Spring 7-19-2018

Cyclists' Queue Discharge Characteristics at Signalized Intersections

Kirk Thomas Paulsen
Portland State University

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by

Kirk Thomas Paulsen

A thesis submitted in partial fulfillment of the
requirements for the degree of

Master of Science
in
Civil and Environmental Engineering

Thesis Committee:
Christopher M. Monsere, Chair
Miguel Figliozzi
Avi Unnikrishnan

Portland State University
2018

Abstract

Wider bike facilities intuitively accommodate a greater number of cyclists in the same amount of time, but specific queue discharge characteristics associated with varying widths and/or types of bike facilities have not been thoroughly documented.

The focus of this research analyzed queues of cyclists at four signalized intersections in Portland, OR with varying widths on the approach and downstream intersection legs. A total of 2,820 cyclists within 630 groups of queued cyclists were observed at five different intersection layouts in Portland, Oregon. The layouts consisted of: a standard bike lane six feet wide connecting bicyclists to a standard bike lane six feet wide, a standard bike lane five feet wide connecting bicyclists to two standard bike lanes each five feet wide, a buffered bike lane 12 feet wide connecting bicyclists to a standard bike lane 6.5 feet wide, a bike box 21 feet wide connecting bicyclists to a buffered bike lane 10 feet wide, and a bike box 15 feet wide connecting bicyclists to two standard bike lanes each five feet wide.

For each configuration, the following aspects were analyzed: average headway per cyclist within each queue, the time required for queues to enter the intersection, the time required for queues to clear the intersection, the number of cyclists within queues, the width of the bicycle facilities, the approach grade, and the utilization of a bike box at the intersection approach if it was present.

The first major focus of the analysis reviewed the average headway values associated with each observed queue of cyclists. The queue size with the lowest mean of the average

headway was for groups of seven cyclists with an average headway of approximately 0.8 seconds per cyclist. For queues larger than seven in size, the mean of the average headway remained relatively stable until queues of 12 in size and started to slightly increase toward approximately 1.0 seconds for queues larger than 12 cyclists. In addition, it appears that utilization of a bike box has a potential relationship with a reduced average headway as compared to queues that do not utilize a bike box. The associated reduction in the mean of the average headway was approximately 0.2 to 0.3 seconds per cyclist for queues of three or more in size.

The second major focus of the analysis reviewed the queue discharge rate associated with each observed queue of cyclists. The results appear to potentially indicate that wider bike facilities approaching an intersection, wider receiving bike facilities, or utilization of a bike box generally discharge queues of bicyclists into the intersection over a shorter amount of time as compared to facilities that are narrower or underutilized. The installation of a bike box at one of the study intersections increased the approach width from five to 15 feet and resulted in consistently lower average discharge times for all queue sizes, a reduction of greater than one second for queues of two cyclists to as much as about four seconds for queues of nine cyclists.

The third major focus of the analysis reviewed the intersection clearance time associated with each observed queue of cyclists. The results appear to potentially indicate that wider bike facilities approaching an intersection, wider receiving bike facilities, or utilization of a bike box generally clear queues of bicyclists through the intersection over a shorter amount of time as compared to facilities that are narrower or underutilized.

Dedication

I would like to dedicate this document to John and Amy Roberson, my grandparents.

John Roberson influenced me at a young age to consider engineering as a future life path by providing gifts of his *Engineering Fluid Mechanics* textbooks that he was a co-author of. He planted the engineering ‘seed’ with those textbooks, and I grew up to follow in his footsteps by attending Washington State University where he had previously been a professor in the engineering department.

Since my time spent in Pullman, my engineering focus has certainly evolved to match what I am truly passionate about: designing active transportation facilities. While active transportation is not exactly fluid mechanics, it’s a joy to be able to share the latest career developments with my grandfather knowing he contributed the perfect amount of ‘water’ to grow the seed that he helped plant.

Amy Roberson played an important and often overlooked role with assisting John on the development of his textbooks, as well as raising their kids and using her green thumb to grow amazing vegetable gardens. It was her work that planted the literal seeds of life that sustained their family, much knowledge of which was passed along to me. Such knowledge has helped guide me forward in life by providing reminders to not forget about the basic aspects that connect each and every one of us.

Acknowledgements

I would like to acknowledge the support of my partner, my family, my friends, and staff at PSU as I proceeded with the development of this document.

My family has always been there for me, providing positive support combined with encouraging thoughts during periods of less optimism.

My friends have always provided a beam of happiness that is frequently distracting, but extremely appreciated.

The staff at PSU have always been helpful and responsive, no matter when it was that I reached out for assistance.

Finally, I want to acknowledge the loving support provided by my partner, Erinne. I cannot even begin to express how much her presence in my life has meant to me.

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Chapter 1 - Introduction

Improved design of bicycle facilities constructed across the world have been shown to attract a wider-range of bicycle riders and are key to developing more cohesive bike networks within urban and suburban regions. Some routes have attracted a significant increase of cyclists, resulting in revisions to bike facilities along roadways and/or at intersections to better accommodate the increase of bike traffic.

Wider bike facilities intuitively accommodate a greater number of cyclists in the same amount of time, but the specific characteristics associated with widely varying widths and/or types of bike facilities has not been thoroughly documented, especially in a North American context.

Better understanding the performance characteristics associated with bicyclists at signalized intersections will aid in improving the accuracy of traffic models for complex intersections where the flow of bike traffic can substantially influence the flow of motorized vehicle traffic. As urban and suburban intersections become more congested while our regions grow in population, such knowledge could allow for the identification of solutions that improve intersection operation efficiencies for both bike traffic and motorized vehicle traffic.

1.1 Background

This research is a partial continuation of previous research (Monsere, et al. 2013). Section 5.2 of the prior research reviewed discharge characteristics of cyclist queues at the intersection of SE Madison Street at SE Grand Avenue in Portland, Oregon, based on video footage from before and after installation of a bike box at the intersection.

The prior research identified that discharge characteristics of queues of cyclists starting from bike boxes had not been previously quantified. The research examined 99 queues that occurred before the installation of the bike box and 143 queues that occurred after the installation of the bike box.

The prior research was used and expanded upon to develop this research. Additional observations of queues at the prior study intersection were performed, as well as observations at various other intersections, to create a more robust set of data.

1.2 Research Objectives

The objective of this research was to quantify and build upon a basic understanding of performance characteristics associated with stopped groups of cyclists at signalized intersections, based on the type of bike facility. The different types of bike facilities were compared to identify physical aspects that may contribute to more efficient intersection operations.

The focus of this research analyzed different study intersections with queues of cyclists based on: the average headway within queues, the time required for queues to enter the intersection, the time required for queues to clear the intersection, the number of cyclists within the queues, the width of the bicycle facilities, the approach grade, and the utilization of a bike box at the intersection approach if it was present.

1.3 Organization

The remainder of this report is organized in the following chapters:

- Chapter 2 - Literature Review: Current knowledge and published literature was reviewed for material related to the topic.
- Chapter 3 - Data Assembly: A description of the data assembled for the research.
- Chapter 4 - Data Reduction Methodology: A description of how data were extracted from the video footage for analysis.
- Chapter 5 - Analysis and Results: A summary of the comparative analysis of bicycle performance characteristics associated with stopped groups of cyclists at a variety of signalized intersections.
- Chapter 6 - Conclusions: Conclusions and findings of the research.
- Chapter 7 - References: References mentioned within the research.

The appendix of the research includes the following:

- Chapter 8 - Appendix: Excel Spreadsheet of Video Footage Data

Chapter 2 - Literature Review

The literature currently available that is related to performance characteristics of queues of bicyclists stopped at signalized intersections is presented within this chapter. The performance characteristics of focus for this research consist of headway, queue discharge rates, and intersection clearance time.

2.1 General Effect of Queues of Bicyclists at Signalized Intersections

It is likely intuitive, yet important to note, that heterogeneous / mixed traffic systems operate very differently compared to homogeneous traffic systems. Traffic in mixed flow conditions can be comprised of a combination of motorized and non-motorized vehicles (Dey, Nandal and Kalyan 2013).

While substantial information is known about the capacity of signalized intersections with respect to motorized vehicles, as recent as two decades ago research had acknowledged relatively little empirical research had been conducted regarding the effect of bicycles on signalized intersection capacity (Allen, et al. 1998). The purpose of the research was to quantify the effects of bicycles on signalized intersection capacity through the videotaping of several intersections that had significant bicycle traffic. The proposed procedure yielded lower saturation flows and capacities as compared to the *Highway Capacity Manual* (HCM) procedure that was available at the time. Based on the empirical data, when combined with pedestrian effects, it was found that the impact of bicycles on the saturation flow of automotive lanes containing right-turning vehicles was probably more detrimental than previously believed, and the motor vehicle capacities of intersections with significant bicycle and pedestrian traffic may be overestimated if using the HCM procedure.

Later research had similar findings, where the analytical results indicated capacity was being overestimated through the HCM 2000 capacity model (Wang, et al. 2011).

The importance of better understanding the relationship between bicycle traffic and motorized vehicle traffic flows was documented within research (Tarko and Tracz 2000) that stated "existing capacity manuals for signalized intersections admit rather considerable standard errors of saturation flow prediction reaching 8–10%. Errors in saturation flow predictions carry over to delay estimates and, consequently, they may lead to erroneous LOS estimates." The research also mentioned that there is a strong need to improve the predictive methods of saturation flow rates as prediction errors in saturation flow rates may cause difficulties in correct determination of level of service (LOS) – one of the main objectives in evaluating signalized intersections. Based on the findings of the research, an incorrect LOS may be different from the actual one by up to three category levels.

In the goal to develop a relationship between bicycle traffic and motorized vehicle traffic, research found that bicycle fluid diffusion at a signalized intersection had a great impact on straight and right-turning vehicles, particularly right-turning vehicles (Lilan, et al. 2009). Similarly, it was found that straight and right-turning vehicles also produce an impact on the normal flow of bicycle traffic. This mutual influence constraints the performance of each, causing slow down for both bicycles and motorized vehicles through the intersection.

Similar research also studied the capacity of signalized intersections influenced by bicycle traffic (Chen, Shao and Yue 2007). In a quantitative form, one study found that the capacity of right-turning motorized vehicles at signalized intersections is greatly impacted when hourly bicycle volumes enter the range of 500 to 1,500 bicycles (Qian and Niu 2010).

Other research explored strategies that segregate distinct modes along the approach and more effectively resolve the disruptive capacity-reducing conflicts that arise between through moving and turning traffic traveling in adjacent lanes. One paper proposed schemes that produce capacities that consistently and significantly reduce travel delays for all modes (Xuan, et al. 2009). One such scheme consisted of priority treatment, which enables one mode to proceed through the intersection ahead of the other mode, such as a bicycle box.

However, more recent research has made the point that the characteristics of bicycle movements at signalized intersections in China, where much of the referenced research has taken place, are very different from those in the United States (Guo, et al. 2012). The research produced a model, the results of which were compared to real-world observations and was reportedly a better match as compared to the HCM model. The research team made the claim that their model could supplement the content of the signalized intersection capacity analysis method in the HCM and provide the basis for design of intersection signal timing and capacity calculation under mixed traffic conditions at signalized intersections.

2.2 Bicycle Saturation Flow Rates

The saturation flow rate for bicycles at intersections represents the potential number of bicycles per hour that could pass through a signalized intersection if the green signal indication was provided for the full hour (Raksuntorn and Khan 2003). The research went on to describe how bicycles may form more than one queue within a bike lane at the approach to the intersection. Since bicycles maintain a certain distance from the adjacent lane and the curb, the number of queues formed varies based on the width of the bike lane. Therefore, the saturation flow rate for a bicycle lane depends on the width of the bike lane.

The saturation flow rate for bicycles is estimated from a procedure similar to determining the saturation flow rate for motorized vehicles, based on calculating the saturation headway using Equation (1).

$$s_b = 3600 \,/\, h_b \qquad (1)$$

Where:

$s_b = saturation\ flow\ rate\ for\ the\ bike\ facility\ (bikes\ per\ hour)$
$h_b = saturation\ headway\ for\ bicycles\ (seconds)$

With the lack of robust data related to this topic, research has recommended future studies be performed based on additional data collected at intersections with high bicycle volumes to examine the factors affecting the saturation flow rate for bicycles at signalized intersections (Raksuntorn and Khan 2003).

