Director: \_\_\_\_\_  
*name (please print)* *date*

\_\_\_\_\_  
*signature*

Implementing  
Division  
Director: \_\_\_\_\_  
*name (please print)* *date*

\_\_\_\_\_  
*signature*

**Ordinance Number 122386**

AN ORDINANCE relating to Seattle's Complete Streets policy, stating guiding principles and practices so that transportation improvements are planned, designed and constructed to encourage walking, bicycling and transit use while promoting safe operations for all users.

Date introduced/referred: April 9, 2007

Date passed: April 30, 2007

Vote: 9-0

Date of Mayor's signature: May 7, 2007

Sponsor: DRAGO, STEINBRUECK

Index Terms: TRANSPORTATION, TRANSPORTATION-PLANNING, PEDESTRIANS, PUBLIC- TRANSIT, BICYCLING, BIKEWAYS, BICYCLES, LAND TRANSPORTATION

AN ORDINANCE relating to Seattle's Complete Streets policy, stating guiding principles and practices so that transportation improvements are planned, designed and constructed to encourage walking, bicycling and transit use while promoting safe operations for all users.

WHEREAS, the City Council, with the Mayor concurring, adopted Resolution 30915 that defines the Complete Streets policy; and

WHEREAS, City policy as stated in the Transportation Strategic Plan and the Seattle Comprehensive Plan is to encourage walking, bicycling, and transit use as safe, convenient and widely available modes of transportation for all people; and

WHEREAS, Seattle's Complete Streets guiding principle is to design, operate and maintain Seattle's streets to promote safe and convenient access and travel for all users --- pedestrians, bicyclists, transit riders, and people of all abilities, as well as freight and motor vehicle drivers; and

WHEREAS, other jurisdictions and agencies nationwide have adopted Complete Streets legislation including the U.S. Department of Transportation, numerous state transportation agencies, San Francisco, Sacramento, San Diego, Boulder, Chicago and Portland; and WHEREAS, the Seattle Department of Transportation (SDOT) will implement Complete Streets policy by designing, operating and maintaining the transportation network to improve travel conditions for bicyclists, pedestrians, transit and freight in a manner consistent with, and supportive of, the surrounding community; and

WHEREAS, transportation improvements will include an array of facilities and amenities that are recognized as contributing to Complete Streets, including: street and sidewalk lighting; pedestrian and bicycle safety improvements; access improvements for freight; access improvements, including compliance with the Americans with Disabilities Act; public transit facilities accommodation including, but not limited, to pedestrian access improvement to transit stops and stations; street trees and landscaping; drainage; and street amenities; and

WHEREAS, SDOT will implement policies and procedures with the construction, reconstruction or other changes of transportation facilities on arterial streets to support the creation of Complete Streets including capital improvements, re-channelization projects and major maintenance, recognizing that all streets are different and in each case user needs must be balanced;

NOW, THEREFORE,  
BE IT ORDAINED BY THE CITY OF SEATTLE AS FOLLOWS

Section 1. SDOT will plan for, design and construct all new City transportation improvement projects to provide appropriate accommodation for pedestrians, bicyclists, transit riders, and persons of all abilities, while promoting safe operation for all users, as provided for below.

Section 2. SDOT will incorporate Complete Streets principles into: the Department's Transportation Strategic Plan; Seattle Transit Plan; Pedestrian and Bicycle Master Plans; Intelligent Transportation System Strategic Plan; and other SDOT plans, manuals, rules, regulations and programs as appropriate.

Section 3. Because freight is important to the basic economy of the City and has unique right- of-way needs to support that role, freight will be the major priority on streets classified as Major Truck Streets. Complete Street improvements that are consistent with freight mobility but also support other modes may be considered on these streets.

Section 4. Except in unusual or extraordinary circumstances, Complete Streets principles will not apply:

- to repairs made pursuant to the Pavement Opening and Restoration Rule (SDOT Director's Rule 2004-02);
- to ordinary maintenance activities designed to keep assets in serviceable condition (e.g., mowing, cleaning, sweeping, spot repair and surface treatments such as chip seal, or interim measures on detour or haul routes);
- where the Director of Transportation issues a documented exception concluding that application of Complete
- Street principles is unnecessary or inappropriate because it would be contrary to public safety; or
- where other available means or factors indicate an absence of need, including future need.

Section 5. Complete Streets may be achieved through single projects or incrementally through a series of smaller improvements or maintenance activities over time. It is the Mayor's and Council's intent that all sources of transportation funding be drawn upon to implement Complete Streets. The City believes that maximum financial flexibility is important to implement Complete Streets principles.

Section 6. This ordinance shall take effect and be in force thirty (30) days from and after its approval by the Mayor, but if not approved and returned by the Mayor within ten (10) days after presentation, it shall take effect as provided by Municipal Code Section 1.04.020.

Passed by the City Council the \_\_\_ day of , 2007, and signed by me in open session in authentication of its passage this \_\_\_ day of , 2007.

President \_\_\_\_\_ of the City Council

Approved by me this \_\_\_ day of , 2007.

Gregory J. Nickels, Mayor

Filed by me this \_\_\_ day of , 2007.

City Clerk

April 24, 2007



<b>Priority Elements Matrix</b>  Preferred <span style="color: green;">■</span> Consider <span style="color: orange;">■</span> Preferred in Center City <span style="color: cyan;">■</span>	Street Types	Regional Connector	Main Street	Green Street	Commercial Connector	Mixed Use Street	Neighborhood Green Street	Local Connector	Industrial Access
	<b>Primary Design Features</b>								
Sidewalks buffered from moving traffic by additional sidewalk width or planting strip		■							
Street trees and landscaping			■	■	■	■	■	■	
Low landscaping or high branching trees in planting strip		■							■
Weather protection integrated with buildings for street level uses and at transit zones		■	■			■			
Pedestrian scaled lighting		■	■	■		■	■		
Emphasis on coordinated street furniture		■	■	■		■			
Short-term, on-street parking			■			■			
Curb bulbs where there is on-street parking			■	■		■	■		
Emphasis on small curb radii and curb bulbs where on-street parking exists				■			■		
Load zones to support delivery activities			■						■
Striped bicycle lanes or sharrows, and signage on designated bicycle routes		■	■		■	■		■	
Bicycle access accommodated if parallel route is not feasible		■							
Bicycle route appropriate to share with motor vehicles				■			■		
Emphasis on bicycle parking in business districts		■	■	■		■			
Truck route signage									■
Traffic calming				■			■	■	
Bus shelters at transit stops					■			■	
Minimize curb cuts and driveways to create continuous sidewalk			■	■			■		
Natural Drainage encouraged				■	■		■	■	

The Seattle Department of Transportation  
700 5<sup>th</sup> Avenue, Suite 3800  
PO Box 34996  
Seattle, WA 98124-4996  
(206) 684-ROAD (7623)  
[www.seattle.gov/transportation](http://www.seattle.gov/transportation)



01.20.2015

# **Appendix B**

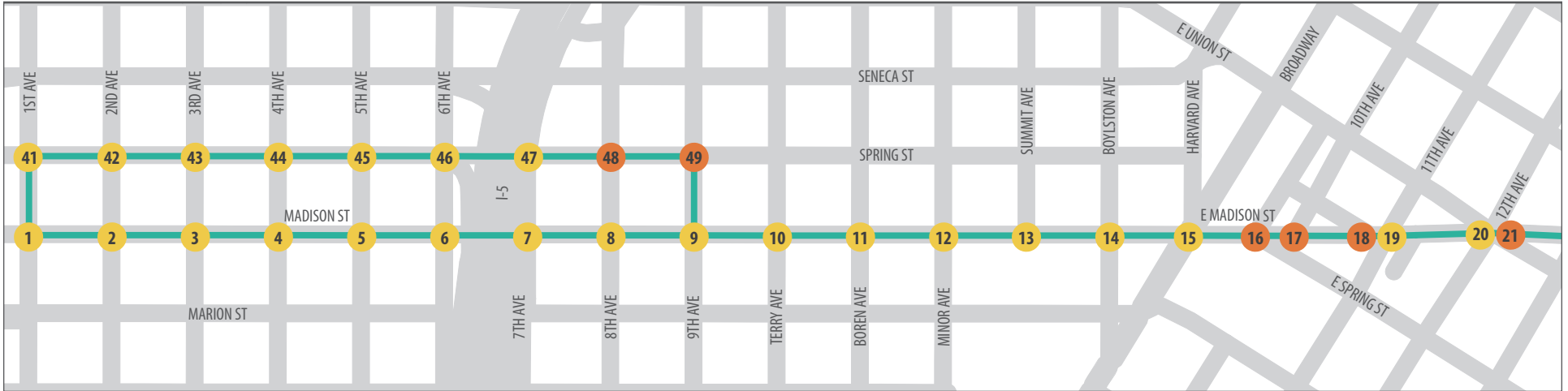
## **Synchro and Vissim Modeling Results**



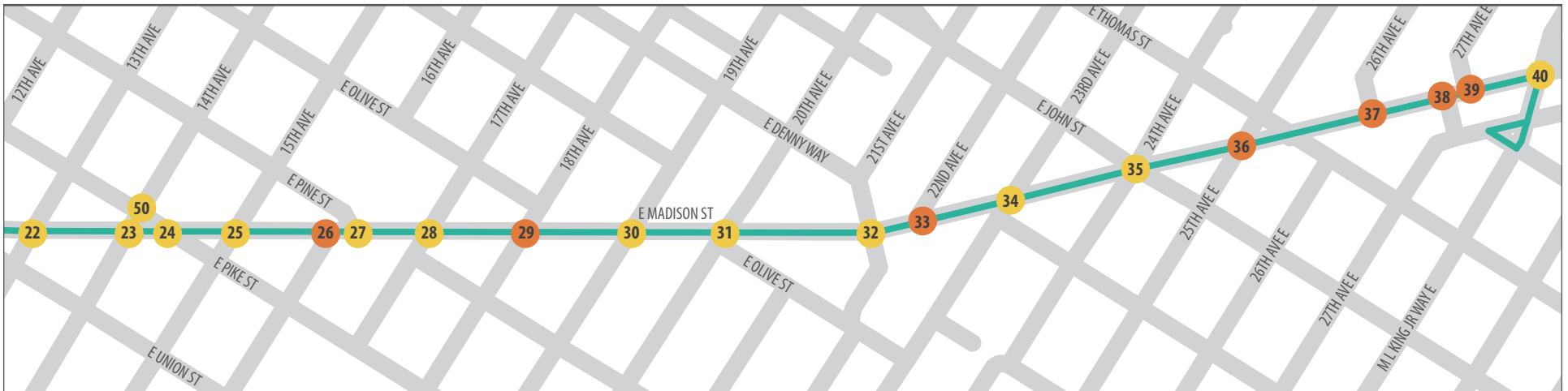
## INTERSECTION VOLUMES

---

1st Ave to 12th Ave/Union St



13th Ave to Martin Luther King Jr Way



Legend

Study Intersections

- # Signalized
- # Unsignalized

— Madison BRT Proposed Route

0 0.075 0.15 MILES



#	Study Intersection	Existing (2015) – PM Peak Hour												Forecasted No-Build (2019) – PM Peak Hour											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
1	1st/Madison	24	512	-	-	510	130	-	-	-	70	226	146	24	512	-	-	510	130	-	-	-	70	226	146
2	2nd/Madison	-	-	-	-	1220	60	-	-	-	180	343	-	-	-	-	-	1220	60	-	-	-	180	343	-
3	3rd/Madison	-	134	-	-	135	56	-	-	-	-	470	60	-	134	-	-	135	56	-	-	-	470	60	-
4	4th/Madison	116	1081	-	-	-	-	-	-	-	-	-	615	116	1081	-	-	-	-	-	-	-	-	-	615
5	5th/Madison	-	-	-	-	870	100	-	-	-	296	487	-	-	-	-	-	870	100	-	-	-	296	487	-
6	6th/Madison	26	150	173	-	-	-	-	-	-	-	746	809	26	150	173	-	-	-	-	-	-	-	746	809
7	7th/Madison	488	276	423	7	-	348	2	174	-	-	742	3	488	276	423	7	-	348	2	174	-	-	742	3
8	8th/Madison	23	105	46	19	43	70	47	506	18	47	693	16	23	105	46	19	43	70	47	506	18	47	693	16
9	9th/Madison	23	98	40	41	83	50	15	533	11	63	669	29	23	98	40	41	83	50	15	533	11	63	669	29
10	Terry/Madison	16	20	27	13	14	18	20	590	11	21	680	19	16	20	27	13	14	18	20	590	11	21	680	19
11	Boren/Madison	83	518	32	187	672	82	64	521	22	54	568	67	83	518	32	187	672	82	64	521	22	54	568	67
12	Minor/Madison	48	76	59	17	32	39	26	701	26	18	621	14	48	76	59	17	32	39	26	701	26	18	621	14
13	Summit/Madison	34	12	19	14	1	34	22	740	15	4	587	10	34	12	19	14	1	34	22	740	15	4	587	10
14	Boylston/Madison	39	57	39	18	10	24	20	720	25	7	556	16	39	57	39	18	10	24	20	720	25	7	556	16
15	Broadway/Madison	-	312	129	-	265	92	107	661	23	66	475	29	-	312	129	-	265	92	107	661	23	66	475	29
16	Broadway Ct/Madison	-	-	-	8	-	12	14	776	-	-	570	5	-	-	-	8	-	12	14	792	-	-	581	5
17	10th/Madison	-	-	-	-	-	10	10	774	-	-	570	-	-	-	-	-	-	10	10	790	-	-	581	-
18	Seneca St/Madison	-	-	-	-	-	-	-	779	-	-	570	14	-	-	-	-	-	-	-	5	790	581	14	-
19	11th/Madison	-	-	-	206	-	12	-	774	-	-	572	-	-	-	-	210	-	12	-	790	-	-	584	-
20	12th/Madison	106	397	69	54	377	83	30	839	108	37	464	156	109	405	70	55	385	84	31	856	110	38	473	159
21	Union/Madison	-	-	-	-	-	-	-	737	225	-	650	2	-	-	-	-	-	-	-	752	230	-	663	2
22	13th/Madison	122	42	9	9	-	23	25	707	-	-	447	4	124	43	9	9	-	23	26	721	-	-	456	4
23	14th/Madison	14	215	53	2	169	12	-	672	51	58	459	-	14	219	54	2	172	12	-	686	52	59	468	-
24*	Pike/Madison	-	-	-	25	4	-	-	708	19	1	537	36	-	-	-	26	4	-	-	722	19	1	548	37
25	15th/Madison	-	-	-	-	-	125	63	670	-	-	479	13	-	-	-	-	-	128	64	684	-	-	489	13
26	16th/Madison	5	-	15	-	-	-	-	670	5	-	493	-	5	-	15	-	-	-	-	684	5	-	503	-
27	Pine/Madison	-	-	-	-	-	-	16	669	-	-	488	197	-	-	-	-	-	-	16	682	-	-	498	201
28	17th/Madison	47	32	11	57	51	56	76	800	41	16	577	50	48	33	11	58	52	57	78	816	42	16	589	51
29	18th/Madison	9	2	5	4	2	19	14	882	40	2	615	3	9	2	5	4	2	19	14	900	41	2	627	3
30	19th/Madison	23	137	19	23	113	54	108	751	32	3	543	21	23	140	19	23	115	55	110	766	33	3	554	21
31*	20th/Madison	-	-	22	3	2	14	9	707	131	4	585	13	-	-	22	3	2	14	9	721	133	4	597	13
32	Denny/22nd NB/Madison	42	-	26	-	-	-	3	702	37	18	483	19	42	-	27	-	-	-	3	716	38	18	493	19
33	22nd SB/Madison	-	-	-	-	-	12	24	714	-	-	489	10	-	-	-	-	-	12	24	728	-	-	499	10

#	Study Intersection	Existing (2015) – PM Peak Hour												Forecasted No-Build (2019) – PM Peak Hour											
		Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
34	23rd/Madison	-	575	33	-	624	114	190	529	33	59	350	11	-	587	34	-	637	116	194	540	34	60	357	11
35*	John/Madison	0	127	6	137	140	10	22	447	6	3	345	206	0	130	6	140	143	10	22	456	6	3	352	210
36	25th/Madison	5	21	14	15	26	10	25	511	10	10	490	13	5	21	14	15	27	10	26	521	10	10	500	13
37	26th/Madison	-	-	-	-	-	-	20	503	-	-	507	3	-	-	-	-	-	-	20	513	-	-	517	3
38	27th NB/Madison	7	-	24	-	-	-	-	451	43	8	492	-	7	-	24	-	-	-	-	460	44	8	502	-
39	27th SB/Madison	-	-	-	-	-	-	16	459	-	-	479	10	-	-	-	-	-	-	16	468	-	-	489	10
40	28th/MLK/Madison	132	98	183	56	210	11	8	394	54	121	353	21	135	100	187	57	214	11	8	402	55	123	360	21
41	1st/Spring	-	576	77	81	590	-	56	214	44	-	-	-	-	576	77	81	590	-	56	214	44	-	-	-
42	2nd/Spring	-	-	-	210	1200	-	-	350	80	-	-	-	-	-	-	210	1200	-	-	350	80	-	-	-
43	3rd/Spring	-	111	65	15	148	-	5	600	28	-	-	-	-	111	65	15	148	-	5	600	28	-	-	-
44	4th/Spring	-	1216	92	-	-	-	200	530	-	-	-	-	-	1216	92	-	-	-	200	530	-	-	-	-
45	5th/Spring	-	-	-	527	919	-	-	605	55	-	-	-	-	-	-	527	919	-	-	605	55	-	-	-
46	6th/Spring	-	335	620	-	-	-	192	189	750	-	-	-	-	335	620	-	-	-	192	189	750	-	-	-
47	7th/Spring	-	256	23	6	328	-	42	137	19	-	-	-	-	256	23	6	328	-	42	137	19	-	-	-
48	8th/Spring	-	143	19	37	178	-	67	113	18	-	-	-	-	143	19	37	178	-	67	113	18	-	-	-
49	9th/Spring	-	145	9	8	126	-	47	70	62	10	-	30	-	145	9	8	126	-	47	70	62	10	-	30
50	14th/Pike	140	69	0	4	98	10	5	25	85	0	31	5	143	70	0	4	100	10	5	26	87	0	32	5

**Note:**

Madison and Spring Streets operate generally in the east-west direction. Pike/Madison, 20<sup>th</sup>/Madison, and John/Madison have unique intersection geometries in which the minor movements are reported in the north-south direction.

“-“ indicates movement prohibited; “-“ indicates movement allowed, but zero counts.

All of the named downtown streets running in the northeast-southwest direction are assumed to be aligned in the east-west direction, while numbered avenues running in the northwest-southeast direction are assumed to be aligned in the north-south direction, which is the usual terminology applied in Seattle.



#	Study Intersection	Build (2019) – PM Peak Hour											
		Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
1	1st/Madison	42	307	-	-	241	107	-	-	-	80	302	104
2	2nd/Madison	-	-	-	-	1456	105	-	-	-	186	341	-
3	3rd/Madison	-	20	-	-	-	77	-	-	-	-	405	10
4	4th/Madison	133	961	-	-	-	-	-	-	-	-	-	685
5	5th/Madison	-	-	-	-	501	127	-	-	-	246	531	-
6	6th/Madison	39	146	190	-	-	-	-	-	-	-	714	707
7	7th/Madison	553	419	199	12	-	215	-	190	-	-	653	1
8	8th/Madison	7	203	32	10	146	42	-	392	9	-	605	15
9	9th/Madison	7	57	5	44	415	5	-	411	23	-	608	8
10	Terry/Madison	-	-	21	-	-	139	-	450	10	-	477	11
11	Boren/Madison	17	755	2	42	830	35	11	456	4	30	436	10
12	Minor/Madison	6	145	1	1	234	50	-	481	19	-	420	5
13	Summit/Madison	12	23	51	7	28	69	-	466	17	-	344	41
14	Boylston/Madison	6	158	11	74	35	31	-	520	4	-	348	5
15	Broadway/Madison	-	182	120	-	229	113	147	432	26	47	240	5
16	Broadway Ct/Madison	-	-	-	-	-	10	-	558	-	-	285	10
17	10th/Madison	-	-	-	-	-	15	-	558	-	-	280	10
18	Seneca St/Madison	-	-	-	-	-	-	-	558	-	-	290	5
19	11th/Madison	-	-	-	141	-	113	-	558	-	-	182	-
20	12th/Madison	51	320	77	156	368	34	75	526	98	125	247	16
21	Union/Madison	-	-	-	-	-	-	-	384	375	-	389	2
22	13th/Madison	183	69	63	113	-	39	-	384	-	-	167	3
23	14th/Madison	48	267	68	59	380	6	-	461	99	-	103	-
24*	Pike/Madison	-	-	9	-	-	-	-	438	148	-	106	51
25	15th/Madison	-	-	-	-	-	78	-	447	-	-	79	-
26	16th/Madison	-	-	56	-	-	-	-	447	-	-	79	-
27	Pine/Madison	-	-	-	-	-	-	-	503	-	-	77	346
28	17th/Madison	109	29	1	101	17	4	-	769	92	-	310	5
29	18th/Madison	-	-	120	-	-	21	-	758	113	-	288	122
30	19th/Madison	77	114	69	9	197	139	285	539	51	183	195	3
31*	20th/Madison	-	-	22	-	10	84	-	593	17	-	318	81
32	Denny/22nd NB/Madison	85	-	87	-	-	-	-	622	38	-	288	26
33	22nd SB/Madison	-	-	-	-	-	53	-	751	-	-	264	11

#	Study Intersection	Build (2019) – PM Peak Hour											
		Northbound			Southbound			Eastbound			Westbound		
		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
34	23rd/Madison	-	609	32	-	617	75	270	419	61	100	200	2
35*	John/Madison	-	130	6	140	143	10	22	388	6	3	302	210
36	25th/Madison	5	21	14	15	27	10	39	478	10	10	500	13
37	26th/Madison	-	-	-	-	-	-	30	410	-	-	517	3
38	27th NB/Madison	7	-	24	-	-	-	-	357	44	8	502	-
39	27th SB/Madison	-	-	-	-	-	-	24	357	-	-	489	10
40	28th/MLK/Madison	135	100	187	57	214	11	12	287	55	123	360	21
41	1st/Spring	-	321	106	82	332	-	91	220	16	-	-	-
42	2nd/Spring	-	-	-	126	1449	-	-	348	112	-	-	-
43	3rd/Spring	-	-	30	-	55	-	5	529	18	-	-	-
44	4th/Spring	-	1274	99	-	-	-	112	412	-	-	-	-
45	5th/Spring	-	-	-	499	546	-	-	501	84	-	-	-
46	6th/Spring	-	141	712	-	-	-	70	151	777	-	-	-
47	7th/Spring	-	315	105	-	215	-	38	119	12	-	-	-
48	8th/Spring	-	201	17	105	186	-	72	140	12	-	-	-
49	9th/Spring	-	64	1	1	171	-	40	60	162	131	-	10
50	14th/Pike	2	267	-	-	363	1	4	-	36	45	3	2

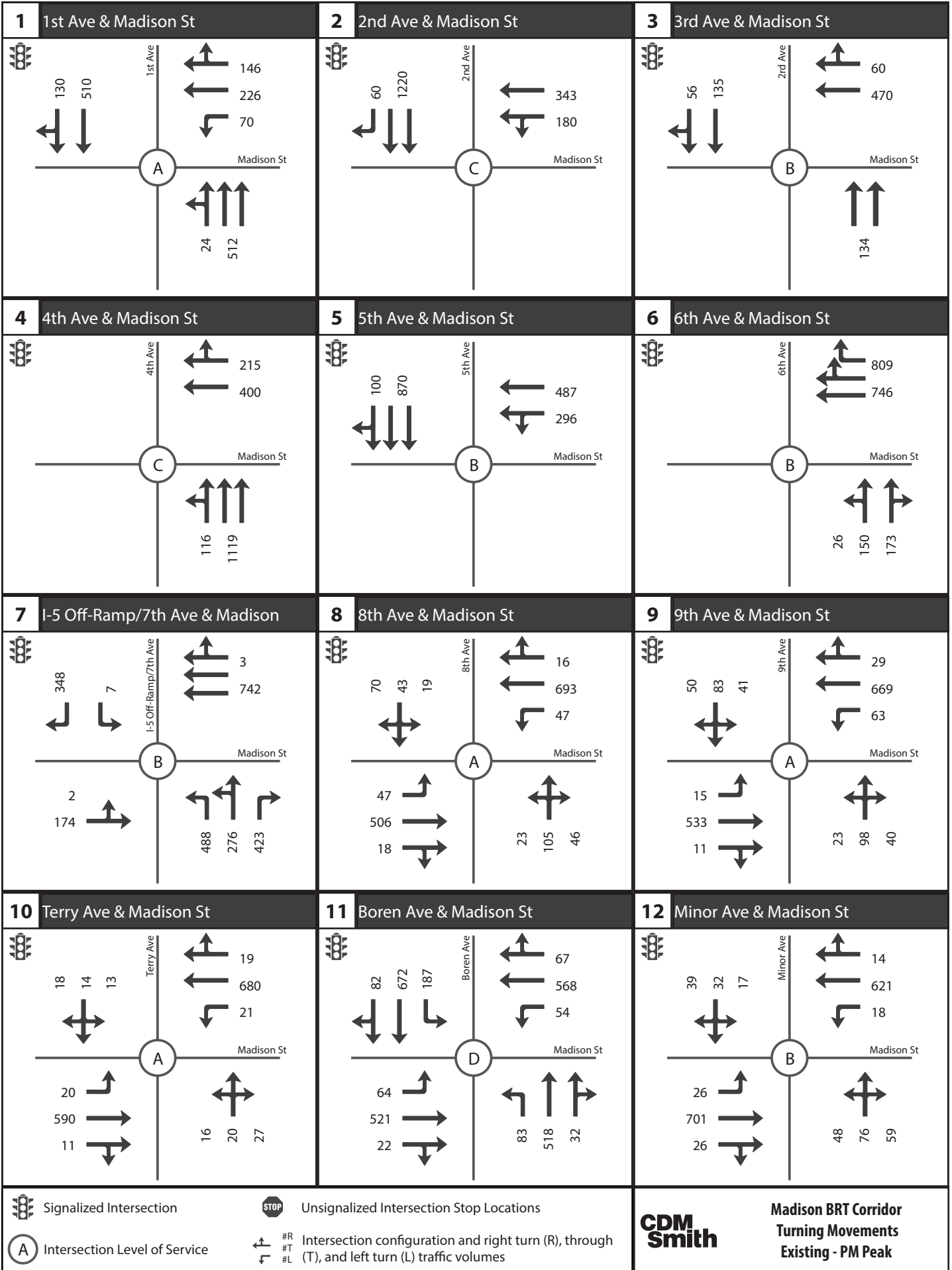
Note:

Madison and Spring Streets operate generally in the east-west direction. Pike/Madison, 20<sup>th</sup>/Madison, and John/Madison have unique intersection geometries in which the minor movements are reported in the north-south direction.

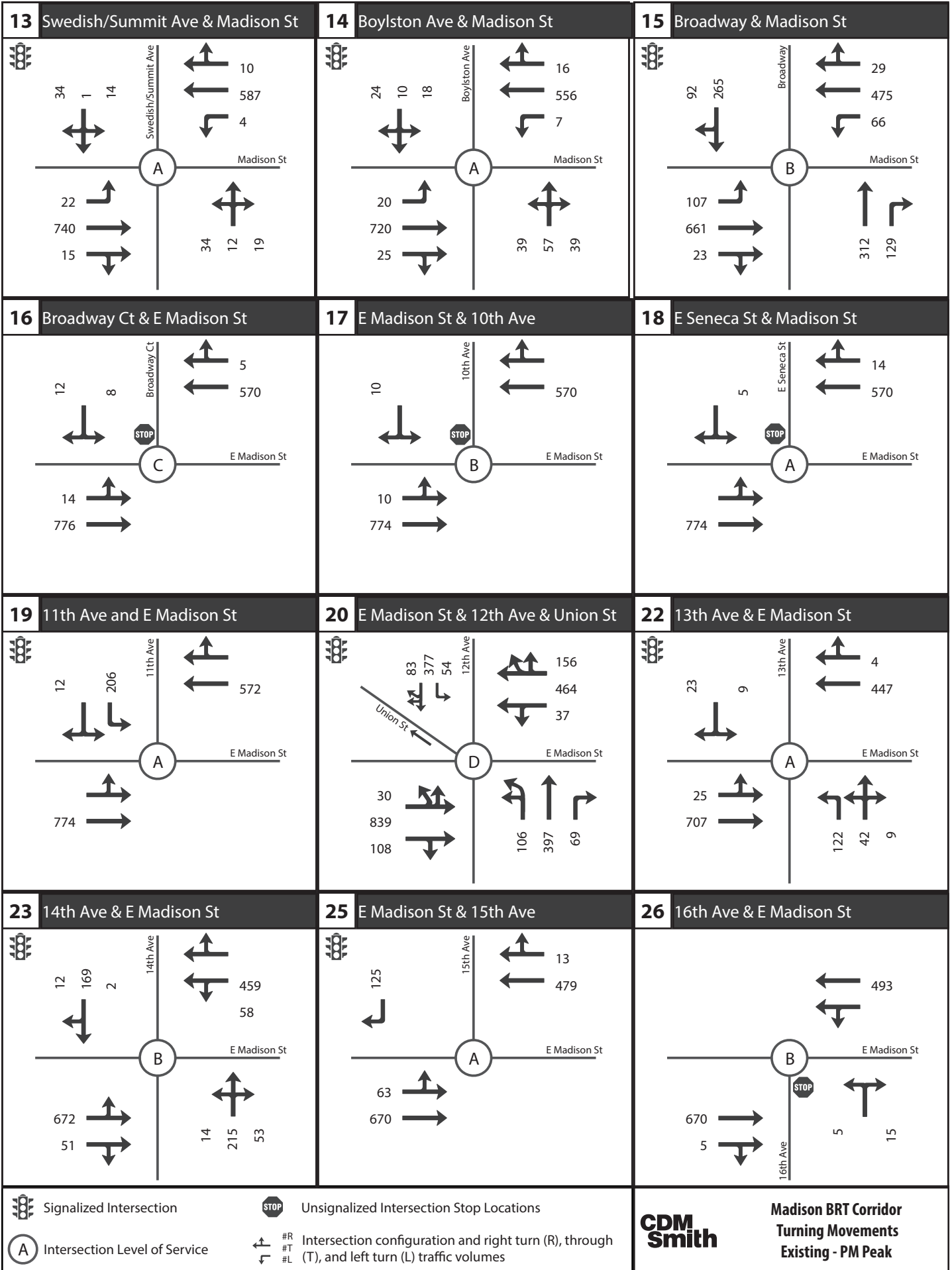
“-“ indicates movement prohibited; “-“ indicates movement allowed, but zero counts.

All of the named downtown streets running in the northeast-southwest direction are assumed to be aligned in the east-west direction, while numbered avenues running in the northwest-southeast direction are assumed to be aligned in the north-south direction, which is the usual terminology applied in Seattle.

**Existing Turning Movements**



**Existing Turning Movements**



Signalized Intersection



Unsignalized Intersection Stop Locations



Intersection Level of Service

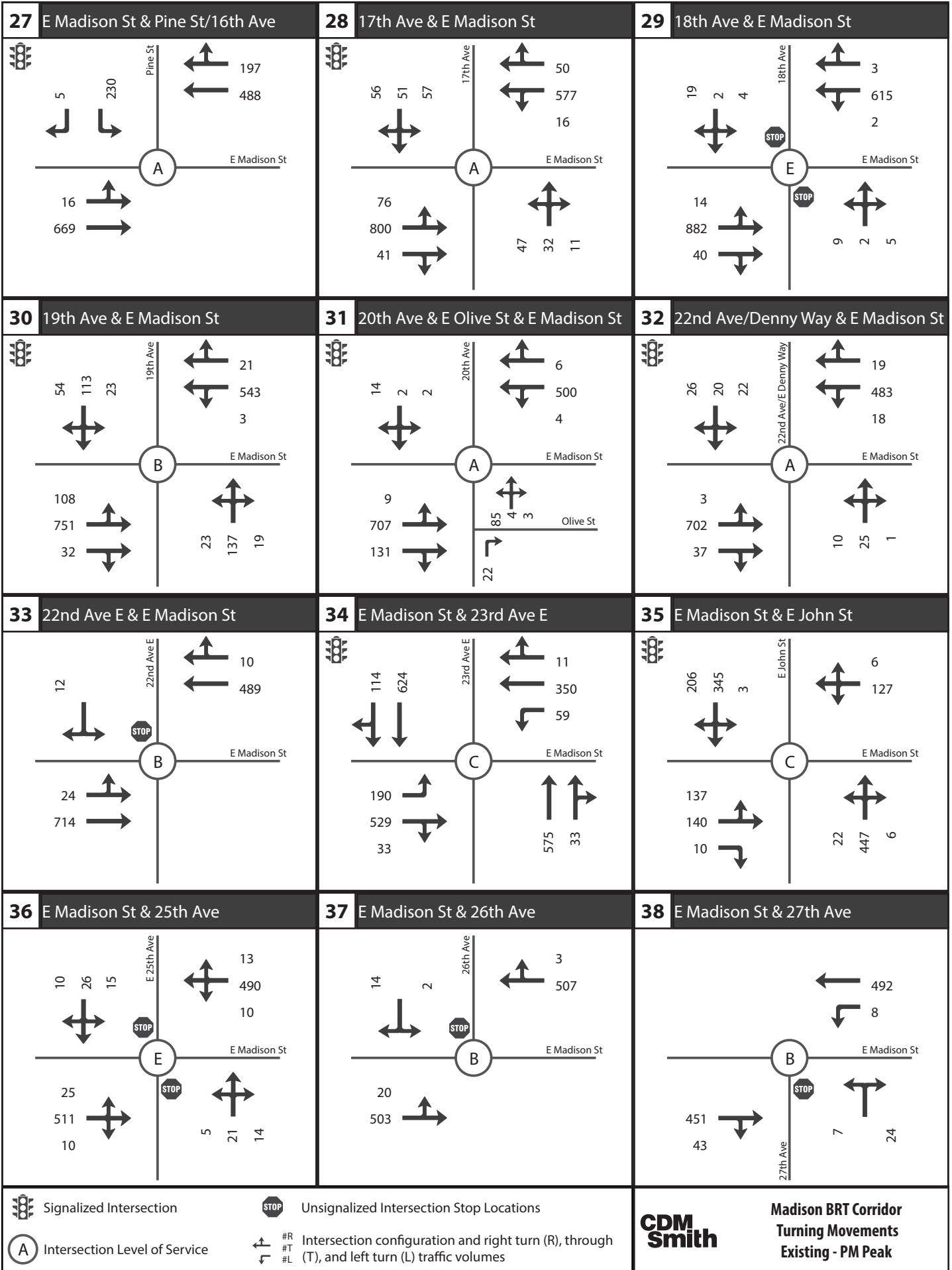


#R Intersection configuration and right turn (R), through (T), and left turn (L) traffic volumes  
#T  
#L

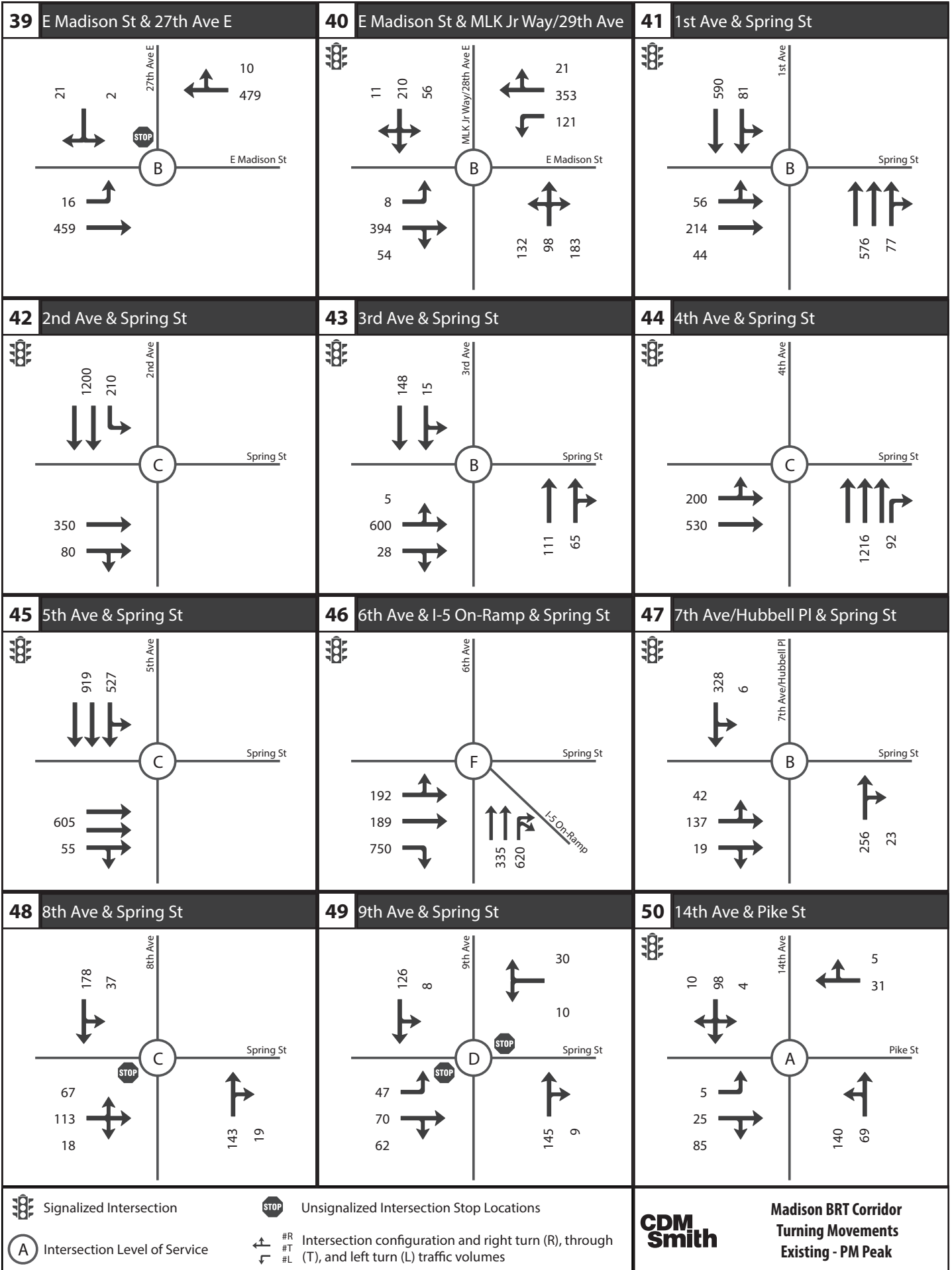


**Madison BRT Corridor**  
**Turning Movements**  
**Existing - PM Peak**

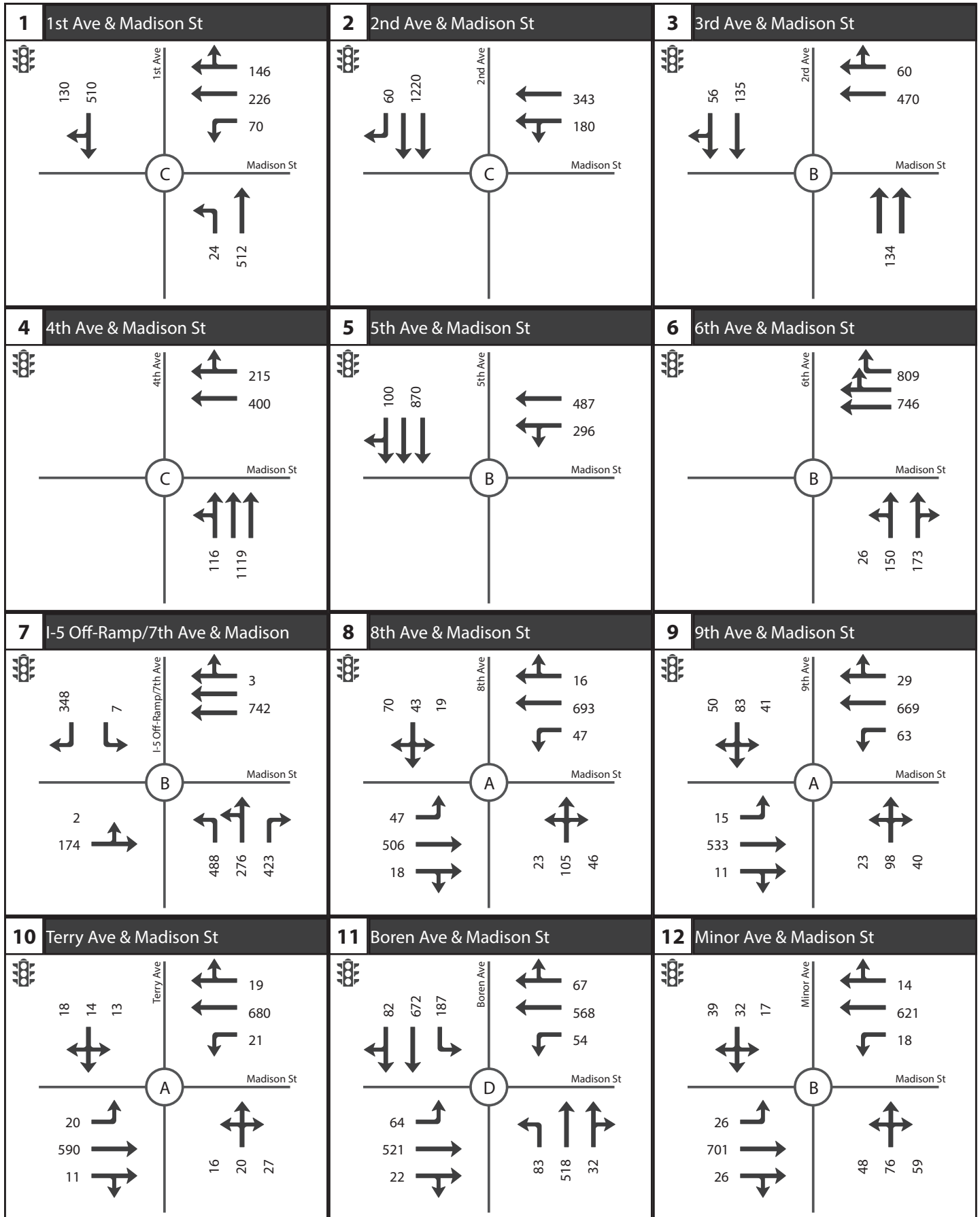
**Existing Turning Movements**



**Existing Turning Movements**



**No Build Turning Movements**



Signalized Intersection

Unsignalized Intersection Stop Locations

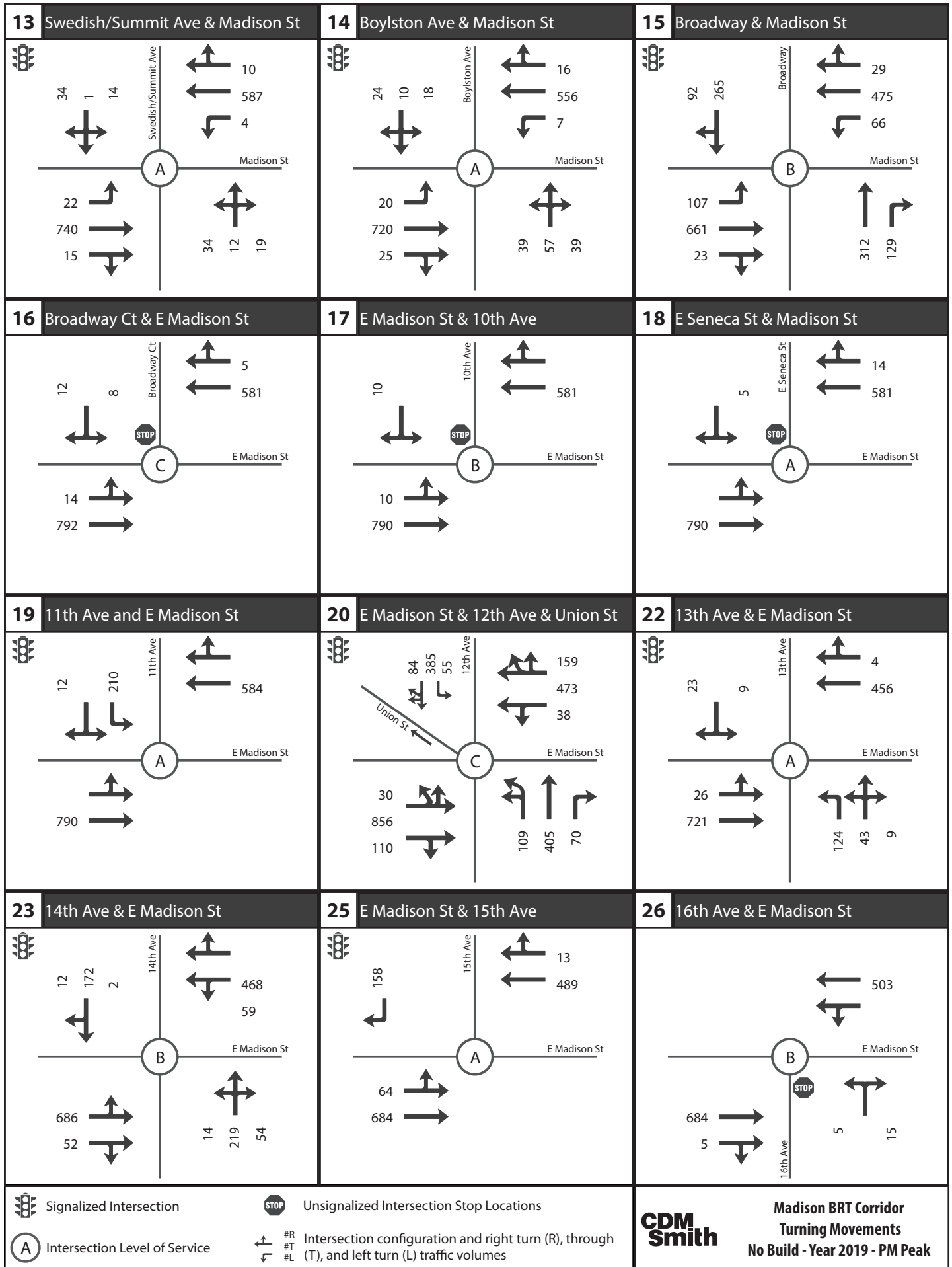
**(A)** Intersection Level of Service

#R Intersection configuration and right turn (R), through (T), and left turn (L) traffic volumes



**Madison BRT Corridor**  
**Turning Movements**  
**No Build - Year 2019 - PM Peak**

**No Build Turning Movements**



Signalized Intersection



Unsignalized Intersection Stop Locations



Intersection Level of Service



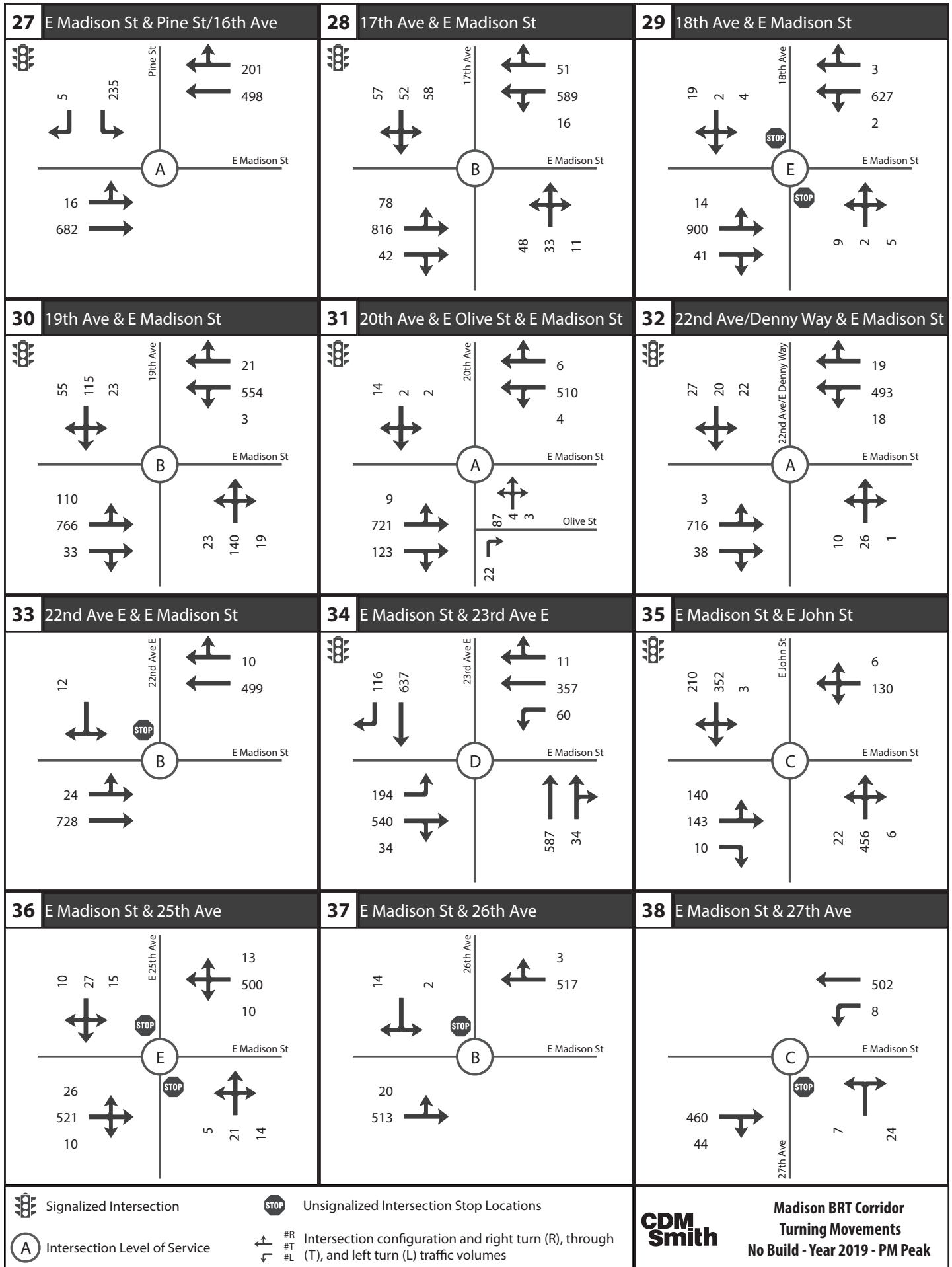
Intersection configuration and right turn (R), through (T), and left turn (L) traffic volumes



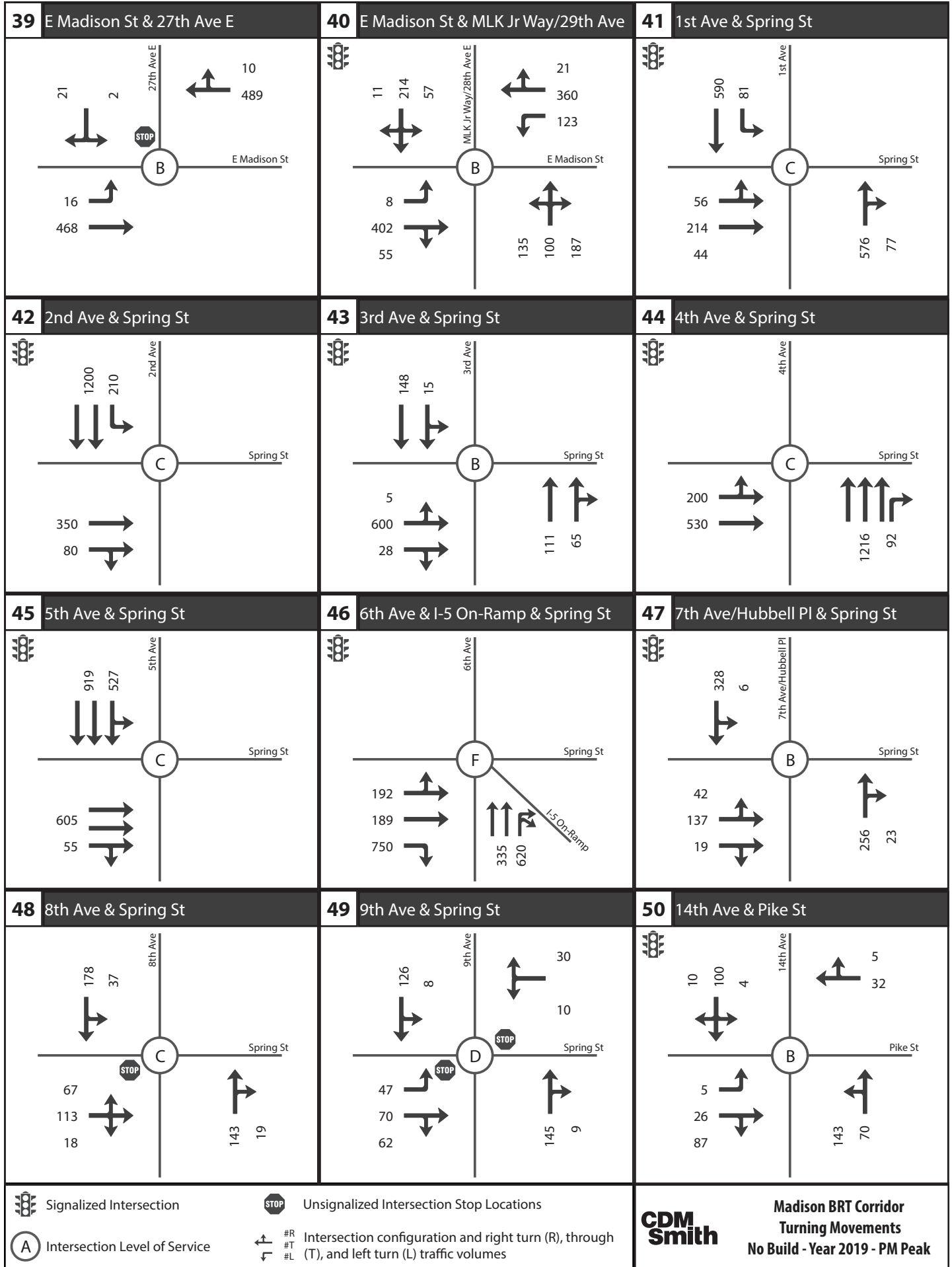
**Madison BRT Corridor**  
**Turning Movements**  
**No Build - Year 2019 - PM Peak**

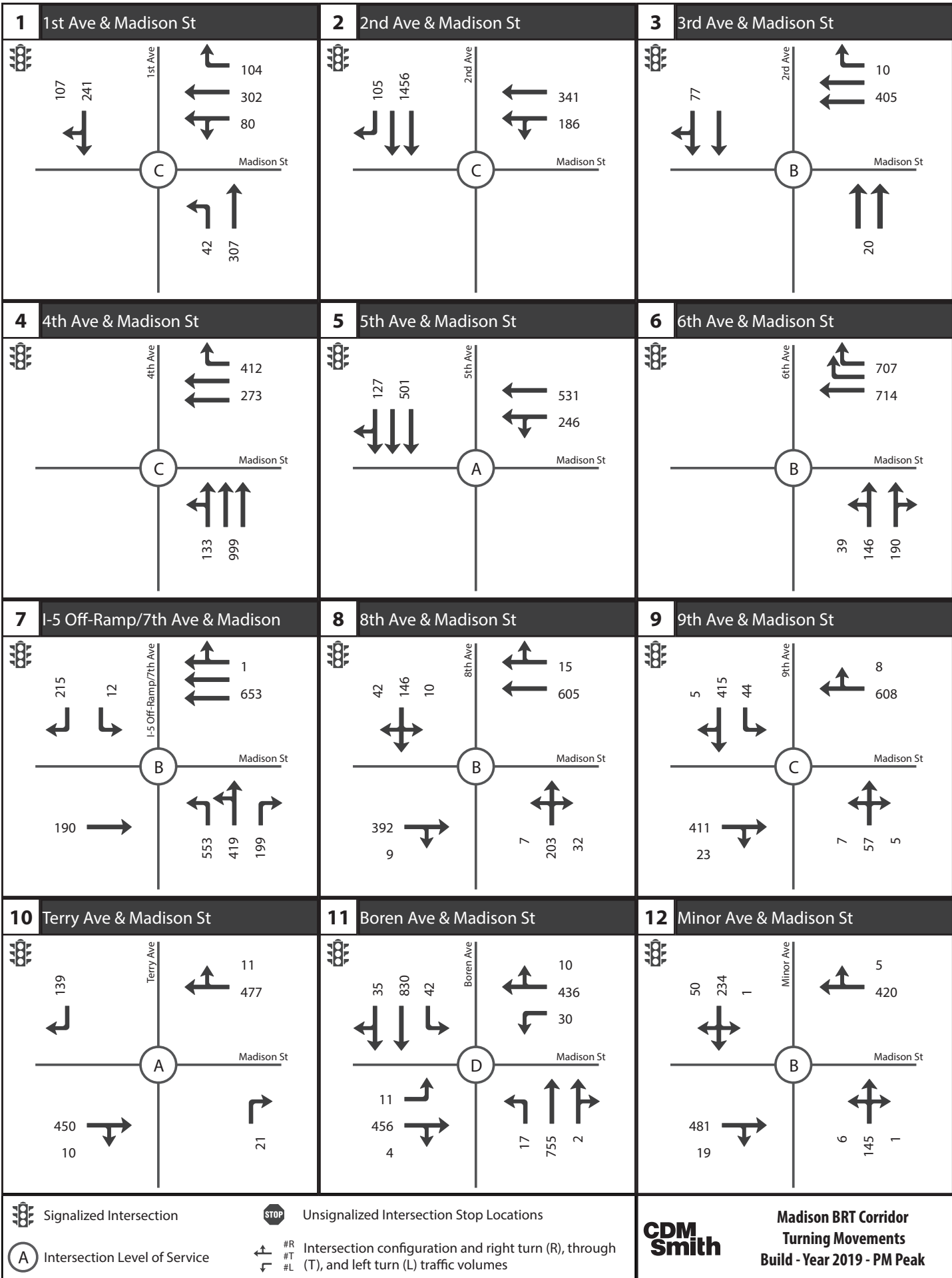


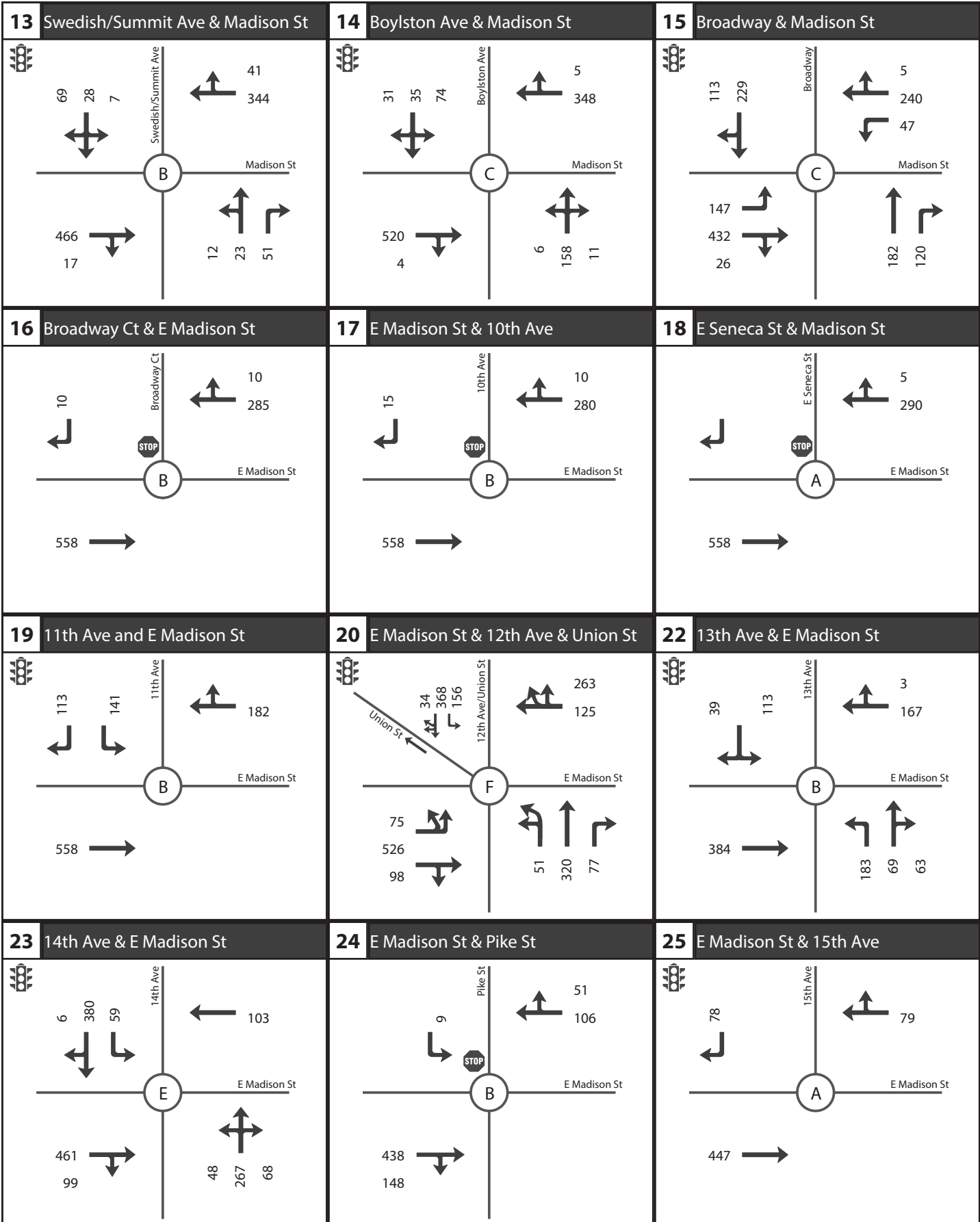
No Build Turning Movements



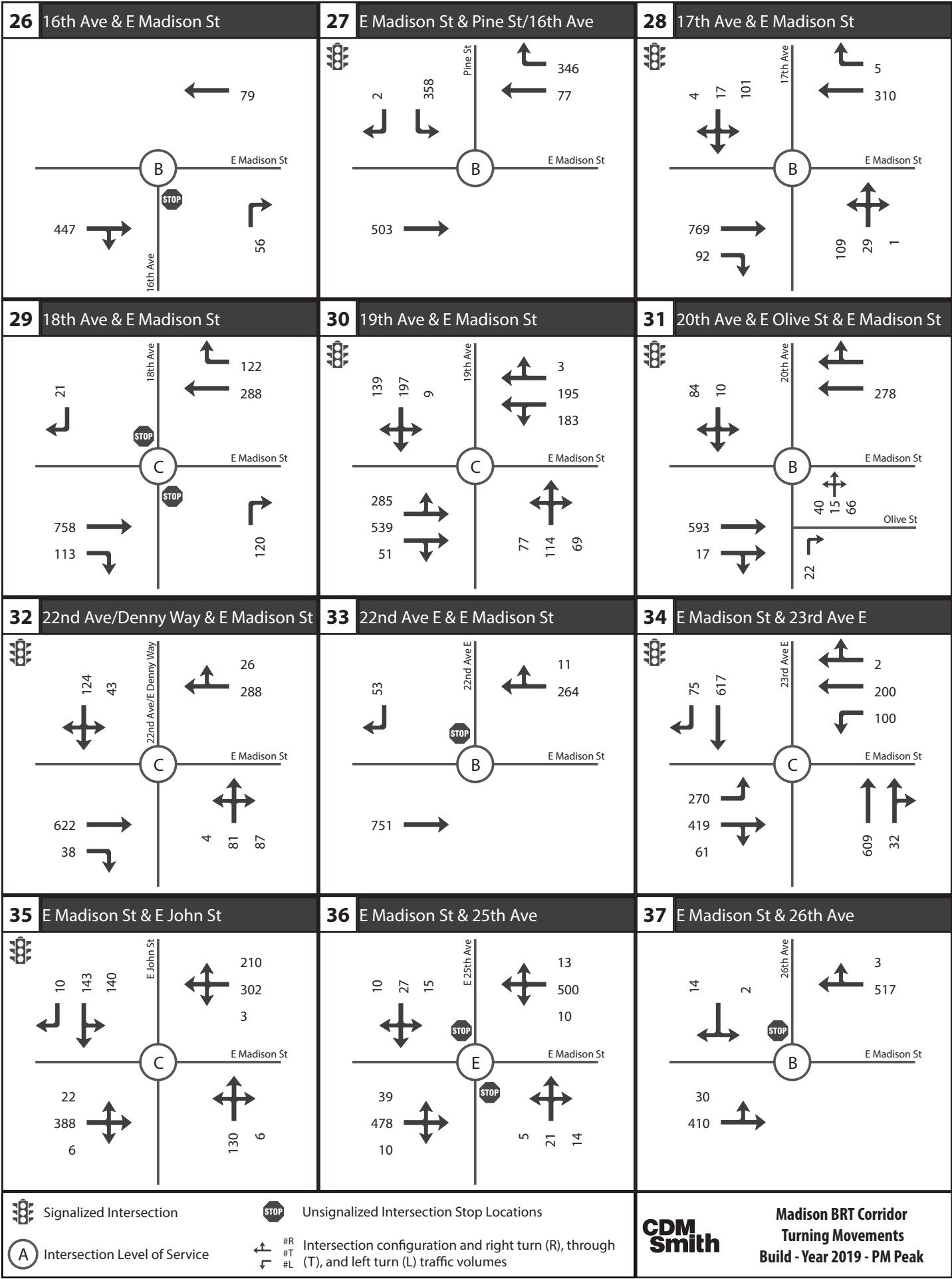
**No Build Turning Movements**







Signalized Intersection     
 Unsignalized Intersection Stop Locations  
 Intersection Level of Service     
 #R Intersection configuration and right turn (R), through (T), and left turn (L) traffic volumes  
 #T  
 #L



Signalized Intersection



Unsignalized Intersection Stop Locations



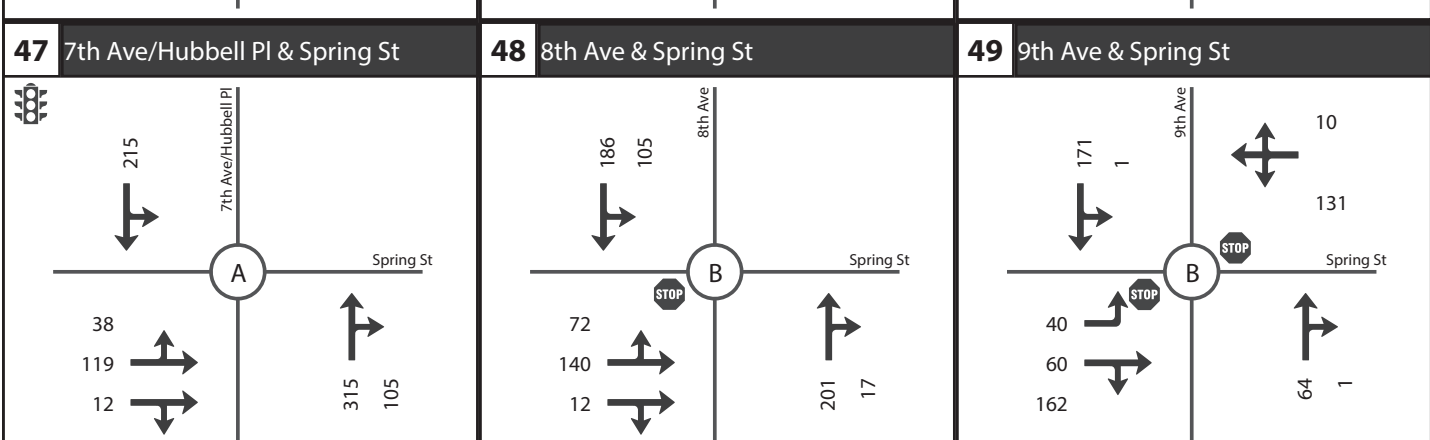
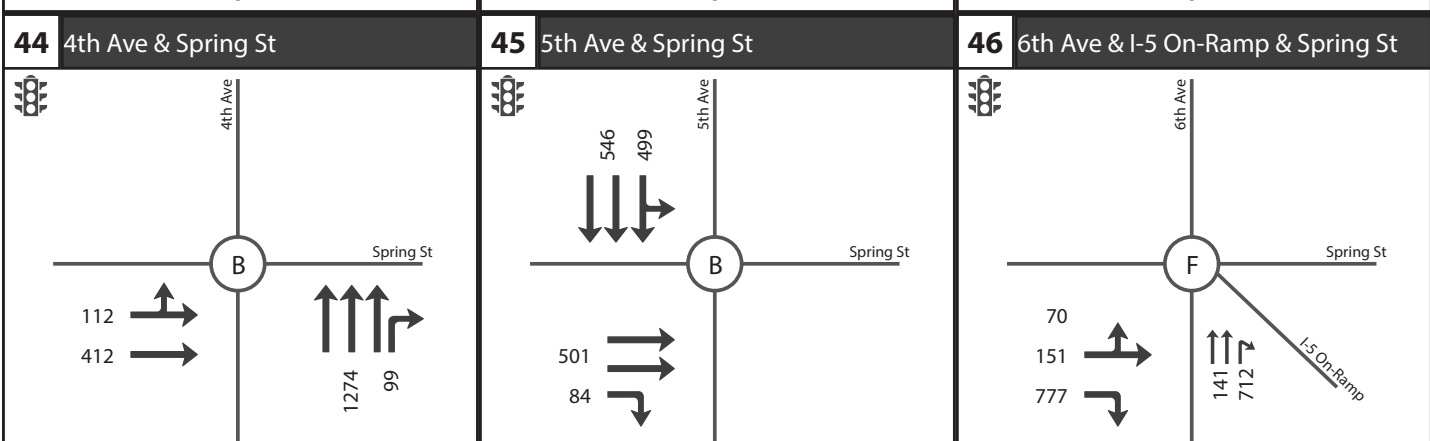
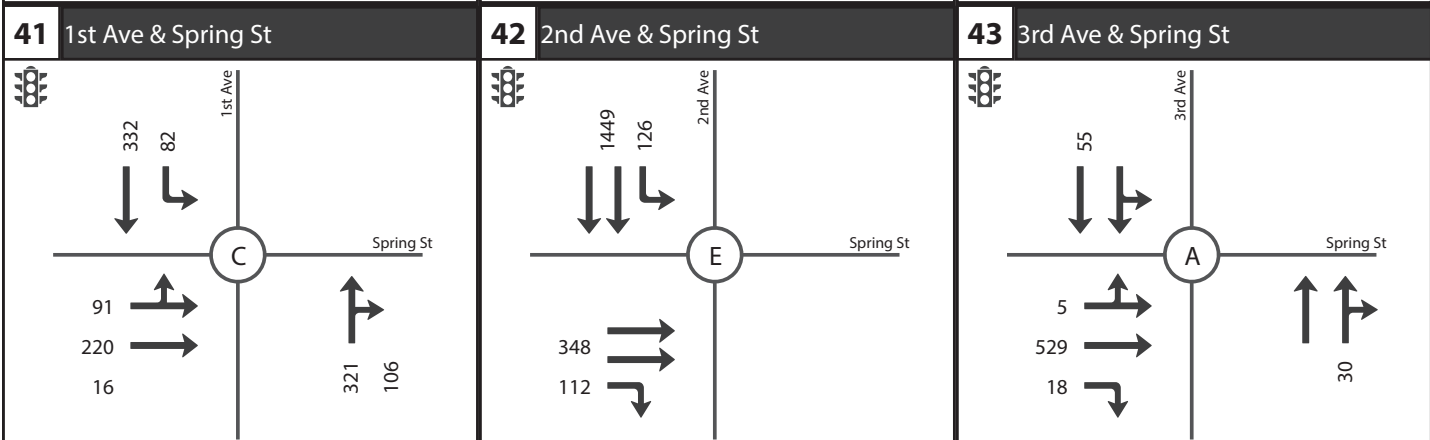
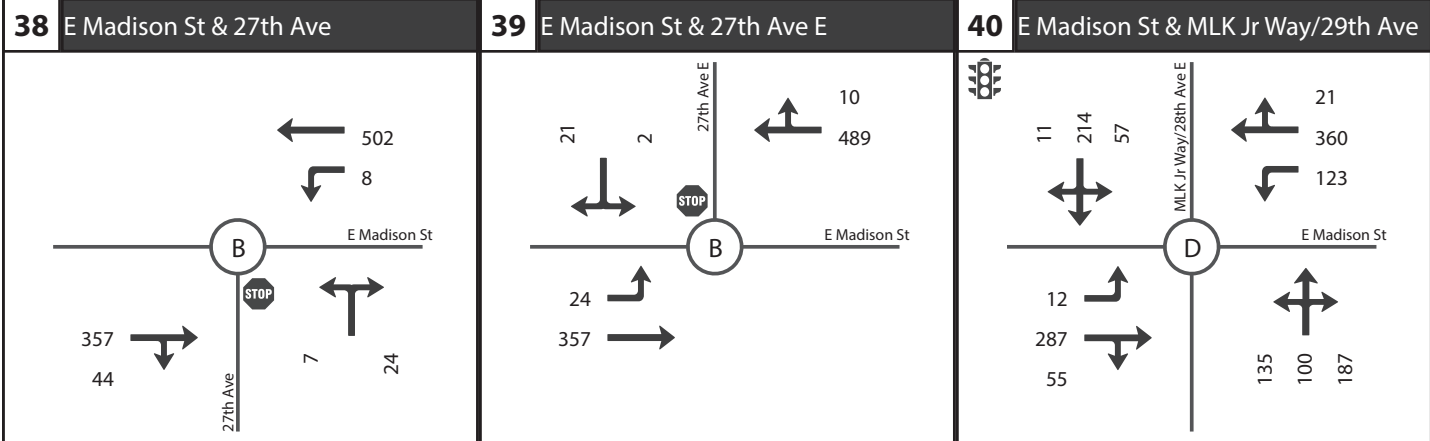
Intersection Level of Service



Intersection configuration and right turn (R), through (T), and left turn (L) traffic volumes



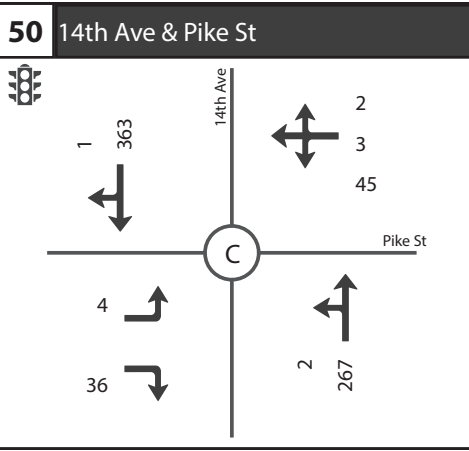
Madison BRT Corridor  
 Turning Movements  
 Build - Year 2019 - PM Peak



Signalized Intersection      Unsignalized Intersection Stop Locations

Intersection Level of Service      #R, #T, #L Intersection configuration and right turn (R), through (T), and left turn (L) traffic volumes

**CDM Smith**      **Madison BRT Corridor**  
**Turning Movements**  
**Build - Year 2019 - PM Peak**



Signalized Intersection Intersection Level of Service	Unsignalized Intersection Stop Locations #R #T #L Intersection configuration and right turn (R), through (T), and left turn (L) traffic volumes	<p><b>Madison BRT Corridor Turning Movements Build - Year 2019 - PM Peak</b></p>
--	--	--

## DIVERSION ANALYSIS

---





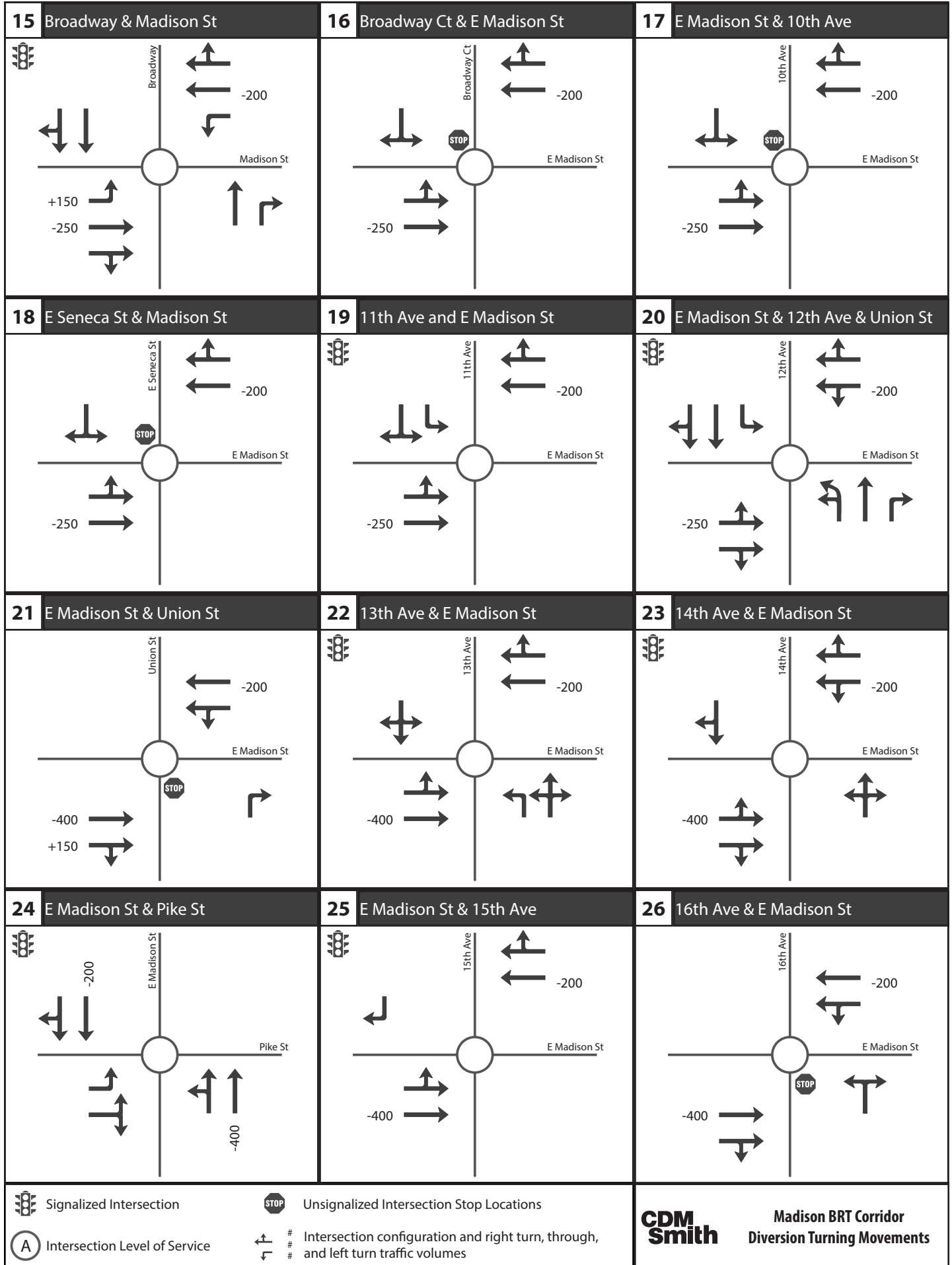
**Legend**

- Red Arrow: Eastbound Diversion
- Blue Arrow: Westbound Diversion
- Green Line: Project Route
- Yellow Circle #: Off-Corridor Intersections
- Yellow Circle ###: Vehicle Volume (Vh/hr)

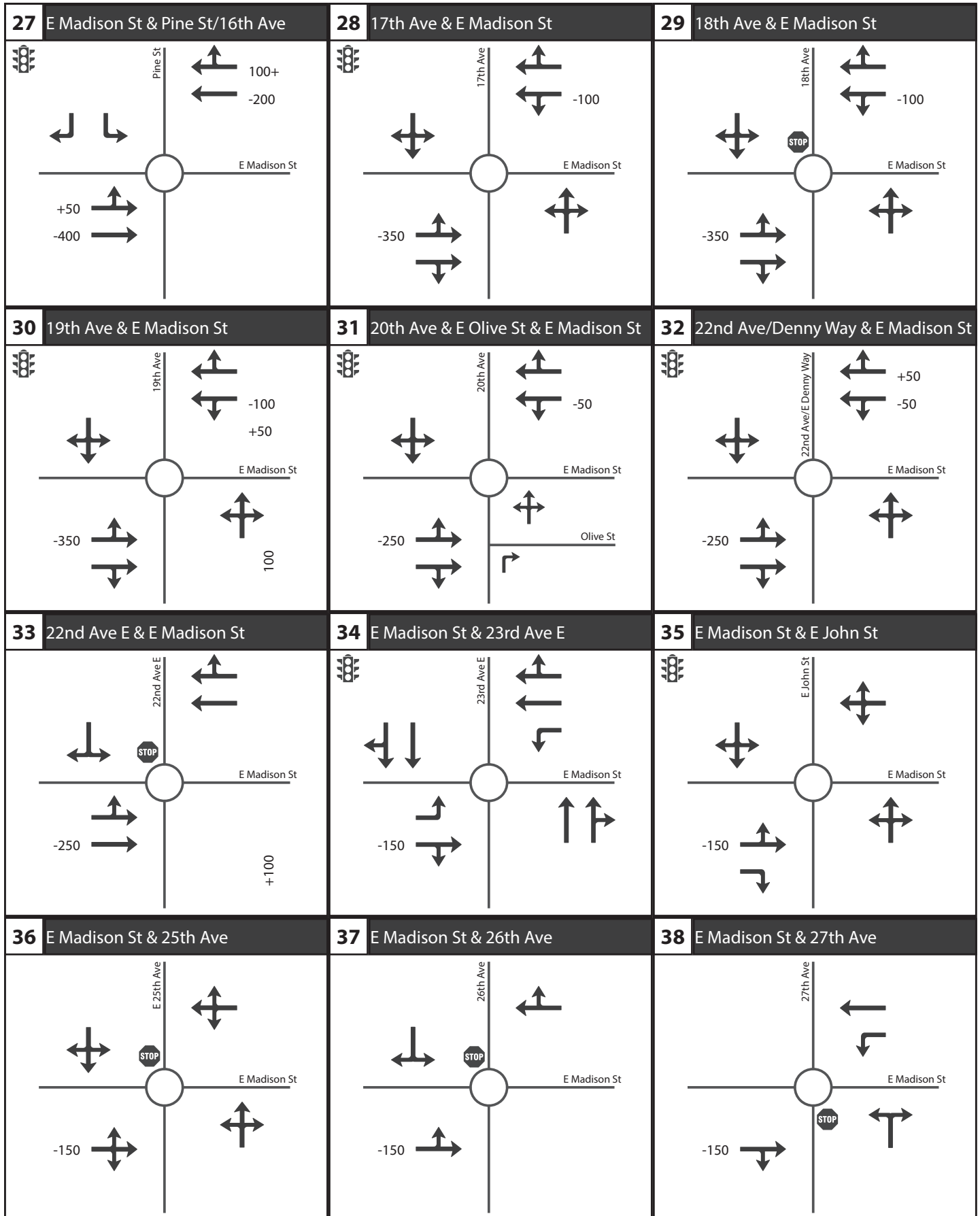
0 0.25 0.5 MILES

NORTH

**Diversion Turning Movements**



**Diversion Turning Movements**



Signalized Intersection

Unsignalized Intersection Stop Locations

Intersection Level of Service

# Intersection configuration and right turn, through, and left turn traffic volumes

**CDM  
Smith**

**Madison BRT Corridor  
Diversion Turning Movements**

# VISSIM MODELING GUIDELINES

---

# Madison BRT 30% Design Analysis - Vissim Modeling Parameters

Vissim Version: 8.00-09

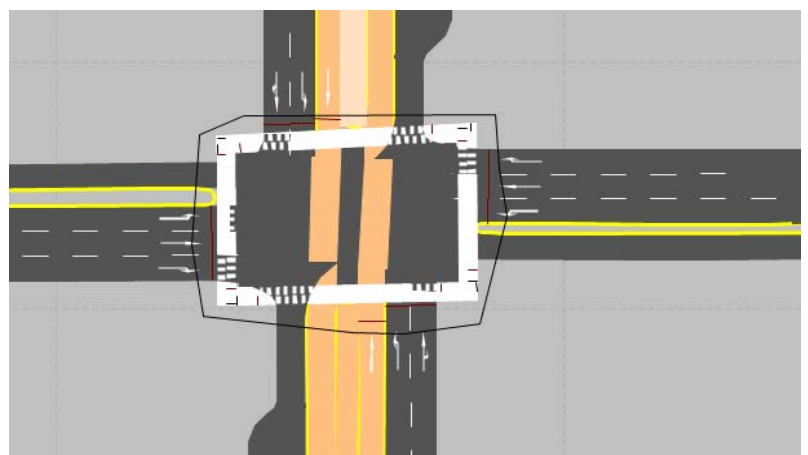
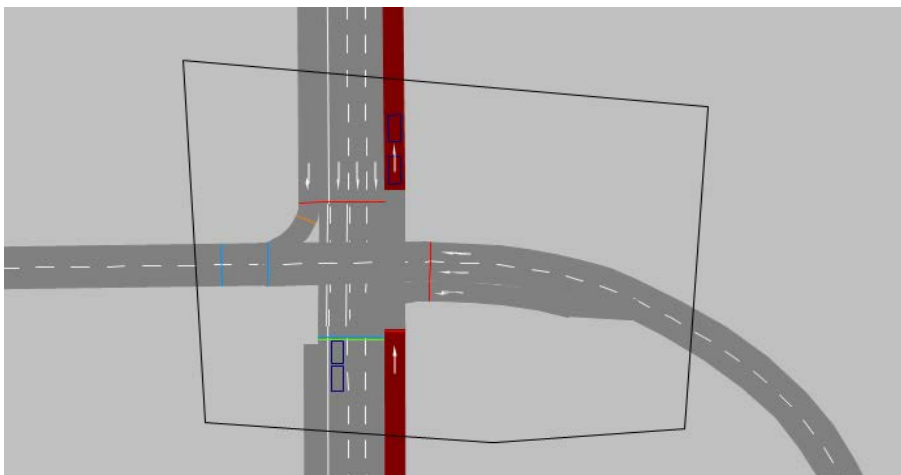
Base Data		Typical Settings
Maximum Acceleration	Car	Default Values
	HGV	Default Values
	Bus	Default Values
	Tram	Default Values
	Pedestrian	Default Values
Desired Acceleration	Car	Default Values
	HGV	Default Values
	Bus	Default Values
	Tram	Default Values
	Pedestrian	Default Values
Maximum Deceleration	Car	Default Values
	HGV	Default Values
	Bus	Default Values
	Tram	Default Values
	Pedestrian	Default Values
Desired Deceleration	Car	Default Values
	HGV	Default Values
	Bus	Default Values
	Tram	Default Values
	Pedestrian	Default Values
Desired Speed Distributions		Should reflect speed limits. Assume +/- 5 mph of speed limits, with 85% at +2 mph. For buses and trucks, assume +/- 3mph over speed limit, with 85% at speed limit.
Power Distributions		Default Values
Weight Distributions		Default Values
Time Distributions		Assume 30s dwell time for existing transit routes
Location distribution		Default Values
Distance distribution		Default Values
Occupancy distribution		Default Values
2D/3D model distribution		Default Values
Color distribution		Default Values
Vehicle Types	Car	Default Values
	HGV	Default Values
	Non-Articulated Buses	40' length
	Bike	Default Values
	Articulated Buses	60'10" long and 102" wide
Vehicle Classes	Car	Default Values
	HGV	Default Values
	Non-Articulated Buses	Same as Vehicle class
	Bike	Default Values
	Articulated Buses	Same as Vehicle class
Driver Behavior Parameters- Urban	Car following model	Default Values Wiedemann 74
	Avg Standstill disc	Default. May adjust case by case for calibration
	Add. part of safety distance	Adjust case by case for calibration.
	Mult. part of safety distance	Adjust case by case for calibration.
	Look ahead distance	Default, can change to Observed vehicles: 4
	Necessary Lane Change (route)	default; adjust for calibration
	Safety distance reduction factor	default; adjust for calibration
	Maximum Deceleration for	Default
Link Behavior Types		Default
Pedestrian Types		Default
Pedestrian classes		Default
Walking Behavior		Default
Area Behavior Types		Not applicable
Vehicle compositions		Based on truck %s
Signal Controllers		Controller frequency=10.
Simulation parameters		
<i>Period</i>		5400s with 1800s of seeding period.
<i>Simulation resolution</i>		10
<i>Random Seed</i>		Starting seed: # 100
<i>Number of Runs</i>		5
<i>Seed Increment</i>		10
<i>Simulation speed</i>		Maximum
<i>Number of cores</i>		Maximum
Desired Speed Decisions		Should be around +/- 5mph of the speed limit with 85% of the vehicles at speeds +2 mph over speed limit.
Reduced Speed areas		Right Turns = 11-13 mph. Left Turns = 13-17 mph
Conflict areas		
<i>Global</i>		N/A
<i>Pedestrian/Bike Conflicts</i>		1 / 1 / 1.5
<i>RTOR</i>		1 / 1 / 2.0
<i>Permitted Lefts</i>		1.5 / 1 / 1.5
<i>Left against right (right Priority)</i>		1.5 / 1 / 2
Priority Rules		Specific to case by case
Nodes		At All signalized intersections. Define nodes close to stop bar.
Travel time segments		Match INRIX/GPS travel time segments. Combine intersection to intersection segments from start to end of corridor.
Parking		not included
Connectors		
<i>Left Turns</i>		Use 15-point spline
<i>Right Turns</i>		Use 7-point spline
Seeding Period Volumes		Use 80% of peak hour volumes

For nodes coding:  
**INCORRECT. Nodes too far from stop bar**

**CORRECT. Node near stop bar**

For WB, node will collect data for only the WB approach as a whole. The WBL and WBT will be lumped into just WB.

For WB, node data will be provided for WBT and WBL. This is the preferred method.