For purposes of comparison, the 2010 *Highway Capacity Manual* (HCM 2010) recommends a saturation flow rate of 2,000 bicycles per hour for a bike lane at a signalized intersection (Transportation Research Board 2010).

2.3 Bicyclist Perception/Reaction and Start-up Lost Time

To determine the saturation flow rate of a bike facility, it is required to understand that the beginning of all queues encounter a perception/reaction and start-up lost time associated with perceiving and reacting to a change in the traffic signal indication, and then accelerating up to speed (Monsere, et al. 2013).

Understanding the perception/reaction and start-up lost time helps determine the saturation headway that can be sustained once the queue is large enough to experience such an effect. The perception/reaction time is typically accounted for at the very beginning of the queue as the traffic signal changes to green. The start-up lost time typically continues from the beginning of the queue until a certain number of vehicles have entered the intersection and start-up lost time no longer influences the headways within the queue. From this point on headways within the queue will remain relatively constant until all vehicles in the queue have passed or the green time has ended (Dey, Nandal and Kalyan 2013).

Research that explored start-up lost time noted the first five bicyclists in a queue tended to experience a combined 2.5 seconds of start-up lost time. After the fifth bicyclist, the effects of start-up lost time were minimal as the headways between the bicyclists remained constant (Raksuntorn and Khan 2003).

2.4 Bicycle Headway

The HCM 2010 states that the headway for the first vehicle is the "elapsed time, in seconds, between the initiation of the green and the front wheels of the first vehicle crossing over the stop line" (Transportation Research Board 2010). Headways for subsequent vehicles are equal to the elapsed time between the front wheels of said vehicle and the one prior (Monsere, et al. 2013).

Recent research resulted in a saturation headway of approximately 1.0 second per cyclist within a bike lane five feet wide for cyclists positioned fifth or higher within the queue, equivalent to a saturation flow rate of 3,610 cyclists per hour (Monsere, et al. 2013). Earlier research of a bike lane eight feet wide demonstrated that headways between bicycles remained constant after the fifth bicycle in the queue, the saturation headway was 0.8 seconds, and the equivalent saturation flow rate was estimated to be 4,500 bicycles per hour of green (Raksuntorn and Khan 2003).

The research reported that both saturation headway and saturation flow rate may be a function of the width of the bicycle lane (Raksuntorn and Khan 2003). However, since bicycles maintain a certain distance from adjacent lanes and curbs, there is unused travel space on both sides of the bike lane. The proportion of the unused travel space relative to the total width decreases as the width of the bike lane increases. Therefore, with a wider bike lane, a higher proportion of space is available as effective travel space as compared to a narrow bike lane. For example, the research identified the following number of bicycle sub-lanes per bike facility width: one sub-lane for a facility three feet wide, one to two at four feet wide, two at five to six feet wide, three at eight feet wide, and four to five at 10 feet wide.

2.5 Bicycle Queue Discharge Times

Prior research determined queue discharge characteristics for one signalized intersection using footage from before and after installation of a bike box (Monsere, et al. 2013). A clear relationship between queue size and discharge time was evident for both study scenarios. The addition of a bike box decreased the discharge time for queues of equal length, as compared to a bike lane without a bike box at the same intersection. Additionally, the reduction in discharge time associated with the introduction of the bike box increased with larger queue sizes.

2.6 Bicycle Queue Intersection Clearance Times

Research found that the time required for a queue to clear an intersection, for queues of four or fewer cyclists, appears to be similar for both standard width bike lanes or relatively wider bike facilities (Monsere, et al. 2013). However, the intersection clearance times for queues of five or more cyclists tend to be less for wider bike facilities.

The research identified that the relationship of queue size to intersection clearance time for a standard bike lane was positive and linear, whereas with a bike box the relationship was positive and nonlinear. The addition of the bike box resulted in reduced intersection clearance times.

2.7 Summary

While the general effects of queues of bicyclists at signalized intersections on overall traffic operations are well known, the precise impact to traffic flow based on queue size and width of bike facility is not fully known.

The review of several queue discharge characteristics of queues of bicyclists at various signalized intersections will assist in developing a better understanding of the flow of bicycle traffic.

Chapter 3 will review the data collection procedures and data sources that were used to expand upon the prior research described within this chapter.

Chapter 3 - Data Assembly

This chapter describes data collection procedures and data sources used to obtain desirable video footage. Data collection took place at several signalized intersections within Portland, Oregon.

3.1 Data Collection Overview

The objective of the video data collection was to obtain observations of cyclists discharging from a stationary queue of cyclists at signalized intersections in Oregon. Table 1 presents a summary of observations collected from video footage; a total of 2,820 cyclists within 630 groups of queued cyclists were observed at five different intersection layouts.

Table 1: Summary of Video Observations

Study Roadway	Intersecting Roadway	# of Queues Observed	Total # of Queued Cyclists Observed
N Williams Avenue	N Russell Street	169	565
SE Hawthorne Boulevard	SE Grand Avenue	52	194
NW Broadway	NW Hoyt Street	136	564
SE Madison Street (Before Bike Box)	SE Grand Avenue	104	594
SE Madison Street (After Bike Box)	SE Grand Avenue	169	903
	Total:	**630**	**2,820**

The dates of data collection and additional details about footage obtained at each intersection are summarized in Table 2.

Table 2: Data Collection Details

Intersection	Footage Details						
	Date(s) (MM/DD/YYYY)	**Day of Week**	**Start Time**	**End Time**	**Hours**	**# of Queues**	**# of Cyclists**
N Williams Avenue at N Russell Street	8/20/2013	Tuesday	17:30	18:30	1:00	31	111
	8/21/2013	Wednesday	17:30	18:30	1:00	29	110
	8/22/2013	Thursday	16:30	18:30	2:00	59	193
	8/23/2013	Friday	16:30	18:30	2:00	50	151
SE Hawthorne Boulevard at SE Grand Avenue	10/13/2014	Monday	16:15	18:00	1:45	52	194
NW Broadway at NW Hoyt Street	8/13/2013	Tuesday	06:30	09:08	2:38	35	146
	8/14/2013	Wednesday	06:30	09:30	3:00	29	134
	8/15/2013	Thursday	06:30	09:30	3:00	44	177
	8/16/2013	Friday	06:30	09:30	3:00	28	107
SE Madison Street at SE Grand Avenue (Before Bike Box)	9/23/2010	Thursday	06:00	10:00	4:00	51	215
	9/24/2010	Friday	08:00	10:00	2:00	32	187
	9/28/2010	Tuesday	07:00	10:00	3:00	21	192
SE Madison Street at SE Grand Avenue (After Bike Box)	2/9/2012	Thursday	06:00	09:00	3:00	78	297
	2/10/2012	Friday	06:00	09:00	3:00	22	104
	6/28/2013	Friday	06:30	10:00	3:30	26	186
	7/1/2013	Monday	06:30	10:00	3:30	43	316

All observed queues are displayed in Figure 3-1 as a histogram based on queue size. A histogram of all observed queues at each intersection layout is displayed in Figure 3-2.

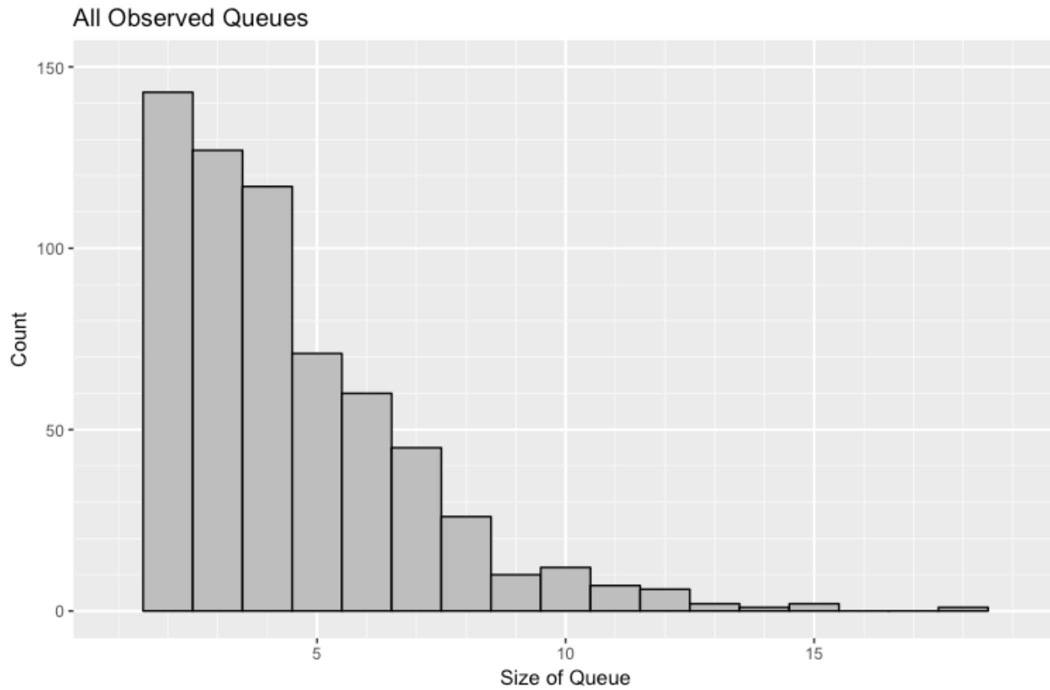

Figure 3-1 Histogram of Size of All Observed Queues

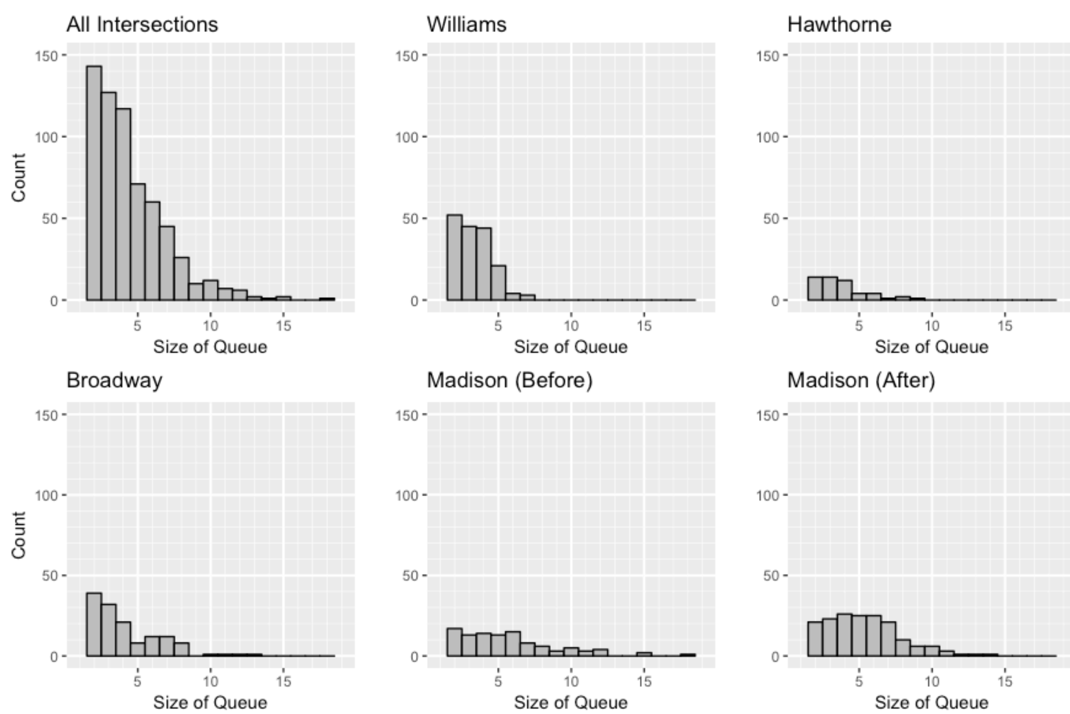

Figure 3-2 Histogram of All Observed Queues at Each Intersection Layout

The following subsections describe the data collection methods and setup procedures employed at the various study intersections, as well as a detailed description of each intersection where data were collected.