## VISSIM MODEL CALIBRATION RESULTS

---

**Madison BRT Design**

**Volume Calibration Summary - Existing PM Peak Hour Conditions**

*FHWA Calibration Criteria - GEH Statistic less than 5 for individual link flows for at least 85% of cases*

#	Intersection	Movement	Peak Hour Volumes (vph)		Calibration Results		Intersection Operations - 2015 PM Conditions			
			Field Count	Vissim Output	% Volume Difference	GEH Value	All Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
1	1st Avenue/Madison Street	SWBL	70	61	-12.9%	1.1	21.0	C	15	126
		SWBT	226	196	-13.3%	2.1	10.8	B	15	126
		SWBR	146	122	-16.4%	2.1	9.6	A	16	130
		NWBL	24	23	-4.2%	0.2	16.8	B	13	155
		NWBT	512	522	2.0%	0.4	9.2	A	13	155
		SEBT	510	520	2.0%	0.4	4.4	A	9	171
		SEBR	130	122	-6.2%	0.7	5.7	A	10	173
	<b>Total</b>	<b>1,618</b>	<b>1,566</b>	<b>-3.2%</b>	<b>1.3</b>	<b>8.2</b>	<b>A</b>	-	-	
2	2nd Avenue/Madison Street	SWBL	180	160	-11.1%	1.5	62.0	E	106	334
		SWBT	343	326	-5.0%	0.9	52.0	D	106	334
		SEBT	1,220	1,236	1.3%	0.5	2.6	A	8	148
		SEBR	60	55	-8.3%	0.7	4.9	A	10	154
	<b>Total</b>	<b>1,803</b>	<b>1,843</b>	<b>2.2%</b>	<b>0.9</b>	<b>16.6</b>	<b>B</b>	-	-	
3	3rd Avenue/Madison Street	SWBT	470	431	-8.3%	1.8	20.2	C	32	219
		SWBR	60	56	-6.7%	0.5	17.1	B	37	226
		NWBT	134	191	42.5%	4.5	11.1	B	21	199
		SEBT	135	155	14.8%	1.7	22.7	C	23	187
		SEBR	56	57	1.8%	0.1	23.6	C	25	192
			<b>Total</b>	<b>855</b>	<b>890</b>	<b>4.1%</b>	<b>1.2</b>	<b>18.7</b>	<b>B</b>	-
4	4th Avenue/Madison Street	SWBT	400	369	-7.8%	1.6	5.8	A	23	248
		SWBR	215	189	-12.1%	1.8	20.6	C	25	251
		NWBL	116	121	4.3%	0.5	12.3	B	28	236
		NWBT	1,081	1,091	0.9%	0.3	9.7	A	24	225
	<b>Total</b>	<b>1,812</b>	<b>1,829</b>	<b>0.9%</b>	<b>0.4</b>	<b>10.7</b>	<b>B</b>	-	-	
5	5th Avenue/Madison Street	SWBL	296	290	-2.0%	0.4	37.2	D	126	343
		SWBT	487	472	-3.1%	0.7	37.5	D	124	340
		SEBT	870	762	-12.4%	3.8	2.1	A	5	123
		SEBR	100	86	-14.0%	1.5	4.5	A	5	126
	<b>Total</b>	<b>1,753</b>	<b>1,611</b>	<b>-8.1%</b>	<b>3.5</b>	<b>19.0</b>	<b>B</b>	-	-	
6	6th Avenue/Madison Street	SWBT	746	749	0.4%	0.1	26.9	C	127	355
		SWBR	809	806	-0.4%	0.1	28.6	C	127	354
		NWBL	26	22	-15.4%	0.8	57.7	E	157	570
		NWBT	150	162	8.0%	1.0	66.7	E	145	554
		NWBR	173	179	3.5%	0.5	57.8	E	145	554
	<b>Total</b>	<b>1,904</b>	<b>1,917</b>	<b>0.7%</b>	<b>0.3</b>	<b>34.3</b>	<b>C</b>	-	-	
7	7th Avenue/Madison Street	NEBL	2	3	50.0%	0.6	30.7	C	7	168
		NEBT	174	176	1.1%	0.2	8.8	A	7	168
		SWBT	742	791	6.6%	1.8	32.8	C	71	334
		SWBR	3	4	33.3%	0.5	37.3	D	70	334
		NWBL	488	438	-10.2%	2.3	99.5	F	501	957
		NWBT	276	230	-16.7%	2.9	99.0	F	501	957
		NWBR	423	366	-13.5%	2.9	92.4	F	500	957
		SEBL	7	6	-14.3%	0.4	25.2	C	57	298
		SEBR	348	333	-4.3%	0.8	24.7	C	57	298
	<b>Total</b>	<b>2,463</b>	<b>2,345</b>	<b>-4.8%</b>	<b>2.4</b>	<b>57.6</b>	<b>E</b>	-	-	
8	8th Avenue/Madison Street	NEBL	47	46	-2.1%	0.1	18.4	B	6	90
		NEBT	506	490	-3.2%	0.7	3.6	A	6	90
		NEBR	18	17	-5.6%	0.2	3.0	A	6	90
		SWBL	47	51	8.5%	0.6	14.7	B	30	289
		SWBT	693	723	4.3%	1.1	12.0	B	30	289
		SWBR	16	14	-12.5%	0.5	10.3	B	30	291
		NWBL	23	29	26.1%	1.2	78.0	E	97	276
		NWBT	105	116	10.5%	1.0	79.1	E	97	276
		NWBR	46	52	13.0%	0.9	68.7	E	97	277
		SEBL	19	30	57.9%	2.2	92.5	F	112	317
		SEBT	43	57	32.6%	2.0	92.8	F	112	317
SEBR	70	95	35.7%	2.8	77.0	E	112	317		
	<b>Total</b>	<b>1,633</b>	<b>1,719</b>	<b>5.3%</b>	<b>2.1</b>	<b>24.8</b>	<b>C</b>	-	-	
9	9th Avenue/Madison Street	NEBL	15	14	-6.7%	0.3	20.0	B	9	109
		NEBT	533	548	2.8%	0.6	5.2	A	9	109
		NEBR	11	10	-9.1%	0.3	5.9	A	10	113
		SWBL	63	70	11.1%	0.9	12.6	B	11	135
		SWBT	669	717	7.2%	1.8	5.1	A	11	135
		SWBR	29	34	17.2%	0.9	4.7	A	10	128
		NWBL	23	24	4.3%	0.2	34.2	C	28	208
		NWBT	98	107	9.2%	0.9	31.3	C	28	208
		NWBR	40	49	22.5%	1.3	20.2	C	29	209
		SEBL	41	45	9.8%	0.6	31.8	C	29	223
		SEBT	83	85	2.4%	0.2	31.4	C	29	223
		SEBR	50	50	0.0%	0.0	21.9	C	36	235
	<b>Total</b>	<b>1,655</b>	<b>1,752</b>	<b>5.9%</b>	<b>2.4</b>	<b>10.4</b>	<b>B</b>	-	-	
10	Terry Avenue/Madison Street	NEBL	20	25	25.0%	1.1	24.2	C	12	108
		NEBT	590	604	2.4%	0.6	6.9	A	12	108
		NEBR	11	13	18.2%	0.6	5.0	A	12	109
		SWBL	21	23	9.5%	0.4	10.2	B	6	74
		SWBT	680	741	9.0%	2.3	3.0	A	6	74
		SWBR	19	20	5.3%	0.2	2.3	A	7	79
		NWBL	16	18	12.5%	0.5	29.9	C	6	83
		NWBT	20	18	-10.0%	0.5	27.2	C	6	83
		NWBR	27	22	-18.5%	1.0	11.1	B	6	83
		SEBL	13	13	0.0%	0.0	35.3	D	5	81
		SEBT	14	13	-7.1%	0.3	24.7	C	5	81
SEBR	18	19	5.6%	0.2	12.1	B	5	81		
	<b>Total</b>	<b>1,449</b>	<b>1,529</b>	<b>5.5%</b>	<b>2.1</b>	<b>6.3</b>	<b>A</b>	-	-	

Madison BRT Design

Volume Calibration Summary - Existing PM Peak Hour Conditions

FHWA Calibration Criteria - GEH Statistic less than 5 for individual link flows for at least 85% of cases

#	Intersection	Movement	Peak Hour Volumes (vph)		Calibration Results		Intersection Operations - 2015 PM Conditions				
			Field Count	Vissim Output	% Volume Difference	GEH Value	All Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	
11	Boren Avenue/Madison Street	NEBL	64	64	0.0%	0.0	56.2	E	54	250	
		NEBT	521	553	6.1%	1.4	25.1	C	54	250	
		NEBR	22	21	-4.5%	0.2	22.2	C	51	250	
		SWBL	54	53	-1.9%	0.1	63.7	E	86	331	
		SWBT	568	594	4.6%	1.1	32.4	C	86	331	
		SWBR	67	70	4.5%	0.4	33.4	C	86	331	
		NWBL	83	106	27.7%	2.4	65.3	E	76	308	
		NWBT	518	633	22.2%	4.8	28.6	C	76	308	
		NWBR	32	36	12.5%	0.7	27.6	C	76	308	
		SEBL	187	190	1.6%	0.2	45.8	D	84	419	
		SEBT	672	651	-3.1%	0.8	24.6	C	84	419	
SEBR	82	82	0.0%	0.0	25.9	C	84	419			
	<b>Total</b>	<b>2,870</b>	<b>3,053</b>	<b>6.4%</b>	<b>3.4</b>	<b>31.4</b>	<b>C</b>	-	-		
12	Minor Avenue/Madison Street	NEBL	26	25	-3.8%	0.2	9.0	A	3	84	
		NEBT	701	729	4.0%	1.0	2.3	A	3	84	
		NEBR	26	25	-3.8%	0.2	2.6	A	3	83	
		SWBL	18	17	-5.6%	0.2	21.0	C	23	217	
		SWBT	621	630	1.4%	0.4	13.1	B	23	217	
		SWBR	14	11	-21.4%	0.8	12.3	B	23	217	
		NWBL	48	48	0.0%	0.0	73.6	E	75	283	
		NWBT	76	79	3.9%	0.3	71.0	E	75	283	
		NWBR	59	57	-3.4%	0.3	55.4	E	78	287	
		SEBL	17	15	-11.8%	0.5	33.7	C	12	131	
		SEBT	32	34	6.3%	0.3	33.4	C	12	131	
		SEBR	39	41	5.1%	0.3	17.7	B	12	131	
			<b>Total</b>	<b>1,677</b>	<b>1,711</b>	<b>2.0%</b>	<b>0.8</b>	<b>14.9</b>	<b>B</b>	-	-
		13	Summit Avenue/Madison Street	NEBL	22	25	13.6%	0.6	17.6	B	19
NEBT	740			764	3.2%	0.9	8.6	A	19	255	
NEBR	15			12	-20.0%	0.8	7.2	A	19	256	
SWBL	4			4	0.0%	0.0	13.0	B	6	132	
SWBT	587			587	0.0%	0.0	3.0	A	6	132	
SWBR	10			10	0.0%	0.0	3.1	A	7	137	
NWBL	34			39	14.7%	0.8	30.9	C	10	120	
NWBT	12			12	0.0%	0.0	26.7	C	10	120	
NWBR	19			20	5.3%	0.2	14.1	B	10	120	
SEBL	14			14	0.0%	0.0	36.2	D	3	62	
SEBT	1			1	0.0%	0.0	26.9	C	3	62	
SEBR	34			34	0.0%	0.0	10.0	A	4	62	
	<b>Total</b>	<b>1,492</b>	<b>1,521</b>	<b>1.9%</b>	<b>0.7</b>	<b>7.6</b>	<b>A</b>	-	-		
14	Boylston Avenue/Madison Street	NEBL	20	19	-5.0%	0.2	10.9	B	7	225	
		NEBT	720	750	4.2%	1.1	5.0	A	7	225	
		NEBR	25	27	8.0%	0.4	2.9	A	8	228	
		SWBL	7	7	0.0%	0.0	12.1	B	1	44	
		SWBT	556	532	-4.3%	1.0	0.7	A	1	44	
		SWBR	16	16	0.0%	0.0	1.1	A	1	44	
		NWBL	39	44	12.8%	0.8	37.8	D	25	150	
		NWBT	57	60	5.3%	0.4	34.6	C	25	150	
		NWBR	39	36	-7.7%	0.5	24.7	C	25	150	
		SEBL	18	17	-5.6%	0.2	35.0	D	6	87	
		SEBT	10	11	10.0%	0.3	23.2	C	6	87	
		SEBR	24	23	-4.2%	0.2	12.6	B	6	87	
			<b>Total</b>	<b>1,531</b>	<b>1,541</b>	<b>0.7%</b>	<b>0.3</b>	<b>6.7</b>	<b>A</b>	-	-
15	Broadway/Madison Street	NEBL	107	115	7.5%	0.8	34.0	C	49	266	
		NEBT	661	662	0.2%	0.0	13.2	B	49	266	
		NEBR	23	24	4.3%	0.2	13.3	B	49	272	
		SWBL	66	63	-4.5%	0.4	47.7	D	54	282	
		SWBT	475	466	-1.9%	0.4	26.1	C	54	282	
		SWBR	29	27	-6.9%	0.4	28.3	C	54	282	
		NBT	312	317	1.6%	0.3	23.4	C	54	337	
		NBR	129	126	-2.3%	0.3	38.4	D	54	337	
		SBT	265	254	-4.2%	0.7	30.9	C	56	372	
		SBR	92	90	-2.2%	0.2	28.0	C	56	372	
			<b>Total</b>	<b>2,159</b>	<b>2,143</b>	<b>-0.7%</b>	<b>0.3</b>	<b>24.1</b>	<b>C</b>	-	-
19	11th Avenue/Madison Street	NEBT	774	774	0.0%	0.0	18.0	B	36	352	
		SWBT	572	533	-6.8%	1.7	1.7	A	3	67	
		SBL	206	219	6.3%	0.9	41.5	D	33	190	
		SBR	12	14	16.7%	0.6	25.3	C	33	190	
			<b>Total</b>	<b>1,564</b>	<b>1,539</b>	<b>-1.6%</b>	<b>0.6</b>	<b>15.9</b>	<b>B</b>	-	-
20	12th Avenue/Madison Street	NEBHL	1	1	0.0%	0.0	46.1	D	99	358	
		NEBBL	29	32	10.3%	0.5	31.6	C	99	358	
		NEBT	839	845	0.7%	0.2	25.6	C	99	358	
		NEBR	108	113	4.6%	0.5	26.0	C	99	358	
		SWBL	37	35	-5.4%	0.3	49.0	D	42	304	
		SWBT	464	447	-3.7%	0.8	28.5	C	42	304	
		SWBBL	124	127	2.4%	0.3	31.4	C	42	304	
		SWBHR	32	28	-12.5%	0.7	31.2	C	42	304	
		NBHL	27	27	0.0%	0.0	65.6	E	119	510	
		NBBL	79	77	-2.5%	0.2	75.4	E	119	510	
		NBT	397	397	0.0%	0.0	35.3	D	119	510	
		NBR	69	65	-5.8%	0.5	28.2	C	116	510	
		SBL	54	52	-3.7%	0.3	35.0	D	81	396	
		SBT	377	380	0.8%	0.2	27.9	C	81	396	
		SBBR	61	58	-4.9%	0.4	28.8	C	81	396	
SBHR	22	22	0.0%	0.0	21.9	C	81	396			
	<b>Total</b>	<b>2,720</b>	<b>2,705</b>	<b>-0.6%</b>	<b>0.3</b>	<b>30.7</b>	<b>C</b>	-	-		



**Madison BRT Design**

**Volume Calibration Summary - Existing PM Peak Hour Conditions**

*FHWA Calibration Criteria - GEH Statistic less than 5 for individual link flows for at least 85% of cases*

#	Intersection	Movement	Peak Hour Volumes (vph)		Calibration Results		Intersection Operations - 2015 PM Conditions			
			Field Count	Vissim Output	% Volume Difference	GEH Value	All Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
41	1st Avenue/Spring Street	NEBL	56	55	-1.8%	0.1	26.6	C	25	190
		NEBT	214	208	-2.8%	0.4	25.9	C	25	190
		NEBR	44	42	-4.5%	0.3	20.8	C	39	215
		NWBT	576	568	-1.4%	0.3	3.7	A	6	84
		NWBR	77	76	-1.3%	0.1	4.5	A	8	89
		SEBL	81	86	6.2%	0.5	13.9	B	19	180
		SEBT	590	595	0.8%	0.2	8.4	A	19	180
	<b>Total</b>	<b>1,638</b>	<b>1,630</b>	<b>-0.5%</b>	<b>0.2</b>	<b>10.0</b>	<b>B</b>	<b>-</b>	<b>-</b>	
42	2nd Avenue/Spring Street	NEBT	350	347	-0.9%	0.2	29.4	C	45	209
		NEBR	80	79	-1.3%	0.1	29.4	C	53	218
		SEBL	210	205	-2.4%	0.3	18.1	B	42	301
		SEBT	1,200	1,200	0.0%	0.0	9.0	A	42	301
	<b>Total</b>	<b>1,840</b>	<b>1,896</b>	<b>3.0%</b>	<b>1.3</b>	<b>15.1</b>	<b>B</b>	<b>-</b>	<b>-</b>	
43	3rd Avenue/Spring Street	NEBL	5	5	0.0%	0.0	24.3	C	41	206
		NEBT	600	584	-2.7%	0.7	25.1	C	41	206
		NEBR	28	30	7.1%	0.4	18.6	B	59	235
		NWBT	111	175	57.7%	5.4	23.4	C	30	239
		NWBR	65	74	13.8%	1.1	34.0	C	44	266
		SEBL	15	15	0.0%	0.0	35.2	D	31	194
		SEBT	148	182	23.0%	2.6	16.4	B	31	194
	<b>Total</b>	<b>972</b>	<b>1,064</b>	<b>9.5%</b>	<b>2.9</b>	<b>23.8</b>	<b>C</b>	<b>-</b>	<b>-</b>	
44	4th Avenue/Spring Street	NEBL	200	196	-2.0%	0.3	46.7	D	168	368
		NEBT	530	523	-1.3%	0.3	48.2	D	160	359
		NWBT	1,216	1,192	-2.0%	0.7	8.2	A	38	253
		NWBR	92	89	-3.3%	0.3	28.9	C	48	271
		<b>Total</b>	<b>2,038</b>	<b>2,060</b>	<b>1.1%</b>	<b>0.5</b>	<b>23.2</b>	<b>C</b>	<b>-</b>	<b>-</b>
45	5th Avenue/Spring Street	NEBT	605	588	-2.8%	0.7	54.5	D	131	327
		NEBR	55	53	-3.6%	0.3	64.1	E	141	339
		SEBL	527	449	-14.8%	3.5	206.1	F	1,028	1,425
		SEBT	919	795	-13.5%	4.2	135.1	F	1,028	1,425
	<b>Total</b>	<b>2,106</b>	<b>1,885</b>	<b>-10.5%</b>	<b>4.9</b>	<b>124.5</b>	<b>F</b>	<b>-</b>	<b>-</b>	
46	6th Avenue/Spring Street/I-5 On-Ramp	NEBL	192	174	-9.4%	1.3	8.2	A	109	362
		NEBT	189	167	-11.6%	1.6	9.5	A	119	360
		NEBR	750	696	-7.2%	2.0	23.2	C	119	360
		NWBT	335	349	4.2%	0.8	33.6	C	142	318
		NWBR	10	9	-10.0%	0.3	44.4	D	168	348
		NWBHR	610	603	-1.1%	0.3	44.7	D	144	321
	<b>Total</b>	<b>2,086</b>	<b>1,998</b>	<b>-4.2%</b>	<b>1.9</b>	<b>29.1</b>	<b>C</b>	<b>-</b>	<b>-</b>	
47	7th Avenue/Spring Street/Hubbell Place	NEBL	42	41	-2.4%	0.2	19.6	B	11	135
		NEBT	137	119	-13.1%	1.6	14.1	B	11	135
		NEBR	19	17	-10.5%	0.5	11.6	B	13	145
		NWBT	256	219	-14.5%	2.4	9.4	A	12	200
		NWBR	23	20	-13.0%	0.6	13.8	B	12	206
		SEBL	6	6	0.0%	0.0	32.3	C	60	363
		SEBT	328	324	-1.2%	0.2	25.1	C	60	363
	<b>Total</b>	<b>811</b>	<b>746</b>	<b>-8.0%</b>	<b>2.3</b>	<b>17.9</b>	<b>B</b>	<b>-</b>	<b>-</b>	
48	8th Avenue/Spring Street	NEBL	67	50	-25.4%	2.2	15.2	B	12	111
		NEBT	113	80	-29.2%	3.4	13.6	B	12	112
		NEBR	18	13	-27.8%	1.3	36.6	D	12	112
		NWBT	143	156	9.1%	1.1	1.7	A	2	116
		NWBR	19	19	0.0%	0.0	3.2	A	0	51
		SEBL	37	40	8.1%	0.5	14.0	B	21	206
		SEBT	178	173	-2.8%	0.4	18.9	B	21	206
	<b>Total</b>	<b>575</b>	<b>532</b>	<b>-7.5%</b>	<b>1.8</b>	<b>12.4</b>	<b>B</b>	<b>-</b>	<b>-</b>	
49	9th Avenue/Spring Street	NEBL	47	34	-27.7%	2.0	9.9	A	5	72
		NEBT	70	61	-12.9%	1.1	9.8	A	5	70
		NEBR	62	44	-29.0%	2.5	8.9	A	5	69
		NWBT	145	144	-0.7%	0.1	3.0	A	2	100
		NWBR	9	9	0.0%	0.0	1.6	A	1	99
		SEBL	8	8	0.0%	0.0	2.3	A	0	34
		SEBT	126	125	-0.8%	0.1	1.8	A	0	38
		SWBL	10	11	10.0%	0.3	10.1	B	1	59
		SWBR	30	33	10.0%	0.5	8.9	A	1	60
	<b>Total</b>	<b>507</b>	<b>470</b>	<b>-7.3%</b>	<b>1.7</b>	<b>5.2</b>	<b>A</b>	<b>-</b>	<b>-</b>	
22	Madison/13th	SBL	9	8	-11.1%	0.3	26.7	C	4	55
		SBR	23	22	-4.3%	0.2	25.5	C	4	55
		NBL	122	129	5.7%	0.6	27.3	C	18	139
		NBT	42	42	0.0%	0.0	30.0	C	18	139
		NBR	9	9	0.0%	0.0	15.7	B	24	151
		NEBL	25	27	8.0%	0.4	17.3	B	22	196
		NEBT	707	727	2.8%	0.7	9.7	A	22	196
		SWBT	447	503	12.5%	2.6	10.7	B	17	235
		SWBR	4	5	25.0%	0.5	10.9	B	18	241
	<b>Total</b>	<b>1,388</b>	<b>1,472</b>	<b>6.1%</b>	<b>2.2</b>	<b>12.7</b>	<b>B</b>	<b>17</b>	<b>244</b>	
23	Madison/14th	SBL	2	2	0.0%	0.0	5.7	A	21	150
		SBT	169	175	3.6%	0.5	6.9	A	10	111
		SBR	12	13	8.3%	0.3	1.1	A	12	120
		NBL	14	15	7.1%	0.3	22.9	C	27	227
		NBT	215	206	-4.2%	0.6	22.6	C	27	227
		NBR	53	51	-3.8%	0.3	19.1	B	29	231
		NEBL	0	0			0.0	A	69	331
		NEBT	672	685	1.9%	0.5	24.9	C	63	327
		NEBR	51	57	11.8%	0.8	26.4	C	65	324
		SWBL	58	66	13.8%	1.0	21.7	C	17	184
		SWBT	459	477	3.9%	0.8	3.2	A	17	184
		SWBR	0	0			0.0	A	17	186
	<b>Total</b>	<b>1,705</b>	<b>1,747</b>	<b>2.5%</b>	<b>1.0</b>	<b>16.4</b>	<b>B</b>	<b>33</b>	<b>336</b>	

**Madison BRT Design**

**Volume Calibration Summary - Existing PM Peak Hour Conditions**

*FHWA Calibration Criteria - GEH Statistic less than 5 for individual link flows for at least 85% of cases*

#	Intersection	Movement	Peak Hour Volumes (vph)		Calibration Results		Intersection Operations - 2015 PM Conditions			
			Field Count	Vissim Output	% Volume Difference	GEH Value	All Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
24	Madison/Pike	EBL	25	25	0.0%	0.0	33.3	C	4	110
		EBT	4	4	0.0%	0.0	35.5	D	4	110
		NEBT	708	719	1.6%	0.4	4.9	A	11	125
		NEBR	19	19	0.0%	0.0	3.2	A	11	125
		SWBL	1	1	0.0%	0.0	11.2	B	39	269
		SWBT	537	544	1.3%	0.3	21.3	C	39	269
		SWBR	36	36	0.0%	0.0	18.1	B	39	269
		<b>Total</b>	<b>1,330</b>	<b>1,348</b>	<b>1.4%</b>	<b>0.5</b>	<b>12.5</b>	<b>B</b>	<b>18</b>	<b>269</b>
25	Madison/15th	SBR	125	130	4.0%	0.4	10.5	B	8	122
		NEBL	63	65	3.2%	0.3	6.8	A	3	208
		NEBT	670	678	1.2%	0.3	1.4	A	3	208
		SWBT	479	452	-5.6%	1.3	0.7	A	0	47
		SWBR	13	11	-15.4%	0.6	1.4	A	0	52
		<b>Total</b>	<b>1,350</b>	<b>1,336</b>	<b>-1.0%</b>	<b>0.4</b>	<b>2.3</b>	<b>A</b>	<b>3</b>	<b>208</b>
26	Madison/16th	NBL	5	6	20.0%	0.4	14.2	B	1	45
		NBR	15	15	0.0%	0.0	7.6	A	0	14
		NEBT	670	673	0.4%	0.1	6.6	A	9	223
		NEBR	5	5	0.0%	0.0	8.7	A	9	223
		SWBT	493	458	-7.1%	1.6	0.0	A	0	95
		<b>Total</b>	<b>1,188</b>	<b>1,157</b>	<b>-2.6%</b>	<b>0.9</b>	<b>4.1</b>	<b>A</b>	<b>3</b>	<b>223</b>
		27	Madison/Pine	SEBL	230	222	-3.5%	0.5	53.2	D
SEBR	5			6	20.0%	0.4	38.6	D	74	317
NEBL	16			18	12.5%	0.5	4.2	A	7	70
NEBT	669			670	0.1%	0.0	1.1	A	7	70
SWBT	488			453	-7.2%	1.6	1.8	A	3	108
SWBR	197			185	-6.1%	0.9	4.4	A	6	128
<b>Total</b>	<b>1,605</b>			<b>1,553</b>	<b>-3.2%</b>	<b>1.3</b>	<b>9.3</b>	<b>A</b>	<b>22</b>	<b>317</b>
28	Madison/17th			SBL	57	58	1.8%	0.1	71.6	E
		SBT	51	45	-11.8%	0.9	73.2	E	68	268
		SBR	56	58	3.6%	0.3	58.7	E	69	270
		NBL	47	46	-2.1%	0.1	44.0	D	21	151
		NBT	32	26	-18.8%	1.1	42.9	D	21	151
		NBR	11	10	-9.1%	0.3	35.1	D	23	155
		NEBL	76	75	-1.3%	0.1	20.8	C	46	303
		NEBT	800	777	-2.9%	0.8	13.1	B	46	303
		NEBR	41	38	-7.3%	0.5	14.3	B	46	303
		SWBL	16	14	-12.5%	0.5	12.3	B	14	221
		SWBT	577	535	-7.3%	1.8	8.0	A	14	221
		SWBR	50	46	-8.0%	0.6	8.1	A	16	229
		<b>Total</b>	<b>1,814</b>	<b>1,728</b>	<b>-4.7%</b>	<b>2.0</b>	<b>18.4</b>	<b>B</b>	<b>37</b>	<b>318</b>
29	Madison/18th	SBL	4	5	25.0%	0.5	11.7	B	1	55
		SBT	2	2	0.0%	0.0	14.4	B	1	59
		SBR	19	19	0.0%	0.0	7.8	A	1	64
		NBL	9	7	-22.2%	0.7	13.7	B	1	38
		NBT	2	2	0.0%	0.0	10.9	B	1	41
		NBR	5	6	20.0%	0.4	8.7	A	1	43
		NEBL	14	16	14.3%	0.5	3.8	A	1	115
		NEBT	882	860	-2.5%	0.7	1.0	A	0	73
		NEBR	40	35	-12.5%	0.8	1.3	A	0	73
		SWBL	2	1	-50.0%	0.8	8.2	A	0	23
		SWBT	615	569	-7.5%	1.9	1.1	A	0	11
		SWBR	3	3	0.0%	0.0	0.9	A	0	11
		<b>Total</b>	<b>1,597</b>	<b>1,526</b>	<b>-4.4%</b>	<b>1.8</b>	<b>1.3</b>	<b>A</b>	<b>1</b>	<b>129</b>
30	Madison/19th	SBL	23	23	0.0%	0.0	23.6	C	38	261
		SBT	113	105	-7.1%	0.8	39.7	D	35	256
		SBR	54	61	13.0%	0.9	24.7	C	37	260
		NBL	23	22	-4.3%	0.2	37.5	D	33	214
		NBT	137	140	2.2%	0.3	36.4	D	33	214
		NBR	19	18	-5.3%	0.2	28.5	C	34	217
		NEBL	108	109	0.9%	0.1	17.1	B	31	282
		NEBT	751	736	-2.0%	0.6	10.5	B	31	282
		NEBR	32	27	-15.6%	0.9	8.7	A	32	283
		SWBL	3	4	33.3%	0.5	19.6	B	15	172
		SWBT	543	491	-9.6%	2.3	10.2	B	15	172
		SWBR	21	16	-23.8%	1.2	7.5	A	16	176
		<b>Total</b>	<b>1,827</b>	<b>1,752</b>	<b>-4.1%</b>	<b>1.8</b>	<b>15.8</b>	<b>B</b>	<b>30</b>	<b>293</b>
31	Madison/20th/Olive	SBHL	1	1	0.0%	0.0	66.9	E	1	42
		SBBL	2	1	-50.0%	0.8	51.7	D	1	42
		SBT	2	2	0.0%	0.0	53.1	D	1	42
		SBR	14	15	7.1%	0.3	10.6	B	2	44
		NBHR	22	28	27.3%	1.2	0.8	A	0	25
		WBBL	85	81	-4.7%	0.4	46.3	D	20	172
		WBBR	4	4	0.0%	0.0	46.0	D	20	172
		WBHR	3	2	-33.3%	0.6	12.8	B	24	179
		NEBL	9	10	11.1%	0.3	9.8	A	15	289
		NEBT	707	690	-2.4%	0.6	6.2	A	15	289
		NEBBR	121	122	0.8%	0.1	5.2	A	15	289
		NEBHR	10	10	0.0%	0.0	5.5	A	15	289
		SWBHL	0	0			0.0	A	10	124
		SWBBL	4	2	-50.0%	1.2	33.1	C	10	124
		SWBT	500	415	-17.0%	4.0	7.1	A	10	124
		SWBR	6	5	-16.7%	0.4	3.8	A	10	125
		<b>Total</b>	<b>1,490</b>	<b>1,388</b>	<b>-6.8%</b>	<b>2.7</b>	<b>9.0</b>	<b>A</b>	<b>11</b>	<b>289</b>

**Madison BRT Design**

**Volume Calibration Summary - Existing PM Peak Hour Conditions**

*FHWA Calibration Criteria - GEH Statistic less than 5 for individual link flows for at least 85% of cases*

#	Intersection	Movement	Peak Hour Volumes (vph)		Calibration Results		Intersection Operations - 2015 PM Conditions			
			Field Count	Vissim Output	% Volume Difference	GEH Value	All Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
32	Madison/Denny/22nd NB	SEBL	10	9	-10.0%	0.3	38.0	D	7	92
		SEBT	25	24	-4.0%	0.2	38.4	D	7	92
		SEBR	1	1	0.0%	0.0	10.3	B	8	94
		NWBL	22	19	-13.6%	0.7	40.3	D	9	103
		NWBT	20	16	-20.0%	0.9	37.2	D	9	103
		NWBR	26	26	0.0%	0.0	16.0	B	9	104
		NEBL	3	2	-33.3%	0.6	8.6	A	0	55
		NEBT	702	655	-6.7%	1.8	0.7	A	0	55
		NEBR	37	32	-13.5%	0.9	1.7	A	0	55
		SWBL	18	15	-16.7%	0.7	7.6	A	3	135
		SWBT	483	399	-17.4%	4.0	0.7	A	3	135
SWBR	19	14	-26.3%	1.2	3.7	A	3	134		
	<b>Total</b>	<b>1,366</b>	<b>1,211</b>	<b>-11.3%</b>	<b>4.3</b>	<b>3.3</b>	<b>A</b>	<b>6</b>	<b>137</b>	
33	Madison/22nd SB	SBL	0	0			0.0	A	0	30
		SBR	12	13	8.3%	0.3	6.9	A	1	38
		NEBL	24	25	4.2%	0.2	6.0	A	3	167
		NEBT	714	666	-6.7%	1.8	3.8	A	5	210
		SWBT	489	415	-15.1%	3.5	0.4	A	0	0
		SWBR	10	9	-10.0%	0.3	0.5	A	0	0
		<b>Total</b>	<b>1,249</b>	<b>1,127</b>	<b>-9.8%</b>	<b>3.5</b>	<b>2.6</b>	<b>A</b>	<b>2</b>	<b>219</b>
34	Madison/23rd	SBT	624	643	3.0%	0.8	21.0	C	47	182
		SBR	114	113	-0.9%	0.1	16.2	B	53	193
		NBT	575	574	-0.2%	0.0	20.7	C	38	206
		NBR	33	31	-6.1%	0.4	19.1	B	44	217
		NEBL	190	171	-10.0%	1.4	53.4	D	121	362
		NEBT	529	465	-12.1%	2.9	36.4	D	121	362
		NEBR	33	28	-15.2%	0.9	38.1	D	121	362
		SWBL	59	48	-18.6%	1.5	51.5	D	38	177
		SWBT	350	310	-11.4%	2.2	27.8	C	38	177
		SWBR	11	11	0.0%	0.0	32.4	C	36	174
<b>Total</b>	<b>2,518</b>	<b>2,394</b>	<b>-4.9%</b>	<b>2.5</b>	<b>27.8</b>	<b>C</b>	<b>54</b>	<b>362</b>		
35	Madison/E John/24th	SBR	13	15	15.4%	0.5	11.5	B	1	48
		NBHL	9	7	-22.2%	0.7	15.2	B	5	100
		NBBL	14	12	-14.3%	0.6	41.9	D	9	107
		NBT	2	3	50.0%	0.6	38.9	D	9	107
		NBBR	46	46	0.0%	0.0	30.9	C	9	107
		NBHR	6	4	-33.3%	0.9	15.3	B	9	107
		EBHL	2	2	0.0%	0.0	42.3	D	69	325
		EBBL	135	143	5.9%	0.7	43.8	D	69	325
		EBT	140	137	-2.1%	0.3	41.1	D	69	325
		EBBR	10	12	20.0%	0.6	26.0	C	69	325
		EBHR	0	0			0.0	A	69	325
		WBHL	0	0			0.0	A	28	163
		WBBL	0	0			0.0	A	28	163
		WBT	127	120	-5.5%	0.6	43.1	D	28	163
		WBBR	3	6	100.0%	1.4	40.4	D	28	163
		WBHR	3	2	-33.3%	0.6	45.2	D	28	163
		NEBHL	0	0			0.0	A	39	441
		NEBBL	6	7	16.7%	0.4	17.7	B	39	441
		NEBT	401	401	0.0%	0.0	10.4	B	39	441
		NEBBR	0	0			0.0	A	40	444
		NEBHR	0	0			0.0	A	15	371
		SWBHL	3	4	33.3%	0.5	12.4	B	63	412
		SWBBL	52	53	1.9%	0.1	31.5	C	61	408
SWBT	293	301	2.7%	0.5	20.0	B	61	408		
SWBBR	202	207	2.5%	0.3	26.0	C	61	408		
SWBHR	4	4	0.0%	0.0	17.1	B	61	408		
<b>Total</b>	<b>1,471</b>	<b>1,485</b>	<b>1.0%</b>	<b>0.4</b>	<b>25.3</b>	<b>C</b>	<b>33</b>	<b>472</b>		
36	Madison/25th	SBL	15	19	26.7%	1.0	17.6	B	4	72
		SBT	26	22	-15.4%	0.8	19.7	B	4	75
		SBR	10	14	40.0%	1.2	18.8	B	5	84
		NBL	5	5	0.0%	0.0	19.0	B	2	51
		NBT	21	25	19.0%	0.8	18.6	B	3	54
		NBR	14	13	-7.1%	0.3	13.9	B	3	68
		NEBL	25	22	-12.0%	0.6	11.2	B	8	305
		NEBT	511	521	2.0%	0.4	3.1	A	6	281
		NEBR	10	9	-10.0%	0.3	2.4	A	6	281
		SWBL	10	9	-10.0%	0.3	8.0	A	9	336
		SWBT	490	503	2.7%	0.6	4.6	A	8	312
		SWBR	13	13	0.0%	0.0	3.3	A	8	312
		<b>Total</b>	<b>1,150</b>	<b>1,176</b>	<b>2.3%</b>	<b>0.8</b>	<b>5.2</b>	<b>A</b>	<b>5</b>	<b>336</b>
37	Madison/26th	SEBL	2	2	0.0%	0.0	20.3	C	1	37
		SEBR	14	14	0.0%	0.0	9.7	A	1	46
		NEBL	20	18	-10.0%	0.5	7.4	A	4	236
		NEBT	503	536	6.6%	1.4	2.4	A	3	208
		SWBT	507	513	1.2%	0.3	1.3	A	0	28
		SWBR	3	2	-33.3%	0.6	3.8	A	0	28
		<b>Total</b>	<b>1,049</b>	<b>1,085</b>	<b>3.4%</b>	<b>1.1</b>	<b>2.1</b>	<b>A</b>	<b>2</b>	<b>236</b>
38	Madison/27th NB	NWBL	7	7	0.0%	0.0	11.1	B	1	49
		NWBR	24	23	-4.2%	0.2	10.8	B	1	49
		NEBT	451	490	8.6%	1.8	4.3	A	10	256
		NEBR	43	47	9.3%	0.6	3.7	A	10	256
		SWBL	8	8	0.0%	0.0	10.2	B	1	110
		SWBT	492	508	3.3%	0.7	0.3	A	1	98
<b>Total</b>	<b>1,025</b>	<b>1,083</b>	<b>5.7%</b>	<b>1.8</b>	<b>2.6</b>	<b>A</b>	<b>3</b>	<b>256</b>		

**Madison BRT Design**

**Volume Calibration Summary - Existing PM Peak Hour Conditions**

*FHWA Calibration Criteria - GEH Statistic less than 5 for individual link flows for at least 85% of cases*

#	Intersection	Movement	Peak Hour Volumes (vph)		Calibration Results		Intersection Operations - 2015 PM Conditions			
			Field Count	Vissim Output	% Volume Difference	GEH Value	All Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
39	Madison/27th SB	SEBL	2	2	0.0%	0.0	9.0	A	0	36
		SEBR	21	20	-4.8%	0.2	8.6	A	1	55
		NEBL	16	16	0.0%	0.0	13.3	B	5	99
		NEBT	459	497	8.3%	1.7	1.3	A	4	82
		SWBT	479	496	3.5%	0.8	1.6	A	0	102
		SWBR	10	8	-20.0%	0.7	0.9	A	0	102
		<b>Total</b>	<b>987</b>	<b>1,039</b>	<b>5.3%</b>	<b>1.6</b>	<b>1.8</b>	<b>A</b>	<b>2</b>	<b>141</b>
40	Madison/MLK Jr	SBL	56	61	8.9%	0.7	35.3	D	52	333
		SBT	210	204	-2.9%	0.4	32.1	C	52	333
		SBR	11	11	0.0%	0.0	31.9	C	52	333
		NBL	132	144	9.1%	1.0	59.3	E	179	599
		NBT	98	100	2.0%	0.2	57.3	E	179	599
		NBR	183	185	1.1%	0.1	54.7	D	179	599
		NEBL	8	12	50.0%	1.3	37.3	D	37	284
		NEBT	394	418	6.1%	1.2	14.1	B	37	284
		NEBR	54	68	25.9%	1.8	11.6	B	38	288
		SWBL	121	119	-1.7%	0.2	35.6	D	47	402
		SWBT	353	350	-0.8%	0.2	19.1	B	47	402
		SWBR	21	20	-4.8%	0.2	15.6	B	48	404
		<b>Total</b>	<b>1,641</b>	<b>1,691</b>	<b>3.0%</b>	<b>1.2</b>	<b>30.7</b>	<b>C</b>	<b>67</b>	<b>601</b>
50	Pike/14th	SBL	4	4	0.0%	0.0	17.7	B	9	103
		SBT	98	102	4.1%	0.4	16.8	B	9	103
		SBR	10	10	0.0%	0.0	11.6	B	9	105
		NBL	140	141	0.7%	0.1	3.8	A	4	115
		NBT	69	65	-5.8%	0.5	2.2	A	4	115
		EBL	5	3	-40.0%	1.0	21.5	C	5	93
		EBT	25	26	4.0%	0.2	22.7	C	5	93
		EBR	85	87	2.4%	0.2	15.6	B	6	96
		WBT	31	30	-3.2%	0.2	4.3	A	1	29
		WBR	5	5	0.0%	0.0	3.5	A	1	30
		<b>Total</b>	<b>472</b>	<b>472</b>	<b>0.0%</b>	<b>0.0</b>	<b>10.0</b>	<b>B</b>	<b>5</b>	<b>119</b>
Percent cases with GEH statistic < 5						100%				
<b>FHWA Calibration Criteria</b>						<b>Met</b>				

## Madison BRT

### Travel Time Calibration Summary - Existing PM Peak Hour Conditions

*FHWA Calibration Criteria - Travel time difference acceptable if within 15% (or 1 minute, if higher) for at least 85% of cases*

#	Segment	Direction	Travel Time (seconds)		Calibration Results		Travel Speed (mph)
			Field Value	Vissim Output	Travel Time Difference (s)	Travel Time Difference (%)	
1	Spring Street (from 1st Avenue to 9th Avenue)	Northeastbound	298	268	-30	-10%	6
2	Madison Street (from 6th Avenue to 23rd Avenue)	Northeastbound	414	382	-32	-8%	14
3	Madison Street (from 23rd Avenue to MLK Way)	Northeastbound	129	126	-3	-2%	14
4	Madison Street (from 6th Avenue to MLK Way)	Northeastbound	543	508	-35	-6%	14
5	Madison Street (from MLK Way to 23rd Avenue)	Southwestbound	120	136	16	13%	13
6	Madison Street (from 23rd Avenue to 6th Avenue)	Southwestbound	456	412	-44	-10%	13
7	Madison Street (from 6th Avenue to 1st Avenue)	Southwestbound	128	169	41	32%	6
8	Madison Street (from MLK Way to 1st Avenue)	Southwestbound	704	717	13	2%	12
Percent cases with travel time with 15% (or 1 minute, if higher)					88%		
<b>FHWA Calibration Criteria</b>					<b>Met</b>		

## VISSIM OUTPUT SUMMARIES

---

**Madison BRT Design**  
**Intersection Operations Summary - PM Peak Hour Conditions**

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build				
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
1	1st Avenue/Madison Street	SWBL	61	19.2	B	13	106	61	64.9	E	77	245	65	9.9	A	24	152
		SWBT	195	9.1	A	13	106	193	57.9	E	77	245	250	7.9	A	24	152
		SWBR	123	8.0	A	13	110	120	50.9	D	83	252	12	28.2	C	3	63
		NWBL	23	16.7	B	13	155	23	41.2	D	45	244	41	43.1	D	30	238
		NWBT	522	9.2	A	13	155	519	14.4	B	45	244	314	16.2	B	30	238
		SEBT	520	4.3	A	9	167	519	7.7	A	23	250	246	22.0	C	46	301
		SEBR	122	5.6	A	10	169	122	6.9	A	24	253	106	18.1	B	48	304
		<b>Total</b>	<b>1,566</b>	<b>7.7</b>	<b>A</b>	-	-	<b>1,579</b>	<b>22.2</b>	<b>C</b>	-	-	<b>1,128</b>	<b>17.8</b>	<b>B</b>	-	-
2	2nd Avenue/Madison Street	SWBL	160	60.0	E	103	341	158	59.0	E	103	327	154	107.8	F	178	364
		SWBT	327	50.8	D	103	341	324	51.4	D	103	327	298	82.9	F	178	364
		SEBT	1,237	2.7	A	9	147	1,236	2.7	A	12	204	1,449	7.9	A	56	342
		SEBR	54	5.5	A	10	155	55	9.1	A	13	212	101	10.4	B	59	350
		<b>Total</b>	<b>1,844</b>	<b>14.4</b>	<b>B</b>	-	-	<b>1,839</b>	<b>14.6</b>	<b>B</b>	-	-	<b>2,066</b>	<b>23.0</b>	<b>C</b>	-	-
3	3rd Avenue/Madison Street	SWBT	429	20.0	C	32	223	426	22.0	C	33	230	350	19.7	B	10	94
		SWBR	56	17.1	B	36	230	56	16.7	B	37	237	9	6.1	A	8	101
		NWBT	192	11.0	B	21	199	192	11.0	B	21	199	67	29.1	C	29	215
		SEBT	155	23.8	C	25	194	155	25.5	C	28	195	27	78.1	E	93	276
		SEBR	57	26.5	C	27	198	57	34.4	C	31	200	68	124.7	F	97	280
		<b>Total</b>	<b>889</b>	<b>19.0</b>	<b>B</b>	-	-	<b>886</b>	<b>20.7</b>	<b>C</b>	-	-	<b>559</b>	<b>37.5</b>	<b>D</b>	-	-
4	4th Avenue/Madison Street	SWBT	365	4.3	A	18	238	363	5.2	A	22	257	217	17.6	B	51	255
		SWBR	187	17.5	B	20	241	186	20.6	C	25	260	318	33.0	C	56	262
		NWBL	121	12.2	B	28	234	121	12.4	B	30	226	142	39.4	D	94	265
		NWBT	1,091	9.5	A	24	224	1,092	10.5	B	26	215	958	31.3	C	86	255
		<b>Total</b>	<b>1,823</b>	<b>9.9</b>	<b>A</b>	-	-	<b>1,820</b>	<b>11.0</b>	<b>B</b>	-	-	<b>1,694</b>	<b>30.6</b>	<b>C</b>	-	-
5	5th Avenue/Madison Street	SWBL	286	34.4	C	116	327	285	35.5	D	120	334	204	6.5	A	11	186
		SWBT	464	35.4	D	115	324	464	36.4	D	118	331	450	6.8	A	10	181
		SEBT	772	1.9	A	5	113	757	2.0	A	5	84	340	16.7	B	22	211
		SEBR	88	3.8	A	4	104	85	5.6	A	5	87	86	20.2	C	23	216
		<b>Total</b>	<b>1,610</b>	<b>17.5</b>	<b>B</b>	-	-	<b>1,592</b>	<b>18.3</b>	<b>B</b>	-	-	<b>1,079</b>	<b>11.2</b>	<b>B</b>	-	-
6	6th Avenue/Madison Street	SWBT	736	28.3	C	132	363	737	31.0	C	146	359	619	38.0	D	176	346
		SWBR	795	28.5	C	132	362	795	32.3	C	146	358	605	55.1	E	176	346
		NWBL	22	58.8	E	157	587	22	73.6	E	207	648	35	29.7	C	33	242
		NWBT	162	67.4	E	144	571	161	84.3	F	194	632	157	25.3	C	33	242
		NWBR	178	56.8	E	144	571	178	75.0	E	194	632	193	18.3	B	33	242
		<b>Total</b>	<b>1,893</b>	<b>34.8</b>	<b>C</b>	-	-	<b>1,892</b>	<b>41.1</b>	<b>D</b>	-	-	<b>1,608</b>	<b>41.0</b>	<b>D</b>	-	-
7	7th Avenue/Madison Street	NEBL	2	31.0	C	6	156	3	36.8	D	7	191	-	-	-	-	-
		NEBT	175	8.7	A	6	156	175	9.2	A	7	191	192	23.3	C	30	223
		SWBT	772	38.5	D	85	329	786	43.6	D	99	340	666	33.6	C	58	291
		SWBR	3	51.7	D	85	329	4	58.2	E	99	340	1	95.9	F	58	291
		NWBL	436	95.5	F	489	960	423	106.1	F	516	960	341	89.7	F	251	334
		NWBT	227	96.8	F	489	960	221	109.5	F	516	960	233	96.7	F	251	334
		NWBR	366	88.6	F	489	960	351	96.9	F	515	960	118	79.8	E	250	333
		SEBL	5	31.1	C	74	337	5	41.2	D	85	338	4	78.1	E	77	334
		SEBR	332	29.1	C	74	337	332	33.9	C	86	338	214	41.1	D	69	315
		<b>Total</b>	<b>2,320</b>	<b>59.0</b>	<b>E</b>	-	-	<b>2,300</b>	<b>64.9</b>	<b>E</b>	-	-	<b>1,768</b>	<b>55.2</b>	<b>E</b>	-	-

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build					
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	
8	8th Avenue/Madison Street	NEBL	45	20.8	C	7	90	43	18.4	B	6	82	-	-	-	-	-	
		NEBT	491	3.8	A	7	90	477	3.3	A	6	82	313	26.3	C	54	261	
		NEBR	17	3.5	A	6	90	17	2.4	A	5	82	7	17.5	B	55	264	
		SWBL	50	16.3	B	43	335	50	17.7	B	61	306	-	-	-	-	-	
		SWBT	714	16.3	B	43	335	725	22.2	C	61	306	616	17.7	B	35	236	
		SWBR	14	16.2	B	43	337	14	19.4	B	61	308	12	20.2	C	37	238	
		NWBL	29	81.1	F	100	276	29	85.5	F	105	276	8	36.7	D	48	276	
		NWBT	117	81.3	F	100	276	116	83.9	F	105	276	206	33.2	C	48	276	
		NWBR	52	68.9	E	101	276	52	76.2	E	105	277	29	33.4	C	48	275	
		SEBL	30	95.2	F	115	317	29	99.3	F	121	319	9	34.8	C	28	242	
		SEBT	57	96.1	F	115	317	57	99.5	F	121	319	139	25.7	C	28	242	
SEBR	94	79.3	E	115	317	95	85.5	F	122	319	44	23.4	C	29	246			
	<b>Total</b>	<b>1,708</b>	<b>27.3</b>	<b>C</b>	-	-	<b>1,703</b>	<b>30.9</b>	<b>C</b>	-	-	<b>1,382</b>	<b>23.6</b>	<b>C</b>	-	-		
9	9th Avenue/Madison Street	NEBL	14	19.2	B	9	96	13	18.7	B	9	96	-	-	-	-	-	
		NEBT	548	5.2	A	9	96	535	5.2	A	9	96	331	27.5	C	70	339	
		NEBR	10	4.5	A	10	100	10	4.9	A	10	100	19	32.9	C	72	344	
		SWBL	70	14.9	B	19	258	71	14.9	B	31	243	-	-	-	-	-	
		SWBT	715	7.6	A	19	258	724	12.3	B	31	243	618	8.9	A	30	294	
		SWBR	34	6.1	A	18	258	34	11.0	B	30	243	9	6.8	A	31	297	
		NWBL	24	35.2	D	30	208	24	37.3	D	30	201	6	39.6	D	13	118	
		NWBT	107	32.5	C	30	208	107	33.2	C	30	201	60	33.8	C	13	118	
		NWBR	49	21.5	C	30	209	49	21.5	C	31	201	7	18.1	B	13	119	
		SEBL	45	33.4	C	30	203	45	36.2	D	36	245	39	42.8	D	115	327	
		SEBT	85	32.5	C	30	203	85	37.4	D	36	245	385	35.9	D	115	326	
		SEBR	50	23.1	C	37	216	50	28.9	C	43	257	5	28.4	C	128	342	
			<b>Total</b>	<b>1,751</b>	<b>11.8</b>	<b>B</b>	-	-	<b>1,746</b>	<b>14.4</b>	<b>B</b>	-	-	<b>1,483</b>	<b>23.0</b>	<b>C</b>	-	-
		10	10 Terry Avenue/Madison Street	NEBL	26	19.7	B	12	112	25	22.5	C	12	97	-	-	-	-
NEBT	604			7.1	A	12	112	592	7.1	A	12	97	367	27.9	C	58	287	
NEBR	13			6.0	A	12	112	12	7.8	A	12	98	9	21.2	C	61	295	
SWBL	23			11.2	B	8	133	23	13.7	B	13	176	-	-	-	-	-	
SWBT	740			4.0	A	8	133	746	5.7	A	13	176	445	3.6	A	8	146	
SWBR	20			3.4	A	9	138	21	5.2	A	14	181	11	4.5	A	8	146	
NWBL	18			30.0	C	6	83	18	30.1	C	6	83	-	-	-	-	-	
NWBT	18			27.2	C	6	83	18	27.2	C	6	83	-	-	-	-	-	
NWBR	22			10.6	B	6	83	22	10.9	B	6	83	17	278.7	F	31	96	
SEBL	13			33.7	C	5	81	13	36.8	D	5	81	-	-	-	-	-	
SEBT	13			24.6	C	5	81	13	24.9	C	5	81	-	-	-	-	-	
SEBR	19			12.1	B	5	81	19	13.2	B	5	81	141	14.4	B	9	117	
	<b>Total</b>			<b>1,529</b>	<b>6.8</b>	<b>A</b>	-	-	<b>1,522</b>	<b>7.8</b>	<b>A</b>	-	-	<b>989</b>	<b>17.5</b>	<b>B</b>	-	-
11	11 Boren Avenue/Madison Street	NEBL	63	58.9	E	56	252	62	58.0	E	53	225	5	90.7	F	128	345	
		NEBT	556	25.9	C	56	252	544	24.9	C	53	225	372	38.8	D	128	345	
		NEBR	21	24.5	C	54	252	20	21.3	C	51	224	3	53.1	D	140	363	
		SWBL	53	64.2	E	86	333	53	66.5	E	96	336	27	67.4	E	54	290	
		SWBT	595	32.3	C	86	333	601	35.3	D	96	336	405	20.7	C	54	290	
		SWBR	71	33.1	C	86	333	72	37.9	D	96	336	11	15.5	B	54	290	
		NWBL	106	70.3	E	78	296	106	71.2	E	80	329	19	48.1	D	51	265	
		NWBT	631	28.3	C	78	296	633	29.0	C	80	329	747	20.9	C	51	265	
		NWBR	36	28.6	C	78	296	36	27.9	C	80	329	1	18.8	B	53	268	
		SEBL	190	46.6	D	84	404	190	46.6	D	85	412	46	57.1	E	59	271	
		SEBT	651	24.7	C	84	404	652	25.0	C	85	412	810	18.8	B	59	271	
		SEBR	83	24.0	C	83	404	83	25.7	C	84	413	32	20.9	C	67	288	
			<b>Total</b>	<b>3,055</b>	<b>31.7</b>	<b>C</b>	-	-	<b>3,052</b>	<b>32.6</b>	<b>C</b>	-	-	<b>2,478</b>	<b>24.3</b>	<b>C</b>	-	-



#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build				
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
12	Minor Avenue/Madison Street	NEBL	25	8.3	A	3	69	25	9.2	A	3	82	-	-	-	-	-
		NEBT	731	2.4	A	3	69	720	2.3	A	3	82	405	31.6	C	78	356
		NEBR	25	2.5	A	3	68	25	3.1	A	3	81	14	28.6	C	78	356
		SWBL	17	19.7	B	22	218	18	20.4	C	29	277	-	-	-	-	-
		SWBT	630	12.8	B	22	218	635	15.3	B	29	277	388	17.9	B	39	302
		SWBR	11	10.7	B	22	218	11	16.0	B	29	277	4	17.1	B	40	303
		NWBL	48	72.7	E	75	283	48	59.9	E	62	263	7	45.3	D	19	187
		NWBT	78	70.9	E	75	283	78	62.7	E	62	263	146	22.7	C	19	187
		NWBR	57	54.7	D	78	287	57	43.8	D	65	267	2	38.1	D	15	186
		SEBL	15	33.7	C	12	131	15	35.2	D	13	131	0	77.1	E	44	230
		SEBT	34	33.4	C	12	131	34	35.0	D	13	131	237	27.4	C	44	230
SEBR	41	17.4	B	12	131	41	20.7	C	13	131	51	24.6	C	43	229		
	<b>Total</b>	<b>1,714</b>	<b>14.7</b>	<b>B</b>	-	-	<b>1,708</b>	<b>14.7</b>	<b>B</b>	-	-	<b>1,253</b>	<b>25.0</b>	<b>C</b>	-	-	
13	Summit Avenue/Madison Street	NEBL	25	17.0	B	19	252	24	16.7	B	18	247	-	-	-	-	-
		NEBT	766	8.6	A	19	252	755	8.4	A	18	247	395	48.7	D	149	352
		NEBR	12	5.8	A	19	252	12	8.9	A	18	247	11	49.7	D	150	353
		SWBL	4	13.9	B	6	129	4	19.4	B	8	153	-	-	-	-	-
		SWBT	587	3.0	A	6	129	592	3.8	A	8	153	310	12.2	B	23	243
		SWBR	10	3.8	A	7	133	10	3.1	A	9	157	36	9.1	A	24	245
		NWBL	39	30.9	C	10	120	39	31.1	C	10	120	14	34.8	C	8	99
		NWBT	12	26.7	C	10	120	12	27.8	C	10	120	24	25.7	C	8	99
		NWBR	20	14.1	B	10	120	20	14.1	B	10	120	53	15.2	B	8	99
		SEBL	14	36.2	D	3	64	14	35.8	D	4	62	7	28.5	C	6	87
		SEBT	1	26.9	C	3	64	1	32.9	C	4	62	29	23.9	C	6	87
		SEBR	34	10.0	B	4	64	34	10.2	B	4	62	67	10.4	B	6	87
			<b>Total</b>	<b>1,523</b>	<b>7.6</b>	<b>A</b>	-	-	<b>1,516</b>	<b>7.8</b>	<b>A</b>	-	-	<b>946</b>	<b>28.7</b>	<b>C</b>	-
14	Boylston Avenue/Madison Street	NEBL	19	9.4	A	7	176	19	11.9	B	7	177	-	-	-	-	-
		NEBT	750	4.9	A	7	176	742	4.5	A	7	177	450	34.0	C	102	322
		NEBR	27	4.4	A	8	179	27	3.8	A	7	181	3	29.6	C	103	324
		SWBL	7	12.7	B	1	62	6	11.0	B	1	49	-	-	-	-	-
		SWBT	532	0.6	A	1	62	536	0.7	A	1	49	309	6.8	A	10	165
		SWBR	16	1.2	A	1	62	16	1.1	A	1	49	5	6.3	A	10	167
		NWBL	44	37.8	D	25	150	44	36.6	D	24	151	7	32.7	C	32	201
		NWBT	60	34.6	C	25	150	60	33.7	C	24	151	163	32.2	C	32	201
		NWBR	36	24.9	C	25	150	36	24.4	C	24	150	10	31.8	C	30	199
		SEBL	17	34.9	C	5	87	17	34.8	C	5	87	72	71.0	E	46	221
		SEBT	11	23.1	C	5	87	11	22.9	C	5	87	35	59.8	E	46	221
		SEBR	23	12.3	B	5	87	23	12.2	B	5	87	29	46.5	D	47	221
	<b>Total</b>	<b>1,541</b>	<b>6.6</b>	<b>A</b>	-	-	<b>1,538</b>	<b>6.4</b>	<b>A</b>	-	-	<b>1,084</b>	<b>29.2</b>	<b>C</b>	-	-	
15	Broadway/Madison Street	NEBL	115	33.2	C	46	279	114	32.0	C	43	246	129	80.5	F	134	307
		NEBT	660	12.3	B	46	279	656	11.7	B	43	246	380	31.2	C	134	307
		NEBR	25	13.0	B	47	285	24	12.8	B	44	252	23	28.1	C	133	307
		SWBL	63	46.1	D	53	278	65	48.2	D	54	280	41	46.9	D	42	340
		SWBT	465	26.2	C	53	278	468	26.3	C	54	280	201	32.6	C	42	340
		SWBR	27	30.0	C	53	278	27	30.5	C	54	280	5	28.9	C	42	340
		NBT	317	23.5	C	55	327	318	23.4	C	55	336	186	20.7	C	39	238
		NBR	126	38.7	D	55	327	126	39.1	D	55	336	119	45.9	D	39	238
		SBT	253	30.8	C	56	377	254	30.8	C	56	381	219	35.4	D	71	404
		SBR	91	27.4	C	56	377	91	27.6	C	56	381	113	33.3	C	71	405
	<b>Total</b>	<b>2,142</b>	<b>23.8</b>	<b>C</b>	-	-	<b>2,142</b>	<b>23.7</b>	<b>C</b>	-	-	<b>1,416</b>	<b>35.9</b>	<b>D</b>	-	-	
19	11th Avenue/Madison Street	NEBT	770	15.3	B	27	340	766	14.6	B	26	348	495	31.2	C	89	576
		SWBT	533	1.6	A	3	58	542	1.6	A	2	60	141	5.8	A	4	81
		SBL	219	41.2	D	32	186	221	41.5	D	34	166	95	522.4	F	419	595
		SBR	14	24.4	C	32	186	14	30.4	C	34	166	89	351.9	F	419	595
		<b>Total</b>	<b>1,536</b>	<b>14.4</b>	<b>B</b>	-	-	<b>1,544</b>	<b>14.1</b>	<b>B</b>	-	-	<b>821</b>	<b>114.5</b>	<b>F</b>	-	-

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build				
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
20	12th Avenue/Madison Street	NEBHL	1	46.9	D	93	353	1	43.3	D	92	342	7	77.9	E	138	354
20		NEBBL	31	30.1	C	93	353	31	29.9	C	92	342	52	78.7	E	138	354
20		NEBT	845	24.2	C	93	353	844	24.6	C	92	342	446	35.5	D	138	354
20		NEBR	113	24.6	C	93	353	112	23.6	C	92	342	80	32.0	C	138	354
20		SWBL	35	48.4	D	44	352	36	48.9	D	47	333	-	-	-	-	-
20		SWBT	447	29.0	C	44	352	455	30.1	C	47	333	90	319.0	F	669	689
20		SWBBR	127	30.8	C	44	352	128	31.3	C	47	333	176	328.9	F	669	689
20		SWBHR	28	30.4	C	44	352	28	28.3	C	47	333	10	372.9	F	669	689
20		NBHL	27	63.9	E	117	510	28	56.9	E	113	508	25	58.8	E	92	462
20		NBBL	77	74.1	E	117	510	79	70.8	E	113	508	25	63.3	E	92	462
20		NBT	400	35.0	C	117	510	410	33.1	C	113	508	314	42.0	D	92	462
20		NBR	65	27.8	C	111	510	65	28.8	C	111	509	73	28.6	C	92	462
20		SBL	52	35.3	D	81	396	53	40.8	D	92	397	120	153.1	F	286	398
20		SBT	380	28.0	C	81	396	387	29.7	C	92	397	267	103.7	F	286	398
20		SBBR	58	28.8	C	81	396	59	31.9	C	92	397	25	106.9	F	286	398
20		SBHR	22	22.0	C	81	396	22	27.7	C	92	397	2	100.8	F	286	398
20		<b>Total</b>	<b>2,708</b>	<b>30.1</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>2,739</b>	<b>30.5</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>1,711</b>	<b>104.6</b>	<b>F</b>	<b>-</b>	<b>-</b>
41	1st Avenue/Spring Street	NEBL	55	27.0	C	25	190	55	30.5	C	32	186	86	41.0	D	39	225
		NEBT	208	26.2	C	25	190	208	32.9	C	32	186	214	34.7	C	39	225
		NEBR	43	21.3	C	39	215	42	27.1	C	49	209	17	29.4	C	57	250
		NWBT	568	3.6	A	7	79	565	8.4	A	30	310	296	24.6	C	66	326
		NWBR	76	4.8	A	8	84	75	9.7	A	31	314	100	22.3	C	70	333
		SEBL	86	13.8	B	19	180	86	54.2	D	76	309	80	39.9	D	27	233
		SEBT	595	8.4	A	19	180	595	15.5	B	76	309	335	9.4	A	27	233
	<b>Total</b>	<b>1,630</b>	<b>10.1</b>	<b>B</b>	<b>-</b>	<b>-</b>	<b>1,648</b>	<b>17.9</b>	<b>B</b>	<b>-</b>	<b>-</b>	<b>1,152</b>	<b>24.9</b>	<b>C</b>	<b>-</b>	<b>-</b>	
42	2nd Avenue/Spring Street	NEBT	347	31.0	C	50	238	346	28.6	C	45	260	335	35.1	D	55	255
42		NEBR	79	33.0	C	57	247	78	27.9	C	52	270	107	37.7	D	60	261
42		SEBL	205	17.8	B	41	303	204	17.9	B	42	303	124	26.8	C	111	312
42		SEBT	1,199	8.8	A	41	303	1,202	8.9	A	42	303	1,413	21.6	C	111	312
42		<b>Total</b>	<b>1,895</b>	<b>13.8</b>	<b>B</b>	<b>-</b>	<b>-</b>	<b>1,896</b>	<b>13.3</b>	<b>B</b>	<b>-</b>	<b>-</b>	<b>2,042</b>	<b>26.7</b>	<b>C</b>	<b>-</b>	<b>-</b>
43	3rd Avenue/Spring Street	NEBL	5	31.1	C	42	225	5	19.5	B	38	212	4	8.4	A	29	242
		NEBT	584	24.3	C	42	225	583	22.7	C	38	212	505	10.0	B	29	242
		NEBR	30	19.1	B	60	254	30	16.9	B	55	240	18	58.0	E	35	262
		NWBT	176	22.3	C	26	203	175	21.9	C	28	196	49	62.5	E	34	181
		NWBR	73	24.8	C	39	230	73	27.3	C	41	223	28	24.9	C	46	205
		SEBL	15	34.3	C	31	194	15	33.3	C	31	184	0	0.0	A	57	233
		SEBT	182	16.2	B	31	194	182	16.2	B	31	184	86	71.9	E	57	233
	<b>Total</b>	<b>1,064</b>	<b>22.5</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>1,062</b>	<b>21.7</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>689</b>	<b>25.8</b>	<b>C</b>	<b>-</b>	<b>-</b>	
44	4th Avenue/Spring Street	NEBL	197	44.6	D	149	368	197	44.2	D	149	368	117	38.2	D	81	345
44		NEBT	524	45.3	D	141	359	522	45.0	D	142	359	413	40.8	D	75	336
44		NWBT	1,191	7.3	A	30	244	1,190	8.5	A	37	251	1,191	13.3	B	54	316
44		NWBR	90	19.1	B	40	262	89	24.0	C	47	269	92	17.0	B	59	326
44		<b>Total</b>	<b>2,061</b>	<b>21.2</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>2,057</b>	<b>22.1</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>1,949</b>	<b>20.6</b>	<b>C</b>	<b>-</b>	<b>-</b>
45	5th Avenue/Spring Street	NEBT	592	50.9	D	121	337	588	50.1	D	120	328	501	41.3	D	86	322
		NEBR	53	59.9	E	132	350	53	58.3	E	130	341	81	22.5	C	5	126
		SEBL	452	208.0	F	1,035	1,430	446	216.5	F	1,050	1,427	316	357.0	F	612	671
		SEBT	806	130.5	F	1,035	1,430	790	136.0	F	1,050	1,427	324	181.3	F	612	671
	<b>Total</b>	<b>1,904</b>	<b>121.9</b>	<b>F</b>	<b>-</b>	<b>-</b>	<b>1,876</b>	<b>125.6</b>	<b>F</b>	<b>-</b>	<b>-</b>	<b>1,222</b>	<b>157.0</b>	<b>F</b>	<b>-</b>	<b>-</b>	
46	6th Avenue/Spring Street/I-5 On-Ramp	NEBL	174	7.4	A	102	368	172	8.5	A	102	362	57	13.3	B	143	372
46		NEBT	167	8.1	A	116	366	166	8.2	A	111	360	130	18.4	B	133	358
46		NEBR	701	22.4	C	116	366	695	22.1	C	111	360	647	25.4	C	133	358
46		NWBT	345	31.9	C	135	317	344	33.6	C	145	318	134	60.6	E	182	320
46		NWBR	9	36.5	D	160	347	9	44.4	D	171	348	-	-	-	-	-
46		NWBHR	600	43.0	D	137	319	596	46.7	D	147	321	625	63.0	E	184	323
46		<b>Total</b>	<b>1,996</b>	<b>27.7</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>1,982</b>	<b>29.2</b>	<b>C</b>	<b>-</b>	<b>-</b>	<b>1,593</b>	<b>42.1</b>	<b>D</b>	<b>-</b>	<b>-</b>

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build				
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
47	7th Avenue/Spring Street/Hubbell Place	NEBL	40	21.2	C	11	151	40	21.1	C	12	157	32	7.3	A	3	51
		NEBT	119	14.5	B	11	151	119	14.9	B	12	157	87	3.9	A	3	51
		NEBR	16	13.3	B	15	161	17	17.1	B	15	167	10	7.4	A	3	57
		NWBT	215	9.2	A	11	176	210	9.3	A	11	184	188	44.3	D	72	326
		NWBR	20	14.7	B	12	182	19	14.1	B	12	190	60	43.4	D	73	329
		SEBL	6	35.2	D	76	488	6	34.5	C	82	493	0	0.0	A	33	255
		SEBT	326	34.1	C	76	488	326	38.1	D	82	493	212	31.5	C	33	255
	<b>Total</b>	<b>743</b>	<b>22.2</b>	<b>C</b>	-	-	<b>737</b>	<b>24.2</b>	<b>C</b>	-	-	<b>588</b>	<b>30.5</b>	<b>C</b>	-	-	
48	8th Avenue/Spring Street	NEBL	50	13.7	B	9	102	50	15.0	B	12	107	50	13.5	B	12	123
		NEBT	80	13.0	B	10	103	80	13.1	B	12	108	89	11.8	B	12	123
		NEBR	14	42.0	D	10	103	13	40.9	D	12	108	9	12.4	B	15	135
		NWBT	156	1.8	A	2	129	154	1.7	A	1	118	199	23.7	C	31	243
		NWBR	19	2.7	A	0	68	19	3.1	A	0	55	16	20.6	C	31	243
		SEBL	40	13.6	B	26	208	40	13.8	B	23	211	107	42.5	D	78	249
		SEBT	171	21.7	C	26	208	172	20.3	C	23	211	183	42.9	D	78	249
			<b>Total</b>	<b>530</b>	<b>13.2</b>	<b>B</b>	-	-	<b>527</b>	<b>12.7</b>	<b>B</b>	-	-	<b>652</b>	<b>29.3</b>	<b>C</b>	-
49	9th Avenue/Spring Street	NEBL	34	9.9	A	6	103	34	9.4	A	6	99	30	12.4	B	13	164
		NEBT	60	10.0	A	5	101	59	10.6	B	6	98	50	14.6	B	13	164
		NEBR	45	9.2	A	5	100	44	10.5	B	6	97	130	15.2	B	15	168
		NWBT	145	3.0	A	2	100	144	3.1	A	2	103	68	26.0	C	10	112
		NWBR	9	1.8	A	1	99	9	2.3	A	1	102	1	37.5	D	11	115
		SEBL	8	2.4	A	0	24	8	2.2	A	0	23	1	41.9	D	31	220
		SEBT	125	1.8	A	0	33	125	1.9	A	0	33	169	33.2	C	31	220
		SWBL	11	10.3	B	1	60	11	10.4	B	1	56	133	42.6	D	33	214
		SWBR	33	9.0	A	1	61	33	9.2	A	1	57	11	26.6	C	35	219
	<b>Total</b>	<b>470</b>	<b>5.2</b>	<b>A</b>	-	-	<b>468</b>	<b>5.5</b>	<b>A</b>	-	-	<b>593</b>	<b>27.6</b>	<b>C</b>	-	-	
22	Madison Avenue/13th Avenue	SBL	8	26.7	C	4	55	8	27.0	C	4	55	84	197.0	F	135	184
		SBR	22	25.5	C	4	55	22	25.5	C	4	55	32	173.1	F	135	184
		NBL	129	27.3	C	18	139	130	28.5	C	19	141	188	39.0	D	61	142
		NBT	42	30.0	C	18	139	44	27.8	C	19	141	66	65.7	E	61	142
		NBR	9	15.7	B	24	151	9	14.0	B	25	153	56	86.7	F	61	142
		NEBL	27	17.3	B	22	196	28	18.0	B	23	189	-	-	-	-	
		NEBT	727	9.7	A	22	196	737	10.1	B	23	189	353	98.9	F	322	518
		SWBT	503	10.7	B	17	235	513	10.8	B	17	217	161	3.7	A	0	68
		SWBR	5	10.9	B	18	241	4	10.8	B	18	222	2	3.3	A	1	68
	<b>Total</b>	<b>1,472</b>	<b>12.7</b>	<b>B</b>	<b>17</b>	<b>244</b>	<b>1,496</b>	<b>13.0</b>	<b>B</b>	<b>18</b>	<b>223</b>	<b>944</b>	<b>78.5</b>	<b>E</b>	<b>77</b>	<b>518</b>	
23	Madison Avenue/14th Avenue	SBL	2	5.7	A	21	150	3	8.1	A	22	151	70	51.0	D	40	134
		SBT	175	6.9	A	10	111	179	6.8	A	10	111	356	10.1	B	40	134
		SBR	13	1.1	A	12	120	13	1.2	A	12	120	5	6.3	A	44	139
		NBL	15	22.9	C	27	227	15	26.0	C	31	249	44	71.7	E	159	291
		NBT	206	22.6	C	27	227	211	24.9	C	31	249	255	72.9	E	159	291
		NBR	51	19.1	B	29	231	52	21.1	C	33	253	66	69.5	E	162	295
		NEBL	0	0.0	A	69	331	0	0.0	A	72	346	-	-	-	-	
		NEBT	685	24.9	C	63	327	696	25.8	C	65	334	400	63.5	E	245	410
		NEBR	57	26.4	C	65	324	57	23.0	C	67	338	95	58.4	E	255	414
		SWBL	66	21.7	C	17	184	67	19.6	B	15	183	-	-	-	-	
		SWBT	477	3.2	A	17	184	488	3.1	A	15	183	113	19.4	B	13	136
		SWBR	0	0.0	A	17	186	0	0.0	A	15	185	0	0.0	A	15	138
	<b>Total</b>	<b>1,747</b>	<b>16.4</b>	<b>B</b>	<b>33</b>	<b>336</b>	<b>1,781</b>	<b>16.9</b>	<b>B</b>	<b>34</b>	<b>346</b>	<b>1,405</b>	<b>47.4</b>	<b>D</b>	<b>94</b>	<b>414</b>	

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build				
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
24	Madison Avenue/Pike Street	EBL	25	33.3	C	4	110	25	32.9	C	4	55	-	-	-	-	-
		EBT	4	35.5	D	4	110	4	40.1	D	4	55	-	-	-	-	-
		NEBT	719	4.9	A	11	125	731	4.8	A	11	131	438	1.7	A	1	109
		NEBR	19	3.2	A	11	125	19	3.2	A	11	131	98	2.7	A	4	161
		SWBL	1	11.2	B	39	269	1	51.8	D	40	262	-	-	-	-	-
		SWBT	544	21.3	C	39	269	556	20.5	C	40	262	114	7.0	A	0	0
		SWBR	36	18.1	B	39	269	37	20.6	C	40	262	50	1.5	A	0	0
	<b>Total</b>	<b>1,348</b>	<b>12.5</b>	<b>B</b>	<b>18</b>	<b>269</b>	<b>1,372</b>	<b>12.2</b>	<b>B</b>	<b>19</b>	<b>262</b>	<b>701</b>	<b>2.7</b>	<b>A</b>	<b>1</b>	<b>161</b>	
25	Madison Avenue/15th Avenue	SBR	130	10.5	B	8	122	133	10.3	B	8	114	83	8.7	A	1	77
		NEBL	65	6.8	A	3	208	65	6.3	A	3	180	-	-	-	-	-
		NEBT	678	1.4	A	3	208	690	1.4	A	3	180	437	2.1	A	2	173
		SWBT	452	0.7	A	0	47	461	1.0	A	0	45	81	1.9	A	0	13
		SWBR	11	1.4	A	0	52	11	2.0	A	0	49	0	0.0	A	0	16
	<b>Total</b>	<b>1,336</b>	<b>2.3</b>	<b>A</b>	<b>3</b>	<b>208</b>	<b>1,361</b>	<b>2.4</b>	<b>A</b>	<b>3</b>	<b>181</b>	<b>602</b>	<b>3.0</b>	<b>A</b>	<b>1</b>	<b>173</b>	
26	Madison Avenue/16th Avenue	NBL	6	14.2	B	1	45	6	13.4	B	1	45	0	0.0	A	20	126
		NBR	15	7.6	A	0	14	15	7.6	A	0	14	59	62.5	E	22	126
		NEBT	673	6.6	A	9	223	686	7.2	A	11	272	73	0.1	A	1	333
		NEBR	5	8.7	A	9	223	4	10.5	B	11	272	0	0.0	A	32	333
		SWBT	458	0.0	A	0	95	467	0.0	A	1	92	69	53.8	D	24	333
			<b>Total</b>	<b>1,157</b>	<b>4.1</b>	<b>A</b>	<b>3</b>	<b>223</b>	<b>1,178</b>	<b>4.4</b>	<b>A</b>	<b>3</b>	<b>272</b>	<b>580</b>	<b>17.6</b>	<b>B</b>	<b>17</b>
27	Madison Avenue/Pine Street	SEBL	222	53.2	D	74	317	229	53.2	D	72	317	349	54.4	D	128	464
		SEBR	6	38.6	D	74	317	6	20.4	C	72	317	1	86.6	F	128	464
		NEBL	18	4.2	A	7	70	19	4.4	A	8	71	0	0.0	A	11	61
		NEBT	670	1.1	A	7	70	682	1.1	A	8	71	499	3.5	A	11	61
		SWBT	453	1.8	A	3	108	461	1.9	A	3	109	82	10.8	B	4	237
		SWBR	185	4.4	A	6	128	188	4.5	A	6	125	341	7.9	A	17	255
			<b>Total</b>	<b>1,553</b>	<b>9.3</b>	<b>A</b>	<b>22</b>	<b>317</b>	<b>1,585</b>	<b>9.4</b>	<b>A</b>	<b>22</b>	<b>317</b>	<b>1,272</b>	<b>19.2</b>	<b>B</b>	<b>28</b>
28	Madison Avenue/17th Avenue	SBL	58	71.6	E	68	268	57	65.6	E	63	237	104	42.1	D	28	168
		SBT	45	73.2	E	68	268	46	69.0	E	63	237	15	43.2	D	28	168
		SBR	58	58.7	E	69	270	57	55.8	E	64	238	4	23.4	C	28	170
		NBL	46	44.0	D	21	151	48	43.0	D	21	153	105	43.1	D	37	208
		NBT	26	42.9	D	21	151	28	42.7	D	21	153	29	41.7	D	37	208
		NBR	10	35.1	D	23	155	9	26.0	C	23	157	1	47.0	D	40	212
		NEBL	75	20.8	C	46	303	77	20.2	C	46	315	0	0.0	A	81	324
		NEBT	777	13.1	B	46	303	792	13.0	B	46	315	763	14.9	B	80	324
		NEBR	38	14.3	B	46	303	39	13.4	B	46	315	85	17.8	B	18	320
		SWBL	14	12.3	B	14	221	14	13.9	B	16	216	0	0.0	A	9	165
		SWBT	535	8.0	A	14	221	545	8.1	A	16	216	315	7.1	A	9	165
		SWBR	46	8.1	A	16	229	47	10.4	B	18	224	5	1.9	A	3	115
			<b>Total</b>	<b>1,728</b>	<b>18.4</b>	<b>B</b>	<b>37</b>	<b>318</b>	<b>1,760</b>	<b>17.7</b>	<b>B</b>	<b>36</b>	<b>325</b>	<b>1,426</b>	<b>18.2</b>	<b>B</b>	<b>27</b>
29	Madison Avenue/18th Avenue	SBL	5	11.7	B	1	55	5	10.0	B	1	54	0	0.0	A	1	52
		SBT	2	14.4	B	1	59	2	12.3	B	1	58	0	0.0	A	1	55
		SBR	19	7.8	A	1	64	19	7.6	A	1	63	21	12.5	B	1	54
		NBL	7	13.7	B	1	38	7	11.7	B	1	38	0	0.0	A	4	90
		NBT	2	10.9	B	1	41	2	14.7	B	1	41	0	0.0	A	4	92
		NBR	6	8.7	A	1	43	6	9.3	A	1	43	115	6.6	A	5	93
		NEBL	16	3.8	A	1	115	16	3.2	A	1	117	0	0.0	A	1	162
		NEBT	860	1.0	A	0	73	873	1.1	A	0	77	770	1.4	A	0	131
		NEBR	35	1.3	A	0	73	35	1.2	A	0	77	99	1.1	A	0	0
		SWBL	1	8.2	A	0	23	1	7.8	A	0	11	0	0.0	A	0	25
		SWBT	569	1.1	A	0	11	580	1.0	A	0	0	299	0.8	A	0	17
		SWBR	3	0.9	A	0	11	3	2.8	A	0	0	121	0.8	A	0	17
			<b>Total</b>	<b>1,526</b>	<b>1.3</b>	<b>A</b>	<b>1</b>	<b>129</b>	<b>1,550</b>	<b>1.3</b>	<b>A</b>	<b>1</b>	<b>126</b>	<b>1,425</b>	<b>1.8</b>	<b>A</b>	<b>2</b>

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build					
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	
30	Madison Avenue/19th Avenue	SBL	23	23.6	C	38	261	24	27.8	C	40	285	9	28.4	C	57	334	
		SBT	105	39.7	D	35	256	108	39.5	D	37	279	183	33.9	C	54	328	
		SBR	61	24.7	C	37	260	62	26.6	C	39	283	139	23.7	C	57	332	
		NBL	22	37.5	D	33	214	22	35.5	D	33	202	76	42.5	D	52	281	
		NBT	140	36.4	D	33	214	142	35.9	D	33	202	111	38.1	D	52	281	
		NBR	18	28.5	C	34	217	18	25.0	C	34	204	69	28.0	C	53	283	
		NEBL	109	17.1	B	31	282	111	18.5	B	33	296	275	13.8	B	28	201	
		NEBT	736	10.5	B	31	282	743	10.6	B	33	296	561	8.0	A	28	201	
		NEBR	27	8.7	A	32	283	29	9.3	A	33	297	49	5.8	A	29	202	
		SWBL	4	19.6	B	15	172	4	19.7	B	20	194	191	27.7	C	40	233	
		SWBT	491	10.2	B	15	172	500	12.9	B	20	194	206	15.0	B	40	233	
		SWBR	16	7.5	A	16	176	16	10.5	B	22	198	2	4.2	A	42	236	
	<b>Total</b>	<b>1,752</b>	<b>15.8</b>	<b>B</b>	<b>30</b>	<b>293</b>	<b>1,779</b>	<b>16.8</b>	<b>B</b>	<b>32</b>	<b>329</b>	<b>1,870</b>	<b>19.3</b>	<b>B</b>	<b>46</b>	<b>349</b>		
31	Madison Avenue/20th Avenue/Olive Way	SBHL	1	66.9	E	1	42	1	58.4	E	1	42	0	0.0	A	18	136	
		SDDL	1	51.7	D	1	42	1	50.9	D	1	42	0	0.0	A	18	136	
		SBT	2	53.1	D	1	42	2	54.7	D	1	42	10	37.0	D	18	136	
		SBR	15	10.6	B	2	44	15	10.9	B	2	44	88	36.1	D	18	136	
		NBHR	28	0.8	A	0	25	28	1.0	A	0	25	28	0.3	A	0	11	
		WBBL	81	46.3	D	20	172	83	44.0	D	20	164	35	40.6	D	16	160	
		WBBL	4	46.0	D	20	172	4	43.3	D	20	164	13	41.6	D	16	160	
		WBHR	2	12.8	B	24	179	2	21.9	C	23	170	69	19.3	B	19	166	
		NEBL	10	9.8	A	15	289	9	9.5	A	13	279	0	0.0	A	7	150	
		NEBT	690	6.2	A	15	289	696	5.6	A	13	279	620	4.3	A	7	150	
		NEBBR	122	5.2	A	15	289	122	5.3	A	13	279	13	3.4	A	7	150	
		NEBHR	10	5.5	A	15	289	10	6.8	A	13	279	3	2.2	A	7	150	
		SWBHL	0	0.0	A	10	124	0	0.0	A	8	106	0	0.0	A	11	117	
		SWBBL	2	33.1	C	10	124	2	15.0	B	8	106	0	0.0	A	11	117	
		SWBT	415	7.1	A	10	124	423	5.0	A	8	106	278	9.4	A	11	117	
		SWBR	5	3.8	A	10	125	5	4.1	A	8	107	0	0.0	A	10	117	
			<b>Total</b>	<b>1,388</b>	<b>9.0</b>	<b>A</b>	<b>11</b>	<b>289</b>	<b>1,403</b>	<b>7.9</b>	<b>A</b>	<b>10</b>	<b>279</b>	<b>1,157</b>	<b>10.5</b>	<b>B</b>	<b>11</b>	<b>179</b>
32	Madison Avenue/Denny Street/22nd AvenueNB	SEBL	9	38.0	D	7	92	9	42.6	D	8	92	39	37.0	D	29	100	
		SEBT	24	38.4	D	7	92	26	37.9	D	8	92	118	31.7	C	29	100	
		SEBR	1	10.3	B	8	94	0	0.0	A	8	94	0	0.0	A	30	101	
		NWBL	19	40.3	D	9	103	20	35.6	D	9	119	3	49.2	D	21	122	
		NWBT	16	37.2	D	9	103	15	45.3	D	9	119	71	33.3	C	21	122	
		NWBR	26	16.0	B	9	104	27	15.4	B	9	120	90	16.9	B	21	124	
		NEBL	2	8.6	A	0	55	2	3.8	A	0	70	0	0.0	A	42	483	
		NEBT	655	0.7	A	0	55	663	0.7	A	0	70	647	11.4	B	42	483	
		NEBR	32	1.7	A	0	55	33	1.8	A	0	70	36	3.0	A	42	483	
		SWBL	15	7.6	A	3	135	16	7.1	A	3	99	0	0.0	A	7	134	
		SWBT	399	0.7	A	3	135	407	0.5	A	3	99	276	5.1	A	7	134	
		SWBR	14	3.7	A	3	134	13	1.7	A	3	99	23	3.0	A	7	136	
			<b>Total</b>	<b>1,211</b>	<b>3.3</b>	<b>A</b>	<b>6</b>	<b>137</b>	<b>1,232</b>	<b>3.3</b>	<b>A</b>	<b>6</b>	<b>120</b>	<b>1,305</b>	<b>14.0</b>	<b>B</b>	<b>22</b>	<b>483</b>
		33	Madison Avenue/22nd Avenue SB	SBL	0	0.0	A	0	30	0	0.0	A	0	30	0	0.0	A	1
SBR	13			6.9	A	1	38	13	7.0	A	1	38	57	7.8	A	3	76	
NEBL	25			6.0	A	3	167	25	4.3	A	3	123	0	0.0	A	15	244	
NEBT	666			3.8	A	5	210	676	4.6	A	4	199	776	6.3	A	16	231	
SWBT	415			0.4	A	0	0	423	0.4	A	0	0	242	0.6	A	0	9	
SWBR	9			0.5	A	0	0	9	0.8	A	0	0	10	0.6	A	0	9	
	<b>Total</b>	<b>1,127</b>	<b>2.6</b>	<b>A</b>	<b>2</b>	<b>219</b>	<b>1,145</b>	<b>3.0</b>	<b>A</b>	<b>2</b>	<b>199</b>	<b>1,085</b>	<b>5.1</b>	<b>A</b>	<b>7</b>	<b>244</b>		

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build						
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)		
34	Madison Avenue/23rd Avenue	SBT	643	21.0	C	47	182	643	25.7	C	80	188	573	42.9	D	116	182		
		SBR	113	16.2	B	53	193	113	15.8	B	80	188	69	38.2	D	116	182		
		NBT	574	20.7	C	38	206	584	18.2	B	35	260	606	26.6	C	57	305		
		NBR	31	19.1	B	44	217	32	11.6	B	41	271	31	18.9	B	64	316		
		NEBL	171	53.4	D	121	362	174	58.1	E	137	365	273	51.8	D	121	360		
		NEBT	465	36.4	D	121	362	468	40.3	D	137	365	452	23.8	C	121	360		
		NEBR	28	38.1	D	121	362	28	41.5	D	137	365	53	22.3	C	121	360		
		SWBL	48	51.5	D	38	177	49	59.1	E	48	174	69	70.6	E	52	335		
		SWBT	310	27.8	C	38	177	315	35.0	D	48	174	180	37.8	D	52	335		
		SWBR	11	32.4	C	36	174	11	45.4	D	46	171	2	44.6	D	52	335		
		<b>Total</b>	<b>2,394</b>	<b>27.8</b>	<b>C</b>	<b>54</b>	<b>362</b>	<b>2,418</b>	<b>30.6</b>	<b>C</b>	<b>64</b>	<b>365</b>	<b>2,306</b>	<b>35.5</b>	<b>D</b>	<b>82</b>	<b>389</b>		
35	Madison Avenue/E John Street/24th Avenue	SBR	15	11.5	B	1	48	15	13.6	B	1	43	16	10.8	B	1	45		
		NBHL	7	15.2	B	5	100	7	21.8	C	6	113	7	38.9	D	15	102		
		NBBL	12	41.9	D	9	107	12	40.3	D	11	120	12	75.3	E	19	106		
		NBT	3	38.9	D	9	107	2	26.1	C	11	120	2	71.5	E	19	106		
		NBBR	46	30.9	C	9	107	48	30.8	C	11	120	47	51.8	D	19	106		
		NBHR	4	15.3	B	9	107	3	25.8	C	11	120	3	33.9	C	19	106		
		EBHL	2	42.3	D	69	325	2	38.9	D	75	367	2	45.8	D	86	386		
		EBBL	143	43.8	D	69	325	145	44.6	D	75	367	143	49.6	D	86	386		
		EBT	137	41.1	D	69	325	141	44.9	D	75	367	139	50.1	D	86	386		
		EBBR	12	26.0	C	69	325	12	31.2	C	75	367	12	34.8	C	86	386		
		EBHR	0	0.0	A	69	325	0	0.0	A	75	367	0	0.0	A	86	386		
		WBHL	0	0.0	A	28	163	0	0.0	A	30	153	0	0.0	A	28	213		
		WBBL	0	0.0	A	28	163	0	0.0	A	30	153	0	0.0	A	28	213		
		WBT	120	43.1	D	28	163	125	43.5	D	30	153	126	40.0	D	28	213		
		WBBR	6	40.4	D	28	163	6	44.5	D	30	153	6	46.9	D	28	213		
		WBHR	2	45.2	D	28	163	2	38.0	D	30	153	2	56.2	E	28	213		
		NEBHL	0	0.0	A	39	441	0	0.0	A	37	431	0	0.0	A	70	483		
		NEBBL	7	17.7	B	39	441	8	13.0	B	37	431	9	26.1	C	70	483		
		NEBT	401	10.4	B	39	441	404	9.9	A	37	431	469	16.6	B	70	483		
		NEBBR	0	0.0	A	40	444	0	0.0	A	39	434	0	0.0	A	73	487		
		NEBHR	0	0.0	A	15	371	0	0.0	A	13	361	0	0.0	A	33	414		
		SWBHL	4	12.4	B	63	412	4	33.4	C	68	412	4	40.1	D	151	399		
		SWBBL	53	31.5	C	61	408	54	29.6	C	68	412	49	52.7	D	151	399		
SWBT	301	20.0	B	61	408	308	22.2	C	68	412	244	46.4	D	151	399				
SWBBR	207	26.0	C	61	408	213	25.1	C	68	412	195	43.8	D	151	399				
SWBHR	4	17.1	B	61	408	4	25.6	C	68	412	4	45.0	D	151	399				
		<b>Total</b>	<b>1,485</b>	<b>25.3</b>	<b>C</b>	<b>33</b>	<b>472</b>	<b>1,514</b>	<b>26.1</b>	<b>C</b>	<b>31</b>	<b>442</b>	<b>1,491</b>	<b>36.8</b>	<b>D</b>	<b>53</b>	<b>487</b>		
36	Madison Avenue/25th Avenue	SBL	19	17.6	B	4	72	18	17.0	B	3	69	19	17.9	B	4	74		
		SBT	22	19.7	B	4	75	23	19.4	B	4	72	24	25.1	C	5	76		
		SBR	14	18.8	B	5	84	14	15.6	B	4	81	14	23.7	C	5	85		
		NBL	5	19.0	B	2	51	5	17.0	B	2	50	5	26.3	C	2	56		
		NBT	25	18.6	B	3	54	25	17.4	B	2	53	24	21.4	C	3	59		
		NBR	13	13.9	B	3	68	13	13.3	B	3	67	13	15.1	B	3	72		
		NEBL	22	11.2	B	8	305	23	10.1	B	8	356	49	13.3	B	21	416		
		NEBT	521	3.1	A	6	281	525	3.0	A	7	332	597	6.1	A	19	396		
		NEBR	9	2.4	A	6	281	9	4.0	A	7	332	15	5.4	A	19	396		
		SWBL	9	8.0	A	9	336	9	10.8	B	10	341	9	27.2	C	80	489		
		SWBT	503	4.6	A	8	312	517	5.0	A	8	317	480	21.3	C	75	465		
		SWBR	13	3.3	A	8	312	13	4.5	A	8	317	12	21.4	C	75	465		
				<b>Total</b>	<b>1,176</b>	<b>5.2</b>	<b>A</b>	<b>5</b>	<b>336</b>	<b>1,194</b>	<b>5.2</b>	<b>A</b>	<b>5</b>	<b>396</b>	<b>1,260</b>	<b>13.7</b>	<b>B</b>	<b>22</b>	<b>523</b>

#	Intersection	Movement	Existing (2015)					2019 No Build					2019 Build				
			Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)	Traffic Volume (vph)	Avg. Vehicle Delay (s)	LOS	Avg. Queue Length (ft)	Max. Queue Length (ft)
37	Madison Avenue/26th Avenue	SEBL	2	20.3	C	1	37	2	11.2	B	1	40	2	12.8	B	0	34
		SEBR	14	9.7	A	1	46	14	10.6	B	1	50	14	11.1	B	1	44
		NEBL	18	7.4	A	4	236	18	6.6	A	3	193	33	10.0	A	21	400
		NEBT	536	2.4	A	3	208	538	2.2	A	2	164	518	7.9	A	17	372
		SWBT	513	1.3	A	0	28	525	1.4	A	0	27	489	3.8	A	7	176
		SWBR	2	3.8	A	0	28	2	0.6	A	0	27	2	0.9	A	7	176
		<b>Total</b>	<b>1,085</b>	<b>2.1</b>	<b>A</b>	<b>2</b>	<b>236</b>	<b>1,098</b>	<b>2.0</b>	<b>A</b>	<b>1</b>	<b>193</b>	<b>1,058</b>	<b>6.1</b>	<b>A</b>	<b>9</b>	<b>400</b>
38	Madison Avenue/27th Avenue NB	NWBL	7	11.1	B	1	49	7	10.2	B	1	45	7	14.4	B	2	49
		NWBR	23	10.8	B	1	49	23	11.4	B	1	45	23	22.9	C	2	48
		NEBT	490	4.3	A	10	256	493	4.2	A	10	302	464	18.0	B	63	357
		NEBR	47	3.7	A	10	256	48	3.5	A	10	302	56	15.9	B	63	357
		SWBL	8	10.2	B	1	110	8	5.1	A	1	109	7	8.9	A	1	117
		SWBT	508	0.3	A	1	98	521	0.3	A	1	100	485	0.5	A	1	101
		<b>Total</b>	<b>1,083</b>	<b>2.6</b>	<b>A</b>	<b>3</b>	<b>256</b>	<b>1,100</b>	<b>2.5</b>	<b>A</b>	<b>3</b>	<b>302</b>	<b>1,042</b>	<b>9.8</b>	<b>A</b>	<b>14</b>	<b>357</b>
39	Madison Avenue/27th Avenue SB	SEBL	2	9.0	A	0	36	2	6.6	A	0	36	2	31.2	C	1	36
		SEBR	20	8.6	A	1	55	20	8.5	A	1	55	20	7.7	A	1	53
		NEBL	16	13.3	B	5	99	16	13.6	B	5	102	30	10.6	B	21	126
		NEBT	497	1.3	A	4	82	502	1.0	A	3	87	454	8.1	A	19	119
		SWBT	496	1.6	A	0	102	509	1.6	A	1	106	473	3.7	A	1	135
		SWBR	8	0.9	A	0	102	8	1.3	A	1	106	7	1.5	A	1	135
		<b>Total</b>	<b>1,039</b>	<b>1.8</b>	<b>A</b>	<b>2</b>	<b>141</b>	<b>1,056</b>	<b>1.7</b>	<b>A</b>	<b>2</b>	<b>139</b>	<b>985</b>	<b>6.0</b>	<b>A</b>	<b>9</b>	<b>165</b>
40	Madison Avenue/MLK Way	SBL	61	35.3	D	52	333	62	38.2	D	55	385	61	69.5	E	110	544
		SBT	204	32.1	C	52	333	207	33.2	C	55	385	205	56.8	E	110	544
		SBR	11	31.9	C	52	333	11	36.3	D	55	385	11	50.9	D	110	544
		NBL	144	59.3	E	179	599	146	58.8	E	193	626	101	162.6	F	988	1,140
		NBT	100	57.3	E	179	599	100	57.8	E	193	626	70	150.6	F	988	1,140
		NBR	185	54.7	D	179	599	187	56.6	E	193	626	133	150.0	F	988	1,140
		NEBL	12	37.3	D	37	284	12	33.3	C	30	282	20	61.1	E	114	295
		NEBT	418	14.1	B	37	284	423	12.3	B	30	282	363	32.4	C	114	295
		NEBR	68	11.6	B	38	288	69	8.9	A	31	286	71	29.3	C	115	297
		SWBL	119	35.6	D	47	402	121	38.0	D	55	460	121	36.5	D	82	654
		SWBT	350	19.1	B	47	402	359	21.1	C	55	460	369	27.2	C	82	654
		SWBR	20	15.6	B	48	404	20	17.6	B	56	463	21	23.1	C	83	657
		<b>Total</b>	<b>1,691</b>	<b>30.7</b>	<b>C</b>	<b>67</b>	<b>601</b>	<b>1,718</b>	<b>31.1</b>	<b>C</b>	<b>70</b>	<b>630</b>	<b>1,546</b>	<b>59.9</b>	<b>E</b>	<b>249</b>	<b>1,140</b>
50	Pike Street/14th Avenue	SBL	4	17.7	B	9	103	4	13.2	B	10	136	-	-	-	-	-
		SBT	102	16.8	B	9	103	105	19.4	B	10	136	343	60.8	E	122	197
		SBR	10	11.6	B	9	105	9	6.1	A	11	139	1	47.2	D	124	200
		NBL	141	3.8	A	4	115	145	4.4	A	5	119	2	14.7	B	7	115
		NBT	65	2.2	A	4	115	67	1.8	A	5	119	259	2.7	A	7	115
		EBL	3	21.5	C	5	93	3	12.1	B	6	100	1	48.7	D	47	158
		EBT	26	22.7	C	5	93	26	22.1	C	6	100	-	-	-	-	-
		EBR	87	15.6	B	6	96	90	18.1	B	8	103	35	237.1	F	50	160
		WBT	30	4.3	A	1	29	31	4.1	A	1	20	4	14.7	B	2	47
		WBR	5	3.5	A	1	30	6	0.9	A	1	21	2	1.2	A	2	49
<b>Total</b>	<b>472</b>	<b>10.0</b>	<b>B</b>	<b>5</b>	<b>119</b>	<b>484</b>	<b>10.9</b>	<b>B</b>	<b>6</b>	<b>148</b>	<b>691</b>	<b>46.5</b>	<b>D</b>	<b>51</b>	<b>224</b>		

**Madison BRT**

**Travel Time Summary - PM Peak Hour Conditions**

#	Segment	Direction	Distance (ft)	Existing (2015)				2019 No Build				2019 Build			
				Travel Time (min)		Travel Speed (mph)		Travel Time (min)		Travel Speed (mph)		Travel Time (min)		Travel Speed (mph)	
				Car	Bus	Car	Bus	Car	Bus	Car	Bus	Car	BRT	Car	BRT
1	Spring Street (from 1st Avenue to 9th Avenue)	Eastbound	2,531	4.3	-	7	-	4.1	-	7	-	4.1	5.8	7	5
2	9th Street (from Spring Street to Madison Street)	Southbound	295	0.8	-	4	-	0.9	-	4	-	0.9	1.0	4	3
3	Madison Street (from 9th Avenue to 13th Avenue)	Eastbound	3,084	2.7	5.7	13	6	2.6	5.7	13	6	6.2	3.7	6	9
4	Madison Street (from 13th Avenue to 23rd Avenue)	Eastbound	3,656	2.7	6.7	15	6	2.8	6.6	15	6	4.0	3.0	10	14
5	Madison Street (from 23rd Avenue to MLK Way)	Eastbound	2,660	2.1	2.9	14	10	2.1	2.9	15	11	2.9	3.4	11	9
6	<b>Study Corridor (from 1st Avenue to MLK Way)</b>	<b>Eastbound</b>	<b>12,227</b>	<b>12.7</b>	<b>-</b>	<b>11</b>	<b>-</b>	<b>12.5</b>	<b>-</b>	<b>11</b>	<b>-</b>	<b>18.1</b>	<b>16.9</b>	<b>8</b>	<b>8</b>
7	Madison Street (from MLK Way to 23rd Avenue)	Westbound	2,660	2.3	3.2	13	9	1.7	3.4	18	9	3.4	3.5	9	9
8	Madison Street (from 23rd Avenue to 13th Avenue)	Westbound	3,641	2.5	5.5	16	8	2.5	5.5	16	8	2.8	3.5	15	12
9	Madison Street (from 13th Avenue to 6th Avenue)	Westbound	4,388	4.6	8.4	11	6	5.1	9.0	10	6	6.4	5.7	8	9
10	Madison Street (from 6th Avenue to 1st Avenue)	Westbound	1,569	2.7	4.5	7	4	3.7	5.5	5	3	3.3	3.3	5	5
11	<b>Study Corridor (from MLK Way to 1st Avenue)</b>	<b>Westbound</b>	<b>12,259</b>	<b>12.1</b>	<b>21.6</b>	<b>12</b>	<b>6</b>	<b>13.0</b>	<b>23.3</b>	<b>11</b>	<b>6</b>	<b>15.9</b>	<b>16.0</b>	<b>9</b>	<b>9</b>



## SYNCHRO OUTPUT SHEETS

---

















***EXISTING PM***

---

# HCM Signalized Intersection Capacity Analysis

















## 1: 1st Ave & Madison St

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	70	226	146	24	512	0	0	510	130
Future Volume (vph)	0	0	0	70	226	146	24	512	0	0	510	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		6%			-8%			0%			0%	
Total Lost time (s)				4.5	4.5			4.5			4.5	
Lane Util. Factor				1.00	0.95			0.91			0.95	
Frbp, ped/bikes				1.00	0.88			1.00			0.93	
Flpb, ped/bikes				0.77	1.00			1.00			1.00	
Frt				1.00	0.94			1.00			0.97	
Flt Protected				0.95	1.00			1.00			1.00	
Satd. Flow (prot)				1173	2602			4287			2713	
Flt Permitted				0.95	1.00			0.89			1.00	
Satd. Flow (perm)				1173	2602			3836			2713	
Peak-hour factor, PHF	0.25	0.25	0.25	0.85	0.85	0.85	0.92	0.92	0.92	0.89	0.89	0.89
Adj. Flow (vph)	0	0	0	82	266	172	26	557	0	0	573	146
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	25	0
Lane Group Flow (vph)	0	0	0	82	426	0	0	583	0	0	694	0
Confl. Peds. (#/hr)	226		156	156		226	276		553	553		276
Heavy Vehicles (%)	0%	0%	0%	3%	0%	0%	0%	1%	0%	0%	1%	0%
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			1			1	
Permitted Phases				2			1					
Actuated Green, G (s)				31.5	31.5			49.5			49.5	
Effective Green, g (s)				31.5	31.5			49.5			49.5	
Actuated g/C Ratio				0.35	0.35			0.55			0.55	
Clearance Time (s)				4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)				410	910			2109			1492	
v/s Ratio Prot					c0.16						c0.26	
v/s Ratio Perm				0.07				0.15				
v/c Ratio				0.20	0.47			0.28			0.47	
Uniform Delay, d1				20.4	22.7			10.7			12.2	
Progression Factor				0.49	0.39			1.00			0.36	
Incremental Delay, d2				0.9	1.4			0.3			0.9	
Delay (s)				10.8	10.3			11.1			5.4	
Level of Service				B	B			B			A	
Approach Delay (s)		0.0			10.4			11.1			5.4	
Approach LOS		A			B			B			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			8.6									
HCM 2000 Volume to Capacity ratio			0.47									
Actuated Cycle Length (s)			90.0									
Intersection Capacity Utilization			53.8%									
Analysis Period (min)			15									
c Critical Lane Group												

HCM 2010 Signalized Intersection Summary  
 2: 2nd Ave & Madison St













7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	180	343	0	0	0	0	0	1220	60
Future Volume (veh/h)	0	0	0	180	343	0	0	0	0	0	1220	60
Number				7	4	14				5	2	12
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.90
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.43
Adj Sat Flow, veh/h/ln				1778	1727	0				0	1569	1569
Adj Flow Rate, veh/h				191	365	0				0	1284	63
Adj No. of Lanes				0	2	0				0	2	1
Peak Hour Factor				0.94	0.94	0.94				0.95	0.95	0.95
Percent Heavy Veh, %				3	3	0				0	9	9
Cap, veh/h				327	550	0				0	1954	327
Arrive On Green				0.28	0.28	0.00				0.00	0.22	0.21
Sat Flow, veh/h				939	2059	0				0	3059	513
Grp Volume(v), veh/h				290	266	0				0	1284	63
Grp Sat Flow(s),veh/h/ln				1427	1493	0				0	1490	513
Q Serve(g_s), s				16.6	14.1	0.0				0.0	35.4	9.1
Cycle Q Clear(g_c), s				16.6	14.1	0.0				0.0	35.4	9.1
Prop In Lane				0.66		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				463	415	0				0	1954	327
V/C Ratio(X)				0.63	0.64	0.00				0.00	0.66	0.19
Avail Cap(c_a), veh/h				463	415	0				0	1954	327
HCM Platoon Ratio				1.00	1.00	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				29.5	28.6	0.0				0.0	26.0	16.4
Incr Delay (d2), s/veh				6.3	7.4	0.0				0.0	1.7	1.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				7.3	6.6	0.0				0.0	15.1	1.4
LnGrp Delay(d),s/veh				35.8	36.0	0.0				0.0	27.8	17.7
LnGrp LOS				D	D						C	B
Approach Vol, veh/h					556						1347	
Approach Delay, s/veh					35.9						27.3	
Approach LOS					D						C	
<b>Timer</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>				
Assigned Phs		2		4								
Phs Duration (G+Y+Rc), s		62.0		28.0								
Change Period (Y+Rc), s		4.5		4.5								
Max Green Setting (Gmax), s		57.5		23.5								
Max Q Clear Time (g_c+I1), s		0.0		0.0								
Green Ext Time (p_c), s		0.0		0.0								
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				29.8								
HCM 2010 LOS				C								

# HCM Signalized Intersection Capacity Analysis

## 3: 3rd Ave & Madison St

7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑			↑↑			↑↑		
Traffic Volume (vph)	0	0	0	0	470	60	0	134	0	0	135	56	
Future Volume (vph)	0	0	0	0	470	60	0	134	0	0	135	56	
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	12	12	11	12	
Grade (%)		10%			-15%			0%			-5%		
Total Lost time (s)					4.0			4.0			4.0		
Lane Util. Factor					0.95			0.95			0.95		
Frbp, ped/bikes					0.96			1.00			0.87		
Flpb, ped/bikes					1.00			1.00			1.00		
Frt					0.98			1.00			0.96		
Flt Protected					1.00			1.00			1.00		
Satd. Flow (prot)					2901			1468			1559		
Flt Permitted					1.00			1.00			1.00		
Satd. Flow (perm)					2901			1468			1559		
Peak-hour factor, PHF	0.25	0.25	0.25	0.91	0.91	0.91	0.93	0.93	0.93	0.87	0.87	0.87	
Adj. Flow (vph)	0	0	0	0	516	66	0	144	0	0	155	64	
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	0	0	9	0	
Lane Group Flow (vph)	0	0	0	0	571	0	0	144	0	0	210	0	
Confl. Peds. (#/hr)	244		457	457		244	588		499	499		588	
Heavy Vehicles (%)	0%	0%	0%	9%	2%	2%	0%	81%	0%	0%	82%	11%	
Bus Blockages (#/hr)	0	0	0	0	10	0	0	62	0	0	29	0	
Parking (#/hr)					15								
Turn Type					NA			NA			NA		
Protected Phases					2			1			1		
Permitted Phases													
Actuated Green, G (s)					30.5			50.5			50.5		
Effective Green, g (s)					31.0			51.0			51.0		
Actuated g/C Ratio					0.34			0.57			0.57		
Clearance Time (s)					4.5			4.5			4.5		
Lane Grp Cap (vph)					999			831			883		
v/s Ratio Prot					c0.20			0.10			c0.13		
v/s Ratio Perm													
v/c Ratio					0.57			0.17			0.24		
Uniform Delay, d1					24.1			9.4			9.8		
Progression Factor					0.42			1.00			2.47		
Incremental Delay, d2					1.2			0.5			0.6		
Delay (s)					11.4			9.8			24.7		
Level of Service					B			A			C		
Approach Delay (s)		0.0			11.4			9.8			24.7		
Approach LOS		A			B			A			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.36										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)						8.0		
Intersection Capacity Utilization			36.7%		ICU Level of Service						A		
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 4: 4th Ave & Madison St

7/29/2016















Movement	WBR	NBL	NBT	SWR	SWR2
Lane Configurations	↗		↕↕↕	↗↘	
Traffic Volume (vph)	38	116	1081	400	215
Future Volume (vph)	38	116	1081	400	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	12	12	10	13	12
Grade (%)			5%		
Total Lost time (s)	3.0		3.5	2.5	
Lane Util. Factor	1.00		0.91	0.88	
Frb, ped/bikes	1.00		1.00	1.00	
Flpb, ped/bikes	1.00		0.96	1.00	
Frt	0.86		1.00	0.85	
Flt Protected	1.00		1.00	1.00	
Satd. Flow (prot)	1450		3534	2458	
Flt Permitted	1.00		1.00	1.00	
Satd. Flow (perm)	1450		3534	2458	
Peak-hour factor, PHF	0.92	0.97	0.97	0.84	0.84
Adj. Flow (vph)	41	120	1114	476	256
RTOR Reduction (vph)	0	0	24	64	0
Lane Group Flow (vph)	41	0	1210	668	0
Confl. Peds. (#/hr)		487			361
Heavy Vehicles (%)	2%	1%	9%	1%	1%
Bus Blockages (#/hr)	0	0	0	10	0
Parking (#/hr)			15	15	
Turn Type	custom	Perm	NA	Prot	
Protected Phases	1		2	4	
Permitted Phases	2	2			
Actuated Green, G (s)	52.5		49.5	25.5	
Effective Green, g (s)	52.5		50.5	27.5	
Actuated g/C Ratio	0.58		0.56	0.31	
Clearance Time (s)	3.0		4.5	4.5	
Vehicle Extension (s)	0.2		0.2	0.2	
Lane Grp Cap (vph)	894		1982	751	
v/s Ratio Prot	c0.00			c0.27	
v/s Ratio Perm	0.03		0.34		
v/c Ratio	0.05		0.61	0.89	
Uniform Delay, d1	8.0		13.2	29.8	
Progression Factor	1.00		1.00	0.84	
Incremental Delay, d2	0.0		1.4	13.7	
Delay (s)	8.0		14.6	38.7	
Level of Service	A		B	D	
Approach Delay (s)			14.6		
Approach LOS			B		
<b>Intersection Summary</b>					
HCM 2000 Control Delay			23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.68		
Actuated Cycle Length (s)			90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization			63.9%	ICU Level of Service	B
Analysis Period (min)			15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 5: 5th Ave & Madison St

7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑						↑↑↑		
Traffic Volume (vph)	0	0	0	296	487	0	0	0	0	0	870	100	
Future Volume (vph)	0	0	0	296	487	0	0	0	0	0	870	100	
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	9	12	
Grade (%)		10%			-10%			0%			0%		
Total Lost time (s)					4.5						4.5		
Lane Util. Factor					0.95						0.91		
Frbp, ped/bikes					1.00						0.97		
Flpb, ped/bikes					0.88						1.00		
Frt					1.00						0.98		
Flt Protected					0.98						1.00		
Satd. Flow (prot)					2646						3654		
Flt Permitted					0.98						1.00		
Satd. Flow (perm)					2646						3654		
Peak-hour factor, PHF	0.25	0.25	0.25	0.96	0.96	0.96	0.25	0.25	0.25	0.97	0.97	0.97	
Adj. Flow (vph)	0	0	0	308	507	0	0	0	0	0	897	103	
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	0	0	15	0	
Lane Group Flow (vph)	0	0	0	0	805	0	0	0	0	0	985	0	
Confl. Peds. (#/hr)	228		242	242		228	311		184	184		311	
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	0%	0%	0%	3%	2%	
Parking (#/hr)					15						15		
Turn Type				Perm	NA						NA		
Protected Phases					2						1		
Permitted Phases				2									
Actuated Green, G (s)					42.5						38.5		
Effective Green, g (s)					42.5						38.5		
Actuated g/C Ratio					0.47						0.43		
Clearance Time (s)					4.5						4.5		
Lane Grp Cap (vph)					1249						1563		
v/s Ratio Prot											c0.27		
v/s Ratio Perm					0.30								
v/c Ratio					0.64						0.63		
Uniform Delay, d1					18.0						20.2		
Progression Factor					0.72						0.36		
Incremental Delay, d2					2.1						1.3		
Delay (s)					15.0						8.5		
Level of Service					B						A		
Approach Delay (s)		0.0			15.0			0.0			8.5		
Approach LOS		A			B			A			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			11.4		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					9.0			
Intersection Capacity Utilization			57.3%		ICU Level of Service					B			
Analysis Period (min)			15										
















c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 6: 6th Ave & Madison St






















7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	0	746	809	26	150	173	0	0	0	
Future Volume (vph)	0	0	0	0	746	809	26	150	173	0	0	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	10	9	12	12	12	12	12	12	
Grade (%)		10%			-10%			5%				-5%	
Total Lost time (s)					3.5	3.5		4.0					
Lane Util. Factor					0.91	0.91		0.95					
Frbp, ped/bikes					0.92	0.76		0.99					
Flpb, ped/bikes					1.00	1.00		0.98					
Frt					0.95	0.85		0.93					
Flt Protected					1.00	1.00		1.00					
Satd. Flow (prot)					2664	936		2479					
Flt Permitted					1.00	1.00		1.00					
Satd. Flow (perm)					2664	936		2479					
Peak-hour factor, PHF	0.25	0.25	0.25	0.97	0.97	0.97	0.85	0.85	0.85	0.25	0.25	0.25	
Adj. Flow (vph)	0	0	0	0	769	834	31	176	204	0	0	0	
RTOR Reduction (vph)	0	0	0	0	51	130	0	163	0	0	0	0	
Lane Group Flow (vph)	0	0	0	0	1060	362	0	248	0	0	0	0	
Confl. Peds. (#/hr)	137		316	316		137	178			1		178	
Confl. Bikes (#/hr)			3			26			2			3	
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	12%	1%	5%	0%	0%	0%	
Parking (#/hr)								15					
Turn Type					NA	Perm	Perm	NA					
Protected Phases					2			1					
Permitted Phases						2	1						
Actuated Green, G (s)					61.0	61.0		20.5					
Effective Green, g (s)					61.5	61.5		21.0					
Actuated g/C Ratio					0.68	0.68		0.23					
Clearance Time (s)					4.0	4.0		4.5					
Lane Grp Cap (vph)					1820	639		578					
v/s Ratio Prot					c0.40								
v/s Ratio Perm						0.39		0.10					
v/c Ratio					0.58	0.57		0.43					
Uniform Delay, d1					7.5	7.4		29.4					
Progression Factor					1.03	2.01		1.00					
Incremental Delay, d2					1.2	3.3		2.3					
Delay (s)					9.0	18.0		31.7					
Level of Service					A	B		C					
Approach Delay (s)		0.0			11.8			31.7			0.0		
Approach LOS		A			B			C			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			15.8		HCM 2000 Level of Service				B				
HCM 2000 Volume to Capacity ratio			0.54										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				7.5				
Intersection Capacity Utilization			62.2%		ICU Level of Service				B				
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 7: I-5 CD NB Off-Ramp/7th Ave & Madison St

7/29/2016























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					  							
Traffic Volume (vph)	2	174	0	0	742	3	488	276	423	7	0	348
Future Volume (vph)	2	174	0	0	742	3	488	276	423	7	0	348
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			5%			-5%	
Total Lost time (s)		3.5			3.5		3.5	3.5	3.5	3.5		4.5
Lane Util. Factor		1.00			0.91		0.95	0.95	1.00	1.00		1.00
Frbp, ped/bikes		1.00			1.00		1.00	1.00	0.90	1.00		1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00	1.00	0.97		1.00
Frt		1.00			1.00		1.00	1.00	0.85	1.00		0.85
Flt Protected		1.00			1.00		0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)		1253			4264		1505	1561	1258	1612		1475
Flt Permitted		1.00			1.00		0.95	0.99	1.00	0.36		1.00
Satd. Flow (perm)		1248			4264		1505	1561	1258	619		1475
Peak-hour factor, PHF	0.81	0.81	0.81	0.94	0.94	0.94	0.94	0.94	0.94	0.90	0.90	0.90
Adj. Flow (vph)	2	215	0	0	789	3	519	294	450	8	0	387
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	28	0	0	24
Lane Group Flow (vph)	0	217	0	0	791	0	400	413	422	8	0	363
Confl. Peds. (#/hr)	114		364	364		114	1		56	56		
Confl. Bikes (#/hr)			2			9			22			
Heavy Vehicles (%)	0%	5%	0%	0%	2%	0%	0%	0%	1%	0%	0%	1%
Parking (#/hr)		15										
Turn Type	Perm	NA			NA		Split	NA	Perm	D.Pm		Prot
Protected Phases		1			1		2!	2				2!
Permitted Phases	1								2	2		
Actuated Green, G (s)		40.3			40.3		40.7	40.7	40.7	40.7		40.7
Effective Green, g (s)		41.3			41.3		41.7	41.7	41.7	41.7		40.7
Actuated g/C Ratio		0.46			0.46		0.46	0.46	0.46	0.46		0.45
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5		4.5
Vehicle Extension (s)		3.0			3.0		5.0	5.0	5.0	5.0		5.0
Lane Grp Cap (vph)		572			1956		697	723	582	286		667
v/s Ratio Prot					c0.19		0.27	0.26				0.25
v/s Ratio Perm		0.17							c0.34	0.01		
v/c Ratio		0.38			0.40		0.57	0.57	0.72	0.03		0.54
Uniform Delay, d1		16.0			16.2		17.7	17.6	19.5	13.1		17.9
Progression Factor		0.94			0.54		1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2		1.7			0.6		1.8	1.7	5.4	0.1		1.6
Delay (s)		16.6			9.3		19.5	19.4	25.0	13.2		19.5
Level of Service		B			A		B	B	C	B		B
Approach Delay (s)		16.6			9.3			21.4			19.4	
Approach LOS		B			A			C			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.1				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			8.0		
Intersection Capacity Utilization			73.5%				ICU Level of Service			D		
Analysis Period (min)			15									

- ! Phase conflict between lane groups.
- c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 8: 8th Ave & Madison St

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	47	506	18	47	693	16	23	105	46	19	43	70
Future Volume (vph)	47	506	18	47	693	16	23	105	46	19	43	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.98		1.00	0.99			0.96			0.96	
Flpb, ped/bikes	0.83	1.00		0.79	1.00			0.99			0.99	
Fr t	1.00	0.99		1.00	1.00			0.96			0.93	
Fl t Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1265	2898		1193	2925			1547			1500	
Fl t Permitted	0.36	1.00		0.42	1.00			0.96			0.95	
Satd. Flow (perm)	477	2898		523	2925			1487			1432	
Peak-hour factor, PHF	0.89	0.89	0.89	0.99	0.99	0.99	0.93	0.93	0.93	0.80	0.80	0.80
Adj. Flow (vph)	53	569	20	47	700	16	25	113	49	24	54	88
RTOR Reduction (vph)	0	3	0	0	2	0	0	14	0	0	45	0
Lane Group Flow (vph)	53	586	0	47	714	0	0	173	0	0	121	0
Confl. Peds. (#/hr)	165		269	169		165	69		96	96		36
Heavy Vehicles (%)	0%	2%	0%	0%	2%	6%	4%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	62.5	62.5		62.5	62.5			18.5			18.5	
Effective Green, g (s)	63.5	63.5		63.5	63.5			19.5			19.5	
Actuated g/C Ratio	0.71	0.71		0.71	0.71			0.22			0.22	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	336	2044		369	2063			322			310	
v/s Ratio Prot		0.20			c0.24							
v/s Ratio Perm	0.11			0.09				c0.12			0.08	
v/c Ratio	0.16	0.29		0.13	0.35			0.54			0.39	
Uniform Delay, d1	4.4	4.9		4.3	5.2			31.2			30.2	
Progression Factor	0.36	0.45		0.38	0.33			1.00			1.00	
Incremental Delay, d2	0.8	0.3		0.7	0.4			6.3			3.6	
Delay (s)	2.4	2.5		2.3	2.1			37.5			33.8	
Level of Service	A	A		A	A			D			C	
Approach Delay (s)		2.5			2.2			37.5			33.8	
Approach LOS		A			A			D			C	

### Intersection Summary























HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 9: 9th Ave & Madison St

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	15	533	11	63	669	29	23	98	40	41	83	50
Future Volume (vph)	15	533	11	63	669	29	23	98	40	41	83	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.99		1.00	0.98			0.98			0.95	
Flpb, ped/bikes	0.89	1.00		0.80	1.00			0.98			0.99	
Fr t	1.00	1.00		1.00	0.99			0.97			0.96	
Fl t Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1344	2931		1143	2909			1460			1517	
Fl t Permitted	0.34	1.00		0.39	1.00			0.94			0.90	
Satd. Flow (perm)	483	2931		468	2909			1385			1387	
Peak-hour factor, PHF	0.88	0.88	0.88	0.97	0.97	0.97	0.81	0.81	0.81	0.87	0.87	0.87
Adj. Flow (vph)	17	606	12	65	690	30	28	121	49	47	95	57
RTOR Reduction (vph)	0	1	0	0	3	0	0	13	0	0	16	0
Lane Group Flow (vph)	17	618	0	65	717	0	0	185	0	0	183	0
Confl. Peds. (#/hr)	132		249	249		132	128		63	63		128
Heavy Vehicles (%)	0%	2%	0%	6%	2%	0%	0%	9%	10%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	55.5	55.5		55.5	55.5			25.5			25.5	
Effective Green, g (s)	56.5	56.5		56.5	56.5			26.5			26.5	
Actuated g/C Ratio	0.63	0.63		0.63	0.63			0.29			0.29	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	303	1840		293	1826			407			408	
v/s Ratio Prot		0.21			c0.25							
v/s Ratio Perm	0.04			0.14				c0.13			0.13	
v/c Ratio	0.06	0.34		0.22	0.39			0.45			0.45	
Uniform Delay, d1	6.5	7.9		7.2	8.3			25.9			25.8	
Progression Factor	0.88	0.69		0.15	0.12			1.00			1.00	
Incremental Delay, d2	0.3	0.5		1.6	0.6			3.6			3.5	
Delay (s)	6.0	5.9		2.7	1.6			29.5			29.3	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		5.9			1.6			29.5			29.3	
Approach LOS		A			A			C			C	

### Intersection Summary























HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 10: Terry Ave & Madison St

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	20	590	11	21	680	19	16	20	27	13	14	18
Future Volume (vph)	20	590	11	21	680	19	16	20	27	13	14	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.0			3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.99		1.00	0.99			0.94			0.96	
Flpb, ped/bikes	0.87	1.00		0.81	1.00			0.98			0.97	
Frt	1.00	1.00		1.00	1.00			0.94			0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1256	2930		1221	2923			1460			1483	
Flt Permitted	0.32	1.00		0.38	1.00			0.94			0.93	
Satd. Flow (perm)	423	2930		493	2923			1393			1406	
Peak-hour factor, PHF	0.95	0.95	0.95	0.90	0.90	0.90	0.83	0.83	0.83	0.75	0.75	0.75
Adj. Flow (vph)	21	621	12	23	756	21	19	24	33	17	19	24
RTOR Reduction (vph)	0	1	0	0	2	0	0	23	0	0	17	0
Lane Group Flow (vph)	21	632	0	23	775	0	0	53	0	0	43	0
Confl. Peds. (#/hr)	152		226	226		152	59		91	91		59
Heavy Vehicles (%)	5%	2%	9%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	56.5	56.5		56.5	56.5			25.0			25.0	
Effective Green, g (s)	57.5	57.5		57.5	57.5			26.0			26.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64			0.29			0.29	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.0			4.0	
Lane Grp Cap (vph)	270	1871		314	1867			402			406	
v/s Ratio Prot		0.22			c0.27							
v/s Ratio Perm	0.05			0.05				c0.04			0.03	
v/c Ratio	0.08	0.34		0.07	0.42			0.13			0.11	
Uniform Delay, d1	6.2	7.5		6.2	8.0			23.6			23.5	
Progression Factor	0.61	0.59		0.27	0.22			1.00			1.00	
Incremental Delay, d2	0.5	0.5		0.2	0.3			0.7			0.5	
Delay (s)	4.3	4.8		1.9	2.0			24.3			24.0	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		4.8			2.0			24.3			24.0	
Approach LOS		A			A			C			C	

### Intersection Summary

























HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.5
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 11: Boren Ave & Madison St

7/29/2016























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	64	521	22	54	568	67	83	518	32	187	672	82
Future Volume (vph)	64	521	22	54	568	67	83	518	32	187	672	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	12	9	9	12	9	9	12
Total Lost time (s)	4.0	3.5		4.0	3.5		4.0	3.5		4.0	3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	0.99		1.00	0.97		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1486	2854		1516	2806		1433	2784		1462	2714	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1486	2854		1516	2806		1433	2784		1462	2714	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84	0.90	0.90	0.90
Adj. Flow (vph)	74	599	25	62	653	77	99	617	38	208	747	91
RTOR Reduction (vph)	0	4	0	0	10	0	0	5	0	0	10	0
Lane Group Flow (vph)	74	620	0	62	720	0	99	650	0	208	828	0
Confl. Peds. (#/hr)	183		335	335		183	144		160	160		144
Heavy Vehicles (%)	2%	2%	4%	0%	2%	0%	2%	2%	6%	0%	2%	1%
Bus Blockages (#/hr)	0	10	0	0	6	0	0	2	0	0	8	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	6.2	24.5		5.5	23.8		6.7	26.7		15.3	35.3	
Effective Green, g (s)	6.7	25.5		6.0	24.8		7.2	27.7		15.8	36.3	
Actuated g/C Ratio	0.07	0.28		0.07	0.28		0.08	0.31		0.18	0.40	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	110	808		101	773		114	856		256	1094	
v/s Ratio Prot	c0.05	0.22		0.04	c0.26		0.07	c0.23		0.14	c0.31	
v/s Ratio Perm												
v/c Ratio	0.67	0.77		0.61	0.93		0.87	0.76		0.81	0.76	
Uniform Delay, d1	40.6	29.5		40.9	31.8		40.9	28.1		35.7	23.1	
Progression Factor	1.38	1.17		0.86	0.96		1.00	1.00		0.97	0.95	
Incremental Delay, d2	11.6	6.7		7.2	18.8		44.5	6.3		16.0	4.7	
Delay (s)	67.4	41.2		42.4	49.2		85.4	34.4		50.5	26.5	
Level of Service	E	D		D	D		F	C		D	C	
Approach Delay (s)		44.0			48.6			41.1			31.3	
Approach LOS		D			D			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			40.4				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			67.5%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 12: Madison St & Minor Ave

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	26	701	26	18	621	14	48	76	59	17	32	39
Future Volume (vph)	26	701	26	18	621	14	48	76	59	17	32	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.98		1.00	0.99			0.96			0.92	
Flpb, ped/bikes	0.84	1.00		0.86	1.00			0.97			0.99	
Fr t	1.00	0.99		1.00	1.00			0.96			0.94	
Fl t Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1266	2903		1306	2932			1497			1452	
Fl t Permitted	0.38	1.00		0.31	1.00			0.91			0.93	
Satd. Flow (perm)	500	2903		430	2932			1375			1367	
Peak-hour factor, PHF	0.89	0.89	0.89	0.95	0.95	0.95	0.83	0.83	0.83	0.76	0.76	0.76
Adj. Flow (vph)	29	788	29	19	654	15	58	92	71	22	42	51
RTOR Reduction (vph)	0	3	0	0	2	0	0	19	0	0	32	0
Lane Group Flow (vph)	29	814	0	19	667	0	0	202	0	0	83	0
Confl. Peds. (#/hr)	157		212	212		157	110		81	81		110
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	60.5	60.5		60.5	60.5			20.5			20.5	
Effective Green, g (s)	61.5	61.5		61.5	61.5			21.5			21.5	
Actuated g/C Ratio	0.68	0.68		0.68	0.68			0.24			0.24	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	341	1983		293	2003			328			326	
v/s Ratio Prot		c0.28			0.23							
v/s Ratio Perm	0.06			0.04				c0.15			0.06	
v/c Ratio	0.09	0.41		0.06	0.33			0.62			0.25	
Uniform Delay, d1	4.8	6.3		4.7	5.8			30.6			27.8	
Progression Factor	0.15	0.11		1.63	1.97			1.00			1.00	
Incremental Delay, d2	0.3	0.4		0.4	0.4			8.4			1.9	
Delay (s)	1.0	1.0		8.1	12.0			39.0			29.6	
Level of Service	A	A		A	B			D			C	
Approach Delay (s)		1.0			11.9			39.0			29.6	
Approach LOS		A			B			D			C	

### Intersection Summary

HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		
























c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 13: Swedish/Summit Ave & Madison St

7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 			 			 		
Traffic Volume (vph)	22	740	15	4	587	10	34	12	19	14	1	34	
Future Volume (vph)	22	740	15	4	587	10	34	12	19	14	1	34	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	10	10	10	12	12	12	12	12	12	12	
Total Lost time (s)	3.5	3.5		3.5	3.5			3.0			3.0		
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00		
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.96			0.92		
Flpb, ped/bikes	0.90	1.00		0.90	1.00			0.96			0.97		
Fr t	1.00	1.00		1.00	1.00			0.96			0.91		
Fl t Protected	0.95	1.00		0.95	1.00			0.97			0.99		
Satd. Flow (prot)	1358	2945		1361	2953			1461			1367		
Fl t Permitted	0.40	1.00		0.33	1.00			0.84			0.92		
Satd. Flow (perm)	571	2945		474	2953			1260			1281		
Peak-hour factor, PHF	0.97	0.97	0.97	0.96	0.96	0.96	0.63	0.63	0.63	0.77	0.77	0.77	
Adj. Flow (vph)	23	763	15	4	611	10	54	19	30	18	1	44	
RTOR Reduction (vph)	0	2	0	0	1	0	0	16	0	0	34	0	
Lane Group Flow (vph)	23	776	0	4	620	0	0	87	0	0	29	0	
Confl. Peds. (#/hr)	101		132	132		101	69		102	102		69	
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		2			2			4			4		
Permitted Phases	2			2			4			4			
Actuated Green, G (s)	61.5	61.5		61.5	61.5			20.0			20.0		
Effective Green, g (s)	62.5	62.5		62.5	62.5			21.0			21.0		
Actuated g/C Ratio	0.69	0.69		0.69	0.69			0.23			0.23		
Clearance Time (s)	4.5	4.5		4.5	4.5			4.0			4.0		
Lane Grp Cap (vph)	396	2045		329	2050			294			298		
v/s Ratio Prot		c0.26			0.21								
v/s Ratio Perm	0.04			0.01				c0.07			0.02		
v/c Ratio	0.06	0.38		0.01	0.30			0.30			0.10		
Uniform Delay, d1	4.4	5.7		4.2	5.3			28.4			27.1		
Progression Factor	1.14	1.14		0.35	0.37			1.00			1.00		
Incremental Delay, d2	0.3	0.5		0.1	0.4			2.5			0.7		
Delay (s)	5.2	7.0		1.6	2.3			31.0			27.7		
Level of Service	A	A		A	A			C			C		
Approach Delay (s)		6.9			2.3			31.0			27.7		
Approach LOS		A			A			C			C		

### Intersection Summary























HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.5
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis






















## 14: Madison St & Boylston Ave

7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 			 			 		
Traffic Volume (vph)	20	720	25	7	556	16	39	57	39	18	10	24	
Future Volume (vph)	20	720	25	7	556	16	39	57	39	18	10	24	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	12	10	9	12	12	12	12	12	12	12	
Total Lost time (s)	3.5	3.5		3.5	3.5			3.0			3.0		
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00		
Frbp, ped/bikes	1.00	0.99		1.00	0.99			0.98			0.96		
Flpb, ped/bikes	0.88	1.00		0.90	1.00			0.98			0.99		
Frt	1.00	1.00		1.00	1.00			0.96			0.94		
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.98		
Satd. Flow (prot)	1334	2918		1365	2832			1566			1499		
Flt Permitted	0.42	1.00		0.33	1.00			0.92			0.83		
Satd. Flow (perm)	591	2918		476	2832			1457			1267		
Peak-hour factor, PHF	0.91	0.91	0.91	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81	
Adj. Flow (vph)	22	791	27	7	585	17	44	64	44	22	12	30	
RTOR Reduction (vph)	0	1	0	0	1	0	0	21	0	0	26	0	
Lane Group Flow (vph)	22	817	0	7	601	0	0	131	0	0	38	0	
Confl. Peds. (#/hr)	88		106	106		88	52		30	30		52	
Heavy Vehicles (%)	0%	2%	8%	0%	2%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		2			2			4			4		
Permitted Phases	2			2			4			4			
Actuated Green, G (s)	70.1	70.1		70.1	70.1			11.4			11.4		
Effective Green, g (s)	71.1	71.1		71.1	71.1			12.4			12.4		
Actuated g/C Ratio	0.79	0.79		0.79	0.79			0.14			0.14		
Clearance Time (s)	4.5	4.5		4.5	4.5			4.0			4.0		
Vehicle Extension (s)	0.2	0.2		0.2	0.2			0.2			0.2		
Lane Grp Cap (vph)	466	2305		376	2237			200			174		
v/s Ratio Prot		c0.28			0.21								
v/s Ratio Perm	0.04			0.01				c0.09			0.03		
v/c Ratio	0.05	0.35		0.02	0.27			0.66			0.22		
Uniform Delay, d1	2.1	2.8		2.0	2.5			36.8			34.5		
Progression Factor	0.25	0.18		0.07	0.13			1.00			1.00		
Incremental Delay, d2	0.2	0.4		0.1	0.3			5.8			0.2		
Delay (s)	0.7	0.9		0.2	0.6			42.6			34.7		
Level of Service	A	A		A	A			D			C		
Approach Delay (s)		0.9			0.6			42.6			34.7		
Approach LOS		A			A			D			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			5.9									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.40										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	6.5
Intersection Capacity Utilization			44.1%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
 15: Broadway & Madison St/E Madison St

7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 								
Traffic Volume (vph)	107	661	23	66	475	29	0	312	129	0	265	92	
Future Volume (vph)	107	661	23	66	475	29	0	312	129	0	265	92	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	11	10	12	10	10	12	12	13	12	12	13	12	
Grade (%)		-9%			8%			0%			0%		
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	5.0		4.0		
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00		
Frbp, ped/bikes	1.00	1.00		1.00	0.99			1.00	1.00		0.98		
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00		
Frt	1.00	0.99		1.00	0.99			1.00	0.85		0.97		
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00		1.00		
Satd. Flow (prot)	1770	3426		1526	3118			1925	1583		1799		
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00		1.00		
Satd. Flow (perm)	1770	3426		1526	3118			1925	1583		1799		
Peak-hour factor, PHF	0.97	0.97	0.97	0.94	0.94	0.94	0.94	0.94	0.94	0.88	0.88	0.88	
Adj. Flow (vph)	110	681	24	70	505	31	0	332	137	0	301	105	
RTOR Reduction (vph)	0	2	0	0	4	0	0	0	97	0	17	0	
Lane Group Flow (vph)	110	703	0	70	532	0	0	332	40	0	389	0	
Confl. Peds. (#/hr)	98		62	62		62	62		62	62		62	
Heavy Vehicles (%)	3%	2%	0%	6%	2%	7%	0%	2%	2%	0%	2%	5%	
Turn Type	Prot	NA		Prot	NA			NA	custom		NA		
Protected Phases	5	2		1	6			4 3	3 1		8		
Permitted Phases													
Actuated Green, G (s)	9.1	39.5		8.7	39.1			26.8	26.4		26.8		
Effective Green, g (s)	10.1	40.5		9.7	40.1			27.8	26.4		27.8		
Actuated g/C Ratio	0.11	0.45		0.11	0.45			0.31	0.29		0.31		
Clearance Time (s)	5.0	5.0		5.0	5.0						5.0		
Vehicle Extension (s)	2.0	2.0		2.0	2.0						2.0		
Lane Grp Cap (vph)	198	1541		164	1389			594	464		555		
v/s Ratio Prot	c0.06	c0.21		0.05	0.17			0.17	0.03		c0.22		
v/s Ratio Perm													
v/c Ratio	0.56	0.46		0.43	0.38			0.56	0.09		0.70		
Uniform Delay, d1	37.8	17.1		37.6	16.7			26.0	23.1		27.4		
Progression Factor	0.78	0.33		1.00	1.00			1.00	1.00		1.00		
Incremental Delay, d2	1.8	0.9		0.7	0.8			0.7	0.0		3.3		
Delay (s)	31.2	6.6		38.2	17.5			26.6	23.1		30.7		
Level of Service	C	A		D	B			C	C		C		
Approach Delay (s)		9.9			19.9			25.6			30.7		
Approach LOS		A			B			C			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			19.4									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.60										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	18.0
Intersection Capacity Utilization			54.2%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

**Intersection**

Int Delay, s/veh 0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↑	↑↑		↕	
Traffic Vol, veh/h	14	776	570	5	8	12
Future Vol, veh/h	14	776	570	5	8	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-8	5	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	843	620	5	9	13

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	625	0	313
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	4.14	-	6.94
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	2.22	-	3.32
Pot Cap-1 Maneuver	952	-	683
Stage 1	-	-	-
Stage 2	-	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	952	-	683
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	15.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	952	-	-	-	358
HCM Lane V/C Ratio	0.016	-	-	-	0.061
HCM Control Delay (s)	8.8	0.1	-	-	15.7
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

**Intersection**

Int Delay, s/veh 0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↑	↑↑		↕	
Traffic Vol, veh/h	10	774	570	0	0	10
Future Vol, veh/h	10	774	570	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-5	2	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	841	620	0	0	11

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	620	0	1062
Stage 1	-	-	620
Stage 2	-	-	442
Critical Hdwy	4.14	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	2.22	-	3.52
Pot Cap-1 Maneuver	956	-	219
Stage 1	-	-	499
Stage 2	-	-	615
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	956	-	214
Mov Cap-2 Maneuver	-	-	214
Stage 1	-	-	499
Stage 2	-	-	601

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	956	-	-	-	686
HCM Lane V/C Ratio	0.011	-	-	-	0.016
HCM Control Delay (s)	8.8	0.1	-	-	10.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

**Intersection**

Int Delay, s/veh 0

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↔		↑	↑	↑	↑
Traffic Vol, veh/h	5	0	570	14	0	774
Future Vol, veh/h	5	0	570	14	0	774
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	0	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	-2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	0	620	15	0	841

Major/Minor	Minor2		Major2		Major1	
Conflicting Flow All	1254	15	0	0	15	0
Stage 1	1254	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Critical Hdwy	6.52	6.22	4.12	-	4.12	-
Critical Hdwy Stg 1	5.52	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	4.018	3.318	2.218	-	2.218	-
Pot Cap-1 Maneuver	172	1065	-	-	1603	-
Stage 1	243	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	0	1065	-	-	1603	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-

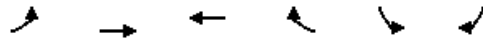
Approach	EB	WB	NE
HCM Control Delay, s			0
HCM LOS	-		

Minor Lane/Major Mvmt	NEL	NER	EBLn1	WBL	WBT
Capacity (veh/h)	1603	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	-
HCM Lane LOS	A	-	-	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

# HCM Signalized Intersection Capacity Analysis

## 19: E Madison St & 11th Ave

7/29/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	0	774	572	0	206	12
Future Volume (vph)	0	774	572	0	206	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	13	13	12	10	12
Grade (%)		0%	-4%		0%	
Total Lost time (s)		5.5	5.5		4.5	
Lane Util. Factor		0.95	0.95		0.97	
Frbp, ped/bikes		1.00	1.00		0.99	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		0.99	
Flt Protected		1.00	1.00		0.95	
Satd. Flow (prot)		3693	3694		3087	
Flt Permitted		1.00	1.00		0.95	
Satd. Flow (perm)		3693	3694		3087	
Peak-hour factor, PHF	0.90	0.90	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	860	650	0	234	14
RTOR Reduction (vph)	0	0	0	0	5	0
Lane Group Flow (vph)	0	860	650	0	243	0
Confl. Peds. (#/hr)	23			38		61
Confl. Bikes (#/hr)				3		17
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Parking (#/hr)						0
Turn Type		NA	NA		Prot	
Protected Phases		6	2		4	
Permitted Phases						
Actuated Green, G (s)		79.3	79.3		10.7	
Effective Green, g (s)		79.3	79.3		10.7	
Actuated g/C Ratio		0.79	0.79		0.11	
Clearance Time (s)		5.5	5.5		4.5	
Vehicle Extension (s)		0.2	0.2		0.2	
Lane Grp Cap (vph)		2928	2929		330	
v/s Ratio Prot		c0.23	0.18		c0.08	
v/s Ratio Perm						
v/c Ratio		0.29	0.22		0.74	
Uniform Delay, d1		2.8	2.6		43.3	
Progression Factor		1.00	0.20		1.00	
Incremental Delay, d2		0.3	0.1		7.1	
Delay (s)		3.0	0.7		50.4	
Level of Service		A	A		D	
Approach Delay (s)		3.0	0.7		50.4	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			8.9		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.35			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	10.0
Intersection Capacity Utilization			42.2%		ICU Level of Service	A
Analysis Period (min)			15			




















c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

20: E Madison St & 12th Ave & Union St

7/29/2016

												
Movement	NBL2	NBL	NBT	NBR	SBL	SBT	SBR	SBR2	NEL2	NEL	NET	NER
Lane Configurations												
Traffic Volume (vph)	27	79	397	69	54	377	61	22	1	29	839	108
Future Volume (vph)	27	79	397	69	54	377	61	22	1	29	839	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	11	12	10	10	12	12	12	12	15	12
Grade (%)			0%			0%					4%	
Total Lost time (s)		5.0	5.0	5.0	5.5	5.5					5.5	
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00					0.95	
Frbp, ped/bikes		1.00	1.00	1.00	1.00	0.94					0.99	
Flpb, ped/bikes		0.92	1.00	1.00	0.97	1.00					1.00	
Frt		1.00	1.00	0.85	1.00	0.97					0.98	
Flt Protected		0.95	1.00	1.00	0.95	1.00					1.00	
Satd. Flow (prot)		1537	1818	1599	1608	1429					3745	
Flt Permitted		0.24	1.00	1.00	0.36	1.00					0.91	
Satd. Flow (perm)		391	1818	1599	606	1429					3421	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.86	0.86	0.86	0.86	0.96	0.96	0.96	0.96
Adj. Flow (vph)	28	82	414	72	63	438	71	26	1	30	874	112
RTOR Reduction (vph)	0	0	0	42	0	2	0	0	0	0	10	0
Lane Group Flow (vph)	0	110	414	30	63	533	0	0	0	0	1008	0
Confl. Peds. (#/hr)	96	34		41	41		96	34	34	27		45
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%	2%	2%	1%	1%	1%	1%
Parking (#/hr)						0						
Turn Type	Perm	Perm	NA	Prot	Perm	NA			Perm	Perm	NA	
Protected Phases			4	4		8					6	
Permitted Phases	4	4			8				6	6		
Actuated Green, G (s)		41.0	41.0	41.0	40.5	40.5					48.5	
Effective Green, g (s)		41.0	41.0	41.0	40.5	40.5					48.5	
Actuated g/C Ratio		0.41	0.41	0.41	0.40	0.40					0.48	
Clearance Time (s)		5.0	5.0	5.0	5.5	5.5					5.5	
Lane Grp Cap (vph)		160	745	655	245	578					1659	
v/s Ratio Prot			0.23	0.02		c0.37						
v/s Ratio Perm		0.28			0.10						c0.29	
v/c Ratio		0.69	0.56	0.05	0.26	0.92					0.61	
Uniform Delay, d1		24.2	22.5	17.7	19.8	28.3					18.8	
Progression Factor		1.00	1.00	1.00	1.81	1.70					1.17	
Incremental Delay, d2		21.5	3.0	0.1	2.5	22.1					1.6	
Delay (s)		45.7	25.5	17.9	38.2	70.2					23.6	
Level of Service		D	C	B	D	E					C	
Approach Delay (s)			28.3			66.9					23.6	
Approach LOS			C			E					C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			35.6			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		11.0				
Intersection Capacity Utilization			94.3%			ICU Level of Service		F				
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 20: E Madison St & 12th Ave & Union St

7/29/2016























Movement	SWL	SWT	SWR	SWR2
Lane Configurations				
Traffic Volume (vph)	37	464	124	32
Future Volume (vph)	37	464	124	32
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width	12	11	12	12
Grade (%)		-8%		
Total Lost time (s)		5.5		
Lane Util. Factor		0.95		
Frbp, ped/bikes		0.96		
Flpb, ped/bikes		1.00		
Frt		0.96		
Flt Protected		1.00		
Satd. Flow (prot)		3282		
Flt Permitted		0.81		
Satd. Flow (perm)		2681		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92
Adj. Flow (vph)	40	504	135	35
RTOR Reduction (vph)	0	4	0	0
Lane Group Flow (vph)	0	710	0	0
Confl. Peds. (#/hr)	45		34	27
Heavy Vehicles (%)	2%	2%	2%	2%
Parking (#/hr)				
Turn Type	Perm	NA		
Protected Phases		2		
Permitted Phases	2			
Actuated Green, G (s)		48.5		
Effective Green, g (s)		48.5		
Actuated g/C Ratio		0.48		
Clearance Time (s)		5.5		
Lane Grp Cap (vph)		1300		
v/s Ratio Prot				
v/s Ratio Perm		0.27		
v/c Ratio		0.55		
Uniform Delay, d1		18.0		
Progression Factor		1.72		
Incremental Delay, d2		1.6		
Delay (s)		32.7		
Level of Service		C		
Approach Delay (s)		32.7		
Approach LOS		C		
<b>Intersection Summary</b>				

# HCM Signalized Intersection Capacity Analysis

## 22: 13th Ave & E Madison St





















7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (vph)	25	707	0	0	447	4	122	42	9	9	0	23
Future Volume (vph)	25	707	0	0	447	4	122	42	9	9	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	11	12	16	16	12	12	13	12
Grade (%)		8%			-7%			0%			0%	
Total Lost time (s)		4.5			4.5		4.5	4.5			4.5	
Lane Util. Factor		0.95			0.95		0.95	0.95			1.00	
Frbp, ped/bikes		1.00			1.00		1.00	0.99			0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00			0.98	
Frt		1.00			1.00		1.00	0.98			0.90	
Flt Protected		1.00			1.00		0.95	0.98			0.99	
Satd. Flow (prot)		3191			3533		1865	1876			1667	
Flt Permitted		0.93			1.00		0.73	0.88			0.94	
Satd. Flow (perm)		2962			3533		1440	1688			1584	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.95	0.95	0.87	0.87	0.87	0.89	0.89	0.89
Adj. Flow (vph)	28	786	0	0	471	4	140	48	10	10	0	26
RTOR Reduction (vph)	0	0	0	0	1	0	0	4	0	0	19	0
Lane Group Flow (vph)	0	814	0	0	474	0	98	96	0	0	17	0
Confl. Peds. (#/hr)	28		29	29		28	1		52	52		1
Confl. Bikes (#/hr)												6
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)									0			0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4				4
Permitted Phases	6						4			4		
Actuated Green, G (s)		63.5			63.5		27.5	27.5				27.5
Effective Green, g (s)		63.5			63.5		27.5	27.5				27.5
Actuated g/C Ratio		0.64			0.64		0.28	0.28				0.28
Clearance Time (s)		4.5			4.5		4.5	4.5				4.5
Lane Grp Cap (vph)		1880			2243		396	464				435
v/s Ratio Prot					0.13							
v/s Ratio Perm		c0.27					c0.07	0.06				0.01
v/c Ratio		0.43			0.21		0.25	0.21				0.04
Uniform Delay, d1		9.2			7.7		28.2	27.9				26.6
Progression Factor		0.34			1.11		0.68	0.67				1.00
Incremental Delay, d2		0.6			0.2		1.5	1.0				0.2
Delay (s)		3.8			8.8		20.7	19.6				26.7
Level of Service		A			A		C	B				C
Approach Delay (s)		3.8			8.8			20.2				26.7
Approach LOS		A			A			C				C
<b>Intersection Summary</b>												
HCM 2000 Control Delay			8.0				HCM 2000 Level of Service			A		
HCM 2000 Volume to Capacity ratio			0.38									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			9.0		
Intersection Capacity Utilization			57.4%				ICU Level of Service			B		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

23: 14th Ave & E Madison St



















7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 			 			 		
Traffic Volume (vph)	0	672	51	58	459	0	14	215	53	2	169	12	
Future Volume (vph)	0	672	51	58	459	0	14	215	53	2	169	12	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	11	12	12	11	12	12	16	12	12	16	12	
Grade (%)		7%			-10%			0%			0%		
Total Lost time (s)		4.5			4.5			8.5			4.5		
Lane Util. Factor		0.95			0.95			1.00			1.00		
Frb, ped/bikes		0.99			1.00			0.99			1.00		
Flpb, ped/bikes		1.00			1.00			1.00			1.00		
Frt		0.99			1.00			0.97			0.99		
Flt Protected		1.00			0.99			1.00			1.00		
Satd. Flow (prot)		3275			3600			2058			2061		
Flt Permitted		1.00			0.76			0.98			1.00		
Satd. Flow (perm)		3275			2737			2020			2058		
Peak-hour factor, PHF	0.92	0.92	0.92	0.91	0.91	0.91	0.85	0.85	0.85	0.86	0.86	0.86	
Adj. Flow (vph)	0	730	55	64	504	0	16	253	62	2	197	14	
RTOR Reduction (vph)	0	5	0	0	0	0	0	8	0	0	3	0	
Lane Group Flow (vph)	0	780	0	0	568	0	0	323	0	0	210	0	
Confl. Peds. (#/hr)	3		31	31		3	37		10	10		37	
Confl. Bikes (#/hr)			7			3			1			1	
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%	
Parking (#/hr)									0			0	
Turn Type		NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		1			1			3				6	
Permitted Phases	1			1			3			6			
Actuated Green, G (s)		46.5			46.5			40.5				44.5	
Effective Green, g (s)		46.5			46.5			40.5				44.5	
Actuated g/C Ratio		0.46			0.46			0.40				0.44	
Clearance Time (s)		4.5			4.5			8.5				4.5	
Lane Grp Cap (vph)		1522			1272			818				915	
v/s Ratio Prot		c0.24											
v/s Ratio Perm					0.21			c0.16				0.10	
v/c Ratio		0.51			0.45			0.39				0.23	
Uniform Delay, d1		18.8			18.1			21.1				17.2	
Progression Factor		0.88			0.13			0.88				0.69	
Incremental Delay, d2		1.1			1.1			1.4				0.6	
Delay (s)		17.7			3.3			19.9				12.4	
Level of Service		B			A			B				B	
Approach Delay (s)		17.7			3.3			19.9				12.4	
Approach LOS		B			A			B				B	
<b>Intersection Summary</b>													
HCM 2000 Control Delay			13.2									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.46										
Actuated Cycle Length (s)			100.0									Sum of lost time (s)	13.0
Intersection Capacity Utilization			74.5%									ICU Level of Service	D
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 24: E Madison St & Pike St

7/29/2016

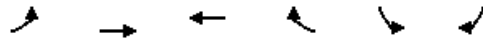
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	25	4	0	0	0	0	0	708	19	1	537	36
Future Volume (vph)	25	4	0	0	0	0	0	708	19	1	537	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	16	12	12	12	12	12	12	12	12	11	12
Grade (%)		6%			0%			10%			-10%	
Total Lost time (s)	4.5	4.5						4.5			4.5	
Lane Util. Factor	0.95	0.95						0.95			0.95	
Fr <sub>t</sub>	1.00	1.00						1.00			0.99	
Fl <sub>t</sub> Protected	0.95	0.96						1.00			1.00	
Satd. Flow (prot)	1522	1688						3349			3558	
Fl <sub>t</sub> Permitted	0.95	0.96						1.00			0.95	
Satd. Flow (perm)	1522	1688						3349			3396	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	4	0	0	0	0	0	770	21	1	584	39
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	0	0	5	0
Lane Group Flow (vph)	15	16	0	0	0	0	0	789	0	0	619	0
Parking (#/hr)		0							0			
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		6						1			1	
Permitted Phases	6									1		
Actuated Green, G (s)	44.5	44.5						46.5			46.5	
Effective Green, g (s)	44.5	44.5						46.5			46.5	
Actuated g/C Ratio	0.44	0.44						0.46			0.46	
Clearance Time (s)	4.5	4.5						4.5			4.5	
Lane Grp Cap (vph)	677	751						1557			1579	
v/s Ratio Prot								c0.24				
v/s Ratio Perm	c0.01	0.01									0.18	
v/c Ratio	0.02	0.02						0.51			0.39	
Uniform Delay, d1	15.6	15.5						18.7			17.5	
Progression Factor	1.41	1.40						0.13			0.60	
Incremental Delay, d2	0.1	0.1						1.0			0.7	
Delay (s)	21.9	21.9						3.5			11.3	
Level of Service	C	C						A			B	
Approach Delay (s)		21.9			0.0			3.5			11.3	
Approach LOS		C			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			7.2					HCM 2000 Level of Service			A	
HCM 2000 Volume to Capacity ratio			0.28									
Actuated Cycle Length (s)			100.0					Sum of lost time (s)		13.0		
Intersection Capacity Utilization			33.5%					ICU Level of Service		A		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 25: E Madison St & 15th Ave

7/29/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔↑	↔↑			↔↑
Traffic Volume (vph)	63	670	479	13	0	125
Future Volume (vph)	63	670	479	13	0	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	16
Grade (%)		10%	-9%		0%	
Total Lost time (s)		4.5	4.5			4.0
Lane Util. Factor		0.95	0.95			1.00
Frb, ped/bikes		1.00	1.00			0.99
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		3264	3591			1752
Flt Permitted		0.84	1.00			1.00
Satd. Flow (perm)		2769	3591			1752
Peak-hour factor, PHF	0.93	0.93	0.85	0.85	0.85	0.85
Adj. Flow (vph)	68	720	564	15	0	147
RTOR Reduction (vph)	0	0	1	0	0	0
Lane Group Flow (vph)	0	788	578	0	0	147
Confl. Peds. (#/hr)	59			59	47	1
Confl. Bikes (#/hr)				2		
Heavy Vehicles (%)	1%	1%	1%	1%	5%	5%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA			Free
Protected Phases		2	6			
Permitted Phases	2					Free
Actuated Green, G (s)		80.0	80.0			100.0
Effective Green, g (s)		80.0	80.0			100.0
Actuated g/C Ratio		0.80	0.80			1.00
Clearance Time (s)		4.5	4.5			
Vehicle Extension (s)		0.2	0.2			
Lane Grp Cap (vph)		2215	2872			1752
v/s Ratio Prot			0.16			
v/s Ratio Perm		c0.28				c0.08
v/c Ratio		0.36	0.20			0.08
Uniform Delay, d1		2.8	2.4			0.0
Progression Factor		0.18	0.47			1.00
Incremental Delay, d2		0.4	0.2			0.1
Delay (s)		0.9	1.3			0.1
Level of Service		A	A			A
Approach Delay (s)		0.9	1.3		0.1	
Approach LOS		A	A		A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			1.0		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.34			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			48.6%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

**Intersection**

Int Delay, s/veh 0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↑↑	
Traffic Vol, veh/h	670	5	0	493	5	15
Future Vol, veh/h	670	5	0	493	5	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	9	-	-	-9	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	728	5	0	536	5	16

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	999
Stage 1	-	-	731
Stage 2	-	-	268
Critical Hdwy	-	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	-	-	3.52
Pot Cap-1 Maneuver	-	0	240
Stage 1	-	0	437
Stage 2	-	0	753
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	240
Mov Cap-2 Maneuver	-	-	240
Stage 1	-	-	437
Stage 2	-	-	753

Approach	EB	WB	NB
HCM Control Delay, s	0	0	13.4
HCM LOS			B

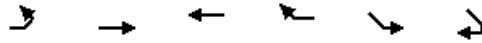
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	448	-	-	-
HCM Lane V/C Ratio	0.049	-	-	-
HCM Control Delay (s)	13.4	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.2	-	-	-



# HCM Signalized Intersection Capacity Analysis

## 27: E Madison St & Pine St

7/29/2016



















Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↔↕	↕↔		↕	↕
Traffic Volume (vph)	16	669	488	197	230	5
Future Volume (vph)	16	669	488	197	230	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	10	10	12	11	11
Grade (%)		9%	-4%		0%	
Total Lost time (s)		4.5	4.5		4.5	4.5
Lane Util. Factor		0.95	0.95		1.00	1.00
Frbp, ped/bikes		1.00	0.97		1.00	0.88
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.96		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3180	3127		1678	1193
Flt Permitted		0.93	1.00		0.95	1.00
Satd. Flow (perm)		2967	3127		1678	1193
Peak-hour factor, PHF	0.95	0.95	0.94	0.94	0.90	0.90
Adj. Flow (vph)	17	704	519	210	256	6
RTOR Reduction (vph)	0	0	28	0	0	5
Lane Group Flow (vph)	0	721	701	0	256	1
Confl. Peds. (#/hr)	62			62	1	43
Confl. Bikes (#/hr)				3		8
Heavy Vehicles (%)	1%	1%	2%	2%	4%	4%
Parking (#/hr)						0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	2		4	
Permitted Phases	2					4
Actuated Green, G (s)		72.6	72.6		18.4	18.4
Effective Green, g (s)		72.6	72.6		18.4	18.4
Actuated g/C Ratio		0.73	0.73		0.18	0.18
Clearance Time (s)		4.5	4.5		4.5	4.5
Vehicle Extension (s)		0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		2154	2270		308	219
v/s Ratio Prot			0.22		c0.15	
v/s Ratio Perm		c0.24				0.00
v/c Ratio		0.33	0.31		0.83	0.01
Uniform Delay, d1		5.0	4.8		39.3	33.3
Progression Factor		0.13	0.45		1.00	1.00
Incremental Delay, d2		0.4	0.3		16.4	0.0
Delay (s)		1.0	2.5		55.7	33.3
Level of Service		A	A		E	C
Approach Delay (s)		1.0	2.5		55.2	
Approach LOS		A	A		E	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.0		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.43			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	9.0
Intersection Capacity Utilization			50.2%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 28: 17th Ave & E Madison St

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	76	800	41	16	577	50	47	32	11	57	51	56
Future Volume (vph)	76	800	41	16	577	50	47	32	11	57	51	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	10	12	10	12	12	16	12
Grade (%)		4%			4%			0%			0%	
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frbp, ped/bikes		0.99			0.98			0.97			0.91	
Flpb, ped/bikes		0.99			1.00			0.93			0.94	
Frt		0.99			0.99			0.98			0.95	
Flt Protected		1.00			1.00			0.97			0.98	
Satd. Flow (prot)		3304			3241			1523			1723	
Flt Permitted		0.82			0.92			0.63			0.83	
Satd. Flow (perm)		2726			2986			988			1455	
Peak-hour factor, PHF	0.92	0.92	0.92	0.96	0.96	0.96	0.80	0.80	0.80	0.93	0.93	0.93
Adj. Flow (vph)	83	870	45	17	601	52	59	40	14	61	55	60
RTOR Reduction (vph)	0	3	0	0	5	0	0	6	0	0	20	0
Lane Group Flow (vph)	0	995	0	0	665	0	0	107	0	0	156	0
Confl. Peds. (#/hr)	95		44	44		95	120		113	113		120
Confl. Bikes (#/hr)			17			23			3			11
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)		76.1			76.1			14.9			14.9	
Effective Green, g (s)		76.1			76.1			14.9			14.9	
Actuated g/C Ratio		0.76			0.76			0.15			0.15	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Vehicle Extension (s)		0.2			0.2			3.0			3.0	
Lane Grp Cap (vph)		2074			2272			147			216	
v/s Ratio Prot												
v/s Ratio Perm		c0.37			0.22			c0.11			0.11	
v/c Ratio		0.48			0.29			0.73			0.72	
Uniform Delay, d1		4.5			3.7			40.6			40.6	
Progression Factor		0.82			1.26			1.00			1.00	
Incremental Delay, d2		0.8			0.3			16.4			11.2	
Delay (s)		4.4			5.0			57.0			51.8	
Level of Service		A			A			E			D	
Approach Delay (s)		4.4			5.0			57.0			51.8	
Approach LOS		A			A			E			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			11.9				HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio			0.52									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		9.0			
Intersection Capacity Utilization			68.0%				ICU Level of Service		C			
Analysis Period (min)			15									
c Critical Lane Group												

Intersection												
Int Delay, s/veh	0.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔↔			↔↔			↔↔			↔↔		
Traffic Vol, veh/h	14	882	40	2	615	3	9	2	5	4	2	19
Future Vol, veh/h	14	882	40	2	615	3	9	2	5	4	2	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-4	-	-	11	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	959	43	2	668	3	10	2	5	4	2	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	672	0	0	1002	0	0	1351	1687	501	1185	1707	336
Stage 1	-	-	-	-	-	-	1011	1011	-	674	674	-
Stage 2	-	-	-	-	-	-	340	676	-	511	1033	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	915	-	-	687	-	-	109	93	515	144	90	660
Stage 1	-	-	-	-	-	-	257	315	-	410	452	-
Stage 2	-	-	-	-	-	-	648	451	-	514	308	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	915	-	-	687	-	-	100	89	515	135	86	660
Mov Cap-2 Maneuver	-	-	-	-	-	-	100	89	-	135	86	-
Stage 1	-	-	-	-	-	-	247	303	-	395	450	-
Stage 2	-	-	-	-	-	-	622	449	-	486	297	-


















Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0	36.6	17.9
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	131	915	-	-	687	-	-	306
HCM Lane V/C Ratio	0.133	0.017	-	-	0.003	-	-	0.089
HCM Control Delay (s)	36.6	9	0.2	-	10.3	0	-	17.9
HCM Lane LOS	E	A	A	-	B	A	-	C
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0	-	-	0.3

# HCM Signalized Intersection Capacity Analysis

30: 19th Ave & E Madison St

7/29/2016

















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	108	751	32	3	543	21	23	137	19	23	113	54	
Future Volume (vph)	108	751	32	3	543	21	23	137	19	23	113	54	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	11	12	12	11	12	12	16	12	12	16	12	
Grade (%)		-11%			8%			0%			0%		
Total Lost time (s)		6.0			6.0			6.0			6.0		
Lane Util. Factor		0.95			0.95			1.00			1.00		
Frb, ped/bikes		1.00			1.00			1.00			0.99		
Flpb, ped/bikes		1.00			1.00			1.00			1.00		
Frt		0.99			0.99			0.99			0.96		
Flt Protected		0.99			1.00			0.99			0.99		
Satd. Flow (prot)		3571			3286			2083			1956		
Flt Permitted		0.78			0.95			0.85			0.87		
Satd. Flow (perm)		2812			3129			1778			1704		
Peak-hour factor, PHF	0.99	0.99	0.99	0.98	0.98	0.98	0.86	0.86	0.86	0.91	0.91	0.91	
Adj. Flow (vph)	109	759	32	3	554	21	27	159	22	25	124	59	
RTOR Reduction (vph)	0	1	0	0	2	0	0	6	0	0	19	0	
Lane Group Flow (vph)	0	899	0	0	576	0	0	202	0	0	189	0	
Confl. Peds. (#/hr)	26		40	40		26	7		2	2		7	
Confl. Bikes (#/hr)			8			4			1			12	
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	4%	4%	4%	
Parking (#/hr)									0			0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		2			2			4			4		
Permitted Phases	2			2			4			4			
Actuated Green, G (s)		72.3			72.3			15.7			15.7		
Effective Green, g (s)		72.3			72.3			15.7			15.7		
Actuated g/C Ratio		0.72			0.72			0.16			0.16		
Clearance Time (s)		6.0			6.0			6.0			6.0		
Vehicle Extension (s)		0.2			0.2			3.0			3.0		
Lane Grp Cap (vph)		2033			2262			279			267		
v/s Ratio Prot													
v/s Ratio Perm		c0.32			0.18			c0.11			0.11		
v/c Ratio		0.44			0.25			0.72			0.71		
Uniform Delay, d1		5.6			4.7			40.1			40.0		
Progression Factor		1.55			1.80			1.00			1.00		
Incremental Delay, d2		0.6			0.3			9.0			8.4		
Delay (s)		9.4			8.7			49.1			48.3		
Level of Service		A			A			D			D		
Approach Delay (s)		9.4			8.7			49.1			48.3		
Approach LOS		A			A			D			D		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			17.8				HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.49										
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		12.0				
Intersection Capacity Utilization			69.9%				ICU Level of Service			C			
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 31: 20th Ave & E Olive St & E Madison St

7/29/2016

													
Movement	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBR2	SBL2	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	9	707	121	10	4	500	6	22	1	2	2	14	
Future Volume (vph)	9	707	121	10	4	500	6	22	1	2	2	14	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	12	10	12	12	12	12	13	12	
Grade (%)		-8%				3%					0%		
Total Lost time (s)		4.5				4.5		4.0			4.5		
Lane Util. Factor		0.95				0.95		1.00			1.00		
Frb, ped/bikes		0.99				1.00		1.00			0.98		
Flpb, ped/bikes		1.00				1.00		1.00			0.99		
Frt		0.98				1.00		0.86			0.90		
Flt Protected		1.00				1.00		1.00			0.99		
Satd. Flow (prot)		3597				3275		1465			1692		
Flt Permitted		0.95				0.95		1.00			0.99		
Satd. Flow (perm)		3418				3115		1465			1692		
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.79	0.59	0.59	0.59	0.59	
Adj. Flow (vph)	9	729	125	10	4	532	6	28	2	3	3	24	
RTOR Reduction (vph)	0	1	0	0	0	1	0	0	0	0	23	0	
Lane Group Flow (vph)	0	872	0	0	0	541	0	28	0	0	9	0	
Confl. Peds. (#/hr)	29		10	2	2		29		12	10		7	
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	
Parking (#/hr)			0					0				0	
Turn Type	Perm	NA			Perm	NA		Free	Perm	Perm		NA	
Protected Phases		2				2						4	
Permitted Phases	2				2			Free	4	4			
Actuated Green, G (s)		74.1				74.1		100.0				4.3	
Effective Green, g (s)		74.1				74.1		100.0				4.3	
Actuated g/C Ratio		0.74				0.74		1.00				0.04	
Clearance Time (s)		4.5				4.5						4.5	
Vehicle Extension (s)		0.2				0.2						2.0	
Lane Grp Cap (vph)		2532				2308		1465				72	
v/s Ratio Prot													
v/s Ratio Perm		c0.26				0.17		0.02				0.01	
v/c Ratio		0.34				0.23		0.02				0.13	
Uniform Delay, d1		4.5				4.1		0.0				46.0	
Progression Factor		0.57				0.98		1.00				1.00	
Incremental Delay, d2		0.3				0.2		0.0				0.3	
Delay (s)		2.9				4.2		0.0				46.3	
Level of Service		A				A		A				D	
Approach Delay (s)		2.9				4.2						46.3	
Approach LOS		A				A						D	
<b>Intersection Summary</b>													
HCM 2000 Control Delay			7.1									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.33										
Actuated Cycle Length (s)			100.0									Sum of lost time (s)	13.5
Intersection Capacity Utilization			55.9%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 31: 20th Ave & E Olive St & E Madison St

7/29/2016



Movement	NWL	NWR	NWR2
Lane Configurations	Y		
Traffic Volume (vph)	85	4	3
Future Volume (vph)	85	4	3
Ideal Flow (vphpl)	1900	1900	1900
Lane Width	16	12	12
Grade (%)	0%		
Total Lost time (s)	4.5		
Lane Util. Factor	1.00		
Frbp, ped/bikes	0.99		
Flpb, ped/bikes	1.00		
Frt	0.99		
Flt Protected	0.96		
Satd. Flow (prot)	1990		
Flt Permitted	0.96		
Satd. Flow (perm)	1990		
Peak-hour factor, PHF	0.82	0.82	0.82
Adj. Flow (vph)	104	5	4
RTOR Reduction (vph)	60	0	0
Lane Group Flow (vph)	53	0	0
Confl. Peds. (#/hr)		29	12
Heavy Vehicles (%)	1%	1%	1%
Parking (#/hr)		0	0
Turn Type	Prot		
Protected Phases	1		
Permitted Phases			
Actuated Green, G (s)	8.1		
Effective Green, g (s)	8.1		
Actuated g/C Ratio	0.08		
Clearance Time (s)	4.5		
Vehicle Extension (s)	2.0		
Lane Grp Cap (vph)	161		
v/s Ratio Prot	c0.03		
v/s Ratio Perm			
v/c Ratio	0.33		
Uniform Delay, d1	43.4		
Progression Factor	1.00		
Incremental Delay, d2	0.4		
Delay (s)	43.8		
Level of Service	D		
Approach Delay (s)	43.8		
Approach LOS	D		

### Intersection Summary



HCM Signalized Intersection Capacity Analysis  
 32: 22nd Ave/E Denny Way & E Madison St

7/29/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	3	702	37	18	483	19	10	25	1	22	20	26
Future Volume (vph)	3	702	37	18	483	19	10	25	1	22	20	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	12	10	12	12	12	12	12	11	12
Grade (%)		-3%			1%			0%			0%	
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frb, ped/bikes		1.00			1.00			1.00			0.97	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		0.99			0.99			1.00			0.95	
Flt Protected		1.00			1.00			0.99			0.98	
Satd. Flow (prot)		3703			3290			1838			1630	
Flt Permitted		0.95			0.92			0.83			0.91	
Satd. Flow (perm)		3533			3017			1554			1500	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.64	0.64	0.64	0.77	0.77	0.77
Adj. Flow (vph)	3	789	42	20	543	21	16	39	2	29	26	34
RTOR Reduction (vph)	0	2	0	0	1	0	0	2	0	0	29	0
Lane Group Flow (vph)	0	832	0	0	583	0	0	55	0	0	60	0
Confl. Peds. (#/hr)	2		25	25		2	39		4	4		39
Confl. Bikes (#/hr)			1						10			2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	2%	2%	2%
Parking (#/hr)			0			0			0			
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)		83.8			83.8			7.2			7.2	
Effective Green, g (s)		83.8			83.8			7.2			7.2	
Actuated g/C Ratio		0.84			0.84			0.07			0.07	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Vehicle Extension (s)		0.2			0.2			1.0			1.0	
Lane Grp Cap (vph)		2960			2528			111			108	
v/s Ratio Prot												
v/s Ratio Perm		c0.24			0.19			0.04			c0.04	
v/c Ratio		0.28			0.23			0.50			0.56	
Uniform Delay, d1		1.7			1.6			44.7			44.9	
Progression Factor		0.10			0.73			1.00			1.00	
Incremental Delay, d2		0.2			0.2			1.3			3.5	
Delay (s)		0.4			1.4			45.9			48.4	
Level of Service		A			A			D			D	
Approach Delay (s)		0.4			1.4			45.9			48.4	
Approach LOS		A			A			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			5.2				HCM 2000 Level of Service		A			
HCM 2000 Volume to Capacity ratio			0.30									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		9.0			
Intersection Capacity Utilization			48.6%				ICU Level of Service		A			
Analysis Period (min)			15									

c Critical Lane Group

**Intersection**

Int Delay, s/veh 0.4

Movement	SBL	SBR	NEL	NET	SWT	SWR
Lane Configurations	Y			↑↑	↑↑	
Traffic Vol, veh/h	0	12	24	714	489	10
Future Vol, veh/h	0	12	24	714	489	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	-1	5	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	13	26	776	532	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	977	271	542	0	-	0
Stage 1	537	-	-	-	-	-
Stage 2	440	-	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-	-
Pot Cap-1 Maneuver	248	727	1023	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	616	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	237	727	1023	-	-	-
Mov Cap-2 Maneuver	237	-	-	-	-	-
Stage 1	550	-	-	-	-	-
Stage 2	588	-	-	-	-	-













Approach	SB	NE	SW
HCM Control Delay, s	10	0.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SBLn1	SWT	SWR
Capacity (veh/h)	1023	-	727	-	-
HCM Lane V/C Ratio	0.026	-	0.018	-	-
HCM Control Delay (s)	8.6	0.2	10	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

# HCM Signalized Intersection Capacity Analysis

## 34: E Madison St & 23rd Ave E



















7/29/2016

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↑↑			↑↑		↖	↗		↖	↑↑	
Traffic Volume (vph)	0	575	33	0	624	114	190	529	33	59	350	11
Future Volume (vph)	0	575	33	0	624	114	190	529	33	59	350	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	9	9	10	10	10	10	16	10	9	10	10
Grade (%)		0%			0%			-5%			10%	
Total Lost time (s)		3.0			3.0		3.0	3.0		3.0	4.5	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	0.95	
Frbp, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.99			0.98		1.00	0.99		1.00	0.99	
Flt Protected		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3179			3254		1693	2145		1528	3109	
Flt Permitted		1.00			1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3179			3254		1693	2145		1528	3109	
Peak-hour factor, PHF	0.92	0.87	0.69	0.25	0.91	0.92	0.92	0.92	0.92	0.64	0.92	0.46
Adj. Flow (vph)	0	661	48	0	686	124	207	575	36	92	380	24
RTOR Reduction (vph)	0	5	0	0	15	0	0	2	0	0	4	0
Lane Group Flow (vph)	0	704	0	0	796	0	207	609	0	92	400	0
Confl. Peds. (#/hr)			2	2								3
Heavy Vehicles (%)	2%	1%	1%	1%	1%	2%	2%	2%	2%	1%	2%	1%
Parking (#/hr)			0									0
Turn Type		NA			NA		Prot	NA		Prot	NA	
Protected Phases		4			4		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)		40.0			40.0		17.5	36.8		9.2	28.5	
Effective Green, g (s)		42.0			42.0		19.0	38.3		10.7	28.5	
Actuated g/C Ratio		0.42			0.42		0.19	0.38		0.11	0.28	
Clearance Time (s)		5.0			5.0		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		0.2			0.2		3.0	0.2		2.0	3.0	
Lane Grp Cap (vph)		1335			1366		321	821		163	886	
v/s Ratio Prot		0.22			c0.24		0.12	c0.28		c0.06	0.13	
v/s Ratio Perm												
v/c Ratio		0.53			0.58		0.64	0.74		0.56	0.45	
Uniform Delay, d1		21.6			22.3		37.4	26.6		42.4	29.3	
Progression Factor		0.87			1.96		1.32	0.88		1.35	1.45	
Incremental Delay, d2		1.3			1.2		4.3	5.9		2.3	1.5	
Delay (s)		20.1			44.8		53.7	29.2		59.4	44.1	
Level of Service		C			D		D	C		E	D	
Approach Delay (s)		20.1			44.8			35.4			46.9	
Approach LOS		C			D			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			36.3				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			10.5		
Intersection Capacity Utilization			66.6%				ICU Level of Service			C		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 35: E Madison St & E JOHN ST

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	137	140	10	0	127	6	22	447	6	3	345	206
Future Volume (vph)	137	140	10	0	127	6	22	447	6	3	345	206
Ideal Flow (vphpl)	1900	1900	1900	1750	1750	1750	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	10	12	16	12	12	16	12
Grade (%)		-15%			0%			-10%			10%	
Total Lost time (s)		2.5	5.5		2.5			2.5			2.5	
Lane Util. Factor		1.00	1.00		1.00			1.00			1.00	
Frbp, ped/bikes		1.00	0.98		1.00			1.00			0.94	
Flpb, ped/bikes		1.00	1.00		1.00			1.00			1.00	
Frt		1.00	0.85		0.99			1.00			0.95	
Flt Protected		0.98	1.00		1.00			1.00			1.00	
Satd. Flow (prot)		1824	1503		1621			2248			1746	
Flt Permitted		0.98	1.00		1.00			0.96			1.00	
Satd. Flow (perm)		1824	1503		1621			2171			1744	
Peak-hour factor, PHF	0.83	0.83	0.83	0.72	0.72	0.72	0.91	0.91	0.91	0.95	0.95	0.95
Adj. Flow (vph)	165	169	12	0	176	8	24	491	7	3	363	217
RTOR Reduction (vph)	0	0	9	0	2	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	334	3	0	182	0	0	521	0	0	583	0
Confl. Peds. (#/hr)	9					9	40		26	26		40
Confl. Bikes (#/hr)			7									6
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	4%	4%	4%
Parking (#/hr)			0						0			0
Turn Type	Split	NA	Perm		NA		Perm	NA		Perm	NA	
Protected Phases	3	3		4	4			2				2
Permitted Phases		3	3				2	2		2		
Actuated Green, G (s)		22.1	22.1		14.8			46.6				46.6
Effective Green, g (s)		25.1	22.1		17.8			49.6				49.6
Actuated g/C Ratio		0.25	0.22		0.18			0.50				0.50
Clearance Time (s)		5.5	5.5		5.5			5.5				5.5
Vehicle Extension (s)		2.0	2.0		2.0			0.2				0.2
Lane Grp Cap (vph)		457	332		288			1076				865
v/s Ratio Prot		c0.18			c0.11							
v/s Ratio Perm			0.00					0.24				c0.33
v/c Ratio		0.73	0.01		0.63			0.48				0.67
Uniform Delay, d1		34.4	30.4		38.1			16.7				19.1
Progression Factor		1.34	1.00		1.00			0.91				1.28
Incremental Delay, d2		2.9	0.0		3.3			1.1				4.0
Delay (s)		48.9	30.4		41.4			16.2				28.4
Level of Service		D	C		D			B				C
Approach Delay (s)		48.2			41.4			16.2				28.4
Approach LOS		D			D			B				C
<b>Intersection Summary</b>												
HCM 2000 Control Delay			30.2									C
HCM 2000 Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			100.0								7.5	
Intersection Capacity Utilization			73.8%									D
Analysis Period (min)			15									

c Critical Lane Group

**Intersection**

Int Delay, s/veh 3.9

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	21	14	15	26	10	25	511	10	10	490	13
Future Vol, veh/h	5	21	14	15	26	10	25	511	10	10	490	13
Conflicting Peds, #/hr	6	0	3	3	0	6	23	0	36	36	0	23
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	1	-	-	-10	-	-	14	-
Peak Hour Factor	71	71	71	75	75	75	98	98	98	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	2	2	2
Mvmt Flow	7	30	20	20	35	13	26	521	10	10	510	14

Major/Minor	Minor1			Minor2			Major1			Major2		
Conflicting Flow All	1182	1182	566	1166	1180	546	547	0	0	568	0	0
Stage 1	614	614	-	561	561	-	-	-	-	-	-	-
Stage 2	568	568	-	605	619	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.9	6.4	7.3	6.7	6.3	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.5	5.9	-	6.3	5.7	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.9	-	6.3	5.7	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	147	168	511	162	180	533	1022	-	-	1004	-	-
Stage 1	451	454	-	500	498	-	-	-	-	-	-	-
Stage 2	480	478	-	472	467	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	111	152	494	125	163	519	1015	-	-	1001	-	-
Mov Cap-2 Maneuver	111	152	-	125	163	-	-	-	-	-	-	-
Stage 1	422	425	-	473	482	-	-	-	-	-	-	-
Stage 2	425	462	-	405	437	-	-	-	-	-	-	-

Approach	NB	SB	NE	SW
HCM Control Delay, s	31.9	39.3	0.4	0.2
HCM LOS	D	E		

Minor Lane/Major Mvmt	NEL	NET	NER	NBLn1	SBLn1	SWL	SWT	SWR
Capacity (veh/h)	1015	-	-	189	171	1001	-	-
HCM Lane V/C Ratio	0.025	-	-	0.298	0.398	0.01	-	-
HCM Control Delay (s)	8.6	0	-	31.9	39.3	8.6	0	-
HCM Lane LOS	A	A	-	D	E	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	1.2	1.7	0	-	-

**Intersection**

Int Delay, s/veh 0.5

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	Y			4	4	
Traffic Vol, veh/h	2	14	20	503	507	3
Future Vol, veh/h	2	14	20	503	507	3
Conflicting Peds, #/hr	3	0	27	0	0	27
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	-3	-	-	-14	10	-
Peak Hour Factor	50	50	92	92	95	95
Heavy Vehicles, %	0	0	2	2	2	2
Mvmt Flow	4	28	22	547	534	3

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1155	562	564 0
Stage 1	562	-	- -
Stage 2	593	-	- -
Critical Hdwy	5.8	5.9	4.12 -
Critical Hdwy Stg 1	4.8	-	- -
Critical Hdwy Stg 2	4.8	-	- -
Follow-up Hdwy	3.5	3.3	2.218 -
Pot Cap-1 Maneuver	266	556	1008 -
Stage 1	631	-	- -
Stage 2	614	-	- -
Platoon blocked, %			- -
Mov Cap-1 Maneuver	246	543	1008 -
Mov Cap-2 Maneuver	246	-	- -
Stage 1	617	-	- -
Stage 2	582	-	- -

Approach	SE	NE	SW
HCM Control Delay, s	13.2	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	1008	-	472	-	-
HCM Lane V/C Ratio	0.022	-	0.068	-	-
HCM Control Delay (s)	8.7	0	13.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-



**Intersection**

Int Delay, s/veh 0.7

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations	Y		P		T	T
Traffic Vol, veh/h	7	24	451	43	8	492
Future Vol, veh/h	7	24	451	43	8	492
Conflicting Peds, #/hr	4	0	0	31	31	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	50	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	-10	-	-	8
Peak Hour Factor	65	65	93	93	96	96
Heavy Vehicles, %	0	0	3	3	2	2
Mvmt Flow	11	37	485	46	8	513

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1072	539	0	0	562	0
Stage 1	539	-	-	-	-	-
Stage 2	533	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.12	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.218	-
Pot Cap-1 Maneuver	246	546	-	-	1009	-
Stage 1	589	-	-	-	-	-
Stage 2	593	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	237	532	-	-	1009	-
Mov Cap-2 Maneuver	237	-	-	-	-	-
Stage 1	574	-	-	-	-	-
Stage 2	586	-	-	-	-	-

Approach	NW		NE		SW
HCM Control Delay, s	14.8		0		0.1
HCM LOS	B				

Minor Lane/Major Mvmt	NET	NERNWLn1	SWL	SWT
Capacity (veh/h)	-	-	415	1009
HCM Lane V/C Ratio	-	-	0.115	0.008
HCM Control Delay (s)	-	-	14.8	8.6
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.4	0

# HCM Unsignalized Intersection Capacity Analysis

## 39: E Madison St & 27th Ave E

7/29/2016



Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Volume (veh/h)	2	21	16	459	479	10
Future Volume (Veh/h)	2	21	16	459	479	10
Sign Control	Stop			Free	Free	
Grade	0%			-8%	4%	
Peak Hour Factor	0.82	0.82	0.93	0.93	0.96	0.96
Hourly flow rate (vph)	2	26	17	494	499	10
Pedestrians	19			19		
Lane Width (ft)	12.0			16.0		
Walking Speed (ft/s)	4.0			4.0		
Percent Blockage	2			2		
Right turn flare (veh)						
Median type				TWLTL	TWLTL	
Median storage (veh)				2	2	
Upstream signal (ft)				293		
pX, platoon unblocked	0.88	0.88	0.88			
vC, conflicting volume	1070	523	528			
vC1, stage 1 conf vol	523					
vC2, stage 2 conf vol	547					
vCu, unblocked vol	1012	392	398			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	95	98			
cM capacity (veh/h)	449	574	1003			
<b>Direction, Lane #</b>	<b>SE 1</b>	<b>NE 1</b>	<b>NE 2</b>	<b>SW 1</b>		
Volume Total	28	17	494	509		
Volume Left	2	17	0	0		
Volume Right	26	0	0	10		
cSH	563	1003	1700	1700		
Volume to Capacity	0.05	0.02	0.29	0.30		
Queue Length 95th (ft)	4	1	0	0		
Control Delay (s)	11.7	8.7	0.0	0.0		
Lane LOS	B	A				
Approach Delay (s)	11.7	0.3		0.0		
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			0.5			
Intersection Capacity Utilization			35.9%	ICU Level of Service	A	
Analysis Period (min)			15			

**Intersection**

Int Delay, s/veh 0.5

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	↘		↙	↑	↘	
Traffic Vol, veh/h	2	21	16	459	479	10
Future Vol, veh/h	2	21	16	459	479	10
Conflicting Peds, #/hr	19	0	19	0	0	19
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	50	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	-8	4	-
Peak Hour Factor	82	82	93	93	96	96
Heavy Vehicles, %	0	0	3	3	2	2
Mvmt Flow	2	26	17	494	499	10



















Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	1070	523	528	0	0
Stage 1	523	-	-	-	-
Stage 2	547	-	-	-	-
Critical Hdwy	6.4	6.2	4.13	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.227	-	-
Pot Cap-1 Maneuver	247	558	1034	-	-
Stage 1	599	-	-	-	-
Stage 2	584	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	235	549	1034	-	-
Mov Cap-2 Maneuver	371	-	-	-	-
Stage 1	590	-	-	-	-
Stage 2	565	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	12.2	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	1034	-	527	-	-
HCM Lane V/C Ratio	0.017	-	0.053	-	-
HCM Control Delay (s)	8.5	-	12.2	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

HCM 2010 Signalized Intersection Summary  
 40: E Madison St & MLK Jr Way E/28th Ave E




















7/29/2016

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	132	98	183	56	210	11	8	394	54	121	353	21
Future Volume (veh/h)	132	98	183	56	210	11	8	394	54	121	353	21
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.92	1.00		0.92	0.99		0.92	0.97		0.92
Parking Bus, Adj	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 Sat Flow, veh/h/ln	1881	1844	1881	1910	1910	1910	1806	1957	1938	1736	1881	1881
Adj Flow Rate, veh/h	145	108	201	59	221	12	8	415	57	129	376	22
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	0	0	0	3	3	3	4	4	4
Cap, veh/h	198	137	229	130	465	24	481	924	127	533	972	57
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	1.00	1.00	1.00	0.56	0.56	0.56
Sat Flow, veh/h	401	366	610	231	1242	63	944	1664	229	830	1750	102
Grp Volume(v), veh/h	454	0	0	292	0	0	8	0	472	129	0	398
Grp Sat Flow(s),veh/h/ln	1378	0	0	1536	0	0	944	0	1893	830	0	1853
Q Serve(g_s), s	17.7	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	8.2	0.0	12.2
Cycle Q Clear(g_c), s	30.8	0.0	0.0	13.1	0.0	0.0	12.4	0.0	0.0	8.2	0.0	12.2
Prop In Lane	0.32		0.44	0.20		0.04	1.00		0.12	1.00		0.06
Lane Grp Cap(c), veh/h	564	0	0	619	0	0	481	0	1051	533	0	1029
V/C Ratio(X)	0.81	0.00	0.00	0.47	0.00	0.00	0.02	0.00	0.45	0.24	0.00	0.39
Avail Cap(c_a), veh/h	703	0	0	784	0	0	481	0	1051	533	0	1029
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	29.2	0.0	0.0	23.3	0.0	0.0	1.4	0.0	0.0	11.7	0.0	12.6
Incr Delay (d2), s/veh	5.5	0.0	0.0	0.6	0.0	0.0	0.1	0.0	1.4	1.1	0.0	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.5	0.0	0.0	6.2	0.0	0.0	0.1	0.0	0.4	2.0	0.0	6.5
LnGrp Delay(d),s/veh	34.7	0.0	0.0	23.9	0.0	0.0	1.4	0.0	1.4	12.8	0.0	13.7
LnGrp LOS	C			C			A		A	B		B
Approach Vol, veh/h		454			292			480				527
Approach Delay, s/veh		34.7			23.9			1.4				13.5
Approach LOS		C			C			A				B
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		59.0		41.0		59.0		41.0				
Change Period (Y+Rc), s		3.5		3.5		3.5		3.5				
Max Green Setting (Gmax), s		45.5		47.5		45.5		47.5				
Max Q Clear Time (g_c+I1), s		14.4		32.8		14.2		15.1				
Green Ext Time (p_c), s		7.7		4.7		7.7		6.2				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				17.4								
HCM 2010 LOS				B								

# HCM Signalized Intersection Capacity Analysis

## 41: 1st Ave & Spring St

7/29/2016













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						  			 	
Traffic Volume (vph)	56	214	44	0	0	0	0	576	77	81	590	0
Future Volume (vph)	56	214	44	0	0	0	0	576	77	81	590	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	12	10	12	12	12	10	10	10	10	10	10
Grade (%)		9%			0%			3%			0%	
Total Lost time (s)		4.5						4.5			4.5	
Lane Util. Factor		0.95						0.91			0.95	
Frbp, ped/bikes		0.95						0.95			1.00	
Flpb, ped/bikes		0.98						1.00			0.98	
Frt		0.98						0.98			1.00	
Flt Protected		0.99						1.00			0.99	
Satd. Flow (prot)		2789						3967			2929	
Flt Permitted		0.99						1.00			0.78	
Satd. Flow (perm)		2789						3967			2287	
Peak-hour factor, PHF	0.88	0.88	0.88	0.25	0.25	0.25	0.95	0.95	0.95	0.93	0.93	0.93
Adj. Flow (vph)	64	243	50	0	0	0	0	606	81	87	634	0
RTOR Reduction (vph)	0	14	0	0	0	0	0	7	0	0	0	0
Lane Group Flow (vph)	0	343	0	0	0	0	0	680	0	0	721	0
Confl. Peds. (#/hr)	90		309	309			90	502		488	488	502
Confl. Bikes (#/hr)			1				5			12		28
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	0%
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		2						1			1	
Permitted Phases	2	2								1		
Actuated Green, G (s)		25.5						55.5			55.5	
Effective Green, g (s)		25.5						55.5			55.5	
Actuated g/C Ratio		0.28						0.62			0.62	
Clearance Time (s)		4.5						4.5			4.5	
Lane Grp Cap (vph)		790						2446			1410	
v/s Ratio Prot								0.17				
v/s Ratio Perm		0.12									c0.32	
v/c Ratio		0.43						0.28			0.51	
Uniform Delay, d1		26.4						8.0			9.7	
Progression Factor		1.00						0.57			1.00	
Incremental Delay, d2		1.7						0.3			1.3	
Delay (s)		28.1						4.8			11.0	
Level of Service		C						A			B	
Approach Delay (s)		28.1			0.0			4.8			11.0	
Approach LOS		C			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			12.0								HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			90.0								Sum of lost time (s)	9.0
Intersection Capacity Utilization			62.4%								ICU Level of Service	B
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 42: 2nd Ave & Spring St

7/29/2016



















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑								↘	↑↑		
Traffic Volume (vph)	0	350	80	0	0	0	0	0	0	210	1200	0	
Future Volume (vph)	0	350	80	0	0	0	0	0	0	210	1200	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10	
Grade (%)		12%			0%			0%			0%		
Total Lost time (s)		4.0								4.0	4.0		
Lane Util. Factor		0.95								1.00	0.95		
Frbp, ped/bikes		0.95								1.00	1.00		
Flpb, ped/bikes		1.00								1.00	1.00		
Frt		0.97								1.00	1.00		
Flt Protected		1.00								0.95	1.00		
Satd. Flow (prot)		2578								1204	2203		
Flt Permitted		1.00								0.95	1.00		
Satd. Flow (perm)		2578								1204	2203		
Peak-hour factor, PHF	0.92	0.92	0.92	0.25	0.25	0.25	0.25	0.25	0.25	0.97	0.97	0.97	
Adj. Flow (vph)	0	380	87	0	0	0	0	0	0	216	1237	0	
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	0	0	
Lane Group Flow (vph)	0	449	0	0	0	0	0	0	0	216	1237	0	
Confl. Peds. (#/hr)	200		178	178		200	340		348	348		340	
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%	
Parking (#/hr)										10	69	69	
Turn Type		NA								Prot	NA		
Protected Phases		2								3	14		
Permitted Phases													
Actuated Green, G (s)		20.5								20.5	60.5		
Effective Green, g (s)		21.0								21.0	61.0		
Actuated g/C Ratio		0.23								0.23	0.68		
Clearance Time (s)		4.5								4.5			
Lane Grp Cap (vph)		601								280	1493		
v/s Ratio Prot		c0.17								0.18	c0.56		
v/s Ratio Perm													
v/c Ratio		0.75								0.77	0.83		
Uniform Delay, d1		32.0								32.3	10.7		
Progression Factor		0.71								1.00	1.00		
Incremental Delay, d2		7.8								18.4	5.4		
Delay (s)		30.4								50.7	16.1		
Level of Service		C								D	B		
Approach Delay (s)		30.4			0.0			0.0			21.2		
Approach LOS		C			A			A			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			23.5		HCM 2000 Level of Service					C			
HCM 2000 Volume to Capacity ratio			0.84										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					11.5			
Intersection Capacity Utilization			58.5%		ICU Level of Service					B			
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 43: 3rd Ave & Spring St



















7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						 			 	
Traffic Volume (vph)	5	600	28	0	0	0	0	111	65	15	148	0
Future Volume (vph)	5	600	28	0	0	0	0	111	65	15	148	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	12	12	12	11	12	12	11	12
Grade (%)		10%			-10%			0%			0%	
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.95						0.95			0.95	
Frbp, ped/bikes		0.99						0.86			1.00	
Flpb, ped/bikes		1.00						1.00			0.97	
Frt		0.99						0.94			1.00	
Flt Protected		1.00						1.00			1.00	
Satd. Flow (prot)		2543						1443			1726	
Flt Permitted		1.00						1.00			0.93	
Satd. Flow (perm)		2543						1443			1605	
Peak-hour factor, PHF	0.97	0.97	0.97	0.25	0.25	0.25	0.80	0.80	0.80	0.91	0.91	0.91
Adj. Flow (vph)	5	619	29	0	0	0	0	139	81	16	163	0
RTOR Reduction (vph)	0	4	0	0	0	0	0	15	0	0	0	0
Lane Group Flow (vph)	0	649	0	0	0	0	0	205	0	0	179	0
Confl. Peds. (#/hr)	396		213	213		396	650		405	405		650
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	87%	0%	40%	67%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	60	0	0	34	0
Parking (#/hr)		15										
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		2						1			1	
Permitted Phases	2									1		
Actuated Green, G (s)		35.5						45.5			45.5	
Effective Green, g (s)		36.0						46.0			46.0	
Actuated g/C Ratio		0.40						0.51			0.51	
Clearance Time (s)		4.5						4.5			4.5	
Lane Grp Cap (vph)		1017						737			820	
v/s Ratio Prot								c0.14				
v/s Ratio Perm		0.26									0.11	
v/c Ratio		0.64						0.28			0.22	
Uniform Delay, d1		21.8						12.5			12.1	
Progression Factor		0.36						1.51			1.00	
Incremental Delay, d2		2.2						0.9			0.6	
Delay (s)		10.0						19.8			12.7	
Level of Service		B						B			B	
Approach Delay (s)		10.0			0.0			19.8			12.7	
Approach LOS		B			A			B			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			12.5					HCM 2000 Level of Service		B		
HCM 2000 Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			90.0					Sum of lost time (s)		8.0		
Intersection Capacity Utilization			47.4%					ICU Level of Service		A		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 44: 4th Ave & Spring St