3.2 Video Recording Descriptions

Three different methods for obtaining video footage were utilized for this research, described in detail within this subsection.

3.2.1 GoPro Video Data

Video footage recorded by a GoPro video unit was collected at one location within Portland, Oregon:

- SE Hawthorne Boulevard at SE Grand Avenue

The setup consisted of a handheld personal GoPro video camera equipped with a single wide-angle lens video camera. The device has a battery and memory card self-contained within the unit. The camera was mounted to a camera tripod attached to a hand railing atop a pedestrian bridge above SE Hawthorne Boulevard. The camera was attended from a location that kept the attendant out of sight of the roadway, with the camera setup located outside the typical line of sight of roadway users.

An example of the setup can be seen in Figure 3-3. Footage from the single camera captured all desired movements that took place within the study intersection.

Figure 3-3 Example of the GoPro Data Collection Setup

3.2.2 Portland State University Type 1 Video Data

Portland State University Type 1 video footage was recorded at three locations within Portland, Oregon:

- N Williams Avenue at N Russell Street
- NW Broadway at NW Hoyt Street
- SE Madison Street at SE Grand Avenue (After Installation of Bike Box)

The setup consisted of a portable video footage collection system equipped with two camera inputs. The device also contained a battery and digital video recorder (DVR). Two wide-angle lens video cameras were utilized and were mounted on a pole separate from the recording device, with the cameras and recording device connected by electronic cables. The entire setup was located outside the typical line of sight of roadway users.

An example of the setup can be seen in Figure 3-4. Footage from the two cameras captured all desired movements that took place within the study intersection.

Figure 3-4 Example of the Portland State University Type 1 Data Collection Setup

3.2.3 Portland State University Type 2 Video Data

Video footage associated with one intersection was available from prior research that analyzed bicyclists' performance characteristics at signalized intersections (Wheeler, Conrad and Figliozzi 2010). Footage was recorded in a manner consistent with PSU Type 1 footage (as described within Section 3.2.2) at the following location:

- SE Madison Street at SE Grand Avenue (Before Installation of Bike Box)

The video footage allowed for a before/after analysis of two different intersection layouts associated with a restriping and lane reconfiguration that took place at a single location.

3.3 Intersection Descriptions

Data were collected from five different intersection layouts. This subsection provides a description of each intersection with the specific approach of main interest described first. An aerial photo and vicinity map is provided for each study intersection. The intersection approach for which data were collected is identified on the aerial image with a blue arrow. Details are summarized in Table 3.

Table 3: Study Approach and Intersection Details

Approach at Intersection	Study Approach[a] [~Grade]	Approach Features[b] [width or area]	Receiving Features[b] [widths]	Intersection Crossing Distance (ft)
N Williams Avenue at N Russell Street	NB [+1%]	BL [6’]	BL [6’]	60
SE Hawthorne Boulevard at SE Grand Avenue	EB [-4%]	BBL [5’+7’]	BL [6.5’]	56
NW Broadway at NW Hoyt Street	SB [-4%]	BBL [3’+7’] + BB [21x19’]	BBL [3’+7’]	46
SE Madison Street at SE Grand Avenue (Before Bike Box)	WB [+2%]	BL [5’]	BL [5’] + BL [5’]	54
SE Madison Street at SE Grand Avenue (After Bike Box)	WB [+2%]	BL [5’] + BB [15x20’]	BL [5’] + BL [5’]	54

a) NB = northbound, EB = eastbound, SB = southbound, WB = westbound; Grade was estimated from elevation data within Google Earth between 50-100 feet in advance of the stop bar.
b) BL = bike lane [lane width], BBL = buffered bike lane [buffer width + lane width], BB = bike box [width x length]

3.3.1 N Williams Avenue at N Russell Street

This four-legged intersection consists of a one-way street (N Williams Avenue) intersecting with a two-way street (N Russell Street).

At the time that data collection took place the N Williams Avenue approach had two motor vehicle lanes oriented in the northbound direction, a painted bike lane located to the right of the two motor vehicle lanes, and a parking lane on both sides of the roadway. The bike lane was measured to be six feet wide before and after the intersection. The distance between the two crosswalks perpendicular to the northbound bike lane was measured to be approximately 60 feet.

The N Russell Street approach had one standard motor vehicle lane in each direction, a painted bike lane located to the right of each standard motor vehicle lane, a dedicated left-turn lane within the eastbound approach, and a parking lane on both sides of the roadway west of N Williams Avenue.

Data were collected in August 2013 in clear weather conditions. Bicyclists were controlled by standard vehicle signals on both approaches. An aerial photo and vicinity map of the intersection is shown in Figure 3-5.

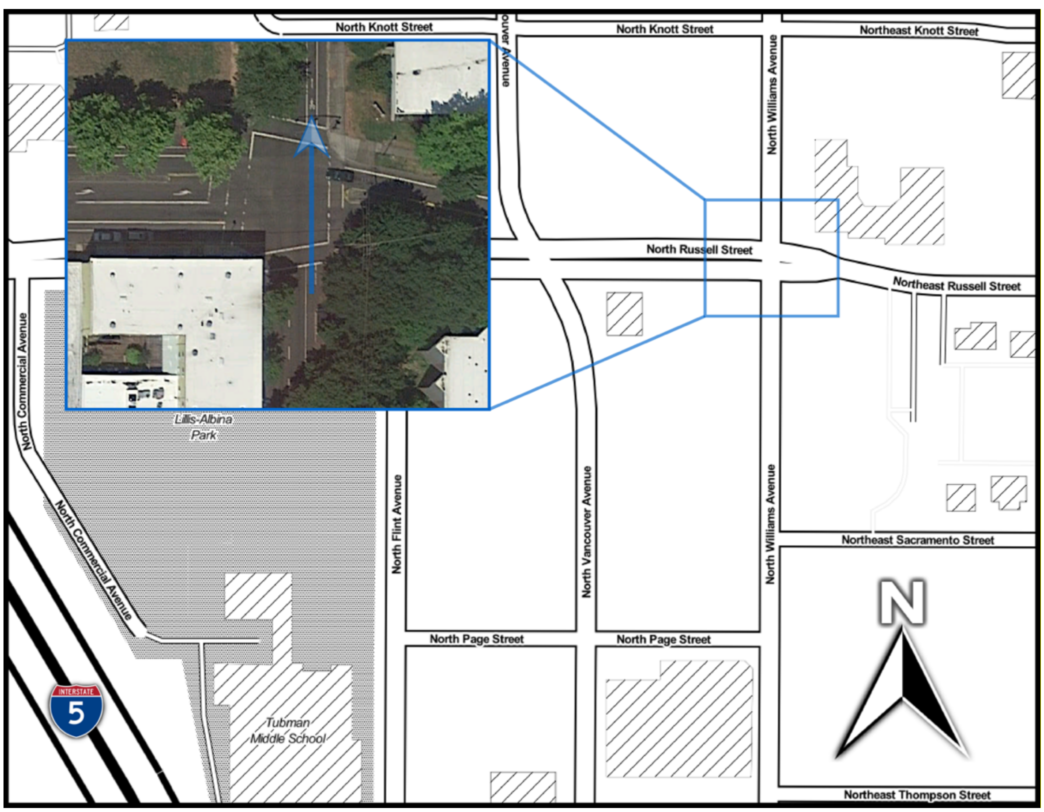

Figure 3-5 Vicinity Map / Aerial Photo, N Williams Avenue at Russell Street

3.3.2 SE Hawthorne Boulevard at SE Grand Avenue

This four-legged intersection consists of a one-way street (SE Hawthorne Boulevard) intersecting with another one-way street (SE Grand Avenue).

At the time that data collection took place the SE Hawthorne Boulevard approach had two motor vehicle lanes oriented in the eastbound direction and a painted buffered bike lane located to the right of the two motor vehicle lanes. The painted buffer between the motor vehicle lanes and the bike lane in advance of the intersection was measured to be five feet wide. There was no painted buffer area after the intersection. The bike lane was measured to be seven feet wide in advance of the intersection and 6.5 feet wide after the intersection. The distance between the two crosswalks perpendicular to the eastbound bike lane was measured to be approximately 56 feet.

The SE Grand Avenue northbound approach had three standard vehicle lanes, a shared vehicle/streetcar lane to the right of the three standard lanes, and a parking lane on both sides of the roadway.

Data were collected in October 2014 in clear weather conditions. Bicyclists were controlled by standard vehicle signals on both approaches. An aerial photo and vicinity map of the intersection is shown in Figure 3-6.

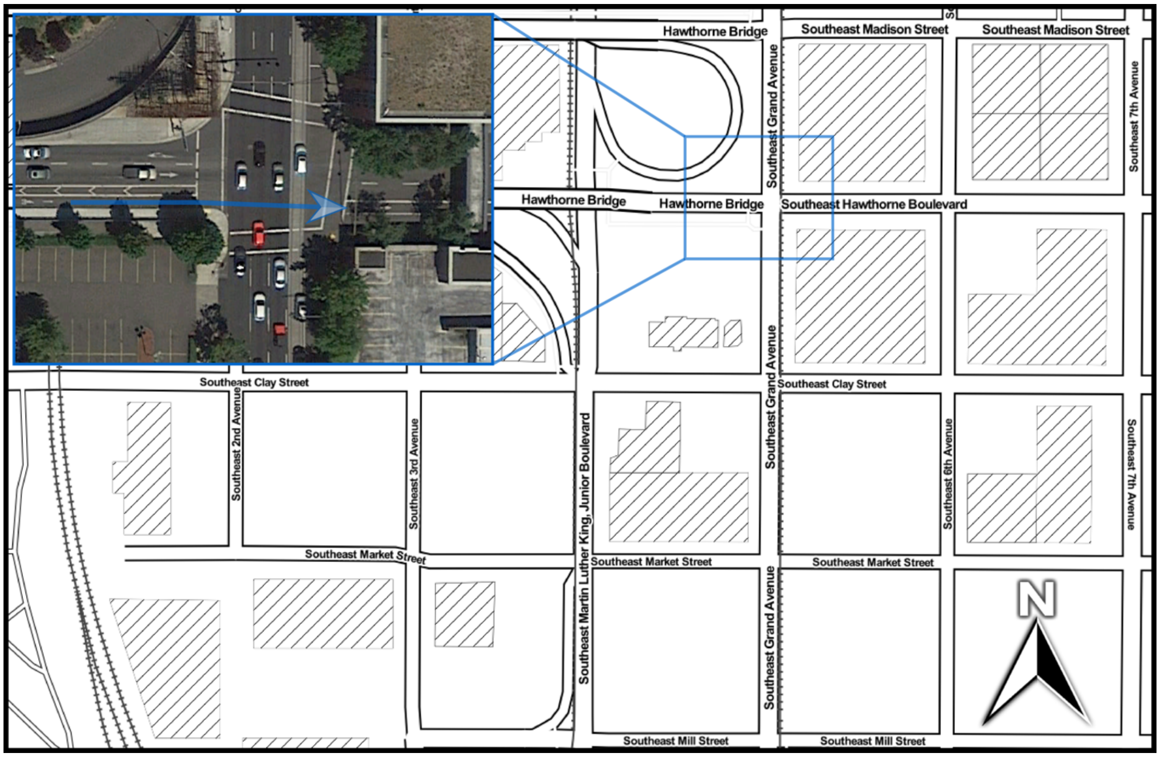

Figure 3-6 Vicinity Map / Aerial Photo, SE Hawthorne Boulevard at Grand Avenue

3.3.3 NW Broadway at NW Hoyt Street

This four-legged intersection consists of a two-way street (NW Broadway) intersecting with another two-way street (NW Hoyt Street).