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						  				
Traffic Volume (vph)	200	530	0	0	0	0	0	1216	92	0	0	0
Future Volume (vph)	200	530	0	0	0	0	0	1216	92	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Grade (%)		15%			-5%			5%			0%	
Total Lost time (s)		4.5						5.5	5.5			
Lane Util. Factor		0.95						0.91	1.00			
Frbp, ped/bikes		1.00						1.00	0.59			
Flpb, ped/bikes		0.91						1.00	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		0.99						1.00	1.00			
Satd. Flow (prot)		2273						3704	818			
Flt Permitted		0.99						1.00	1.00			
Satd. Flow (perm)		2273						3704	818			
Peak-hour factor, PHF	0.96	0.96	0.96	0.25	0.25	0.25	0.95	0.95	0.95	0.25	0.25	0.25
Adj. Flow (vph)	208	552	0	0	0	0	0	1280	97	0	0	0
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	9	0	0	0
Lane Group Flow (vph)	0	749	0	0	0	0	0	1280	88	0	0	0
Confl. Peds. (#/hr)	315		294	294			315	452		497	497	452
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	8%	2%	0%	0%	0%
Parking (#/hr)		15						15				
Turn Type	Perm	NA						NA	Perm			
Protected Phases		2						1				
Permitted Phases	2								1			
Actuated Green, G (s)		34.5						46.5	46.5			
Effective Green, g (s)		34.5						45.5	45.5			
Actuated g/C Ratio		0.38						0.51	0.51			
Clearance Time (s)		4.5						4.5	4.5			
Lane Grp Cap (vph)		871						1872	413			
v/s Ratio Prot								c0.35				
v/s Ratio Perm		0.33							0.11			
v/c Ratio		0.86						0.68	0.21			
Uniform Delay, d1		25.5						16.8	12.3			
Progression Factor		1.53						0.60	0.48			
Incremental Delay, d2		9.3						1.6	0.9			
Delay (s)		48.2						11.7	6.8			
Level of Service		D						B	A			
Approach Delay (s)		48.2			0.0			11.4			0.0	
Approach LOS		D			A			B			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			24.5				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)		10.0			
Intersection Capacity Utilization			60.5%				ICU Level of Service			B		
Analysis Period (min)			15									













c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 45: 5th Ave & Spring St

7/29/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑↑									↓↑↓		
Traffic Volume (vph)	0	605	55	0	0	0	0	0	0	527	919	0	
Future Volume (vph)	0	605	55	0	0	0	0	0	0	527	919	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	12	12	12	10	10	12	
Grade (%)		15%			-5%			0%			0%		
Total Lost time (s)		3.5									3.5		
Lane Util. Factor		0.91									0.91		
Frbp, ped/bikes		0.98									1.00		
Flpb, ped/bikes		1.00									0.89		
Frt		0.99									1.00		
Flt Protected		1.00									0.98		
Satd. Flow (prot)		3503									3713		
Flt Permitted		1.00									0.98		
Satd. Flow (perm)		3503									3713		
Peak-hour factor, PHF	0.90	0.90	0.90	0.25	0.25	0.25	0.25	0.25	0.25	0.93	0.93	0.93	
Adj. Flow (vph)	0	672	61	0	0	0	0	0	0	567	988	0	
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	13	0	
Lane Group Flow (vph)	0	728	0	0	0	0	0	0	0	0	1542	0	
Confl. Peds. (#/hr)	210		133	133		210	392		208	208		392	
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%	0%	0%	0%	1%	3%	0%	
Parking (#/hr)		30											
Turn Type		NA								custom	NA		
Protected Phases		2								3	14		
Permitted Phases										4			
Actuated Green, G (s)		35.0									45.0		
Effective Green, g (s)		36.5									46.5		
Actuated g/C Ratio		0.41									0.52		
Clearance Time (s)		5.0											
Lane Grp Cap (vph)		1420									1918		
v/s Ratio Prot		c0.21									c0.22		
v/s Ratio Perm											0.20		
v/c Ratio		0.51									0.80		
Uniform Delay, d1		20.1									18.0		
Progression Factor		1.63									1.00		
Incremental Delay, d2		1.0									3.7		
Delay (s)		33.8									21.7		
Level of Service		C									C		
Approach Delay (s)		33.8			0.0			0.0			21.7		
Approach LOS		C			A			A			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			25.5									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.69										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	8.5
Intersection Capacity Utilization			60.7%									ICU Level of Service	B
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 46: 6th Ave & I-5 CD SB On-Ramp & Spring St

7/29/2016





















Movement	EBL	EBT	EBR	NBT	NBR	NBR2
Lane Configurations		↔↑	↗	↑↑	↖	
Traffic Volume (vph)	192	189	750	335	10	610
Future Volume (vph)	192	189	750	335	10	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	10	11	10	11	12
Grade (%)		10%		5%		
Total Lost time (s)		4.5	4.5	4.5	4.5	
Lane Util. Factor		0.95	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	1.00	1.00	1.00	
Flpb, ped/bikes		0.84	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.85	
Flt Protected		0.98	1.00	1.00	1.00	
Satd. Flow (prot)		2114	1322	2927	1357	
Flt Permitted		0.98	1.00	1.00	1.00	
Satd. Flow (perm)		2114	1322	2927	1357	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	206	203	806	360	11	656
RTOR Reduction (vph)	0	85	0	0	0	0
Lane Group Flow (vph)	0	324	806	360	667	0
Confl. Peds. (#/hr)	224					
Heavy Vehicles (%)	1%	1%	1%	1%	0%	1%
Bus Blockages (#/hr)	0	5	0	0	0	0
Parking (#/hr)		15				
Turn Type	Perm	NA	Perm	NA	Perm	
Protected Phases		4		2		
Permitted Phases	4		4		2	
Actuated Green, G (s)		42.5	42.5	38.5	38.5	
Effective Green, g (s)		42.5	42.5	38.5	38.5	
Actuated g/C Ratio		0.47	0.47	0.43	0.43	
Clearance Time (s)		4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)		998	624	1252	580	
v/s Ratio Prot				0.12		
v/s Ratio Perm		0.15	c0.61		c0.49	
v/c Ratio		0.32	1.29	0.29	1.15	
Uniform Delay, d1		14.8	23.8	16.8	25.8	
Progression Factor		0.09	1.13	0.96	0.90	
Incremental Delay, d2		0.7	140.2	0.5	83.0	
Delay (s)		2.1	166.9	16.5	106.2	
Level of Service		A	F	B	F	
Approach Delay (s)		111.5		74.8		
Approach LOS		F		E		
<b>Intersection Summary</b>						
HCM 2000 Control Delay			94.7		HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio			1.22			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	9.0
Intersection Capacity Utilization			101.8%		ICU Level of Service	G
Analysis Period (min)			15			
c Critical Lane Group						

# HCM Signalized Intersection Capacity Analysis

## 47: 7th Ave/Hubbell PI & Spring St

7/29/2016


















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						 			 	
Traffic Volume (vph)	42	137	19	0	0	0	0	256	23	6	328	0
Future Volume (vph)	42	137	19	0	0	0	0	256	23	6	328	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5						4.5			4.5	
Lane Util. Factor		0.95						1.00			1.00	
Frbp, ped/bikes		0.99						1.00			1.00	
Flpb, ped/bikes		0.92						1.00			1.00	
Frt		0.98						0.99			1.00	
Flt Protected		0.99						1.00			1.00	
Satd. Flow (prot)		2760						1688			1675	
Flt Permitted		0.99						1.00			0.99	
Satd. Flow (perm)		2760						1688			1668	
Peak-hour factor, PHF	0.87	0.92	0.87	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85
Adj. Flow (vph)	48	149	22	0	0	0	0	278	25	7	386	0
RTOR Reduction (vph)	0	14	0	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	205	0	0	0	0	0	298	0	0	393	0
Confl. Peds. (#/hr)	166		20					4				4
Heavy Vehicles (%)	17%	2%	0%	2%	2%	2%	0%	0%	2%	2%	2%	0%
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			2	
Permitted Phases	4									2		
Actuated Green, G (s)		19.5						31.5			31.5	
Effective Green, g (s)		19.5						31.5			31.5	
Actuated g/C Ratio		0.32						0.52			0.52	
Clearance Time (s)		4.5						4.5			4.5	
Lane Grp Cap (vph)		897						886			875	
v/s Ratio Prot								0.18				
v/s Ratio Perm		0.07									c0.24	
v/c Ratio		0.23						0.34			0.45	
Uniform Delay, d1		14.8						8.2			8.9	
Progression Factor		1.00						1.00			1.00	
Incremental Delay, d2		0.6						1.0			1.7	
Delay (s)		15.4						9.2			10.5	
Level of Service		B						A			B	
Approach Delay (s)		15.4			0.0			9.2			10.5	
Approach LOS		B			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			11.3					HCM 2000 Level of Service		B		
HCM 2000 Volume to Capacity ratio			0.36									
Actuated Cycle Length (s)			60.0					Sum of lost time (s)		9.0		
Intersection Capacity Utilization			43.7%					ICU Level of Service		A		
Analysis Period (min)			15									
c Critical Lane Group												

Intersection												
Int Delay, s/veh	5.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↔			↔	
Traffic Vol, veh/h	67	113	18	0	0	0	0	143	19	37	178	0
Future Vol, veh/h	67	113	18	0	0	0	0	143	19	37	178	0
Conflicting Peds, #/hr	116	0	65	0	0	0	115	0	104	104	0	115
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	73	123	20	0	0	0	0	155	21	40	193	0
Major/Minor	Minor2			Major1			Major2					
Conflicting Flow All	556	554	258	-	0	0	-	0	0	280	0	0
Stage 1	274	274	-	-	-	-	-	-	-	-	-	-
Stage 2	282	280	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	492	440	781	0	-	-	0	-	-	1283	-	0
Stage 1	772	683	-	0	-	-	0	-	-	-	-	0
Stage 2	766	679	-	0	-	-	0	-	-	-	-	0
Platoon blocked, %												
Mov Cap-1 Maneuver	473	0	739	-	-	-	-	-	-	1159	-	-
Mov Cap-2 Maneuver	473	0	-	-	-	-	-	-	-	-	-	-
Stage 1	742	0	-	-	-	-	-	-	-	-	-	-
Stage 2	766	0	-	-	-	-	-	-	-	-	-	-
Approach	EB			NB			SB					
HCM Control Delay, s	13.7			0			1.4					
HCM LOS	B											
Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	SBL	SBT						
Capacity (veh/h)	-	-	473	739	1159	-						
HCM Lane V/C Ratio	-	-	0.284	0.11	0.035	-						
HCM Control Delay (s)	-	-	15.6	10.5	8.2	0						
HCM Lane LOS	-	-	C	B	A	A						
HCM 95th %tile Q(veh)	-	-	1.2	0.4	0.1	-						

Intersection												
Int Delay, s/veh	5.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗		↕			↘			↖	
Traffic Vol, veh/h	47	70	62	10	0	30	0	145	9	8	126	0
Future Vol, veh/h	47	70	62	10	0	30	0	145	9	8	126	0
Conflicting Peds, #/hr	209	0	58	58	0	209	104	0	111	111	0	104
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	51	76	67	11	0	33	0	158	10	9	137	0
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	542	432	195	524	428	483	-	0	0	278	0	0
Stage 1	154	154	-	274	274	-	-	-	-	-	-	-
Stage 2	388	278	-	250	154	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	451	516	846	464	519	584	0	-	-	1285	-	0
Stage 1	848	770	-	732	683	-	0	-	-	-	-	0
Stage 2	636	680	-	754	770	-	0	-	-	-	-	0
Platoon blocked, %												
Mov Cap-1 Maneuver	342	464	805	319	467	438	-	-	-	1061	-	-
Mov Cap-2 Maneuver	342	464	-	319	467	-	-	-	-	-	-	-
Stage 1	848	763	-	732	620	-	-	-	-	-	-	-
Stage 2	486	617	-	587	763	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	12.2			15.1			0			0.5		
HCM LOS	B			C								
Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT					
Capacity (veh/h)	-	-	464	805	401	1061	-					
HCM Lane V/C Ratio	-	-	0.164	0.084	0.108	0.008	-					
HCM Control Delay (s)	-	-	14.3	9.9	15.1	8.4	0					
HCM Lane LOS	-	-	B	A	C	A	A					
HCM 95th %tile Q(veh)	-	-	0.6	0.3	0.4	0	-					

HCM Signalized Intersection Capacity Analysis  
 50: 14th Ave & Pike St

7/29/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	25	85	0	31	5	140	69	0	4	98	10
Future Volume (vph)	5	25	85	0	31	5	140	69	0	4	98	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	16	12	12	16	12	12	16	12
Grade (%)		6%			-6%			0%			0%	
Total Lost time (s)	4.5	4.5			4.5			4.5			8.5	
Lane Util. Factor	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.88			0.98			1.00			0.99	
Flt Protected	0.95	1.00			1.00			0.97			1.00	
Satd. Flow (prot)	1717	1342			2137			2043			1874	
Flt Permitted	0.73	1.00			1.00			0.73			0.99	
Satd. Flow (perm)	1322	1342			2137			1542			1859	
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)	5	27	92	0	34	5	152	75	0	4	107	11
RTOR Reduction (vph)	0	49	0	0	3	0	0	0	0	0	4	0
Lane Group Flow (vph)	5	70	0	0	36	0	0	227	0	0	118	0
Parking (#/hr)		0									0	
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		4			4			6			3	
Permitted Phases	4						6			3		
Actuated Green, G (s)	46.5	46.5			46.5			44.5			40.5	
Effective Green, g (s)	46.5	46.5			46.5			44.5			40.5	
Actuated g/C Ratio	0.46	0.46			0.46			0.44			0.40	
Clearance Time (s)	4.5	4.5			4.5			4.5			8.5	
Lane Grp Cap (vph)	614	624			993			686			752	
v/s Ratio Prot		c0.05			0.02							
v/s Ratio Perm	0.00							c0.15			0.06	
v/c Ratio	0.01	0.11			0.04			0.33			0.16	
Uniform Delay, d1	14.4	15.1			14.6			18.1			18.9	
Progression Factor	1.00	1.00			0.04			0.03			1.00	
Incremental Delay, d2	0.0	0.4			0.1			1.2			0.4	
Delay (s)	14.4	15.5			0.7			1.8			19.4	
Level of Service	B	B			A			A			B	
Approach Delay (s)		15.4			0.7			1.8			19.4	
Approach LOS		B			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			9.2					HCM 2000 Level of Service			A	
HCM 2000 Volume to Capacity ratio			0.23									
Actuated Cycle Length (s)			100.0					Sum of lost time (s)		13.0		
Intersection Capacity Utilization			32.1%					ICU Level of Service		A		
Analysis Period (min)			15									

c Critical Lane Group


















**2019 NO-BUILD PM**

---

# HCM Signalized Intersection Capacity Analysis

## 1: 1st Ave & Madison St

















7/28/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	70	226	146	24	512	0	0	510	130	
Future Volume (vph)	0	0	0	70	226	146	24	512	0	0	510	130	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	10	10	10	10	10	11	10	10	11	10	
Grade (%)		6%			-8%			0%			0%		
Total Lost time (s)				4.5	4.5		4.5	4.5			4.5		
Lane Util. Factor				1.00	0.95		1.00	1.00			1.00		
Frbp, ped/bikes				1.00	0.79		1.00	1.00			0.93		
Flpb, ped/bikes				0.61	1.00		1.00	1.00			1.00		
Frt				1.00	0.94		1.00	1.00			0.97		
Flt Protected				0.95	1.00		0.95	1.00			1.00		
Satd. Flow (prot)				934	2359		1516	1637			1483		
Flt Permitted				0.95	1.00		0.95	1.00			1.00		
Satd. Flow (perm)				934	2359		1516	1637			1483		
Peak-hour factor, PHF	0.25	0.25	0.25	0.85	0.85	0.85	0.92	0.92	0.92	0.89	0.89	0.89	
Adj. Flow (vph)	0	0	0	82	266	172	26	557	0	0	573	146	
RTOR Reduction (vph)	0	0	0	0	110	0	0	0	0	0	10	0	
Lane Group Flow (vph)	0	0	0	82	328	0	26	557	0	0	709	0	
Confl. Peds. (#/hr)	226		156	156		226	276		553	553		276	
Heavy Vehicles (%)	0%	0%	0%	3%	0%	0%	0%	1%	0%	0%	1%	0%	
Turn Type				Perm	NA		Prot	NA			NA		
Protected Phases					2		3	1			1		
Permitted Phases				2									
Actuated Green, G (s)				19.5	19.5		6.5	50.5			50.5		
Effective Green, g (s)				19.5	19.5		6.5	50.5			50.5		
Actuated g/C Ratio				0.22	0.22		0.07	0.56			0.56		
Clearance Time (s)				4.5	4.5		4.5	4.5			4.5		
Lane Grp Cap (vph)				202	511		109	918			832		
v/s Ratio Prot					c0.14		c0.02	0.34			c0.48		
v/s Ratio Perm				0.09									
v/c Ratio				0.41	0.64		0.24	0.61			0.85		
Uniform Delay, d1				30.3	32.1		39.4	13.1			16.6		
Progression Factor				1.56	1.83		1.00	1.00			0.35		
Incremental Delay, d2				5.0	5.1		5.1	3.0			8.2		
Delay (s)				52.1	63.6		44.5	16.1			14.1		
Level of Service				D	E		D	B			B		
Approach Delay (s)		0.0			61.8			17.4			14.1		
Approach LOS		A			E			B			B		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			28.8		HCM 2000 Level of Service						C		
HCM 2000 Volume to Capacity ratio			0.75										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					13.5			
Intersection Capacity Utilization			63.1%		ICU Level of Service					B			
Analysis Period (min)			15										
c Critical Lane Group													



HCM 2010 Signalized Intersection Summary  
 2: 2nd Ave & Madison St













7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	180	343	0	0	0	0	0	1220	60
Future Volume (veh/h)	0	0	0	180	343	0	0	0	0	0	1220	60
Number				7	4	14				5	2	12
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.90
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.43
Adj Sat Flow, veh/h/ln				1778	1727	0				0	1569	1569
Adj Flow Rate, veh/h				191	365	0				0	1284	63
Adj No. of Lanes				0	2	0				0	2	1
Peak Hour Factor				0.94	0.94	0.94				0.95	0.95	0.95
Percent Heavy Veh, %				3	3	0				0	9	9
Cap, veh/h				327	550	0				0	1954	327
Arrive On Green				0.28	0.28	0.00				0.00	0.22	0.21
Sat Flow, veh/h				939	2059	0				0	3059	513
Grp Volume(v), veh/h				290	266	0				0	1284	63
Grp Sat Flow(s),veh/h/ln				1427	1493	0				0	1490	513
Q Serve(g_s), s				16.6	14.1	0.0				0.0	35.4	9.1
Cycle Q Clear(g_c), s				16.6	14.1	0.0				0.0	35.4	9.1
Prop In Lane				0.66		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				463	415	0				0	1954	327
V/C Ratio(X)				0.63	0.64	0.00				0.00	0.66	0.19
Avail Cap(c_a), veh/h				463	415	0				0	1954	327
HCM Platoon Ratio				1.00	1.00	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				29.5	28.6	0.0				0.0	26.0	16.4
Incr Delay (d2), s/veh				6.3	7.4	0.0				0.0	1.7	1.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				7.3	6.6	0.0				0.0	15.1	1.4
LnGrp Delay(d),s/veh				35.8	36.0	0.0				0.0	27.8	17.7
LnGrp LOS				D	D						C	B
Approach Vol, veh/h					556						1347	
Approach Delay, s/veh					35.9						27.3	
Approach LOS					D						C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4								
Phs Duration (G+Y+Rc), s		62.0		28.0								
Change Period (Y+Rc), s		4.5		4.5								
Max Green Setting (Gmax), s		57.5		23.5								
Max Q Clear Time (g_c+I1), s		0.0		0.0								
Green Ext Time (p_c), s		0.0		0.0								
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				29.8								
HCM 2010 LOS				C								

# HCM Signalized Intersection Capacity Analysis

## 3: 3rd Ave & Madison St

7/28/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑			↑↑			↑↑		
Traffic Volume (vph)	0	0	0	0	470	60	0	134	0	0	135	56	
Future Volume (vph)	0	0	0	0	470	60	0	134	0	0	135	56	
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	12	12	11	12	
Grade (%)		10%			-15%			0%			-5%		
Total Lost time (s)					4.0			4.0			4.0		
Lane Util. Factor					0.95			0.95			0.95		
Frbp, ped/bikes					0.96			1.00			0.87		
Flpb, ped/bikes					1.00			1.00			1.00		
Frt					0.98			1.00			0.96		
Flt Protected					1.00			1.00			1.00		
Satd. Flow (prot)					2901			1468			1559		
Flt Permitted					1.00			1.00			1.00		
Satd. Flow (perm)					2901			1468			1559		
Peak-hour factor, PHF	0.25	0.25	0.25	0.91	0.91	0.91	0.93	0.93	0.93	0.87	0.87	0.87	
Adj. Flow (vph)	0	0	0	0	516	66	0	144	0	0	155	64	
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	0	0	9	0	
Lane Group Flow (vph)	0	0	0	0	571	0	0	144	0	0	210	0	
Confl. Peds. (#/hr)	244		457	457		244	588		499	499		588	
Heavy Vehicles (%)	0%	0%	0%	9%	2%	2%	0%	81%	0%	0%	82%	11%	
Bus Blockages (#/hr)	0	0	0	0	10	0	0	62	0	0	29	0	
Parking (#/hr)					15								
Turn Type					NA			NA			NA		
Protected Phases					2			1			1		
Permitted Phases													
Actuated Green, G (s)					30.5			50.5			50.5		
Effective Green, g (s)					31.0			51.0			51.0		
Actuated g/C Ratio					0.34			0.57			0.57		
Clearance Time (s)					4.5			4.5			4.5		
Lane Grp Cap (vph)					999			831			883		
v/s Ratio Prot					c0.20			0.10			c0.13		
v/s Ratio Perm													
v/c Ratio					0.57			0.17			0.24		
Uniform Delay, d1					24.1			9.4			9.8		
Progression Factor					0.42			1.00			2.47		
Incremental Delay, d2					1.2			0.5			0.6		
Delay (s)					11.4			9.8			24.7		
Level of Service					B			A			C		
Approach Delay (s)		0.0			11.4			9.8			24.7		
Approach LOS		A			B			A			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			14.2		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.36										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)						8.0		
Intersection Capacity Utilization			36.7%		ICU Level of Service						A		
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 4: 4th Ave & Madison St

7/28/2016















Movement	WBR	NBL	NBT	SWR	SWR2
Lane Configurations	↗		↕↕↕	↗↘	
Traffic Volume (vph)	38	116	1081	400	215
Future Volume (vph)	38	116	1081	400	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	12	12	10	13	12
Grade (%)			5%		
Total Lost time (s)	3.0		3.5	2.5	
Lane Util. Factor	1.00		0.91	0.88	
Frbp, ped/bikes	1.00		1.00	1.00	
Flpb, ped/bikes	1.00		0.96	1.00	
Frt	0.86		1.00	0.85	
Flt Protected	1.00		1.00	1.00	
Satd. Flow (prot)	1450		3534	2458	
Flt Permitted	1.00		1.00	1.00	
Satd. Flow (perm)	1450		3534	2458	
Peak-hour factor, PHF	0.92	0.97	0.97	0.84	0.84
Adj. Flow (vph)	41	120	1114	476	256
RTOR Reduction (vph)	0	0	24	64	0
Lane Group Flow (vph)	41	0	1210	668	0
Confl. Peds. (#/hr)		487			361
Heavy Vehicles (%)	2%	1%	9%	1%	1%
Bus Blockages (#/hr)	0	0	0	10	0
Parking (#/hr)			15	15	
Turn Type	custom	Perm	NA	Prot	
Protected Phases	1		2	4	
Permitted Phases	2	2			
Actuated Green, G (s)	52.5		49.5	25.5	
Effective Green, g (s)	52.5		50.5	27.5	
Actuated g/C Ratio	0.58		0.56	0.31	
Clearance Time (s)	3.0		4.5	4.5	
Vehicle Extension (s)	0.2		0.2	0.2	
Lane Grp Cap (vph)	894		1982	751	
v/s Ratio Prot	c0.00			c0.27	
v/s Ratio Perm	0.03		0.34		
v/c Ratio	0.05		0.61	0.89	
Uniform Delay, d1	8.0		13.2	29.8	
Progression Factor	1.00		1.00	0.84	
Incremental Delay, d2	0.0		1.4	13.7	
Delay (s)	8.0		14.6	38.7	
Level of Service	A		B	D	
Approach Delay (s)			14.6		
Approach LOS			B		
<b>Intersection Summary</b>					
HCM 2000 Control Delay			23.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.68		
Actuated Cycle Length (s)			90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization			63.9%	ICU Level of Service	B
Analysis Period (min)			15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 5: 5th Ave & Madison St

7/28/2016
















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑						↑↑↑		
Traffic Volume (vph)	0	0	0	296	487	0	0	0	0	0	870	100	
Future Volume (vph)	0	0	0	296	487	0	0	0	0	0	870	100	
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	9	12	
Grade (%)		10%			-10%			0%			0%		
Total Lost time (s)					4.5						4.5		
Lane Util. Factor					0.95						0.91		
Frbp, ped/bikes					1.00						0.97		
Flpb, ped/bikes					0.88						1.00		
Frt					1.00						0.98		
Flt Protected					0.98						1.00		
Satd. Flow (prot)					2646						3654		
Flt Permitted					0.98						1.00		
Satd. Flow (perm)					2646						3654		
Peak-hour factor, PHF	0.25	0.25	0.25	0.96	0.96	0.96	0.25	0.25	0.25	0.97	0.97	0.97	
Adj. Flow (vph)	0	0	0	308	507	0	0	0	0	0	897	103	
RTOR Reduction (vph)	0	0	0	0	10	0	0	0	0	0	15	0	
Lane Group Flow (vph)	0	0	0	0	805	0	0	0	0	0	985	0	
Confl. Peds. (#/hr)	228		242	242		228	311		184	184		311	
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	0%	0%	0%	3%	2%	
Parking (#/hr)					15						15		
Turn Type				Perm	NA						NA		
Protected Phases					2						1		
Permitted Phases				2									
Actuated Green, G (s)					42.5						38.5		
Effective Green, g (s)					42.5						38.5		
Actuated g/C Ratio					0.47						0.43		
Clearance Time (s)					4.5						4.5		
Lane Grp Cap (vph)					1249						1563		
v/s Ratio Prot											c0.27		
v/s Ratio Perm					0.30								
v/c Ratio					0.64						0.63		
Uniform Delay, d1					18.0						20.2		
Progression Factor					0.72						0.36		
Incremental Delay, d2					2.1						1.3		
Delay (s)					15.0						8.5		
Level of Service					B						A		
Approach Delay (s)		0.0			15.0			0.0			8.5		
Approach LOS		A			B			A			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			11.4		HCM 2000 Level of Service					B			
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					9.0			
Intersection Capacity Utilization			57.3%		ICU Level of Service					B			
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis






















## 6: 6th Ave & Madison St

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	746	809	26	150	173	0	0	0
Future Volume (vph)	0	0	0	0	746	809	26	150	173	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	10	9	12	12	12	12	12	12
Grade (%)		10%			-10%			5%				-5%
Total Lost time (s)					3.5	3.5		4.0				
Lane Util. Factor					0.91	0.91		0.95				
Frbp, ped/bikes					0.92	0.76		0.99				
Flpb, ped/bikes					1.00	1.00		0.98				
Frt					0.95	0.85		0.93				
Flt Protected					1.00	1.00		1.00				
Satd. Flow (prot)					2664	936		2479				
Flt Permitted					1.00	1.00		1.00				
Satd. Flow (perm)					2664	936		2479				
Peak-hour factor, PHF	0.25	0.25	0.25	0.97	0.97	0.97	0.85	0.85	0.85	0.25	0.25	0.25
Adj. Flow (vph)	0	0	0	0	769	834	31	176	204	0	0	0
RTOR Reduction (vph)	0	0	0	0	51	130	0	163	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1060	362	0	248	0	0	0	0
Confl. Peds. (#/hr)	137		316	316		137	178			1		178
Confl. Bikes (#/hr)			3			26			2			3
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	12%	1%	5%	0%	0%	0%
Parking (#/hr)								15				
Turn Type					NA	Perm	Perm	NA				
Protected Phases					2			1				
Permitted Phases						2	1					
Actuated Green, G (s)					61.0	61.0		20.5				
Effective Green, g (s)					61.5	61.5		21.0				
Actuated g/C Ratio					0.68	0.68		0.23				
Clearance Time (s)					4.0	4.0		4.5				
Lane Grp Cap (vph)					1820	639		578				
v/s Ratio Prot					c0.40							
v/s Ratio Perm						0.39		0.10				
v/c Ratio					0.58	0.57		0.43				
Uniform Delay, d1					7.5	7.4		29.4				
Progression Factor					1.03	2.01		1.00				
Incremental Delay, d2					1.2	3.3		2.3				
Delay (s)					9.0	18.0		31.7				
Level of Service					A	B		C				
Approach Delay (s)		0.0			11.8			31.7			0.0	
Approach LOS		A			B			C			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			15.8		HCM 2000 Level of Service				B			
HCM 2000 Volume to Capacity ratio			0.54									
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				7.5			
Intersection Capacity Utilization			62.2%		ICU Level of Service				B			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 7: I-5 CD NB Off-Ramp/7th Ave & Madison St

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					  							
Traffic Volume (vph)	2	174	0	0	742	3	488	276	423	7	0	348
Future Volume (vph)	2	174	0	0	742	3	488	276	423	7	0	348
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			5%			-5%	
Total Lost time (s)		3.5			3.5		3.5	3.5	3.5	3.5		4.5
Lane Util. Factor		1.00			0.91		0.95	0.95	1.00	1.00		1.00
Frbp, ped/bikes		1.00			1.00		1.00	1.00	0.90	1.00		1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00	1.00	0.97		1.00
Frt		1.00			1.00		1.00	1.00	0.85	1.00		0.85
Flt Protected		1.00			1.00		0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)		1253			4264		1505	1561	1258	1612		1475
Flt Permitted		1.00			1.00		0.95	0.99	1.00	0.36		1.00
Satd. Flow (perm)		1248			4264		1505	1561	1258	619		1475
Peak-hour factor, PHF	0.81	0.81	0.81	0.94	0.94	0.94	0.94	0.94	0.94	0.90	0.90	0.90
Adj. Flow (vph)	2	215	0	0	789	3	519	294	450	8	0	387
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	28	0	0	24
Lane Group Flow (vph)	0	217	0	0	791	0	400	413	422	8	0	363
Confl. Peds. (#/hr)	114		364	364		114	1		56	56		
Confl. Bikes (#/hr)			2			9			22			
Heavy Vehicles (%)	0%	5%	0%	0%	2%	0%	0%	0%	1%	0%	0%	1%
Parking (#/hr)		15										
Turn Type	Perm	NA			NA		Split	NA	Perm	D.Pm		Prot
Protected Phases		1			1		2!	2				2!
Permitted Phases	1								2	2		
Actuated Green, G (s)		40.3			40.3		40.7	40.7	40.7	40.7		40.7
Effective Green, g (s)		41.3			41.3		41.7	41.7	41.7	41.7		40.7
Actuated g/C Ratio		0.46			0.46		0.46	0.46	0.46	0.46		0.45
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5		4.5
Vehicle Extension (s)		3.0			3.0		5.0	5.0	5.0	5.0		5.0
Lane Grp Cap (vph)		572			1956		697	723	582	286		667
v/s Ratio Prot					c0.19		0.27	0.26				0.25
v/s Ratio Perm		0.17							c0.34	0.01		
v/c Ratio		0.38			0.40		0.57	0.57	0.72	0.03		0.54
Uniform Delay, d1		16.0			16.2		17.7	17.6	19.5	13.1		17.9
Progression Factor		0.94			0.54		1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2		1.7			0.6		1.8	1.7	5.4	0.1		1.6
Delay (s)		16.6			9.3		19.5	19.4	25.0	13.2		19.5
Level of Service		B			A		B	B	C	B		B
Approach Delay (s)		16.6			9.3			21.4				19.4
Approach LOS		B			A			C				B
<b>Intersection Summary</b>												
HCM 2000 Control Delay			17.1				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.57									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			8.0		
Intersection Capacity Utilization			73.5%				ICU Level of Service			D		
Analysis Period (min)			15									























- ! Phase conflict between lane groups.
- c Critical Lane Group



# HCM Signalized Intersection Capacity Analysis

## 8: 8th Ave & Madison St

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	47	506	18	47	693	16	23	105	46	19	43	70
Future Volume (vph)	47	506	18	47	693	16	23	105	46	19	43	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.98		1.00	0.99			0.96			0.96	
Flpb, ped/bikes	0.83	1.00		0.79	1.00			0.99			0.99	
Fr t	1.00	0.99		1.00	1.00			0.96			0.93	
Fl t Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1265	2898		1193	2925			1547			1500	
Fl t Permitted	0.36	1.00		0.42	1.00			0.96			0.95	
Satd. Flow (perm)	477	2898		523	2925			1487			1432	
Peak-hour factor, PHF	0.89	0.89	0.89	0.99	0.99	0.99	0.93	0.93	0.93	0.80	0.80	0.80
Adj. Flow (vph)	53	569	20	47	700	16	25	113	49	24	54	88
RTOR Reduction (vph)	0	3	0	0	2	0	0	14	0	0	45	0
Lane Group Flow (vph)	53	586	0	47	714	0	0	173	0	0	121	0
Confl. Peds. (#/hr)	165		269	169		165	69		96	96		36
Heavy Vehicles (%)	0%	2%	0%	0%	2%	6%	4%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	62.5	62.5		62.5	62.5			18.5			18.5	
Effective Green, g (s)	63.5	63.5		63.5	63.5			19.5			19.5	
Actuated g/C Ratio	0.71	0.71		0.71	0.71			0.22			0.22	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	336	2044		369	2063			322			310	
v/s Ratio Prot		0.20			c0.24							
v/s Ratio Perm	0.11			0.09				c0.12			0.08	
v/c Ratio	0.16	0.29		0.13	0.35			0.54			0.39	
Uniform Delay, d1	4.4	4.9		4.3	5.2			31.2			30.2	
Progression Factor	0.36	0.45		0.38	0.33			1.00			1.00	
Incremental Delay, d2	0.8	0.3		0.7	0.4			6.3			3.6	
Delay (s)	2.4	2.5		2.3	2.1			37.5			33.8	
Level of Service	A	A		A	A			D			C	
Approach Delay (s)		2.5			2.2			37.5			33.8	
Approach LOS		A			A			D			C	

### Intersection Summary























HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 9: 9th Ave & Madison St

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	15	533	11	63	669	29	23	98	40	41	83	50
Future Volume (vph)	15	533	11	63	669	29	23	98	40	41	83	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.99		1.00	0.98			0.98			0.95	
Flpb, ped/bikes	0.89	1.00		0.80	1.00			0.98			0.99	
Fr t	1.00	1.00		1.00	0.99			0.97			0.96	
Fl t Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1344	2931		1143	2909			1460			1517	
Fl t Permitted	0.34	1.00		0.39	1.00			0.94			0.90	
Satd. Flow (perm)	483	2931		468	2909			1385			1387	
Peak-hour factor, PHF	0.88	0.88	0.88	0.97	0.97	0.97	0.81	0.81	0.81	0.87	0.87	0.87
Adj. Flow (vph)	17	606	12	65	690	30	28	121	49	47	95	57
RTOR Reduction (vph)	0	1	0	0	3	0	0	13	0	0	16	0
Lane Group Flow (vph)	17	618	0	65	717	0	0	185	0	0	183	0
Confl. Peds. (#/hr)	132		249	249		132	128		63	63		128
Heavy Vehicles (%)	0%	2%	0%	6%	2%	0%	0%	9%	10%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	55.5	55.5		55.5	55.5			25.5			25.5	
Effective Green, g (s)	56.5	56.5		56.5	56.5			26.5			26.5	
Actuated g/C Ratio	0.63	0.63		0.63	0.63			0.29			0.29	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	303	1840		293	1826			407			408	
v/s Ratio Prot		0.21			c0.25							
v/s Ratio Perm	0.04			0.14				c0.13			0.13	
v/c Ratio	0.06	0.34		0.22	0.39			0.45			0.45	
Uniform Delay, d1	6.5	7.9		7.2	8.3			25.9			25.8	
Progression Factor	0.88	0.69		0.15	0.12			1.00			1.00	
Incremental Delay, d2	0.3	0.5		1.6	0.6			3.6			3.5	
Delay (s)	6.0	5.9		2.7	1.5			29.5			29.3	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		5.9			1.6			29.5			29.3	
Approach LOS		A			A			C			C	

### Intersection Summary























HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 10: Terry Ave & Madison St

7/28/2016

























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	20	590	11	21	680	19	16	20	27	13	14	18
Future Volume (vph)	20	590	11	21	680	19	16	20	27	13	14	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.0			3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.99		1.00	0.99			0.94			0.96	
Flpb, ped/bikes	0.87	1.00		0.81	1.00			0.98			0.97	
Frt	1.00	1.00		1.00	1.00			0.94			0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1256	2930		1221	2923			1460			1483	
Flt Permitted	0.32	1.00		0.38	1.00			0.94			0.93	
Satd. Flow (perm)	423	2930		493	2923			1393			1406	
Peak-hour factor, PHF	0.95	0.95	0.95	0.90	0.90	0.90	0.83	0.83	0.83	0.75	0.75	0.75
Adj. Flow (vph)	21	621	12	23	756	21	19	24	33	17	19	24
RTOR Reduction (vph)	0	1	0	0	2	0	0	23	0	0	17	0
Lane Group Flow (vph)	21	632	0	23	775	0	0	53	0	0	43	0
Confl. Peds. (#/hr)	152		226	226		152	59		91	91		59
Heavy Vehicles (%)	5%	2%	9%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	56.5	56.5		56.5	56.5			25.0			25.0	
Effective Green, g (s)	57.5	57.5		57.5	57.5			26.0			26.0	
Actuated g/C Ratio	0.64	0.64		0.64	0.64			0.29			0.29	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.0			4.0	
Lane Grp Cap (vph)	270	1871		314	1867			402			406	
v/s Ratio Prot		0.22			c0.27							
v/s Ratio Perm	0.05			0.05				c0.04			0.03	
v/c Ratio	0.08	0.34		0.07	0.42			0.13			0.11	
Uniform Delay, d1	6.2	7.5		6.2	8.0			23.6			23.5	
Progression Factor	0.61	0.59		0.27	0.22			1.00			1.00	
Incremental Delay, d2	0.5	0.5		0.2	0.3			0.7			0.5	
Delay (s)	4.3	4.8		1.9	2.0			24.3			24.0	
Level of Service	A	A		A	A			C			C	
Approach Delay (s)		4.8			2.0			24.3			24.0	
Approach LOS		A			A			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			5.1				HCM 2000 Level of Service			A		
HCM 2000 Volume to Capacity ratio			0.33									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			6.5		
Intersection Capacity Utilization			43.4%				ICU Level of Service			A		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 11: Boren Ave & Madison St

7/28/2016























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	64	521	22	54	568	67	83	518	32	187	672	82
Future Volume (vph)	64	521	22	54	568	67	83	518	32	187	672	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	12	9	9	12	9	9	12
Total Lost time (s)	4.0	3.5		4.0	3.5		4.0	3.5		4.0	3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	0.99		1.00	0.97		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1486	2854		1516	2806		1433	2784		1462	2714	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1486	2854		1516	2806		1433	2784		1462	2714	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84	0.90	0.90	0.90
Adj. Flow (vph)	74	599	25	62	653	77	99	617	38	208	747	91
RTOR Reduction (vph)	0	4	0	0	10	0	0	5	0	0	10	0
Lane Group Flow (vph)	74	620	0	62	720	0	99	650	0	208	828	0
Confl. Peds. (#/hr)	183		335	335		183	144		160	160		144
Heavy Vehicles (%)	2%	2%	4%	0%	2%	0%	2%	2%	6%	0%	2%	1%
Bus Blockages (#/hr)	0	10	0	0	6	0	0	2	0	0	8	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	6.2	24.5		5.5	23.8		6.7	26.7		15.3	35.3	
Effective Green, g (s)	6.7	25.5		6.0	24.8		7.2	27.7		15.8	36.3	
Actuated g/C Ratio	0.07	0.28		0.07	0.28		0.08	0.31		0.18	0.40	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	110	808		101	773		114	856		256	1094	
v/s Ratio Prot	c0.05	0.22		0.04	c0.26		0.07	c0.23		0.14	c0.31	
v/s Ratio Perm												
v/c Ratio	0.67	0.77		0.61	0.93		0.87	0.76		0.81	0.76	
Uniform Delay, d1	40.6	29.5		40.9	31.8		40.9	28.1		35.7	23.1	
Progression Factor	1.38	1.17		1.31	1.02		1.00	1.00		0.97	0.95	
Incremental Delay, d2	11.6	6.7		7.1	18.5		44.5	6.3		16.0	4.7	
Delay (s)	67.4	41.2		60.5	51.0		85.4	34.4		50.5	26.5	
Level of Service	E	D		E	D		F	C		D	C	
Approach Delay (s)		44.0			51.7			41.1			31.3	
Approach LOS		D			D			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			41.1			HCM 2000 Level of Service				D		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			15.0			
Intersection Capacity Utilization			67.5%			ICU Level of Service				C		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 12: Madison St & Minor Ave

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	26	701	26	18	621	14	48	76	59	17	32	39
Future Volume (vph)	26	701	26	18	621	14	48	76	59	17	32	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12
Total Lost time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frbp, ped/bikes	1.00	0.98		1.00	0.99			0.96			0.92	
Flpb, ped/bikes	0.85	1.00		0.88	1.00			0.97			0.99	
Fr t	1.00	0.99		1.00	1.00			0.96			0.94	
Fl t Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1294	2903		1338	2932			1495			1450	
Fl t Permitted	0.35	1.00		0.28	1.00			0.90			0.93	
Satd. Flow (perm)	472	2903		394	2932			1365			1361	
Peak-hour factor, PHF	0.89	0.89	0.89	0.95	0.95	0.95	0.83	0.83	0.83	0.76	0.76	0.76
Adj. Flow (vph)	29	788	29	19	654	15	58	92	71	22	42	51
RTOR Reduction (vph)	0	3	0	0	2	0	0	19	0	0	32	0
Lane Group Flow (vph)	29	814	0	19	667	0	0	202	0	0	83	0
Confl. Peds. (#/hr)	157		212	212		157	110		81	81		110
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)	48.5	48.5		48.5	48.5			32.5			32.5	
Effective Green, g (s)	49.5	49.5		49.5	49.5			33.5			33.5	
Actuated g/C Ratio	0.55	0.55		0.55	0.55			0.37			0.37	
Clearance Time (s)	4.5	4.5		4.5	4.5			4.5			4.5	
Lane Grp Cap (vph)	259	1596		216	1612			508			506	
v/s Ratio Prot		c0.28			0.23							
v/s Ratio Perm	0.06			0.05				c0.15			0.06	
v/c Ratio	0.11	0.51		0.09	0.41			0.40			0.16	
Uniform Delay, d1	9.7	12.7		9.6	11.8			20.8			18.9	
Progression Factor	0.17	0.19		0.97	0.74			1.00			1.00	
Incremental Delay, d2	0.5	0.7		0.8	0.8			2.3			0.7	
Delay (s)	2.2	3.1		10.1	9.4			23.1			19.6	
Level of Service	A	A		B	A			C			B	
Approach Delay (s)		3.0			9.5			23.1			19.6	
Approach LOS		A			A			C			B	

### Intersection Summary
























HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	7.0
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 13: Swedish/Summit Ave & Madison St

7/28/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 			 			 		
Traffic Volume (vph)	22	740	15	4	587	10	34	12	19	14	1	34	
Future Volume (vph)	22	740	15	4	587	10	34	12	19	14	1	34	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	10	10	10	12	12	12	12	12	12	12	
Total Lost time (s)	3.5	3.5		3.5	3.5			3.0			3.0		
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00		
Frbp, ped/bikes	1.00	0.99		1.00	1.00			0.96			0.92		
Flpb, ped/bikes	0.90	1.00		0.91	1.00			0.95			0.97		
Fr t	1.00	1.00		1.00	1.00			0.96			0.91		
Fl t Protected	0.95	1.00		0.95	1.00			0.97			0.99		
Satd. Flow (prot)	1367	2945		1373	2953			1460			1366		
Fl t Permitted	0.38	1.00		0.31	1.00			0.85			0.93		
Satd. Flow (perm)	551	2945		450	2953			1272			1288		
Peak-hour factor, PHF	0.97	0.97	0.97	0.96	0.96	0.96	0.63	0.63	0.63	0.77	0.77	0.77	
Adj. Flow (vph)	23	763	15	4	611	10	54	19	30	18	1	44	
RTOR Reduction (vph)	0	2	0	0	1	0	0	16	0	0	30	0	
Lane Group Flow (vph)	23	776	0	4	620	0	0	87	0	0	33	0	
Confl. Peds. (#/hr)	101		132	132		101	69		102	102		69	
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		2			2			4			4		
Permitted Phases	2			2			4			4			
Actuated Green, G (s)	53.5	53.5		53.5	53.5			28.0			28.0		
Effective Green, g (s)	54.5	54.5		54.5	54.5			29.0			29.0		
Actuated g/C Ratio	0.61	0.61		0.61	0.61			0.32			0.32		
Clearance Time (s)	4.5	4.5		4.5	4.5			4.0			4.0		
Lane Grp Cap (vph)	333	1783		272	1788			409			415		
v/s Ratio Prot		c0.26			0.21								
v/s Ratio Perm	0.04			0.01				c0.07			0.03		
v/c Ratio	0.07	0.44		0.01	0.35			0.21			0.08		
Uniform Delay, d1	7.3	9.5		7.1	8.9			22.2			21.2		
Progression Factor	0.32	0.26		0.16	0.23			1.00			1.00		
Incremental Delay, d2	0.4	0.7		0.1	0.5			1.2			0.4		
Delay (s)	2.7	3.1		1.3	2.6			23.4			21.6		
Level of Service	A	A		A	A			C			C		
Approach Delay (s)		3.1			2.6			23.4			21.6		
Approach LOS		A			A			C			C		

### Intersection Summary























HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	6.5
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis






















## 14: Madison St & Boylston Ave

7/28/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 			 			 		
Traffic Volume (vph)	20	720	25	7	556	16	39	57	39	18	10	24	
Future Volume (vph)	20	720	25	7	556	16	39	57	39	18	10	24	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	12	10	9	12	12	12	12	12	12	12	
Total Lost time (s)	3.5	3.5		3.5	3.5			3.0			3.0		
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00		
Frbp, ped/bikes	1.00	0.99		1.00	0.99			0.98			0.96		
Flpb, ped/bikes	0.88	1.00		0.90	1.00			0.98			0.99		
Frt	1.00	1.00		1.00	1.00			0.96			0.94		
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.98		
Satd. Flow (prot)	1334	2918		1365	2832			1566			1499		
Flt Permitted	0.42	1.00		0.33	1.00			0.92			0.83		
Satd. Flow (perm)	591	2918		476	2832			1457			1267		
Peak-hour factor, PHF	0.91	0.91	0.91	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81	
Adj. Flow (vph)	22	791	27	7	585	17	44	64	44	22	12	30	
RTOR Reduction (vph)	0	1	0	0	1	0	0	21	0	0	26	0	
Lane Group Flow (vph)	22	817	0	7	601	0	0	131	0	0	38	0	
Confl. Peds. (#/hr)	88		106	106		88	52		30	30		52	
Heavy Vehicles (%)	0%	2%	8%	0%	2%	0%	0%	0%	0%	0%	0%	0%	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		2			2			4			4		
Permitted Phases	2			2			4			4			
Actuated Green, G (s)	70.1	70.1		70.1	70.1			11.4			11.4		
Effective Green, g (s)	71.1	71.1		71.1	71.1			12.4			12.4		
Actuated g/C Ratio	0.79	0.79		0.79	0.79			0.14			0.14		
Clearance Time (s)	4.5	4.5		4.5	4.5			4.0			4.0		
Vehicle Extension (s)	0.2	0.2		0.2	0.2			0.2			0.2		
Lane Grp Cap (vph)	466	2305		376	2237			200			174		
v/s Ratio Prot		c0.28			0.21								
v/s Ratio Perm	0.04			0.01				c0.09			0.03		
v/c Ratio	0.05	0.35		0.02	0.27			0.66			0.22		
Uniform Delay, d1	2.1	2.8		2.0	2.5			36.8			34.5		
Progression Factor	0.23	0.18		0.40	0.46			1.00			1.00		
Incremental Delay, d2	0.2	0.4		0.1	0.3			5.8			0.2		
Delay (s)	0.7	0.9		0.9	1.4			42.6			34.7		
Level of Service	A	A		A	A			D			C		
Approach Delay (s)		0.9			1.4			42.6			34.7		
Approach LOS		A			A			D			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			6.2									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.40										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	6.5
Intersection Capacity Utilization			44.1%									ICU Level of Service	A
Analysis Period (min)			15										
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis  
 15: Broadway & Madison St/E Madison St

7/28/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 								
Traffic Volume (vph)	107	661	23	66	475	29	0	312	129	0	265	92	
Future Volume (vph)	107	661	23	66	475	29	0	312	129	0	265	92	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	11	10	12	10	10	12	12	13	12	12	13	12	
Grade (%)		-9%			8%			0%			0%		
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	5.0		4.0		
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00		
Frbp, ped/bikes	1.00	1.00		1.00	0.99			1.00	1.00		0.98		
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00		
Frt	1.00	0.99		1.00	0.99			1.00	0.85		0.97		
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00		1.00		
Satd. Flow (prot)	1770	3426		1526	3118			1925	1583		1799		
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00		1.00		
Satd. Flow (perm)	1770	3426		1526	3118			1925	1583		1799		
Peak-hour factor, PHF	0.97	0.97	0.97	0.94	0.94	0.94	0.94	0.94	0.94	0.88	0.88	0.88	
Adj. Flow (vph)	110	681	24	70	505	31	0	332	137	0	301	105	
RTOR Reduction (vph)	0	2	0	0	4	0	0	0	106	0	16	0	
Lane Group Flow (vph)	110	703	0	70	532	0	0	332	31	0	390	0	
Confl. Peds. (#/hr)	98		62	62		62	62		62	62		62	
Heavy Vehicles (%)	3%	2%	0%	6%	2%	7%	0%	2%	2%	0%	2%	5%	
Turn Type	Prot	NA		Prot	NA			NA	custom		NA		
Protected Phases	5	2		1	6			4 3	3 1		8		
Permitted Phases													
Actuated Green, G (s)	8.7	41.3		9.1	41.7			24.6	20.1		24.6		
Effective Green, g (s)	9.7	42.3		10.1	42.7			25.6	20.1		25.6		
Actuated g/C Ratio	0.11	0.47		0.11	0.47			0.28	0.22		0.28		
Clearance Time (s)	5.0	5.0		5.0	5.0						5.0		
Vehicle Extension (s)	2.0	2.0		2.0	2.0						2.0		
Lane Grp Cap (vph)	190	1610		171	1479			547	353		511		
v/s Ratio Prot	c0.06	c0.21		0.05	0.17			0.17	0.02		c0.22		
v/s Ratio Perm													
v/c Ratio	0.58	0.44		0.41	0.36			0.61	0.09		0.76		
Uniform Delay, d1	38.2	15.9		37.2	15.0			27.8	27.7		29.4		
Progression Factor	0.82	1.41		1.00	1.00			1.00	1.00		1.00		
Incremental Delay, d2	2.5	0.8		0.6	0.7			1.3	0.0		6.0		
Delay (s)	34.0	23.3		37.8	15.7			29.2	27.7		35.4		
Level of Service	C	C		D	B			C	C		D		
Approach Delay (s)		24.7			18.2			28.7			35.4		
Approach LOS		C			B			C			D		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			25.7									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.60										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	18.0
Intersection Capacity Utilization			54.2%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group



**Intersection**

Int Delay, s/veh 0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↑	↑↑		↕	
Traffic Vol, veh/h	14	792	581	5	8	12
Future Vol, veh/h	14	792	581	5	8	12
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-8	5	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	15	861	632	5	9	13

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	637	0	1095
Stage 1	-	-	634
Stage 2	-	-	461
Critical Hdwy	4.14	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	2.22	-	3.52
Pot Cap-1 Maneuver	943	-	208
Stage 1	-	-	491
Stage 2	-	-	601
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	943	-	202
Mov Cap-2 Maneuver	-	-	202
Stage 1	-	-	491
Stage 2	-	-	583

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	16
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	943	-	-	-	349
HCM Lane V/C Ratio	0.016	-	-	-	0.062
HCM Control Delay (s)	8.9	0.1	-	-	16
HCM Lane LOS	A	A	-	-	C
HCM 95th %tile Q(veh)	0	-	-	-	0.2

**Intersection**

Int Delay, s/veh 0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↑	↑↑		↕	
Traffic Vol, veh/h	10	790	581	0	0	10
Future Vol, veh/h	10	790	581	0	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-5	2	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	859	632	0	0	11

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	632	0	1083
Stage 1	-	-	632
Stage 2	-	-	451
Critical Hdwy	4.14	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	2.22	-	3.52
Pot Cap-1 Maneuver	947	-	212
Stage 1	-	-	492
Stage 2	-	-	609
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	947	-	207
Mov Cap-2 Maneuver	-	-	207
Stage 1	-	-	492
Stage 2	-	-	596

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	10.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	947	-	-	-	680
HCM Lane V/C Ratio	0.011	-	-	-	0.016
HCM Control Delay (s)	8.8	0.1	-	-	10.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

**Intersection**

Int Delay, s/veh 0

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations	↔		↑	↑	↑	↑
Traffic Vol, veh/h	5	0	581	14	0	790
Future Vol, veh/h	5	0	581	14	0	790
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	0	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	-2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	0	632	15	0	859

Major/Minor	Minor2		Major2		Major1	
Conflicting Flow All	1278	15	0	0	15	0
Stage 1	1278	-	-	-	-	-
Stage 2	0	-	-	-	-	-
Critical Hdwy	6.52	6.22	4.12	-	4.12	-
Critical Hdwy Stg 1	5.52	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	4.018	3.318	2.218	-	2.218	-
Pot Cap-1 Maneuver	166	1065	-	-	1603	-
Stage 1	237	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Platoon blocked, %						
Mov Cap-1 Maneuver	0	1065	-	-	1603	-
Mov Cap-2 Maneuver	0	-	-	-	-	-
Stage 1	0	-	-	-	-	-
Stage 2	0	-	-	-	-	-

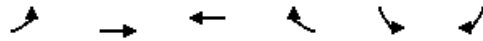
Approach	EB	WB	NE
HCM Control Delay, s			0
HCM LOS	-		

Minor Lane/Major Mvmt	NEL	NER	EBLn1	WBL	WBT
Capacity (veh/h)	1603	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	-
HCM Lane LOS	A	-	-	-	-
HCM 95th %tile Q(veh)	0	-	-	-	-

# HCM Signalized Intersection Capacity Analysis

## 19: E Madison St & 11th Ave

7/28/2016






















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	0	790	584	0	210	12
Future Volume (vph)	0	790	584	0	210	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	13	13	12	10	12
Grade (%)		0%	-4%		0%	
Total Lost time (s)		5.5	5.5		4.5	
Lane Util. Factor		0.95	0.95		0.97	
Frbp, ped/bikes		1.00	1.00		0.99	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		0.99	
Flt Protected		1.00	1.00		0.95	
Satd. Flow (prot)		3693	3694		3089	
Flt Permitted		1.00	1.00		0.95	
Satd. Flow (perm)		3693	3694		3089	
Peak-hour factor, PHF	0.90	0.90	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	878	664	0	239	14
RTOR Reduction (vph)	0	0	0	0	5	0
Lane Group Flow (vph)	0	878	664	0	248	0
Confl. Peds. (#/hr)	23			38		61
Confl. Bikes (#/hr)				3		17
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Parking (#/hr)						0
Turn Type		NA	NA		Prot	
Protected Phases		6	2		4	
Permitted Phases						
Actuated Green, G (s)		79.2	79.2		10.8	
Effective Green, g (s)		79.2	79.2		10.8	
Actuated g/C Ratio		0.79	0.79		0.11	
Clearance Time (s)		5.5	5.5		4.5	
Vehicle Extension (s)		0.2	0.2		0.2	
Lane Grp Cap (vph)		2924	2925		333	
v/s Ratio Prot		c0.24	0.18		c0.08	
v/s Ratio Perm						
v/c Ratio		0.30	0.23		0.74	
Uniform Delay, d1		2.8	2.6		43.3	
Progression Factor		1.00	0.28		1.00	
Incremental Delay, d2		0.3	0.1		7.6	
Delay (s)		3.1	0.9		50.9	
Level of Service		A	A		D	
Approach Delay (s)		3.1	0.9		50.9	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			9.0		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.35			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	10.0
Intersection Capacity Utilization			42.6%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 20: E Madison St & 12th Ave & Union St

7/28/2016

												
Movement	NBL2	NBL	NBT	NBR	SBL	SBT	SBR	SBR2	NEL2	NEL	NET	NER
Lane Configurations												
Traffic Volume (vph)	28	81	405	70	55	385	62	22	1	30	856	110
Future Volume (vph)	28	81	405	70	55	385	62	22	1	30	856	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	11	12	10	10	12	12	12	12	15	12
Grade (%)			0%			0%					4%	
Total Lost time (s)		5.0	5.0	5.0	5.5	5.5					5.5	
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00					0.95	
Frbp, ped/bikes		1.00	1.00	1.00	1.00	0.94					0.99	
Flpb, ped/bikes		0.91	1.00	1.00	0.97	1.00					1.00	
Frt		1.00	1.00	0.85	1.00	0.97					0.98	
Flt Protected		0.95	1.00	1.00	0.95	1.00					1.00	
Satd. Flow (prot)		1521	1818	1599	1604	1430					3746	
Flt Permitted		0.30	1.00	1.00	0.40	1.00					0.91	
Satd. Flow (perm)		482	1818	1599	681	1430					3408	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.86	0.86	0.86	0.86	0.96	0.96	0.96	0.96
Adj. Flow (vph)	29	84	422	73	64	448	72	26	1	31	892	115
RTOR Reduction (vph)	0	0	0	21	0	2	0	0	0	0	10	0
Lane Group Flow (vph)	0	113	422	52	64	544	0	0	0	0	1029	0
Confl. Peds. (#/hr)	96	34		41	41		96	34	34	27		45
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%	2%	2%	1%	1%	1%	1%
Parking (#/hr)						0						
Turn Type	Perm	Perm	NA	Prot	Perm	NA			Perm	Perm	NA	
Protected Phases			4	4		8					6	
Permitted Phases	4	4			8				6	6		
Actuated Green, G (s)		49.0	49.0	49.0	48.5	48.5					40.5	
Effective Green, g (s)		49.0	49.0	49.0	48.5	48.5					40.5	
Actuated g/C Ratio		0.49	0.49	0.49	0.48	0.48					0.40	
Clearance Time (s)		5.0	5.0	5.0	5.5	5.5					5.5	
Lane Grp Cap (vph)		236	890	783	330	693					1380	
v/s Ratio Prot			0.23	0.03		c0.38						
v/s Ratio Perm		0.23			0.09						c0.30	
v/c Ratio		0.48	0.47	0.07	0.19	0.79					0.75	
Uniform Delay, d1		17.0	16.9	13.4	14.6	21.4					25.4	
Progression Factor		1.00	1.00	1.00	0.45	0.43					0.77	
Incremental Delay, d2		6.8	1.8	0.2	1.3	8.5					3.6	
Delay (s)		23.8	18.8	13.6	7.9	17.6					23.2	
Level of Service		C	B	B	A	B					C	
Approach Delay (s)			19.1			16.6					23.2	
Approach LOS			B			B					C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			21.0			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.77									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		11.0				
Intersection Capacity Utilization			96.2%			ICU Level of Service		F				
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 20: E Madison St & 12th Ave & Union St

7/28/2016























Movement	SWL	SWT	SWR	SWR2
Lane Configurations				
Traffic Volume (vph)	38	473	126	33
Future Volume (vph)	38	473	126	33
Ideal Flow (vphpl)	1900	1900	1900	1900
Lane Width	12	11	12	12
Grade (%)		-8%		
Total Lost time (s)		5.5		
Lane Util. Factor		0.95		
Frbp, ped/bikes		0.96		
Flpb, ped/bikes		1.00		
Frt		0.96		
Flt Protected		1.00		
Satd. Flow (prot)		3284		
Flt Permitted		0.74		
Satd. Flow (perm)		2428		
Peak-hour factor, PHF	0.92	0.92	0.92	0.92
Adj. Flow (vph)	41	514	137	36
RTOR Reduction (vph)	0	4	0	0
Lane Group Flow (vph)	0	724	0	0
Confl. Peds. (#/hr)	45		34	27
Heavy Vehicles (%)	2%	2%	2%	2%
Parking (#/hr)				
Turn Type	Perm	NA		
Protected Phases		2		
Permitted Phases	2			
Actuated Green, G (s)		40.5		
Effective Green, g (s)		40.5		
Actuated g/C Ratio		0.40		
Clearance Time (s)		5.5		
Lane Grp Cap (vph)		983		
v/s Ratio Prot				
v/s Ratio Perm		0.30		
v/c Ratio		0.74		
Uniform Delay, d1		25.2		
Progression Factor		0.73		
Incremental Delay, d2		4.9		
Delay (s)		23.2		
Level of Service		C		
Approach Delay (s)		23.2		
Approach LOS		C		
<b>Intersection Summary</b>				

# HCM Signalized Intersection Capacity Analysis

22: 13th Ave & E Madison St

7/28/2016






















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (vph)	26	721	0	0	456	4	124	43	9	9	0	23
Future Volume (vph)	26	721	0	0	456	4	124	43	9	9	0	23
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	11	12	16	16	12	12	13	12
Grade (%)		8%			-7%			0%			0%	
Total Lost time (s)		4.5			4.5		4.5	4.5			4.5	
Lane Util. Factor		0.95			0.95		0.95	0.95			1.00	
Frbp, ped/bikes		1.00			1.00		1.00	0.99			0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00			0.98	
Frt		1.00			1.00		1.00	0.99			0.90	
Flt Protected		1.00			1.00		0.95	0.98			0.99	
Satd. Flow (prot)		3191			3533		1865	1877			1667	
Flt Permitted		0.93			1.00		0.73	0.88			0.94	
Satd. Flow (perm)		2957			3533		1440	1685			1582	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.95	0.95	0.87	0.87	0.87	0.89	0.89	0.89
Adj. Flow (vph)	29	801	0	0	480	4	143	49	10	10	0	26
RTOR Reduction (vph)	0	0	0	0	1	0	0	4	0	0	19	0
Lane Group Flow (vph)	0	830	0	0	483	0	100	98	0	0	17	0
Confl. Peds. (#/hr)	28		29	29		28	1		52	52		1
Confl. Bikes (#/hr)												6
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)									0			0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4				4
Permitted Phases	6						4			4		
Actuated Green, G (s)		64.5			64.5		26.5	26.5				26.5
Effective Green, g (s)		64.5			64.5		26.5	26.5				26.5
Actuated g/C Ratio		0.64			0.64		0.26	0.26				0.26
Clearance Time (s)		4.5			4.5		4.5	4.5				4.5
Lane Grp Cap (vph)		1907			2278		381	446				419
v/s Ratio Prot					0.14							
v/s Ratio Perm		c0.28					c0.07	0.06				0.01
v/c Ratio		0.44			0.21		0.26	0.22				0.04
Uniform Delay, d1		8.8			7.3		29.0	28.7				27.3
Progression Factor		0.19			0.14		0.85	0.84				1.00
Incremental Delay, d2		0.6			0.2		1.6	1.1				0.2
Delay (s)		2.2			1.2		26.3	25.1				27.5
Level of Service		A			A		C	C				C
Approach Delay (s)		2.2			1.2			25.7				27.5
Approach LOS		A			A			C				C
<b>Intersection Summary</b>												
HCM 2000 Control Delay			5.5				HCM 2000 Level of Service				A	
HCM 2000 Volume to Capacity ratio			0.38									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)				9.0	
Intersection Capacity Utilization			58.0%				ICU Level of Service				B	
Analysis Period (min)			15									
c Critical Lane Group												



# HCM Signalized Intersection Capacity Analysis

23: 14th Ave & E Madison St



















7/28/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 			 			 			 		
Traffic Volume (vph)	0	686	52	59	468	0	14	219	54	2	172	12	
Future Volume (vph)	0	686	52	59	468	0	14	219	54	2	172	12	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	11	12	12	11	12	12	16	12	12	16	12	
Grade (%)		7%			-10%			0%			0%		
Total Lost time (s)		4.5			4.5			8.5			4.5		
Lane Util. Factor		0.95			0.95			1.00			1.00		
Frb, ped/bikes		0.99			1.00			0.99			1.00		
Flpb, ped/bikes		1.00			1.00			1.00			1.00		
Frt		0.99			1.00			0.97			0.99		
Flt Protected		1.00			0.99			1.00			1.00		
Satd. Flow (prot)		3274			3600			2058			2061		
Flt Permitted		1.00			0.77			0.98			1.00		
Satd. Flow (perm)		3274			2773			2019			2058		
Peak-hour factor, PHF	0.92	0.92	0.92	0.91	0.91	0.91	0.85	0.85	0.85	0.86	0.86	0.86	
Adj. Flow (vph)	0	746	57	65	514	0	16	258	64	2	200	14	
RTOR Reduction (vph)	0	5	0	0	0	0	0	8	0	0	2	0	
Lane Group Flow (vph)	0	798	0	0	579	0	0	330	0	0	214	0	
Confl. Peds. (#/hr)	3		31	31		3	37		10	10		37	
Confl. Bikes (#/hr)			7			3			1			1	
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%	
Parking (#/hr)									0			0	
Turn Type		NA		Perm	NA		Perm	NA		Perm	NA		
Protected Phases		1			1			3				6	
Permitted Phases	1			1			3			6			
Actuated Green, G (s)		50.5			50.5			36.5				40.5	
Effective Green, g (s)		50.5			50.5			36.5				40.5	
Actuated g/C Ratio		0.50			0.50			0.36				0.40	
Clearance Time (s)		4.5			4.5			8.5				4.5	
Lane Grp Cap (vph)		1653			1400			736				833	
v/s Ratio Prot		c0.24											
v/s Ratio Perm					0.21			c0.16				0.10	
v/c Ratio		0.48			0.41			0.45				0.26	
Uniform Delay, d1		16.2			15.5			24.1				19.8	
Progression Factor		0.26			0.13			0.76				0.66	
Incremental Delay, d2		0.9			0.9			1.9				0.7	
Delay (s)		5.2			2.8			20.3				13.9	
Level of Service		A			A			C				B	
Approach Delay (s)		5.2			2.8			20.3				13.9	
Approach LOS		A			A			C				B	
<b>Intersection Summary</b>													
HCM 2000 Control Delay			8.1				HCM 2000 Level of Service			A			
HCM 2000 Volume to Capacity ratio			0.47										
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			13.0			
Intersection Capacity Utilization			75.2%				ICU Level of Service			D			
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 24: E Madison St & Pike St

7/28/2016

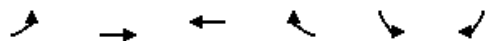
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	26	4	0	0	0	0	0	722	19	1	548	37
Future Volume (vph)	26	4	0	0	0	0	0	722	19	1	548	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	16	12	12	12	12	12	12	12	12	11	12
Grade (%)		6%			0%			10%			-10%	
Total Lost time (s)	4.5	4.5						4.5			4.5	
Lane Util. Factor	0.95	0.95						0.95			0.95	
Fr <sub>t</sub>	1.00	1.00						1.00			0.99	
Fl <sub>t</sub> Protected	0.95	0.96						1.00			1.00	
Satd. Flow (prot)	1522	1688						3349			3558	
Fl <sub>t</sub> Permitted	0.95	0.96						1.00			0.95	
Satd. Flow (perm)	1522	1688						3349			3396	
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	4	0	0	0	0	0	785	21	1	596	40
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	0	0	5	0
Lane Group Flow (vph)	16	16	0	0	0	0	0	804	0	0	632	0
Parking (#/hr)		0							0			
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		6						1			1	
Permitted Phases	6									1		
Actuated Green, G (s)	40.5	40.5						50.5			50.5	
Effective Green, g (s)	40.5	40.5						50.5			50.5	
Actuated g/C Ratio	0.40	0.40						0.50			0.50	
Clearance Time (s)	4.5	4.5						4.5			4.5	
Lane Grp Cap (vph)	616	683						1691			1714	
v/s Ratio Prot								c0.24				
v/s Ratio Perm	c0.01	0.01									0.19	
v/c Ratio	0.03	0.02						0.48			0.37	
Uniform Delay, d1	17.9	17.9						16.1			15.1	
Progression Factor	1.34	1.34						0.26			0.62	
Incremental Delay, d2	0.1	0.1						0.9			0.6	
Delay (s)	24.1	24.0						5.1			10.0	
Level of Service	C	C						A			A	
Approach Delay (s)		24.1			0.0			5.1			10.0	
Approach LOS		C			A			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			7.6					HCM 2000 Level of Service		A		
HCM 2000 Volume to Capacity ratio			0.29									
Actuated Cycle Length (s)			100.0					Sum of lost time (s)		13.0		
Intersection Capacity Utilization			33.9%					ICU Level of Service		A		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 25: E Madison St & 15th Ave

7/28/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕			↗
Traffic Volume (vph)	64	684	489	13	0	128
Future Volume (vph)	64	684	489	13	0	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	12	16
Grade (%)		10%	-9%		0%	
Total Lost time (s)		4.5	4.5			4.0
Lane Util. Factor		0.95	0.95			1.00
Frb, ped/bikes		1.00	1.00			0.99
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		3264	3592			1752
Flt Permitted		0.84	1.00			1.00
Satd. Flow (perm)		2763	3592			1752
Peak-hour factor, PHF	0.93	0.93	0.85	0.85	0.85	0.85
Adj. Flow (vph)	69	735	575	15	0	151
RTOR Reduction (vph)	0	0	1	0	0	0
Lane Group Flow (vph)	0	804	589	0	0	151
Confl. Peds. (#/hr)	59			59	47	1
Confl. Bikes (#/hr)				2		
Heavy Vehicles (%)	1%	1%	1%	1%	5%	5%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA			Free
Protected Phases		2	6			
Permitted Phases	2					Free
Actuated Green, G (s)		80.0	80.0			100.0
Effective Green, g (s)		80.0	80.0			100.0
Actuated g/C Ratio		0.80	0.80			1.00
Clearance Time (s)		4.5	4.5			
Vehicle Extension (s)		0.2	0.2			
Lane Grp Cap (vph)		2210	2873			1752
v/s Ratio Prot			0.16			
v/s Ratio Perm		c0.29				c0.09
v/c Ratio		0.36	0.20			0.09
Uniform Delay, d1		2.8	2.4			0.0
Progression Factor		0.07	0.60			1.00
Incremental Delay, d2		0.4	0.2			0.1
Delay (s)		0.6	1.6			0.1
Level of Service		A	A			A
Approach Delay (s)		0.6	1.6		0.1	
Approach LOS		A	A		A	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			0.9		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.35			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	12.0
Intersection Capacity Utilization			49.3%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

**Intersection**

Int Delay, s/veh 0.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↑	
Traffic Vol, veh/h	684	5	0	503	5	15
Future Vol, veh/h	684	5	0	503	5	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	9	-	-	-9	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	743	5	0	547	5	16

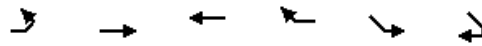
Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	1019
Stage 1	-	-	746
Stage 2	-	-	273
Critical Hdwy	-	-	6.84
Critical Hdwy Stg 1	-	-	5.84
Critical Hdwy Stg 2	-	-	5.84
Follow-up Hdwy	-	-	3.52
Pot Cap-1 Maneuver	-	0	233
Stage 1	-	0	430
Stage 2	-	0	748
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	233
Mov Cap-2 Maneuver	-	-	233
Stage 1	-	-	430
Stage 2	-	-	748

Approach	EB	WB	NB
HCM Control Delay, s	0	0	13.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	439	-	-	-
HCM Lane V/C Ratio	0.05	-	-	-
HCM Control Delay (s)	13.6	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.2	-	-	-

HCM Signalized Intersection Capacity Analysis  
 27: E Madison St & Pine St

7/28/2016




















Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↔↔	↔↔		↔	↔
Traffic Volume (vph)	16	682	498	201	235	5
Future Volume (vph)	16	682	498	201	235	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	10	10	12	11	11
Grade (%)		9%	-4%		0%	
Total Lost time (s)		4.5	4.5		4.5	4.5
Lane Util. Factor		0.95	0.95		1.00	1.00
Frbp, ped/bikes		1.00	0.97		1.00	0.88
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	0.96		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		3180	3128		1678	1193
Flt Permitted		0.93	1.00		0.95	1.00
Satd. Flow (perm)		2967	3128		1678	1193
Peak-hour factor, PHF	0.95	0.95	0.94	0.94	0.90	0.90
Adj. Flow (vph)	17	718	530	214	261	6
RTOR Reduction (vph)	0	0	27	0	0	5
Lane Group Flow (vph)	0	735	717	0	261	1
Confl. Peds. (#/hr)	62			62	1	43
Confl. Bikes (#/hr)				3		8
Heavy Vehicles (%)	1%	1%	2%	2%	4%	4%
Parking (#/hr)						0
Turn Type	Perm	NA	NA		Prot	Perm
Protected Phases		2	2		4	
Permitted Phases	2					4
Actuated Green, G (s)		72.2	72.2		18.8	18.8
Effective Green, g (s)		72.2	72.2		18.8	18.8
Actuated g/C Ratio		0.72	0.72		0.19	0.19
Clearance Time (s)		4.5	4.5		4.5	4.5
Vehicle Extension (s)		0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		2142	2258		315	224
v/s Ratio Prot			0.23		c0.16	
v/s Ratio Perm		c0.25				0.00
v/c Ratio		0.34	0.32		0.83	0.01
Uniform Delay, d1		5.1	5.0		39.1	33.0
Progression Factor		0.13	0.89		1.00	1.00
Incremental Delay, d2		0.4	0.4		15.5	0.0
Delay (s)		1.1	4.8		54.6	33.0
Level of Service		A	A		D	C
Approach Delay (s)		1.1	4.8		54.1	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			10.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.44			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	9.0
Intersection Capacity Utilization			50.8%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 28: 17th Ave & E Madison St

7/28/2016

														
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
Lane Configurations														
Traffic Volume (vph)	78	816	42	16	589	51	48	33	11	58	52	57		
Future Volume (vph)	78	816	42	16	589	51	48	33	11	58	52	57		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Lane Width	12	11	12	12	11	10	12	10	12	12	16	12		
Grade (%)		4%			4%			0%				0%		
Total Lost time (s)		4.5			4.5			4.5				4.5		
Lane Util. Factor		0.95			0.95			1.00				1.00		
Frb, ped/bikes		0.99			0.98			0.97				0.91		
Flpb, ped/bikes		0.99			1.00			0.93				0.95		
Frt		0.99			0.99			0.98				0.95		
Flt Protected		1.00			1.00			0.97				0.98		
Satd. Flow (prot)		3304			3241			1526				1725		
Flt Permitted		0.82			0.92			0.63				0.83		
Satd. Flow (perm)		2712			2985			983				1454		
Peak-hour factor, PHF	0.92	0.92	0.92	0.96	0.96	0.96	0.80	0.80	0.80	0.93	0.93	0.93		
Adj. Flow (vph)	85	887	46	17	614	53	60	41	14	62	56	61		
RTOR Reduction (vph)	0	2	0	0	5	0	0	6	0	0	21	0		
Lane Group Flow (vph)	0	1016	0	0	679	0	0	109	0	0	158	0		
Confl. Peds. (#/hr)	95		44	44		95	120		113	113		120		
Confl. Bikes (#/hr)			17			23			3			11		
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%		
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA			
Protected Phases		2			2			4				4		
Permitted Phases	2			2			4			4				
Actuated Green, G (s)		76.0			76.0			15.0				15.0		
Effective Green, g (s)		76.0			76.0			15.0				15.0		
Actuated g/C Ratio		0.76			0.76			0.15				0.15		
Clearance Time (s)		4.5			4.5			4.5				4.5		
Vehicle Extension (s)		0.2			0.2			3.0				3.0		
Lane Grp Cap (vph)		2061			2268			147				218		
v/s Ratio Prot														
v/s Ratio Perm		c0.37			0.23			c0.11				0.11		
v/c Ratio		0.49			0.30			0.74				0.72		
Uniform Delay, d1		4.6			3.7			40.6				40.5		
Progression Factor		0.60			0.43			1.00				1.00		
Incremental Delay, d2		0.8			0.3			18.1				11.3		
Delay (s)		3.6			1.9			58.8				51.8		
Level of Service		A			A			E				D		
Approach Delay (s)		3.6			1.9			58.8				51.8		
Approach LOS		A			A			E				D		
<b>Intersection Summary</b>														
HCM 2000 Control Delay			10.5										HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.53											
Actuated Cycle Length (s)			100.0										Sum of lost time (s)	9.0
Intersection Capacity Utilization			69.0%										ICU Level of Service	C
Analysis Period (min)			15											
c Critical Lane Group														



Intersection												
Int Delay, s/veh	0.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	14	900	41	2	627	3	9	2	5	4	2	19
Future Vol, veh/h	14	900	41	2	627	3	9	2	5	4	2	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-4	-	-	11	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	15	978	45	2	682	3	10	2	5	4	2	21

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	685	0	0	1023	0	0	1377	1720	511	1209	1741	342
Stage 1	-	-	-	-	-	-	1031	1031	-	688	688	-
Stage 2	-	-	-	-	-	-	346	689	-	521	1053	-
Critical Hdwy	4.14	-	-	4.14	-	-	7.54	6.54	6.94	7.54	6.54	6.94
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.54	5.54	-
Follow-up Hdwy	2.22	-	-	2.22	-	-	3.52	4.02	3.32	3.52	4.02	3.32
Pot Cap-1 Maneuver	904	-	-	674	-	-	104	89	508	139	86	654
Stage 1	-	-	-	-	-	-	249	309	-	403	445	-
Stage 2	-	-	-	-	-	-	643	445	-	507	301	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	904	-	-	674	-	-	95	85	508	130	82	654
Mov Cap-2 Maneuver	-	-	-	-	-	-	95	85	-	130	82	-
Stage 1	-	-	-	-	-	-	239	297	-	387	443	-
Stage 2	-	-	-	-	-	-	617	443	-	478	289	-

















Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0	38.4	18.3
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	125	904	-	-	674	-	-	297
HCM Lane V/C Ratio	0.139	0.017	-	-	0.003	-	-	0.091
HCM Control Delay (s)	38.4	9.1	0.2	-	10.4	0	-	18.3
HCM Lane LOS	E	A	A	-	B	A	-	C
HCM 95th %tile Q(veh)	0.5	0.1	-	-	0	-	-	0.3

# HCM Signalized Intersection Capacity Analysis

30: 19th Ave & E Madison St

7/28/2016

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	766	33	3	554	21	23	140	19	23	115	55
Future Volume (vph)	110	766	33	3	554	21	23	140	19	23	115	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		-11%			8%			0%			0%	
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frbp, ped/bikes		1.00			1.00			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.99			0.96	
Flt Protected		0.99			1.00			0.99			0.99	
Satd. Flow (prot)		3571			3286			2083			1956	
Flt Permitted		0.78			0.95			0.85			0.86	
Satd. Flow (perm)		2800			3129			1779			1700	
Peak-hour factor, PHF	0.99	0.99	0.99	0.98	0.98	0.98	0.86	0.86	0.86	0.91	0.91	0.91
Adj. Flow (vph)	111	774	33	3	565	21	27	163	22	25	126	60
RTOR Reduction (vph)	0	2	0	0	2	0	0	5	0	0	16	0
Lane Group Flow (vph)	0	916	0	0	587	0	0	207	0	0	195	0
Confl. Peds. (#/hr)	26		40	40		26	7		2	2		7
Confl. Bikes (#/hr)			8			4			1			12
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Parking (#/hr)									0			0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2			4			4		
Actuated Green, G (s)		72.2			72.2			15.8				15.8
Effective Green, g (s)		72.2			72.2			15.8				15.8
Actuated g/C Ratio		0.72			0.72			0.16				0.16
Clearance Time (s)		6.0			6.0			6.0				6.0
Vehicle Extension (s)		0.2			0.2			3.0				3.0
Lane Grp Cap (vph)		2021			2259			281				268
v/s Ratio Prot												
v/s Ratio Perm		c0.33			0.19			c0.12				0.11
v/c Ratio		0.45			0.26			0.74				0.73
Uniform Delay, d1		5.7			4.8			40.1				40.1
Progression Factor		1.35			0.60			1.00				1.00
Incremental Delay, d2		0.7			0.3			9.6				9.5
Delay (s)		8.4			3.1			49.8				49.5
Level of Service		A			A			D				D
Approach Delay (s)		8.4			3.1			49.8				49.5
Approach LOS		A			A			D				D
<b>Intersection Summary</b>												
HCM 2000 Control Delay			15.8									B
HCM 2000 Volume to Capacity ratio			0.50									
Actuated Cycle Length (s)			100.0								12.0	
Intersection Capacity Utilization			70.9%									C
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 31: 20th Ave & E Olive St & E Madison St

7/28/2016

												
Movement	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBR2	SBL2	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	721	123	10	4	510	6	22	1	2	2	14
Future Volume (vph)	9	721	123	10	4	510	6	22	1	2	2	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	10	12	12	12	12	13	12
Grade (%)		-8%				3%					0%	
Total Lost time (s)		4.5				4.5		4.0			4.5	
Lane Util. Factor		0.95				0.95		1.00			1.00	
Frbp, ped/bikes		0.99				1.00		1.00			0.98	
Flpb, ped/bikes		1.00				1.00		1.00			0.99	
Frt		0.98				1.00		0.86			0.90	
Flt Protected		1.00				1.00		1.00			0.99	
Satd. Flow (prot)		3598				3276		1465			1692	
Flt Permitted		0.95				0.95		1.00			0.99	
Satd. Flow (perm)		3418				3116		1465			1692	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.94	0.94	0.94	0.79	0.59	0.59	0.59	0.59
Adj. Flow (vph)	9	743	127	10	4	543	6	28	2	3	3	24
RTOR Reduction (vph)	0	1	0	0	0	1	0	0	0	0	23	0
Lane Group Flow (vph)	0	888	0	0	0	552	0	28	0	0	9	0
Confl. Peds. (#/hr)	29		10	2	2		29		12	10		7
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)			0					0				0
Turn Type	Perm	NA			Perm	NA		Free	Perm	Perm	NA	
Protected Phases		2				2						4
Permitted Phases	2				2			Free	4	4		
Actuated Green, G (s)		74.0				74.0		100.0				4.3
Effective Green, g (s)		74.0				74.0		100.0				4.3
Actuated g/C Ratio		0.74				0.74		1.00				0.04
Clearance Time (s)		4.5				4.5						4.5
Vehicle Extension (s)		0.2				0.2						2.0
Lane Grp Cap (vph)		2529				2305		1465				72
v/s Ratio Prot												
v/s Ratio Perm		c0.26				0.18		0.02				0.01
v/c Ratio		0.35				0.24		0.02				0.13
Uniform Delay, d1		4.6				4.1		0.0				46.0
Progression Factor		0.68				1.75		1.00				1.00
Incremental Delay, d2		0.4				0.2		0.0				0.3
Delay (s)		3.5				7.4		0.0				46.3
Level of Service		A				A		A				D
Approach Delay (s)		3.5				7.4						46.3
Approach LOS		A				A						D
<b>Intersection Summary</b>												
HCM 2000 Control Delay			8.5			HCM 2000 Level of Service			A			
HCM 2000 Volume to Capacity ratio			0.34									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		13.5				
Intersection Capacity Utilization			56.3%			ICU Level of Service			B			
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 31: 20th Ave & E Olive St & E Madison St

7/28/2016



Movement	NWL	NWR	NWR2
Lane Configurations	Y		
Traffic Volume (vph)	87	4	3
Future Volume (vph)	87	4	3
Ideal Flow (vphpl)	1900	1900	1900
Lane Width	16	12	12
Grade (%)	0%		
Total Lost time (s)	4.5		
Lane Util. Factor	1.00		
Frbp, ped/bikes	0.99		
Flpb, ped/bikes	1.00		
Frt	0.99		
Flt Protected	0.96		
Satd. Flow (prot)	1991		
Flt Permitted	0.96		
Satd. Flow (perm)	1991		
Peak-hour factor, PHF	0.82	0.82	0.82
Adj. Flow (vph)	106	5	4
RTOR Reduction (vph)	60	0	0
Lane Group Flow (vph)	55	0	0
Confl. Peds. (#/hr)		29	12
Heavy Vehicles (%)	1%	1%	1%
Parking (#/hr)		0	0
Turn Type	Prot		
Protected Phases	1		
Permitted Phases			
Actuated Green, G (s)	8.2		
Effective Green, g (s)	8.2		
Actuated g/C Ratio	0.08		
Clearance Time (s)	4.5		
Vehicle Extension (s)	2.0		
Lane Grp Cap (vph)	163		
v/s Ratio Prot	c0.03		
v/s Ratio Perm			
v/c Ratio	0.34		
Uniform Delay, d1	43.3		
Progression Factor	1.00		
Incremental Delay, d2	0.5		
Delay (s)	43.8		
Level of Service	D		
Approach Delay (s)	43.8		
Approach LOS	D		
<b>Intersection Summary</b>			

HCM Signalized Intersection Capacity Analysis  
 32: 22nd Ave/E Denny Way & E Madison St

7/28/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↔			↔			↔			↔	
Traffic Volume (vph)	3	716	38	18	493	19	10	26	1	22	20	27
Future Volume (vph)	3	716	38	18	493	19	10	26	1	22	20	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	13	12	12	10	12	12	12	12	12	11	12
Grade (%)		-3%			1%			0%			0%	
Total Lost time (s)		4.5			4.5			4.5			4.5	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frbp, ped/bikes		1.00			1.00			1.00			0.97	
Flpb, ped/bikes		1.00			1.00			0.99			1.00	
Frt		0.99			0.99			1.00			0.95	
Flt Protected		1.00			1.00			0.99			0.98	
Satd. Flow (prot)		3703			3291			1840			1627	
Flt Permitted		0.95			0.92			0.83			0.90	
Satd. Flow (perm)		3533			3016			1557			1493	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.64	0.64	0.64	0.77	0.77	0.77
Adj. Flow (vph)	3	804	43	20	554	21	16	41	2	29	26	35
RTOR Reduction (vph)	0	2	0	0	1	0	0	2	0	0	30	0
Lane Group Flow (vph)	0	848	0	0	594	0	0	57	0	0	60	0
Confl. Peds. (#/hr)	2		25	25		2	39		4	4		39
Confl. Bikes (#/hr)			1						10			2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	2%	2%	2%
Parking (#/hr)			0			0			0			
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)		83.8			83.8			7.2			7.2	
Effective Green, g (s)		83.8			83.8			7.2			7.2	
Actuated g/C Ratio		0.84			0.84			0.07			0.07	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Vehicle Extension (s)		0.2			0.2			1.0			1.0	
Lane Grp Cap (vph)		2960			2527			112			107	
v/s Ratio Prot												
v/s Ratio Perm		c0.24			0.20			0.04			c0.04	
v/c Ratio		0.29			0.24			0.51			0.56	
Uniform Delay, d1		1.7			1.6			44.7			44.9	
Progression Factor		1.77			0.21			1.00			0.99	
Incremental Delay, d2		0.2			0.2			1.6			4.0	
Delay (s)		3.3			0.6			46.3			48.6	
Level of Service		A			A			D			D	
Approach Delay (s)		3.3			0.6			46.3			48.6	
Approach LOS		A			A			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			6.4				HCM 2000 Level of Service		A			
HCM 2000 Volume to Capacity ratio			0.31									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		9.0			
Intersection Capacity Utilization			48.9%				ICU Level of Service		A			
Analysis Period (min)			15									

c Critical Lane Group

**Intersection**

Int Delay, s/veh 0.4

Movement	SBL	SBR	NEL	NET	SWT	SWR
Lane Configurations	Y			↑↑	↑↑	
Traffic Vol, veh/h	0	12	24	728	499	10
Future Vol, veh/h	0	12	24	728	499	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	-1	5	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	13	26	791	542	11

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	996	277	553	0	0
Stage 1	548	-	-	-	-
Stage 2	448	-	-	-	-
Critical Hdwy	6.84	6.94	4.14	-	-
Critical Hdwy Stg 1	5.84	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-
Follow-up Hdwy	3.52	3.32	2.22	-	-
Pot Cap-1 Maneuver	241	720	1013	-	-
Stage 1	543	-	-	-	-
Stage 2	611	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	230	720	1013	-	-
Mov Cap-2 Maneuver	230	-	-	-	-
Stage 1	543	-	-	-	-
Stage 2	583	-	-	-	-

Approach	SB	NE	SW
HCM Control Delay, s	10.1	0.5	0
HCM LOS	B		




















Minor Lane/Major Mvmt	NEL	NET	SBLn1	SWT	SWR
Capacity (veh/h)	1013	-	720	-	-
HCM Lane V/C Ratio	0.026	-	0.018	-	-
HCM Control Delay (s)	8.6	0.2	10.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-



# HCM Signalized Intersection Capacity Analysis

## 34: E Madison St & 23rd Ave E

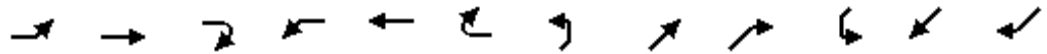
7/29/2016

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	0	587	34	0	637	116	194	540	34	60	357	11
Future Volume (vph)	0	587	34	0	637	116	194	540	34	60	357	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	9	9	10	10	10	10	16	10	9	10	10
Grade (%)		0%			0%			-5%			10%	
Total Lost time (s)		3.0			3.0	5.0	3.0	3.0		3.0	4.5	
Lane Util. Factor		0.95			1.00	1.00	1.00	1.00		1.00	0.95	
Frbp, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3179			1756	1478	1693	2145		1528	3109	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3179			1756	1478	1693	2145		1528	3109	
Peak-hour factor, PHF	0.92	0.87	0.69	0.25	0.91	0.92	0.92	0.92	0.92	0.64	0.92	0.46
Adj. Flow (vph)	0	675	49	0	700	126	211	587	37	94	388	24
RTOR Reduction (vph)	0	5	0	0	0	71	0	3	0	0	4	0
Lane Group Flow (vph)	0	719	0	0	700	55	211	621	0	94	408	0
Confl. Peds. (#/hr)			2	2								3
Heavy Vehicles (%)	2%	1%	1%	1%	1%	2%	2%	2%	2%	1%	2%	1%
Parking (#/hr)			0									0
Turn Type		NA			NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			4		5	2		1		6
Permitted Phases						4						
Actuated Green, G (s)		44.0			44.0	44.0	16.7	35.4		6.6		25.3
Effective Green, g (s)		46.0			46.0	44.0	18.2	36.9		8.1		25.3
Actuated g/C Ratio		0.46			0.46	0.44	0.18	0.37		0.08		0.25
Clearance Time (s)		5.0			5.0	5.0	4.5	4.5		4.5		4.5
Vehicle Extension (s)		0.2			0.2	0.2	3.0	0.2		2.0		3.0
Lane Grp Cap (vph)		1462			807	650	308	791		123		786
v/s Ratio Prot		0.23			c0.40		0.12	c0.29		c0.06		0.13
v/s Ratio Perm						0.04						
v/c Ratio		0.49			0.87	0.09	0.69	0.79		0.76		0.52
Uniform Delay, d1		18.8			24.3	16.3	38.2	28.0		45.0		32.1
Progression Factor		0.82			0.98	2.81	0.87	0.83		0.66		0.57
Incremental Delay, d2		1.0			8.0	0.2	6.1	7.6		21.5		2.4
Delay (s)		16.4			31.7	46.0	39.3	30.7		51.3		20.7
Level of Service		B			C	D	D	C		D		C
Approach Delay (s)		16.4			33.9			32.9				26.4
Approach LOS		B			C			C				C
<b>Intersection Summary</b>												
HCM 2000 Control Delay			27.9				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)			10.5			
Intersection Capacity Utilization			79.8%			ICU Level of Service			D			
Analysis Period (min)			15									
c	Critical Lane Group											

# HCM Signalized Intersection Capacity Analysis

## 35: E Madison St & E JOHN ST

7/29/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR		
Lane Configurations		↕	↕		↕			↕			↕	↕		
Traffic Volume (vph)	140	143	10	0	130	6	22	456	6	3	352	210		
Future Volume (vph)	140	143	10	0	130	6	22	456	6	3	352	210		
Ideal Flow (vphpl)	1900	1900	1900	1750	1750	1750	1900	1900	1900	1900	1900	1900		
Lane Width	10	10	12	10	10	10	12	16	12	12	16	12		
Grade (%)		-15%			0%			-10%			10%			
Total Lost time (s)		2.5	5.5		2.5			2.5			2.5	4.5		
Lane Util. Factor		1.00	1.00		1.00			1.00			1.00	1.00		
Frbp, ped/bikes		1.00	0.98		1.00			1.00			1.00	0.83		
Flpb, ped/bikes		1.00	1.00		1.00			1.00			1.00	1.00		
Frt		1.00	0.85		0.99			1.00			1.00	0.85		
Flt Protected		0.98	1.00		1.00			1.00			1.00	1.00		
Satd. Flow (prot)		1824	1503		1621			2243			1966	1096		
Flt Permitted		0.98	1.00		1.00			0.97			1.00	1.00		
Satd. Flow (perm)		1824	1503		1621			2191			1961	1096		
Peak-hour factor, PHF	0.83	0.83	0.83	0.72	0.72	0.72	0.91	0.91	0.91	0.95	0.95	0.95		
Adj. Flow (vph)	169	172	12	0	181	8	24	501	7	3	371	221		
RTOR Reduction (vph)	0	0	9	0	2	0	0	1	0	0	0	0		
Lane Group Flow (vph)	0	341	3	0	187	0	0	531	0	0	374	221		
Confl. Peds. (#/hr)	9					9	40		26	26		40		
Confl. Bikes (#/hr)			7									6		
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	4%	4%	4%		
Parking (#/hr)			0						0			0		
Turn Type	Split	NA	Perm		NA		Perm	NA		Perm	NA	Perm		
Protected Phases	3	3		4	4			2			2			
Permitted Phases		3	3				2	2		2		2		
Actuated Green, G (s)		22.3	22.3		14.7			46.5			46.5	46.5		
Effective Green, g (s)		25.3	22.3		17.7			49.5			49.5	47.5		
Actuated g/C Ratio		0.25	0.22		0.18			0.50			0.50	0.48		
Clearance Time (s)		5.5	5.5		5.5			5.5			5.5	5.5		
Vehicle Extension (s)		2.0	2.0		2.0			0.2			0.2	0.2		
Lane Grp Cap (vph)		461	335		286			1084			970	520		
v/s Ratio Prot		c0.19			c0.12									
v/s Ratio Perm			0.00					c0.24			0.19	0.20		
v/c Ratio		0.74	0.01		0.66			0.49			0.39	0.42		
Uniform Delay, d1		34.3	30.2		38.3			16.8			15.8	17.3		
Progression Factor		1.17	1.00		1.00			0.57			0.69	0.69		
Incremental Delay, d2		2.8	0.0		4.1			1.0			1.1	2.4		
Delay (s)		42.9	30.2		42.4			10.7			12.0	14.3		
Level of Service		D	C		D			B			B	B		
Approach Delay (s)		42.4			42.4			10.7			12.9			
Approach LOS		D			D			B			B			
<b>Intersection Summary</b>														
HCM 2000 Control Delay			21.8									HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio			0.59											
Actuated Cycle Length (s)			100.0								7.5			
Intersection Capacity Utilization			77.1%										ICU Level of Service	D
Analysis Period (min)			15											

c Critical Lane Group

Intersection												
Int Delay, s/veh	4.1											
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	5	21	14	15	27	10	26	521	10	10	500	13
Future Vol, veh/h	5	21	14	15	27	10	26	521	10	10	500	13
Conflicting Peds, #/hr	6	0	3	3	0	6	23	0	36	36	0	23
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	1	-	-	-10	-	-	14	-
Peak Hour Factor	71	71	71	75	75	75	98	98	98	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	2	2	2
Mvmt Flow	7	30	20	20	36	13	27	532	10	10	521	14

Major/Minor	Minor1			Minor2			Major1			Major2		
Conflicting Flow All	1205	1204	576	1188	1202	557	557	0	0	578	0	0
Stage 1	626	626	-	571	571	-	-	-	-	-	-	-
Stage 2	579	578	-	617	631	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.9	6.4	7.3	6.7	6.3	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.5	5.9	-	6.3	5.7	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.9	-	6.3	5.7	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	142	162	504	156	174	526	1014	-	-	996	-	-
Stage 1	443	448	-	493	492	-	-	-	-	-	-	-
Stage 2	473	473	-	465	461	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	106	146	487	119	157	512	1007	-	-	993	-	-
Mov Cap-2 Maneuver	106	146	-	119	157	-	-	-	-	-	-	-
Stage 1	413	418	-	465	476	-	-	-	-	-	-	-
Stage 2	417	457	-	398	430	-	-	-	-	-	-	-

Approach	NB	SB	NE	SW
HCM Control Delay, s	33.4	42.1	0.4	0.2
HCM LOS	D	E		

Minor Lane/Major Mvmt	NEL	NET	NER	NBLn1	SBLn1	SWL	SWT	SWR
Capacity (veh/h)	1007	-	-	182	164	993	-	-
HCM Lane V/C Ratio	0.026	-	-	0.31	0.423	0.01	-	-
HCM Control Delay (s)	8.7	0	-	33.4	42.1	8.7	0	-
HCM Lane LOS	A	A	-	D	E	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	1.2	1.9	0	-	-

**Intersection**

Int Delay, s/veh 0.5

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	Y			X	T	
Traffic Vol, veh/h	2	14	20	513	517	3
Future Vol, veh/h	2	14	20	513	517	3
Conflicting Peds, #/hr	3	0	27	0	0	27
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	-3	-	-	-14	10	-
Peak Hour Factor	50	50	92	92	95	95
Heavy Vehicles, %	0	0	2	2	2	2
Mvmt Flow	4	28	22	558	544	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1177	573	574	0	-	0
Stage 1	573	-	-	-	-	-
Stage 2	604	-	-	-	-	-
Critical Hdwy	5.8	5.9	4.12	-	-	-
Critical Hdwy Stg 1	4.8	-	-	-	-	-
Critical Hdwy Stg 2	4.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.218	-	-	-
Pot Cap-1 Maneuver	259	548	999	-	-	-
Stage 1	625	-	-	-	-	-
Stage 2	608	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	240	536	999	-	-	-
Mov Cap-2 Maneuver	240	-	-	-	-	-
Stage 1	611	-	-	-	-	-
Stage 2	575	-	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	13.3	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	999	-	464	-	-
HCM Lane V/C Ratio	0.022	-	0.069	-	-
HCM Control Delay (s)	8.7	0	13.3	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

**Intersection**

Int Delay, s/veh 0.7

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations	Y		P		T	T
Traffic Vol, veh/h	7	24	460	44	8	502
Future Vol, veh/h	7	24	460	44	8	502
Conflicting Peds, #/hr	4	0	0	31	31	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	50	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	-10	-	-	8
Peak Hour Factor	65	65	93	93	96	96
Heavy Vehicles, %	0	0	3	3	2	2
Mvmt Flow	11	37	495	47	8	523

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1093	549	0	0	573	0
Stage 1	549	-	-	-	-	-
Stage 2	544	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.12	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.218	-
Pot Cap-1 Maneuver	239	539	-	-	1000	-
Stage 1	583	-	-	-	-	-
Stage 2	586	-	-	-	-	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	230	525	-	-	1000	-
Mov Cap-2 Maneuver	230	-	-	-	-	-
Stage 1	568	-	-	-	-	-
Stage 2	579	-	-	-	-	-

Approach	NW		NE		SW
HCM Control Delay, s	15		0		0.1
HCM LOS	C				

Minor Lane/Major Mvmt	NET	NERNWLn1	SWL	SWT
Capacity (veh/h)	-	-	407	1000
HCM Lane V/C Ratio	-	-	0.117	0.008
HCM Control Delay (s)	-	-	15	8.6
HCM Lane LOS	-	-	C	A
HCM 95th %tile Q(veh)	-	-	0.4	0

**Intersection**

Int Delay, s/veh 0.5

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	↘		↙	↑	↘	
Traffic Vol, veh/h	2	21	16	468	489	10
Future Vol, veh/h	2	21	16	468	489	10
Conflicting Peds, #/hr	19	0	19	0	0	19
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	50	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	-8	4	-
Peak Hour Factor	82	82	93	93	96	96
Heavy Vehicles, %	0	0	3	3	2	2
Mvmt Flow	2	26	17	503	509	10



















Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	1091	534	539 0
Stage 1	534	-	-
Stage 2	557	-	-
Critical Hdwy	6.4	6.2	4.13 -
Critical Hdwy Stg 1	5.4	-	-
Critical Hdwy Stg 2	5.4	-	-
Follow-up Hdwy	3.5	3.3	2.227 -
Pot Cap-1 Maneuver	240	550	1024 -
Stage 1	592	-	-
Stage 2	578	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	229	541	1024 -
Mov Cap-2 Maneuver	365	-	-
Stage 1	583	-	-
Stage 2	559	-	-

Approach	SE	NE	SW
HCM Control Delay, s	12.3	0.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	1024	-	519	-	-
HCM Lane V/C Ratio	0.017	-	0.054	-	-
HCM Control Delay (s)	8.6	-	12.3	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

HCM 2010 Signalized Intersection Summary  
 40: E Madison St & MLK Jr Way E/28th Ave E

7/29/2016



















												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (veh/h)	135	100	187	57	214	11	8	402	55	123	360	21
Future Volume (veh/h)	135	100	187	57	214	11	8	402	55	123	360	21
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.93	1.00		0.92	0.99		0.92	1.00		0.92
Parking Bus, Adj	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 Sat Flow, veh/h/ln	1881	1844	1881	1910	1910	1910	1806	1957	1938	1736	1881	1881
Adj Flow Rate, veh/h	148	110	205	60	225	12	8	423	58	131	383	22
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.91	0.91	0.91	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.94	0.94
Percent Heavy Veh, %	2	2	2	0	0	0	3	3	3	4	4	4
Cap, veh/h	201	139	232	132	473	24	468	913	125	344	961	55
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.18	0.18	0.18	0.55	0.55	0.55
Sat Flow, veh/h	402	364	608	231	1238	62	939	1665	228	848	1752	101
Grp Volume(v), veh/h	463	0	0	297	0	0	8	0	481	131	0	405
Grp Sat Flow(s),veh/h/ln	1374	0	0	1531	0	0	939	0	1893	848	0	1853
Q Serve(g_s), s	18.3	0.0	0.0	0.0	0.0	0.0	0.7	0.0	22.7	12.4	0.0	12.6
Cycle Q Clear(g_c), s	31.5	0.0	0.0	13.3	0.0	0.0	13.4	0.0	22.7	35.1	0.0	12.6
Prop In Lane	0.32		0.44	0.20		0.04	1.00		0.12	1.00		0.05
Lane Grp Cap(c), veh/h	572	0	0	628	0	0	468	0	1038	344	0	1016
V/C Ratio(X)	0.81	0.00	0.00	0.47	0.00	0.00	0.02	0.00	0.46	0.38	0.00	0.40
Avail Cap(c_a), veh/h	701	0	0	781	0	0	468	0	1038	344	0	1016
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	28.9	0.0	0.0	22.9	0.0	0.0	29.4	0.0	27.8	27.3	0.0	13.1
Incr Delay (d2), s/veh	5.9	0.0	0.0	0.6	0.0	0.0	0.1	0.0	1.5	3.2	0.0	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.8	0.0	0.0	6.2	0.0	0.0	0.2	0.0	12.3	3.2	0.0	6.7
LnGrp Delay(d),s/veh	34.7	0.0	0.0	23.4	0.0	0.0	29.5	0.0	29.3	30.4	0.0	14.2
LnGrp LOS	C			C			C		C	C		B
Approach Vol, veh/h		463			297			489			536	
Approach Delay, s/veh		34.7			23.4			29.3			18.2	
Approach LOS		C			C			C			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		58.3		41.7		58.3		41.7				
Change Period (Y+Rc), s		3.5		3.5		3.5		3.5				
Max Green Setting (Gmax), s		45.5		47.5		45.5		47.5				
Max Q Clear Time (g_c+I1), s		24.7		33.5		37.1		15.3				
Green Ext Time (p_c), s		6.9		4.6		4.1		6.3				
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				26.4								
HCM 2010 LOS				C								



# HCM Signalized Intersection Capacity Analysis

## 41: 1st Ave & Spring St

7/28/2016













													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 								 			
Traffic Volume (vph)	56	214	44	0	0	0	0	576	77	81	590	0	
Future Volume (vph)	56	214	44	0	0	0	0	576	77	81	590	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	12	10	12	12	12	10	11	10	10	11	10	
Grade (%)		9%			0%			3%			0%		
Total Lost time (s)		4.5						4.5		4.5	4.5		
Lane Util. Factor		0.95						1.00		1.00	1.00		
Frbp, ped/bikes		0.92						0.95		1.00	1.00		
Flpb, ped/bikes		0.96						1.00		1.00	1.00		
Frt		0.98						0.98		1.00	1.00		
Flt Protected		0.99						1.00		0.95	1.00		
Satd. Flow (prot)		2651						1508		1501	1637		
Flt Permitted		0.99						1.00		0.95	1.00		
Satd. Flow (perm)		2651						1508		1501	1637		
Peak-hour factor, PHF	0.88	0.88	0.88	0.25	0.25	0.25	0.95	0.95	0.95	0.93	0.93	0.93	
Adj. Flow (vph)	64	243	50	0	0	0	0	606	81	87	634	0	
RTOR Reduction (vph)	0	15	0	0	0	0	0	5	0	0	0	0	
Lane Group Flow (vph)	0	342	0	0	0	0	0	682	0	87	634	0	
Confl. Peds. (#/hr)	90		309	309			90	502		488	488	502	
Confl. Bikes (#/hr)			1				5			12		28	
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	0%	
Turn Type	Perm	NA						NA		Prot	NA		
Protected Phases		2						1		3	1		
Permitted Phases	2	2											
Actuated Green, G (s)		19.5						49.5		7.5	49.5		
Effective Green, g (s)		19.5						49.5		7.5	49.5		
Actuated g/C Ratio		0.22						0.55		0.08	0.55		
Clearance Time (s)		4.5						4.5		4.5	4.5		
Lane Grp Cap (vph)		574						829		125	900		
v/s Ratio Prot								c0.45		c0.06	0.39		
v/s Ratio Perm		0.13											
v/c Ratio		0.60						0.82		0.70	0.70		
Uniform Delay, d1		31.7						16.6		40.1	14.9		
Progression Factor		1.00						0.61		1.00	1.00		
Incremental Delay, d2		4.5						7.1		27.5	4.6		
Delay (s)		36.2						17.2		67.6	19.5		
Level of Service		D						B		E	B		
Approach Delay (s)		36.2			0.0			17.2			25.3		
Approach LOS		D			A			B			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			24.4		HCM 2000 Level of Service						C		
HCM 2000 Volume to Capacity ratio			0.75										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					13.5			
Intersection Capacity Utilization			71.3%		ICU Level of Service					C			
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 42: 2nd Ave & Spring St

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑								↘	↑↑	
Traffic Volume (vph)	0	350	80	0	0	0	0	0	0	210	1200	0
Future Volume (vph)	0	350	80	0	0	0	0	0	0	210	1200	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		12%			0%			0%			0%	
Total Lost time (s)		4.0								4.0	4.0	
Lane Util. Factor		0.95								1.00	0.95	
Frbp, ped/bikes		0.95								1.00	1.00	
Flpb, ped/bikes		1.00								1.00	1.00	
Frt		0.97								1.00	1.00	
Flt Protected		1.00								0.95	1.00	
Satd. Flow (prot)		2578								1204	2203	
Flt Permitted		1.00								0.95	1.00	
Satd. Flow (perm)		2578								1204	2203	
Peak-hour factor, PHF	0.92	0.92	0.92	0.25	0.25	0.25	0.25	0.25	0.25	0.97	0.97	0.97
Adj. Flow (vph)	0	380	87	0	0	0	0	0	0	216	1237	0
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	449	0	0	0	0	0	0	0	216	1237	0
Confl. Peds. (#/hr)	200		178	178		200	340		348	348		340
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)										10	69	69
Turn Type		NA								Prot	NA	
Protected Phases		2								3	14	
Permitted Phases												
Actuated Green, G (s)		20.5								20.5	60.5	
Effective Green, g (s)		21.0								21.0	61.0	
Actuated g/C Ratio		0.23								0.23	0.68	
Clearance Time (s)		4.5								4.5		
Lane Grp Cap (vph)		601								280	1493	
v/s Ratio Prot		c0.17								0.18	c0.56	
v/s Ratio Perm												
v/c Ratio		0.75								0.77	0.83	
Uniform Delay, d1		32.0								32.3	10.7	
Progression Factor		0.81								1.00	1.00	
Incremental Delay, d2		6.8								18.4	5.4	
Delay (s)		32.7								50.7	16.1	
Level of Service		C								D	B	
Approach Delay (s)		32.7			0.0			0.0			21.2	
Approach LOS		C			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			24.0									C
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			90.0							11.5		
Intersection Capacity Utilization			58.5%									B
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 43: 3rd Ave & Spring St

7/28/2016





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↔↔			↔↔	
Traffic Volume (vph)	5	600	28	0	0	0	0	111	65	15	148	0
Future Volume (vph)	5	600	28	0	0	0	0	111	65	15	148	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	12	12	12	11	12	12	11	12
Grade (%)		10%			-10%			0%			0%	
Total Lost time (s)		4.0						4.0			4.0	
Lane Util. Factor		0.95						0.95			0.95	
Frbp, ped/bikes		0.99						0.86			1.00	
Flpb, ped/bikes		1.00						1.00			0.97	
Frt		0.99						0.94			1.00	
Flt Protected		1.00						1.00			1.00	
Satd. Flow (prot)		2543						1443			1726	
Flt Permitted		1.00						1.00			0.93	
Satd. Flow (perm)		2543						1443			1605	
Peak-hour factor, PHF	0.97	0.97	0.97	0.25	0.25	0.25	0.80	0.80	0.80	0.91	0.91	0.91
Adj. Flow (vph)	5	619	29	0	0	0	0	139	81	16	163	0
RTOR Reduction (vph)	0	4	0	0	0	0	0	15	0	0	0	0
Lane Group Flow (vph)	0	649	0	0	0	0	0	205	0	0	179	0
Confl. Peds. (#/hr)	396		213	213		396	650		405	405		650
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	87%	0%	40%	67%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	60	0	0	34	0
Parking (#/hr)		15										
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		2						1			1	
Permitted Phases	2									1		
Actuated Green, G (s)		35.5						45.5			45.5	
Effective Green, g (s)		36.0						46.0			46.0	
Actuated g/C Ratio		0.40						0.51			0.51	
Clearance Time (s)		4.5						4.5			4.5	
Lane Grp Cap (vph)		1017						737			820	
v/s Ratio Prot								c0.14				
v/s Ratio Perm		0.26									0.11	
v/c Ratio		0.64						0.28			0.22	
Uniform Delay, d1		21.8						12.5			12.1	
Progression Factor		0.32						1.51			1.00	
Incremental Delay, d2		2.2						0.9			0.6	
Delay (s)		9.1						19.8			12.7	
Level of Service		A						B			B	
Approach Delay (s)		9.1			0.0			19.8			12.7	
Approach LOS		A			A			B			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			11.9					HCM 2000 Level of Service		B		
HCM 2000 Volume to Capacity ratio			0.44									
Actuated Cycle Length (s)			90.0					Sum of lost time (s)		8.0		
Intersection Capacity Utilization			47.4%					ICU Level of Service		A		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 44: 4th Ave & Spring St

7/28/2016













													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 						  					
Traffic Volume (vph)	200	530	0	0	0	0	0	1216	92	0	0	0	
Future Volume (vph)	200	530	0	0	0	0	0	1216	92	0	0	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12	
Grade (%)		15%			-5%			5%			0%		
Total Lost time (s)		4.5						5.5	5.5				
Lane Util. Factor		0.95						0.91	1.00				
Frbp, ped/bikes		1.00						1.00	0.59				
Flpb, ped/bikes		0.91						1.00	1.00				
Frt		1.00						1.00	0.85				
Flt Protected		0.99						1.00	1.00				
Satd. Flow (prot)		2273						3704	818				
Flt Permitted		0.99						1.00	1.00				
Satd. Flow (perm)		2273						3704	818				
Peak-hour factor, PHF	0.96	0.96	0.96	0.25	0.25	0.25	0.95	0.95	0.95	0.25	0.25	0.25	
Adj. Flow (vph)	208	552	0	0	0	0	0	1280	97	0	0	0	
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	9	0	0	0	
Lane Group Flow (vph)	0	749	0	0	0	0	0	1280	88	0	0	0	
Confl. Peds. (#/hr)	315		294	294			315	452		497	497	452	
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	8%	2%	0%	0%	0%	
Parking (#/hr)		15						15					
Turn Type	Perm	NA						NA	Perm				
Protected Phases		2						1					
Permitted Phases	2								1				
Actuated Green, G (s)		34.5						46.5	46.5				
Effective Green, g (s)		34.5						45.5	45.5				
Actuated g/C Ratio		0.38						0.51	0.51				
Clearance Time (s)		4.5						4.5	4.5				
Lane Grp Cap (vph)		871						1872	413				
v/s Ratio Prot								c0.35					
v/s Ratio Perm		0.33							0.11				
v/c Ratio		0.86						0.68	0.21				
Uniform Delay, d1		25.5						16.8	12.3				
Progression Factor		1.52						0.60	0.48				
Incremental Delay, d2		9.3						1.6	0.9				
Delay (s)		48.2						11.7	6.8				
Level of Service		D						B	A				
Approach Delay (s)		48.2			0.0			11.4			0.0		
Approach LOS		D			A			B			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			24.5		HCM 2000 Level of Service					C			
HCM 2000 Volume to Capacity ratio			0.76										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					10.0			
Intersection Capacity Utilization			60.5%		ICU Level of Service					B			
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 45: 5th Ave & Spring St

7/28/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↑↑↑									↑↑↑		
Traffic Volume (vph)	0	605	55	0	0	0	0	0	0	527	919	0	
Future Volume (vph)	0	605	55	0	0	0	0	0	0	527	919	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	10	12	12	12	12	12	12	12	10	10	12	
Grade (%)		15%			-5%			0%			0%		
Total Lost time (s)		3.5									3.5		
Lane Util. Factor		0.91									0.91		
Frbp, ped/bikes		0.98									1.00		
Flpb, ped/bikes		1.00									0.89		
Frt		0.99									1.00		
Flt Protected		1.00									0.98		
Satd. Flow (prot)		3503									3713		
Flt Permitted		1.00									0.98		
Satd. Flow (perm)		3503									3713		
Peak-hour factor, PHF	0.90	0.90	0.90	0.25	0.25	0.25	0.25	0.25	0.25	0.93	0.93	0.93	
Adj. Flow (vph)	0	672	61	0	0	0	0	0	0	567	988	0	
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	13	0	
Lane Group Flow (vph)	0	728	0	0	0	0	0	0	0	0	1542	0	
Confl. Peds. (#/hr)	210		133	133		210	392		208	208		392	
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%	0%	0%	0%	1%	3%	0%	
Parking (#/hr)		30											
Turn Type		NA								custom	NA		
Protected Phases		2								3	14		
Permitted Phases										4			
Actuated Green, G (s)		35.0									45.0		
Effective Green, g (s)		36.5									46.5		
Actuated g/C Ratio		0.41									0.52		
Clearance Time (s)		5.0											
Lane Grp Cap (vph)		1420									1918		
v/s Ratio Prot		c0.21									c0.22		
v/s Ratio Perm											0.20		
v/c Ratio		0.51									0.80		
Uniform Delay, d1		20.1									18.0		
Progression Factor		1.63									1.00		
Incremental Delay, d2		1.0									3.7		
Delay (s)		33.8									21.7		
Level of Service		C									C		
Approach Delay (s)		33.8			0.0			0.0			21.7		
Approach LOS		C			A			A			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			25.5									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.69										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	8.5
Intersection Capacity Utilization			60.7%									ICU Level of Service	B
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 46: 6th Ave & I-5 CD SB On-Ramp & Spring St

7/28/2016


















Movement	EBL	EBT	EBR	NBT	NBR	NBR2
Lane Configurations		↔↑	↗	↑↑	↖	
Traffic Volume (vph)	192	189	750	335	10	610
Future Volume (vph)	192	189	750	335	10	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	10	11	10	11	12
Grade (%)		10%		5%		
Total Lost time (s)		4.5	4.5	4.5	4.5	
Lane Util. Factor		0.95	1.00	0.95	1.00	
Frbp, ped/bikes		1.00	1.00	1.00	1.00	
Flpb, ped/bikes		0.84	1.00	1.00	1.00	
Frt		1.00	0.85	1.00	0.85	
Flt Protected		0.98	1.00	1.00	1.00	
Satd. Flow (prot)		2114	1322	2927	1357	
Flt Permitted		0.98	1.00	1.00	1.00	
Satd. Flow (perm)		2114	1322	2927	1357	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	206	203	806	360	11	656
RTOR Reduction (vph)	0	85	0	0	0	0
Lane Group Flow (vph)	0	324	806	360	667	0
Confl. Peds. (#/hr)	224					
Heavy Vehicles (%)	1%	1%	1%	1%	0%	1%
Bus Blockages (#/hr)	0	5	0	0	0	0
Parking (#/hr)		15				
Turn Type	Perm	NA	Perm	NA	Perm	
Protected Phases		4		2		
Permitted Phases	4		4		2	
Actuated Green, G (s)		42.5	42.5	38.5	38.5	
Effective Green, g (s)		42.5	42.5	38.5	38.5	
Actuated g/C Ratio		0.47	0.47	0.43	0.43	
Clearance Time (s)		4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)		998	624	1252	580	
v/s Ratio Prot				0.12		
v/s Ratio Perm		0.15	c0.61		c0.49	
v/c Ratio		0.32	1.29	0.29	1.15	
Uniform Delay, d1		14.8	23.8	16.8	25.8	
Progression Factor		0.09	1.13	0.96	0.90	
Incremental Delay, d2		0.7	140.2	0.5	83.0	
Delay (s)		2.1	166.9	16.5	106.2	
Level of Service		A	F	B	F	
Approach Delay (s)		111.5		74.8		
Approach LOS		F		E		
<b>Intersection Summary</b>						
HCM 2000 Control Delay			94.7		HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio			1.22			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	9.0
Intersection Capacity Utilization			101.8%		ICU Level of Service	G
Analysis Period (min)			15			
c Critical Lane Group						

# HCM Signalized Intersection Capacity Analysis

## 47: 7th Ave/Hubbell PI & Spring St

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	137	19	0	0	0	0	256	23	6	328	0
Future Volume (vph)	42	137	19	0	0	0	0	256	23	6	328	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5						4.5			4.5	
Lane Util. Factor		0.95						1.00			1.00	
Frb, ped/bikes		0.99						1.00			1.00	
Flpb, ped/bikes		0.92						1.00			1.00	
Frt		0.98						0.99			1.00	
Flt Protected		0.99						1.00			1.00	
Satd. Flow (prot)		2760						1688			1675	
Flt Permitted		0.99						1.00			0.99	
Satd. Flow (perm)		2760						1688			1668	
Peak-hour factor, PHF	0.87	0.92	0.87	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85
Adj. Flow (vph)	48	149	22	0	0	0	0	278	25	7	386	0
RTOR Reduction (vph)	0	14	0	0	0	0	0	5	0	0	0	0
Lane Group Flow (vph)	0	205	0	0	0	0	0	298	0	0	393	0
Confl. Peds. (#/hr)	166		20					4				4
Heavy Vehicles (%)	17%	2%	0%	2%	2%	2%	0%	0%	2%	2%	2%	0%
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		4						2			2	
Permitted Phases	4									2		
Actuated Green, G (s)		19.5						31.5			31.5	
Effective Green, g (s)		19.5						31.5			31.5	
Actuated g/C Ratio		0.32						0.52			0.52	
Clearance Time (s)		4.5						4.5			4.5	
Lane Grp Cap (vph)		897						886			875	
v/s Ratio Prot								0.18				
v/s Ratio Perm		0.07									c0.24	
v/c Ratio		0.23						0.34			0.45	
Uniform Delay, d1		14.8						8.2			8.9	
Progression Factor		1.00						1.00			1.00	
Incremental Delay, d2		0.6						1.0			1.7	
Delay (s)		15.4						9.2			10.5	
Level of Service		B						A			B	
Approach Delay (s)		15.4			0.0			9.2			10.5	
Approach LOS		B			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			11.3								HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.36									
Actuated Cycle Length (s)			60.0								Sum of lost time (s)	9.0
Intersection Capacity Utilization			43.7%								ICU Level of Service	A
Analysis Period (min)			15									
c Critical Lane Group												

Intersection

Int Delay, s/veh 5.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔						↔			↔	
Traffic Vol, veh/h	67	113	18	0	0	0	0	143	19	37	178	0
Future Vol, veh/h	67	113	18	0	0	0	0	143	19	37	178	0
Conflicting Peds, #/hr	116	0	65	0	0	0	115	0	104	104	0	115
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	73	123	20	0	0	0	0	155	21	40	193	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	556	554	258	-	0	0	280	0	0
Stage 1	274	274	-	-	-	-	-	-	-
Stage 2	282	280	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	492	440	781	0	-	-	1283	-	0
Stage 1	772	683	-	0	-	-	-	-	0
Stage 2	766	679	-	0	-	-	-	-	0
Platoon blocked, %									
Mov Cap-1 Maneuver	473	0	739	-	-	-	1159	-	-
Mov Cap-2 Maneuver	473	0	-	-	-	-	-	-	-
Stage 1	742	0	-	-	-	-	-	-	-
Stage 2	766	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.7	0	1.4
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	SBL	SBT
Capacity (veh/h)	-	-	473	739	1159	-
HCM Lane V/C Ratio	-	-	0.284	0.11	0.035	-
HCM Control Delay (s)	-	-	15.6	10.5	8.2	0
HCM Lane LOS	-	-	C	B	A	A
HCM 95th %tile Q(veh)	-	-	1.2	0.4	0.1	-





















Intersection												
Int Delay, s/veh	5.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗		↕			↘			↖	
Traffic Vol, veh/h	47	70	62	10	0	30	0	145	9	8	126	0
Future Vol, veh/h	47	70	62	10	0	30	0	145	9	8	126	0
Conflicting Peds, #/hr	209	0	58	58	0	209	104	0	111	111	0	104
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	0	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	51	76	67	11	0	33	0	158	10	9	137	0
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	542	432	195	524	428	483	-	0	0	278	0	0
Stage 1	154	154	-	274	274	-	-	-	-	-	-	-
Stage 2	388	278	-	250	154	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	-	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	-	-	-	2.218	-	-
Pot Cap-1 Maneuver	451	516	846	464	519	584	0	-	-	1285	-	0
Stage 1	848	770	-	732	683	-	0	-	-	-	-	0
Stage 2	636	680	-	754	770	-	0	-	-	-	-	0
Platoon blocked, %												
Mov Cap-1 Maneuver	342	464	805	319	467	438	-	-	-	1061	-	-
Mov Cap-2 Maneuver	342	464	-	319	467	-	-	-	-	-	-	-
Stage 1	848	763	-	732	620	-	-	-	-	-	-	-
Stage 2	486	617	-	587	763	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	12.2			15.1			0			0.5		
HCM LOS	B			C								
Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT					
Capacity (veh/h)	-	-	464	805	401	1061	-					
HCM Lane V/C Ratio	-	-	0.164	0.084	0.108	0.008	-					
HCM Control Delay (s)	-	-	14.3	9.9	15.1	8.4	0					
HCM Lane LOS	-	-	B	A	C	A	A					
HCM 95th %tile Q(veh)	-	-	0.6	0.3	0.4	0	-					

# HCM Signalized Intersection Capacity Analysis

## 50: 14th Ave & Pike St

7/28/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	26	87	0	32	5	143	70	0	4	100	10
Future Volume (vph)	5	26	87	0	32	5	143	70	0	4	100	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	16	12	12	16	12	12	16	12
Grade (%)		6%			-6%			0%			0%	
Total Lost time (s)	4.5	4.5			4.5			4.5			8.5	
Lane Util. Factor	1.00	1.00			1.00			1.00			1.00	
Flt	1.00	0.88			0.98			1.00			0.99	
Flt Protected	0.95	1.00			1.00			0.97			1.00	
Satd. Flow (prot)	1717	1342			2138			2043			1874	
Flt Permitted	0.73	1.00			1.00			0.73			0.99	
Satd. Flow (perm)	1321	1342			2138			1531			1858	
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)	5	28	95	0	35	5	155	76	0	4	109	11
RTOR Reduction (vph)	0	47	0	0	2	0	0	0	0	0	4	0
Lane Group Flow (vph)	5	76	0	0	38	0	0	231	0	0	120	0
Parking (#/hr)		0									0	
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		4			4			6			3	
Permitted Phases	4						6			3		
Actuated Green, G (s)	50.5	50.5			50.5			40.5			36.5	
Effective Green, g (s)	50.5	50.5			50.5			40.5			36.5	
Actuated g/C Ratio	0.50	0.50			0.50			0.40			0.36	
Clearance Time (s)	4.5	4.5			4.5			4.5			8.5	
Lane Grp Cap (vph)	667	677			1079			620			678	
v/s Ratio Prot		c0.06			0.02							
v/s Ratio Perm	0.00							c0.15			0.06	
v/c Ratio	0.01	0.11			0.03			0.37			0.18	
Uniform Delay, d1	12.3	13.0			12.5			20.8			21.6	
Progression Factor	1.00	1.00			0.05			0.03			1.00	
Incremental Delay, d2	0.0	0.3			0.1			1.6			0.6	
Delay (s)	12.3	13.3			0.7			2.2			22.1	
Level of Service	B	B			A			A			C	
Approach Delay (s)		13.3			0.7			2.2			22.1	
Approach LOS		B			A			A			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			9.5					HCM 2000 Level of Service			A	
HCM 2000 Volume to Capacity ratio			0.24									
Actuated Cycle Length (s)			100.0					Sum of lost time (s)		13.0		
Intersection Capacity Utilization			32.5%					ICU Level of Service		A		
Analysis Period (min)			15									

c Critical Lane Group


















## ***OFF-CORRIDOR INTERSECTIONS***

---

# HCM Signalized Intersection Capacity Analysis

## 51: 15th Ave E & E DENNY WAY/E Denny Wy

9/7/2016




















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	12	12	11	72	27	104	10	236	22	57	249	11	
Future Volume (vph)	12	12	11	72	27	104	10	236	22	57	249	11	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	10	12	12	12	12	12	12	12	
Total Lost time (s)		4.5			4.5			4.5	4.5		4.5		
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00		
Frbp, ped/bikes		0.97			0.94			1.00	0.80		0.99		
Flpb, ped/bikes		0.98			0.97			1.00	1.00		0.98		
Frt		0.96			0.93			1.00	0.85		1.00		
Flt Protected		0.98			0.98			1.00	1.00		0.99		
Satd. Flow (prot)		1695			1444			1633	1122		1751		
Flt Permitted		0.87			0.86			0.99	1.00		0.90		
Satd. Flow (perm)		1492			1267			1612	1122		1599		
Peak-hour factor, PHF	0.55	0.55	0.55	0.91	0.91	0.91	0.85	0.85	0.85	0.93	0.93	0.93	
Adj. Flow (vph)	22	22	20	79	30	114	12	278	26	61	268	12	
RTOR Reduction (vph)	0	16	0	0	68	0	0	0	8	0	1	0	
Lane Group Flow (vph)	0	48	0	0	155	0	0	290	18	0	340	0	
Confl. Peds. (#/hr)	52		50	50		52	111		100	100		111	
Confl. Bikes (#/hr)			3			1			12			6	
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	4%	4%	4%	
Parking (#/hr)			0					0	0			0	
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA		
Protected Phases		4			4			2			6		
Permitted Phases	4			4			2		2	6			
Actuated Green, G (s)		13.8			13.8			47.2	47.2		47.2		
Effective Green, g (s)		13.8			13.8			47.2	47.2		47.2		
Actuated g/C Ratio		0.20			0.20			0.67	0.67		0.67		
Clearance Time (s)		4.5			4.5			4.5	4.5		4.5		
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0		
Lane Grp Cap (vph)		294			249			1086	756		1078		
v/s Ratio Prot													
v/s Ratio Perm		0.03			c0.12			0.18	0.02		c0.21		
v/c Ratio		0.16			0.62			0.27	0.02		0.32		
Uniform Delay, d1		23.3			25.7			4.5	3.8		4.7		
Progression Factor		1.00			1.00			1.00	1.00		1.00		
Incremental Delay, d2		0.3			4.8			0.6	0.1		0.8		
Delay (s)		23.6			30.5			5.1	3.8		5.5		
Level of Service		C			C			A	A		A		
Approach Delay (s)		23.6			30.5			5.0			5.5		
Approach LOS		C			C			A			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			12.5									HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.38										
Actuated Cycle Length (s)			70.0									Sum of lost time (s)	9.0
Intersection Capacity Utilization			62.8%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

Intersection												
Int Delay, s/veh	1.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	7	1	13	7	30	9	6	262	3	9	173	8
Future Vol, veh/h	7	1	13	7	30	9	6	262	3	9	173	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	1	14	8	33	10	7	285	3	10	188	9
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	533	513	192	519	515	286	197	0	0	288	0	0
Stage 1	212	212	-	299	299	-	-	-	-	-	-	-
Stage 2	321	301	-	220	216	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	458	465	850	467	464	753	1376	-	-	1274	-	-
Stage 1	790	727	-	710	666	-	-	-	-	-	-	-
Stage 2	691	665	-	782	724	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	423	458	850	453	457	753	1376	-	-	1274	-	-
Mov Cap-2 Maneuver	423	458	-	453	457	-	-	-	-	-	-	-
Stage 1	785	720	-	706	662	-	-	-	-	-	-	-
Stage 2	645	661	-	761	717	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	11.1			13.1			0.2			0.4		
HCM LOS	B			B								
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1376	-	-	617	494	1274	-	-				
HCM Lane V/C Ratio	0.005	-	-	0.037	0.101	0.008	-	-				
HCM Control Delay (s)	7.6	0	-	11.1	13.1	7.8	0	-				
HCM Lane LOS	A	A	-	B	B	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	0.1	0.3	0	-	-				

# HCM Signalized Intersection Capacity Analysis






















## 53: Broadway & E Pine St

9/7/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	242	61	59	304	94	0	464	124	0	466	79
Future Volume (vph)	42	242	61	59	304	94	0	464	124	0	466	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	15	12	11	16	12	11	12	11	11	12	12
Grade (%)		5%			-2%			0%			0%	
Total Lost time (s)	3.5	6.0		3.5	6.0			4.5			4.5	3.5
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frbp, ped/bikes	1.00	0.87		1.00	0.80			0.79			1.00	0.46
Flpb, ped/bikes	1.00	1.00		0.90	1.00			1.00			1.00	1.00
Frt	1.00	0.97		1.00	0.96			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	1620	1630		1548	1626			1423			1845	719
Flt Permitted	0.15	1.00		0.38	1.00			1.00			1.00	1.00
Satd. Flow (perm)	252	1630		612	1626			1423			1845	719
Peak-hour factor, PHF	0.50	0.96	0.85	0.87	0.93	0.76	0.86	0.89	0.78	0.94	0.95	0.73
Adj. Flow (vph)	84	252	72	68	327	124	0	521	159	0	491	108
RTOR Reduction (vph)	0	10	0	0	13	0	0	10	0	0	0	13
Lane Group Flow (vph)	84	314	0	68	438	0	0	670	0	0	491	95
Confl. Peds. (#/hr)	559		311	311		559	396		448	448		396
Heavy Vehicles (%)	5%	5%	5%	3%	3%	3%	2%	2%	2%	3%	3%	3%
Parking (#/hr)						0			0			
Turn Type	pm+pt	NA		pm+pt	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases	4			8								6
Actuated Green, G (s)	34.4	27.1		31.6	25.7			46.0			53.0	60.3
Effective Green, g (s)	34.4	27.1		31.6	25.7			46.0			53.0	60.3
Actuated g/C Ratio	0.34	0.27		0.32	0.26			0.46			0.53	0.60
Clearance Time (s)	3.5	6.0		3.5	6.0			4.5			4.5	3.5
Vehicle Extension (s)	2.0	0.2		2.0	0.2			0.2			0.2	2.0
Lane Grp Cap (vph)	186	441		248	417			654			977	433
v/s Ratio Prot	c0.03	0.19		0.02	c0.27			c0.47			c0.27	0.02
v/s Ratio Perm	0.12			0.07								0.12
v/c Ratio	0.45	0.71		0.27	1.05			1.02			0.50	0.22
Uniform Delay, d1	24.9	32.9		24.9	37.1			27.0			15.1	9.1
Progression Factor	1.14	1.14		1.00	1.00			1.61			1.00	1.00
Incremental Delay, d2	0.6	9.0		0.2	57.6			29.9			1.8	0.1
Delay (s)	29.0	46.5		25.1	94.8			73.5			16.9	9.2
Level of Service	C	D		C	F			E			B	A
Approach Delay (s)		42.9			85.6			73.5			15.5	
Approach LOS		D			F			E			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			54.9			HCM 2000 Level of Service			D			
HCM 2000 Volume to Capacity ratio			0.96									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		17.0				
Intersection Capacity Utilization			74.4%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 54: Broadway & E James Way/E James St

9/7/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	212	472	31	28	346	88	25	392	18	59	419	50
Future Volume (vph)	212	472	31	28	346	88	25	392	18	59	419	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	10	11	16	10	11	10	10	11	10
Grade (%)		6%			12%			0%			0%	
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	1.00
Frbp, ped/bikes		1.00			0.96		1.00	0.95		1.00	1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.99			0.97		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.99			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		3249			2998		1652	1686		1652	1801	1478
Flt Permitted		0.99			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		3249			2998		1652	1686		1652	1801	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.64	0.92	0.85	0.92	0.56	0.25	0.92	0.92	0.92
Adj. Flow (vph)	230	513	34	44	376	104	27	700	72	64	455	54
RTOR Reduction (vph)	0	3	0	0	23	0	0	3	0	0	0	25
Lane Group Flow (vph)	0	774	0	0	501	0	27	769	0	64	455	29
Confl. Peds. (#/hr)				80		80			80	80		
Parking (#/hr)						0			0			
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	4	4		3	3		5	2		1	6	4
Permitted Phases												6
Actuated Green, G (s)		19.5			20.9		3.9	16.4		6.0	33.7	53.2
Effective Green, g (s)		19.5			20.9		3.9	16.4		6.0	33.7	53.2
Actuated g/C Ratio		0.20			0.21		0.04	0.16		0.06	0.34	0.53
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)		2.0			2.0		2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)		633			626		64	276		99	606	786
v/s Ratio Prot		c0.24			c0.17		0.02	c0.46		c0.04	c0.25	0.01
v/s Ratio Perm												0.01
v/c Ratio		1.22			0.80		0.42	2.78		0.65	0.75	0.04
Uniform Delay, d1		40.2			37.6		46.9	41.8		46.0	29.4	11.2
Progression Factor		1.00			1.04		0.93	1.09		1.16	0.80	0.12
Incremental Delay, d2		113.8			6.8		1.6	813.2		10.1	8.1	0.0
Delay (s)		154.1			45.9		45.4	858.9		63.6	31.8	1.4
Level of Service		F			D		D	F		E	C	A
Approach Delay (s)		154.1			45.9			831.4			32.5	
Approach LOS		F			D			F			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			309.2				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.36									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			25.5		
Intersection Capacity Utilization			85.1%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group

Intersection												
Int Delay, s/veh	1.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	347	9	14	257	3	13	5	13	10	1	7
Future Vol, veh/h	1	347	9	14	257	3	13	5	13	10	1	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	14	-	-	-14	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	377	10	15	279	3	14	5	14	11	1	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	283	0	0	387	0	0	700	697	382	705	700	281
Stage 1	-	-	-	-	-	-	384	384	-	311	311	-
Stage 2	-	-	-	-	-	-	316	313	-	394	389	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1279	-	-	1171	-	-	354	365	665	351	363	758
Stage 1	-	-	-	-	-	-	639	611	-	699	658	-
Stage 2	-	-	-	-	-	-	695	657	-	631	608	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1279	-	-	1171	-	-	345	359	665	335	357	758
Mov Cap-2 Maneuver	-	-	-	-	-	-	345	359	-	335	357	-
Stage 1	-	-	-	-	-	-	638	610	-	698	648	-
Stage 2	-	-	-	-	-	-	677	647	-	611	607	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	13.9	13.8
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	436	1279	-	-	1171	-	-	430
HCM Lane V/C Ratio	0.077	0.001	-	-	0.013	-	-	0.046
HCM Control Delay (s)	13.9	7.8	0	-	8.1	0	-	13.8
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.1



Intersection												
Int Delay, s/veh	32.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↶	↷		↶	↷		↕			↕		
Traffic Vol, veh/h	43	404	7	12	317	128	7	62	15	75	58	35
Future Vol, veh/h	43	404	7	12	317	128	7	62	15	75	58	35
Conflicting Peds, #/hr	36	0	67	67	0	36	5	0	23	23	0	5
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	40	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-12	-	-	8	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	87	87	87	80	80	80	88	88	88
Heavy Vehicles, %	1	1	1	3	3	3	1	1	1	1	1	1
Mvmt Flow	45	421	7	14	364	147	9	78	19	85	66	40

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	547	0	0	495	0	0	1104	1156	514	1087	1087	479
Stage 1	-	-	-	-	-	-	581	581	-	502	502	-
Stage 2	-	-	-	-	-	-	523	575	-	585	585	-
Critical Hdwy	4.11	-	-	4.13	-	-	7.11	6.51	6.21	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Follow-up Hdwy	2.209	-	-	2.227	-	-	3.509	4.009	3.309	3.509	4.009	3.309
Pot Cap-1 Maneuver	1027	-	-	1064	-	-	189	197	562	194	217	589
Stage 1	-	-	-	-	-	-	501	501	-	553	544	-
Stage 2	-	-	-	-	-	-	539	504	-	499	499	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1023	-	-	1044	-	-	115	170	520	110	187	567
Mov Cap-2 Maneuver	-	-	-	-	-	-	115	170	-	110	187	-
Stage 1	-	-	-	-	-	-	452	452	-	511	519	-
Stage 2	-	-	-	-	-	-	430	481	-	374	450	-























Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0.2	47.3	192.3
HCM LOS			E	F

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	185	1023	-	-	1044	-	-	159
HCM Lane V/C Ratio	0.568	0.044	-	-	0.013	-	-	1.201
HCM Control Delay (s)	47.3	8.7	-	-	8.5	-	-	192.3
HCM Lane LOS	E	A	-	-	A	-	-	F
HCM 95th %tile Q(veh)	3	0.1	-	-	0	-	-	10.7

# HCM Signalized Intersection Capacity Analysis

57: 23rd Ave & E UNION ST





















9/7/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	57	340	180	54	282	128	141	629	61	143	627	27
Future Volume (vph)	57	340	180	54	282	128	141	629	61	143	627	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	10	12	10	10	12	10
Grade (%)		-4%			3%			0%			0%	
Total Lost time (s)	3.0	3.0		3.0	2.5		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.96		1.00	0.97		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.95		1.00	0.99		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)	1685	3053		1611	2980		1668	1849		1652	1848	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1685	3053		1611	2980		1668	1849		1652	1848	
Peak-hour factor, PHF	0.99	0.99	0.99	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96
Adj. Flow (vph)	58	343	182	57	297	135	153	684	66	149	653	28
RTOR Reduction (vph)	0	68	0	0	52	0	0	3	0	0	1	0
Lane Group Flow (vph)	58	457	0	57	380	0	153	747	0	149	680	0
Confl. Peds. (#/hr)	23		33	33		23	16		22	22		16
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	1%	1%	1%	2%	2%	2%
Parking (#/hr)			0			0			0			0
Turn Type	Prot	NA		Prot	NA		Split	NA		Split	NA	
Protected Phases	7	4		3	8		2	2		1	1	
Permitted Phases												
Actuated Green, G (s)	4.0	18.4		4.0	18.9		30.5	30.5		29.1	29.1	
Effective Green, g (s)	5.5	19.9		5.5	20.4		32.0	32.0		30.6	30.6	
Actuated g/C Ratio	0.06	0.20		0.06	0.20		0.32	0.32		0.31	0.31	
Clearance Time (s)	4.5	4.5		4.5	4.0		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.0	0.2		2.0	0.2		0.2	0.2		0.2	0.2	
Lane Grp Cap (vph)	92	607		88	607		533	591		505	565	
v/s Ratio Prot	0.03	c0.15		c0.04	0.13		0.09	c0.40		0.09	c0.37	
v/s Ratio Perm												
v/c Ratio	0.63	0.75		0.65	0.63		0.29	1.26		0.30	1.20	
Uniform Delay, d1	46.3	37.7		46.3	36.3		25.5	34.0		26.5	34.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.9	8.4		11.6	4.8		1.4	131.6		1.5	107.3	
Delay (s)	56.1	46.1		57.9	41.2		26.8	165.6		28.0	142.0	
Level of Service	E	D		E	D		C	F		C	F	
Approach Delay (s)		47.1			43.1			142.1			121.6	
Approach LOS		D			D			F			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			99.0				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.09									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			79.0%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 58: 23rd Ave & E CHERRY ST

9/7/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	74	234	50	59	128	94	55	571	103	99	681	47
Future Volume (vph)	74	234	50	59	128	94	55	571	103	99	681	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	10	12	10	10	12	10
Grade (%)		-6%			0%			0%			0%	
Total Lost time (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Frbp, ped/bikes		0.99			0.97		1.00	0.99		1.00	1.00	
Flpb, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	
Frt		0.98			0.95		1.00	0.98		1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3248			3006		1478	1620		1636	1823	
Flt Permitted		0.69			0.61		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		2273			1840		1478	1620		1636	1823	
Peak-hour factor, PHF	0.78	0.78	0.78	0.94	0.94	0.94	0.92	0.92	0.92	0.93	0.93	0.93
Adj. Flow (vph)	95	300	64	63	136	100	60	621	112	106	732	51
RTOR Reduction (vph)	0	13	0	0	63	0	0	6	0	0	3	0
Lane Group Flow (vph)	0	446	0	0	236	0	60	727	0	106	780	0
Confl. Peds. (#/hr)	21		9	9		21	11		12	12		11
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	14%	14%	14%	3%	3%	3%
Parking (#/hr)						0			0			0
Turn Type	Perm	NA		Perm	NA		Split	NA		Split	NA	
Protected Phases		4			4		2	2		1	1	
Permitted Phases	4			4								
Actuated Green, G (s)		15.5			15.5		35.5	35.5		35.5	35.5	
Effective Green, g (s)		17.0			17.0		37.0	37.0		37.0	37.0	
Actuated g/C Ratio		0.17			0.17		0.37	0.37		0.37	0.37	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)		386			312		546	599		605	674	
v/s Ratio Prot							0.04	c0.45		0.06	c0.43	
v/s Ratio Perm		c0.20			0.13							
v/c Ratio		1.15			0.76		0.11	1.21		0.18	1.16	
Uniform Delay, d1		41.5			39.5		20.7	31.5		21.2	31.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		95.1			15.7		0.4	110.7		0.6	87.1	
Delay (s)		136.6			55.2		21.1	142.2		21.9	118.6	
Level of Service		F			E		C	F		C	F	
Approach Delay (s)		136.6			55.2			133.1			107.0	
Approach LOS		F			E			F			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			114.7				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.18									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			9.0		
Intersection Capacity Utilization			85.4%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group


















**2019 BUILD PM**

---

# HCM Signalized Intersection Capacity Analysis













## 1: 1st Ave & Madison St

8/2/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	0	0	80	302	104	42	307	0	0	241	107	
Future Volume (vph)	0	0	0	80	302	104	42	307	0	0	241	107	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	10	14	11	15	10	11	10	10	11	10	
Grade (%)		6%			-8%			0%			0%		
Total Lost time (s)					4.5	4.5	4.5	4.5			4.5		
Lane Util. Factor					0.95	1.00	1.00	1.00			1.00		
Frbp, ped/bikes					1.00	1.00	1.00	1.00			0.89		
Flpb, ped/bikes					0.92	1.00	1.00	1.00			1.00		
Frt					1.00	0.85	1.00	1.00			0.96		
Flt Protected					0.99	1.00	0.95	1.00			1.00		
Satd. Flow (prot)					2950	1663	1516	1637			1407		
Flt Permitted					0.99	1.00	0.95	1.00			1.00		
Satd. Flow (perm)					2950	1663	1516	1637			1407		
Peak-hour factor, PHF	0.25	0.25	0.25	0.85	0.85	0.85	0.92	0.92	0.92	0.89	0.89	0.89	
Adj. Flow (vph)	0	0	0	94	355	122	46	334	0	0	271	120	
RTOR Reduction (vph)	0	0	0	0	0	109	0	0	0	0	18	0	
Lane Group Flow (vph)	0	0	0	0	449	13	46	334	0	0	373	0	
Confl. Peds. (#/hr)	226		156	156		226	276		553	553		276	
Heavy Vehicles (%)	0%	0%	0%	3%	0%	0%	0%	1%	0%	0%	1%	0%	
Turn Type				Perm	NA	custom	Prot	NA			NA		
Protected Phases					8	3	5	2			6		
Permitted Phases				8									
Actuated Green, G (s)					32.0	9.5	7.5	49.0			37.0		
Effective Green, g (s)					32.0	9.5	7.5	49.0			37.0		
Actuated g/C Ratio					0.36	0.11	0.08	0.54			0.41		
Clearance Time (s)					4.5	4.5	4.5	4.5			4.5		
Lane Grp Cap (vph)					1048	175	126	891			578		
v/s Ratio Prot						0.01	0.03	c0.20			c0.27		
v/s Ratio Perm					0.15								
v/c Ratio					0.43	0.07	0.37	0.37			0.65		
Uniform Delay, d1					22.0	36.3	39.0	11.7			21.2		
Progression Factor					0.36	3.43	1.00	1.00			0.77		
Incremental Delay, d2					1.0	0.6	8.0	1.2			5.3		
Delay (s)					9.0	125.2	47.0	12.9			21.7		
Level of Service					A	F	D	B			C		
Approach Delay (s)		0.0			33.8			17.1			21.7		
Approach LOS		A			C			B			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			25.5		HCM 2000 Level of Service						C		
HCM 2000 Volume to Capacity ratio			0.57										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)					18.0			
Intersection Capacity Utilization			54.5%		ICU Level of Service					A			
Analysis Period (min)			15										
c Critical Lane Group													

HCM 2010 Signalized Intersection Summary  
 2: 2nd Ave & Madison St













8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕↕						↕↕	↗
Traffic Volume (veh/h)	0	0	0	186	341	0	0	0	0	0	1456	105
Future Volume (veh/h)	0	0	0	186	341	0	0	0	0	0	1456	105
Number				5	2	12				7	4	14
Initial Q (Qb), veh				0	0	0				0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00				1.00		0.82
Parking Bus, Adj				1.00	1.00	1.00				1.00	1.00	0.43
Adj Sat Flow, veh/h/ln				1778	1727	0				0	1569	1569
Adj Flow Rate, veh/h				198	363	0				0	1533	111
Adj No. of Lanes				0	2	0				0	2	1
Peak Hour Factor				0.94	0.94	0.94				0.95	0.95	0.95
Percent Heavy Veh, %				3	3	0				0	9	9
Cap, veh/h				300	479	0				0	2053	313
Arrive On Green				0.08	0.08	0.00				0.00	0.23	0.22
Sat Flow, veh/h				955	2038	0				0	3059	466
Grp Volume(v), veh/h				295	266	0				0	1533	111
Grp Sat Flow(s),veh/h/ln				1422	1493	0				0	1490	466
Q Serve(g_s), s				18.4	15.7	0.0				0.0	43.1	18.1
Cycle Q Clear(g_c), s				18.4	15.7	0.0				0.0	43.1	18.1
Prop In Lane				0.67		0.00				0.00		1.00
Lane Grp Cap(c), veh/h				414	365	0				0	2053	313
V/C Ratio(X)				0.71	0.73	0.00				0.00	0.75	0.35
Avail Cap(c_a), veh/h				414	365	0				0	2053	313
HCM Platoon Ratio				0.33	0.33	1.00				1.00	0.33	0.33
Upstream Filter(I)				1.00	1.00	0.00				0.00	1.00	1.00
Uniform Delay (d), s/veh				39.7	38.5	0.0				0.0	27.5	18.5
Incr Delay (d2), s/veh				9.9	12.1	0.0				0.0	2.5	3.1
Initial Q Delay(d3),s/veh				0.0	0.0	0.0				0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				8.4	7.7	0.0				0.0	18.5	2.6
LnGrp Delay(d),s/veh				49.7	50.6	0.0				0.0	30.0	21.6
LnGrp LOS				D	D						C	C
Approach Vol, veh/h					561						1644	
Approach Delay, s/veh					50.1						29.4	
Approach LOS					D						C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4								
Phs Duration (G+Y+Rc), s		25.0		65.0								
Change Period (Y+Rc), s		4.5		4.5								
Max Green Setting (Gmax), s		20.5		60.5								
Max Q Clear Time (g_c+I1), s		0.0		0.0								
Green Ext Time (p_c), s		0.0		0.0								
<b>Intersection Summary</b>												
HCM 2010 Ctrl Delay				34.7								
HCM 2010 LOS				C								

# HCM Signalized Intersection Capacity Analysis

## 3: 3rd Ave & Madison St

8/2/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑↑	↑		↑↑			↑↑		
Traffic Volume (vph)	0	0	0	0	405	10	0	20	0	0	0	77	
Future Volume (vph)	0	0	0	0	405	10	0	20	0	0	0	77	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	10	11	12	10	12	12	11	12	
Grade (%)		10%			-15%			0%				-5%	
Total Lost time (s)					4.0	4.5		4.0				4.0	
Lane Util. Factor					0.95	1.00		0.95				0.95	
Frbp, ped/bikes					1.00	0.84		1.00				0.55	
Flpb, ped/bikes					1.00	1.00		1.00				1.00	
Frt					1.00	0.85		1.00				0.85	
Flt Protected					1.00	1.00		1.00				1.00	
Satd. Flow (prot)					2858	1248		1468				1266	
Flt Permitted					1.00	1.00		1.00				1.00	
Satd. Flow (perm)					2858	1248		1468				1266	
Peak-hour factor, PHF	0.25	0.25	0.25	0.91	0.91	0.91	0.93	0.93	0.93	0.87	0.87	0.87	
Adj. Flow (vph)	0	0	0	0	445	11	0	22	0	0	0	89	
RTOR Reduction (vph)	0	0	0	0	0	5	0	0	0	0	58	0	
Lane Group Flow (vph)	0	0	0	0	445	6	0	22	0	0	31	0	
Confl. Peds. (#/hr)	244		457	457		244	588		499	499		588	
Heavy Vehicles (%)	0%	0%	0%	9%	2%	2%	0%	81%	0%	0%	82%	11%	
Bus Blockages (#/hr)	0	0	0	0	10	0	0	62	0	0	29	0	
Parking (#/hr)					15								
Turn Type					NA	custom		NA				NA	
Protected Phases					6	2		4				4	
Permitted Phases						1							
Actuated Green, G (s)					50.5	46.0		30.5				30.5	
Effective Green, g (s)					51.0	46.0		31.0				31.0	
Actuated g/C Ratio					0.57	0.51		0.34				0.34	
Clearance Time (s)					4.5	4.5		4.5				4.5	
Lane Grp Cap (vph)					1619	700		505				436	
v/s Ratio Prot					c0.16	0.00		0.01				c0.02	
v/s Ratio Perm						0.00							
v/c Ratio					0.27	0.01		0.04				0.07	
Uniform Delay, d1					10.0	10.8		19.6				19.8	
Progression Factor					0.75	1.04		1.00				1.69	
Incremental Delay, d2					0.4	0.0		0.2				0.3	
Delay (s)					7.9	11.3		19.8				33.9	
Level of Service					A	B		B				C	
Approach Delay (s)		0.0			8.0			19.8				33.9	
Approach LOS		A			A			B				C	
<b>Intersection Summary</b>													
HCM 2000 Control Delay			12.5		HCM 2000 Level of Service						B		
HCM 2000 Volume to Capacity ratio			0.21										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)						13.0		
Intersection Capacity Utilization			34.8%		ICU Level of Service						A		
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 4: 4th Ave & Madison St

8/2/2016



Movement	WBR	NBL	NBT	SWR	SWR2
Lane Configurations	↗		↕↕↕	↗↗	↗
Traffic Volume (vph)	38	133	961	273	412
Future Volume (vph)	38	133	961	273	412
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	12	12	10	11	12
Grade (%)			5%		
Total Lost time (s)	3.5		3.5	1.0	4.5
Lane Util. Factor	1.00		0.91	0.88	1.00
Frbp, ped/bikes	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00		1.00	1.00	1.00
Frt	0.86		1.00	0.85	0.85
Flt Protected	1.00		0.99	1.00	1.00
Satd. Flow (prot)	1450		3681	2299	1511
Flt Permitted	1.00		0.99	1.00	1.00
Satd. Flow (perm)	1450		3681	2299	1511
Peak-hour factor, PHF	0.92	0.97	0.97	0.84	0.84
Adj. Flow (vph)	41	137	991	325	490
RTOR Reduction (vph)	0	0	68	0	67
Lane Group Flow (vph)	41	0	1060	325	423
Confl. Peds. (#/hr)		487			361
Heavy Vehicles (%)	2%	1%	9%	1%	1%
Bus Blockages (#/hr)	0	0	0	10	0
Parking (#/hr)			15	15	
Turn Type	custom	Split	NA	Prot	custom
Protected Phases	3	4	4	6	2
Permitted Phases	4				1
Actuated Green, G (s)	32.0		29.4	47.0	45.5
Effective Green, g (s)	32.0		30.4	49.0	45.5
Actuated g/C Ratio	0.36		0.34	0.54	0.51
Clearance Time (s)	3.5		4.5	3.0	4.5
Vehicle Extension (s)	0.2		0.2	0.2	0.2
Lane Grp Cap (vph)	571		1243	1251	763
v/s Ratio Prot	c0.00		c0.29	0.14	c0.28
v/s Ratio Perm	0.03				
v/c Ratio	0.07		0.85	0.26	0.55
Uniform Delay, d1	19.2		27.7	10.9	15.3
Progression Factor	1.00		1.00	0.77	1.24
Incremental Delay, d2	0.0		7.5	0.5	0.5
Delay (s)	19.2		35.2	8.8	19.4
Level of Service	B		D	A	B
Approach Delay (s)			35.2		
Approach LOS			D		
<b>Intersection Summary</b>					
HCM 2000 Control Delay			26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.69		
Actuated Cycle Length (s)			90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization			74.8%	ICU Level of Service	D
Analysis Period (min)			15		















c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 5: 5th Ave & Madison St

8/2/2016













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑						↑↑↑	
Traffic Volume (vph)	0	0	0	246	531	0	0	0	0	0	501	127
Future Volume (vph)	0	0	0	246	531	0	0	0	0	0	501	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	11	12	12	12	12	12	9	12
Grade (%)		10%			-10%			0%			0%	
Total Lost time (s)					4.5						4.5	
Lane Util. Factor					0.95						0.91	
Frbp, ped/bikes					1.00						0.93	
Flpb, ped/bikes					0.90						1.00	
Frt					1.00						0.97	
Flt Protected					0.98						1.00	
Satd. Flow (prot)					2621						3476	
Flt Permitted					0.98						1.00	
Satd. Flow (perm)					2621						3476	
Peak-hour factor, PHF	0.25	0.25	0.25	0.96	0.96	0.96	0.25	0.25	0.25	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	256	553	0	0	0	0	0	516	131
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	50	0
Lane Group Flow (vph)	0	0	0	0	797	0	0	0	0	0	597	0
Confl. Peds. (#/hr)	228		242	242		228	311		184	184		311
Heavy Vehicles (%)	0%	0%	0%	1%	2%	0%	0%	0%	0%	0%	3%	2%
Parking (#/hr)					15						15	
Turn Type				Perm	NA						NA	
Protected Phases					2						4	
Permitted Phases				2								
Actuated Green, G (s)					51.5						29.5	
Effective Green, g (s)					51.5						29.5	
Actuated g/C Ratio					0.57						0.33	
Clearance Time (s)					4.5						4.5	
Lane Grp Cap (vph)					1499						1139	
v/s Ratio Prot											c0.17	
v/s Ratio Perm					0.30							
v/c Ratio					0.53						0.52	
Uniform Delay, d1					11.8						24.6	
Progression Factor					0.58						0.43	
Incremental Delay, d2					1.1						1.5	
Delay (s)					7.9						12.0	
Level of Service					A						B	
Approach Delay (s)		0.0			7.9			0.0			12.0	
Approach LOS		A			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			9.7								HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.53									
Actuated Cycle Length (s)			90.0								Sum of lost time (s)	9.0
Intersection Capacity Utilization			50.7%								ICU Level of Service	A
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 6: 6th Ave & Madison St













8/2/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations					↑	↑↑		↑↓					
Traffic Volume (vph)	0	0	0	0	714	707	39	146	190	0	0	0	
Future Volume (vph)	0	0	0	0	714	707	39	146	190	0	0	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	12	12	12	10	10	12	12	12	12	12	12	
Grade (%)		10%			-10%			5%			-5%		
Total Lost time (s)					3.5	4.0		4.0					
Lane Util. Factor					1.00	0.88		0.95					
Frbp, ped/bikes					1.00	1.00		0.99					
Flpb, ped/bikes					1.00	1.00		0.97					
Frt					1.00	0.85		0.92					
Flt Protected					1.00	1.00		0.99					
Satd. Flow (prot)					1659	2482		2450					
Flt Permitted					1.00	1.00		0.99					
Satd. Flow (perm)					1659	2482		2450					
Peak-hour factor, PHF	0.25	0.25	0.25	0.97	0.97	0.97	0.85	0.85	0.85	0.25	0.25	0.25	
Adj. Flow (vph)	0	0	0	0	736	729	46	172	224	0	0	0	
RTOR Reduction (vph)	0	0	0	0	0	436	0	186	0	0	0	0	
Lane Group Flow (vph)	0	0	0	0	736	293	0	256	0	0	0	0	
Confl. Peds. (#/hr)	137		316	316		137	178			1		178	
Confl. Bikes (#/hr)			3			26			2			3	
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	12%	1%	5%	0%	0%	0%	
Parking (#/hr)								15					
Turn Type					NA	custom	Perm	NA					
Protected Phases					6	1		4					
Permitted Phases							4						
Actuated Green, G (s)					63.0	23.7		18.5					
Effective Green, g (s)					63.5	24.2		19.0					
Actuated g/C Ratio					0.71	0.27		0.21					
Clearance Time (s)					4.0	4.5		4.5					
Vehicle Extension (s)					0.2	0.2		0.2					
Lane Grp Cap (vph)					1170	667		517					
v/s Ratio Prot					0.44	0.12							
v/s Ratio Perm								0.10					
v/c Ratio					0.63	0.44		0.49					
Uniform Delay, d1					7.0	27.3		31.3					
Progression Factor					0.61	0.76		1.00					
Incremental Delay, d2					2.3	2.0		3.4					
Delay (s)					6.5	22.6		34.6					
Level of Service					A	C		C					
Approach Delay (s)		0.0			14.5			34.6			0.0		
Approach LOS		A			B			C			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			19.2		HCM 2000 Level of Service				B				
HCM 2000 Volume to Capacity ratio			0.65										
Actuated Cycle Length (s)			90.0		Sum of lost time (s)				14.5				
Intersection Capacity Utilization			64.3%		ICU Level of Service				C				
Analysis Period (min)			15										

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis  
 7: I-5 CD NB Off-Ramp/7th Ave & Madison St

8/2/2016





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↑↑↑		↖	↖	↖	↖		↖
Traffic Volume (vph)	0	190	0	0	653	1	553	419	199	12	0	215
Future Volume (vph)	0	190	0	0	653	1	553	419	199	12	0	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	10	12	12	12	12	12	12	12
Grade (%)		0%			0%			5%			-5%	
Total Lost time (s)		3.5			3.5		3.5	3.5	3.5	3.5		4.5
Lane Util. Factor		1.00			0.91		0.95	0.95	1.00	1.00		1.00
Frbp, ped/bikes		1.00			1.00		1.00	1.00	0.83	1.00		1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00	1.00	0.96		1.00
Frt		1.00			1.00		1.00	1.00	0.85	1.00		0.85
Flt Protected		1.00			1.00		0.95	0.99	1.00	0.95		1.00
Satd. Flow (prot)		1299			4269		1502	1571	1163	1604		1475
Flt Permitted		1.00			1.00		0.95	0.99	1.00	0.29		1.00
Satd. Flow (perm)		1299			4269		1502	1571	1163	492		1475
Peak-hour factor, PHF	0.81	0.81	0.81	0.94	0.94	0.94	0.94	0.94	0.94	0.90	0.90	0.90
Adj. Flow (vph)	0	235	0	0	695	1	588	446	212	13	0	239
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	13	0	0	17
Lane Group Flow (vph)	0	235	0	0	696	0	506	528	199	13	0	222
Confl. Peds. (#/hr)	114		364	364		114	1		56	56		
Confl. Bikes (#/hr)			2			9			22			
Heavy Vehicles (%)	0%	5%	0%	0%	2%	0%	0%	0%	1%	0%	0%	1%
Parking (#/hr)		15										
Turn Type		NA			NA		Perm	NA	Perm	D.Pm		Perm
Protected Phases		6			2			4				
Permitted Phases							4		4	4		4
Actuated Green, G (s)		36.6			36.6		44.4	44.4	44.4	44.4		44.4
Effective Green, g (s)		37.6			37.6		45.4	45.4	45.4	45.4		44.4
Actuated g/C Ratio		0.42			0.42		0.50	0.50	0.50	0.50		0.49
Clearance Time (s)		4.5			4.5		4.5	4.5	4.5	4.5		4.5
Vehicle Extension (s)		3.0			5.0		5.0	5.0	5.0	5.0		5.0
Lane Grp Cap (vph)		542			1783		757	792	586	248		727
v/s Ratio Prot		c0.18			0.16							
v/s Ratio Perm							c0.34	0.34	0.17	0.03		0.15
v/c Ratio		0.43			0.39		0.67	0.67	0.34	0.05		0.31
Uniform Delay, d1		18.6			18.2		16.7	16.7	13.3	11.4		13.6
Progression Factor		0.46			0.43		1.00	1.00	1.00	0.45		0.42
Incremental Delay, d2		2.0			0.6		3.0	2.8	0.7	0.2		0.5
Delay (s)		10.6			8.5		19.6	19.5	14.1	5.3		6.2
Level of Service		B			A		B	B	B	A		A
Approach Delay (s)		10.6			8.5			18.6				6.2
Approach LOS		B			A			B				A
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.7				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			7.0		
Intersection Capacity Utilization			69.5%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 8: 8th Ave & Madison St

8/2/2016


















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	392	9	0	605	15	7	203	32	10	146	42	
Future Volume (vph)	0	392	9	0	605	15	7	203	32	10	146	42	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	11	12	10	12	12	12	12	12	12	12	12	
Total Lost time (s)		3.5			3.5			3.5			3.5		
Lane Util. Factor		1.00			0.95			1.00			1.00		
Frbp, ped/bikes		0.99			0.99			0.96			0.99		
Flpb, ped/bikes		1.00			1.00			1.00			0.99		
Frt		1.00			1.00			0.98			0.97		
Flt Protected		1.00			1.00			1.00			1.00		
Satd. Flow (prot)		1595			3130			1613			1622		
Flt Permitted		1.00			1.00			0.99			0.98		
Satd. Flow (perm)		1595			3130			1601			1595		
Peak-hour factor, PHF	0.89	0.89	0.89	0.99	0.99	0.99	0.93	0.93	0.93	0.80	0.80	0.80	
Adj. Flow (vph)	0	440	10	0	611	15	8	218	34	12	182	52	
RTOR Reduction (vph)	0	1	0	0	2	0	0	6	0	0	11	0	
Lane Group Flow (vph)	0	449	0	0	624	0	0	254	0	0	238	0	
Confl. Peds. (#/hr)	165		269	169		165	69		96	96		36	
Heavy Vehicles (%)	0%	2%	0%	0%	2%	6%	4%	0%	0%	0%	0%	0%	
Turn Type		NA			NA		Perm	NA		Perm	NA		
Protected Phases		6			2			4			8		
Permitted Phases							4			8			
Actuated Green, G (s)		50.5			50.5			30.5			30.5		
Effective Green, g (s)		51.5			51.5			31.5			31.5		
Actuated g/C Ratio		0.57			0.57			0.35			0.35		
Clearance Time (s)		4.5			4.5			4.5			4.5		
Lane Grp Cap (vph)		912			1791			560			558		
v/s Ratio Prot		c0.28			0.20								
v/s Ratio Perm								c0.16			0.15		
v/c Ratio		0.49			0.35			0.45			0.43		
Uniform Delay, d1		11.5			10.3			22.6			22.3		
Progression Factor		0.51			1.90			1.00			0.68		
Incremental Delay, d2		1.8			0.3			2.6			2.3		
Delay (s)		7.6			19.8			25.2			17.6		
Level of Service		A			B			C			B		
Approach Delay (s)		7.6			19.8			25.2			17.6		
Approach LOS		A			B			C			B		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			16.9								HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio			0.48										
Actuated Cycle Length (s)			90.0								Sum of lost time (s)	7.0	
Intersection Capacity Utilization			47.8%								ICU Level of Service	A	
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 9: 9th Ave & Madison St

8/2/2016

















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	411	23	0	608	8	7	57	5	44	415	5	
Future Volume (vph)	0	411	23	0	608	8	7	57	5	44	415	5	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	15	12	10	11	12	12	12	12	11	11	12	
Total Lost time (s)		3.5			3.5			3.5		2.5	3.5		
Lane Util. Factor		1.00			1.00			1.00		1.00	1.00		
Frbp, ped/bikes		0.97			1.00			0.99		1.00	1.00		
Flpb, ped/bikes		1.00			1.00			0.99		0.93	1.00		
Frt		0.99			1.00			0.99		1.00	1.00		
Flt Protected		1.00			1.00			0.99		0.95	1.00		
Satd. Flow (prot)		1780			1610			1528		1454	1646		
Flt Permitted		1.00			1.00			0.95		0.66	1.00		
Satd. Flow (perm)		1780			1610			1457		1014	1646		
Peak-hour factor, PHF	0.88	0.88	0.88	0.97	0.97	0.97	0.81	0.81	0.81	0.87	0.87	0.87	
Adj. Flow (vph)	0	467	26	0	627	8	9	70	6	51	477	6	
RTOR Reduction (vph)	0	3	0	0	1	0	0	3	0	0	1	0	
Lane Group Flow (vph)	0	490	0	0	634	0	0	82	0	51	482	0	
Confl. Peds. (#/hr)	132		249	249		132	128		63	63		128	
Heavy Vehicles (%)	0%	2%	0%	6%	2%	0%	0%	9%	10%	0%	0%	0%	
Turn Type		NA			NA		Perm	NA		pm+pt	NA		
Protected Phases		6			2			4		3	8		
Permitted Phases							4			8			
Actuated Green, G (s)		42.4			42.4			26.6		39.6	38.6		
Effective Green, g (s)		43.4			43.4			27.6		40.6	39.6		
Actuated g/C Ratio		0.48			0.48			0.31		0.45	0.44		
Clearance Time (s)		4.5			4.5			4.5			4.5		
Vehicle Extension (s)		0.2			0.2			0.2			0.2		
Lane Grp Cap (vph)		858			776			446		491	724		
v/s Ratio Prot		0.28			c0.39					0.01	c0.29		
v/s Ratio Perm								0.06		0.04			
v/c Ratio		0.57			0.82			0.18		0.10	0.67		
Uniform Delay, d1		16.7			19.9			22.9		14.2	20.0		
Progression Factor		0.95			0.66			1.00		0.76	0.76		
Incremental Delay, d2		2.5			8.6			0.9		0.0	4.7		
Delay (s)		18.3			21.8			23.8		10.8	19.8		
Level of Service		B			C			C		B	B		
Approach Delay (s)		18.3			21.8			23.8			19.0		
Approach LOS		B			C			C			B		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			20.0									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.79										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	12.0
Intersection Capacity Utilization			67.5%									ICU Level of Service	C
Analysis Period (min)			15										
c Critical Lane Group													



# HCM Signalized Intersection Capacity Analysis

## 10: Terry Ave & Madison St

8/2/2016





















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	450	10	0	477	11	0	0	21	0	0	139	
Future Volume (vph)	0	450	10	0	477	11	0	0	21	0	0	139	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	11	12	10	10	12	12	12	12	12	12	12	
Total Lost time (s)		3.5			3.5				4.5			4.5	
Lane Util. Factor		1.00			1.00				1.00			1.00	
Frbp, ped/bikes		0.99			0.99				0.69			0.79	
Flpb, ped/bikes		1.00			1.00				1.00			1.00	
Frt		1.00			1.00				0.86			0.86	
Flt Protected		1.00			1.00				1.00			1.00	
Satd. Flow (prot)		1593			1543				1026			1175	
Flt Permitted		1.00			1.00				1.00			1.00	
Satd. Flow (perm)		1593			1543				1026			1175	
Peak-hour factor, PHF	0.95	0.95	0.95	0.90	0.90	0.90	0.83	0.83	0.83	0.75	0.75	0.75	
Adj. Flow (vph)	0	474	11	0	530	12	0	0	25	0	0	185	
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	9	0	0	65	
Lane Group Flow (vph)	0	484	0	0	541	0	0	0	16	0	0	120	
Confl. Peds. (#/hr)	152		226	226		152	59		91	91		59	
Heavy Vehicles (%)	5%	2%	9%	0%	2%	0%	0%	0%	0%	0%	0%	0%	
Turn Type		NA			NA				Perm			Perm	
Protected Phases		6			2								
Permitted Phases									6			2	
Actuated Green, G (s)		58.5			58.5				58.5			58.5	
Effective Green, g (s)		59.5			59.5				58.5			58.5	
Actuated g/C Ratio		0.66			0.66				0.65			0.65	
Clearance Time (s)		4.5			4.5				4.5			4.5	
Lane Grp Cap (vph)		1053			1020				666			763	
v/s Ratio Prot		0.30			0.35								
v/s Ratio Perm									0.02			0.10	
v/c Ratio		0.46			0.53				0.02			0.16	
Uniform Delay, d1		7.4			8.0				5.6			6.1	
Progression Factor		0.26			0.36				1.00			1.00	
Incremental Delay, d2		1.3			0.9				0.1			0.4	
Delay (s)		3.2			3.8				5.7			6.6	
Level of Service		A			A				A			A	
Approach Delay (s)		3.2			3.8			5.7			6.6		
Approach LOS		A			A			A			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			4.0									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.38										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	7.0
Intersection Capacity Utilization			49.9%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 11: Boren Ave & Madison St

8/2/2016

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	456	4	30	436	10	17	755	2	42	830	35
Future Volume (vph)	11	456	4	30	436	10	17	755	2	42	830	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	9	10	10	9	10	12	9	9	12	9	9	12
Total Lost time (s)	4.0	3.5		4.0	3.5		4.0	3.5		4.0	3.5	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frbp, ped/bikes	1.00	1.00		1.00	0.99		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	1.00		1.00	1.00		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)	1433	1495		1462	1513		1433	2851		1462	2765	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1433	1495		1462	1513		1433	2851		1462	2765	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84	0.90	0.90	0.90
Adj. Flow (vph)	13	524	5	34	501	11	20	899	2	47	922	39
RTOR Reduction (vph)	0	1	0	0	1	0	0	0	0	0	3	0
Lane Group Flow (vph)	13	528	0	34	511	0	20	901	0	47	958	0
Confl. Peds. (#/hr)	183		335	335		183	144		160	160		144
Heavy Vehicles (%)	2%	2%	4%	0%	2%	0%	2%	2%	6%	0%	2%	1%
Bus Blockages (#/hr)	0	10	0	0	6	0	0	2	0	0	8	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	1.2	30.3		3.7	32.8		2.4	34.1		3.9	35.6	
Effective Green, g (s)	1.7	31.3		4.2	33.8		2.9	35.1		4.4	36.6	
Actuated g/C Ratio	0.02	0.35		0.05	0.38		0.03	0.39		0.05	0.41	
Clearance Time (s)	4.5	4.5		4.5	4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	27	519		68	568		46	1111		71	1124	
v/s Ratio Prot	0.01	c0.35		c0.02	0.34		0.01	0.32		c0.03	c0.35	
v/s Ratio Perm												
v/c Ratio	0.48	1.02		0.50	0.90		0.43	0.81		0.66	0.85	
Uniform Delay, d1	43.7	29.4		41.9	26.5		42.7	24.5		42.1	24.2	
Progression Factor	1.29	0.66		1.23	0.89		1.00	1.00		0.97	0.94	
Incremental Delay, d2	4.5	42.7		1.9	18.1		2.4	6.5		15.7	7.8	
Delay (s)	61.1	62.3		53.5	41.6		45.1	31.0		56.4	30.6	
Level of Service	E	E		D	D		D	C		E	C	
Approach Delay (s)		62.2			42.4			31.3			31.8	
Approach LOS		E			D			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			39.0				HCM 2000 Level of Service				D	
HCM 2000 Volume to Capacity ratio			0.90									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			15.0		
Intersection Capacity Utilization			68.9%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 12: Madison St & Minor Ave

8/2/2016



















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	481	19	0	420	5	6	145	1	1	234	50
Future Volume (vph)	0	481	19	0	420	5	6	145	1	1	234	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	12	10	11	12	12	12	12	12	12	12
Total Lost time (s)		3.5			3.5			3.5			3.5	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frbp, ped/bikes		0.98			0.99			1.00			0.95	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			1.00			1.00			0.98	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1527			1610			1697			1584	
Flt Permitted		1.00			1.00			0.99			1.00	
Satd. Flow (perm)		1527			1610			1675			1583	
Peak-hour factor, PHF	0.89	0.89	0.89	0.95	0.95	0.95	0.83	0.83	0.83	0.76	0.76	0.76
Adj. Flow (vph)	0	540	21	0	442	5	7	175	1	1	308	66
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	559	0	0	447	0	0	183	0	0	367	0
Confl. Peds. (#/hr)	157		212	212		157	110		81	81		110
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4			4	
Permitted Phases							4			4		
Actuated Green, G (s)		49.5			49.5			31.5			31.5	
Effective Green, g (s)		50.5			50.5			32.5			32.5	
Actuated g/C Ratio		0.56			0.56			0.36			0.36	
Clearance Time (s)		4.5			4.5			4.5			4.5	
Lane Grp Cap (vph)		856			903			604			571	
v/s Ratio Prot		c0.37			0.28							
v/s Ratio Perm								0.11			c0.23	
v/c Ratio		0.65			0.49			0.30			0.64	
Uniform Delay, d1		13.7			12.0			20.6			23.9	
Progression Factor		0.30			0.69			1.00			1.00	
Incremental Delay, d2		0.4			1.8			1.3			5.5	
Delay (s)		4.4			10.0			21.9			29.4	
Level of Service		A			B			C			C	
Approach Delay (s)		4.4			10.0			21.9			29.4	
Approach LOS		A			B			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			14.1									B
HCM 2000 Volume to Capacity ratio			0.65									
Actuated Cycle Length (s)			90.0								7.0	
Intersection Capacity Utilization			54.9%									A
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 13: Swedish/Summit Ave & Madison St

8/2/2016


















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	466	17	0	344	41	12	23	51	7	28	69	
Future Volume (vph)	0	466	17	0	344	41	12	23	51	7	28	69	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	11	10	10	10	12	12	12	12	12	12	12	
Total Lost time (s)		3.5			3.5			3.0	4.0		3.0		
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00		
Frbp, ped/bikes		0.99			0.97			1.00	0.74		0.88		
Flpb, ped/bikes		1.00			1.00			0.96	1.00		0.99		
Frt		1.00			0.99			1.00	0.85		0.91		
Flt Protected		1.00			1.00			0.98	1.00		1.00		
Satd. Flow (prot)		1593			1499			1615	1080		1344		
Flt Permitted		1.00			1.00			0.91	1.00		0.99		
Satd. Flow (perm)		1593			1499			1493	1080		1332		
Peak-hour factor, PHF	0.97	0.97	0.97	0.96	0.96	0.96	0.63	0.63	0.63	0.77	0.77	0.77	
Adj. Flow (vph)	0	480	18	0	358	43	19	37	81	9	36	90	
RTOR Reduction (vph)	0	1	0	0	5	0	0	0	58	0	63	0	
Lane Group Flow (vph)	0	497	0	0	396	0	0	56	23	0	72	0	
Confl. Peds. (#/hr)	101		132	132		101	69		102	102		69	
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	0%	0%	0%	
Turn Type		NA			NA		Perm	NA	Perm	Perm	NA		
Protected Phases		6			2			4			4		
Permitted Phases							4		4	4			
Actuated Green, G (s)		55.5			55.5			26.0	26.0		26.0		
Effective Green, g (s)		56.5			56.5			27.0	26.0		27.0		
Actuated g/C Ratio		0.63			0.63			0.30	0.29		0.30		
Clearance Time (s)		4.5			4.5			4.0	4.0		4.0		
Lane Grp Cap (vph)		1000			941			447	312		399		
v/s Ratio Prot		c0.31			0.26								
v/s Ratio Perm								0.04	0.02		c0.05		
v/c Ratio		0.50			0.42			0.13	0.07		0.18		
Uniform Delay, d1		9.1			8.5			22.9	23.3		23.3		
Progression Factor		0.00			1.24			1.00	1.00		1.00		
Incremental Delay, d2		1.3			1.3			0.6	0.5		1.0		
Delay (s)		1.3			11.8			23.5	23.7		24.3		
Level of Service		A			B			C	C		C		
Approach Delay (s)		1.3			11.8			23.6			24.3		
Approach LOS		A			B			C			C		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			10.2				HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.39										
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			6.5			
Intersection Capacity Utilization			70.3%				ICU Level of Service			C			
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 14: Madison St & Boylston Ave




















8/2/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	0	520	4	0	348	5	6	158	11	74	35	31	
Future Volume (vph)	0	520	4	0	348	5	6	158	11	74	35	31	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	12	10	10	12	12	12	12	12	12	12	
Total Lost time (s)		3.5			3.5			3.0			3.0		
Lane Util. Factor		1.00			1.00			1.00			1.00		
Frbp, ped/bikes		1.00			1.00			0.99			0.97		
Flpb, ped/bikes		1.00			1.00			1.00			0.98		
Frt		1.00			1.00			0.99			0.97		
Flt Protected		1.00			1.00			1.00			0.97		
Satd. Flow (prot)		1559			1556			1679			1534		
Flt Permitted		1.00			1.00			0.99			0.51		
Satd. Flow (perm)		1559			1556			1667			805		
Peak-hour factor, PHF	0.91	0.91	0.91	0.95	0.95	0.95	0.89	0.89	0.89	0.81	0.81	0.81	
Adj. Flow (vph)	0	571	4	0	366	5	7	178	12	91	43	38	
RTOR Reduction (vph)	0	0	0	0	0	0	0	3	0	0	13	0	
Lane Group Flow (vph)	0	575	0	0	371	0	0	194	0	0	159	0	
Confl. Peds. (#/hr)	88		106	106		88	52		30	30		52	
Heavy Vehicles (%)	0%	2%	8%	0%	2%	0%	0%	0%	0%	0%	0%	0%	
Turn Type		NA			NA		Perm	NA		Perm	NA		
Protected Phases		6			2			4			4		
Permitted Phases							4			4			
Actuated Green, G (s)		66.1			66.1			15.4			15.4		
Effective Green, g (s)		67.1			67.1			16.4			16.4		
Actuated g/C Ratio		0.75			0.75			0.18			0.18		
Clearance Time (s)		4.5			4.5			4.0			4.0		
Vehicle Extension (s)		0.2			0.2			0.2			0.2		
Lane Grp Cap (vph)		1162			1160			303			146		
v/s Ratio Prot		c0.37			0.24								
v/s Ratio Perm								0.12			c0.20		
v/c Ratio		0.49			0.32			0.64			1.09		
Uniform Delay, d1		4.6			3.8			34.1			36.8		
Progression Factor		0.15			0.85			1.00			1.00		
Incremental Delay, d2		1.4			0.7			3.2			100.1		
Delay (s)		2.0			3.9			37.3			136.9		
Level of Service		A			A			D			F		
Approach Delay (s)		2.0			3.9			37.3			136.9		
Approach LOS		A			A			D			F		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			25.5				HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.61										
Actuated Cycle Length (s)			90.0				Sum of lost time (s)		6.5				
Intersection Capacity Utilization			69.3%				ICU Level of Service		C				
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 15: Broadway & Madison St/E Madison St

8/2/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (vph)	147	432	26	47	240	5	0	182	120	0	229	113	
Future Volume (vph)	147	432	26	47	240	5	0	182	120	0	229	113	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	9	10	12	9	10	12	12	13	12	12	13	12	
Grade (%)		-9%			8%			0%			0%		
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	5.0		4.0		
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00	1.00		1.00		
Frbp, ped/bikes	1.00	0.99		1.00	1.00			1.00	1.00		0.95		
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00		
Frt	1.00	0.99		1.00	1.00			1.00	0.85		0.96		
Flt Protected	0.95	1.00		0.95	1.00			1.00	1.00		1.00		
Satd. Flow (prot)	1648	1794		1471	1660			1925	1583		1727		
Flt Permitted	0.95	1.00		0.95	1.00			1.00	1.00		1.00		
Satd. Flow (perm)	1648	1794		1471	1660			1925	1583		1727		
Peak-hour factor, PHF	0.97	0.97	0.97	0.94	0.94	0.94	0.94	0.94	0.94	0.88	0.88	0.88	
Adj. Flow (vph)	152	445	27	50	255	5	0	194	128	0	260	128	
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	102	0	23	0	
Lane Group Flow (vph)	152	470	0	50	259	0	0	194	26	0	365	0	
Confl. Peds. (#/hr)	98		62	62		62	62		62	62		62	
Heavy Vehicles (%)	3%	2%	0%	6%	2%	7%	0%	2%	2%	0%	2%	5%	
Turn Type	Prot	NA		Prot	NA			NA	custom		NA		
Protected Phases	5	2		1	6			3	4	1	3	8	
Permitted Phases													
Actuated Green, G (s)	12.0	44.6		6.4	39.0			24.0	18.6		24.0		
Effective Green, g (s)	13.0	45.6		7.4	40.0			25.0	18.6		25.0		
Actuated g/C Ratio	0.14	0.51		0.08	0.44			0.28	0.21		0.28		
Clearance Time (s)	5.0	5.0		5.0	5.0						5.0		
Vehicle Extension (s)	2.0	2.0		2.0	2.0						2.0		
Lane Grp Cap (vph)	238	908		120	737			534	327		479		
v/s Ratio Prot	c0.09	c0.26		0.03	0.16			0.10	0.02		c0.21		
v/s Ratio Perm													
v/c Ratio	0.64	0.52		0.42	0.35			0.36	0.08		0.76		
Uniform Delay, d1	36.3	14.8		39.2	16.5			26.1	28.8		29.8		
Progression Factor	1.30	0.40		0.82	0.98			1.00	1.00		1.00		
Incremental Delay, d2	3.6	1.8		0.8	1.3			0.2	0.0		6.4		
Delay (s)	50.6	7.8		33.2	17.4			26.3	28.8		36.1		
Level of Service	D	A		C	B			C	C		D		
Approach Delay (s)		18.2			19.9			27.3			36.1		
Approach LOS		B			B			C			D		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			24.5									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.68										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	18.0
Intersection Capacity Utilization			59.2%									ICU Level of Service	B
Analysis Period (min)			15										

c Critical Lane Group

**Intersection**

Int Delay, s/veh 0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑			↑
Traffic Vol, veh/h	0	558	285	10	0	10
Future Vol, veh/h	0	558	285	10	0	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-8	5	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	607	310	11	0	11

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	-	0	315
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	6.22
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	3.318
Pot Cap-1 Maneuver	0	-	725
Stage 1	0	-	-
Stage 2	0	-	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	725
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	10
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	725
HCM Lane V/C Ratio	-	-	-	0.015
HCM Control Delay (s)	-	-	-	10
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0

**Intersection**

Int Delay, s/veh 0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↑			↑
Traffic Vol, veh/h	0	558	280	10	0	15
Future Vol, veh/h	0	558	280	10	0	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	-5	2	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	607	304	11	0	16

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	- 0	- 0	- 310
Stage 1	- -	- -	- -
Stage 2	- -	- -	- -
Critical Hdwy	- -	- -	- 6.22
Critical Hdwy Stg 1	- -	- -	- -
Critical Hdwy Stg 2	- -	- -	- -
Follow-up Hdwy	- -	- -	- 3.318
Pot Cap-1 Maneuver	0 -	- -	0 730
Stage 1	0 -	- -	0 -
Stage 2	0 -	- -	0 -
Platoon blocked, %	- -	- -	- -
Mov Cap-1 Maneuver	- -	- -	- 730
Mov Cap-2 Maneuver	- -	- -	- -
Stage 1	- -	- -	- -
Stage 2	- -	- -	- -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	10
HCM LOS			B

Minor Lane/Major Mvmt	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	-	-	-	730
HCM Lane V/C Ratio	-	-	-	0.022
HCM Control Delay (s)	-	-	-	10
HCM Lane LOS	-	-	-	B
HCM 95th %tile Q(veh)	-	-	-	0.1



**Intersection**

Int Delay, s/veh 0

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations		↗		↖		↗
Traffic Vol, veh/h	0	0	290	5	0	558
Future Vol, veh/h	0	0	290	5	0	558
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	-2	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	0	315	5	0	607

Major/Minor	Minor2	Major2	Major1
Conflicting Flow All	- 5	0 0	- 0
Stage 1	- -	- -	- -
Stage 2	- -	- -	- -
Critical Hdwy	- 6.22	4.12 -	- -
Critical Hdwy Stg 1	- -	- -	- -
Critical Hdwy Stg 2	- -	- -	- -
Follow-up Hdwy	- 3.318	2.218 -	- -
Pot Cap-1 Maneuver	0 1078	- -	0 -
Stage 1	0 -	- -	0 -
Stage 2	0 -	- -	0 -
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	0 1078	- -	- -
Mov Cap-2 Maneuver	0 -	- -	- -
Stage 1	0 -	- -	- -
Stage 2	0 -	- -	- -

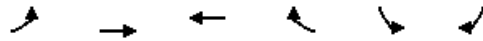
Approach	EB	WB	NE
HCM Control Delay, s	0		0
HCM LOS	A		

Minor Lane/Major Mvmt	NER EBLn1	WBL	WBT
Capacity (veh/h)	- -	- -	- -
HCM Lane V/C Ratio	- -	- -	- -
HCM Control Delay (s)	- 0	- -	- -
HCM Lane LOS	- A	- -	- -
HCM 95th %tile Q(veh)	- -	- -	- -

# HCM Signalized Intersection Capacity Analysis

## 19: E Madison St & 11th Ave

8/2/2016






















Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↗		↖	↗
Traffic Volume (vph)	0	558	182	0	141	113
Future Volume (vph)	0	558	182	0	141	113
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	10	12
Grade (%)		0%	-4%		0%	
Total Lost time (s)		5.5	5.5		4.5	4.5
Lane Util. Factor		1.00	1.00		1.00	1.00
Frbp, ped/bikes		1.00	1.00		1.00	0.77
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)		1818	1819		1620	1080
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		1818	1819		1620	1080
Peak-hour factor, PHF	0.90	0.90	0.88	0.88	0.88	0.88
Adj. Flow (vph)	0	620	207	0	160	128
RTOR Reduction (vph)	0	0	0	0	0	111
Lane Group Flow (vph)	0	620	207	0	160	17
Confl. Peds. (#/hr)	23			38		61
Confl. Bikes (#/hr)				3		17
Heavy Vehicles (%)	1%	1%	3%	3%	4%	4%
Parking (#/hr)						0
Turn Type		NA	NA		Prot	Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		68.1	68.1		11.9	11.9
Effective Green, g (s)		68.1	68.1		11.9	11.9
Actuated g/C Ratio		0.76	0.76		0.13	0.13
Clearance Time (s)		5.5	5.5		4.5	4.5
Vehicle Extension (s)		0.2	0.2		0.2	0.2
Lane Grp Cap (vph)		1375	1376		214	142
v/s Ratio Prot		c0.34	0.11		c0.10	
v/s Ratio Perm						0.02
v/c Ratio		0.45	0.15		0.75	0.12
Uniform Delay, d1		4.0	3.0		37.6	34.4
Progression Factor		0.43	0.47		1.00	1.00
Incremental Delay, d2		1.0	0.0		11.7	0.1
Delay (s)		2.7	1.4		49.3	34.6
Level of Service		A	A		D	C
Approach Delay (s)		2.7	1.4		42.8	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			12.8		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.49			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	10.0
Intersection Capacity Utilization			50.3%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 20: E Madison St & 12th Ave & Union St