The NW Broadway southbound approach had two motor vehicle lanes and a painted buffered bike lane located to the right of the two motor vehicle lanes. The painted buffer between the motor vehicle lanes and the bike lane was measured to be three feet wide. The bike lane was measured to be seven feet wide. The bike lane connected to an uncolored bike box at the intersection approach that was measured to be approximately 21 feet wide and 19 feet deep. The roadway layout associated with southbound travel lanes and dimensions of the painted buffered bike lane also apply to the segment of roadway immediately south of the study intersection. The distance between the two crosswalks perpendicular to the southbound bike lane was measured to be approximately 46 feet.

The NW Broadway northbound approach had a standard vehicle lane and a parking lane located to the right of the standard lane.

The NW Hoyt Street approaches had one standard vehicle lane in each direction, a dedicated left-turn lane within the eastbound approach, and a parking lane to the right of each standard lane.

Data were collected in August 2013 in clear weather conditions. Bicyclists were controlled by standard vehicle signals on all approaches. An aerial photo and vicinity map of the intersection is shown in Figure 3-7.

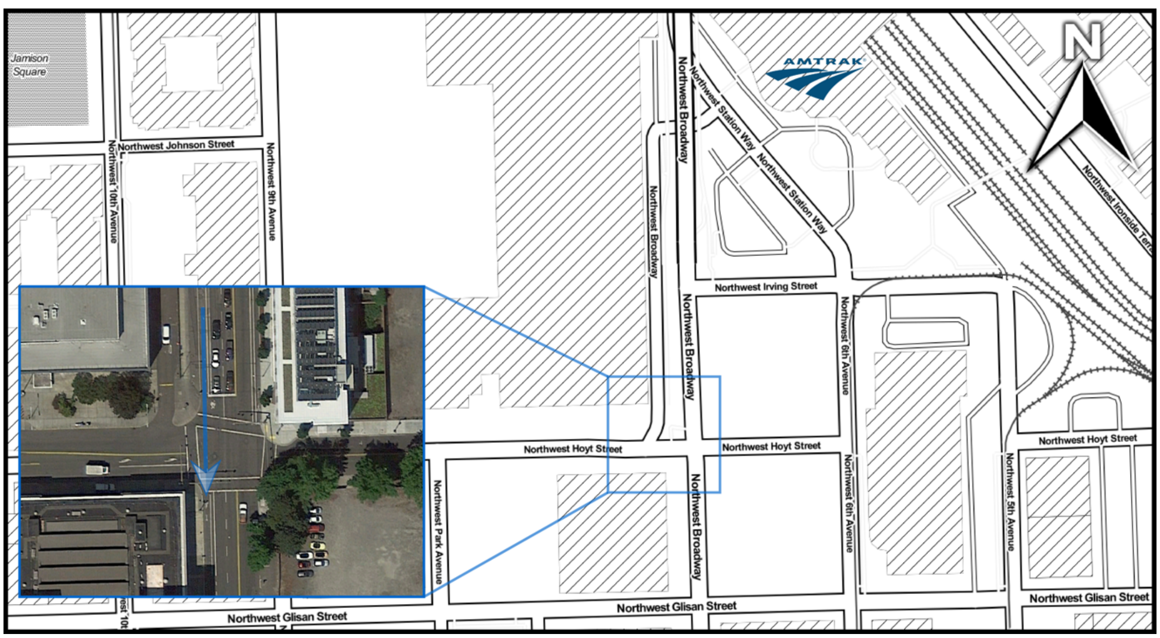

Figure 3-7 Vicinity Map / Aerial Photo, NW Broadway at Hoyt Street

3.3.4 SE Madison Street at SE Grand Avenue – Before Bike Box

This four-legged intersection consists of a one-way street (SE Madison Street) intersecting with another one-way street (SE Grand Avenue).

At the time that data collection took place for this analysis scenario the SE Madison Street approach had two standard motor vehicle lanes oriented in the westbound direction, a painted bike lane located to the right of the two standard motor vehicle lanes, and a shared right-turn-only/except-bus lane to the right of the bike lane. The bike lane was measured to be five feet wide in advance of the intersection and as wide as 10 feet after the intersection. The receiving bike facility was marked as two bike lanes each five feet wide to accommodate the relatively large numbers of bicyclists that routinely travel westbound through the intersection during the weekday morning peak hours. The distance between the crosswalk perpendicular to the westbound bike lane and the area immediately west of the northbound travel lanes was measured to be approximately 54 feet.

The SE Grand Avenue northbound approach had four standard vehicle lanes and a parking lane on the east side of the roadway.

Data were collected in September 2010 in clear weather conditions. Bicyclists were controlled by standard vehicle signals on both approaches. An aerial photo and vicinity map of the intersection is shown in Figure 3-8.

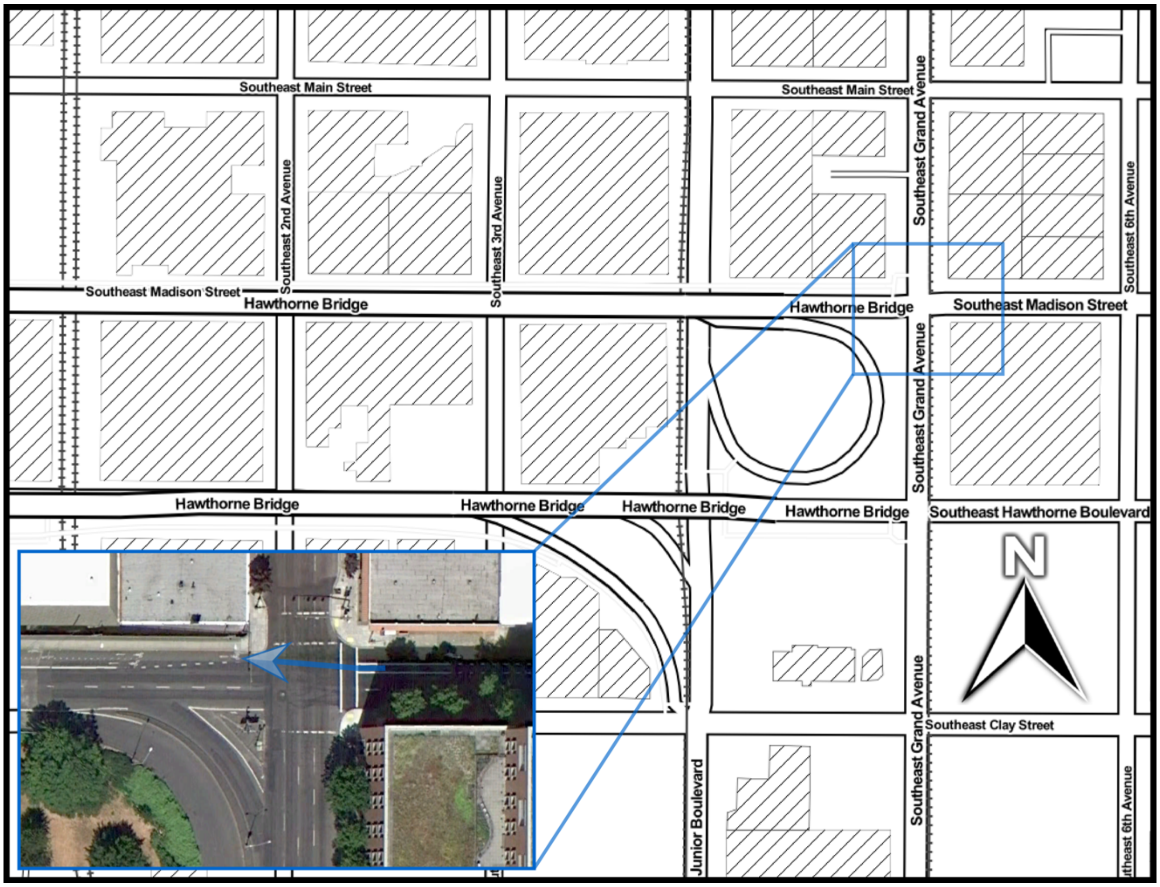

Figure 3-8 Vicinity Map / Aerial Photo, SE Madison Street at Grand Avenue (Before)

3.3.5 SE Madison Street at SE Grand Avenue – After Bike Box

This study intersection is the same intersection location as described within Section 3.3.4. The differences between this analysis scenario and the scenario described within Section 3.3.4 relate to striping revisions associated with the SE Madison Street approach and physical revisions associated with the SE Grand Avenue approach. The revisions were implemented after video footage was recorded for the analysis scenario associated with Section 3.3.4 and before video footage was recorded for this analysis scenario.

The SE Madison Street approach underwent the following revisions:

- The segment of the painted bike lane in advance of the intersection where motor vehicles are directed to cross over to access the dedicated right-turn lane was filled in with solid green paint.
- A green colored painted bike box was added to the existing bike lane immediately east of the study intersection. The existing bike lane connected to the bike box which was measured to be approximately 15 feet wide and 20 feet deep.

The SE Grand Avenue approach underwent the following revisions:

- Streetcar tracks were installed within the eastern standard travel lane converting the travel lane into a shared vehicle/streetcar lane.
- The southwest corner of the intersection was reconstructed to permit pedestrian access.
- Two crosswalks were installed connecting to the southwest corner of the intersection.
- The reconstructed southwest corner of the intersection revised the travel path for northbound vehicles turning left to travel westbound. Previously vehicles were required to transition onto an off-ramp prior to the intersection. The layout associated with this analysis scenario required vehicles to perform the left-turn maneuver directly around the southwestern intersection corner.

The distance between the two crosswalks perpendicular to the westbound bike lane was measured to be approximately 54 feet.

While numerous roadway revisions were implemented between the two analysis scenarios, the only revision of significance to westbound bicyclists was the introduction of the bike box. Therefore, the purpose of this analysis scenario was to obtain video footage that would allow for an extremely accurate before/after review regarding how such a revision affected the behavior of bicyclists within queues at the study intersection.

Data were collected in February 2012 in slightly rainy weather conditions as well as June and July of 2013 in clear weather conditions. Bicyclists were controlled by standard vehicle signals. An aerial photo and vicinity map of the intersection is shown in Figure 3-9.

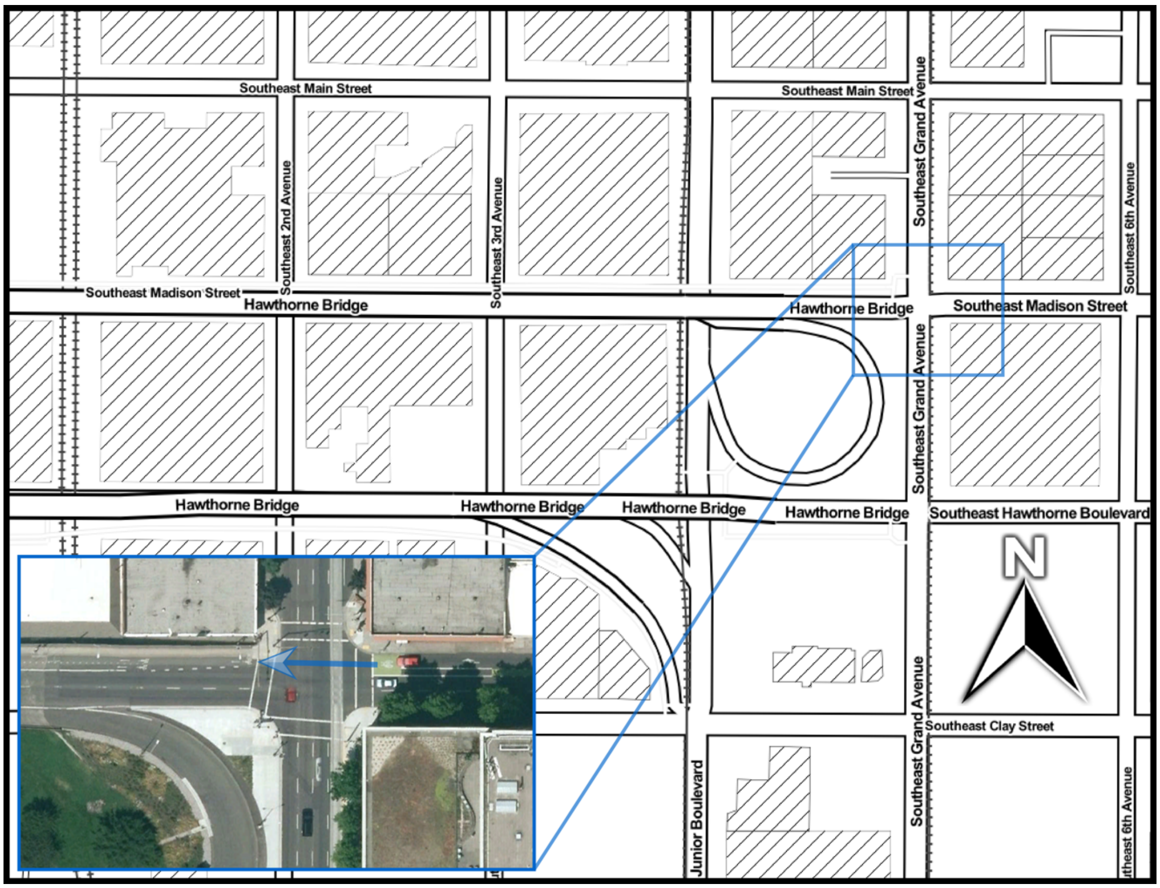

Figure 3-9 Vicinity Map / Aerial Photo, SE Madison Street at Grand Avenue (After)

3.4 Summary

The data collected at the five intersection analysis scenarios provide the ability to compare detailed queue characteristics associated with a wide range of bike facilities. The next chapter describes the methodology used to transform the data into a format that allowed for the desired analysis.