9/7/2016

												
Movement	NBL2	NBL	NBT	NBR	SBL	SBT	SBR	SBR2	NEL2	NEL	NET	NER
Lane Configurations												
Traffic Volume (vph)	24	27	320	77	156	368	32	2	8	67	526	98
Future Volume (vph)	24	27	320	77	156	368	32	2	8	67	526	98
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	11	12	10	10	12	12	12	9	10	12
Grade (%)			0%			0%						4%
Total Lost time (s)		5.0	5.0	5.0	5.5	5.5				5.5	5.5	
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00				1.00	1.00	
Frbp, ped/bikes		1.00	1.00	0.93	1.00	0.97				1.00	0.99	
Flpb, ped/bikes		0.90	1.00	1.00	0.95	1.00				1.00	1.00	
Frt		1.00	1.00	0.85	1.00	0.99				1.00	0.98	
Flt Protected		0.95	1.00	1.00	0.95	1.00				0.95	1.00	
Satd. Flow (prot)		1502	1818	1484	1574	1506				1576	1661	
Flt Permitted		0.30	1.00	1.00	0.44	1.00				0.95	1.00	
Satd. Flow (perm)		471	1818	1484	726	1506				1576	1661	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.86	0.86	0.86	0.86	0.96	0.96	0.96	0.96
Adj. Flow (vph)	25	28	333	80	181	428	37	2	8	70	548	102
RTOR Reduction (vph)	0	0	0	49	0	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	53	333	31	181	467	0	0	0	78	642	0
Confl. Peds. (#/hr)	96	34		41	41		96	34	34	27		45
Heavy Vehicles (%)	1%	1%	1%	1%	2%	2%	2%	2%	1%	1%	1%	1%
Parking (#/hr)						0						
Turn Type	Perm	Perm	NA	Perm	Perm	NA			Prot	Prot	NA	
Protected Phases			4			8			5	5	6 5	
Permitted Phases	4	4		4	8							
Actuated Green, G (s)		35.0	35.0	35.0	34.5	34.5				7.5	44.5	
Effective Green, g (s)		35.0	35.0	35.0	34.5	34.5				7.5	44.5	
Actuated g/C Ratio		0.39	0.39	0.39	0.38	0.38				0.08	0.49	
Clearance Time (s)		5.0	5.0	5.0	5.5	5.5				5.5		
Lane Grp Cap (vph)		183	707	577	278	577				131	821	
v/s Ratio Prot			0.18			c0.31				0.05	c0.39	
v/s Ratio Perm		0.11		0.02	0.25							
v/c Ratio		0.29	0.47	0.05	0.65	0.81				0.60	0.78	
Uniform Delay, d1		18.9	20.6	17.2	22.8	24.8				39.8	18.8	
Progression Factor		1.00	1.00	1.00	1.00	1.00				1.22	0.49	
Incremental Delay, d2		4.0	2.2	0.2	11.3	11.7				16.9	6.7	
Delay (s)		22.9	22.8	17.3	34.1	36.5				65.5	16.0	
Level of Service		C	C	B	C	D				E	B	
Approach Delay (s)			21.9			35.8					21.3	
Approach LOS			C			D					C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			26.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.85									
Actuated Cycle Length (s)			90.0			Sum of lost time (s)			16.5			
Intersection Capacity Utilization			76.3%			ICU Level of Service			D			
Analysis Period (min)			15									
c	Critical Lane Group											

# HCM Signalized Intersection Capacity Analysis

## 20: E Madison St & 12th Ave & Union St

9/7/2016















Movement	SWT	SWR	SWR2
Lane Configurations	↻		
Traffic Volume (vph)	125	247	16
Future Volume (vph)	125	247	16
Ideal Flow (vphpl)	1900	1900	1900
Lane Width	11	12	12
Grade (%)	-8%		
Total Lost time (s)	5.5		
Lane Util. Factor	1.00		
Frbp, ped/bikes	0.90		
Flpb, ped/bikes	1.00		
Frt	0.91		
Flt Protected	1.00		
Satd. Flow (prot)	1524		
Flt Permitted	1.00		
Satd. Flow (perm)	1524		
Peak-hour factor, PHF	0.92	0.92	0.92
Adj. Flow (vph)	136	268	17
RTOR Reduction (vph)	2	0	0
Lane Group Flow (vph)	419	0	0
Confl. Peds. (#/hr)		34	27
Heavy Vehicles (%)	2%	2%	2%
Parking (#/hr)			
Turn Type	NA		
Protected Phases	2		
Permitted Phases			
Actuated Green, G (s)	31.5		
Effective Green, g (s)	31.5		
Actuated g/C Ratio	0.35		
Clearance Time (s)	5.5		
Lane Grp Cap (vph)	533		
v/s Ratio Prot	0.28		
v/s Ratio Perm			
v/c Ratio	0.79		
Uniform Delay, d1	26.2		
Progression Factor	0.62		
Incremental Delay, d2	10.2		
Delay (s)	26.4		
Level of Service	C		
Approach Delay (s)	26.4		
Approach LOS	C		

### Intersection Summary

# HCM Signalized Intersection Capacity Analysis

22: 13th Ave & E Madison St

8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑			↔		↔	↔			↕	
Traffic Volume (vph)	0	384	0	0	167	3	183	69	63	113	0	39
Future Volume (vph)	0	384	0	0	167	3	183	69	63	113	0	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	16	16	12	12	13	12
Grade (%)		8%			-7%			0%			0%	
Total Lost time (s)		4.5			4.5		4.5	4.5			4.5	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frbp, ped/bikes		1.00			1.00		1.00	0.94			0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00			0.94	
Frt		1.00			1.00		1.00	0.93			0.97	
Flt Protected		1.00			1.00		0.95	1.00			0.96	
Satd. Flow (prot)		1746			1856		1964	1811			1687	
Flt Permitted		1.00			1.00		0.68	1.00			0.64	
Satd. Flow (perm)		1746			1856		1404	1811			1112	
Peak-hour factor, PHF	0.90	0.90	0.90	0.95	0.95	0.95	0.87	0.87	0.87	0.89	0.89	0.89
Adj. Flow (vph)	0	427	0	0	176	3	210	79	72	127	0	44
RTOR Reduction (vph)	0	0	0	0	1	0	0	37	0	0	46	0
Lane Group Flow (vph)	0	427	0	0	178	0	210	114	0	0	125	0
Confl. Peds. (#/hr)	28		29	29		28	1		52	52		1
Confl. Bikes (#/hr)												6
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	4%	4%	4%	1%	1%	1%
Parking (#/hr)									0			0
Turn Type		NA			NA		Perm	NA		Perm	NA	
Protected Phases		6			2			4			4	
Permitted Phases							4			4		
Actuated Green, G (s)		37.0			37.0		22.5	22.5			22.5	
Effective Green, g (s)		37.0			37.0		22.5	22.5			22.5	
Actuated g/C Ratio		0.41			0.41		0.25	0.25			0.25	
Clearance Time (s)		4.5			4.5		4.5	4.5			4.5	
Lane Grp Cap (vph)		717			763		351	452			278	
v/s Ratio Prot		c0.24			0.10			0.06				
v/s Ratio Perm							c0.15				0.11	
v/c Ratio		0.60			0.23		0.60	0.25			0.45	
Uniform Delay, d1		20.7			17.3		29.8	27.0			28.5	
Progression Factor		0.37			0.27		1.01	1.02			1.00	
Incremental Delay, d2		0.9			0.6		7.3	1.3			5.2	
Delay (s)		8.6			5.3		37.5	29.0			33.7	
Level of Service		A			A		D	C			C	
Approach Delay (s)		8.6			5.3			34.0			33.7	
Approach LOS		A			A			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			19.9				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.46									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			12.5		
Intersection Capacity Utilization			50.3%				ICU Level of Service			A		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

23: 14th Ave & E Madison St

8/4/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		↻			↻			↻		↻	↻		
Traffic Volume (vph)	0	461	99	0	103	0	48	267	68	59	380	6	
Future Volume (vph)	0	461	99	0	103	0	48	267	68	59	380	6	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	11	12	12	11	12	12	16	12	12	16	12	
Grade (%)		7%			-10%			0%			0%		
Total Lost time (s)		4.5			4.5			4.5		4.5	4.5		
Lane Util. Factor		1.00			1.00			1.00		1.00	1.00		
Frbp, ped/bikes		0.99			1.00			0.99		1.00	1.00		
Flpb, ped/bikes		1.00			1.00			1.00		0.99	1.00		
Frt		0.98			1.00			0.98		1.00	1.00		
Flt Protected		1.00			1.00			0.99		0.95	1.00		
Satd. Flow (prot)		1694			1909			2043		1739	2082		
Flt Permitted		1.00			1.00			0.69		0.36	1.00		
Satd. Flow (perm)		1694			1909			1412		664	2082		
Peak-hour factor, PHF	0.92	0.92	0.92	0.91	0.91	0.91	0.85	0.85	0.85	0.86	0.86	0.86	
Adj. Flow (vph)	0	501	108	0	113	0	56	314	80	69	442	7	
RTOR Reduction (vph)	0	9	0	0	0	0	0	9	0	0	1	0	
Lane Group Flow (vph)	0	600	0	0	113	0	0	441	0	69	448	0	
Confl. Peds. (#/hr)	3		31	31		3	37		10	10		37	
Confl. Bikes (#/hr)			7			3			1			1	
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	3%	3%	3%	
Parking (#/hr)									0			0	
Turn Type		NA			NA		Perm	NA		Perm	NA		
Protected Phases		1			1			3			3		
Permitted Phases							3			3			
Actuated Green, G (s)		37.0			37.0			32.5		32.5	32.5		
Effective Green, g (s)		37.0			37.0			32.5		32.5	32.5		
Actuated g/C Ratio		0.41			0.41			0.36		0.36	0.36		
Clearance Time (s)		4.5			4.5			4.5		4.5	4.5		
Lane Grp Cap (vph)		696			784			509		239	751		
v/s Ratio Prot		c0.35			0.06							0.22	
v/s Ratio Perm								c0.31		0.10			
v/c Ratio		0.86			0.14			0.87		0.29	0.60		
Uniform Delay, d1		24.2			16.6			26.7		20.5	23.4		
Progression Factor		0.48			0.80			1.00		0.35	0.32		
Incremental Delay, d2		11.5			0.4			17.7		2.7	3.2		
Delay (s)		23.2			13.7			44.5		9.8	10.7		
Level of Service		C			B			D		A	B		
Approach Delay (s)		23.2			13.7			44.5			10.6		
Approach LOS		C			B			D			B		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			24.4									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.78										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	13.5
Intersection Capacity Utilization			83.5%									ICU Level of Service	E
Analysis Period (min)			15										
c Critical Lane Group													

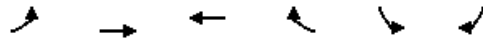
Intersection												
Int Delay, s/veh	0.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations						↗		↘			↘	
Traffic Vol, veh/h	0	0	0	0	0	9	0	438	148	0	106	51
Future Vol, veh/h	0	0	0	0	0	9	0	438	148	0	106	51
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	6	-	-	0	-	-	10	-	-	-10	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	0	0	10	0	476	161	0	115	55
Major/Minor	Minor1			Major1			Major2					
Conflicting Flow All	-	-	557	-	0	0	-	-	-	-	-	0
Stage 1	-	-	-	-	-	-	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy	-	-	6.22	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-	-	-	-	-	-	-
Follow-up Hdwy	-	-	3.318	-	-	-	-	-	-	-	-	-
Pot Cap-1 Maneuver	0	0	530	0	-	-	0	-	-	0	-	-
Stage 1	0	0	-	0	-	-	0	-	-	0	-	-
Stage 2	0	0	-	0	-	-	0	-	-	0	-	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	0	530	-	-	-	-	-	-	-	-	-
Mov Cap-2 Maneuver	-	0	-	-	-	-	-	-	-	-	-	-
Stage 1	-	0	-	-	-	-	-	-	-	-	-	-
Stage 2	-	0	-	-	-	-	-	-	-	-	-	-
Approach	WB			NE			SW					
HCM Control Delay, s	11.9			0			0					
HCM LOS	B											
Minor Lane/Major Mvmt	NET	NERWBLn1	SWT	SWR								
Capacity (veh/h)	-	-	530	-	-							
HCM Lane V/C Ratio	-	-	0.018	-	-							
HCM Control Delay (s)	-	-	11.9	-	-							
HCM Lane LOS	-	-	B	-	-							
HCM 95th %tile Q(veh)	-	-	0.1	-	-							



# HCM Signalized Intersection Capacity Analysis

## 25: E Madison St & 15th Ave

8/2/2016



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑	↔			↗
Traffic Volume (vph)	0	447	79	0	0	78
Future Volume (vph)	0	447	79	0	0	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	10	12	12	16
Grade (%)		10%	-9%		0%	
Total Lost time (s)		4.5	4.5			4.5
Lane Util. Factor		1.00	1.00			1.00
Frbp, ped/bikes		1.00	1.00			1.00
Flpb, ped/bikes		1.00	1.00			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		1728	1835			1774
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		1728	1835			1774
Peak-hour factor, PHF	0.93	0.93	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	481	93	0	0	92
RTOR Reduction (vph)	0	0	0	0	0	81
Lane Group Flow (vph)	0	481	93	0	0	11
Confl. Peds. (#/hr)	59			59	47	1
Confl. Bikes (#/hr)				2		
Heavy Vehicles (%)	1%	1%	1%	1%	5%	5%
Parking (#/hr)				0		
Turn Type		NA	NA			Prot
Protected Phases		2	6			4
Permitted Phases						
Actuated Green, G (s)		70.2	70.2			10.8
Effective Green, g (s)		70.2	70.2			10.8
Actuated g/C Ratio		0.78	0.78			0.12
Clearance Time (s)		4.5	4.5			4.5
Vehicle Extension (s)		0.2	0.2			0.2
Lane Grp Cap (vph)		1347	1431			212
v/s Ratio Prot		c0.28	0.05			c0.01
v/s Ratio Perm						
v/c Ratio		0.36	0.06			0.05
Uniform Delay, d1		3.0	2.3			35.1
Progression Factor		0.06	1.12			1.00
Incremental Delay, d2		0.1	0.1			0.0
Delay (s)		0.2	2.7			35.1
Level of Service		A	A			D
Approach Delay (s)		0.2	2.7		35.1	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			5.4		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.35			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	16.0
Intersection Capacity Utilization			33.7%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

**Intersection**

Int Delay, s/veh 1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↔			↑		↗
Traffic Vol, veh/h	447	0	0	79	0	56
Future Vol, veh/h	447	0	0	79	0	56
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	9	-	-	-9	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	486	0	0	86	0	61

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	486
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	-	6.22
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	-	3.318
Pot Cap-1 Maneuver	-	0	581
Stage 1	-	0	-
Stage 2	-	0	-
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	-	581
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

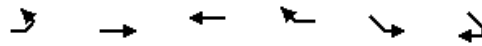
Approach	EB	WB	NB
HCM Control Delay, s	0	0	11.9
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT
Capacity (veh/h)	581	-	-	-
HCM Lane V/C Ratio	0.105	-	-	-
HCM Control Delay (s)	11.9	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.3	-	-	-

# HCM Signalized Intersection Capacity Analysis

## 27: E Madison St & Pine St

8/2/2016





















Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑	↑	↗	↘	↗
Traffic Volume (vph)	0	503	77	346	358	2
Future Volume (vph)	0	503	77	346	358	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	11	11	11
Grade (%)		9%	-4%		0%	
Total Lost time (s)		4.5	4.5	4.5	4.5	4.5
Lane Util. Factor		1.00	1.00	1.00	1.00	1.00
Frbp, ped/bikes		1.00	1.00	0.91	1.00	0.83
Flpb, ped/bikes		1.00	1.00	1.00	1.00	1.00
Frt		1.00	1.00	0.85	1.00	0.85
Flt Protected		1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)		1737	1837	1413	1678	1115
Flt Permitted		1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)		1737	1837	1413	1678	1115
Peak-hour factor, PHF	0.95	0.95	0.94	0.94	0.90	0.90
Adj. Flow (vph)	0	529	82	368	398	2
RTOR Reduction (vph)	0	0	0	139	0	1
Lane Group Flow (vph)	0	529	82	229	398	1
Confl. Peds. (#/hr)	62			62	1	43
Confl. Bikes (#/hr)				3		8
Heavy Vehicles (%)	1%	1%	2%	2%	4%	4%
Parking (#/hr)						0
Turn Type		NA	NA	Perm	Prot	Perm
Protected Phases		2	2		4	
Permitted Phases				2		4
Actuated Green, G (s)		56.0	56.0	56.0	25.0	25.0
Effective Green, g (s)		56.0	56.0	56.0	25.0	25.0
Actuated g/C Ratio		0.62	0.62	0.62	0.28	0.28
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5
Vehicle Extension (s)		0.2	0.2	0.2	0.2	0.2
Lane Grp Cap (vph)		1080	1143	879	466	309
v/s Ratio Prot		c0.30	0.04		c0.24	
v/s Ratio Perm				0.16		0.00
v/c Ratio		0.49	0.07	0.26	0.85	0.00
Uniform Delay, d1		9.2	6.7	7.7	30.8	23.5
Progression Factor		0.12	0.91	0.73	1.00	1.00
Incremental Delay, d2		1.5	0.1	0.7	13.7	0.0
Delay (s)		2.6	6.2	6.3	44.4	23.5
Level of Service		A	A	A	D	C
Approach Delay (s)		2.6	6.3		44.3	
Approach LOS		A	A		D	
<b>Intersection Summary</b>						
HCM 2000 Control Delay			15.9		HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio			0.60			
Actuated Cycle Length (s)			90.0		Sum of lost time (s)	9.0
Intersection Capacity Utilization			53.8%		ICU Level of Service	A
Analysis Period (min)			15			

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

28: 17th Ave & E Madison St

8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	769	92	0	310	5	109	29	1	101	17	4
Future Volume (vph)	0	769	92	0	310	5	109	29	1	101	17	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	11	12	11	11	12	10	12	12	16	12
Grade (%)		4%			4%			0%			0%	
Total Lost time (s)		4.5	4.5		4.5	4.5		4.5			4.5	
Lane Util. Factor		1.00	1.00		1.00	1.00		1.00			1.00	
Frbp, ped/bikes		1.00	0.87		1.00	0.76		1.00			0.99	
Flpb, ped/bikes		1.00	1.00		1.00	1.00		0.82			0.84	
Frt		1.00	0.85		1.00	0.85		1.00			1.00	
Flt Protected		1.00	1.00		1.00	1.00		0.96			0.96	
Satd. Flow (prot)		1782	1325		1765	1141		1384			1703	
Flt Permitted		1.00	1.00		1.00	1.00		0.73			0.71	
Satd. Flow (perm)		1782	1325		1765	1141		1050			1253	
Peak-hour factor, PHF	0.92	0.92	0.92	0.96	0.96	0.96	0.80	0.80	0.80	0.93	0.93	0.93
Adj. Flow (vph)	0	836	100	0	323	5	136	36	1	109	18	4
RTOR Reduction (vph)	0	0	33	0	0	2	0	0	0	0	2	0
Lane Group Flow (vph)	0	836	67	0	323	3	0	173	0	0	129	0
Confl. Peds. (#/hr)	95		44	44		95	120		113	113		120
Confl. Bikes (#/hr)			17			23			3			11
Heavy Vehicles (%)	1%	1%	1%	2%	2%	2%	1%	1%	1%	1%	1%	1%
Turn Type		NA	Perm		NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases			2			2	4			4		
Actuated Green, G (s)		60.5	60.5		60.5	60.5		20.5			20.5	
Effective Green, g (s)		60.5	60.5		60.5	60.5		20.5			20.5	
Actuated g/C Ratio		0.67	0.67		0.67	0.67		0.23			0.23	
Clearance Time (s)		4.5	4.5		4.5	4.5		4.5			4.5	
Vehicle Extension (s)		0.2	0.2		0.2	0.2		3.0			3.0	
Lane Grp Cap (vph)		1197	890		1186	767		239			285	
v/s Ratio Prot		c0.47			0.18							
v/s Ratio Perm			0.05			0.00		c0.16			0.10	
v/c Ratio		0.70	0.08		0.27	0.00		0.72			0.45	
Uniform Delay, d1		9.1	5.1		5.9	4.8		32.1			29.9	
Progression Factor		0.56	0.46		0.58	1.00		1.00			1.00	
Incremental Delay, d2		2.9	0.1		0.5	0.0		10.4			1.2	
Delay (s)		8.0	2.5		3.9	4.9		42.5			31.1	
Level of Service		A	A		A	A		D			C	
Approach Delay (s)		7.4			3.9			42.5			31.1	
Approach LOS		A			A			D			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			12.5									B
HCM 2000 Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			90.0							12.5		
Intersection Capacity Utilization			62.0%									B
Analysis Period (min)			15									
c Critical Lane Group												

**Intersection**

Int Delay, s/veh 1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↗		↑	↗			↗			↗
Traffic Vol, veh/h	0	758	113	0	288	122	0	0	120	0	0	21
Future Vol, veh/h	0	758	113	0	288	122	0	0	120	0	0	21
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	120	-	-	0	-	-	0	-	-	0
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-4	-	-	11	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	824	123	0	313	133	0	0	130	0	0	23

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	- 0 0	- - 0	- - 824	- - 313
Stage 1	- - -	- - -	- - -	- - -
Stage 2	- - -	- - -	- - -	- - -
Critical Hdwy	- - -	- - -	- - 6.22	- - 6.22
Critical Hdwy Stg 1	- - -	- - -	- - -	- - -
Critical Hdwy Stg 2	- - -	- - -	- - -	- - -
Follow-up Hdwy	- - -	- - -	- - 3.318	- - 3.318
Pot Cap-1 Maneuver	0 - -	0 - -	0 0 373	0 0 727
Stage 1	0 - -	0 - -	0 0 -	0 0 -
Stage 2	0 - -	0 - -	0 0 -	0 0 -
Platoon blocked, %	- - -	- - -	- - -	- - -
Mov Cap-1 Maneuver	- - -	- - -	- - 373	- - 727
Mov Cap-2 Maneuver	- - -	- - -	- - -	- - -
Stage 1	- - -	- - -	- - -	- - -
Stage 2	- - -	- - -	- - -	- - -





















Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	19.8	10.1
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBT	WBR	SBLn1
Capacity (veh/h)	373	-	-	-	-	727
HCM Lane V/C Ratio	0.35	-	-	-	-	0.031
HCM Control Delay (s)	19.8	-	-	-	-	10.1
HCM Lane LOS	C	-	-	-	-	B
HCM 95th %tile Q(veh)	1.5	-	-	-	-	0.1

# HCM Signalized Intersection Capacity Analysis

30: 19th Ave & E Madison St

8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 			 			 	
Traffic Volume (vph)	285	539	51	183	195	3	77	114	69	9	197	139
Future Volume (vph)	285	539	51	183	195	3	77	114	69	9	197	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	16	12	12	16	12
Grade (%)		-11%			8%			0%			0%	
Total Lost time (s)		6.0			6.0			6.0			6.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frbp, ped/bikes		0.99			1.00			1.00			0.99	
Flpb, ped/bikes		0.99			0.99			1.00			1.00	
Frt		0.99			1.00			0.96			0.95	
Flt Protected		0.98			0.98			0.99			1.00	
Satd. Flow (prot)		3482			3194			2015			1929	
Flt Permitted		0.70			0.53			0.54			0.99	
Satd. Flow (perm)		2492			1736			1109			1908	
Peak-hour factor, PHF	0.99	0.99	0.99	0.98	0.98	0.98	0.86	0.86	0.86	0.91	0.91	0.91
Adj. Flow (vph)	288	544	52	187	199	3	90	133	80	10	216	153
RTOR Reduction (vph)	0	4	0	0	0	0	0	16	0	0	31	0
Lane Group Flow (vph)	0	880	0	0	389	0	0	287	0	0	348	0
Confl. Peds. (#/hr)	26		40	40		26	7		2	2		7
Confl. Bikes (#/hr)			8			4			1			12
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	4%	4%	4%
Parking (#/hr)									0			0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2			4			4		
Actuated Green, G (s)		54.3			54.3			23.7				23.7
Effective Green, g (s)		54.3			54.3			23.7				23.7
Actuated g/C Ratio		0.60			0.60			0.26				0.26
Clearance Time (s)		6.0			6.0			6.0				6.0
Vehicle Extension (s)		0.2			0.2			3.0				3.0
Lane Grp Cap (vph)		1503			1047			292				502
v/s Ratio Prot												
v/s Ratio Perm		c0.35			0.22			c0.26				0.18
v/c Ratio		0.59			0.37			0.98				0.69
Uniform Delay, d1		10.9			9.1			32.9				29.9
Progression Factor		0.52			0.58			1.00				1.00
Incremental Delay, d2		1.4			1.0			47.5				4.1
Delay (s)		7.1			6.3			80.4				34.0
Level of Service		A			A			F				C
Approach Delay (s)		7.1			6.3			80.4				34.0
Approach LOS		A			A			F				C
<b>Intersection Summary</b>												
HCM 2000 Control Delay			23.5				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			93.3%				ICU Level of Service			F		
Analysis Period (min)			15									



c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 31: 20th Ave & E Olive St & E Madison St

8/2/2016















Movement	EBT	EBR	EBR2	WBT	NBR2	SBT	SBR	NWL	NWR	NWR2
Lane Configurations	↑↑			↑↑	↑	↕		↘		
Traffic Volume (vph)	593	14	3	278	22	10	84	40	15	66
Future Volume (vph)	593	14	3	278	22	10	84	40	15	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	13	12	16	12	12
Grade (%)	-8%			3%		0%		0%		
Total Lost time (s)	4.5			4.5	4.0	4.5		4.5		
Lane Util. Factor	0.95			0.95	1.00	1.00		1.00		
Frbp, ped/bikes	1.00			1.00	1.00	0.98		0.91		
Flpb, ped/bikes	1.00			1.00	1.00	1.00		1.00		
Frt	1.00			1.00	0.86	0.88		0.91		
Flt Protected	1.00			1.00	1.00	1.00		0.98		
Satd. Flow (prot)	3697			3521	1465	1678		1731		
Flt Permitted	1.00			1.00	1.00	1.00		0.98		
Satd. Flow (perm)	3697			3521	1465	1678		1731		
Peak-hour factor, PHF	0.97	0.97	0.97	0.94	0.79	0.59	0.59	0.82	0.82	0.82
Adj. Flow (vph)	611	14	3	296	28	17	142	49	18	80
RTOR Reduction (vph)	0	0	0	0	0	129	0	66	0	0
Lane Group Flow (vph)	628	0	0	296	28	30	0	81	0	0
Confl. Peds. (#/hr)		10	2				7		29	12
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Parking (#/hr)		0			0		0		0	0
Turn Type	NA			NA	Free	NA		Prot		
Protected Phases	2			2		4		1		
Permitted Phases					Free					
Actuated Green, G (s)	59.9			59.9	90.0	8.1		8.5		
Effective Green, g (s)	59.9			59.9	90.0	8.1		8.5		
Actuated g/C Ratio	0.67			0.67	1.00	0.09		0.09		
Clearance Time (s)	4.5			4.5		4.5		4.5		
Vehicle Extension (s)	0.2			0.2		2.0		2.0		
Lane Grp Cap (vph)	2460			2343	1465	151		163		
v/s Ratio Prot	c0.17			0.08		c0.02		c0.05		
v/s Ratio Perm					0.02					
v/c Ratio	0.26			0.13	0.02	0.20		0.50		
Uniform Delay, d1	6.1			5.5	0.0	37.9		38.7		
Progression Factor	0.30			1.34	1.00	1.00		1.00		
Incremental Delay, d2	0.2			0.1	0.0	0.2		0.9		
Delay (s)	2.0			7.5	0.0	38.2		39.6		
Level of Service	A			A	A	D		D		
Approach Delay (s)	2.0			7.5		38.2		39.6		
Approach LOS	A			A		D		D		

### Intersection Summary

HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis  
 32: 22nd Ave/E Denny Way & E Madison St

8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↑	↗		↖			↕			↕	
Traffic Volume (vph)	0	622	38	0	288	26	43	124	0	4	81	87
Future Volume (vph)	0	622	38	0	288	26	43	124	0	4	81	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	12	11	12	12	12	12	12	11	12
Grade (%)		-3%			1%			0%			0%	
Total Lost time (s)		4.5	4.5		4.5			4.5			4.5	
Lane Util. Factor		1.00	1.00		1.00			1.00			1.00	
Frbp, ped/bikes		1.00	0.92		1.00			1.00			0.94	
Flpb, ped/bikes		1.00	1.00		1.00			0.99			1.00	
Frt		1.00	0.85		0.99			1.00			0.93	
Flt Protected		1.00	1.00		1.00			0.99			1.00	
Satd. Flow (prot)		1846	1341		1786			1853			1583	
Flt Permitted		1.00	1.00		1.00			0.71			0.99	
Satd. Flow (perm)		1846	1341		1786			1333			1575	
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.64	0.64	0.64	0.77	0.77	0.77
Adj. Flow (vph)	0	699	43	0	324	29	67	194	0	5	105	113
RTOR Reduction (vph)	0	0	13	0	3	0	0	0	0	0	46	0
Lane Group Flow (vph)	0	699	30	0	350	0	0	261	0	0	177	0
Confl. Peds. (#/hr)	2		25	25		2	39		4	4		39
Confl. Bikes (#/hr)			1						10			2
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	0%	0%	0%	2%	2%	2%
Parking (#/hr)			0			0			0			
Turn Type		NA	Perm		NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases			2				4			4		
Actuated Green, G (s)		62.6	62.6		62.6			18.4				18.4
Effective Green, g (s)		62.6	62.6		62.6			18.4				18.4
Actuated g/C Ratio		0.70	0.70		0.70			0.20				0.20
Clearance Time (s)		4.5	4.5		4.5			4.5				4.5
Vehicle Extension (s)		0.2	0.2		0.2			1.0				1.0
Lane Grp Cap (vph)		1283	932		1242			272				322
v/s Ratio Prot		c0.38			0.20							
v/s Ratio Perm			0.02					c0.20				0.11
v/c Ratio		0.54	0.03		0.28			0.96				0.55
Uniform Delay, d1		6.7	4.3		5.2			35.4				32.1
Progression Factor		0.31	0.12		1.07			1.00				1.00
Incremental Delay, d2		1.6	0.1		0.6			42.7				1.0
Delay (s)		3.7	0.6		6.1			78.1				33.1
Level of Service		A	A		A			E				C
Approach Delay (s)		3.5			6.1			78.1				33.1
Approach LOS		A			A			E				C
<b>Intersection Summary</b>												
HCM 2000 Control Delay			20.6				HCM 2000 Level of Service				C	
HCM 2000 Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			9.0		
Intersection Capacity Utilization			69.1%				ICU Level of Service			C		
Analysis Period (min)			15									

c Critical Lane Group

**Intersection**

Int Delay, s/veh 0.5

Movement	SBL	SBR	NEL	NET	SWT	SWR
Lane Configurations		↗		↖	↘	
Traffic Vol, veh/h	0	53	0	751	264	11
Future Vol, veh/h	0	53	0	751	264	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	-1	5	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	58	0	816	287	12

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	293	- 0
Stage 1	-	-	- -
Stage 2	-	-	- -
Critical Hdwy	-	6.22	- -
Critical Hdwy Stg 1	-	-	- -
Critical Hdwy Stg 2	-	-	- -
Follow-up Hdwy	-	3.318	- -
Pot Cap-1 Maneuver	0	746	0 -
Stage 1	0	-	0 -
Stage 2	0	-	0 -
Platoon blocked, %			- -
Mov Cap-1 Maneuver	-	746	- -
Mov Cap-2 Maneuver	-	-	- -
Stage 1	-	-	- -
Stage 2	-	-	- -






















Approach	SB	NE	SW
HCM Control Delay, s	10.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET SBLn1	SWT	SWR
Capacity (veh/h)	- 746	-	-
HCM Lane V/C Ratio	- 0.077	-	-
HCM Control Delay (s)	- 10.2	-	-
HCM Lane LOS	- B	-	-
HCM 95th %tile Q(veh)	- 0.2	-	-

# HCM Signalized Intersection Capacity Analysis

## 34: E Madison St & 23rd Ave E



















8/2/2016

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		 									 	
Traffic Volume (vph)	0	609	32	0	617	75	270	419	61	100	200	2
Future Volume (vph)	0	609	32	0	617	75	270	419	61	100	200	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	9	9	10	10	10	10	14	10	10	11	10
Grade (%)		0%			0%			-5%			10%	
Total Lost time (s)		3.0			3.0	5.0	3.0	3.0		3.0	4.5	
Lane Util. Factor		0.95			1.00	1.00	1.00	1.00		1.00	0.95	
Frbp, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Frt		0.99			1.00	0.85	1.00	0.98		1.00	1.00	
Flt Protected		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3182			1756	1478	1693	1998		1585	3241	
Flt Permitted		1.00			1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3182			1756	1478	1693	1998		1585	3241	
Peak-hour factor, PHF	0.92	0.87	0.69	0.25	0.91	0.92	0.92	0.92	0.92	0.64	0.92	0.46
Adj. Flow (vph)	0	700	46	0	678	82	293	455	66	156	217	4
RTOR Reduction (vph)	0	6	0	0	0	47	0	5	0	0	2	0
Lane Group Flow (vph)	0	740	0	0	678	35	293	516	0	156	219	0
Confl. Peds. (#/hr)			2	2								3
Heavy Vehicles (%)	2%	1%	1%	1%	1%	2%	2%	2%	2%	1%	2%	1%
Parking (#/hr)			0									0
Turn Type		NA			NA	Perm	Prot	NA		Prot	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		38.0			38.0	38.0	17.3	27.3		10.7	20.7	
Effective Green, g (s)		40.0			40.0	38.0	18.8	28.8		12.2	20.7	
Actuated g/C Ratio		0.44			0.44	0.42	0.21	0.32		0.14	0.23	
Clearance Time (s)		5.0			5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)		0.2			0.2	0.2	2.0	0.2		2.0	0.2	
Lane Grp Cap (vph)		1414			780	624	353	639		214	745	
v/s Ratio Prot		0.23			c0.39		c0.17	c0.26		0.10	0.07	
v/s Ratio Perm						0.02						
v/c Ratio		0.52			0.87	0.06	0.83	0.81		0.73	0.29	
Uniform Delay, d1		18.1			22.6	15.4	34.1	28.1		37.3	28.6	
Progression Factor		1.00			1.00	1.00	0.89	0.80		1.34	0.99	
Incremental Delay, d2		1.4			12.6	0.2	12.6	9.1		8.1	0.8	
Delay (s)		19.5			35.3	15.6	43.0	31.4		58.1	29.2	
Level of Service		B			D	B	D	C		E	C	
Approach Delay (s)		19.5			33.1			35.6			41.2	
Approach LOS		B			C			D			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			31.2				HCM 2000 Level of Service			C		
HCM 2000 Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			10.5		
Intersection Capacity Utilization			74.1%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 35: E Madison St & E JOHN ST

8/2/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR	
Lane Configurations													
Traffic Volume (vph)	140	143	10	0	130	6	22	388	6	3	302	210	
Future Volume (vph)	140	143	10	0	130	6	22	388	6	3	302	210	
Ideal Flow (vphpl)	1900	1900	1900	1750	1750	1750	1900	1900	1900	1900	1900	1900	
Lane Width	10	10	12	10	10	10	12	11	12	12	12	12	
Grade (%)		-15%			0%			-10%			10%		
Total Lost time (s)		2.5	5.5		2.5			2.5			2.5		
Lane Util. Factor		1.00	1.00		1.00			1.00			1.00		
Frbp, ped/bikes		1.00	0.97		1.00			1.00			0.93		
Flpb, ped/bikes		1.00	1.00		1.00			1.00			1.00		
Frt		1.00	0.85		0.99			1.00			0.94		
Flt Protected		0.98	1.00		1.00			1.00			1.00		
Satd. Flow (prot)		1824	1482		1621			1916			1533		
Flt Permitted		0.98	1.00		1.00			0.96			1.00		
Satd. Flow (perm)		1824	1482		1621			1848			1530		
Peak-hour factor, PHF	0.83	0.83	0.83	0.72	0.72	0.72	0.91	0.91	0.91	0.95	0.95	0.95	
Adj. Flow (vph)	169	172	12	0	181	8	24	426	7	3	318	221	
RTOR Reduction (vph)	0	0	10	0	2	0	0	1	0	0	0	0	
Lane Group Flow (vph)	0	341	2	0	187	0	0	456	0	0	542	0	
Confl. Peds. (#/hr)	9					9	40		26	26		40	
Confl. Bikes (#/hr)			7									6	
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	4%	4%	4%	
Parking (#/hr)			0						0			0	
Turn Type	Split	NA	Perm		NA		Perm	NA		Perm	NA		
Protected Phases	3	3		4	4			2				2	
Permitted Phases		3	3				2	2		2			
Actuated Green, G (s)		18.5	18.5		13.9			41.1				41.1	
Effective Green, g (s)		21.5	18.5		16.9			44.1				44.1	
Actuated g/C Ratio		0.24	0.21		0.19			0.49				0.49	
Clearance Time (s)		5.5	5.5		5.5			5.5				5.5	
Vehicle Extension (s)		2.0	2.0		2.0			0.2				0.2	
Lane Grp Cap (vph)		435	304		304			905				749	
v/s Ratio Prot		c0.19			c0.12								
v/s Ratio Perm			0.00					0.25				c0.35	
v/c Ratio		0.78	0.01		0.62			0.50				0.72	
Uniform Delay, d1		32.1	28.4		33.6			15.5				18.1	
Progression Factor		1.00	1.00		1.00			0.18				0.81	
Incremental Delay, d2		8.3	0.0		2.6			1.2				5.4	
Delay (s)		40.4	28.5		36.2			4.0				20.1	
Level of Service		D	C		D			A				C	
Approach Delay (s)		40.0			36.2			4.0				20.1	
Approach LOS		D			D			A				C	
<b>Intersection Summary</b>													
HCM 2000 Control Delay			21.8									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.72										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	7.5
Intersection Capacity Utilization			71.0%									ICU Level of Service	C
Analysis Period (min)			15										

c Critical Lane Group



Intersection												
Int Delay, s/veh	4.3											
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	5	21	14	15	27	10	39	478	10	10	500	13
Future Vol, veh/h	5	21	14	15	27	10	39	478	10	10	500	13
Conflicting Peds, #/hr	6	0	3	3	0	6	23	0	36	36	0	23
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	2	-	-	1	-	-	-10	-	-	14	-
Peak Hour Factor	71	71	71	75	75	75	98	98	98	96	96	96
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	2	2	2
Mvmt Flow	7	30	20	20	36	13	40	488	10	10	521	14

Major/Minor	Minor1			Minor2			Major1			Major2		
Conflicting Flow All	1187	1186	532	1171	1185	557	557	0	0	534	0	0
Stage 1	608	608	-	571	571	-	-	-	-	-	-	-
Stage 2	579	578	-	600	614	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.9	6.4	7.3	6.7	6.3	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.5	5.9	-	6.3	5.7	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.9	-	6.3	5.7	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	146	167	535	160	178	526	1014	-	-	1034	-	-
Stage 1	454	457	-	493	492	-	-	-	-	-	-	-
Stage 2	473	473	-	475	470	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	107	148	517	121	158	513	1008	-	-	1031	-	-
Mov Cap-2 Maneuver	107	148	-	121	158	-	-	-	-	-	-	-
Stage 1	416	419	-	457	476	-	-	-	-	-	-	-
Stage 2	417	457	-	400	431	-	-	-	-	-	-	-

Approach	NB	SB	NE	SW
HCM Control Delay, s	32.8	41.8	0.6	0.2
HCM LOS	D	E		

Minor Lane/Major Mvmt	NEL	NET	NER	NBLn1	SBLn1	SWL	SWT	SWR
Capacity (veh/h)	1008	-	-	185	165	1031	-	-
HCM Lane V/C Ratio	0.039	-	-	0.305	0.42	0.01	-	-
HCM Control Delay (s)	8.7	0	-	32.8	41.8	8.5	0	-
HCM Lane LOS	A	A	-	D	E	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	1.2	1.9	0	-	-

**Intersection**

Int Delay, s/veh 0.7

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	Y			Y	Y	
Traffic Vol, veh/h	2	14	30	410	517	3
Future Vol, veh/h	2	14	30	410	517	3
Conflicting Peds, #/hr	3	0	27	0	0	27
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	-3	-	-	-14	10	-
Peak Hour Factor	50	50	92	92	95	95
Heavy Vehicles, %	0	0	2	2	2	2
Mvmt Flow	4	28	33	446	544	3

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1087	573	574	0	-	0
Stage 1	573	-	-	-	-	-
Stage 2	514	-	-	-	-	-
Critical Hdwy	5.8	5.9	4.12	-	-	-
Critical Hdwy Stg 1	4.8	-	-	-	-	-
Critical Hdwy Stg 2	4.8	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.218	-	-	-
Pot Cap-1 Maneuver	289	548	999	-	-	-
Stage 1	625	-	-	-	-	-
Stage 2	659	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	264	536	999	-	-	-
Mov Cap-2 Maneuver	264	-	-	-	-	-
Stage 1	611	-	-	-	-	-
Stage 2	616	-	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	13.1	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	999	-	475	-	-
HCM Lane V/C Ratio	0.033	-	0.067	-	-
HCM Control Delay (s)	8.7	0	13.1	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

**Intersection**

Int Delay, s/veh 0.7

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations	↘		↗		↘	↗
Traffic Vol, veh/h	7	24	357	44	8	502
Future Vol, veh/h	7	24	357	44	8	502
Conflicting Peds, #/hr	4	0	0	31	31	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	50	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	-10	-	-	8
Peak Hour Factor	65	65	93	93	96	96
Heavy Vehicles, %	0	0	3	3	2	2
Mvmt Flow	11	37	384	47	8	523

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	983	439	0	0	462	0
Stage 1	439	-	-	-	-	-
Stage 2	544	-	-	-	-	-
Critical Hdwy	7.1	6.2	-	-	4.12	-
Critical Hdwy Stg 1	6.1	-	-	-	-	-
Critical Hdwy Stg 2	6.1	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.218	-
Pot Cap-1 Maneuver	230	622	-	-	1099	-
Stage 1	601	-	-	-	-	-
Stage 2	527	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	222	606	-	-	1099	-
Mov Cap-2 Maneuver	222	-	-	-	-	-
Stage 1	601	-	-	-	-	-
Stage 2	521	-	-	-	-	-

Approach	NW		NE		SW
HCM Control Delay, s	14.3		0		0.1
HCM LOS	B				

Minor Lane/Major Mvmt	NET	NERNWLn1	SWL	SWT
Capacity (veh/h)	-	-	436	1099
HCM Lane V/C Ratio	-	-	0.109	0.008
HCM Control Delay (s)	-	-	14.3	8.3
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.4	0

**Intersection**

Int Delay, s/veh 0.6

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations	↘		↖	↗	↘	
Traffic Vol, veh/h	2	21	24	357	489	10
Future Vol, veh/h	2	21	24	357	489	10
Conflicting Peds, #/hr	19	0	19	0	0	19
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	50	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	-8	4	-
Peak Hour Factor	82	82	93	93	96	96
Heavy Vehicles, %	0	0	3	3	2	2
Mvmt Flow	2	26	26	384	509	10



















Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	988	534	539 0
Stage 1	534	-	-
Stage 2	454	-	-
Critical Hdwy	6.4	6.2	4.13 -
Critical Hdwy Stg 1	5.4	-	-
Critical Hdwy Stg 2	5.4	-	-
Follow-up Hdwy	3.5	3.3	2.227 -
Pot Cap-1 Maneuver	276	550	1024 -
Stage 1	592	-	-
Stage 2	644	-	-
Platoon blocked, %			-
Mov Cap-1 Maneuver	261	541	1024 -
Mov Cap-2 Maneuver	393	-	-
Stage 1	583	-	-
Stage 2	618	-	-

Approach	SE	NE	SW
HCM Control Delay, s	12.3	0.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SWT	SWR
Capacity (veh/h)	1024	-	524	-	-
HCM Lane V/C Ratio	0.025	-	0.054	-	-
HCM Control Delay (s)	8.6	-	12.3	-	-
HCM Lane LOS	A	-	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	-	-

HCM Signalized Intersection Capacity Analysis  
 40: E Madison St & MLK Jr Way E/28th Ave E



















8/2/2016

												
Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	135	100	187	57	214	11	12	287	55	123	360	21
Future Volume (vph)	135	100	187	57	214	11	12	287	55	123	360	21
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	10	11	10	9	16	10
Grade (%)		2%			-1%			-4%			2%	
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frbp, ped/bikes		0.95			1.00		1.00	0.97		1.00	0.99	
Flpb, ped/bikes		0.99			0.99		0.96	1.00		0.92	1.00	
Frt		0.94			0.99		1.00	0.98		1.00	0.99	
Flt Protected		0.98			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1602			1862		1608	1723		1421	2022	
Flt Permitted		0.73			0.83		0.44	1.00		0.48	1.00	
Satd. Flow (perm)		1181			1560		746	1723		716	2022	
Peak-hour factor, PHF	0.91	0.91	0.91	0.95	0.95	0.95	0.95	0.95	0.95	0.94	0.94	0.94
Adj. Flow (vph)	148	110	205	60	225	12	13	302	58	131	383	22
RTOR Reduction (vph)	0	0	0	0	0	0	0	5	0	0	1	0
Lane Group Flow (vph)	0	463	0	0	297	0	13	355	0	131	404	0
Confl. Peds. (#/hr)	26		36	36		26	32		64	64		32
Confl. Bikes (#/hr)			9			15			6			5
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	3%	3%	3%	4%	4%	4%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)		32.9			32.9		48.1	48.1		48.1	48.1	
Effective Green, g (s)		32.9			32.9		48.1	48.1		48.1	48.1	
Actuated g/C Ratio		0.37			0.37		0.53	0.53		0.53	0.53	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		431			570		398	920		382	1080	
v/s Ratio Prot								c0.21			0.20	
v/s Ratio Perm		c0.39			0.19		0.02			0.18		
v/c Ratio		1.07			0.52		0.03	0.39		0.34	0.37	
Uniform Delay, d1		28.6			22.4		9.9	12.3		11.9	12.2	
Progression Factor		1.00			1.00		0.35	0.39		1.00	1.00	
Incremental Delay, d2		64.6			0.9		0.1	1.1		2.4	1.0	
Delay (s)		93.2			23.2		3.6	5.9		14.4	13.2	
Level of Service		F			C		A	A		B	B	
Approach Delay (s)		93.2			23.2			5.8			13.5	
Approach LOS		F			C			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			35.6				HCM 2000 Level of Service			D		
HCM 2000 Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			13.5		
Intersection Capacity Utilization			77.9%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 41: 1st Ave & Spring St













8/2/2016

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 								 			
Traffic Volume (vph)	91	220	16	0	0	0	0	321	106	82	332	0	
Future Volume (vph)	91	220	16	0	0	0	0	321	106	82	332	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	10	12	10	12	12	12	10	11	10	10	11	10	
Grade (%)		9%			0%			3%			0%		
Total Lost time (s)		4.5						4.5		4.5	4.5		
Lane Util. Factor		0.95						1.00		1.00	1.00		
Frbp, ped/bikes		0.97						0.90		1.00	1.00		
Flpb, ped/bikes		0.94						1.00		1.00	1.00		
Frt		0.99						0.97		1.00	1.00		
Flt Protected		0.99						1.00		0.95	1.00		
Satd. Flow (prot)		2755						1395		1501	1637		
Flt Permitted		0.99						1.00		0.95	1.00		
Satd. Flow (perm)		2755						1395		1501	1637		
Peak-hour factor, PHF	0.88	0.88	0.88	0.25	0.25	0.25	0.95	0.95	0.95	0.93	0.93	0.93	
Adj. Flow (vph)	103	250	18	0	0	0	0	338	112	88	357	0	
RTOR Reduction (vph)	0	4	0	0	0	0	0	13	0	0	0	0	
Lane Group Flow (vph)	0	367	0	0	0	0	0	437	0	88	357	0	
Confl. Peds. (#/hr)	90		309	309			90	502		488	488	502	
Confl. Bikes (#/hr)			1				5			12		28	
Heavy Vehicles (%)	2%	0%	0%	0%	0%	0%	0%	1%	1%	1%	1%	0%	
Turn Type	Perm	NA						NA		Prot	NA		
Protected Phases		4						9		2	6		
Permitted Phases	4	4											
Actuated Green, G (s)		19.5						37.5		19.5	61.5		
Effective Green, g (s)		19.5						37.5		19.5	61.5		
Actuated g/C Ratio		0.22						0.42		0.22	0.68		
Clearance Time (s)		4.5						4.5		4.5	4.5		
Vehicle Extension (s)		0.2						0.2		0.2	0.2		
Lane Grp Cap (vph)		596						581		325	1118		
v/s Ratio Prot								c0.31		0.06	c0.22		
v/s Ratio Perm		0.13											
v/c Ratio		0.62						0.75		0.27	0.32		
Uniform Delay, d1		31.9						22.3		29.3	5.8		
Progression Factor		1.00						0.69		1.00	1.00		
Incremental Delay, d2		4.7						8.2		2.0	0.8		
Delay (s)		36.6						23.5		31.4	6.5		
Level of Service		D						C		C	A		
Approach Delay (s)		36.6			0.0			23.5			11.4		
Approach LOS		D			A			C			B		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			23.1									HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio			0.64										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	17.0
Intersection Capacity Utilization			59.7%									ICU Level of Service	B
Analysis Period (min)			15										
c Critical Lane Group													

# HCM Signalized Intersection Capacity Analysis

## 42: 2nd Ave & Spring St

8/2/2016





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗							↘	↑↑	
Traffic Volume (vph)	0	348	112	0	0	0	0	0	0	126	1449	0
Future Volume (vph)	0	348	112	0	0	0	0	0	0	126	1449	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	10	10	10	10	10	10
Grade (%)		12%			0%			0%			0%	
Total Lost time (s)		4.0	4.0							3.5	4.0	
Lane Util. Factor		0.95	1.00							1.00	0.95	
Frbp, ped/bikes		1.00	0.78							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		1.00	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		2795	976							1204	2203	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		2795	976							1204	2203	
Peak-hour factor, PHF	0.92	0.92	0.92	0.25	0.25	0.25	0.25	0.25	0.25	0.97	0.97	0.97
Adj. Flow (vph)	0	378	122	0	0	0	0	0	0	130	1494	0
RTOR Reduction (vph)	0	0	46	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	378	76	0	0	0	0	0	0	130	1494	0
Confl. Peds. (#/hr)	200		178	178		200	340		348	348		340
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	0%	0%	0%	7%	7%	7%
Parking (#/hr)										10	69	69
Turn Type		NA	custom							Prot	NA	
Protected Phases		2 5	5							4	1	
Permitted Phases			2									
Actuated Green, G (s)		27.0	22.5							32.5	54.5	
Effective Green, g (s)		27.5	22.5							33.0	55.0	
Actuated g/C Ratio		0.31	0.25							0.37	0.61	
Clearance Time (s)			4.0							4.0	4.5	
Lane Grp Cap (vph)		854	244							441	1346	
v/s Ratio Prot		c0.14	0.02							0.11	c0.68	
v/s Ratio Perm			0.06									
v/c Ratio		0.44	0.31							0.29	1.11	
Uniform Delay, d1		25.1	27.5							20.2	17.5	
Progression Factor		0.73	0.59							1.00	1.00	
Incremental Delay, d2		1.4	2.9							1.7	60.5	
Delay (s)		19.7	19.0							21.9	78.0	
Level of Service		B	B							C	E	
Approach Delay (s)		19.5			0.0			0.0			73.5	
Approach LOS		B			A			A			E	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			60.8									HCM 2000 Level of Service E
HCM 2000 Volume to Capacity ratio			0.98									
Actuated Cycle Length (s)			90.0							15.0		Sum of lost time (s)
Intersection Capacity Utilization			66.4%									ICU Level of Service C
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 43: 3rd Ave & Spring St

8/2/2016



















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 	 					 			 	
Traffic Volume (vph)	5	529	18	0	0	0	0	0	30	0	55	0
Future Volume (vph)	5	529	18	0	0	0	0	0	30	0	55	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	12	12	12	11	12	12	11	12
Grade (%)		10%			-10%			0%			0%	
Total Lost time (s)		4.0	4.5					4.0			4.0	
Lane Util. Factor		0.95	1.00					0.95			0.95	
Frbp, ped/bikes		1.00	0.87					0.61			1.00	
Flpb, ped/bikes		1.00	1.00					1.00			1.00	
Frt		1.00	0.85					0.85			1.00	
Flt Protected		1.00	1.00					1.00			1.00	
Satd. Flow (prot)		2593	1200					1433			1753	
Flt Permitted		1.00	1.00					1.00			1.00	
Satd. Flow (perm)		2593	1200					1433			1753	
Peak-hour factor, PHF	0.97	0.97	0.97	0.25	0.25	0.25	0.80	0.80	0.80	0.91	0.91	0.91
Adj. Flow (vph)	5	545	19	0	0	0	0	0	38	0	60	0
RTOR Reduction (vph)	0	0	8	0	0	0	0	27	0	0	0	0
Lane Group Flow (vph)	0	550	11	0	0	0	0	11	0	0	60	0
Confl. Peds. (#/hr)	396		213	213		396	650		405	405		650
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	87%	0%	40%	67%	0%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	60	0	0	34	0
Parking (#/hr)		15										
Turn Type	Perm	NA	custom					NA			NA	
Protected Phases		2	6					4			4	
Permitted Phases	2		5							4		
Actuated Green, G (s)		56.5	52.0					24.5			24.5	
Effective Green, g (s)		57.0	52.0					25.0			25.0	
Actuated g/C Ratio		0.63	0.58					0.28			0.28	
Clearance Time (s)		4.5	4.5					4.5			4.5	
Lane Grp Cap (vph)		1642	753					398			486	
v/s Ratio Prot			0.01					0.01			c0.03	
v/s Ratio Perm		0.21	0.00									
v/c Ratio		0.33	0.02					0.03			0.12	
Uniform Delay, d1		7.7	8.1					23.6			24.3	
Progression Factor		0.33	0.31					1.00			1.00	
Incremental Delay, d2		0.5	0.0					0.1			0.5	
Delay (s)		3.1	2.6					23.8			24.8	
Level of Service		A	A					C			C	
Approach Delay (s)		3.1			0.0			23.8			24.8	
Approach LOS		A			A			C			C	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			6.2					HCM 2000 Level of Service			A	
HCM 2000 Volume to Capacity ratio			0.29									
Actuated Cycle Length (s)			90.0					Sum of lost time (s)		13.0		
Intersection Capacity Utilization			38.9%					ICU Level of Service		A		
Analysis Period (min)			15									
c Critical Lane Group												



# HCM Signalized Intersection Capacity Analysis

## 44: 4th Ave & Spring St

8/2/2016













												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 						  				
Traffic Volume (vph)	112	412	0	0	0	0	0	1274	99	0	0	0
Future Volume (vph)	112	412	0	0	0	0	0	1274	99	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	12	12	12	10	12	12	12	12
Grade (%)		15%			-5%			5%			0%	
Total Lost time (s)		4.5						5.5	5.5			
Lane Util. Factor		0.95						0.91	1.00			
Frbp, ped/bikes		1.00						1.00	0.59			
Flpb, ped/bikes		0.93						1.00	1.00			
Frt		1.00						1.00	0.85			
Flt Protected		0.99						1.00	1.00			
Satd. Flow (prot)		2330						3704	818			
Flt Permitted		0.99						1.00	1.00			
Satd. Flow (perm)		2330						3704	818			
Peak-hour factor, PHF	0.96	0.96	0.96	0.25	0.25	0.25	0.95	0.95	0.95	0.25	0.25	0.25
Adj. Flow (vph)	117	429	0	0	0	0	0	1341	104	0	0	0
RTOR Reduction (vph)	0	11	0	0	0	0	0	0	13	0	0	0
Lane Group Flow (vph)	0	535	0	0	0	0	0	1341	91	0	0	0
Confl. Peds. (#/hr)	315		294	294			315	452		497	497	452
Heavy Vehicles (%)	0%	1%	0%	0%	0%	0%	0%	8%	2%	0%	0%	0%
Parking (#/hr)		15						15				
Turn Type	Perm	NA						NA	Perm			
Protected Phases		2						4				
Permitted Phases	2								4			
Actuated Green, G (s)		33.5						47.5	47.5			
Effective Green, g (s)		33.5						46.5	46.5			
Actuated g/C Ratio		0.37						0.52	0.52			
Clearance Time (s)		4.5						4.5	4.5			
Lane Grp Cap (vph)		867						1913	422			
v/s Ratio Prot								c0.36				
v/s Ratio Perm		0.23							0.11			
v/c Ratio		0.62						0.70	0.22			
Uniform Delay, d1		23.0						16.5	11.8			
Progression Factor		1.45						0.70	0.33			
Incremental Delay, d2		3.2						1.5	0.8			
Delay (s)		36.4						13.1	4.6			
Level of Service		D						B	A			
Approach Delay (s)		36.4			0.0			12.4			0.0	
Approach LOS		D			A			B			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			19.0					HCM 2000 Level of Service		B		
HCM 2000 Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			90.0					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

# HCM Signalized Intersection Capacity Analysis

## 45: 5th Ave & Spring St

8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗								↖↑↑	
Traffic Volume (vph)	0	501	84	0	0	0	0	0	0	499	546	0
Future Volume (vph)	0	501	84	0	0	0	0	0	0	499	546	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	10	12	12	12	12	12	12	10	10	12
Grade (%)		15%			-5%			0%			0%	
Total Lost time (s)		3.5	5.0								2.5	
Lane Util. Factor		0.95	1.00								0.91	
Frbp, ped/bikes		1.00	0.75								1.00	
Flpb, ped/bikes		1.00	1.00								0.86	
Frt		1.00	0.85								1.00	
Flt Protected		1.00	1.00								0.98	
Satd. Flow (prot)		2492	927								3575	
Flt Permitted		1.00	1.00								0.98	
Satd. Flow (perm)		2492	927								3575	
Peak-hour factor, PHF	0.90	0.90	0.90	0.25	0.25	0.25	0.25	0.25	0.25	0.93	0.93	0.93
Adj. Flow (vph)	0	557	93	0	0	0	0	0	0	537	587	0
RTOR Reduction (vph)	0	0	32	0	0	0	0	0	0	0	26	0
Lane Group Flow (vph)	0	557	61	0	0	0	0	0	0	0	1098	0
Confl. Peds. (#/hr)	210		133	133		210	392		208	208		392
Heavy Vehicles (%)	0%	2%	2%	0%	0%	0%	0%	0%	0%	1%	3%	0%
Parking (#/hr)		30										
Turn Type		NA	Perm							custom	NA	
Protected Phases		2								3	8	
Permitted Phases			2							4		
Actuated Green, G (s)		38.0	38.0								43.0	
Effective Green, g (s)		39.5	38.0								44.5	
Actuated g/C Ratio		0.44	0.42								0.49	
Clearance Time (s)		5.0	5.0								4.0	
Lane Grp Cap (vph)		1093	391								1767	
v/s Ratio Prot		c0.22									c0.16	
v/s Ratio Perm			0.07								0.14	
v/c Ratio		0.51	0.16								0.62	
Uniform Delay, d1		18.2	16.1								16.6	
Progression Factor		0.49	0.51								1.00	
Incremental Delay, d2		1.5	0.8								1.7	
Delay (s)		10.5	9.0								18.3	
Level of Service		B	A								B	
Approach Delay (s)		10.3			0.0			0.0			18.3	
Approach LOS		B			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			15.3				HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio			0.59									
Actuated Cycle Length (s)			90.0				Sum of lost time (s)			9.0		
Intersection Capacity Utilization			59.4%				ICU Level of Service			B		
Analysis Period (min)			15									

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 46: 6th Ave & I-5 CD SB On-Ramp & Spring St

8/2/2016





















Movement	EBL	EBT	EBR	NBT	NBR2
Lane Configurations		↔	↔	↕	↔
Traffic Volume (vph)	70	151	777	141	712
Future Volume (vph)	70	151	777	141	712
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Lane Width	12	10	10	10	12
Grade (%)		10%		5%	
Total Lost time (s)		4.5	4.5	4.5	4.5
Lane Util. Factor		1.00	1.00	0.95	1.00
Frbp, ped/bikes		1.00	1.00	1.00	1.00
Flpb, ped/bikes		0.90	1.00	1.00	1.00
Frt		1.00	0.85	1.00	0.85
Flt Protected		0.98	1.00	1.00	1.00
Satd. Flow (prot)		1075	1276	2927	1403
Flt Permitted		0.98	1.00	1.00	1.00
Satd. Flow (perm)		1075	1276	2927	1403
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	75	162	835	152	766
RTOR Reduction (vph)	0	45	0	0	0
Lane Group Flow (vph)	0	192	835	152	766
Confl. Peds. (#/hr)	224				
Heavy Vehicles (%)	1%	1%	1%	1%	1%
Bus Blockages (#/hr)	0	5	0	0	0
Parking (#/hr)		15			
Turn Type	Perm	NA	Prot	NA	custom
Protected Phases		2	2	4	4
Permitted Phases	2				1 9
Actuated Green, G (s)		50.5	50.5	30.5	30.5
Effective Green, g (s)		50.5	50.5	30.5	30.5
Actuated g/C Ratio		0.56	0.56	0.34	0.34
Clearance Time (s)		4.5	4.5	4.5	4.5
Vehicle Extension (s)		0.2	0.2	0.2	0.2
Lane Grp Cap (vph)		603	715	991	475
v/s Ratio Prot			c0.65	0.05	c0.55
v/s Ratio Perm		0.18			
v/c Ratio		0.32	1.17	0.15	1.61
Uniform Delay, d1		10.6	19.8	20.7	29.8
Progression Factor		0.52	0.57	0.78	0.80
Incremental Delay, d2		1.2	88.2	0.3	283.2
Delay (s)		6.7	99.5	16.5	307.1
Level of Service		A	F	B	F
Approach Delay (s)		79.0		259.0	
Approach LOS		E		F	
<b>Intersection Summary</b>					
HCM 2000 Control Delay			162.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio			1.46		
Actuated Cycle Length (s)			90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization			109.9%	ICU Level of Service	H
Analysis Period (min)			15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 47: 7th Ave/Hubbell PI & Spring St

8/2/2016

















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations		 						 			 		
Traffic Volume (vph)	38	119	12	0	0	0	0	315	105	0	215	0	
Future Volume (vph)	38	119	12	0	0	0	0	315	105	0	215	0	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width	12	14	12	12	12	12	12	12	12	12	12	12	
Total Lost time (s)		4.5						4.5			4.5		
Lane Util. Factor		0.95						1.00			1.00		
Frbp, ped/bikes		0.99						1.00			1.00		
Flpb, ped/bikes		0.88						1.00			1.00		
Frt		0.99						0.97			1.00		
Flt Protected		0.99						1.00			1.00		
Satd. Flow (prot)		2821						1644			1676		
Flt Permitted		0.99						1.00			1.00		
Satd. Flow (perm)		2821						1644			1676		
Peak-hour factor, PHF	0.87	0.92	0.87	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.85	0.85	
Adj. Flow (vph)	44	129	14	0	0	0	0	342	114	0	253	0	
RTOR Reduction (vph)	0	7	0	0	0	0	0	13	0	0	0	0	
Lane Group Flow (vph)	0	180	0	0	0	0	0	443	0	0	253	0	
Confl. Peds. (#/hr)	166		20					4				4	
Heavy Vehicles (%)	17%	2%	0%	2%	2%	2%	0%	0%	2%	2%	2%	0%	
Turn Type	Perm	NA						NA			NA		
Protected Phases		2						4			4		
Permitted Phases	2									4			
Actuated Green, G (s)		24.5						56.5			56.5		
Effective Green, g (s)		24.5						56.5			56.5		
Actuated g/C Ratio		0.27						0.63			0.63		
Clearance Time (s)		4.5						4.5			4.5		
Lane Grp Cap (vph)		767						1032			1052		
v/s Ratio Prot								c0.27			0.15		
v/s Ratio Perm		0.06											
v/c Ratio		0.24						0.43			0.24		
Uniform Delay, d1		25.5						8.5			7.3		
Progression Factor		0.49						0.26			1.00		
Incremental Delay, d2		0.7						1.1			0.5		
Delay (s)		13.2						3.3			7.9		
Level of Service		B						A			A		
Approach Delay (s)		13.2			0.0			3.3			7.9		
Approach LOS		B			A			A			A		
<b>Intersection Summary</b>													
HCM 2000 Control Delay			6.7									HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.37										
Actuated Cycle Length (s)			90.0									Sum of lost time (s)	9.0
Intersection Capacity Utilization			45.5%									ICU Level of Service	A
Analysis Period (min)			15										

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

## 48: 8th Ave & Spring St


















8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 										
Traffic Volume (vph)	72	140	12	0	0	0	0	201	17	105	186	0
Future Volume (vph)	72	140	12	0	0	0	0	201	17	105	186	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5						4.5			4.5	
Lane Util. Factor		0.95						1.00			1.00	
Frb, ped/bikes		0.99						0.98			1.00	
Flpb, ped/bikes		0.89						1.00			0.95	
Frt		0.99						0.99			1.00	
Flt Protected		0.98						1.00			0.98	
Satd. Flow (prot)		3034						1816			1744	
Flt Permitted		0.98						1.00			0.81	
Satd. Flow (perm)		3034						1816			1433	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	78	152	13	0	0	0	0	218	18	114	202	0
RTOR Reduction (vph)	0	5	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	0	238	0	0	0	0	0	233	0	0	316	0
Confl. Peds. (#/hr)	116		65					115	104	104		115
Confl. Bikes (#/hr)			5						13			2
Turn Type	Perm	NA						NA		Perm	NA	
Protected Phases		2						4			4	
Permitted Phases	2									4		
Actuated Green, G (s)		27.5						53.5			53.5	
Effective Green, g (s)		27.5						53.5			53.5	
Actuated g/C Ratio		0.31						0.59			0.59	
Clearance Time (s)		4.5						4.5			4.5	
Lane Grp Cap (vph)		927						1079			851	
v/s Ratio Prot								0.13				
v/s Ratio Perm		0.08									c0.22	
v/c Ratio		0.26						0.22			0.37	
Uniform Delay, d1		23.5						8.5			9.5	
Progression Factor		0.60						0.46			1.00	
Incremental Delay, d2		0.6						0.4			1.2	
Delay (s)		14.7						4.3			10.7	
Level of Service		B						A			B	
Approach Delay (s)		14.7			0.0			4.3			10.7	
Approach LOS		B			A			A			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			10.1					HCM 2000 Level of Service		B		
HCM 2000 Volume to Capacity ratio			0.33									
Actuated Cycle Length (s)			90.0					Sum of lost time (s)		9.0		
Intersection Capacity Utilization			51.8%					ICU Level of Service		A		
Analysis Period (min)			15									
c Critical Lane Group												

# HCM Signalized Intersection Capacity Analysis

## 49: 9th Ave & Spring St

8/2/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	40	60	162	131	0	10	0	64	1	1	171	0
Future Volume (vph)	40	60	162	131	0	10	0	64	1	1	171	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	11	12	12	12	12
Total Lost time (s)	4.5	4.5			4.5			4.5			4.5	
Lane Util. Factor	1.00	1.00			1.00			1.00			1.00	
Frbp, ped/bikes	1.00	0.86			0.96			1.00			1.00	
Flpb, ped/bikes	0.59	1.00			0.89			1.00			1.00	
Fr t	1.00	0.89			0.99			1.00			1.00	
Fl t Protected	0.95	1.00			0.96			1.00			1.00	
Satd. Flow (prot)	1053	1425			1511			1788			1859	
Fl t Permitted	0.67	1.00			0.61			1.00			1.00	
Satd. Flow (perm)	745	1425			959			1788			1859	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	65	176	142	0	11	0	70	1	1	186	0
RTOR Reduction (vph)	0	79	0	0	8	0	0	1	0	0	0	0
Lane Group Flow (vph)	43	162	0	0	145	0	0	70	0	0	187	0
Confl. Peds. (#/hr)	209		58	58		209	104		111	111		104
Confl. Bikes (#/hr)			4			1			4			3
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		2			2			4				4
Permitted Phases	2			2						4		
Actuated Green, G (s)	49.5	49.5			49.5			31.5			31.5	
Effective Green, g (s)	49.5	49.5			49.5			31.5			31.5	
Actuated g/C Ratio	0.55	0.55			0.55			0.35			0.35	
Clearance Time (s)	4.5	4.5			4.5			4.5			4.5	
Lane Grp Cap (vph)	409	783			527			625			650	
v/s Ratio Prot		0.11						0.04				
v/s Ratio Perm	0.06				c0.15						0.10	
v/c Ratio	0.11	0.21			0.27			0.11			0.29	
Uniform Delay, d1	9.7	10.3			10.7			19.8			21.1	
Progression Factor	0.70	0.44			1.00			1.96			1.00	
Incremental Delay, d2	0.5	0.6			1.3			0.4			1.1	
Delay (s)	7.3	5.1			12.0			39.2			22.3	
Level of Service	A	A			B			D			C	
Approach Delay (s)		5.4			12.0			39.2			22.3	
Approach LOS		A			B			D			C	

### Intersection Summary

HCM 2000 Control Delay	14.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

# HCM Signalized Intersection Capacity Analysis

50: 14th Ave & Pike St

8/4/2016



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	0	36	45	3	2	2	267	0	0	363	1
Future Volume (vph)	4	0	36	45	3	2	2	267	0	0	363	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	10	12	12	16	12	12	16	12	12	16	12
Grade (%)		6%			-6%			0%				0%
Total Lost time (s)	4.5		4.5		4.5			4.5			4.5	
Lane Util. Factor	1.00		1.00		1.00			1.00			1.00	
Frt	1.00		0.85		0.99			1.00			1.00	
Flt Protected	0.95		1.00		0.96			1.00			1.00	
Satd. Flow (prot)	1717		1536		2070			2110			1899	
Flt Permitted	0.72		1.00		0.96			1.00			1.00	
Satd. Flow (perm)	1304		1536		2070			2107			1899	
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)	4	0	39	49	3	2	2	290	0	0	395	1
RTOR Reduction (vph)	0	0	36	0	1	0	0	0	0	0	0	0
Lane Group Flow (vph)	4	0	3	0	53	0	0	292	0	0	396	0
Parking (#/hr)		0										0
Turn Type	Perm		Perm	Perm	NA		Perm	NA			NA	
Protected Phases					4			3				3
Permitted Phases	2		2	4			3					
Actuated Green, G (s)	7.0		7.0		48.5			32.5				32.5
Effective Green, g (s)	7.0		7.0		48.5			32.5				32.5
Actuated g/C Ratio	0.08		0.08		0.54			0.36				0.36
Clearance Time (s)	4.5		4.5		4.5			4.5				4.5
Lane Grp Cap (vph)	101		119		1115			760				685
v/s Ratio Prot												c0.21
v/s Ratio Perm	0.00		0.00		0.03			0.14				
v/c Ratio	0.04		0.03		0.05			0.38				0.58
Uniform Delay, d1	38.4		38.3		9.8			21.3				23.2
Progression Factor	1.00		1.00		0.73			0.18				1.00
Incremental Delay, d2	0.7		0.4		0.1			0.7				3.5
Delay (s)	39.1		38.7		7.2			4.4				26.7
Level of Service	D		D		A			A				C
Approach Delay (s)		38.8			7.2			4.4				26.7
Approach LOS		D			A			A				C

## Intersection Summary

HCM 2000 Control Delay	17.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.28		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group




















## ***OFF-CORRIDOR INTERSECTIONS***

---

# HCM Signalized Intersection Capacity Analysis

## 51: 15th Ave E & E DENNY WAY/E Denny Wy

9/7/2016




















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	12	11	72	27	154	10	236	22	57	249	11
Future Volume (vph)	12	12	11	72	27	154	10	236	22	57	249	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	10	12	12	12	12	12	12	12
Total Lost time (s)		4.5			4.5			4.5	4.5		4.5	
Lane Util. Factor		1.00			1.00			1.00	1.00		1.00	
Frbp, ped/bikes		0.97			0.93			1.00	0.80		0.99	
Flpb, ped/bikes		0.98			0.98			1.00	1.00		0.98	
Frt		0.96			0.92			1.00	0.85		1.00	
Flt Protected		0.98			0.99			1.00	1.00		0.99	
Satd. Flow (prot)		1699			1420			1633	1122		1751	
Flt Permitted		0.83			0.88			0.99	1.00		0.90	
Satd. Flow (perm)		1437			1273			1612	1122		1598	
Peak-hour factor, PHF	0.55	0.55	0.55	0.91	0.91	0.91	0.85	0.85	0.85	0.93	0.93	0.93
Adj. Flow (vph)	22	22	20	79	30	169	12	278	26	61	268	12
RTOR Reduction (vph)	0	16	0	0	103	0	0	0	9	0	1	0
Lane Group Flow (vph)	0	48	0	0	175	0	0	290	17	0	340	0
Confl. Peds. (#/hr)	52		50	50		52	111		100	100		111
Confl. Bikes (#/hr)			3			1			12			6
Heavy Vehicles (%)	0%	0%	0%	3%	3%	3%	4%	4%	4%	4%	4%	4%
Parking (#/hr)			0					0	0			0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			4			2			6	
Permitted Phases	4			4			2		2	6		
Actuated Green, G (s)		14.7			14.7			46.3	46.3		46.3	
Effective Green, g (s)		14.7			14.7			46.3	46.3		46.3	
Actuated g/C Ratio		0.21			0.21			0.66	0.66		0.66	
Clearance Time (s)		4.5			4.5			4.5	4.5		4.5	
Vehicle Extension (s)		3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		301			267			1066	742		1056	
v/s Ratio Prot												
v/s Ratio Perm		0.03			c0.14			0.18	0.02		c0.21	
v/c Ratio		0.16			0.65			0.27	0.02		0.32	
Uniform Delay, d1		22.6			25.3			4.9	4.1		5.1	
Progression Factor		1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2		0.3			5.6			0.6	0.1		0.8	
Delay (s)		22.9			31.0			5.5	4.1		5.9	
Level of Service		C			C			A	A		A	
Approach Delay (s)		22.9			31.0			5.4			5.9	
Approach LOS		C			C			A			A	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			13.8									B
HCM 2000 Volume to Capacity ratio			0.40									
Actuated Cycle Length (s)			70.0								9.0	
Intersection Capacity Utilization			65.9%									C
Analysis Period (min)			15									
c Critical Lane Group												

Intersection												
Int Delay, s/veh	3.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	7	1	13	7	80	9	6	262	3	9	173	8
Future Vol, veh/h	7	1	13	7	80	9	6	262	3	9	173	8
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	1	14	8	87	10	7	285	3	10	188	9
Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	560	513	192	519	515	286	197	0	0	288	0	0
Stage 1	212	212	-	299	299	-	-	-	-	-	-	-
Stage 2	348	301	-	220	216	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	439	465	850	467	464	753	1376	-	-	1274	-	-
Stage 1	790	727	-	710	666	-	-	-	-	-	-	-
Stage 2	668	665	-	782	724	-	-	-	-	-	-	-
Platoon blocked, %												
Mov Cap-1 Maneuver	366	458	850	453	457	753	1376	-	-	1274	-	-
Mov Cap-2 Maneuver	366	458	-	453	457	-	-	-	-	-	-	-
Stage 1	785	720	-	706	662	-	-	-	-	-	-	-
Stage 2	569	661	-	761	717	-	-	-	-	-	-	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	11.5			14.7			0.2			0.4		
HCM LOS	B			B								
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1376	-	-	574	474	1274	-	-				
HCM Lane V/C Ratio	0.005	-	-	0.04	0.22	0.008	-	-				
HCM Control Delay (s)	7.6	0	-	11.5	14.7	7.8	0	-				
HCM Lane LOS	A	A	-	B	B	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	0.1	0.8	0	-	-				

# HCM Signalized Intersection Capacity Analysis






















## 53: Broadway & E Pine St

9/7/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	42	292	61	59	404	94	0	614	124	0	466	79
Future Volume (vph)	42	292	61	59	404	94	0	614	124	0	466	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	15	12	11	16	12	11	12	11	11	12	12
Grade (%)		5%			-2%			0%			0%	
Total Lost time (s)	3.5	6.0		3.5	6.0			4.5			4.5	3.5
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frbp, ped/bikes	1.00	0.89		1.00	0.84			0.83			1.00	0.46
Flpb, ped/bikes	1.00	1.00		0.94	1.00			1.00			1.00	1.00
Frt	1.00	0.97		1.00	0.97			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			1.00			1.00	1.00
Satd. Flow (prot)	1620	1672		1614	1716			1509			1845	719
Flt Permitted	0.15	1.00		0.29	1.00			1.00			1.00	1.00
Satd. Flow (perm)	252	1672		493	1716			1509			1845	719
Peak-hour factor, PHF	0.50	0.96	0.85	0.87	0.93	0.76	0.86	0.89	0.78	0.94	0.95	0.73
Adj. Flow (vph)	84	304	72	68	434	124	0	690	159	0	491	108
RTOR Reduction (vph)	0	8	0	0	10	0	0	8	0	0	0	13
Lane Group Flow (vph)	84	368	0	68	548	0	0	841	0	0	491	95
Confl. Peds. (#/hr)	559		311	311		559	396		448	448		396
Heavy Vehicles (%)	5%	5%	5%	3%	3%	3%	2%	2%	2%	3%	3%	3%
Parking (#/hr)						0			0			
Turn Type	pm+pt	NA		pm+pt	NA			NA			NA	pm+ov
Protected Phases	7	4		3	8			2			6	7
Permitted Phases	4			8								6
Actuated Green, G (s)	34.4	27.1		31.6	25.7			46.0			53.0	60.3
Effective Green, g (s)	34.4	27.1		31.6	25.7			46.0			53.0	60.3
Actuated g/C Ratio	0.34	0.27		0.32	0.26			0.46			0.53	0.60
Clearance Time (s)	3.5	6.0		3.5	6.0			4.5			4.5	3.5
Vehicle Extension (s)	2.0	0.2		2.0	0.2			0.2			0.2	2.0
Lane Grp Cap (vph)	186	453		221	441			694			977	433
v/s Ratio Prot	c0.03	0.22		0.02	c0.32			c0.56			c0.27	0.02
v/s Ratio Perm	0.12			0.08								0.12
v/c Ratio	0.45	0.81		0.31	1.24			1.21			0.50	0.22
Uniform Delay, d1	25.5	34.1		25.2	37.1			27.0			15.1	9.1
Progression Factor	1.12	1.12		1.00	1.00			1.63			1.00	1.00
Incremental Delay, d2	0.6	14.2		0.3	126.8			96.6			1.8	0.1
Delay (s)	29.2	52.5		25.5	163.9			140.5			16.9	9.2
Level of Service	C	D		C	F			F			B	A
Approach Delay (s)		48.2			148.9			140.5			15.5	
Approach LOS		D			F			F			B	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			96.3			HCM 2000 Level of Service		F				
HCM 2000 Volume to Capacity ratio			1.12									
Actuated Cycle Length (s)			100.0			Sum of lost time (s)		17.0				
Intersection Capacity Utilization			86.6%			ICU Level of Service		E				
Analysis Period (min)			15									
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis  
 54: Broadway & E James Way/E James St

9/7/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	212	522	31	28	396	88	25	392	18	59	419	50
Future Volume (vph)	212	522	31	28	396	88	25	392	18	59	419	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	11	12	10	11	16	10	11	10	10	11	10
Grade (%)		6%			12%			0%			0%	
Total Lost time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	1.00
Frbp, ped/bikes		1.00			0.97		1.00	0.95		1.00	1.00	1.00
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	1.00
Frt		0.99			0.97		1.00	0.99		1.00	1.00	0.85
Flt Protected		0.99			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		3253			3018		1652	1686		1652	1801	1478
Flt Permitted		0.99			1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		3253			3018		1652	1686		1652	1801	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.64	0.92	0.85	0.92	0.56	0.25	0.92	0.92	0.92
Adj. Flow (vph)	230	567	34	44	430	104	27	700	72	64	455	54
RTOR Reduction (vph)	0	3	0	0	19	0	0	3	0	0	0	26
Lane Group Flow (vph)	0	828	0	0	559	0	27	769	0	64	455	28
Confl. Peds. (#/hr)				80		80			80	80		
Parking (#/hr)						0			0			
Turn Type	Split	NA		Split	NA		Prot	NA		Prot	NA	pm+ov
Protected Phases	4	4		3	3		5	2		1	6	4
Permitted Phases												6
Actuated Green, G (s)		19.5			22.3		3.8	16.4		5.7	32.4	51.9
Effective Green, g (s)		19.5			22.3		3.8	16.4		5.7	32.4	51.9
Actuated g/C Ratio		0.20			0.22		0.04	0.16		0.06	0.32	0.52
Clearance Time (s)		5.5			5.5		5.5	5.5		5.5	5.5	5.5
Vehicle Extension (s)		2.0			2.0		2.0	2.0		2.0	2.0	2.0
Lane Grp Cap (vph)		634			673		62	276		94	583	767
v/s Ratio Prot		c0.25			c0.19		0.02	c0.46		c0.04	c0.25	0.01
v/s Ratio Perm												0.01
v/c Ratio		1.31			0.83		0.44	2.78		0.68	0.78	0.04
Uniform Delay, d1		40.2			37.0		47.1	41.8		46.3	30.6	11.8
Progression Factor		1.00			1.06		0.94	1.09		0.86	0.98	0.80
Incremental Delay, d2		148.8			7.8		1.8	813.2		14.6	9.7	0.0
Delay (s)		189.0			47.1		45.8	858.9		54.1	39.8	9.4
Level of Service		F			D		D	F		D	D	A
Approach Delay (s)		189.0			47.1			831.4			38.6	
Approach LOS		F			D			F			D	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			313.1				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.40									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			25.5		
Intersection Capacity Utilization			86.6%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group

Intersection												
Int Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	497	9	14	257	3	13	5	13	10	1	7
Future Vol, veh/h	1	497	9	14	257	3	13	5	13	10	1	7
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	0	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	14	-	-	-14	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	540	10	15	279	3	14	5	14	11	1	8
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	283	0	0	550	0	0	863	860	545	868	863	281
Stage 1	-	-	-	-	-	-	547	547	-	311	311	-
Stage 2	-	-	-	-	-	-	316	313	-	557	552	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1279	-	-	1020	-	-	275	294	538	273	292	758
Stage 1	-	-	-	-	-	-	521	517	-	699	658	-
Stage 2	-	-	-	-	-	-	695	657	-	515	515	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1279	-	-	1020	-	-	268	289	538	258	287	758
Mov Cap-2 Maneuver	-	-	-	-	-	-	268	289	-	258	287	-
Stage 1	-	-	-	-	-	-	520	516	-	698	647	-
Stage 2	-	-	-	-	-	-	675	646	-	496	514	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.4			16.6			15.9		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	345	1279	-	-	1020	-	-	350				
HCM Lane V/C Ratio	0.098	0.001	-	-	0.015	-	-	0.056				
HCM Control Delay (s)	16.6	7.8	0	-	8.6	0	-	15.9				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	0.2				

Intersection												
Int Delay, s/veh	174.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗		↕			↕		
Traffic Vol, veh/h	143	454	7	12	317	128	7	62	15	75	108	35
Future Vol, veh/h	143	454	7	12	317	128	7	62	15	75	108	35
Conflicting Peds, #/hr	36	0	67	67	0	36	5	0	23	23	0	5
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	100	-	-	40	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	-12	-	-	8	-	-	0	-	-	0	-
Peak Hour Factor	96	96	96	87	87	87	80	80	80	88	88	88
Heavy Vehicles, %	1	1	1	3	3	3	1	1	1	1	1	1
Mvmt Flow	149	473	7	14	364	147	9	78	19	85	123	40

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	547	0	0	547	0	0	1393	1416	567	1348	1347	479
Stage 1	-	-	-	-	-	-	841	841	-	502	502	-
Stage 2	-	-	-	-	-	-	552	575	-	846	845	-
Critical Hdwy	4.11	-	-	4.13	-	-	7.11	6.51	6.21	7.11	6.51	6.21
Critical Hdwy Stg 1	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.11	5.51	-	6.11	5.51	-
Follow-up Hdwy	2.209	-	-	2.227	-	-	3.509	4.009	3.309	3.509	4.009	3.309
Pot Cap-1 Maneuver	1027	-	-	1017	-	-	120	138	525	129	152	589
Stage 1	-	-	-	-	-	-	361	382	-	553	544	-
Stage 2	-	-	-	-	-	-	520	504	-	358	380	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1023	-	-	998	-	-	-	106	486	~ 43	~ 117	567
Mov Cap-2 Maneuver	-	-	-	-	-	-	-	106	-	~ 43	~ 117	-
Stage 1	-	-	-	-	-	-	291	308	-	457	519	-
Stage 2	-	-	-	-	-	-	362	481	-	216	307	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.2	0.2		\$ 1055.8
HCM LOS			-	F























Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	-	1023	-	-	998	-	-	80
HCM Lane V/C Ratio	-	0.146	-	-	0.014	-	-	3.097
HCM Control Delay (s)	-	9.1	-	-	8.7	-	-	\$ 1055.8
HCM Lane LOS	-	A	-	-	A	-	-	F
HCM 95th %tile Q(veh)	-	0.5	-	-	0	-	-	24.7

Notes  
 ~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

# HCM Signalized Intersection Capacity Analysis

57: 23rd Ave & E UNION ST

9/7/2016























												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 							
Traffic Volume (vph)	107	340	180	54	282	128	141	679	61	143	627	27
Future Volume (vph)	107	340	180	54	282	128	141	679	61	143	627	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	10	12	10	10	12	10
Grade (%)		-4%			3%			0%			0%	
Total Lost time (s)	3.0	3.0		3.0	2.5		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frbp, ped/bikes	1.00	0.96		1.00	0.97		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.95		1.00	0.99		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)	1685	3053		1611	2980		1668	1851		1652	1848	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1685	3053		1611	2980		1668	1851		1652	1848	
Peak-hour factor, PHF	0.99	0.99	0.99	0.95	0.95	0.95	0.92	0.92	0.92	0.96	0.96	0.96
Adj. Flow (vph)	108	343	182	57	297	135	153	738	66	149	653	28
RTOR Reduction (vph)	0	68	0	0	52	0	0	3	0	0	1	0
Lane Group Flow (vph)	108	457	0	57	380	0	153	801	0	149	680	0
Confl. Peds. (#/hr)	23		33	33		23	16		22	22		16
Heavy Vehicles (%)	2%	2%	2%	3%	3%	3%	1%	1%	1%	2%	2%	2%
Parking (#/hr)			0			0			0			0
Turn Type	Prot	NA		Prot	NA		Split	NA		Split	NA	
Protected Phases	7	4		3	8		2	2		1	1	
Permitted Phases												
Actuated Green, G (s)	5.0	18.4		4.0	17.9		31.5	31.5		28.1	28.1	
Effective Green, g (s)	6.5	19.9		5.5	19.4		33.0	33.0		29.6	29.6	
Actuated g/C Ratio	0.06	0.20		0.06	0.19		0.33	0.33		0.30	0.30	
Clearance Time (s)	4.5	4.5		4.5	4.0		4.5	4.5		4.5	4.5	
Vehicle Extension (s)	2.0	0.2		2.0	0.2		0.2	0.2		0.2	0.2	
Lane Grp Cap (vph)	109	607		88	578		550	610		488	547	
v/s Ratio Prot	c0.06	c0.15		0.04	0.13		0.09	c0.43		0.09	c0.37	
v/s Ratio Perm												
v/c Ratio	0.99	0.75		0.65	0.66		0.28	1.31		0.31	1.24	
Uniform Delay, d1	46.7	37.7		46.3	37.2		24.7	33.5		27.2	35.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	83.0	8.4		11.6	5.7		1.3	152.1		1.6	123.9	
Delay (s)	129.7	46.1		57.9	43.0		26.0	185.6		28.9	159.1	
Level of Service	F	D		E	D		C	F		C	F	
Approach Delay (s)		60.4			44.7			160.1			135.7	
Approach LOS		E			D			F			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			112.0				HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio			1.15									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			81.6%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												



# HCM Signalized Intersection Capacity Analysis

## 58: 23rd Ave & E CHERRY ST

9/7/2016

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 					 	 	
Traffic Volume (vph)	124	234	50	59	128	94	55	571	103	99	681	47
Future Volume (vph)	124	234	50	59	128	94	55	571	103	99	681	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	10	12	10	10	12	10
Grade (%)		-6%			0%			0%			0%	
Total Lost time (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor		0.95			0.95		1.00	1.00		1.00	1.00	
Frbp, ped/bikes		0.99			0.97		1.00	0.99		1.00	1.00	
Flpb, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	
Frt		0.98			0.95		1.00	0.98		1.00	0.99	
Flt Protected		0.99			0.99		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3231			3007		1478	1620		1636	1823	
Flt Permitted		0.67			0.60		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		2205			1823		1478	1620		1636	1823	
Peak-hour factor, PHF	0.78	0.78	0.78	0.94	0.94	0.94	0.92	0.92	0.92	0.93	0.93	0.93
Adj. Flow (vph)	159	300	64	63	136	100	60	621	112	106	732	51
RTOR Reduction (vph)	0	11	0	0	63	0	0	7	0	0	3	0
Lane Group Flow (vph)	0	512	0	0	236	0	60	727	0	106	780	0
Confl. Peds. (#/hr)	21		9	9		21	11		12	12		11
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	14%	14%	14%	3%	3%	3%
Parking (#/hr)						0			0			0
Turn Type	Perm	NA		Perm	NA		Split	NA		Split	NA	
Protected Phases		4			4		2	2		1	1	
Permitted Phases	4			4								
Actuated Green, G (s)		17.5			17.5		33.5	33.5		35.5	35.5	
Effective Green, g (s)		19.0			19.0		35.0	35.0		37.0	37.0	
Actuated g/C Ratio		0.19			0.19		0.35	0.35		0.37	0.37	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)		418			346		517	567		605	674	
v/s Ratio Prot							0.04	c0.45		0.06	c0.43	
v/s Ratio Perm		c0.23			0.13							
v/c Ratio		1.23			0.68		0.12	1.28		0.18	1.16	
Uniform Delay, d1		40.5			37.7		22.0	32.5		21.2	31.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		121.3			10.4		0.5	139.7		0.6	87.1	
Delay (s)		161.8			48.1		22.5	172.2		21.9	118.6	
Level of Service		F			D		C	F		C	F	
Approach Delay (s)		161.8			48.1			160.9			107.0	
Approach LOS		F			D			F			F	
<b>Intersection Summary</b>												
HCM 2000 Control Delay			128.5				HCM 2000 Level of Service				F	
HCM 2000 Volume to Capacity ratio			1.22									
Actuated Cycle Length (s)			100.0				Sum of lost time (s)			9.0		
Intersection Capacity Utilization			85.4%				ICU Level of Service			E		
Analysis Period (min)			15									

c Critical Lane Group



# **Appendix C**

## **Signal Warrant Analysis**



# Traffic Signal Warrant Summary Worksheet

The Worksheet(s) attached are provided as an attachment to the  
Madison BRT Early Spring St Study for:

Intersection: Spring St & 8th St  
County: King County  
City: Seattle

Major Street: 8th st  
Street Classification: Minor Arterial  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

Minor Street: Spring St  
Street Classification: Minor Arterial  
Critical Approach Speed: 25 mph  
Lanes: 2 lanes each direction

**Analysis based on EXISTING volume data.**

Date	Day of The Week	Time Interval
5/19/2016	Thursday	7:00 am - 9:00 am
5/19/2016	Thursday	4:00 pm - 6:00 pm
6/9/2016	Thursday	9:00 am - 4:00 pm

Warrant Evaluation Summary		Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume		No
	Condition A: Minimum Vehicular Volume	No
	Condition B: Interruption of Continuous Traffic	No
	Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume		No
Warrant 3: Peak Hour Volume		No
Warrant 4: Pedestrian Volume		No
	Criterion A: Four-Hour	No
	Criterion B: Peak-Hour	No

# Warrant 1: Eight-Hour Vehicular Volume

8-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
7:00 AM	8:00 AM	208	175
8:00 AM	9:00 AM	308	190
9:00 AM	10:00 AM	210	182
11:00 AM	12:00 PM	163	202
2:00 PM	3:00 PM	143	184
3:00 PM	4:00 PM	244	196
4:00 PM	5:00 PM	336	198
5:00 PM	6:00 PM	377	198

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street				Vehicles per hour on higher-volume			
		(total of both approaches)				minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112
Condition B—Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street				Vehicles per hour on higher-volume			
		(total of both approaches)				minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

<sup>a</sup> Basic minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

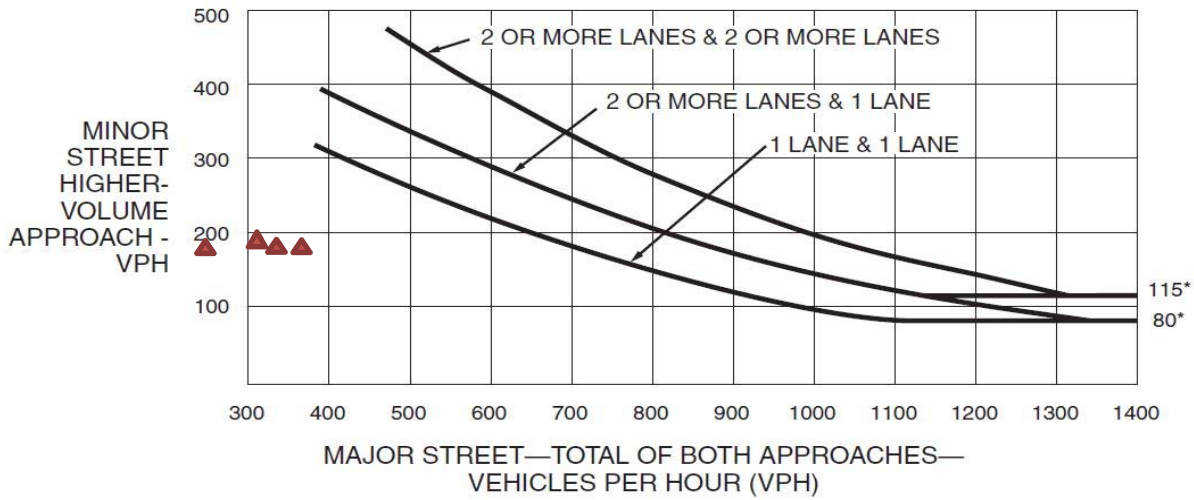
<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

<sup>d</sup> May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

## Warrant 2: Four-Hour Vehicular Volume

4-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
8:00 AM	9:00 AM	308	190
3:00 PM	4:00 PM	244	196
4:00 PM	5:00 PM	336	198
5:00 PM	6:00 PM	377	198

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**

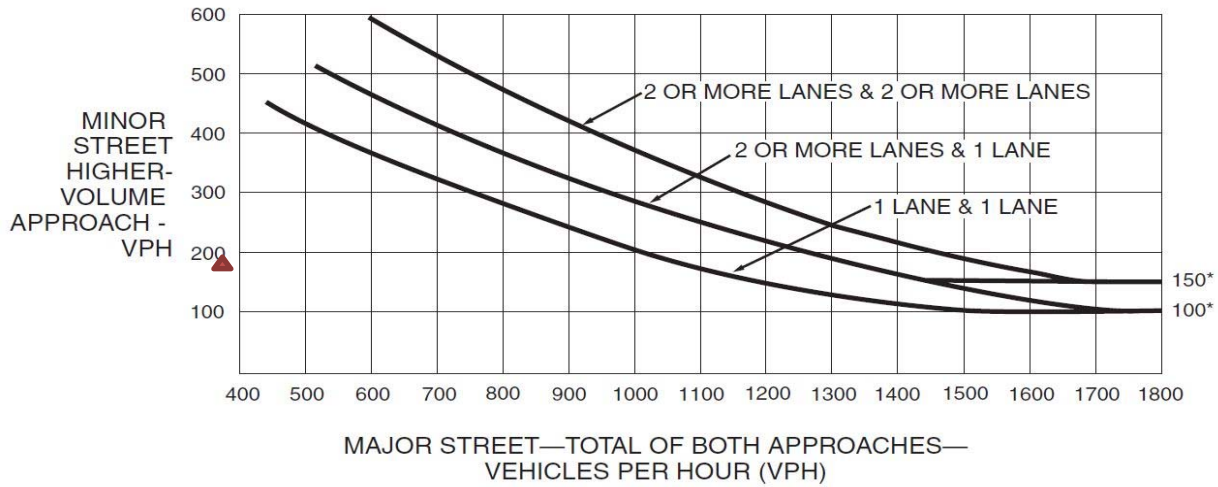


\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 3: Peak Hour Volume

Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
5:00 PM	6:00 PM	377	198

Figure 4C-3. Warrant 3, Peak Hour



\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

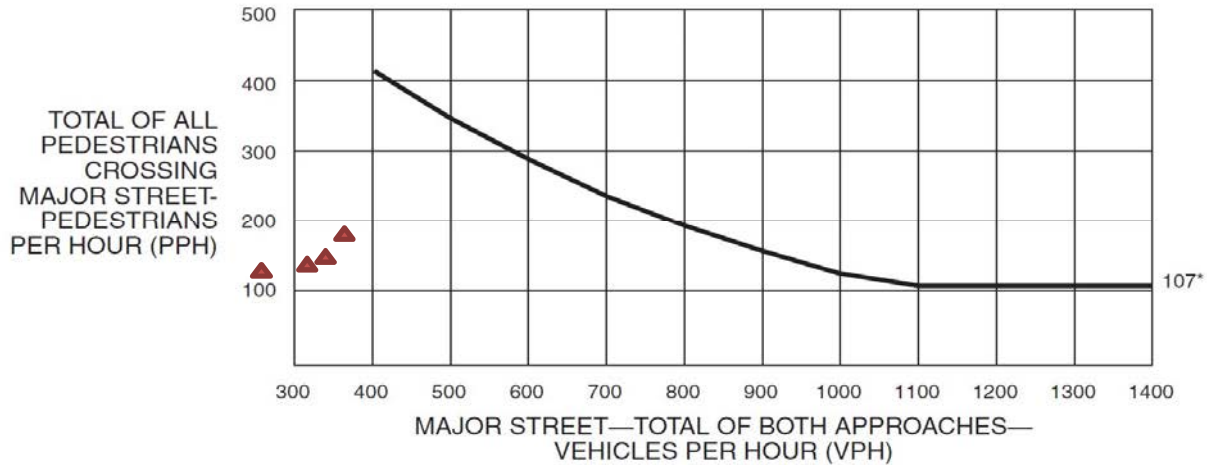


# Warrant 4: Pedestrian Volume

## Criterion A: Four-Hour

Four-Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Ped Vol crossing Major St
8:00 AM	9:00 AM	308	133
3:00 PM	4:00 PM	244	121
4:00 PM	5:00 PM	336	149
5:00 PM	6:00 PM	377	181

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

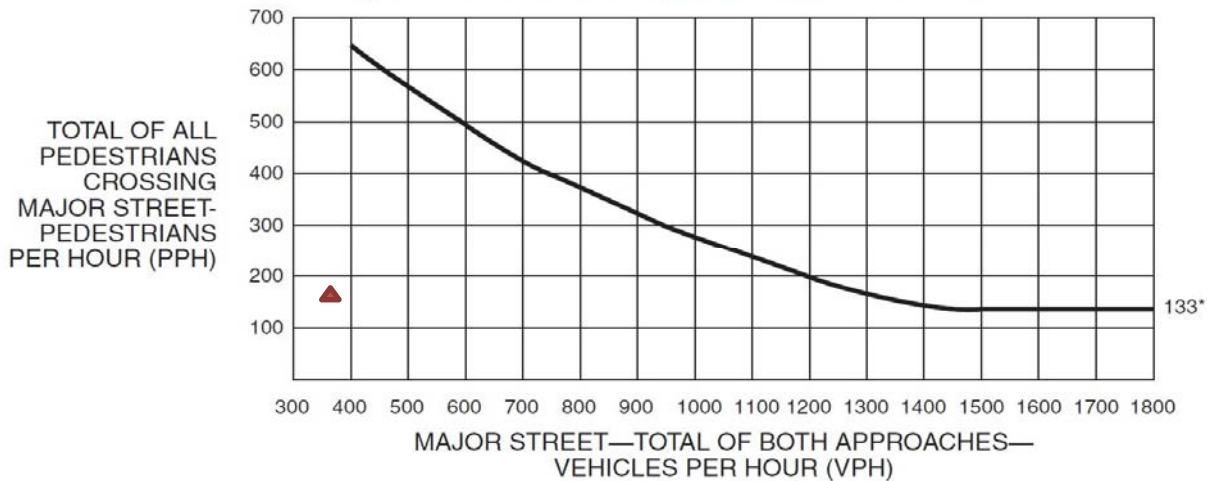


\*Note: 107 pph applies as the lower threshold volume.