Chapter 4 - Data Reduction Methodology

To acquire the necessary data to complete this research, video footage was reviewed and various data were extracted for each group of cyclists observed to have formed a queue. Data for each group of cyclists were recorded in an Excel spreadsheet. The description of each documented type of data is defined below in the following subsections.

4.1 Events

These data refer to a specific time that an event took place or the observed characteristics of an event.

Although a timestamp was displayed on many of the original video files that was accurate to within one second, greater precision was necessary for calculating time between events used in the various analyses.

The media software program QuickTime Player 7 (version 7.6.6) was used to view the video, as the software provides the ability to display the frame number associated with the video footage. The frame number at the start and/or end of each event was recorded. The number of frames per second (fps) at which the video file was created was referenced to convert the difference in frame numbers between two events to determine the elapsed time in seconds, resulting in precision of at least $1/10^{th}$ of a second.

The accuracy of this method was validated by comparing the passage of time displayed as part of the timestamps on the video footage to the amount of time calculated to have passed based on the difference of frame numbers. This validation process was completed for numerous sample video files for each study intersection.

4.1.1 Date

The date that the group of cyclists were recorded, documented in the MM/DD/YYYY format.

4.1.2 Start of Walk *or* Start of Red *or* Start of Green

Each video file provided a display of the intersection focused on a limited viewing angle. The limited viewing angle was chosen with the intention of capturing at least one of the following three events related to specific phase changes of the traffic signal: start of walk, start of red, and start of green.

- Start of Walk: Time at the beginning of the walk indication provided to pedestrians traveling parallel to the bicyclists that are associated with this study, recorded as 'Hour' (military time), 'Minute', 'Second', and 'Frame #'.
- Start of Red: Time at the beginning of the red indication provided to traffic traveling perpendicular to the bicyclists that are associated with this study, recorded as 'Hour' (military time), 'Minute', 'Second', and 'Frame #'.
- Start of Green: Time at the beginning of the green indication provided to the bicyclists that are associated with this study, recorded as 'Hour' (military time), 'Minute', 'Second', and 'Frame #'.

The values for 'Hour', 'Minute', and 'Second' were obtained from the timestamp displayed as part of the video footage. For video footage that did not display a timestamp (GoPro Video Data), the time that the video file was created was used for this category. The main purpose of documenting the time of the relevant video footage was to improve the ability to revisit the video files at a later date to find and review specific events within the numerous video files associated with the study.

The value for ‘Frame #’ was obtained from the software program QuickTime Player 7, as described earlier within subsection 4.1.

Understanding the precise time of at least one of the three identified signal phase changes is necessary for an accurate comparative analysis of queue discharge rates associated with the various intersection layouts. The ‘start of walk’ and 'start of red' events were used to determine when the green indication was provided to the queue of bicyclists if the video footage did not contain a view that included the signal head controlling the movement for the queue of bicyclists. Based on the signal timing for the signalized intersection it was possible to deduce the time at which the green indication was provided to the queue of bicyclists relative to the ‘start of walk’ or ‘start of red’ event.

4.1.3 # of Cyclists

The number of people operating bicycles determined to have come to a complete stop at the approach of the study intersection during the respective signal cycle.

The documentation of this event was separated into specific sub-events based on the general location of the bicyclist(s), with the type and number of sub-events documented dependent on the type of bike facility studied.

For standard bike lane approaches, the general location of where the bicyclist(s) were positioned while waiting at the red light was separated into the areas 1) within the bike lane, and 2) beyond the bike lane, as shown in Figure 4-1. The total number of stationary bicyclists within each general location was documented for each observed queue of bicyclists.

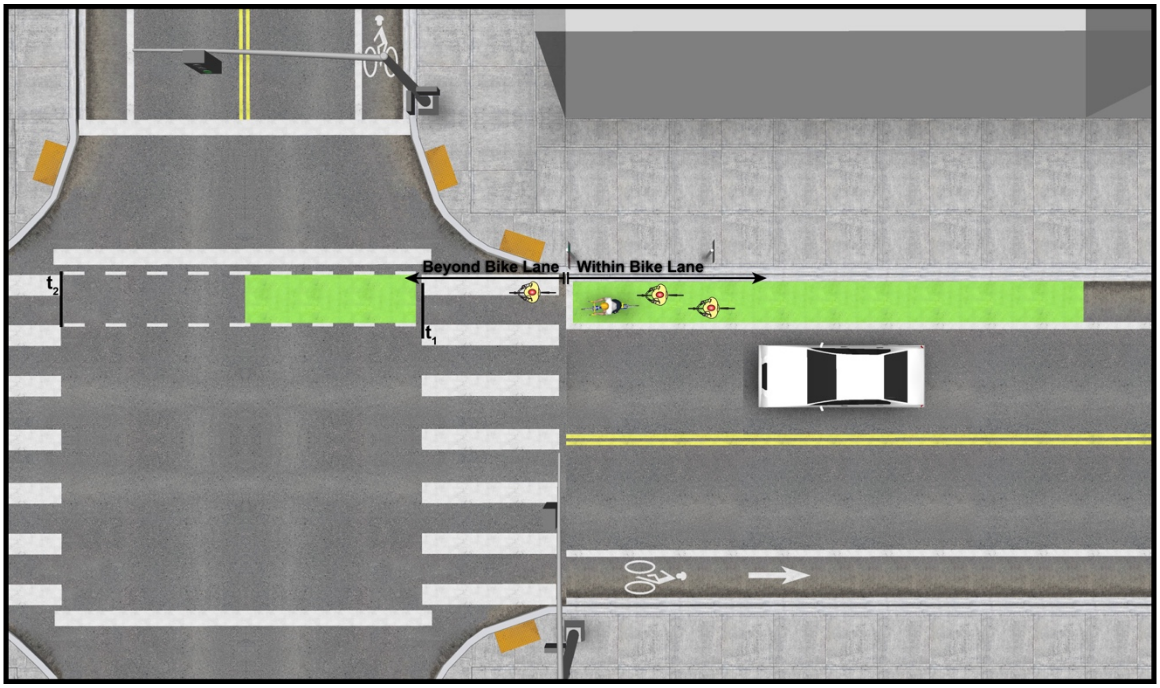

Figure 4-1 General Locations of Possible Cyclist Positions for a Standard Bike Lane Approach (Source Image: NACTO *Urban Bikeway Design Guide*)

For standard bike lane approaches that also contain a bike box as part of the intersection approach, the general location of where the bicyclist(s) were positioned while waiting at the red light was separated into the areas 1) within the bike lane in advance of the bike box or adjacent to the bike box, 2) within the bike box, and 3) beyond the bike box, as shown in Figure 4-2.

Figure 4-2 General Locations of Possible Cyclist Positions for a Standard Bike Lane + Bike Box Approach (Source Image: NACTO *Urban Bikeway Design Guide*)

The total number of stationary bicyclists within each general location was documented for each observed queue of bicyclists. Bicyclists that had their bike physically spanning across two of the general location areas were documented as being located within the area that contained most of their bike/body.

The bicyclists that were documented as being located beyond the bike facilities were not considered to be part of the total number of bicyclists within the queue. The reason being that the distance of the bicyclists located beyond the bike facility routinely varied and was therefore difficult to measure and accurately compare to other observed queues.

In some instances, the presence of a bus at a bus stop directly adjacent to the intersection approach would result in a large gap within the queue of cyclists as a portion of the cyclists would yield to the bus re-entering the traffic stream. In these instances, only cyclists within the initial queue before the bus re-entered the traffic stream were documented as being part of the queue to avoid involving artificially large headways associated with merging bus traffic.

4.1.4 Time Front Wheel of 1st Bike Crossed Far Line of Near X-walk.

Time when the front wheel of the first bicyclist considered to be part of the queue crossed the far line of the nearside crosswalk (reference point t_1 in Figure 4-1 and Figure 4-2).

This was the time at which the queue of bicyclists was considered to have entered the intersection.

4.1.5 Time Front Wheel of Last Bike Crossed Far Line of Near X-walk.

Time when the front wheel of the last bicyclist considered to be part of the queue crossed the far line of the nearside crosswalk (reference point t_1).

This was the time at which the final member of the observed queue of bicyclists was considered to have entered the intersection.

4.1.6 Time Back Wheel of Last Bike Crossed First Line of Far X-walk.

Time when the back wheel of the last bicyclist considered to be part of the queue crossed the first line of the far crosswalk (reference point t_2 in Figure 4-1 and Figure 4-2).

This was the time at which the entire observed queue of bicyclists was considered to have departed the intersection.

4.1.7 Video FPS

Number of frames per second of the video footage as calculated by the method described in Section 4.1.

4.2 Bicycle Queue Performance Characteristics

The purpose of the analysis is to compare the discharge characteristics of observed queues of bicyclists at a variety of signalized intersection approaches that contain dedicated bicycle facilities. The following subsections provide a description of the queue discharge characteristics that were the focus of analysis.

4.2.1 Average Headway within Queues of Bicycle Traffic

In HCM 2010, the headway for the first vehicle is the "elapsed time, in seconds, between the initiation of the green and the front wheels of the first vehicle crossing over the stop line."

Headway for the first cyclist in the queue is calculated using Equation (2).

$$h_1 = (Ref_{1[t1]} - Ref_G) \, / \, FPS \qquad (2)$$

Where:

$h_1 = headway\ (seconds)\ for\ the\ 1^{st}\ cyclist$
$Ref_{1[t1]} = frame\ \#\ when\ 1^{st}\ cyclist's\ front\ wheel\ crossed\ reference\ line\ t_1$
$Ref_G = frame\ \#\ when\ the\ signal\ phase\ changed\ to\ green\ for\ bicyclists$
$FPS = frames\ per\ second\ of\ the\ video\ file$

Headways for subsequent vehicles are equal to the elapsed time between the front wheels of said vehicle and the one prior.

Consistent with the HCM 2010 methods, the time used to calculate headways involved the time that a bicyclist's front wheel crossed a reference point. However, all study locations did not contain typical stop lines, resulting in the closest marking of the nearside crosswalk to be perceived and treated as a stop line by many of the vehicle operators.

Although the closest marking of the nearside crosswalk was frequently in front of the queue of motorized vehicles, numerous bicyclists located at the front of queues were observed to have come to a complete stop with their front wheel resting on or immediately beyond the closest marking of the nearside crosswalk. The routine placement of bicyclists' front wheels in such a location made it difficult to accurately discern when the first cyclist within the queue would initiate movement and cross the closest reference point typically used to determine headways. For this reason, the nearside crosswalk's marking located furthest away from the queue of bicyclists was chosen as the standard reference point to obtain more accurate timing comparisons used within this analysis. All study approaches contained similar crosswalk markings consisting of two lines perpendicular to the flow of approaching traffic.

Furthermore, in some scenarios the type and size of the bike facility did not constrain bicyclists to form a queue as a single-file line and instead allowed for lateral grouping of multiple bicyclists to occur. Such facilities also allowed faster bicyclists to overtake slower bicyclists when the queue dispersed in advance of reference point t_1, previously defined within Section 4.1. Therefore, individual headway information was determined to be too difficult to determine as part of this study. Thus, calculation of individual headways using the HCM 2010 method was not an easy method to replicate.

However, there remained a desire to review the average of headways between the first and last cyclist within each queue so as to understand general flow rates amongst queues of various sizes.

This study identified the 'average headway' within each queue by determining the elapsed time between the first and last cyclist to have crossed reference point t_1 and dividing by the total number of cyclists within the queue after they first cyclist, calculated as shown in Equation (3).

$$h_A = \frac{(Ref_{n[t1]} - Ref_{1[t1]})}{(n-1)*FPS} \qquad (3)$$

Where:

$h_A = average\ headway\ (seconds)\ after\ 1^{st}\ cyclist\ within\ queue$
$Ref_{n[t1]} = frame\ \#\ when\ n^{th}\ cyclist's\ front\ wheel\ crossed\ reference\ line\ t_1$
$Ref_{1[t1]} = frame\ \#\ when\ 1^{st}\ cyclist's\ front\ wheel\ crossed\ reference\ line\ t_1$
$n = \#\ of\ cyclists\ within\ queue$

The resulting average headway value for each queue is based on queue size, without including delays associated with varied perception and reaction times of the traffic signal changing phases to display the green indication. For example, some queues of cyclists were observed to not see the traffic signal turn green until after a semi-truck passed completely through the intersection no longer blocking the cyclists' view of the signal. Therefore, the average headway value is independent of the varied perception and reaction times.

4.2.2 Queue Discharge Time

The 'queue discharge time' is a calculation of the time required for the entire queue of bicyclists to enter the intersection. The calculation was based on the difference of time between the ‘start of green’ and when the front wheel of the last bicyclist within the queue crossed reference point t_1, as shown in Equation (4) .

$$QD = (Ref_{n[t1]} - SG) / FPS \qquad (4)$$

Where:

$QD = time\ (seconds)\ for\ a\ queue\ of\ n\ bicyclists\ to\ enter\ the\ intersection$
$Ref_{n[t1]} = frame\ \#\ when\ n^{th}\ cyclist's\ front\ wheel\ crossed\ reference\ line\ t_1$
$SG = frame\ \#\ at\ the\ 'Start\ of\ Green'$

The far line of the nearside crosswalk was chosen as reference point t_1, previously defined within Section 4.1, as this was the point at which bicyclists began to conflict with the path of motorized vehicles traveling along the intersecting roadway.

The queue discharge time incorporates delays associated with the perception and reaction time, which allows for a better understanding of intersection operations per signal cycle.

4.2.3 Queue Intersection Clearance Time

The ‘intersection clearance time’ is a calculation of the time required for the queue of bicyclists to clear the intersection. The calculation was based on the difference of time between the ‘start of green’ and when the back wheel of the last bicyclist within the queue crossed reference point t_2, as shown in Equation (5).

$$IC = (Ref_{n[t2]} - SG) / FPS \qquad (5)$$

Where:

$IC = time\ (seconds)\ for\ a\ queue\ of\ n\ bicyclists\ to\ clear\ an\ intersection$
$Ref_{n[t2]} = frame\ \#\ when\ n^{th}\ cyclist's\ rear\ wheel\ crossed\ reference\ line\ t_2$
$SG = frame\ \#\ at\ the\ 'Start\ of\ Green'$

The first line of the far-side crosswalk was chosen as reference point t_2, previously defined within Section 4.1, as this was the point at which bicyclists were no longer in conflict with the path of motorized vehicles traveling along the intersecting roadway.

Similar to the queue discharge time, the intersection clearance time incorporates delays associated with the perception and reaction time, which allows for a better understanding of intersection operations per signal cycle.

4.3 Types of Bike Facilities Analyzed

The queue discharge characteristics described within Section 4.2 were determined for five different types of bike facility layouts located at signalized intersections: a standard bike lane connecting to a standard bike lane, a standard bike lane connecting to two standard bike lanes, a buffered bike lane connecting to a standard bike lane, a bike box connecting to a buffered bike lane, and a bike box connecting to two standard bike lanes.

4.3.1 Standard Bike Lane to Standard Bike Lane

The analysis scenario that contained a standard bike lane in advance of the intersection as well as following the intersection was represented by the study intersection of N Williams Avenue at N Russell Street.

The bike lane that was the focus of this analysis was measured to be six feet wide before and after the intersection. There was a parking lane to the right of the bike lane in advance of the intersection. The area to the right of the bike lane immediately following the intersection was designated as a ‘No Parking / Bus Zone’ curb area.

While it is not intended for bicyclists to utilize the area to the right of the bike lane, it should be noted that the area was observed to have been utilized by a portion of the bicyclists when there was an absence of motorized vehicles in the respective spaces designated for such use. Both faster bicyclists as well as slower bicyclists were observed to use the area to the right of the bike lane, usually to pass other bicyclists or let other bicyclists pass them. The variation of the constrained width available for use by bicyclists at this intersection was not accounted for in the analysis.

The distance between the two crosswalks perpendicular to the northbound bike lane was measured to be approximately 60 feet.

4.3.2 Standard Bike Lane to Two Standard Bike Lanes

The analysis scenario that contained a standard bike lane in advance of the intersection and two standard bike lanes following the intersection was represented by the study intersection of SE Madison Street at SE Grand Avenue (Before Bike Box).

The bike lane was measured to be five feet wide before the intersection and as wide as 10 feet after the intersection. The receiving bike lane is marked as two bike lanes each five feet wide to intentionally accommodate large numbers of bicyclists.

The distance between the crosswalk perpendicular to the westbound bike lane and the area immediately west of the northbound travel lanes was measured to be approximately 54 feet.

4.3.3 Buffered Bike Lane to Standard Bike Lane

The analysis scenario that contained a buffered bike lane in advance of the intersection and a standard bike lane following the intersection was represented by the study intersection of SE Hawthorne Boulevard at SE Grand Avenue.

The painted buffer between the motor vehicle lanes and the bike lane was measured to be five feet wide in advance of the intersection. There was no painted buffer area after the intersection. The bike lane was measured to be seven feet wide in advance of the intersection and 6.5 feet wide after the intersection.

The distance between the two crosswalks perpendicular to the eastbound bike lane was measured to be approximately 56 feet.

4.3.4 Bike Box to Buffered Bike Lane

The analysis scenario that contained a bike box in advance of the intersection and a buffered bike lane following the intersection was represented by the study intersection of NW Broadway at NW Hoyt Street.

The bike box at the intersection approach was measured to be approximately 21 feet wide and 19 feet deep. The painted buffer area between the motor vehicle lanes and the bike lane was measured to be three feet wide. The bike lane was measured to be seven feet wide. The measured widths of the bike lane and buffer area apply to the locations both in advance of the bike box and immediately after the intersection.

The distance between the two crosswalks perpendicular to the southbound bike lane was measured to be approximately 46 feet.

4.3.5 Bike Box to Two Standard Bike Lanes

The analysis scenario that contained a bike box in advance of the intersection and two standard bike lanes following the intersection was represented by the study intersection of SE Madison Street at SE Grand Avenue (After Bike Box).

The bike box at the intersection approach was measured to be approximately 15 feet wide and 20 feet deep. The bike lane in advance of the bike box was measured to be five feet wide. The bike lanes immediately after the intersection was measured to be as wide as 10 feet. The two receiving lanes are intended to accommodate large numbers of bicyclists.

The distance between the crosswalk perpendicular to the westbound bike lane and the area immediately west of the northbound travel lanes was measured to be approximately 54 feet.

4.4 Summary

With the data events from video footage associated with different sized bike facilities successfully obtained, they were prepared for analysis in accordance with the desired performance characteristics of groups of cyclists queued at signalized intersections.

The next chapter presents the analysis and results from comparisons of data described within this chapter.

Chapter 5 - Analysis & Results

This chapter presents the analysis and results of the reduced data. The main aspects of the cyclist queue discharge characteristics that were analyzed consist of: average headway of queues, queue discharge rates, and intersection clearance times.

The queue characteristics were analyzed with respect to queue size, bikeway departure width, bikeway receiving width, bikeway crossing distance, intersection grade, and whether the bike box was utilized.

5.1 Average Headway of Queues

This section presents detailed analysis of the average headway of queues of cyclists based on their respective size. All observed queues are tabulated in Table 4 and displayed in Figure 5-1 as a scatterplot with a smoothed line showing the conditional mean and the 95 percent confidence interval as the shaded area. This line was plotted using R and the "+ stat_smooth(se=T)" option within the ggplot2 package.

Table 4: Average, Standard Deviation and Number of Observations of Average Headway

Queue Size	All Observations		
	Avg (sec)	Std Dev (sec)	n
2	1.31	0.70	144
3	1.19	0.45	125
4	1.09	0.28	118
5	0.94	0.28	71
6	0.88	0.24	60
7	0.78	0.22	44
8	0.82	0.22	27
9	0.82	0.28	10
10	0.80	0.23	12
11	0.82	0.15	7
12	0.91	0.12	6
13	0.64	0.08	2
14	0.83	0.00	1
15	1.03	0.07	2
16	-	-	-
17	-	-	-
18	0.85	0.00	1
Total	-	-	630

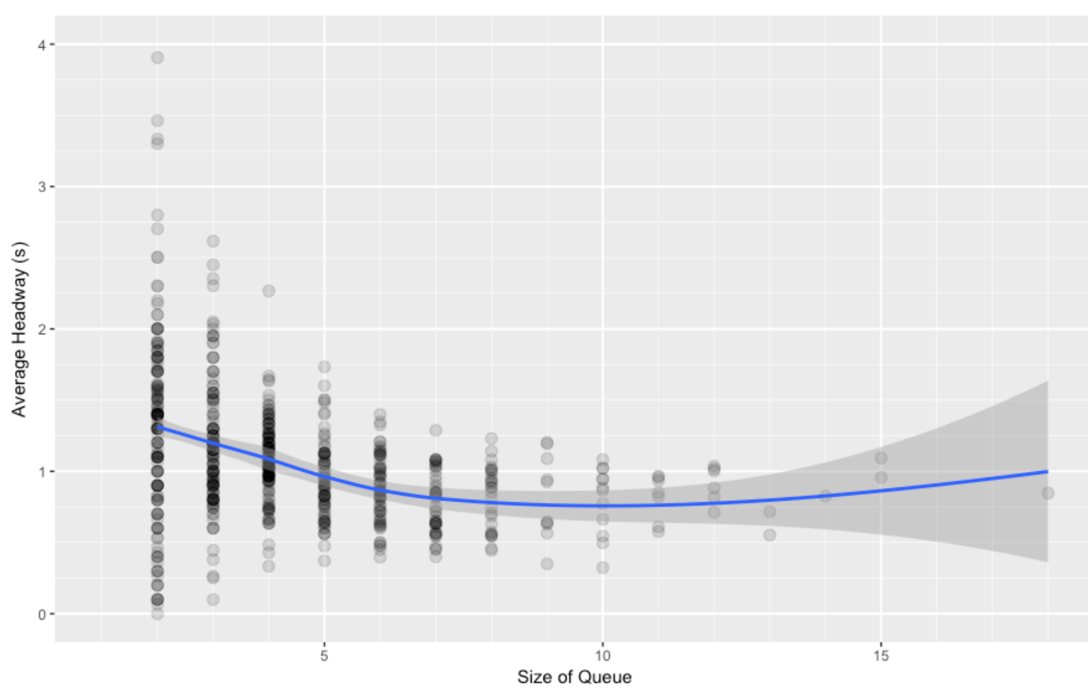

Figure 5-1 Average Headway for All Observed Queues

As queues increase in size from two to seven cyclists, the mean of the average headway within queues starts at approximately 1.3 seconds and approaches 0.8 seconds. The mean of the average headway for queues of more than seven cyclists remains stable until queues of 12 in size and starts to slightly increase toward approximately 1.0 seconds for queues larger than 12 cyclists.