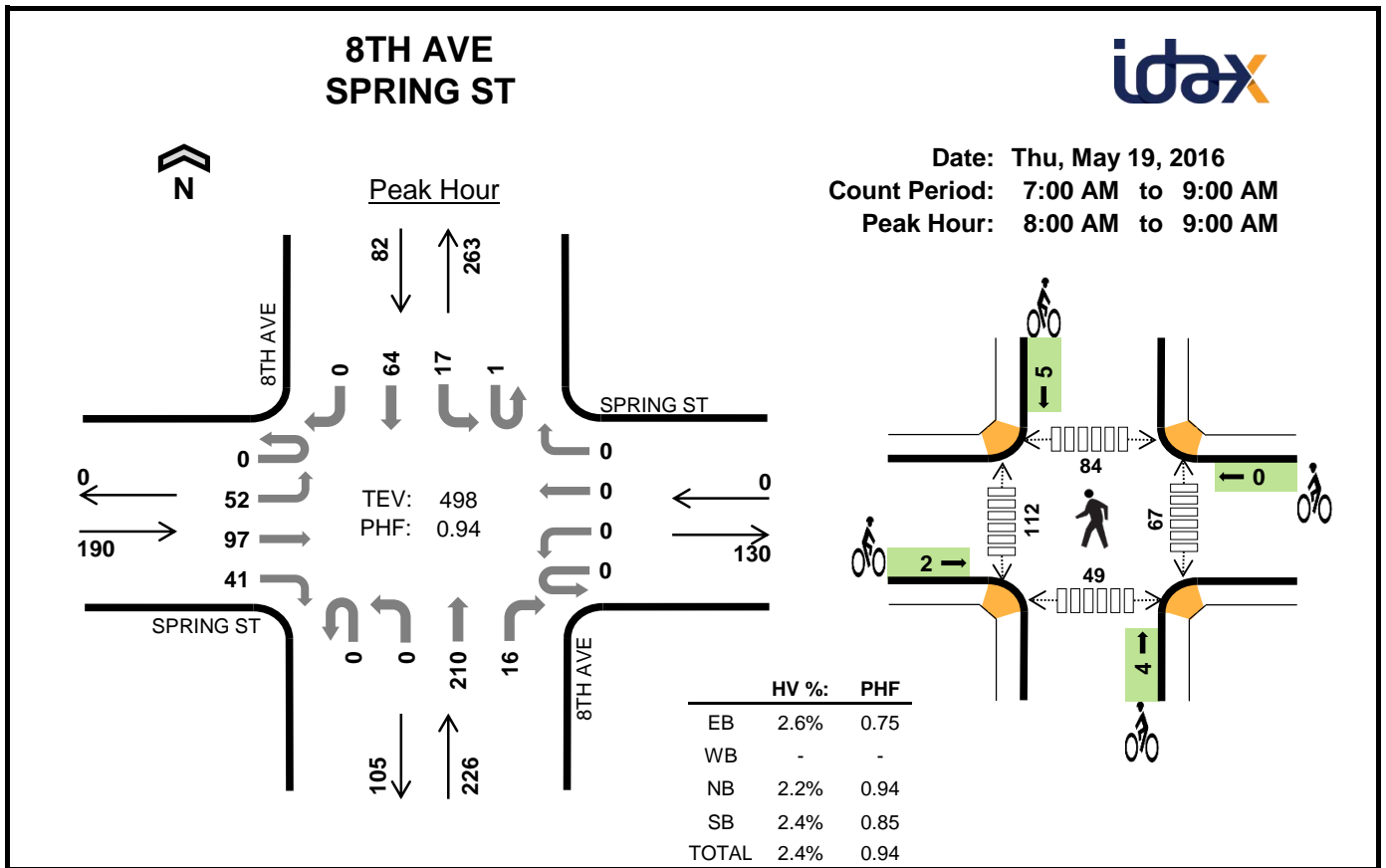
## Criterion B: Peak Hour

Peak Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Pedestrian Volume
5:00 PM	6:00 PM	377	181

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



\*Note: 133 pph applies as the lower threshold volume.

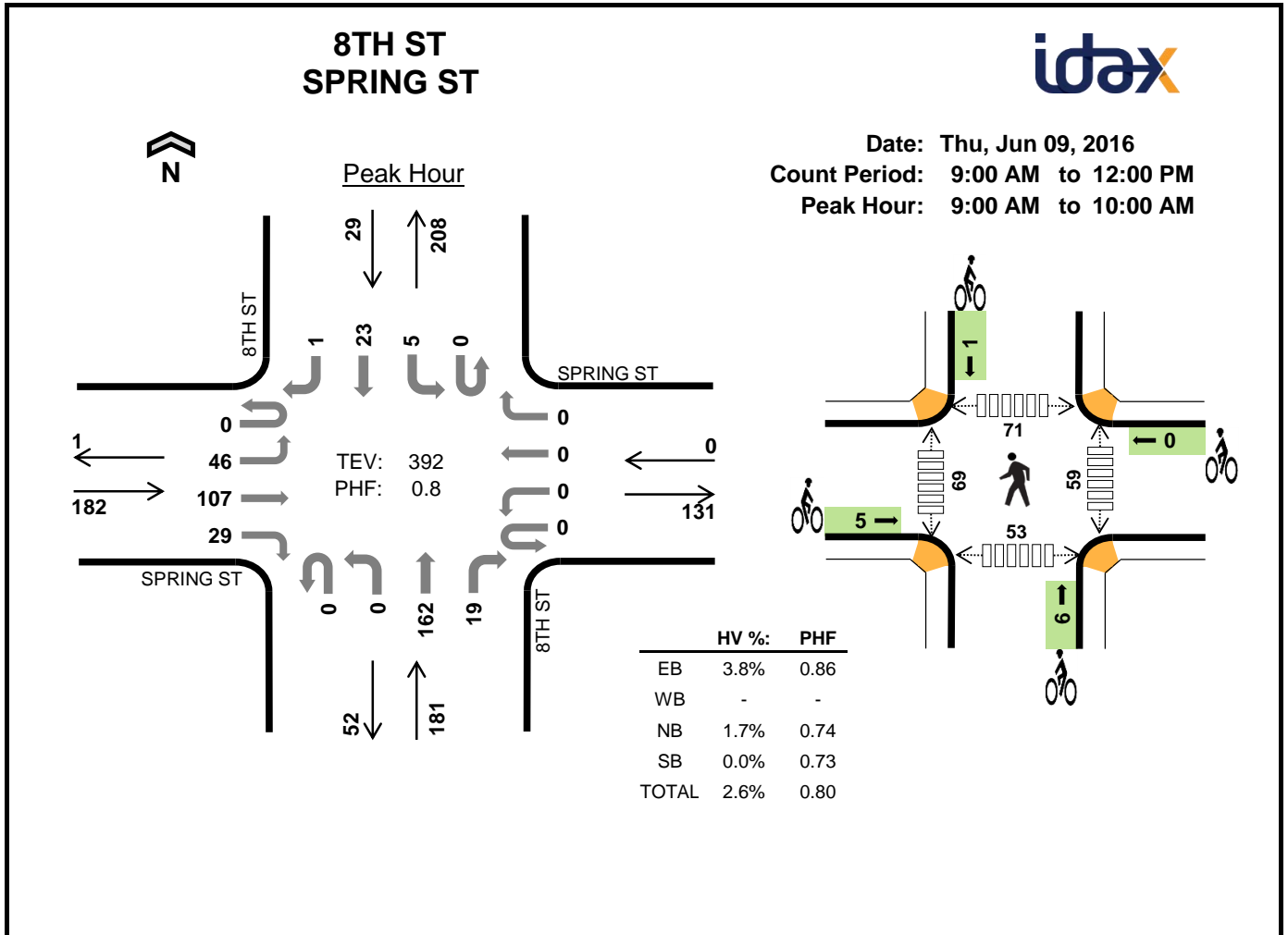


#### Two-Hour Count Summaries

Interval Start	SPRING ST Eastbound				SPRING ST Westbound				8TH AVE Northbound				8TH AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
	7:00 AM	0	11	18	6	0	0	0	0	0	0	28	1	0	6	7		
7:15 AM	0	8	31	8	0	0	0	0	0	0	27	2	0	2	14	0	92	0
7:30 AM	0	10	19	7	0	0	0	0	0	0	38	2	0	3	17	0	96	0
7:45 AM	0	14	30	13	0	0	0	0	0	0	36	3	0	3	19	0	118	383
<b>8:00 AM</b>	<b>0</b>	<b>7</b>	<b>17</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>51</b>	<b>8</b>	<b>1</b>	<b>4</b>	<b>13</b>	<b>0</b>	<b>107</b>	<b>413</b>
<b>8:15 AM</b>	<b>0</b>	<b>23</b>	<b>19</b>	<b>21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>48</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>16</b>	<b>0</b>	<b>133</b>	<b>454</b>
8:30 AM	0	11	27	11	0	0	0	0	0	0	60	0	0	4	20	0	133	491
8:45 AM	0	11	34	3	0	0	0	0	0	0	51	5	0	6	15	0	125	498
Count Total	0	95	195	75	0	0	0	0	0	0	339	24	1	31	121	0	881	0
<b>Peak Hour</b>	<b>0</b>	<b>52</b>	<b>97</b>	<b>41</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>210</b>	<b>16</b>	<b>1</b>	<b>17</b>	<b>64</b>	<b>0</b>	<b>498</b>	<b>0</b>

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	2	0	1	1	4	0	0	0	1	1	13	20	14	6	53
7:15 AM	2	0	1	1	4	1	0	0	1	2	8	18	16	8	50
7:30 AM	0	0	0	1	1	1	0	0	1	2	19	28	22	17	86
7:45 AM	0	0	0	0	0	0	0	0	1	1	10	34	32	17	93
<b>8:00 AM</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>17</b>	<b>26</b>	<b>20</b>	<b>22</b>	<b>85</b>
<b>8:15 AM</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>16</b>	<b>37</b>	<b>26</b>	<b>11</b>	<b>90</b>
8:30 AM	1	0	1	0	2	0	0	1	0	1	14	28	20	9	71
8:45 AM	1	0	3	1	5	0	0	2	2	4	20	21	18	7	66
Count Total	9	0	7	5	21	4	0	4	9	17	117	212	168	97	594
<b>Peak Hour</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>2</b>	<b>12</b>	<b>2</b>	<b>0</b>	<b>4</b>	<b>5</b>	<b>11</b>	<b>67</b>	<b>112</b>	<b>84</b>	<b>49</b>	<b>312</b>



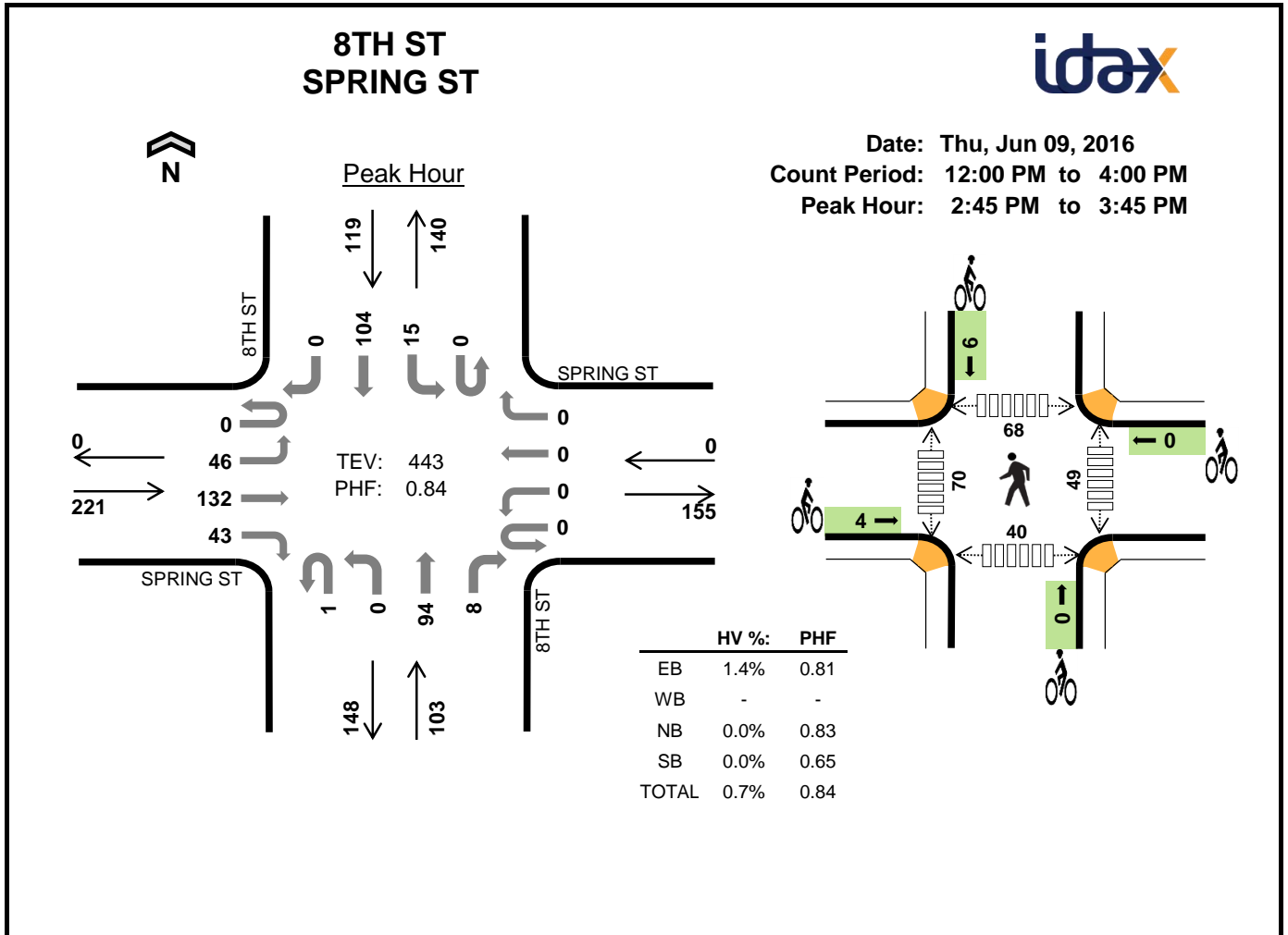
**Three-Hour Count Summaries**

Interval Start	SPRING ST Eastbound				SPRING ST Westbound				8TH ST Northbound				8TH ST Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
9:00 AM	0	17	29	7	0	0	0	0	0	0	56	5	0	1	7	0	122	0
9:15 AM	0	7	25	12	0	0	0	0	0	0	33	3	0	1	3	0	84	0
9:30 AM	0	14	27	5	0	0	0	0	0	0	34	4	0	0	7	0	91	0
9:45 AM	0	8	26	5	0	0	0	0	0	0	39	7	0	3	6	1	95	392
Peak Hour	0	46	107	29	0	0	0	0	0	0	162	19	0	5	23	1	392	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
9:00 AM	0	0	0	0	0	2	0	2	0	4	20	20	15	11	66
9:15 AM	0	0	2	0	2	2	0	2	1	5	13	21	19	22	75
9:30 AM	6	0	1	0	7	1	0	0	0	1	15	14	21	10	60
9:45 AM	1	0	0	0	1	0	0	2	0	2	11	14	16	10	51
Peak Hour	7	0	3	0	10	5	0	6	1	12	59	69	71	53	252

<b>Three-Hour Count Summaries</b>																		
Interval Start	SPRING ST				SPRING ST				8TH ST				8TH ST				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
9:00 AM	0	17	29	7	0	0	0	0	0	0	56	5	0	1	7	0	122	0
9:15 AM	0	7	25	12	0	0	0	0	0	0	33	3	0	1	3	0	84	0
9:30 AM	0	14	27	5	0	0	0	0	0	0	34	4	0	0	7	0	91	0
9:45 AM	0	8	26	5	0	0	0	0	0	0	39	7	0	3	6	1	95	392
10:00 AM	0	15	31	12	0	0	0	0	0	0	28	6	0	1	3	0	96	366
10:15 AM	0	10	25	4	0	0	0	0	0	0	33	4	0	2	6	0	84	366
10:30 AM	0	10	28	9	0	0	0	0	0	0	19	4	0	4	3	0	77	352
10:45 AM	0	12	29	8	0	0	0	0	0	0	11	1	0	2	10	0	73	330
11:00 AM	0	9	26	8	0	0	0	0	0	0	36	3	0	2	10	0	94	328
11:15 AM	0	14	36	8	0	0	0	0	0	0	24	1	1	2	5	0	91	335
11:30 AM	0	13	23	14	0	0	0	0	0	0	24	2	0	4	8	0	88	346
11:45 AM	0	11	32	8	0	0	0	1	0	0	29	5	0	1	6	0	93	366
Count Total	0	140	337	100	0	0	0	1	0	0	366	45	1	23	74	1	1,088	0
Peak Hour	0	46	107	29	0	0	0	0	0	0	162	19	0	5	23	1	392	0
<i>Note: Three-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.</i>																		
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)							
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total			
9:00 AM	0	0	0	0	0	2	0	2	0	4	20	20	15	11	66			
9:15 AM	0	0	2	0	2	2	0	2	1	5	13	21	19	22	75			
9:30 AM	6	0	1	0	7	1	0	0	0	1	15	14	21	10	60			
9:45 AM	1	0	0	0	1	0	0	2	0	2	11	14	16	10	51			
10:00 AM	1	0	0	0	1	3	0	2	0	5	7	15	13	8	43			
10:15 AM	3	0	0	1	4	0	0	1	0	1	10	19	16	9	54			
10:30 AM	3	0	1	0	4	0	0	0	0	0	7	13	12	7	39			
10:45 AM	0	0	0	1	1	1	0	1	1	3	5	14	10	9	38			
11:00 AM	2	0	0	0	2	0	0	0	0	0	8	17	14	11	50			
11:15 AM	2	0	1	0	3	1	0	1	0	2	12	9	9	4	34			
11:30 AM	2	0	0	1	3	0	0	1	0	1	16	8	14	7	45			
11:45 AM	0	0	0	0	0	2	0	1	0	3	11	21	7	12	51			
Count Total	20	0	5	3	28	12	0	13	2	27	135	185	166	120	606			
Peak Hour	7	0	3	0	10	5	0	6	1	12	59	69	71	53	252			



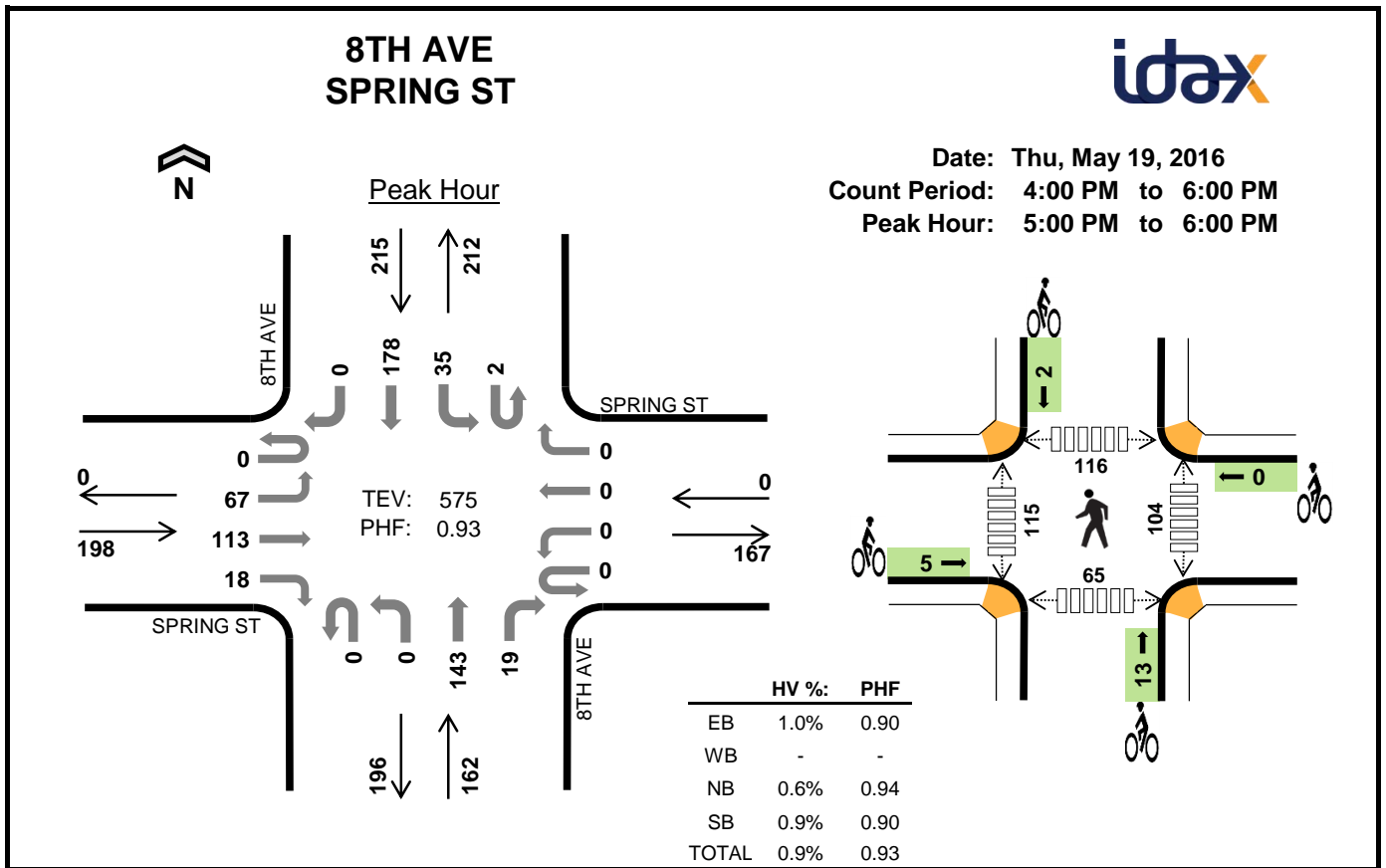
**Four-Hour Count Summaries**

Interval Start	SPRING ST Eastbound				SPRING ST Westbound				8TH ST Northbound				8TH ST Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
2:45 PM	0	7	45	12	0	0	0	0	0	0	27	2	0	1	5	0	99	0
3:00 PM	0	10	28	7	0	0	0	0	0	0	29	2	0	3	19	0	98	0
3:15 PM	0	16	35	17	0	0	0	0	1	0	16	2	0	7	38	0	132	0
3:30 PM	0	13	24	7	0	0	0	0	0	0	22	2	0	4	42	0	114	443
Peak Hour	0	46	132	43	0	0	0	0	1	0	94	8	0	15	104	0	443	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
2:45 PM	0	0	0	0	0	1	0	0	1	2	13	20	10	5	48
3:00 PM	2	0	0	0	2	0	0	0	2	2	13	12	22	7	54
3:15 PM	1	0	0	0	1	0	0	0	2	2	9	15	13	13	50
3:30 PM	0	0	0	0	0	3	0	0	1	4	14	23	23	15	75
Peak Hour	3	0	0	0	3	4	0	0	6	10	49	70	68	40	227

<b>Four-Hour Count Summaries</b>																		
Interval Start	SPRING ST				SPRING ST				8TH ST				8TH ST				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
12:00 PM	0	12	33	9	0	0	0	0	1	0	26	4	0	0	6	0	91	0
12:15 PM	0	14	24	8	0	0	0	0	0	0	22	3	0	2	11	0	84	0
12:30 PM	0	9	24	8	0	0	0	0	0	0	15	3	1	4	4	0	68	0
12:45 PM	0	12	33	12	0	0	0	0	0	0	18	3	0	5	3	0	86	329
1:00 PM	0	8	19	10	0	0	0	0	0	0	13	2	0	1	12	0	65	303
1:15 PM	0	4	28	12	0	0	0	0	0	1	16	6	0	1	6	0	74	293
1:30 PM	0	15	14	4	0	0	0	0	0	0	24	4	0	0	13	0	74	299
1:45 PM	0	9	30	9	0	0	0	0	0	0	18	3	0	1	4	0	74	287
2:00 PM	0	13	30	7	0	0	0	0	0	0	23	3	0	2	9	0	87	309
2:15 PM	0	7	21	7	0	0	0	1	1	0	12	4	0	1	16	0	70	305
2:30 PM	0	6	26	3	0	0	0	0	0	0	24	5	0	2	6	0	72	303
2:45 PM	0	7	45	12	0	0	0	0	0	0	27	2	0	1	5	0	99	328
3:00 PM	0	10	28	7	0	0	0	0	0	0	29	2	0	3	19	0	98	339
3:15 PM	0	16	35	17	0	0	0	0	1	0	16	2	0	7	38	0	132	401
3:30 PM	0	13	24	7	0	0	0	0	0	0	22	2	0	4	42	0	114	443
3:45 PM	0	16	18	5	0	0	0	0	0	0	20	1	0	1	35	0	96	440
Count Total	0	171	432	137	0	0	0	1	3	1	325	49	1	35	229	0	1,384	0
Peak Hour	0	46	132	43	0	0	0	0	1	0	94	8	0	15	104	0	443	0
<i>Note: Four-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.</i>																		
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)							
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total			
12:00 PM	1	0	0	0	1	3	0	1	0	4	12	13	14	8	47			
12:15 PM	1	0	1	0	2	0	0	0	0	0	9	22	13	12	56			
12:30 PM	1	0	0	0	1	1	0	0	0	1	16	18	18	6	58			
12:45 PM	0	0	0	0	0	1	0	2	0	3	10	10	14	14	48			
1:00 PM	1	0	0	0	1	0	0	0	0	0	11	10	22	11	54			
1:15 PM	0	0	1	0	1	0	0	0	0	0	10	9	8	9	36			
1:30 PM	1	0	1	0	2	0	0	0	0	0	14	14	13	16	57			
1:45 PM	0	0	0	0	0	0	0	0	1	1	7	19	20	5	51			
2:00 PM	0	0	0	0	0	1	0	0	2	3	19	11	14	3	47			
2:15 PM	0	0	0	1	1	0	0	0	1	1	9	8	22	7	46			
2:30 PM	0	0	1	0	1	0	0	0	0	0	15	9	15	14	53			
2:45 PM	0	0	0	0	0	1	0	0	1	2	13	20	10	5	48			
3:00 PM	2	0	0	0	2	0	0	0	2	2	13	12	22	7	54			
3:15 PM	1	0	0	0	1	0	0	0	2	2	9	15	13	13	50			
3:30 PM	0	0	0	0	0	3	0	0	1	4	14	23	23	15	75			
3:45 PM	0	0	0	0	0	2	0	3	1	6	15	20	24	4	63			
Count Total	8	0	4	1	13	12	0	6	11	29	196	233	265	149	843			
Peak Hour	3	0	0	0	3	4	0	0	6	10	49	70	68	40	227			



### Two-Hour Count Summaries

Interval Start	SPRING ST Eastbound				SPRING ST Westbound				8TH AVE Northbound				8TH AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
	4:00 PM	0	12	27	6	0	0	0	0	0	0	36	1	0	4	39		
4:15 PM	0	14	27	10	0	0	0	0	0	0	32	2	0	4	40	0	129	0
4:30 PM	0	15	36	4	0	0	0	0	0	0	47	4	1	10	35	0	152	0
4:45 PM	0	17	26	4	0	0	0	0	0	0	36	1	1	11	32	0	128	534
<b>5:00 PM</b>	<b>0</b>	<b>15</b>	<b>26</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>36</b>	<b>4</b>	<b>0</b>	<b>7</b>	<b>36</b>	<b>0</b>	<b>131</b>	<b>540</b>
5:15 PM	0	13	34	3	0	0	0	0	0	0	38	3	1	6	48	0	146	557
<b>5:30 PM</b>	<b>0</b>	<b>25</b>	<b>25</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>39</b>	<b>4</b>	<b>1</b>	<b>16</b>	<b>40</b>	<b>0</b>	<b>155</b>	<b>560</b>
5:45 PM	0	14	28	3	0	0	0	0	0	0	30	8	0	6	54	0	143	575
Count Total	0	125	229	42	0	0	0	0	0	0	294	27	4	64	324	0	1,109	0
<b>Peak Hour</b>	<b>0</b>	<b>67</b>	<b>113</b>	<b>18</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>143</b>	<b>19</b>	<b>2</b>	<b>35</b>	<b>178</b>	<b>0</b>	<b>575</b>	<b>0</b>

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	1	0	0	0	1	2	0	3	0	5	20	21	28	8	77
4:15 PM	3	0	0	1	4	1	0	0	1	2	16	23	20	14	73
4:30 PM	1	0	1	0	2	0	0	0	0	0	14	26	23	11	74
4:45 PM	2	0	1	0	3	6	0	1	1	8	15	35	30	15	95
<b>5:00 PM</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>	<b>6</b>	<b>23</b>	<b>35</b>	<b>32</b>	<b>16</b>	<b>106</b>
5:15 PM	0	0	0	1	1	3	0	2	0	5	27	32	26	13	98
<b>5:30 PM</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>8</b>	<b>27</b>	<b>23</b>	<b>38</b>	<b>22</b>	<b>110</b>
5:45 PM	0	0	0	1	1	1	0	0	0	1	27	25	20	14	86
Count Total	9	0	3	3	15	14	0	17	4	35	169	220	217	113	719
<b>Peak Hour</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>5</b>	<b>5</b>	<b>0</b>	<b>13</b>	<b>2</b>	<b>20</b>	<b>104</b>	<b>115</b>	<b>116</b>	<b>65</b>	<b>400</b>

# Traffic Signal Warrant Summary Worksheet

The Worksheet(s) attached are provided as an attachment to the  
Madison BRT Early Spring St Study for:

Intersection: Spring St & 9th St  
County: King County  
City: Seattle

Major Street: 9th st  
Street Classification: Minor Arterial  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

Minor Street: Spring St  
Street Classification: Minor Arterial  
Critical Approach Speed: 25 mph  
Lanes: 2 lanes each direction

**Analysis based on EXISTING volume data.**

Date	Day of The Week	Time Interval
5/19/2016	Thursday	7:00 am - 9:00 am
5/19/2016	Thursday	4:00 pm - 6:00 pm
6/9/2016	Thursday	9:00 am - 4:00 pm

Warrant Evaluation Summary		Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume		No
	Condition A: Minimum Vehicular Volume	No
	Condition B: Interruption of Continuous Traffic	No
	Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume		No
Warrant 3: Peak Hour Volume		No
Warrant 4: Pedestrian Volume		No
	Criterion A: Four-Hour	No
	Criterion B: Peak-Hour	No



# Warrant 1: Eight-Hour Vehicular Volume

8-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
10:00 AM	11:00 AM	275	148
11:00 AM	12:00 PM	291	159
12:00 PM	1:00 PM	270	153
1:00 PM	2:00 PM	259	116
2:00 PM	3:00 PM	302	157
3:00 PM	4:00 PM	302	133
4:00 PM	5:00 PM	263	168
5:00 PM	6:00 PM	289	175

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street				Vehicles per hour on higher-volume			
		(total of both approaches)				minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112
Condition B—Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street				Vehicles per hour on higher-volume			
		(total of both approaches)				minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

<sup>a</sup> Basic minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

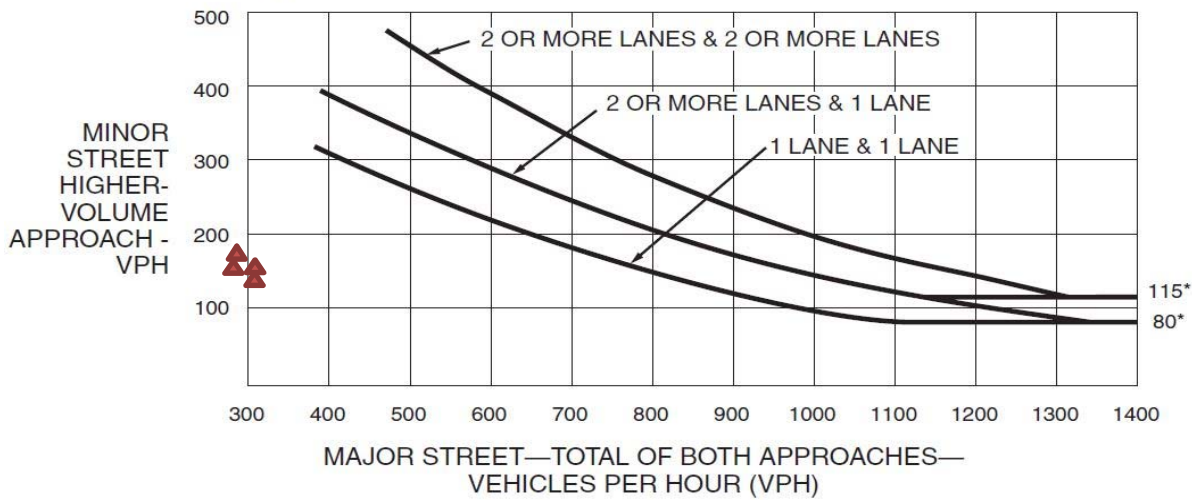
<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

<sup>d</sup> May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

## Warrant 2: Four-Hour Vehicular Volume

4-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
11:00 AM	12:00 PM	291	159
2:00 PM	3:00 PM	302	157
3:00 PM	4:00 PM	302	133
5:00 PM	6:00 PM	289	175

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**

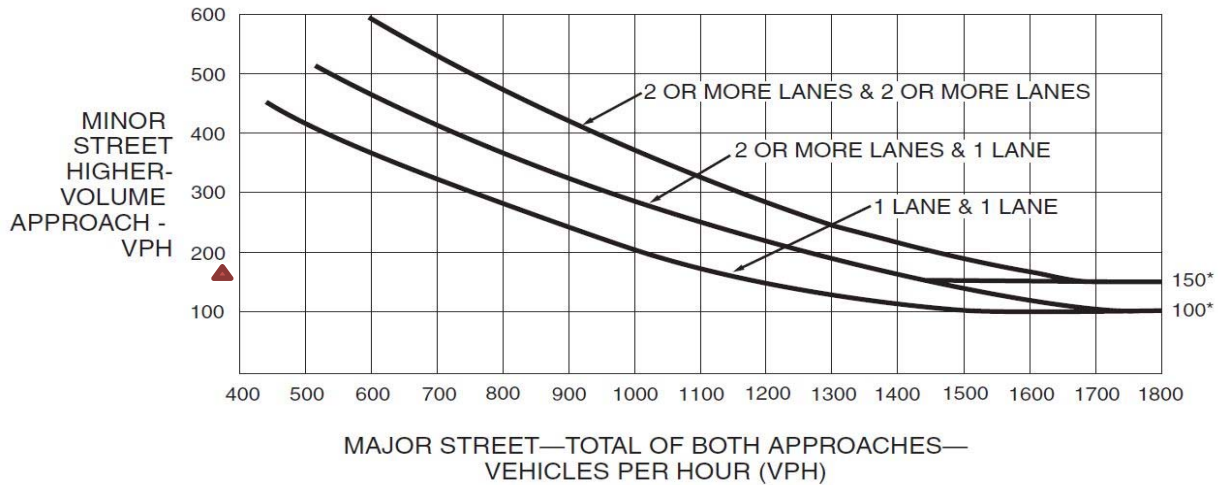


\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 3: Peak Hour Volume

Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
2:30 PM	3:30 PM	312	161

Figure 4C-3. Warrant 3, Peak Hour



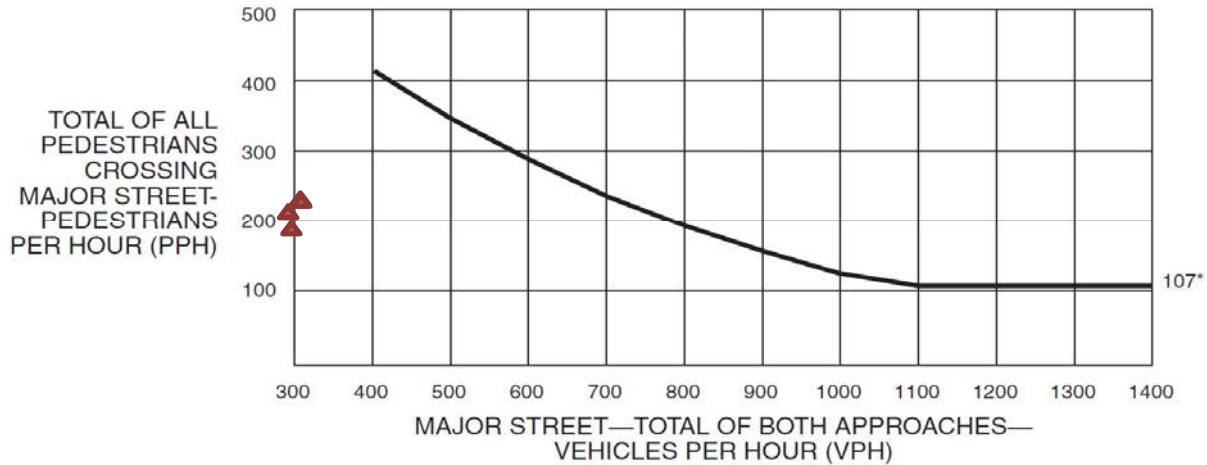
\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 4: Pedestrian Volume

## Criterion A: Four-Hour

Four-Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Ped Vol crossing Major St
11:00 AM	12:00 PM	291	193
2:00 PM	3:00 PM	302	234
3:00 PM	4:00 PM	302	234
5:00 PM	6:00 PM	289	212

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

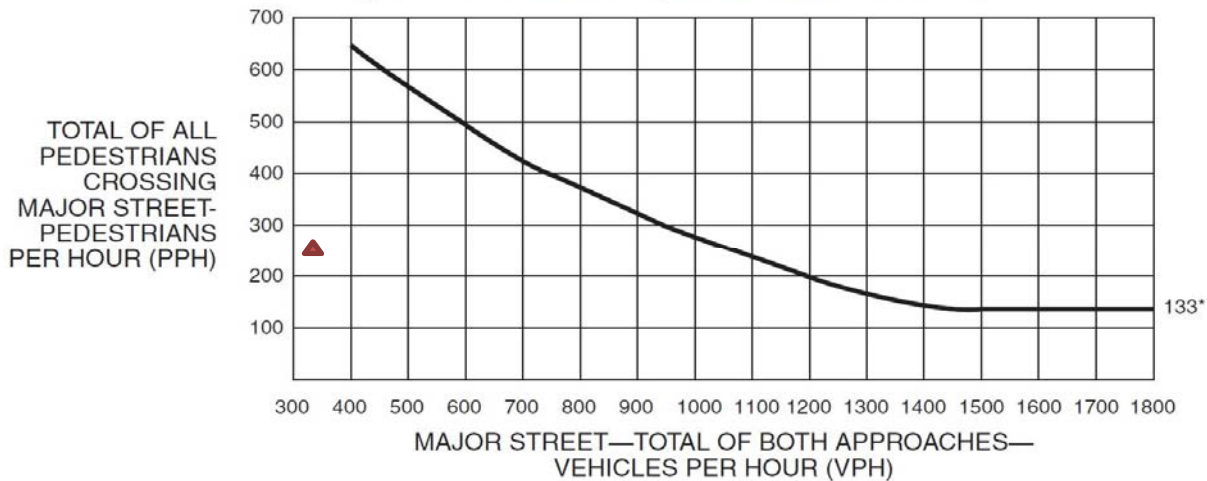


\*Note: 107 pph applies as the lower threshold volume.

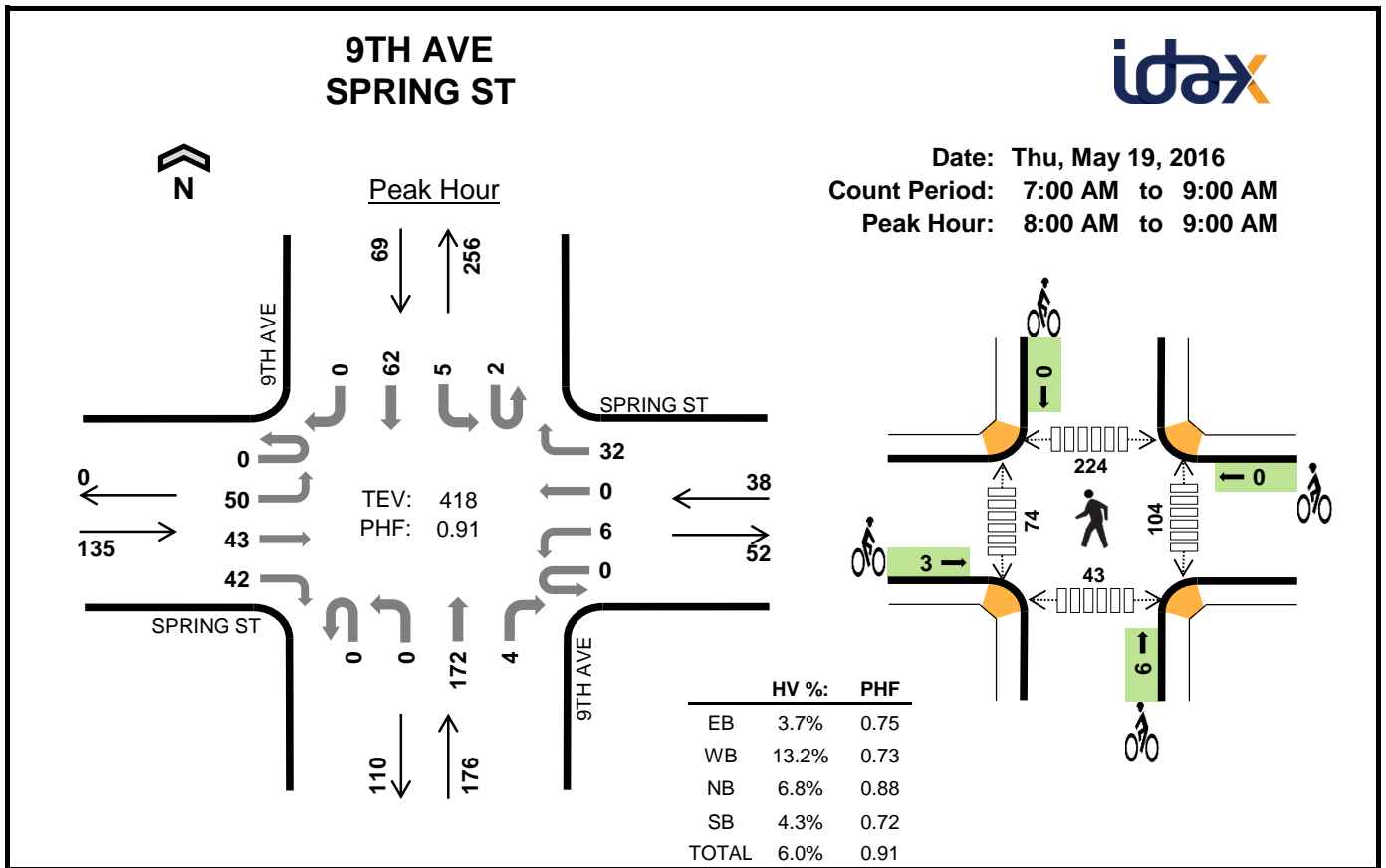
## Criterion B: Peak Hour

Peak Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Pedestrian Volume
2:30 PM	3:30 PM	312	242

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



\*Note: 133 pph applies as the lower threshold volume.

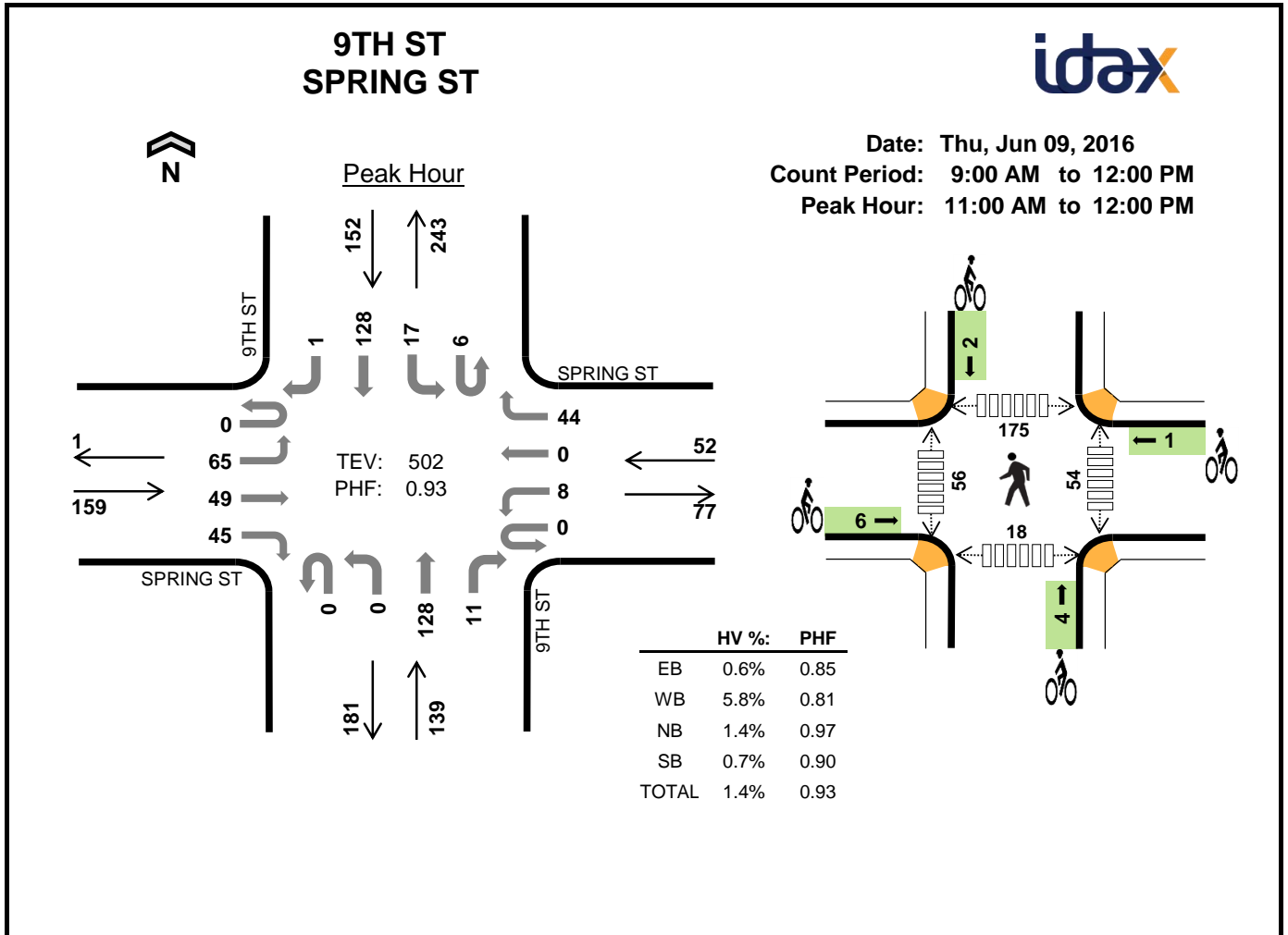


#### Two-Hour Count Summaries

Interval Start	SPRING ST Eastbound				SPRING ST Westbound				9TH AVE Northbound				9TH AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
	7:00 AM	0	12	7	7	0	1	0	3	0	0	24	3	0	1	14		
7:15 AM	0	12	14	11	0	2	0	4	0	0	28	0	0	3	16	0	90	0
7:30 AM	0	7	6	12	0	3	0	7	0	0	28	0	0	4	27	0	94	0
7:45 AM	0	15	17	5	0	0	0	5	0	0	48	2	0	0	20	0	112	368
<b>8:00 AM</b>	<b>0</b>	<b>13</b>	<b>6</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>44</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>0</b>	<b>107</b>	<b>403</b>
8:15 AM	0	8	9	11	0	2	0	5	0	0	36	2	0	0	9	0	82	395
8:30 AM	0	15	10	5	0	2	0	11	0	0	49	1	0	3	18	0	114	415
<b>8:45 AM</b>	<b>0</b>	<b>14</b>	<b>18</b>	<b>13</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>0</b>	<b>43</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>11</b>	<b>0</b>	<b>115</b>	<b>418</b>
Count Total	0	96	87	77	0	12	0	51	0	0	300	9	2	13	139	0	786	0
<b>Peak Hour</b>	<b>0</b>	<b>50</b>	<b>43</b>	<b>42</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>32</b>	<b>0</b>	<b>0</b>	<b>172</b>	<b>4</b>	<b>2</b>	<b>5</b>	<b>62</b>	<b>0</b>	<b>418</b>	<b>0</b>

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	3	0	3	0	6	1	0	0	0	1	30	15	38	3	86
7:15 AM	2	0	2	0	4	0	0	0	0	0	23	14	45	2	84
7:30 AM	0	1	1	0	2	0	0	1	1	2	34	21	45	10	110
7:45 AM	0	0	2	0	2	0	0	2	1	3	35	23	63	12	133
<b>8:00 AM</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>4</b>	<b>31</b>	<b>13</b>	<b>41</b>	<b>8</b>	<b>93</b>
8:15 AM	2	1	2	0	5	1	0	0	0	1	26	19	58	15	118
8:30 AM	1	1	4	1	7	0	0	2	0	2	21	25	54	9	109
<b>8:45 AM</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>8</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>26</b>	<b>17</b>	<b>71</b>	<b>11</b>	<b>125</b>
Count Total	10	6	20	3	39	4	0	9	2	15	226	147	415	70	858
<b>Peak Hour</b>	<b>5</b>	<b>5</b>	<b>12</b>	<b>3</b>	<b>25</b>	<b>3</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>9</b>	<b>104</b>	<b>74</b>	<b>224</b>	<b>43</b>	<b>445</b>



**Three-Hour Count Summaries**

Interval Start	SPRING ST Eastbound				SPRING ST Westbound				9TH ST Northbound				9TH ST Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
11:00 AM	0	18	11	8	0	2	0	14	0	0	33	2	1	5	30	0	124	0
11:15 AM	0	14	13	12	0	2	0	9	0	0	33	3	1	4	31	0	122	0
11:30 AM	0	14	11	11	0	3	0	10	0	0	31	3	3	6	29	0	121	0
11:45 AM	0	19	14	14	0	1	0	11	0	0	31	3	1	2	38	1	135	502
Peak Hour	0	65	49	45	0	8	0	44	0	0	128	11	6	17	128	1	502	0

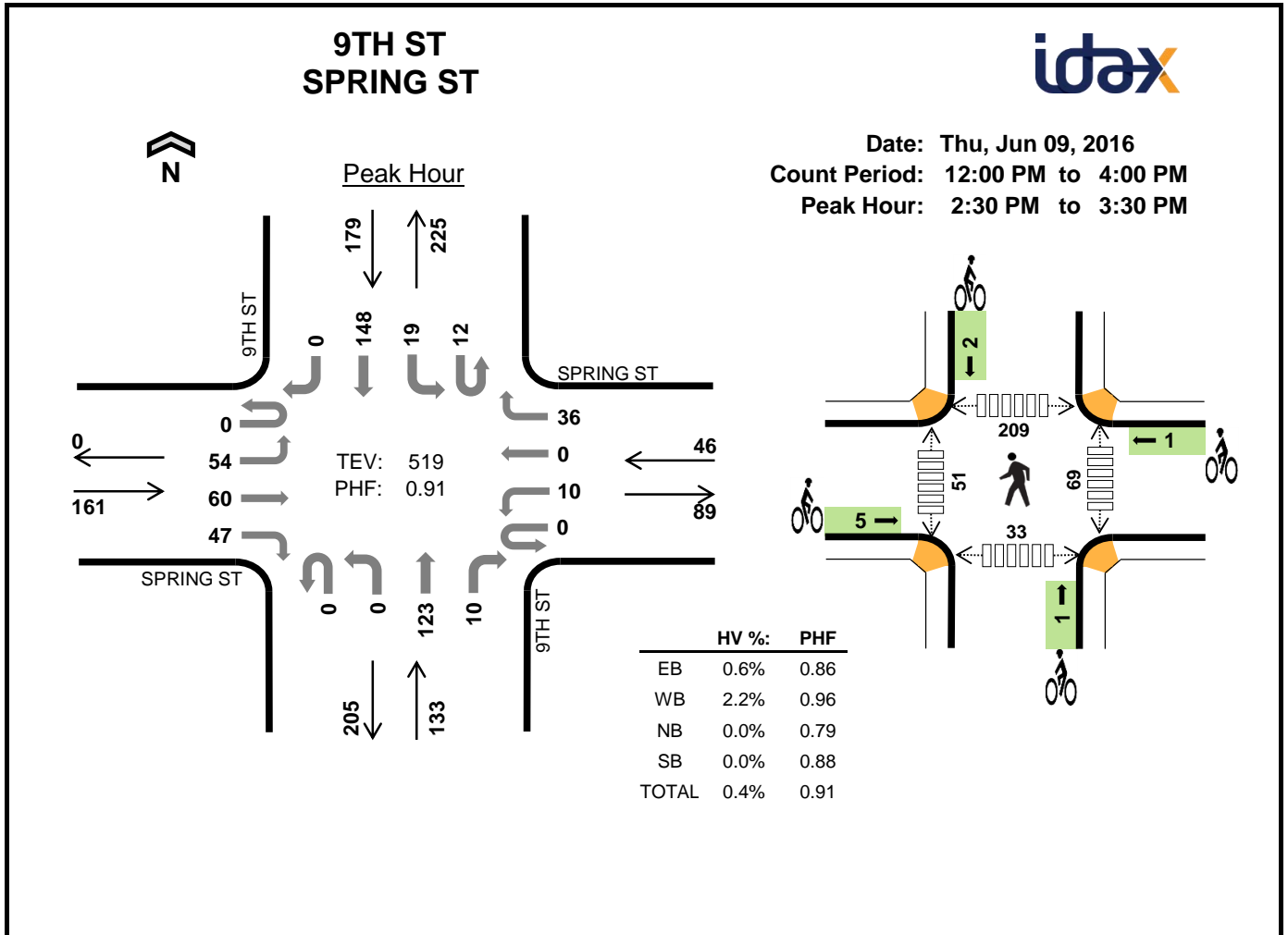
Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
11:00 AM	0	1	1	0	2	1	0	3	0	4	11	13	30	8	62
11:15 AM	1	1	1	0	3	2	0	0	0	2	9	8	40	1	58
11:30 AM	0	1	0	1	2	1	1	0	1	3	15	20	46	9	90
11:45 AM	0	0	0	0	0	2	0	1	1	4	19	15	59	0	93
Peak Hour	1	3	2	1	7	6	1	4	2	13	54	56	175	18	303

<b>Three-Hour Count Summaries</b>																		
Interval Start	SPRING ST				SPRING ST				9TH ST				9TH ST				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
9:00 AM	0	14	9	12	0	1	0	8	0	0	40	5	1	0	22	0	112	0
9:15 AM	0	15	7	14	0	3	0	6	1	0	31	4	1	2	22	1	107	0
9:30 AM	0	10	6	10	0	1	0	8	1	0	34	3	0	3	22	0	98	0
9:45 AM	0	21	7	10	0	1	0	4	0	0	31	6	0	0	18	0	98	415
10:00 AM	0	22	9	13	0	1	0	5	1	0	32	3	4	3	26	0	119	422
10:15 AM	0	19	7	7	0	5	0	11	0	0	45	3	1	1	25	1	125	440
10:30 AM	0	16	12	12	0	2	0	13	0	0	29	1	4	3	34	1	127	469
10:45 AM	0	15	9	7	0	1	0	6	0	0	33	2	4	2	17	0	96	467
11:00 AM	0	18	11	8	0	2	0	14	0	0	33	2	1	5	30	0	124	472
11:15 AM	0	14	13	12	0	2	0	9	0	0	33	3	1	4	31	0	122	469
11:30 AM	0	14	11	11	0	3	0	10	0	0	31	3	3	6	29	0	121	463
11:45 AM	0	19	14	14	0	1	0	11	0	0	31	3	1	2	38	1	135	502
Count Total	0	197	115	130	0	23	0	105	3	0	403	38	21	31	314	4	1,384	0
Peak Hour	0	65	49	45	0	8	0	44	0	0	128	11	6	17	128	1	502	0

Note: Three-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
9:00 AM	0	0	0	0	0	1	0	2	1	4	10	14	53	6	83
9:15 AM	0	0	0	0	0	2	0	1	1	4	8	11	44	7	70
9:30 AM	1	0	0	0	1	1	0	1	0	2	12	10	40	7	69
9:45 AM	0	0	0	0	0	1	0	2	2	5	16	14	45	6	81
10:00 AM	0	0	0	0	0	2	0	0	1	3	13	9	49	3	74
10:15 AM	2	1	0	0	3	0	1	0	1	2	14	16	63	7	100
10:30 AM	0	2	0	1	3	0	0	1	0	1	11	11	49	1	72
10:45 AM	0	0	0	1	1	4	0	1	0	5	10	6	43	12	71
11:00 AM	0	1	1	0	2	1	0	3	0	4	11	13	30	8	62
11:15 AM	1	1	1	0	3	2	0	0	0	2	9	8	40	1	58
11:30 AM	0	1	0	1	2	1	1	0	1	3	15	20	46	9	90
11:45 AM	0	0	0	0	0	2	0	1	1	4	19	15	59	0	93
Count Total	4	6	2	3	15	17	2	12	8	39	148	147	561	67	923
Peak Hour	1	3	2	1	7	6	1	4	2	13	54	56	175	18	303



**Four-Hour Count Summaries**

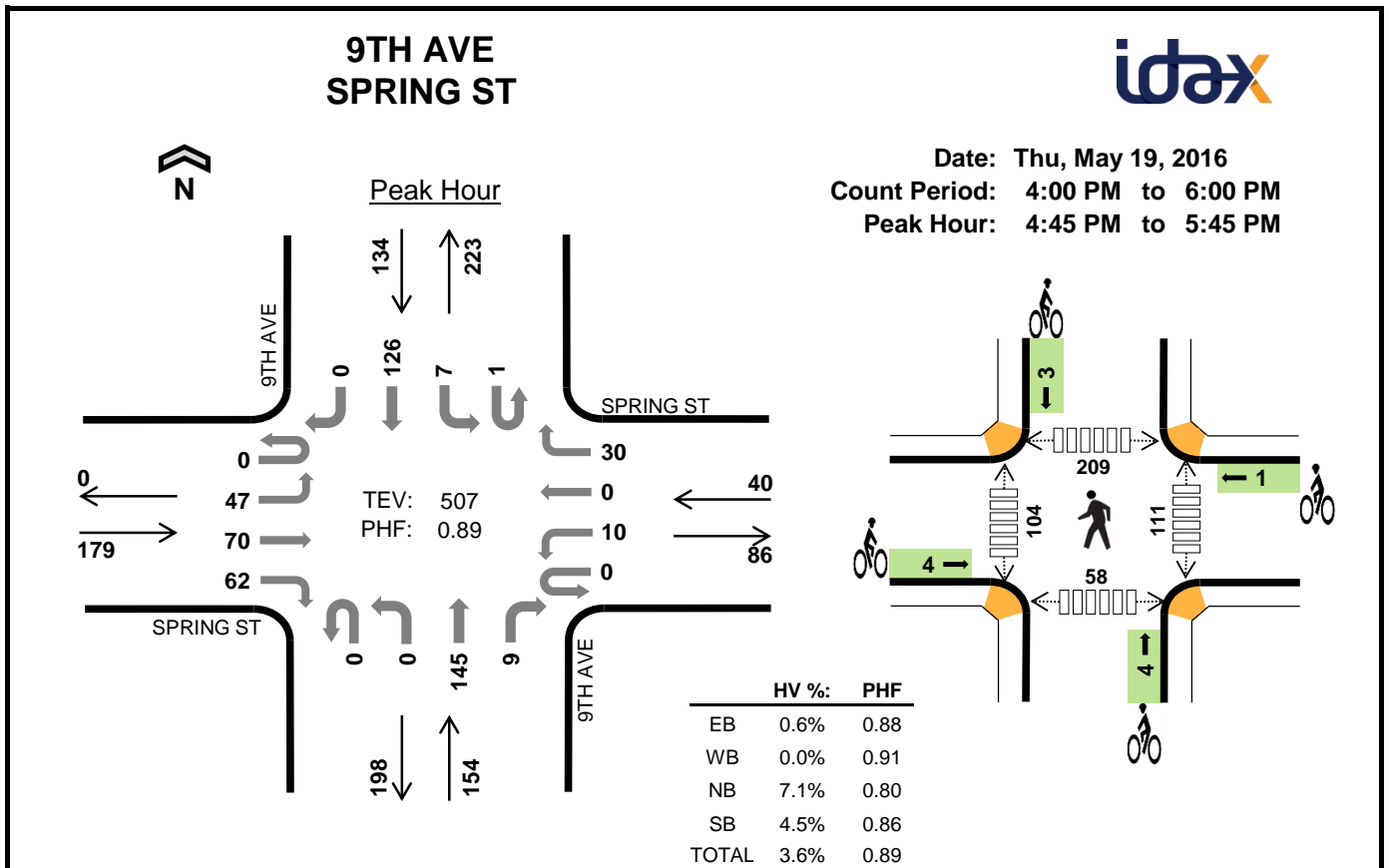
Interval Start	SPRING ST Eastbound				SPRING ST Westbound				9TH ST Northbound				9TH ST Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
2:30 PM	0	17	14	6	0	3	0	9	0	0	38	4	1	2	32	0	126	0
2:45 PM	0	16	19	12	0	1	0	10	0	0	34	4	6	7	33	0	142	0
3:00 PM	0	14	10	10	0	3	0	9	0	0	26	0	2	4	45	0	123	0
3:15 PM	0	7	17	19	0	3	0	8	0	0	25	2	3	6	38	0	128	519
<b>Peak Hour</b>	<b>0</b>	<b>54</b>	<b>60</b>	<b>47</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>36</b>	<b>0</b>	<b>0</b>	<b>123</b>	<b>10</b>	<b>12</b>	<b>19</b>	<b>148</b>	<b>0</b>	<b>519</b>	<b>0</b>

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
2:30 PM	0	0	0	0	0	0	0	1	2	3	12	17	63	13	105
2:45 PM	0	1	0	0	1	2	0	0	0	2	20	7	46	3	76
3:00 PM	0	0	0	0	0	1	0	0	0	1	13	12	52	9	86
3:15 PM	1	0	0	0	1	2	1	0	0	3	24	15	48	8	95
<b>Peak Hour</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>9</b>	<b>69</b>	<b>51</b>	<b>209</b>	<b>33</b>	<b>362</b>



<b>Four-Hour Count Summaries</b>																		
Interval Start	SPRING ST				SPRING ST				9TH ST				9TH ST				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
12:00 PM	0	15	12	14	0	5	0	7	1	0	13	5	1	6	37	0	116	0
12:15 PM	0	14	9	9	0	0	0	11	0	0	42	2	1	4	35	0	127	0
12:30 PM	0	21	10	3	0	0	0	7	1	0	29	2	1	2	20	0	96	0
12:45 PM	0	18	15	13	0	2	0	10	0	0	32	2	4	5	25	0	126	465
1:00 PM	0	12	4	6	0	2	1	9	1	0	34	2	0	2	21	0	94	443
1:15 PM	0	14	14	6	0	1	0	8	0	0	47	1	5	3	18	0	117	433
1:30 PM	0	10	9	7	0	2	0	12	1	0	30	3	0	5	28	0	107	444
1:45 PM	0	15	15	4	0	2	0	12	0	0	22	2	2	6	26	0	106	424
2:00 PM	0	19	8	12	0	2	0	8	1	0	38	5	2	4	37	0	136	466
2:15 PM	0	13	12	9	0	1	0	5	0	0	22	5	5	1	21	0	94	443
<b>2:30 PM</b>	<b>0</b>	<b>17</b>	<b>14</b>	<b>6</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>38</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>32</b>	<b>0</b>	<b>126</b>	<b>462</b>
<b>2:45 PM</b>	<b>0</b>	<b>16</b>	<b>19</b>	<b>12</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>0</b>	<b>34</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>33</b>	<b>0</b>	<b>142</b>	<b>498</b>
3:00 PM	0	14	10	10	0	3	0	9	0	0	26	0	2	4	45	0	123	485
3:15 PM	0	7	17	19	0	3	0	8	0	0	25	2	3	6	38	0	128	519
3:30 PM	0	12	14	6	0	1	0	14	0	0	31	4	0	5	34	2	123	516
3:45 PM	0	12	3	9	0	5	0	3	0	0	38	2	0	3	32	0	107	481
Count Total	0	229	185	145	0	33	1	142	5	0	501	45	33	65	482	2	1,868	0
Peak Hour	0	54	60	47	0	10	0	36	0	0	123	10	12	19	148	0	519	0
<i>Note: Four-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.</i>																		
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)							
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total			
12:00 PM	0	0	0	0	0	2	0	0	0	2	27	27	54	6	114			
12:15 PM	0	0	0	0	0	1	0	1	0	2	19	24	24	3	70			
12:30 PM	1	0	0	0	1	0	0	1	1	2	16	14	64	4	98			
12:45 PM	0	0	0	1	1	2	2	0	1	5	13	12	39	9	73			
1:00 PM	0	0	0	0	0	0	0	0	0	0	23	16	43	6	88			
1:15 PM	0	0	0	0	0	0	0	1	0	1	19	14	56	10	99			
1:30 PM	0	0	1	0	1	0	0	0	1	1	10	13	66	5	94			
1:45 PM	0	0	0	0	0	1	0	0	0	1	6	14	65	5	90			
2:00 PM	0	0	0	0	0	4	0	0	0	4	10	13	54	3	80			
2:15 PM	0	0	0	0	0	1	0	0	0	1	16	14	47	5	82			
<b>2:30 PM</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>12</b>	<b>17</b>	<b>63</b>	<b>13</b>	<b>105</b>			
<b>2:45 PM</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>20</b>	<b>7</b>	<b>46</b>	<b>3</b>	<b>76</b>			
3:00 PM	0	0	0	0	0	1	0	0	0	1	13	12	52	9	86			
3:15 PM	1	0	0	0	1	2	1	0	0	3	24	15	48	8	95			
3:30 PM	0	0	0	0	0	5	0	2	1	8	22	20	52	9	103			
3:45 PM	0	0	2	0	2	1	0	4	0	5	13	21	45	11	90			
Count Total	2	1	3	1	7	22	3	10	6	41	263	253	818	109	1,443			
Peak Hour	1	1	0	0	2	5	1	1	2	9	69	51	209	33	362			



#### Two-Hour Count Summaries

Interval Start	SPRING ST Eastbound				SPRING ST Westbound				9TH AVE Northbound				9TH AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	21	5	11	0	5	0	8	0	0	32	1	1	2	37	0	123	0
4:15 PM	0	10	14	13	0	2	0	8	0	0	27	9	0	4	32	0	119	0
4:30 PM	0	23	11	18	0	2	0	10	1	0	30	2	0	0	31	0	128	0
<b>4:45 PM</b>	<b>0</b>	<b>11</b>	<b>12</b>	<b>19</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>27</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>23</b>	<b>0</b>	<b>105</b>	<b>475</b>
5:00 PM	0	15	14	9	0	1	0	8	0	0	34	3	0	1	38	0	123	475
<b>5:15 PM</b>	<b>0</b>	<b>11</b>	<b>21</b>	<b>19</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>45</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>31</b>	<b>0</b>	<b>142</b>	<b>498</b>
5:30 PM	0	10	23	15	0	3	0	8	0	0	39	2	0	3	34	0	137	507
5:45 PM	0	9	15	14	0	2	0	7	0	0	24	5	1	1	24	0	102	504
Count Total	0	110	115	118	0	21	0	63	1	0	258	26	3	14	250	0	979	0
<b>Peak Hour</b>	<b>0</b>	<b>47</b>	<b>70</b>	<b>62</b>	<b>0</b>	<b>10</b>	<b>0</b>	<b>30</b>	<b>0</b>	<b>0</b>	<b>145</b>	<b>9</b>	<b>1</b>	<b>7</b>	<b>126</b>	<b>0</b>	<b>507</b>	<b>0</b>

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	1	0	3	1	5	1	0	1	0	2	39	23	60	8	130
4:15 PM	1	0	4	0	5	0	0	1	0	1	29	25	52	12	118
4:30 PM	1	0	1	0	2	0	0	1	1	2	37	29	52	3	121
<b>4:45 PM</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>6</b>	<b>29</b>	<b>29</b>	<b>69</b>	<b>18</b>	<b>145</b>
5:00 PM	0	0	1	2	3	1	1	0	0	2	35	28	64	12	139
<b>5:15 PM</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>2</b>	<b>9</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>28</b>	<b>29</b>	<b>38</b>	<b>14</b>	<b>109</b>
5:30 PM	0	0	1	0	1	0	0	0	1	1	19	18	38	14	89
5:45 PM	1	0	1	0	2	1	0	0	0	1	21	15	24	8	68
Count Total	5	0	20	7	32	6	1	7	4	18	237	196	397	89	919
<b>Peak Hour</b>	<b>1</b>	<b>0</b>	<b>11</b>	<b>6</b>	<b>18</b>	<b>4</b>	<b>1</b>	<b>4</b>	<b>3</b>	<b>12</b>	<b>111</b>	<b>104</b>	<b>209</b>	<b>58</b>	<b>482</b>

# Traffic Signal Warrant Summary Worksheet

The Worksheet(s) attached are provided as an attachment to the  
Madison BRT project for:

Intersection: 18th Ave & E Madison St.  
County: King County  
City: Seattle

Major Street: E Madison St  
Street Classification: Principal Arterial  
Critical Approach Speed: 25 mph  
Lanes: 2 lanes each direction

Minor Street: 18th Ave  
Street Classification: Access Street  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

**Analysis based on EXISTING volume data.**

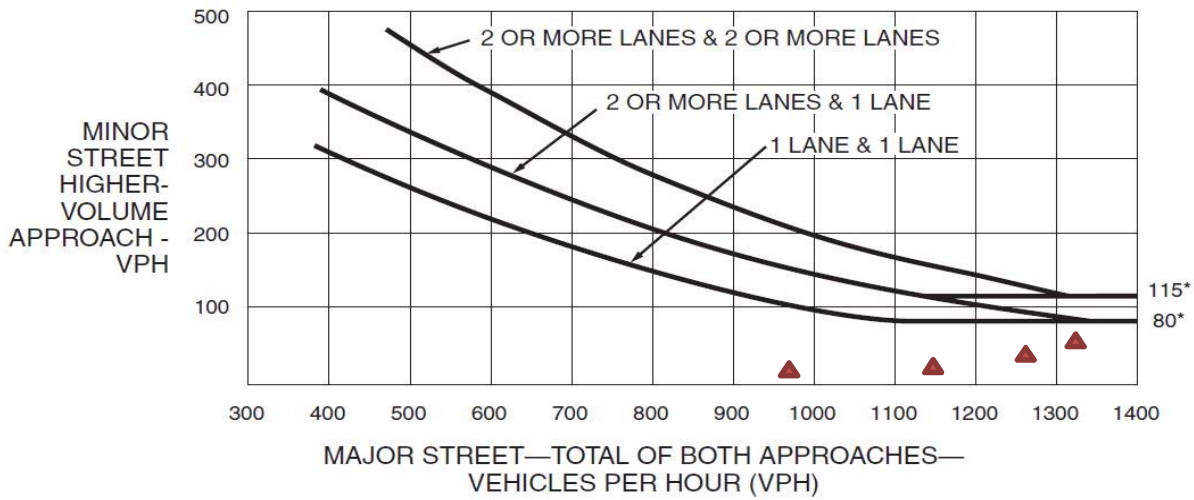
Date	Day of The Week	Time Interval
6/30/2016	Thursday	7:00 am - 9:00 am
6/30/2016	Thursday	4:00 pm - 6:00 pm

Warrant Evaluation Summary		Warrant Met:
Warrant 2: Four-Hour Volume		No
Warrant 3: Peak Hour Volume		No
Warrant 4: Pedestrian Volume		No
	Criterion A: Four-Hour	No
	Criterion B: Peak-Hour	No

## Warrant 2: Four-Hour Vehicular Volume

4-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
7:00 AM	8:00 AM	966	26
8:00 AM	9:00 AM	1,151	36
4:00 PM	5:00 PM	1,262	43
5:00 PM	6:00 PM	1,332	59

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**

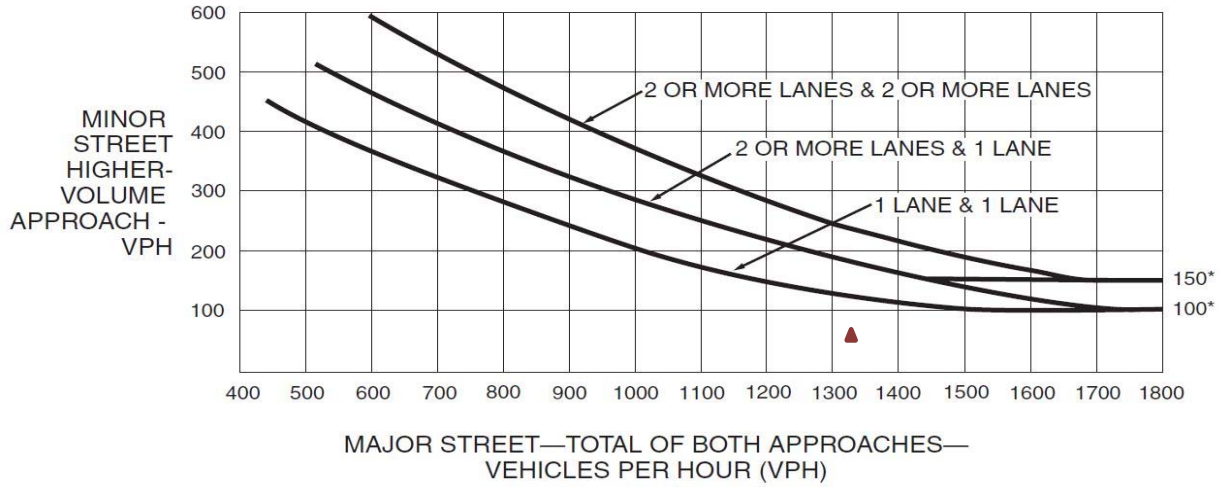


\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 3: Peak Hour Volume

Hour Vehicular Volume		
Hour	Major Street	Highest Minor Street Approach
5:00 PM -6:00 PM	1,332	59

Figure 4C-3. Warrant 3, Peak Hour



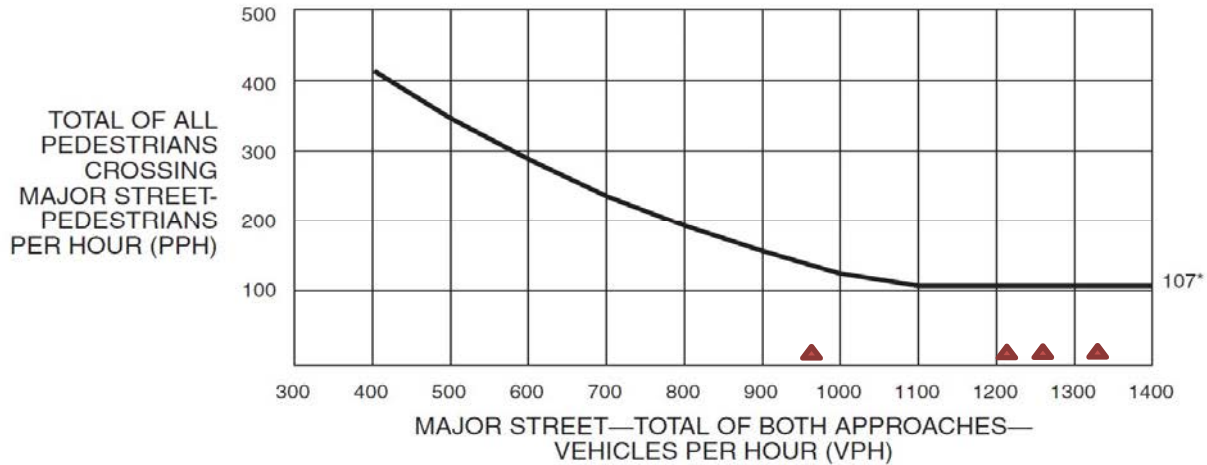
\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 4: Pedestrian Volume

## Criterion A: Four-Hour

Four-Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Ped Vol crossing Major St
7:00 AM	8:00 AM	966	12
8:00 AM	9:00 AM	1,215	11
4:00 PM	5:00 PM	1,262	11
5:00 PM	6:00 PM	1,332	16

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

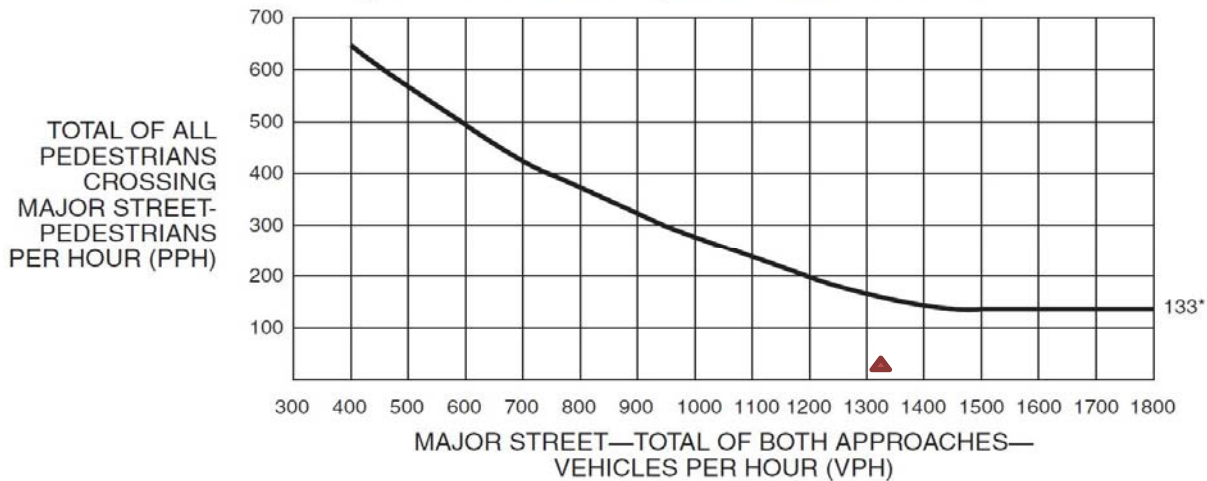


\*Note: 107 pph applies as the lower threshold volume.

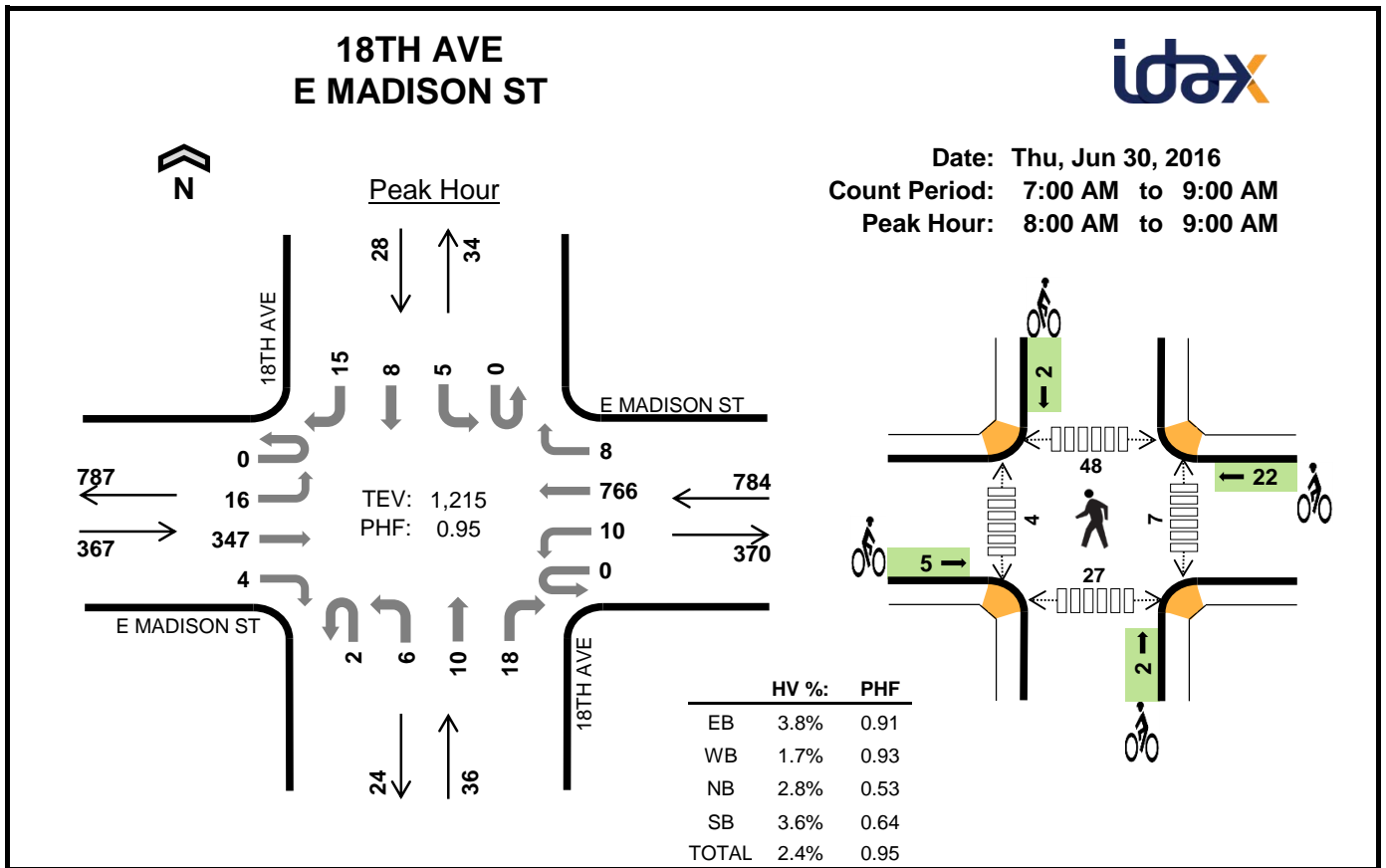
## Criterion B: Peak Hour

Peak Hour Pedestrian Volume v.s. Vehicular Volume		
Hour	Major Street	Pedestrian Volume
5:00 PM -6:00 PM	1,332	16

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



\*Note: 133 pph applies as the lower threshold volume.