The queue characteristics that were analyzed in detail with respect to queue size consist of bikeway approach width, intersection grade, and whether the bike box was utilized. The queue characteristics associated with the intersection crossing distance and the bikeway receiving width were not evaluated with respect to the average headway as the two characteristics are more related to activity that occurs throughout the intersection whereas average headway is specific to activity that occurs at the near side of the intersection.

5.1.1 Per Bikeway Approach Width

The average headway data based on the queue size and bikeway approach width are tabulated in Table 5 and displayed in Figure 5-2 as a scatterplot with smoothed lines showing the conditional means associated with the various facility widths. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 5: Average, Standard Deviation and Number of Observations of Average Headway based on Bikeway Approach Width

Queue Size	5' Wide			6' Wide			10' Wide			12' Wide			15' Wide			21' Wide		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	1.64	0.52	17	1.14	0.60	52	1.32	0.64	28	1.51	0.69	14	1.12	0.78	22	1.76	0.89	11
3	1.16	0.27	13	1.26	0.36	45	1.49	0.44	18	1.34	0.55	14	0.91	0.45	21	0.88	0.26	14
4	1.15	0.14	14	1.15	0.29	44	1.07	0.28	13	1.08	0.26	12	0.93	0.25	27	1.18	0.29	8
5	1.27	0.24	13	0.95	0.19	21	0.98	0.12	5	1.11	0.29	4	0.74	0.19	25	0.84	0.19	3
6	1.10	0.17	15	0.79	0.11	4	0.99	0.03	3	0.83	0.13	4	0.75	0.23	25	0.90	0.19	9
7	1.01	0.10	8	0.79	0.11	3	0.86	0.16	6	1.04	0.00	1	0.66	0.20	21	0.79	0.16	5
8	1.02	0.07	6	-	-	-	0.93	0.06	4	0.86	0.15	2	0.61	0.14	10	0.88	0.23	5
9	1.16	0.05	3	-	-	-	-	-	-	0.63	0.00	1	0.68	0.21	6	-	-	-
10	0.99	0.07	5	-	-	-	-	-	-	-	-	-	0.62	0.20	6	0.87	0.00	1
11	0.95	0.01	3	-	-	-	0.82	0.00	1	-	-	-	0.68	0.12	3	-	-	-
12	0.97	0.09	4	-	-	-	0.88	0.00	1	-	-	-	0.71	0.00	1	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	0.55	0.00	1	0.72	0.00	1
14	-	-	-	-	-	-	-	-	-	-	-	-	0.83	0.00	1	-	-	-
15	1.03	0.07	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	0.85	0.00	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	104	-	-	169	-	-	79	-	-	52	-	-	169	-	-	57

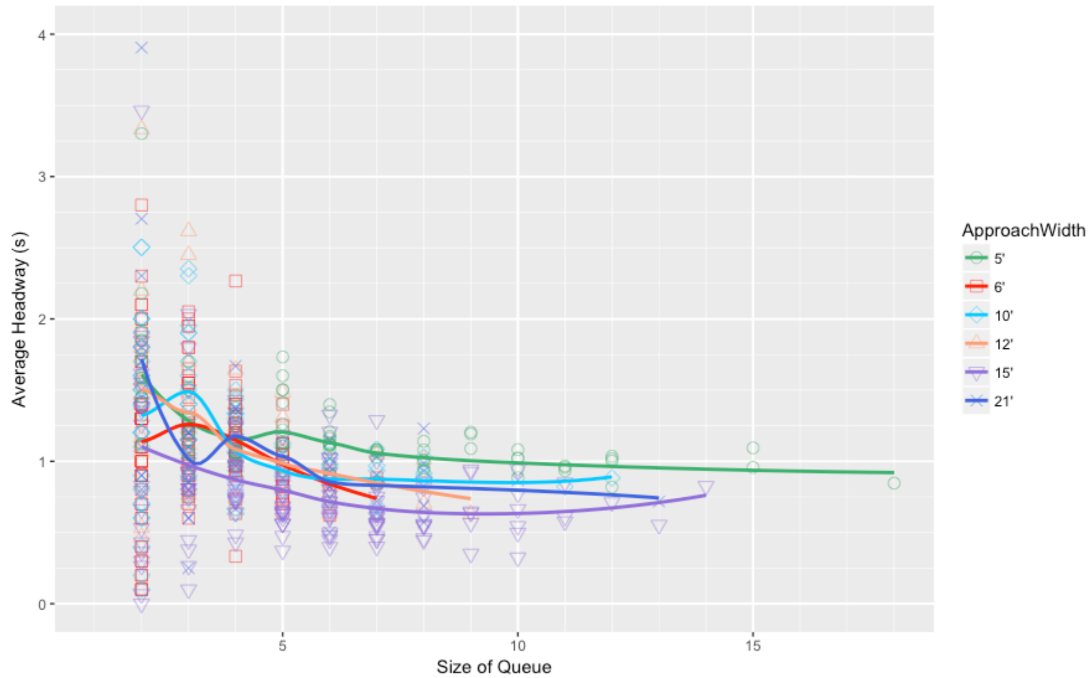

Figure 5-2 Average Headway based on Bikeway Approach Width

With the many overlapping trend lines, the results do not display an easily apparent relationship associated with the approach width of the facility.

However, there are notable differences amongst the approach widths. For example, the 5' trend line is consistently larger than the 15' trend line. The lower average headway associated with the 15' trend line is likely indicative of the time savings from installation of the bike box at the Madison Street approach. The difference in average headway between the two trends is approximately 0.5 seconds for queues of two cyclists and approximately 0.25 seconds for queues of 12 cyclists.

Similarly, given that the bike box at the Broadway approach was infrequently utilized, the queues that did not utilize any portion of the bike box were considered to have an approach width of 10 feet (7' bike lane + 3' buffer) rather than 21 feet that was available for queues that did utilize the bike box. However, the only apparent difference between the 10’ and 21’ trend lines is a time savings for queues of three cyclists if at least one of the users is located within the bike box area. Aside from that difference, the trend lines are relatively similar.

5.1.2 Per Approach Grade

The average headway data based on the queue size and approach grade of the bikeway are tabulated in Table 6 and displayed in Figure 5-3 as a scatterplot with smoothed lines showing the conditional means associated with the various grades. The lines were plotted using R and the “+ stat_smooth(se=F)” option within the ggplot2 package.

Table 6: Average, Standard Deviation and Number of Observations of Average Headway based on Approach Grade

Queue Size	-4%			+1%			+2%		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	1.46	0.73	53	1.14	0.60	52	1.35	0.73	39
3	1.26	0.50	46	1.26	0.36	45	1.01	0.41	34
4	1.10	0.28	33	1.15	0.29	44	1.01	0.24	41
5	0.99	0.23	12	0.95	0.19	21	0.92	0.33	38
6	0.90	0.17	16	0.79	0.11	4	0.88	0.27	40
7	0.84	0.17	12	0.79	0.11	3	0.76	0.24	29
8	0.89	0.18	11	-	-	-	0.77	0.23	16
9	0.63	0.00	1	-	-	-	0.84	0.28	9
10	0.87	0.00	1	-	-	-	0.79	0.24	11
11	0.82	0.00	1	-	-	-	0.82	0.16	6
12	0.88	0.00	1	-	-	-	0.92	0.13	5
13	0.72	0.00	1	-	-	-	0.55	0.00	1
14	-	-	-	-	-	-	0.83	0.00	1
15	-	-	-	-	-	-	1.03	0.07	2
16	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	0.85	0.00	1
Total	-	-	188	-	-	169	-	-	273

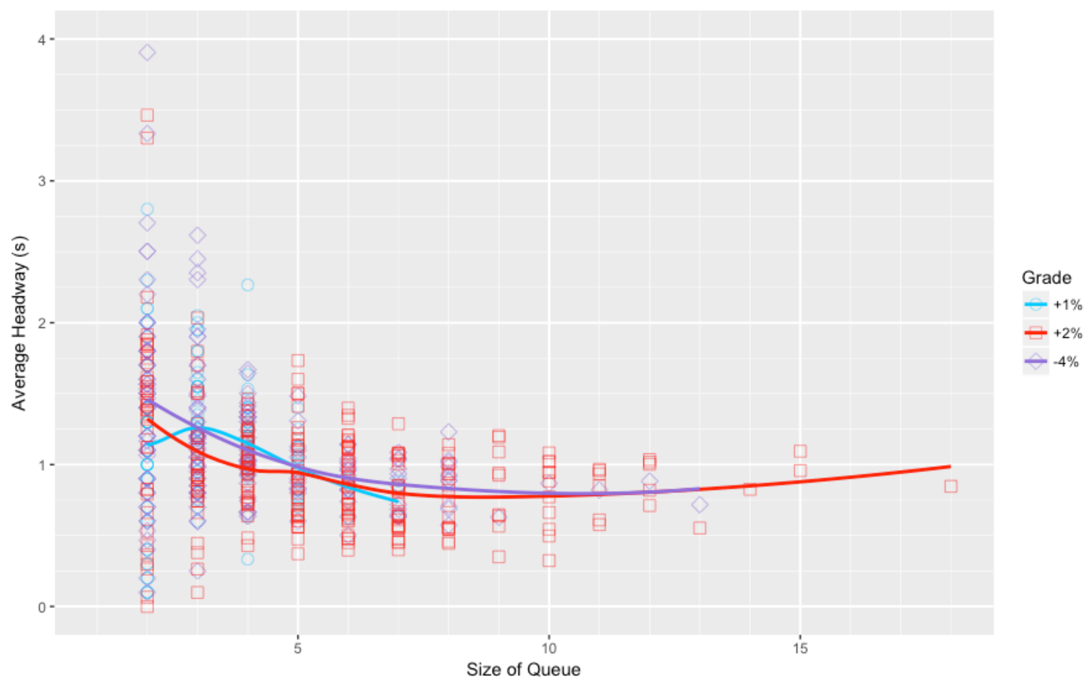

Figure 5-3 Average Headway based on Approach Grade

The results do not appear to indicate that the approach grade of the intersection has a significant relationship with the average headway as both downhill and uphill approaches experience similar average headway values.

5.1.3 Per Utilization of the Bike Box

The average headway data based on the queue size and utilization of the bike box at the intersection approach are tabulated in Table 7 and displayed in Figure 5-4 as a scatterplot with smoothed lines showing the conditional means and the 95 percent confidence interval as the shaded area. The lines were plotted using R and the “+ stat_smooth(se=T)” option within the ggplot2 package.