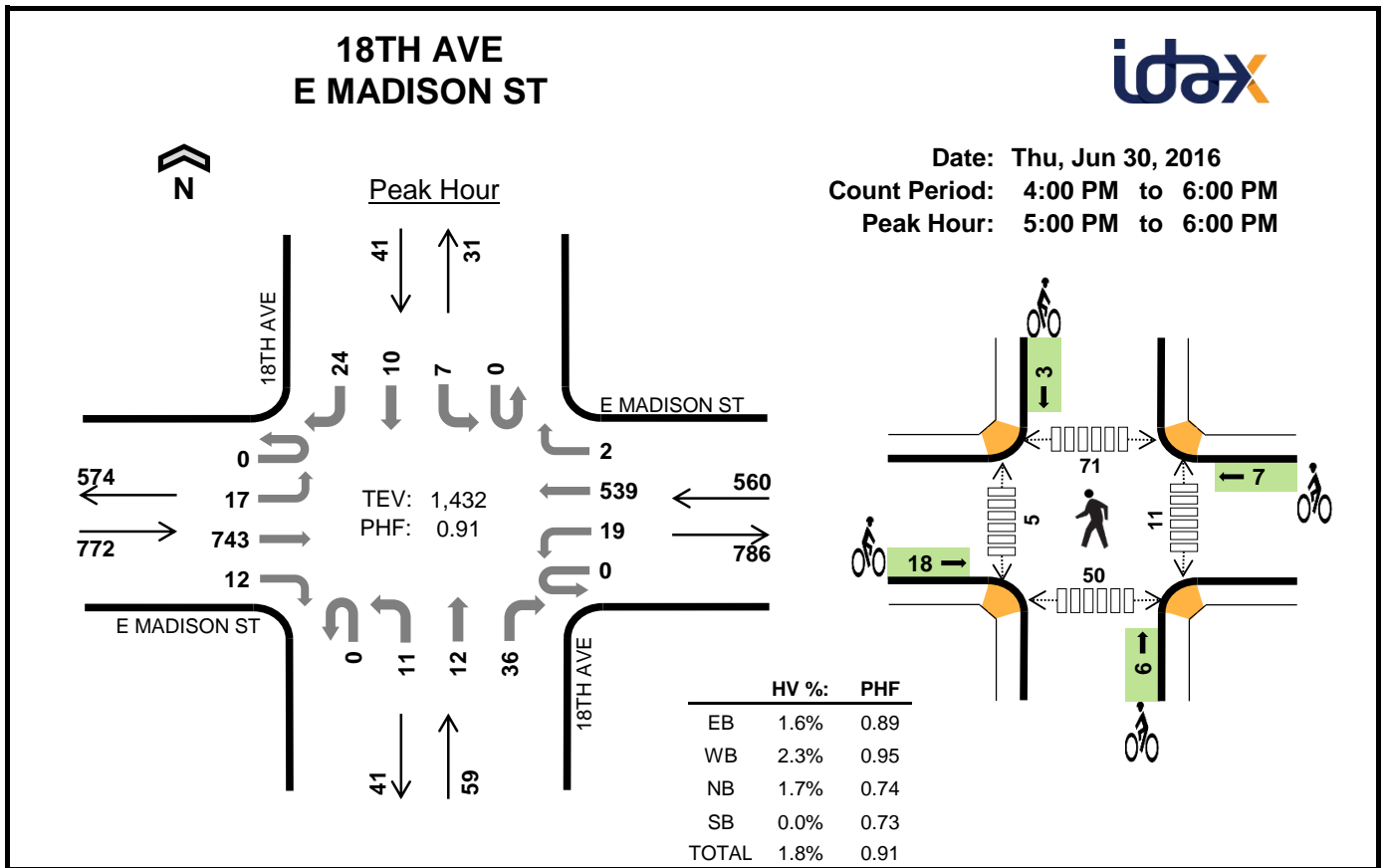


#### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				18TH AVE Northbound				18TH AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	1	67	1	0	3	126	0	0	1	0	3	0	0	0	1	203	0
7:15 AM	0	5	72	3	0	2	132	1	0	3	1	1	0	1	2	2	225	0
7:30 AM	0	2	78	1	0	4	171	0	0	4	1	2	0	1	0	4	268	0
7:45 AM	0	4	81	1	0	3	204	4	0	1	3	6	0	0	0	3	310	1,006
<b>8:00 AM</b>	<b>0</b>	<b>1</b>	<b>72</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>171</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>260</b>	<b>1,063</b>
<b>8:15 AM</b>	<b>0</b>	<b>2</b>	<b>94</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>195</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>12</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>4</b>	<b>319</b>	<b>1,157</b>
8:30 AM	0	5	90	1	0	1	209	1	1	2	1	2	0	2	1	3	319	1,208
8:45 AM	0	8	91	2	0	5	191	1	0	1	3	4	0	1	6	4	317	1,215
Count Total	0	28	645	10	0	22	1,399	13	2	15	15	30	0	7	10	25	2,221	0
<b>Peak Hour</b>	<b>0</b>	<b>16</b>	<b>347</b>	<b>4</b>	<b>0</b>	<b>10</b>	<b>766</b>	<b>8</b>	<b>2</b>	<b>6</b>	<b>10</b>	<b>18</b>	<b>0</b>	<b>5</b>	<b>8</b>	<b>15</b>	<b>1,215</b>	<b>0</b>

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	7	5	0	0	12	1	5	0	0	6	1	3	13	6	23
7:15 AM	3	5	0	0	8	2	3	2	0	7	1	0	7	7	15
7:30 AM	4	5	0	0	9	1	5	2	0	8	2	1	11	8	22
7:45 AM	3	4	0	0	7	1	3	0	0	4	2	2	8	12	24
8:00 AM	2	4	0	0	6	0	5	1	0	6	3	3	8	4	18
<b>8:15 AM</b>	<b>6</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>11</b>	<b>4</b>	<b>4</b>	<b>1</b>	<b>0</b>	<b>9</b>	<b>1</b>	<b>0</b>	<b>11</b>	<b>8</b>	<b>20</b>
8:30 AM	2	2	0	0	4	1	6	0	2	9	0	1	15	5	21
8:45 AM	4	3	1	0	8	0	7	0	0	7	3	0	14	10	27
Count Total	31	32	1	1	65	10	38	6	2	56	13	10	87	60	170
<b>Peak Hour</b>	<b>14</b>	<b>13</b>	<b>1</b>	<b>1</b>	<b>29</b>	<b>5</b>	<b>22</b>	<b>2</b>	<b>2</b>	<b>31</b>	<b>7</b>	<b>4</b>	<b>48</b>	<b>27</b>	<b>86</b>



### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				18TH AVE Northbound				18TH AVE Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	2	135	5	0	8	141	1	0	4	1	5	0	5	4	4	315	0
4:15 PM	0	3	203	3	0	5	132	3	0	1	3	4	0	2	0	7	366	0
4:30 PM	0	1	165	3	0	2	132	4	0	3	2	11	0	1	1	7	332	0
4:45 PM	0	2	164	1	0	3	141	3	0	2	1	6	0	2	0	3	328	1,341
<b>5:00 PM</b>	<b>0</b>	<b>6</b>	<b>205</b>	<b>5</b>	<b>0</b>	<b>4</b>	<b>143</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>6</b>	<b>0</b>	<b>5</b>	<b>2</b>	<b>7</b>	<b>393</b>	<b>1,419</b>
5:15 PM	0	4	182	3	0	4	131	2	0	2	2	7	0	1	3	3	344	1,397
5:30 PM	0	1	194	1	0	8	130	0	0	2	3	15	0	0	3	9	366	1,431
5:45 PM	0	6	162	3	0	3	135	0	0	2	2	8	0	1	2	5	329	1,432
Count Total	0	25	1,410	24	0	37	1,085	13	0	21	19	62	0	17	15	45	2,773	0
<b>Peak Hour</b>	<b>0</b>	<b>17</b>	<b>743</b>	<b>12</b>	<b>0</b>	<b>19</b>	<b>539</b>	<b>2</b>	<b>0</b>	<b>11</b>	<b>12</b>	<b>36</b>	<b>0</b>	<b>7</b>	<b>10</b>	<b>24</b>	<b>1,432</b>	<b>0</b>

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	4	2	0	0	6	4	3	1	2	10	3	0	12	5	20
4:15 PM	4	4	1	0	9	3	0	0	0	3	1	0	14	19	34
4:30 PM	2	2	0	1	5	3	1	1	0	5	2	2	17	14	35
4:45 PM	3	5	0	0	8	4	1	0	0	5	1	2	18	17	38
<b>5:00 PM</b>	<b>2</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>7</b>	<b>2</b>	<b>0</b>	<b>16</b>	<b>21</b>	<b>39</b>
5:15 PM	3	2	0	0	5	4	2	0	1	7	2	4	14	13	33
5:30 PM	3	3	1	0	7	4	2	2	0	8	5	1	17	10	33
5:45 PM	4	4	0	0	8	8	1	2	1	12	2	0	24	6	32
Count Total	25	26	2	1	54	32	12	8	5	57	18	9	132	105	264
<b>Peak Hour</b>	<b>12</b>	<b>13</b>	<b>1</b>	<b>0</b>	<b>26</b>	<b>18</b>	<b>7</b>	<b>6</b>	<b>3</b>	<b>34</b>	<b>11</b>	<b>5</b>	<b>71</b>	<b>50</b>	<b>137</b>



# Traffic Signal Warrant Summary Worksheet

The Worksheet(s) attached are provided as an attachment to the  
Madison BRT Project for:

Intersection: 25th Ave & E Madison St.  
County: King County  
City: Seattle

Major Street: E Madison St  
Street Classification: Minor Arterial  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

Minor Street: 25th Ave  
Street Classification: Access Street  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

**Analysis based on EXISTING volume data.**

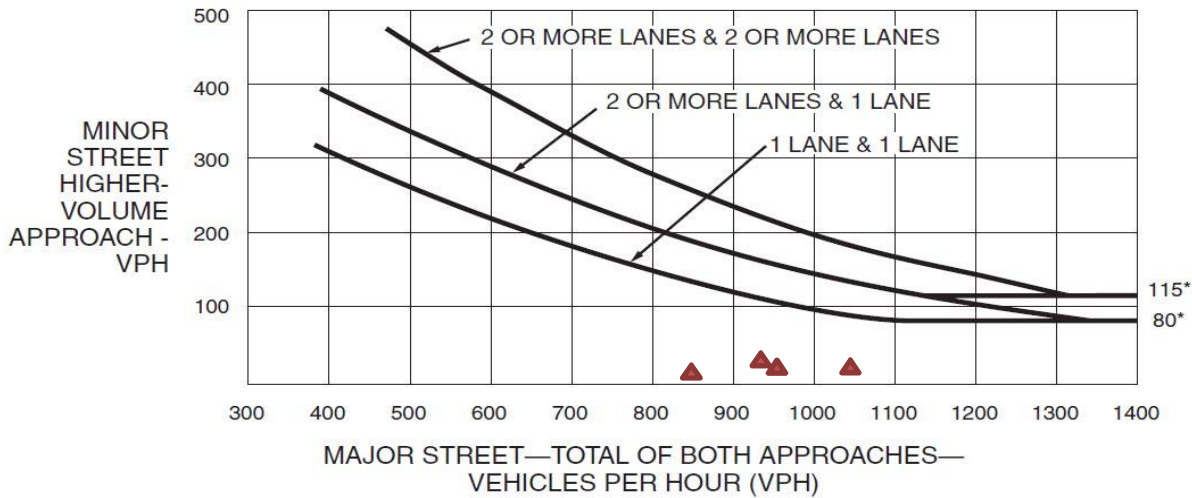
Date	Day of The Week	Time Interval
6/9/2016	Thursday	7:00 am - 9:00 am
6/9/2016	Thursday	4:00 pm - 6:00 pm

Warrant Evaluation Summary		Warrant Met:
Warrant 2: Four-Hour Volume		No
Warrant 3: Peak Hour Volume		No
Warrant 4: Pedestrian Volume		No
	Criterion A: Four-Hour	No
	Criterion B: Peak-Hour	No

## Warrant 2: Four-Hour Vehicular Volume

4-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
7:00 AM	8:00 AM	844	23
8:00 AM	9:00 AM	937	49
4:00 PM	5:00 PM	958	36
5:00 PM	6:00 PM	1,024	45

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**

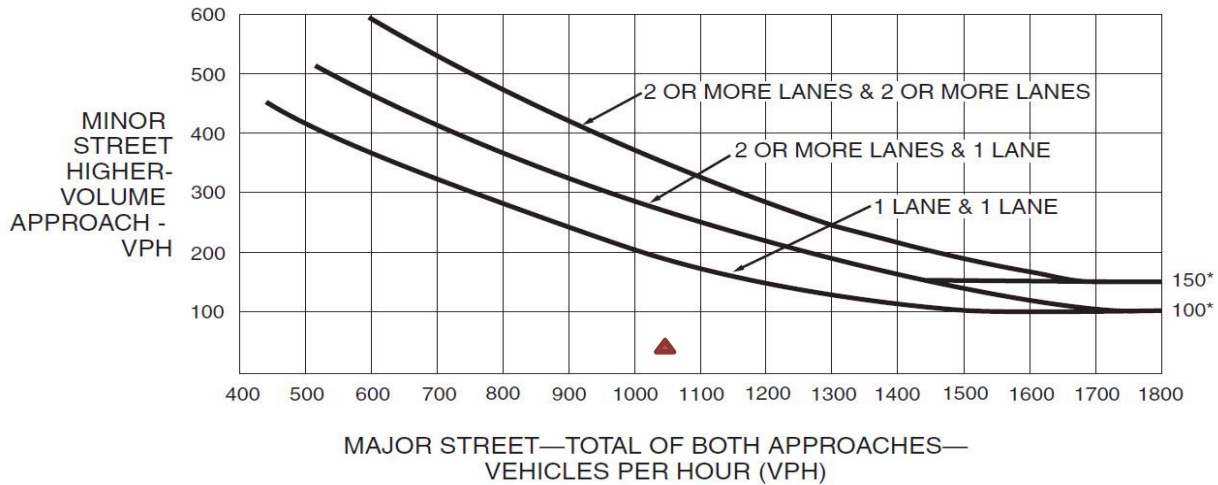


\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 3: Peak Hour Volume

Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
4:45 PM	5:45 PM	1,059	51

Figure 4C-3. Warrant 3, Peak Hour



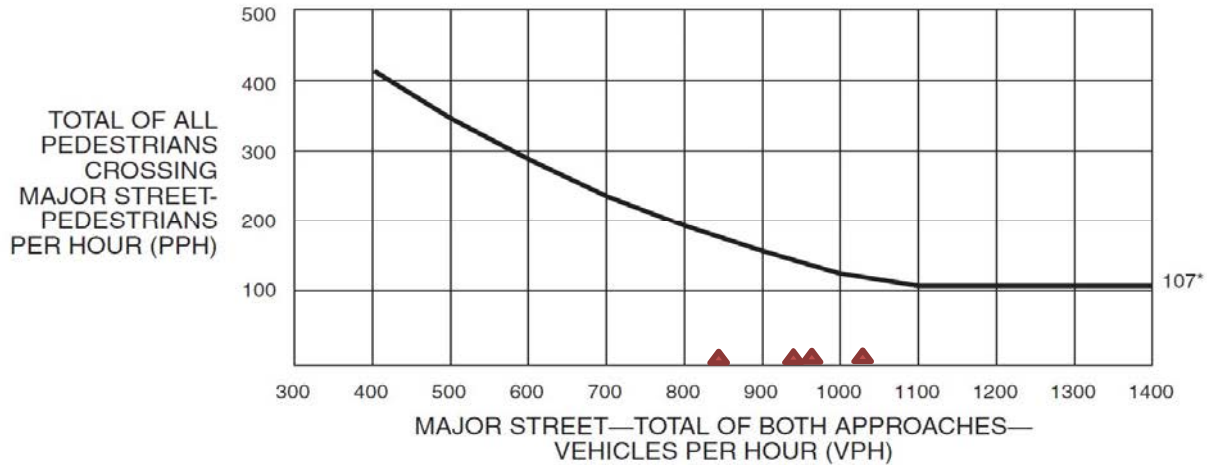
\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 4: Pedestrian Volume

## Criterion A: Four-Hour

Four-Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Ped Vol crossing Major St
7:00 AM	8:00 AM	844	7
8:00 AM	9:00 AM	937	10
4:00 PM	5:00 PM	958	11
5:00 PM	6:00 PM	1,024	9

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

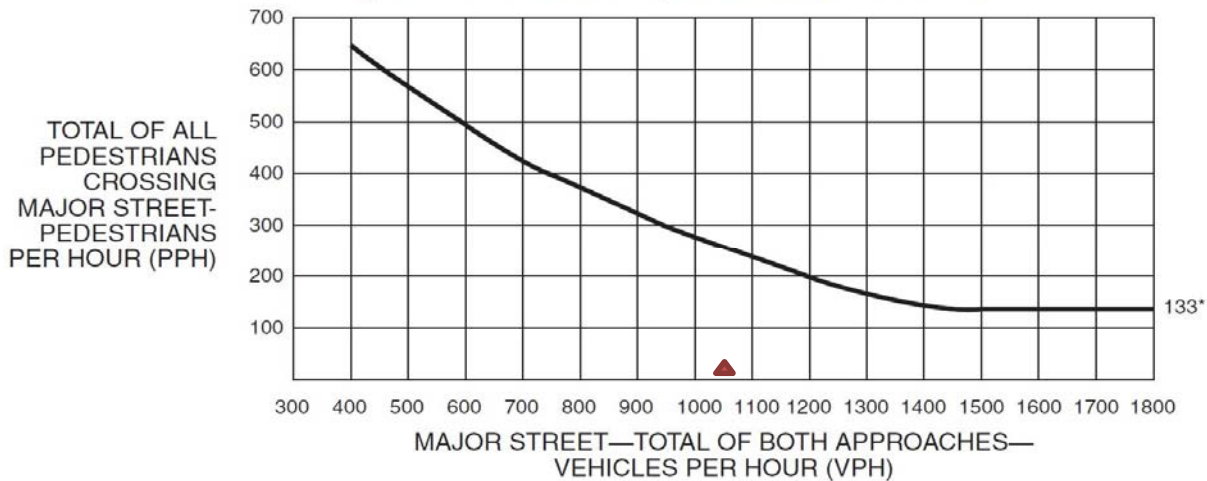


\*Note: 107 pph applies as the lower threshold volume.

## Criterion B: Peak Hour

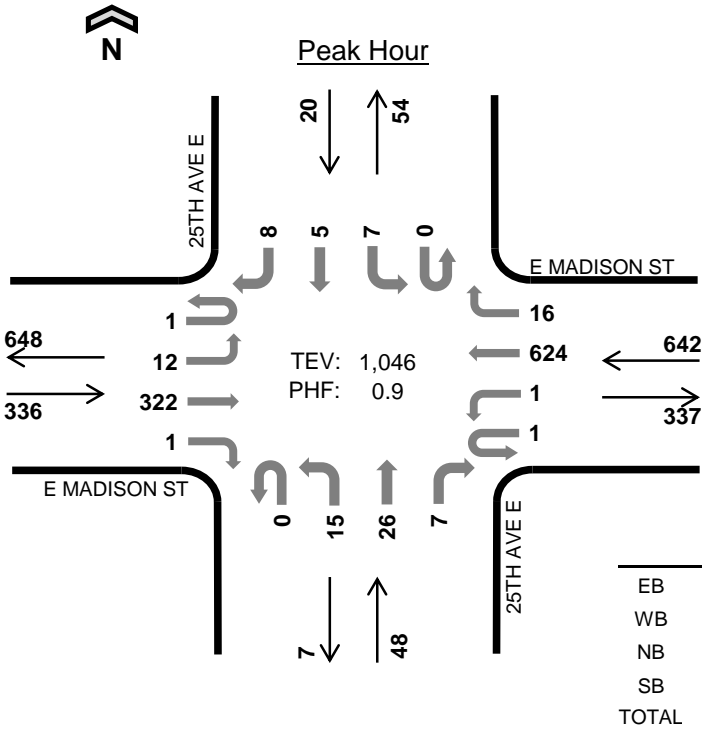
Peak Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Pedestrian Volume
4:45 PM	5:45 PM	1,059	9

Figure 4C-7. Warrant 4, Pedestrian Peak Hour

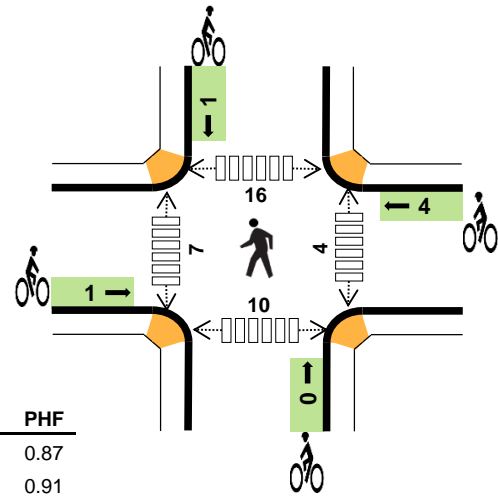


\*Note: 133 pph applies as the lower threshold volume.

## 25TH AVE E E MADISON ST



Date: Thu, Jun 09, 2016  
 Count Period: 7:00 AM to 9:00 AM  
 Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	3.9%	0.87
WB	2.8%	0.91
NB	0.0%	0.86
SB	0.0%	0.71
TOTAL	3.0%	0.90

### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				25TH AVE E Northbound				25TH AVE E Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	2	43	0	0	0	97	3	0	2	0	2	0	2	1	1	153	0
7:15 AM	0	2	56	2	0	1	140	2	0	0	2	3	0	1	0	4	213	0
7:30 AM	0	1	79	0	0	1	169	5	0	0	2	3	0	1	0	2	263	0
<b>7:45 AM</b>	<b>1</b>	<b>5</b>	<b>63</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>169</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>257</b>	<b>886</b>
8:00 AM	0	3	81	0	0	0	144	6	0	3	10	1	0	2	0	2	252	985
8:15 AM	0	1	84	0	1	1	138	4	0	6	7	0	0	3	0	0	245	1,017
<b>8:30 AM</b>	<b>0</b>	<b>3</b>	<b>94</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>173</b>	<b>4</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>292</b>	<b>1,046</b>
8:45 AM	0	2	73	0	0	1	122	2	0	3	2	5	0	4	1	5	220	1,009
Count Total	1	19	573	3	1	4	1,152	28	0	20	32	20	0	15	7	20	1,895	0
<b>Peak Hour</b>	<b>1</b>	<b>12</b>	<b>322</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>624</b>	<b>16</b>	<b>0</b>	<b>15</b>	<b>26</b>	<b>7</b>	<b>0</b>	<b>7</b>	<b>5</b>	<b>8</b>	<b>1,046</b>	<b>0</b>

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

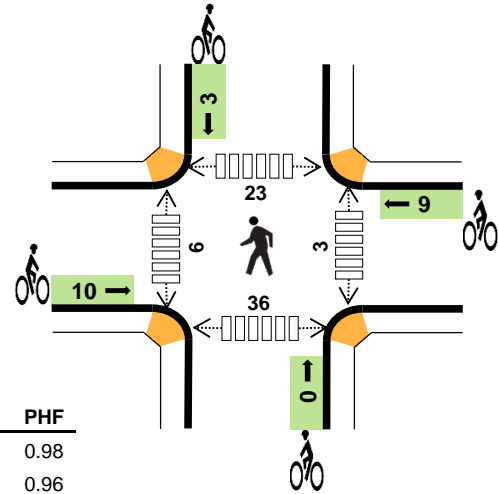
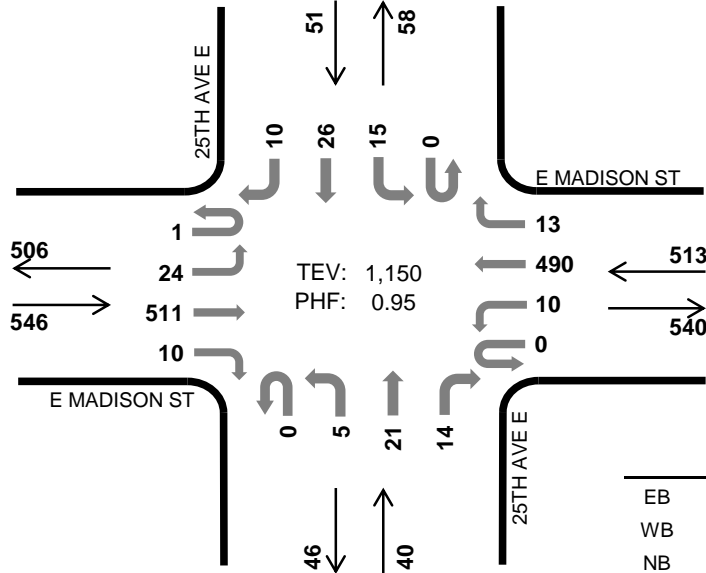
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	3	3	0	0	6	0	3	0	0	3	0	2	4	6	12
7:15 AM	3	5	0	0	8	1	1	0	1	3	0	0	2	2	4
7:30 AM	1	5	0	0	6	1	1	0	0	2	0	3	6	6	15
<b>7:45 AM</b>	<b>3</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>4</b>
8:00 AM	3	5	0	0	8	0	1	0	0	1	2	1	2	6	11
8:15 AM	3	7	0	0	10	0	1	0	0	1	1	4	5	2	12
<b>8:30 AM</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>7</b>	<b>2</b>	<b>10</b>
8:45 AM	2	5	0	0	7	1	7	0	0	8	1	0	2	1	4
Count Total	22	36	0	0	58	4	16	0	2	22	5	12	30	25	72
<b>Peak Hour</b>	<b>13</b>	<b>18</b>	<b>0</b>	<b>0</b>	<b>31</b>	<b>1</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>6</b>	<b>4</b>	<b>7</b>	<b>16</b>	<b>10</b>	<b>37</b>

## 25TH AVE E E MADISON ST



Peak Hour

Date: Thu, Jun 09, 2016  
Count Period: 4:00 PM to 6:00 PM  
Peak Hour: 4:45 PM to 5:45 PM



	HV %:	PHF
EB	1.8%	0.98
WB	2.1%	0.96
NB	0.0%	0.71
SB	0.0%	0.75
TOTAL	1.8%	0.95

### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				25TH AVE E Northbound				25TH AVE E Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	3	112	0	0	2	103	6	0	0	4	3	0	3	1	3	240	0
4:15 PM	0	5	123	0	0	0	91	3	0	2	1	0	0	3	2	3	233	0
4:30 PM	1	11	108	0	0	0	118	2	0	6	4	4	0	3	1	4	262	0
<b>4:45 PM</b>	<b>0</b>	<b>7</b>	<b>129</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>129</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>5</b>	<b>7</b>	<b>1</b>	<b>288</b>	1,023
<b>5:00 PM</b>	<b>1</b>	<b>1</b>	<b>136</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>124</b>	<b>5</b>	<b>0</b>	<b>2</b>	<b>7</b>	<b>5</b>	<b>0</b>	<b>6</b>	<b>7</b>	<b>4</b>	<b>302</b>	1,085
5:15 PM	0	11	123	5	0	2	115	2	0	0	5	3	0	3	4	3	276	1,128
5:30 PM	0	5	123	4	0	2	122	4	0	2	7	4	0	1	8	2	284	1,150
5:45 PM	0	5	123	2	0	3	98	4	0	1	4	5	0	2	4	0	251	1,113
Count Total	2	48	977	12	0	15	900	28	0	14	34	26	0	26	34	20	2,136	0
Peak Hour	1	24	511	10	0	10	490	13	0	5	21	14	0	15	26	10	1,150	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	3	5	0	0	8	0	1	0	0	1	1	4	4	1	10
4:15 PM	1	3	0	1	5	2	0	0	0	2	1	2	10	8	21
4:30 PM	2	3	0	0	5	3	1	0	0	4	0	0	4	5	9
4:45 PM	2	2	0	0	4	4	1	0	0	5	2	1	6	4	13
<b>5:00 PM</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>10</b>	<b>17</b>
5:15 PM	3	3	0	0	6	5	3	0	2	10	0	0	7	10	17
5:30 PM	4	4	0	0	8	1	3	0	1	5	0	4	5	12	21
5:45 PM	1	1	0	0	2	3	3	1	0	7	1	2	7	4	14
Count Total	17	23	0	1	41	18	14	1	3	36	6	14	48	54	122
Peak Hour	10	11	0	0	21	10	9	0	3	22	3	6	23	36	68

# Traffic Signal Warrant Summary Worksheet

The Worksheet(s) attached are provided as an attachment to the  
Madison BRT Project for:

Intersection: 26th Ave & E Madison St.  
County: King County  
City: Seattle

Major Street: E Madison St  
Street Classification: Minor Arterial  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

Minor Street: 26th Ave  
Street Classification: Access Street  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

**Analysis based on EXISTING volume data.**

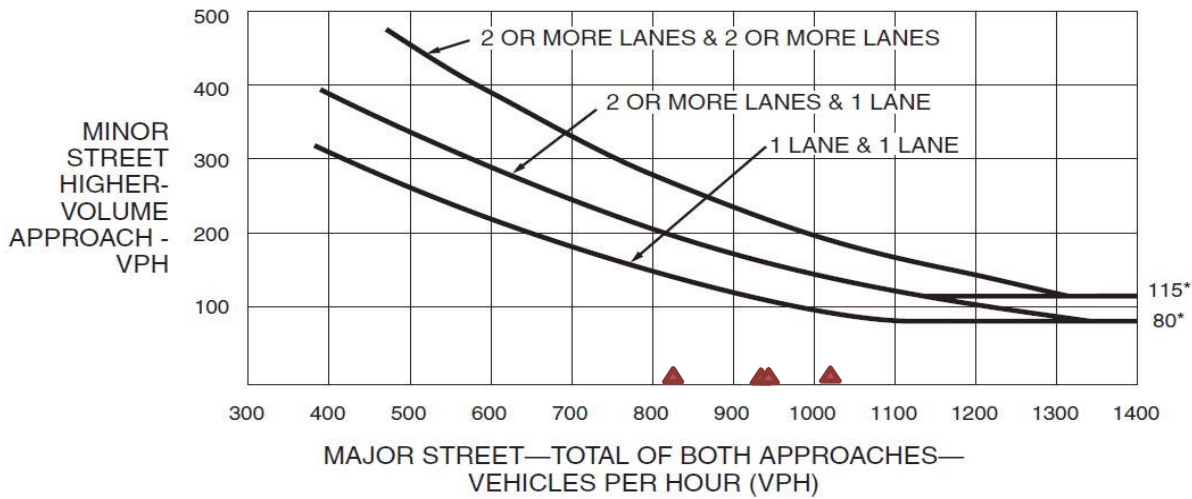
Date	Day of The Week	Time Interval
6/9/2016	Thursday	7:00 am - 9:00 am
6/9/2016	Thursday	4:00 pm - 6:00 pm

Warrant Evaluation Summary		Warrant Met:
Warrant 2: Four-Hour Volume		No
Warrant 3: Peak Hour Volume		No
Warrant 4: Pedestrian Volume		No
	Criterion A: Four-Hour	No
	Criterion B: Peak-Hour	No

## Warrant 2: Four-Hour Vehicular Volume

4-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
7:00 AM	8:00 AM	826	15
8:00 AM	9:00 AM	944	14
4:00 PM	5:00 PM	940	20
5:00 PM	6:00 PM	1,014	17

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**



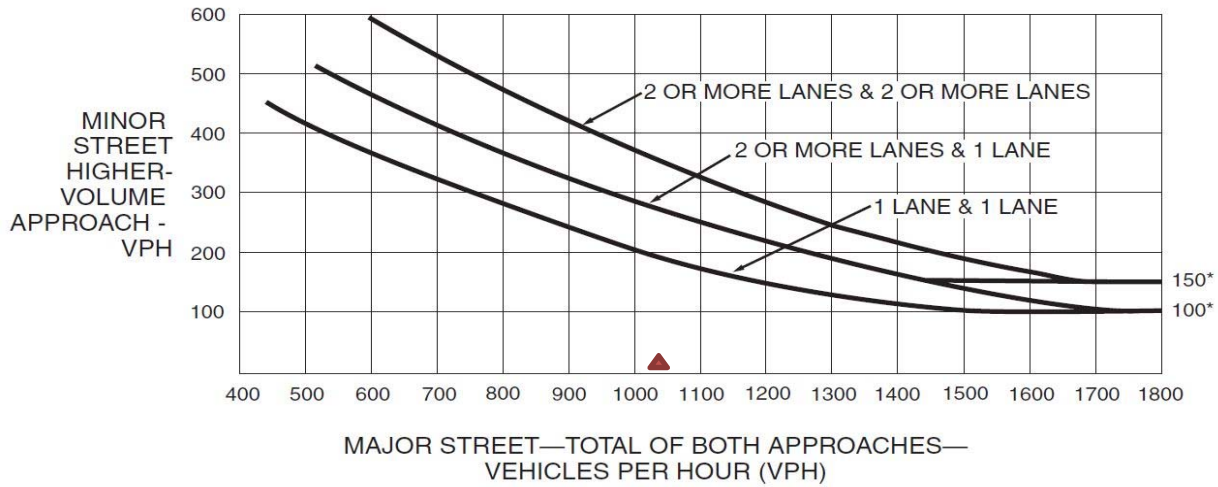
\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.



# Warrant 3: Peak Hour Volume

Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
4:45 PM	5:45 PM	1,034	16

Figure 4C-3. Warrant 3, Peak Hour



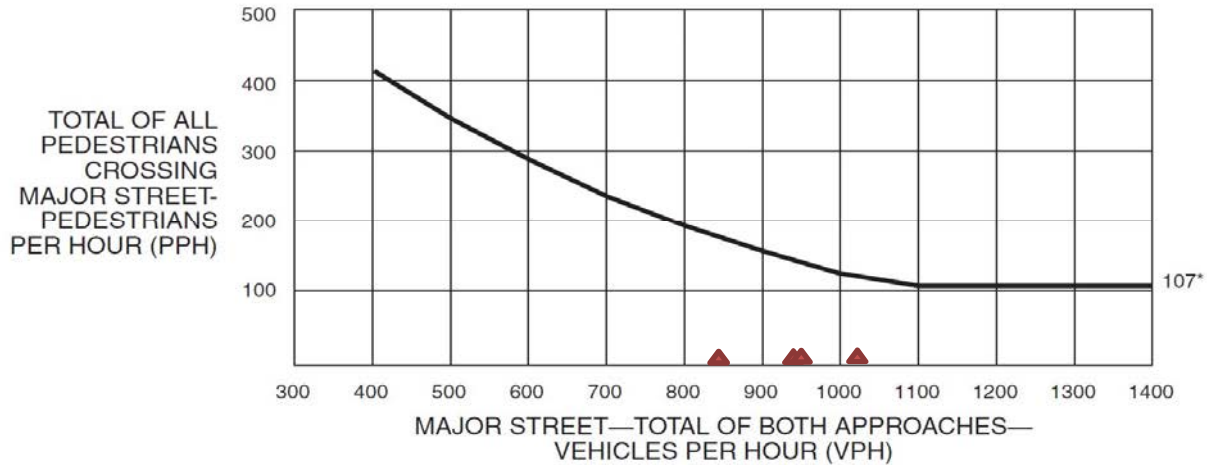
\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 4: Pedestrian Volume

## Criterion A: Four-Hour

Four-Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Ped Vol crossing Major St
7:00 AM	8:00 AM	826	9
8:00 AM	9:00 AM	944	1
4:00 PM	5:00 PM	940	3
5:00 PM	6:00 PM	1,014	2

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

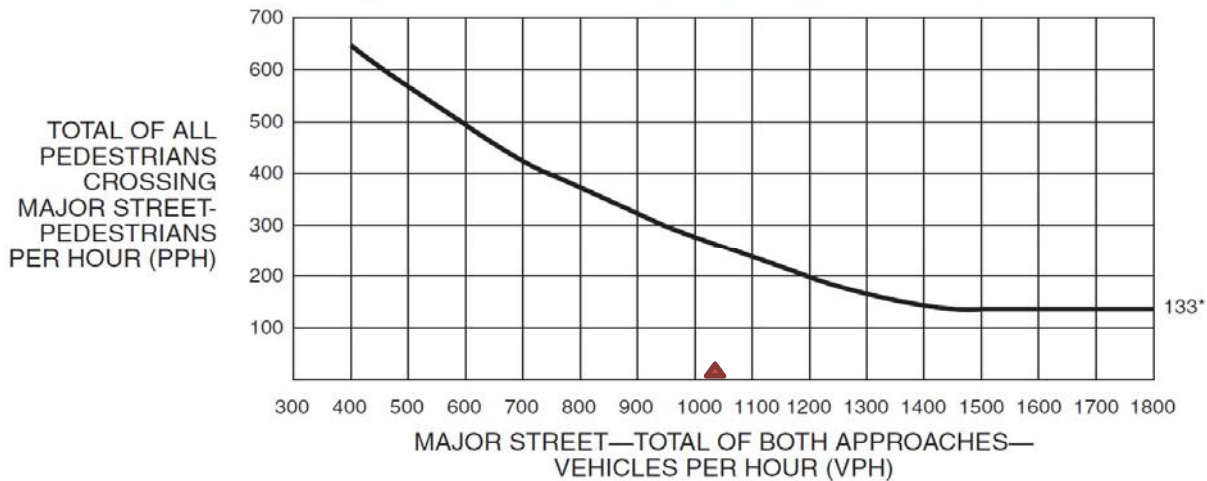


\*Note: 107 pph applies as the lower threshold volume.

## Criterion B: Peak Hour

Peak Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Pedestrian Volume
4:45 PM	5:45 PM	1,034	3

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



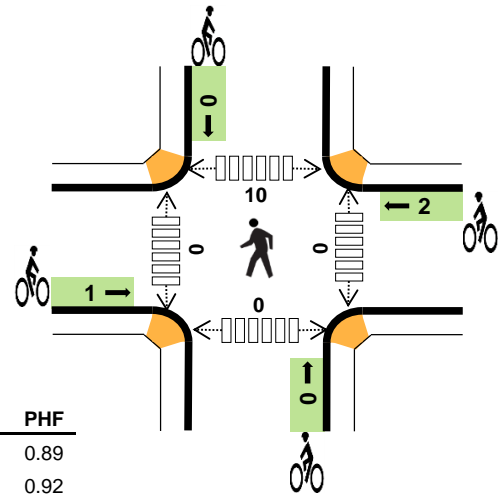
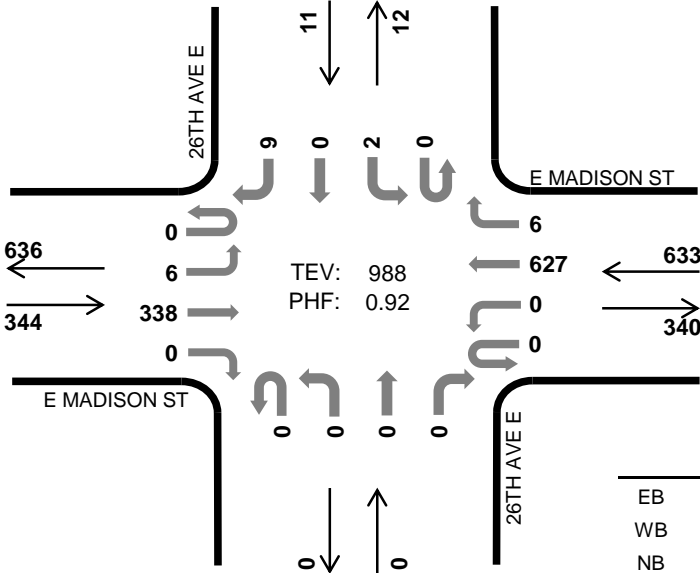
\*Note: 133 pph applies as the lower threshold volume.

## 26TH AVE E E MADISON ST



Peak Hour

Date: Thu, Jun 09, 2016  
Count Period: 7:00 AM to 9:00 AM  
Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	4.1%	0.89
WB	2.8%	0.92
NB	-	-
SB	0.0%	0.55
TOTAL	3.2%	0.92

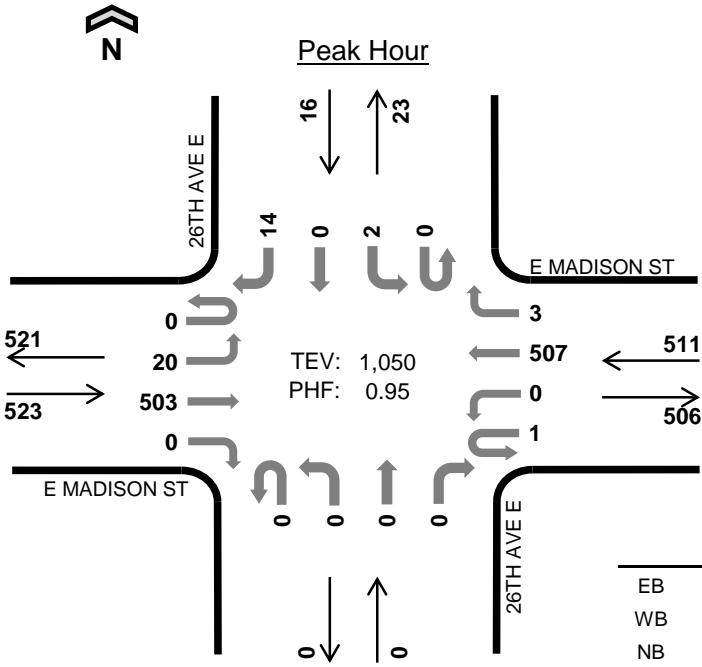
### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				26TH AVE E Northbound				26TH AVE E Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	0	48	0	0	0	97	0	0	0	0	0	0	1	0	1	147	0
7:15 AM	0	1	59	0	0	0	138	1	0	0	0	0	0	2	0	3	204	0
7:30 AM	0	3	80	0	0	0	169	1	0	0	0	0	0	1	0	5	259	0
<b>7:45 AM</b>	<b>0</b>	<b>0</b>	<b>66</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>163</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>231</b>	<b>841</b>
8:00 AM	0	0	87	0	0	0	148	5	0	0	0	0	0	1	0	4	245	939
8:15 AM	0	2	95	0	0	0	145	0	0	0	0	0	0	1	0	0	243	978
<b>8:30 AM</b>	<b>0</b>	<b>4</b>	<b>90</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>171</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>269</b>	<b>988</b>
8:45 AM	0	1	78	0	0	0	117	0	0	0	0	0	0	2	0	3	201	958
Count Total	0	11	603	0	0	0	1,148	8	0	0	0	0	0	8	0	21	1,799	0
Peak Hour	0	6	338	0	0	0	627	6	0	0	0	0	0	2	0	9	988	0

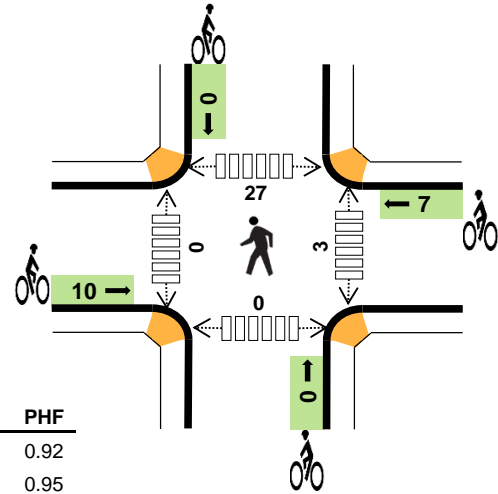
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	5	3	0	0	8	0	3	0	0	3	4	0	5	0	9
7:15 AM	3	6	0	0	9	2	1	0	0	3	3	0	0	0	3
7:30 AM	2	4	0	1	7	1	2	0	0	3	1	1	6	0	8
<b>7:45 AM</b>	<b>3</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>
8:00 AM	3	7	0	0	10	0	2	0	0	2	0	0	1	0	1
8:15 AM	4	5	0	0	9	0	0	0	0	0	0	0	3	0	3
<b>8:30 AM</b>	<b>4</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>
8:45 AM	1	3	0	0	4	1	4	0	0	5	1	0	5	0	6
Count Total	25	34	0	1	60	5	12	0	0	17	9	1	26	0	36
Peak Hour	14	18	0	0	32	1	2	0	0	3	0	0	10	0	10

## 26TH AVE E E MADISON ST



Date: Thu, Jun 09, 2016  
 Count Period: 4:00 PM to 6:00 PM  
 Peak Hour: 4:45 PM to 5:45 PM



	HV %:	PHF
EB	1.7%	0.92
WB	1.8%	0.95
NB	-	-
SB	0.0%	0.50
TOTAL	1.7%	0.95

### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				26TH AVE E Northbound				26TH AVE E Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	2	114	0	0	0	112	2	0	0	0	0	0	2	0	1	233	0
4:15 PM	0	2	120	0	1	0	91	1	0	0	0	0	0	4	0	3	222	0
4:30 PM	1	2	115	0	0	0	112	0	0	0	0	0	0	3	0	5	238	0
4:45 PM	0	5	125	0	1	0	133	1	0	0	0	0	0	0	0	2	267	960
5:00 PM	0	8	134	0	0	0	126	1	0	0	0	0	0	1	0	7	277	1,004
5:15 PM	0	4	112	0	0	0	121	1	0	0	0	0	0	0	0	1	239	1,021
5:30 PM	0	3	132	0	0	0	127	0	0	0	0	0	0	1	0	4	267	1,050
5:45 PM	0	9	123	0	0	0	113	0	0	0	0	0	0	0	0	3	248	1,031
Count Total	1	35	975	0	2	0	935	6	0	0	0	0	0	11	0	26	1,991	0
Peak Hour	0	20	503	0	1	0	507	3	0	0	0	0	0	2	0	14	1,050	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	3	6	0	0	9	0	1	0	0	1	1	0	5	0	6
4:15 PM	1	2	0	2	5	2	0	0	0	2	1	0	10	0	11
4:30 PM	2	4	0	0	6	3	2	0	1	6	0	0	6	0	6
4:45 PM	2	2	0	0	4	3	1	0	0	4	1	0	2	0	3
5:00 PM	1	2	0	0	3	0	0	0	0	0	0	0	7	0	7
5:15 PM	2	2	0	0	4	5	3	0	0	8	1	0	6	0	7
5:30 PM	4	3	0	0	7	2	3	0	0	5	1	0	12	0	13
5:45 PM	1	1	0	0	2	4	1	0	0	5	0	0	4	0	4
Count Total	16	22	0	2	40	19	11	0	1	31	5	0	52	0	57
Peak Hour	9	9	0	0	18	10	7	0	0	17	3	0	27	0	30

# Traffic Signal Warrant Summary Worksheet

The Worksheet(s) attached are provided as an attachment to the  
Madison BRT Project for:

Intersection: 27th Ave & E Madison St.  
County: King County  
City: Seattle

Major Street: E Madison St  
Street Classification: Minor Arterial  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

Minor Street: 27th Ave  
Street Classification: Access Street  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

**Analysis based on EXISTING volume data.**

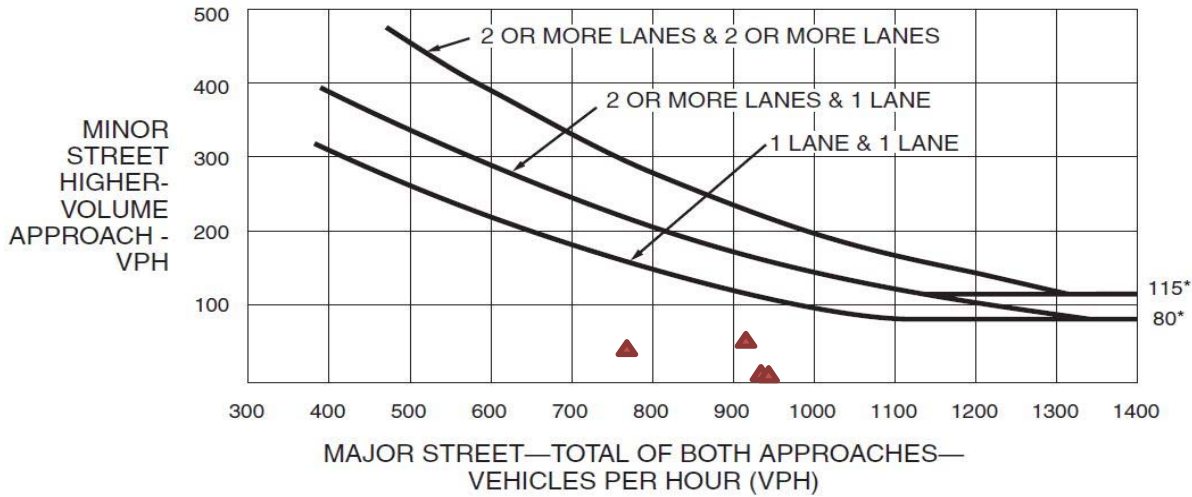
Date	Day of The Week	Time Interval
6/9/2016	Thursday	7:00 am - 9:00 am
6/9/2016	Thursday	4:00 pm - 6:00 pm

Warrant Evaluation Summary		Warrant Met:
Warrant 2: Four-Hour Volume		No
Warrant 3: Peak Hour Volume		No
Warrant 4: Pedestrian Volume		No
	Criterion A: Four-Hour	No
	Criterion B: Peak-Hour	No

## Warrant 2: Four-Hour Vehicular Volume

4-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
7:00 AM	8:00 AM	771	47
8:00 AM	9:00 AM	904	60
4:00 PM	5:00 PM	938	24
5:00 PM	6:00 PM	960	29

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**

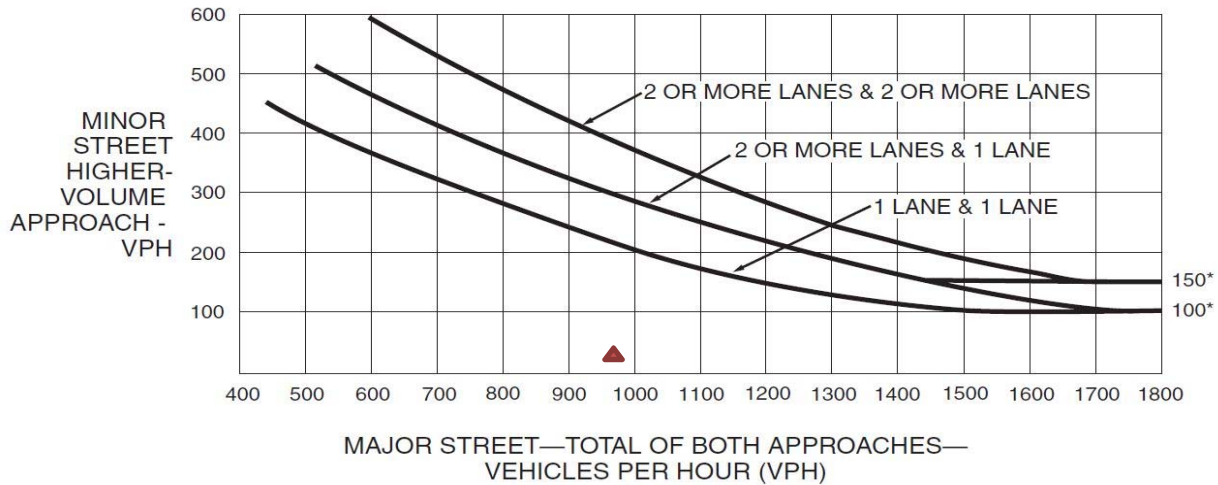


\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 3: Peak Hour Volume

Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
4:45 PM	5:45 PM	983	31

Figure 4C-3. Warrant 3, Peak Hour



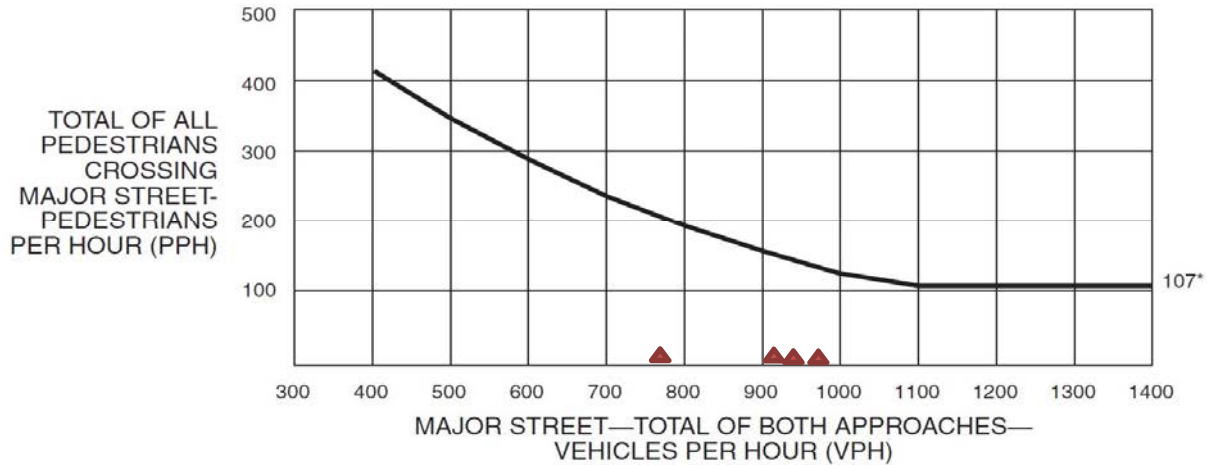
\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 4: Pedestrian Volume

## Criterion A: Four-Hour

Four-Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Ped Vol crossing Major St
7:00 AM	8:00 AM	771	13
8:00 AM	9:00 AM	904	11
4:00 PM	5:00 PM	938	13
5:00 PM	6:00 PM	960	23

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

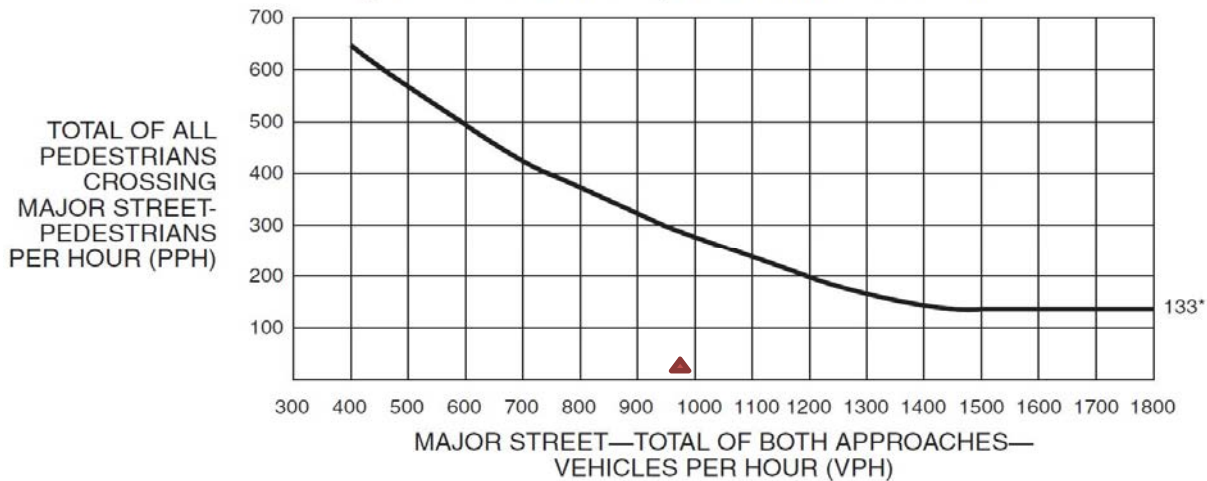


\*Note: 107 pph applies as the lower threshold volume.

## Criterion B: Peak Hour

Peak Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Pedestrian Volume
4:45 PM	5:45 PM	983	23

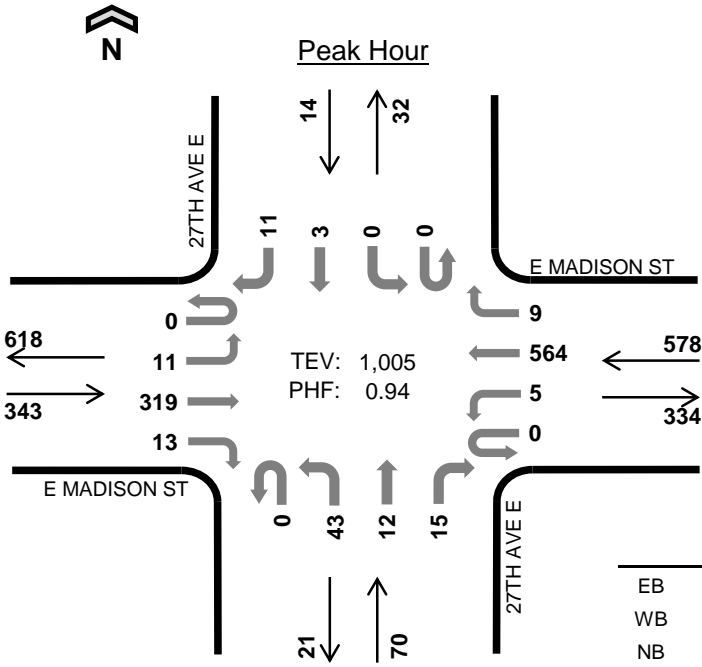
Figure 4C-7. Warrant 4, Pedestrian Peak Hour



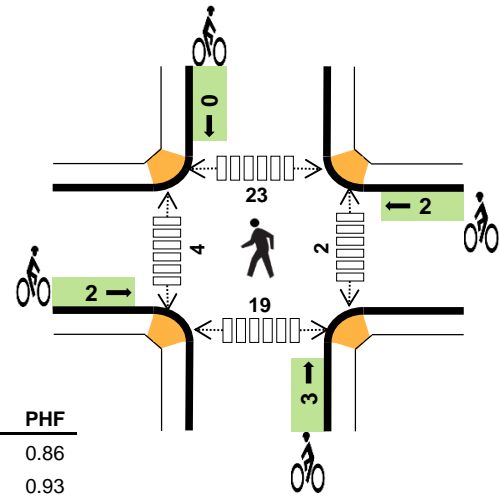
\*Note: 133 pph applies as the lower threshold volume.



## 27TH AVE E E MADISON ST



Date: Thu, Jun 09, 2016  
 Count Period: 7:00 AM to 9:00 AM  
 Peak Hour: 7:45 AM to 8:45 AM



	HV %:	PHF
EB	5.0%	0.86
WB	4.0%	0.93
NB	0.0%	0.88
SB	0.0%	0.88
TOTAL	4.0%	0.94

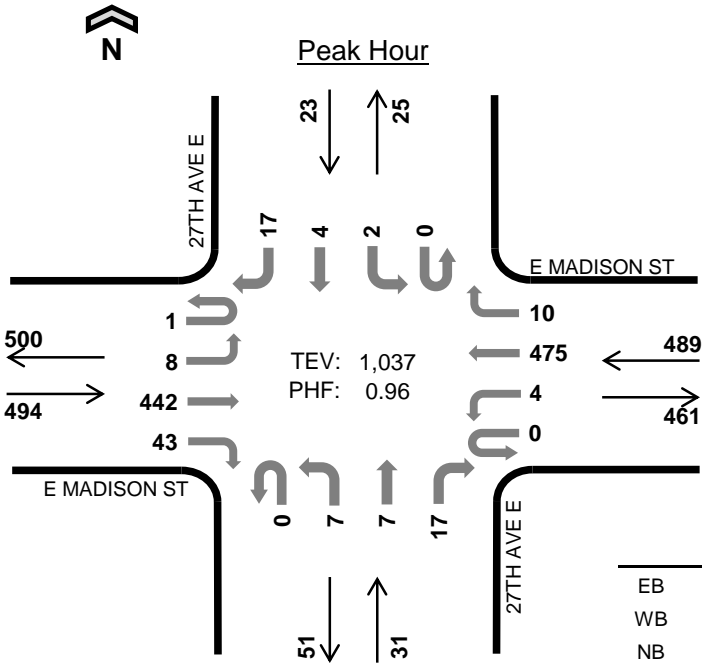
### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				27TH AVE E Northbound				27TH AVE E Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	2	47	5	2	1	81	0	0	10	0	1	0	0	1	2	152	0
7:15 AM	0	1	54	2	0	0	128	2	0	2	0	4	0	0	1	4	198	0
7:30 AM	0	1	76	2	0	1	149	0	0	10	2	0	0	2	0	7	250	0
<b>7:45 AM</b>	<b>0</b>	<b>3</b>	<b>60</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>146</b>	<b>4</b>	<b>0</b>	<b>12</b>	<b>1</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>238</b>	<b>838</b>
8:00 AM	0	2	81	3	0	2	134	1	0	11	6	3	0	0	0	4	247	933
8:15 AM	0	4	90	6	0	0	132	3	0	8	4	4	0	0	0	3	254	989
<b>8:30 AM</b>	<b>0</b>	<b>2</b>	<b>88</b>	<b>1</b>	<b>0</b>	<b>2</b>	<b>152</b>	<b>1</b>	<b>0</b>	<b>12</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>266</b>	<b>1,005</b>
8:45 AM	0	0	79	2	0	1	116	2	0	2	2	4	0	0	1	1	210	977
Count Total	0	15	575	24	2	8	1,038	13	0	67	16	24	0	2	6	25	1,815	0
Peak Hour	0	11	319	13	0	5	564	9	0	43	12	15	0	0	3	11	1,005	0

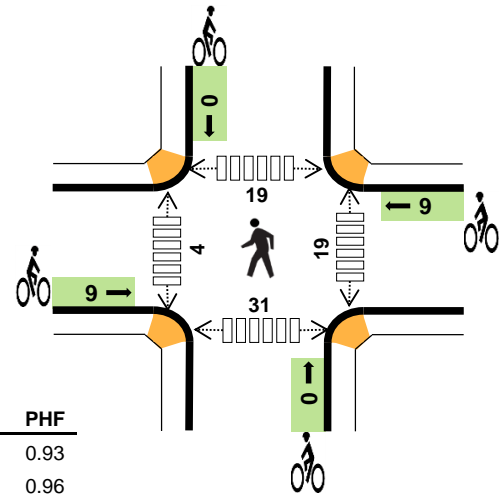
Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	5	3	0	0	8	0	3	0	0	3	1	3	7	4	15
7:15 AM	4	5	0	0	9	1	1	0	0	2	2	4	6	3	15
7:30 AM	4	4	0	0	8	1	1	0	0	2	0	2	11	4	17
<b>7:45 AM</b>	<b>3</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>5</b>	<b>1</b>	<b>7</b>
8:00 AM	3	7	0	0	10	0	2	1	0	3	0	2	6	8	16
8:15 AM	6	7	0	0	13	1	0	2	0	3	0	1	6	4	11
<b>8:30 AM</b>	<b>5</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>14</b>
8:45 AM	1	4	0	0	5	1	4	1	0	6	3	3	4	2	12
Count Total	31	39	0	0	70	5	11	4	0	20	8	16	51	32	107
Peak Hour	17	23	0	0	40	2	2	3	0	7	2	4	23	19	48

## 27TH AVE E E MADISON ST



Date: Thu, Jun 09, 2016  
 Count Period: 4:00 PM to 6:00 PM  
 Peak Hour: 4:45 PM to 5:45 PM



	HV %:	PHF
EB	2.6%	0.93
WB	2.2%	0.96
NB	0.0%	0.65
SB	0.0%	0.82
TOTAL	2.3%	0.96

### Two-Hour Count Summaries

Interval Start	E MADISON ST Eastbound				E MADISON ST Westbound				27TH AVE E Northbound				27TH AVE E Southbound				15-min Total	Rolling One Hour
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
4:00 PM	0	5	105	9	0	2	107	3	0	2	0	2	0	1	0	4	240	0
4:15 PM	0	6	102	11	0	4	88	2	0	1	1	4	0	0	0	2	221	0
4:30 PM	0	6	113	7	0	2	109	6	0	5	0	1	0	0	0	3	252	0
<b>4:45 PM</b>	<b>1</b>	<b>1</b>	<b>109</b>	<b>12</b>	<b>0</b>	<b>2</b>	<b>123</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>3</b>	<b>263</b>	976
<b>5:00 PM</b>	<b>0</b>	<b>4</b>	<b>112</b>	<b>17</b>	<b>0</b>	<b>2</b>	<b>120</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>270</b>	1,006
5:15 PM	0	3	102	5	0	0	114	2	0	1	1	2	0	1	0	5	236	1,021
5:30 PM	0	0	119	9	0	0	118	3	0	2	4	6	0	0	4	3	268	1,037
5:45 PM	0	2	113	7	0	1	104	1	0	3	2	1	0	1	1	3	239	1,013
Count Total	1	27	875	77	0	13	883	22	0	18	10	25	0	4	5	29	1,989	0
Peak Hour	1	8	442	43	0	4	475	10	0	7	7	17	0	2	4	17	1,037	0

Note: Two-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
4:00 PM	3	4	0	0	7	0	1	0	0	1	2	1	6	1	10
4:15 PM	2	2	0	0	4	2	0	0	0	2	0	2	11	3	16
4:30 PM	2	5	0	0	7	2	2	0	0	4	2	2	14	7	25
4:45 PM	2	2	0	0	4	3	2	0	0	5	4	0	2	7	13
<b>5:00 PM</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>2</b>	<b>5</b>	<b>7</b>	<b>18</b>
5:15 PM	4	3	0	0	7	5	2	0	0	7	2	2	5	10	19
5:30 PM	6	4	0	0	10	1	3	0	0	4	9	0	7	7	23
5:45 PM	2	1	0	0	3	3	1	0	0	4	4	0	5	3	12
Count Total	22	23	0	0	45	16	13	0	0	29	27	9	55	45	136
Peak Hour	13	11	0	0	24	9	9	0	0	18	19	4	19	31	73

# Traffic Signal Warrant Summary Worksheet

The Worksheet(s) attached are provided as an attachment to the  
Madison BRT Early Spring St Study for:

Intersection: MLK Jr Way E & E Harrison St  
County: King County  
City: Seattle

Major Street: MLK Jr Way E  
Street Classification: Collector Arterial  
Critical Approach Speed: 30 mph  
Lanes: 1 lane each direction

Minor Street: E Harrison St  
Street Classification: Access Street  
Critical Approach Speed: 25 mph  
Lanes: 1 lane each direction

**Analysis based on EXISTING volume data.**

Date	Day of The Week	Time Interval
9/15/2016	Thursday	7:00 am - 11:00 am
9/15/2016	Thursday	11:00 am - 3:00 pm
9/15/2016	Thursday	3:00 pm - 7:00 pm

Warrant Evaluation Summary		Warrant Met:
Warrant 1: Eight - Hour Vehicular Volume		No
	Condition A: Minimum Vehicular Volume	No
	Condition B: Interruption of Continuous Traffic	No
	Condition C: Combination: 80% of A and B	No
Warrant 2: Four-Hour Volume		No
Warrant 3: Peak Hour Volume		No
Warrant 4: Pedestrian Volume		No
	Criterion A: Four-Hour	No
	Criterion B: Peak-Hour	No

# Warrant 1: Eight-Hour Vehicular Volume

8-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
7:00 AM	8:00 AM	680	43
8:00 AM	9:00 AM	872	89
9:00 AM	10:00 AM	700	30
2:00 PM	3:00 PM	640	32
3:00 PM	4:00 PM	850	82
4:00 PM	5:00 PM	829	60
5:00 PM	6:00 PM	842	53
6:00 PM	7:00 PM	785	50

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street				Vehicles per hour on higher-volume			
		(total of both approaches)				minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112
Condition B—Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street				Vehicles per hour on higher-volume			
		(total of both approaches)				minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

<sup>a</sup> Basic minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

<sup>d</sup> May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

## Warrant 2: Four-Hour Vehicular Volume

4-Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
8:00 AM	9:00 AM	872	89
3:00 PM	4:00 PM	850	82
4:00 PM	5:00 PM	829	60
5:00 PM	6:00 PM	842	53

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**

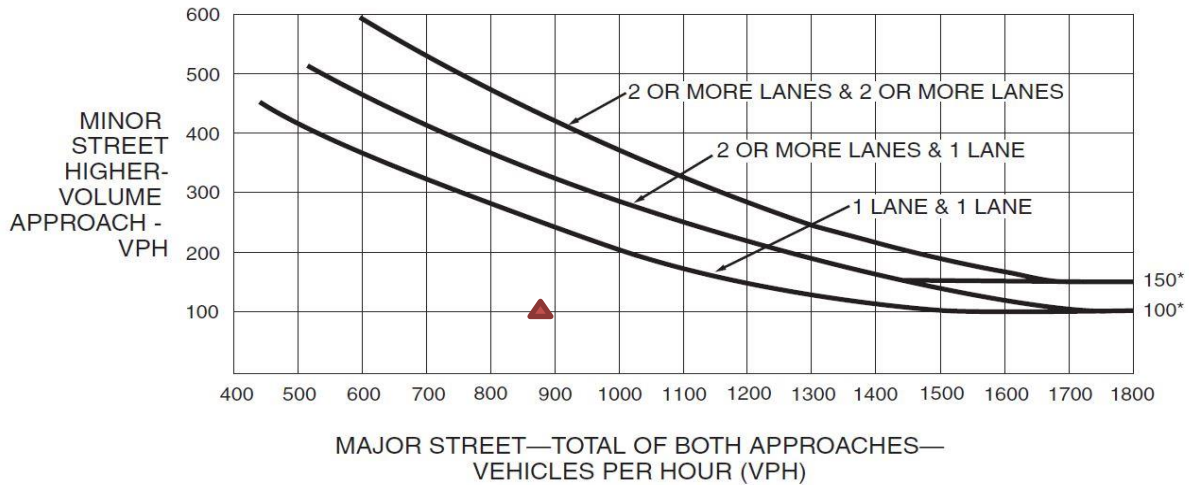


\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 3: Peak Hour Volume

Hour Vehicular Volume			
Hour		Major Street	Highest Minor Street Approach
7:45 AM	8:45 AM	888	100

Figure 4C-3. Warrant 3, Peak Hour



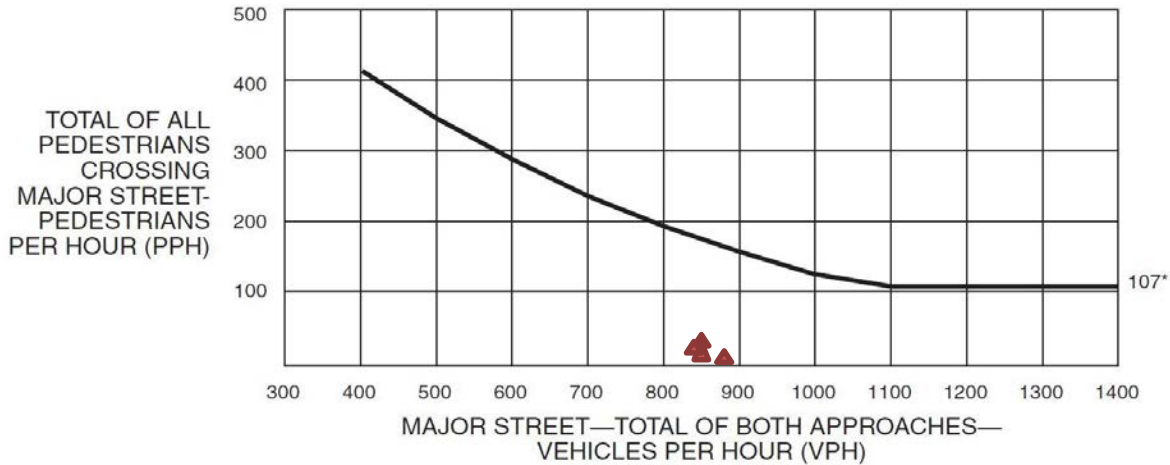
\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

# Warrant 4: Pedestrian Volume

## Criterion A: Four-Hour

Four-Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Ped Vol crossing Major St
8:00 AM	9:00 AM	872	10
3:00 PM	4:00 PM	850	12
4:00 PM	5:00 PM	829	17
5:00 PM	6:00 PM	842	21

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

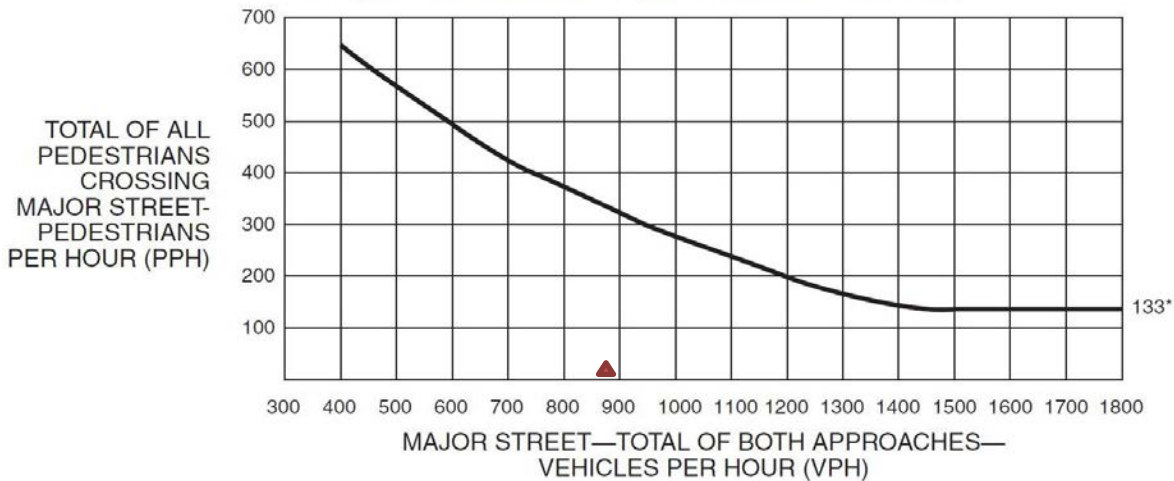


\*Note: 107 pph applies as the lower threshold volume.

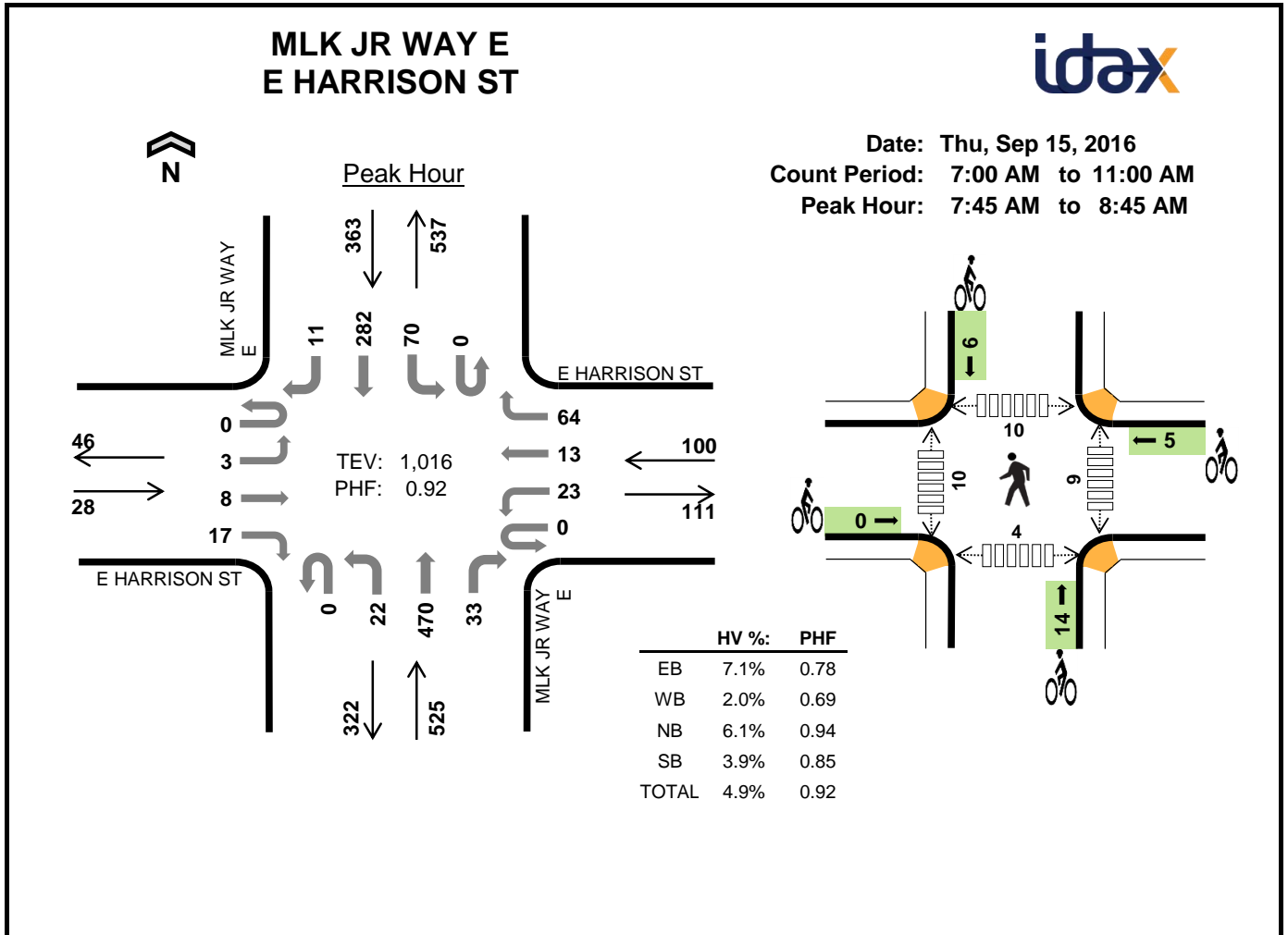
## Criterion B: Peak Hour

Peak Hour Pedestrian Volume v.s. Vehicular Volume			
Hour		Major Street	Pedestrian Volume
7:45 AM	8:45 AM	888	14

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



\*Note: 133 pph applies as the lower threshold volume.



**Four-Hour Count Summaries**

Interval Start	E HARRISON ST				E HARRISON ST				MLK JR WAY E				MLK JR WAY E				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:45 AM	0	1	3	3	0	5	3	11	0	8	116	12	0	22	62	4	250	0
8:00 AM	0	1	1	3	0	6	3	18	0	11	119	6	0	33	74	0	275	0
8:15 AM	0	0	1	6	0	7	4	25	0	1	107	6	0	8	86	5	256	0
8:30 AM	0	1	3	5	0	5	3	10	0	2	128	9	0	7	60	2	235	1,016
<b>Peak Hour</b>	<b>0</b>	<b>3</b>	<b>8</b>	<b>17</b>	<b>0</b>	<b>23</b>	<b>13</b>	<b>64</b>	<b>0</b>	<b>22</b>	<b>470</b>	<b>33</b>	<b>0</b>	<b>70</b>	<b>282</b>	<b>11</b>	<b>1,016</b>	<b>0</b>

Note: For all three-hour count summary, see next page.

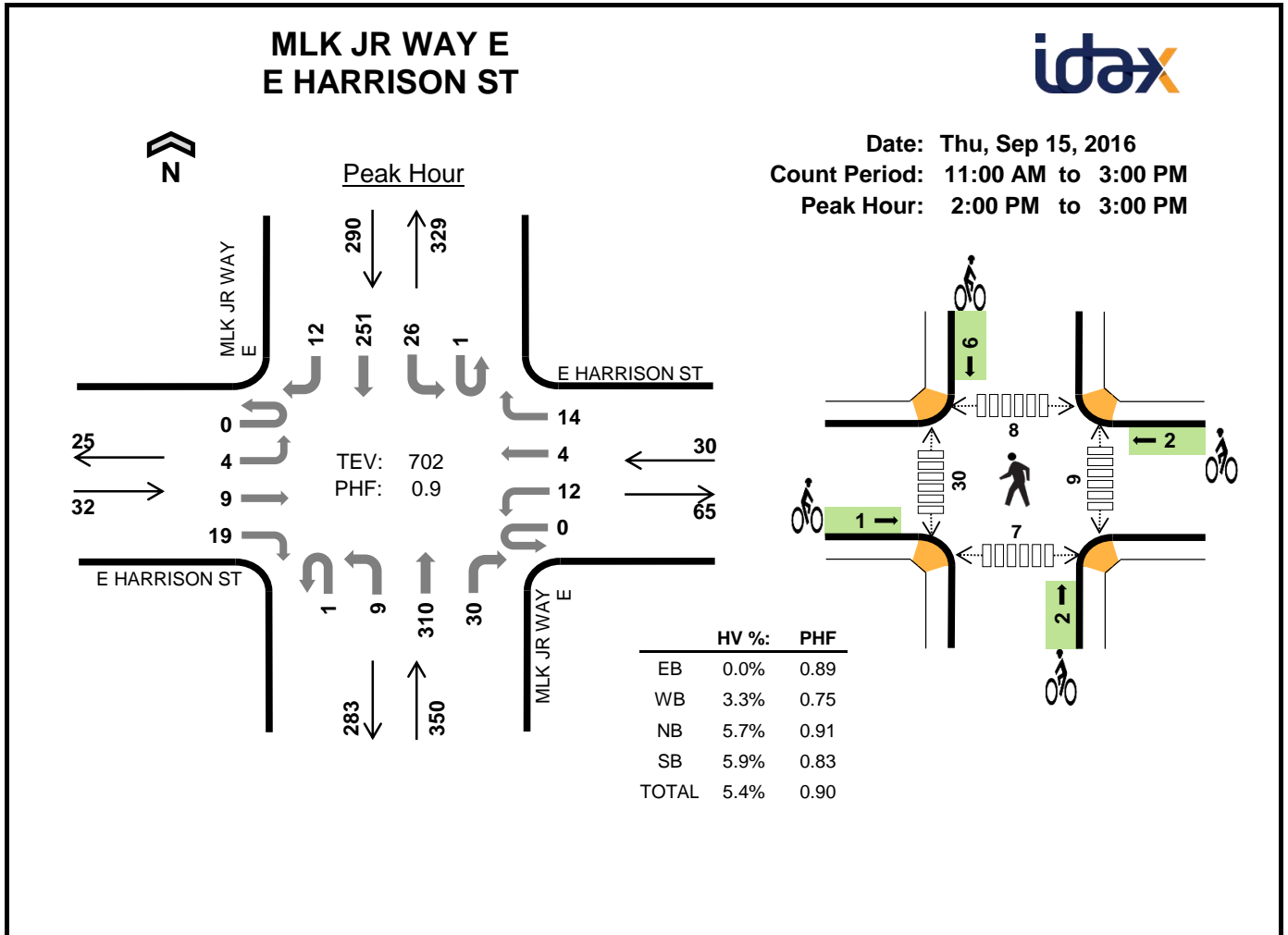
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:45 AM	1	2	7	4	14	0	1	3	2	6	3	3	6	3	15
8:00 AM	0	0	10	2	12	0	2	1	3	6	1	1	1	0	3
8:15 AM	0	0	8	4	12	0	2	5	1	8	1	1	1	0	3
8:30 AM	1	0	7	4	12	0	0	5	0	5	4	5	2	1	12
<b>Peak Hour</b>	<b>2</b>	<b>2</b>	<b>32</b>	<b>14</b>	<b>50</b>	<b>0</b>	<b>5</b>	<b>14</b>	<b>6</b>	<b>25</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>4</b>	<b>33</b>



<b>Four-Hour Count Summaries</b>																		
Interval Start	E HARRISON ST				E HARRISON ST				MLK JR WAY E				MLK JR WAY E				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
7:00 AM	0	1	0	0	0	4	0	2	0	7	86	9	0	1	23	0	133	0
7:15 AM	0	0	0	1	0	2	0	5	0	2	99	9	0	4	40	2	164	0
7:30 AM	0	0	0	3	0	5	0	6	0	3	104	10	0	5	51	1	188	0
<b>7:45 AM</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>5</b>	<b>3</b>	<b>11</b>	<b>0</b>	<b>8</b>	<b>116</b>	<b>12</b>	<b>0</b>	<b>22</b>	<b>62</b>	<b>4</b>	<b>250</b>	735
<b>8:00 AM</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>6</b>	<b>3</b>	<b>18</b>	<b>0</b>	<b>11</b>	<b>119</b>	<b>6</b>	<b>0</b>	<b>33</b>	<b>74</b>	<b>0</b>	<b>275</b>	877
<b>8:15 AM</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>6</b>	<b>0</b>	<b>7</b>	<b>4</b>	<b>25</b>	<b>0</b>	<b>1</b>	<b>107</b>	<b>6</b>	<b>0</b>	<b>8</b>	<b>86</b>	<b>5</b>	<b>256</b>	969
<b>8:30 AM</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>3</b>	<b>10</b>	<b>0</b>	<b>2</b>	<b>128</b>	<b>9</b>	<b>0</b>	<b>7</b>	<b>60</b>	<b>2</b>	<b>235</b>	<b>1,016</b>
8:45 AM	0	0	2	5	0	1	0	7	0	3	128	14	0	3	56	4	223	989
9:00 AM	0	2	1	3	0	3	1	3	0	2	124	7	0	6	48	5	205	919
9:15 AM	0	0	1	2	0	4	1	3	0	1	99	12	0	6	45	4	178	841
9:30 AM	0	0	0	3	0	5	1	2	1	5	117	7	0	4	44	1	190	796
9:45 AM	0	0	1	4	0	1	0	6	0	4	96	8	0	4	46	4	174	747
10:00 AM	0	4	1	0	0	1	1	6	0	0	87	8	0	3	42	5	158	700
10:15 AM	0	0	5	3	0	0	0	0	0	2	73	9	0	5	35	1	133	655
10:30 AM	0	0	1	0	0	3	0	9	0	0	67	4	0	6	45	7	142	607
10:45 AM	0	0	1	3	0	1	0	5	0	1	74	8	0	1	34	2	130	563
Count Total	0	10	21	44	0	53	17	118	1	52	1,624	138	0	118	791	47	3,034	0
Peak Hour	<b>0</b>	<b>3</b>	<b>8</b>	<b>17</b>	<b>0</b>	<b>23</b>	<b>13</b>	<b>64</b>	<b>0</b>	<b>22</b>	<b>470</b>	<b>33</b>	<b>0</b>	<b>70</b>	<b>282</b>	<b>11</b>	<b>1,016</b>	<b>0</b>

Note: Four-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
7:00 AM	0	0	9	3	12	0	0	1	1	2	0	2	0	2	4
7:15 AM	0	0	11	2	13	0	1	2	5	8	4	0	3	1	8
7:30 AM	0	1	5	5	11	0	2	0	4	6	3	3	7	2	15
<b>7:45 AM</b>	<b>1</b>	<b>2</b>	<b>7</b>	<b>4</b>	<b>14</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>6</b>	<b>3</b>	<b>3</b>	<b>6</b>	<b>3</b>	<b>15</b>
<b>8:00 AM</b>	<b>0</b>	<b>0</b>	<b>10</b>	<b>2</b>	<b>12</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>3</b>
<b>8:15 AM</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>4</b>	<b>12</b>	<b>0</b>	<b>2</b>	<b>5</b>	<b>1</b>	<b>8</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>3</b>
<b>8:30 AM</b>	<b>1</b>	<b>0</b>	<b>7</b>	<b>4</b>	<b>12</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>5</b>	<b>4</b>	<b>5</b>	<b>2</b>	<b>1</b>	<b>12</b>
8:45 AM	1	0	8	5	14	0	0	0	2	2	1	1	5	0	7
9:00 AM	1	0	13	5	19	0	2	3	0	5	2	7	2	1	12
9:15 AM	0	1	9	5	15	0	0	3	1	4	2	5	3	1	11
9:30 AM	0	0	5	5	10	0	0	3	1	4	7	7	6	0	20
9:45 AM	0	1	3	4	8	0	0	3	1	4	1	4	1	2	8
10:00 AM	0	0	5	2	7	0	1	1	0	2	2	6	4	1	13
10:15 AM	1	0	6	5	12	0	0	0	3	3	0	6	5	2	13
10:30 AM	0	0	4	2	6	0	0	2	1	3	3	11	0	1	15
10:45 AM	0	1	5	3	9	0	0	0	4	4	0	6	1	1	8
Count Total	5	6	115	60	186	0	11	32	29	72	34	68	47	18	167
Peak Hour	<b>2</b>	<b>2</b>	<b>32</b>	<b>14</b>	<b>50</b>	<b>0</b>	<b>5</b>	<b>14</b>	<b>6</b>	<b>25</b>	<b>9</b>	<b>10</b>	<b>10</b>	<b>4</b>	<b>33</b>



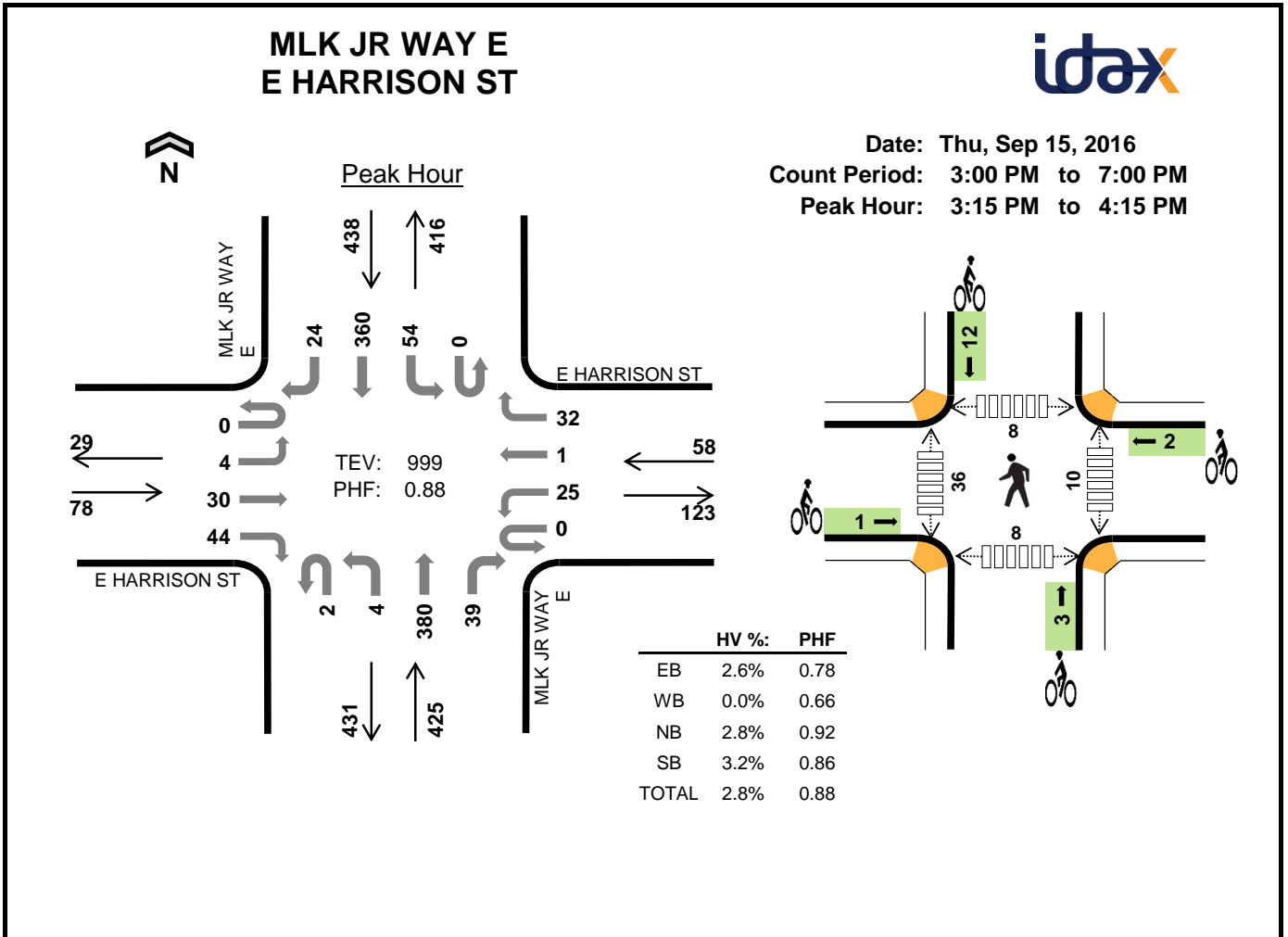
**Four-Hour Count Summaries**

Interval Start	E HARRISON ST				E HARRISON ST				MLK JR WAY E				MLK JR WAY E				15-min Total	Rolling One Hour
	Eastbound		Westbound		Northbound		Southbound		UT	LT	TH	RT	UT	LT	TH	RT		
2:00 PM	0	0	2	7	0	5	1	3	0	3	83	8	0	8	57	4	181	0
2:15 PM	0	2	3	4	0	2	1	7	0	1	77	6	1	3	69	1	177	0
2:30 PM	0	2	1	3	0	4	1	2	0	2	69	5	0	8	49	3	149	0
2:45 PM	0	0	3	5	0	1	1	2	1	3	81	11	0	7	76	4	195	702
<b>Peak Hour</b>	0	4	9	19	0	12	4	14	1	9	310	30	1	26	251	12	702	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
2:00 PM	0	0	4	5	9	0	0	0	3	3	5	16	4	0	25
2:15 PM	0	1	4	4	9	0	1	1	1	3	3	5	0	1	9
2:30 PM	0	0	8	3	11	0	1	0	0	1	1	3	0	4	8
2:45 PM	0	0	4	5	9	1	0	1	2	4	0	6	4	2	12
<b>Peak Hour</b>	0	1	20	17	38	1	2	2	6	11	9	30	8	7	54

<b>Four-Hour Count Summaries</b>																		
Interval Start	E HARRISON ST				E HARRISON ST				MLK JR WAY E				MLK JR WAY E				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
11:00 AM	0	2	3	2	0	4	2	4	1	4	66	9	0	2	41	5	145	0
11:15 AM	0	0	1	2	0	4	0	6	0	0	73	7	0	4	38	6	141	0
11:30 AM	0	0	1	0	0	4	4	6	0	2	82	4	0	3	56	6	168	0
11:45 AM	0	2	1	2	0	6	0	9	0	1	64	6	0	6	48	5	150	604
12:00 PM	0	0	6	4	0	3	0	1	0	1	59	4	0	4	62	2	146	605
12:15 PM	0	0	2	1	0	3	0	6	0	0	66	6	0	4	52	2	142	606
12:30 PM	0	2	1	0	0	1	0	4	0	0	67	8	0	6	55	7	151	589
12:45 PM	0	0	0	3	0	5	0	10	1	2	75	1	0	4	54	3	158	597
1:00 PM	0	4	2	3	0	3	3	5	0	2	92	5	0	6	47	7	179	630
1:15 PM	0	0	1	4	0	5	2	7	0	2	73	7	0	5	55	5	166	654
1:30 PM	0	0	3	3	0	3	1	6	0	2	77	5	0	10	45	2	157	660
1:45 PM	0	0	4	2	0	4	1	2	0	1	72	3	0	6	45	3	143	645
<b>2:00 PM</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>7</b>	<b>0</b>	<b>5</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>83</b>	<b>8</b>	<b>0</b>	<b>8</b>	<b>57</b>	<b>4</b>	<b>181</b>	647
<b>2:15 PM</b>	<b>0</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>7</b>	<b>0</b>	<b>1</b>	<b>77</b>	<b>6</b>	<b>1</b>	<b>3</b>	<b>69</b>	<b>1</b>	<b>177</b>	658
<b>2:30 PM</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>69</b>	<b>5</b>	<b>0</b>	<b>8</b>	<b>49</b>	<b>3</b>	<b>149</b>	650
<b>2:45 PM</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>81</b>	<b>11</b>	<b>0</b>	<b>7</b>	<b>76</b>	<b>4</b>	<b>195</b>	<b>702</b>
Count Total	0	14	34	45	0	57	17	80	3	26	1,176	95	1	86	849	65	2,548	0
Peak Hour	0	4	9	19	0	12	4	14	1	9	310	30	1	26	251	12	702	0
<i>Note: Four-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.</i>																		
Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)							
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total			
11:00 AM	0	0	3	4	7	0	1	1	1	3	0	3	1	1	5			
11:15 AM	0	1	5	3	9	0	0	0	0	0	0	4	2	0	6			
11:30 AM	0	0	8	7	15	0	0	1	1	2	1	10	1	2	14			
11:45 AM	0	0	5	4	9	0	0	0	2	2	1	13	3	0	17			
12:00 PM	0	0	3	3	6	0	2	1	1	4	2	3	4	1	10			
12:15 PM	1	0	2	11	14	0	2	0	1	3	2	6	0	1	9			
12:30 PM	0	1	5	1	7	0	1	0	0	1	2	4	1	3	10			
12:45 PM	0	1	2	3	6	0	0	1	4	5	2	8	2	0	12			
1:00 PM	1	0	8	4	13	0	0	0	1	1	0	6	3	0	9			
1:15 PM	0	0	8	7	15	0	0	1	0	1	1	5	1	2	9			
1:30 PM	0	0	7	2	9	0	0	0	1	1	3	6	7	1	17			
1:45 PM	0	1	6	3	10	0	0	0	2	2	2	0	4	1	7			
<b>2:00 PM</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>5</b>	<b>9</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>16</b>	<b>4</b>	<b>0</b>	<b>25</b>			
<b>2:15 PM</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>4</b>	<b>9</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>0</b>	<b>1</b>	<b>9</b>			
<b>2:30 PM</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>3</b>	<b>11</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>4</b>	<b>8</b>			
<b>2:45 PM</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>5</b>	<b>9</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>4</b>	<b>0</b>	<b>6</b>	<b>4</b>	<b>2</b>	<b>12</b>			
Count Total	2	5	82	69	158	1	8	7	20	36	25	98	37	19	179			
Peak Hour	0	1	20	17	38	1	2	2	6	11	9	30	8	7	54			



**Four-Hour Count Summaries**

Interval Start	E HARRISON ST				E HARRISON ST				MLK JR WAY E				MLK JR WAY E				15-min Total	Rolling One Hour
	Eastbound		Westbound		Northbound		Southbound		UT	LT	TH	RT	UT	LT	TH	RT		
3:15 PM	0	0	14	11	0	4	0	4	1	0	94	11	0	19	81	4	243	0
3:30 PM	0	0	8	11	0	6	0	16	1	1	102	12	0	16	104	7	284	0
3:45 PM	0	3	4	10	0	9	0	5	0	2	98	9	0	11	87	9	247	0
4:00 PM	0	1	4	12	0	6	1	7	0	1	86	7	0	8	88	4	225	999
<b>Peak Hour</b>	0	4	30	44	0	25	1	32	2	4	380	39	0	54	360	24	999	0

Note: For all three-hour count summary, see next page.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
3:15 PM	1	0	2	6	9	0	0	2	1	3	2	4	0	1	7
3:30 PM	0	0	3	2	5	0	0	0	3	3	2	10	2	3	17
3:45 PM	0	0	2	4	6	1	0	1	3	5	2	13	2	2	19
4:00 PM	1	0	5	2	8	0	2	0	5	7	4	9	4	2	19
<b>Peak Hour</b>	2	0	12	14	28	1	2	3	12	18	10	36	8	8	62

<b>Four-Hour Count Summaries</b>																		
Interval Start	E HARRISON ST				E HARRISON ST				MLK JR WAY E				MLK JR WAY E				15-min Total	Rolling One Hour
	Eastbound				Westbound				Northbound				Southbound					
	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT	UT	LT	TH	RT		
3:00 PM	0	4	7	10	0	7	1	7	1	0	83	9	0	11	69	8	217	0
3:15 PM	0	0	14	11	0	4	0	4	1	0	94	11	0	19	81	4	243	0
3:30 PM	0	0	8	11	0	6	0	16	1	1	102	12	0	16	104	7	284	0
3:45 PM	0	3	4	10	0	9	0	5	0	2	98	9	0	11	87	9	247	991
4:00 PM	0	1	4	12	0	6	1	7	0	1	86	7	0	8	88	4	225	999
4:15 PM	0	0	6	14	0	2	0	10	0	0	75	7	0	4	87	2	207	963
4:30 PM	0	1	3	12	0	3	2	7	0	2	109	14	0	3	105	4	265	944
4:45 PM	0	1	3	3	0	3	1	9	0	3	102	9	0	8	98	3	243	940
5:00 PM	0	2	6	6	0	3	1	11	0	2	103	10	0	10	89	2	245	960
5:15 PM	0	1	1	10	0	7	1	6	0	4	87	10	0	8	78	1	214	967
5:30 PM	0	1	2	7	0	5	1	7	0	4	95	10	0	6	102	3	243	945
5:45 PM	0	3	6	8	0	5	1	5	0	4	113	13	0	7	79	2	246	948
6:00 PM	0	1	3	4	0	7	2	9	0	4	93	14	0	3	99	4	243	946
6:15 PM	0	1	2	8	0	5	2	4	0	3	93	6	0	5	95	3	227	959
6:30 PM	0	0	4	4	0	7	1	5	1	6	103	15	0	5	70	4	225	941
6:45 PM	0	0	0	3	0	4	0	4	1	4	64	7	1	7	69	6	170	865
Count Total	0	19	73	133	0	83	14	116	5	40	1,500	163	1	131	1,400	66	3,744	0
Peak Hour	0	4	30	44	0	25	1	32	2	4	380	39	0	54	360	24	999	0

Note: Four-hour count summary volumes include heavy vehicles but exclude bicycles in overall count.

Interval Start	Heavy Vehicle Totals					Bicycles					Pedestrians (Crossing Leg)				
	EB	WB	NB	SB	Total	EB	WB	NB	SB	Total	East	West	North	South	Total
3:00 PM	0	0	3	5	8	1	1	0	1	3	1	9	0	2	12
3:15 PM	1	0	2	6	9	0	0	2	1	3	2	4	0	1	7
3:30 PM	0	0	3	2	5	0	0	0	3	3	2	10	2	3	17
3:45 PM	0	0	2	4	6	1	0	1	3	5	2	13	2	2	19
4:00 PM	1	0	5	2	8	0	2	0	5	7	4	9	4	2	19
4:15 PM	0	0	3	5	8	0	0	1	4	5	1	8	0	2	11
4:30 PM	0	0	5	6	11	0	2	1	3	6	3	4	2	0	9
4:45 PM	0	0	1	5	6	0	2	3	2	7	3	7	3	4	17
5:00 PM	0	0	1	3	4	0	2	3	1	6	4	4	4	5	17
5:15 PM	0	0	3	1	4	0	2	3	3	8	1	8	1	4	14
5:30 PM	0	0	3	2	5	0	0	0	8	8	2	6	3	0	11
5:45 PM	0	0	2	2	4	0	1	3	8	12	3	3	3	1	10
6:00 PM	0	0	3	1	4	1	2	0	8	11	3	11	2	0	16
6:15 PM	0	0	3	5	8	0	2	0	0	2	8	4	1	1	14
6:30 PM	0	0	3	2	5	0	2	0	8	10	5	8	1	2	16
6:45 PM	0	0	2	3	5	1	0	4	5	10	5	9	2	2	18
Count Total	2	0	44	54	100	4	18	21	63	106	49	117	30	31	227
Peak Hour	2	0	12	14	28	1	2	3	12	18	10	36	8	8	62



# **Appendix D**

## **Protected Signal Control Analysis**





Location Madison Street/19th Avenue  
 Date of Counts Year of Opening - LPA  
 By DKS  
 Date 1/28/2016

Existing LT Phase? Y/N Y/N  
 Number of Lanes 0 2 0 0 2 0

Period/Movement	EBLT	EBT	EBRT	WBLT	WBT	WBRT	EBLT x WB	WBLT x EB
AM							0	0
Off							0	0
PM	282	534	50	181	193	3	106314	156746

Meet Vol Warrant? Y/N Y/N

Existing LT Phase? Y/N Y/N  
 Number of Lanes 0 1 0 0 1 0

Period/Movement	NBLT	NBT	NBRT	SBLT	SBT	SBRT	NBLT x SB	SBLT x NB
AM							0	0
Off							0	0
PM							0	0

Meet Vol Warrant? Y/N Y/N

Volume Warrant met if LT x Opp T > 50000 when there is only 1 Opp T lane  
 Volume Warrant met if LT x Opp T > 100000 when there are 2 or more Opp T lanes  
 Include Opp LT and Opp RT volumes in Opp T volume if they do not have own lanes

Product formulas assume no left turn or right turn lanes for all approaches  
 Please adjust formulas if the above does not apply