Table 7: Average, Standard Deviation and Number of Observations of Average Headway based on Utilization of Bike Box

Queue Size	Bike Box Utilized			Bike Box Not Utilized		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	1.33	0.87	33	1.31	0.64	111
3	0.90	0.39	35	1.31	0.41	90
4	0.99	0.28	35	1.13	0.26	83
5	0.75	0.20	28	1.07	0.26	43
6	0.79	0.23	34	1.00	0.19	26
7	0.69	0.20	26	0.93	0.15	18
8	0.70	0.21	15	0.96	0.11	12
9	0.68	0.21	6	1.03	0.24	4
10	0.66	0.20	7	0.99	0.07	5
11	0.68	0.12	3	0.92	0.06	4
12	0.71	0.00	1	0.95	0.09	5
13	0.64	0.08	2	-	-	-
14	0.83	0.00	1	-	-	-
15	-	-	-	1.03	0.07	2
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18	-	-	-	0.85	0.00	1
Total	-	-	226	-	-	404

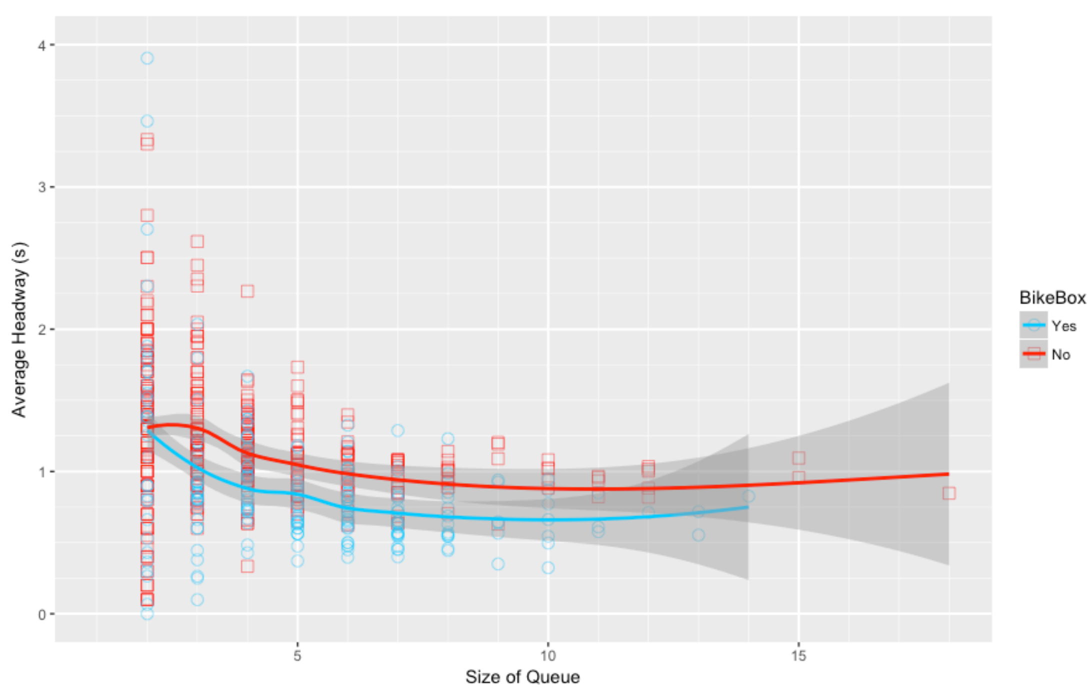

Figure 5-4 Average Headway based on Utilization of Bike Box

The results appear to indicate that utilization of the bike box has a potential relationship with a reduced average headway as compared to queues that do not utilize the bike box. The associated reduction in average headway is approximately 0.2 to 0.3 seconds per cyclist for queues of three or more cyclists in size.

5.1.4 Findings

For all observations, the lowest mean of the average headway within queues is approximately 0.8 seconds per cyclist and occurs for groups of seven cyclists. For queues larger than seven in size, the mean of the average headway remains stable until queues of 12 in size and starts to slightly increase toward approximately 1.0 seconds for queues larger than 12 cyclists.

Regarding the mean of the average headway based on approach width, the direct 'before and after' comparison of the bike box study location appeared to demonstrate a potential reduction of average headway associated with the installation of the bike box. The remaining study approaches did not appear to demonstrate any significant trends.

Regarding the mean of the average headway based on utilization of a bike box, it appears that utilization of a bike box has a potential relationship with a reduced average headway as compared to queues that do not utilize the bike box. The associated reduction in average headway was approximately 0.2 to 0.3 seconds per cyclist for queues of three or more cyclists in size.

Regarding the mean of the average headway based on approach grade, there was no apparent relationship observed from the analysis.

5.2 Queue Discharge Rates

This section presents detailed analysis of the queue discharge rates for queues of cyclists based on their respective size. All observed queues are tabulated in Table 8 and displayed in Figure 5-5 as a scatterplot with a smoothed line showing the mean and the 95 percent confidence interval as the shaded area. This line was plotted using R and the "+ stat_smooth(se=T)" option within the ggplot2 package.

Table 8: Average, Standard Deviation and Number of Observations of Queue Discharge

Queue Size	All Observations		
	Avg (sec)	Std Dev (sec)	n
2	4.30	1.04	144
3	5.32	1.12	125
4	6.02	1.08	118
5	6.53	1.41	71
6	6.89	1.42	60
7	7.52	1.73	44
8	8.27	1.76	27
9	9.27	2.26	10
10	9.50	2.23	12
11	10.85	1.97	7
12	12.86	1.40	6
Total	-	-	630

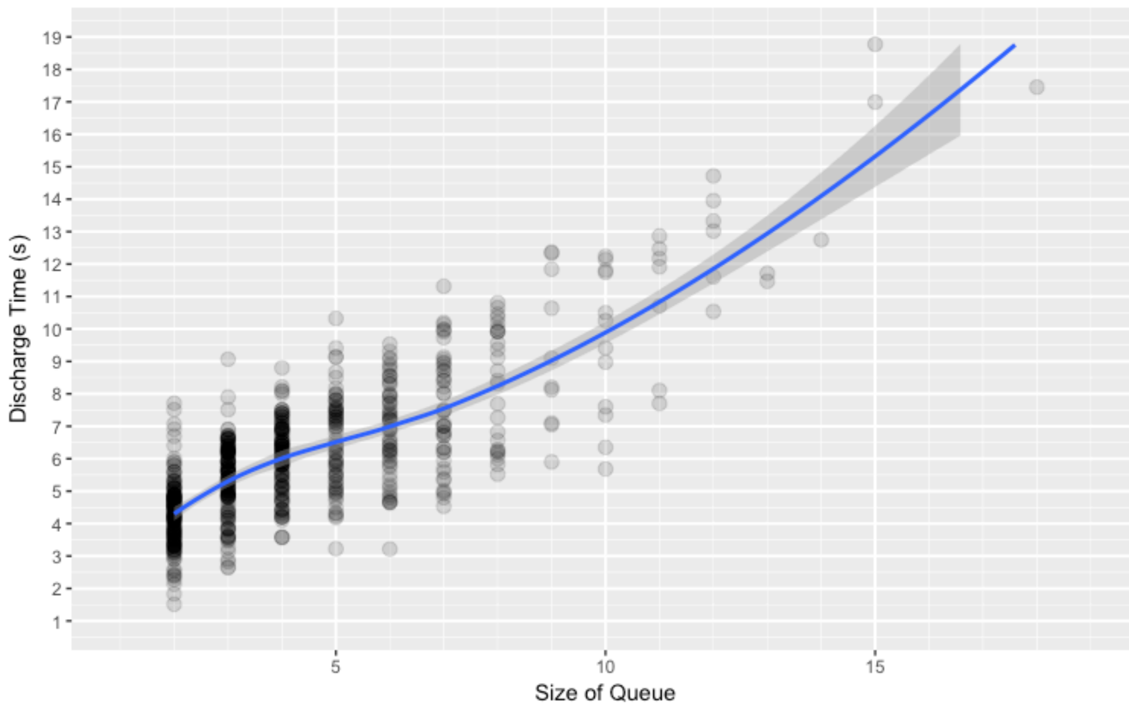

Figure 5-5 Queue Discharge Time for All Observed Queues

The queue characteristics that were analyzed in detail with respect to queue size consist of bikeway approach width, bikeway receiving width, bikeway crossing distance, intersection grade, and whether a bike box was utilized.

5.2.1 Per Bikeway Approach Width

The queue discharge times based on the queue size and bikeway approach width are tabulated in Table 9 and displayed in Figure 5-6 as a scatterplot with smoothed lines showing the conditional means associated with the various facility widths. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 9: Average, Standard Deviation and Number of Observations of Queue Discharge based on Bikeway Approach Width

Queue Size	5' Wide			6' Wide			10' Wide			12' Wide			15' Wide			21' Wide		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	4.31	0.74	17	4.46	0.83	52	4.57	1.16	28	4.58	0.96	14	3.14	0.78	22	4.76	1.02	11
3	5.75	0.55	13	5.68	0.74	45	5.77	0.80	18	5.48	1.44	14	4.08	1.12	21	4.91	1.01	14
4	6.45	0.62	14	6.53	0.79	44	6.43	0.74	13	6.09	1.02	12	4.78	0.76	27	5.85	1.21	8
5	7.82	1.01	13	7.04	0.67	21	7.39	1.24	5	7.02	1.63	4	5.22	0.87	25	6.11	1.43	3
6	7.97	0.96	15	7.80	0.37	4	8.58	0.90	3	7.08	1.38	4	5.78	1.10	25	7.12	0.77	9
7	9.09	0.49	8	8.80	1.10	3	8.74	1.43	6	9.97	0.00	1	6.27	1.37	21	7.55	0.76	5
8	10.19	0.36	6	-	-	-	9.41	0.52	4	8.32	1.05	2	6.54	0.82	10	8.49	1.74	5
9	12.18	0.24	3	-	-	-	-	-	-	7.10	0.00	1	8.17	1.49	6	-	-	-
10	11.64	0.72	5	-	-	-	-	-	-	-	-	-	7.74	1.61	6	9.41	0.00	1
11	12.50	0.28	3	-	-	-	11.92	0.00	1	-	-	-	8.84	1.33	3	-	-	-
12	13.40	1.15	4	-	-	-	13.02	0.00	1	-	-	-	10.54	0.00	1	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	11.47	0.00	1	11.72	0.00	1
14	-	-	-	-	-	-	-	-	-	-	-	-	12.75	0.00	1	-	-	-
15	17.88	0.89	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	17.45	0.00	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	104	-	-	169	-	-	79	-	-	52	-	-	169	-	-	57

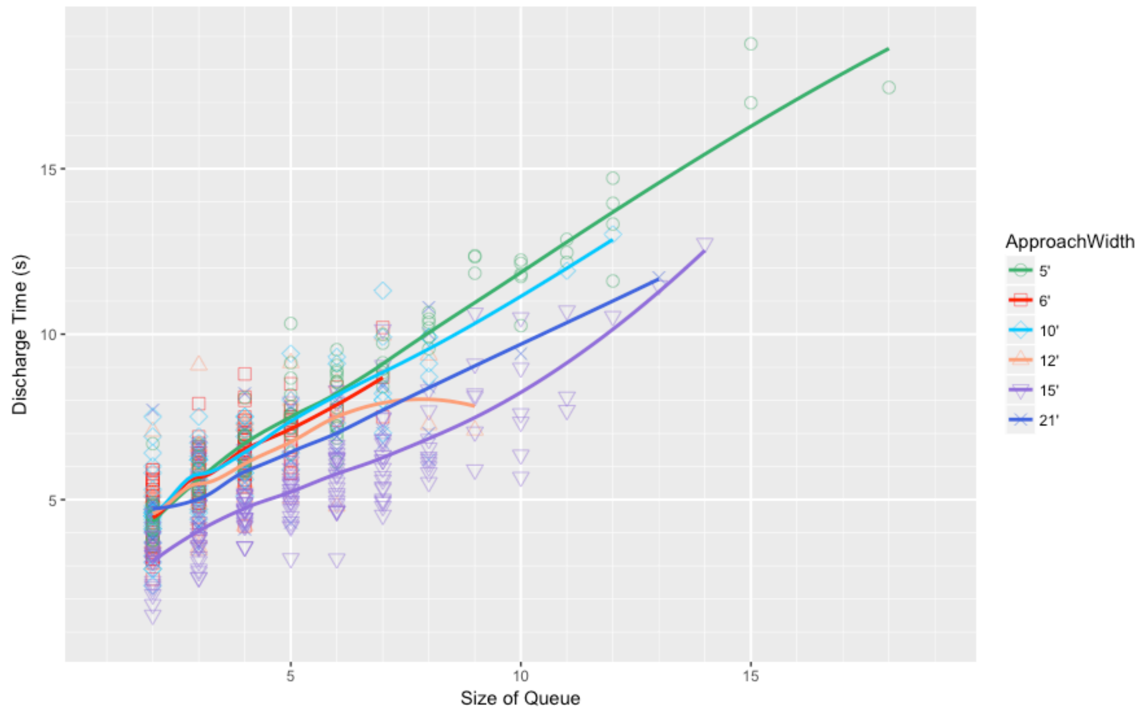

Figure 5-6 Queue Discharge Time based on Bikeway Approach Width

The results appear to indicate that, in general, wider bike facilities approaching an intersection discharge queues of bicyclists into the intersection over a shorter amount of time as compared to narrower approaches.

The installation of the bike box along the Madison approach, which increased the approach width from five to 15 feet, resulted in consistently lower average discharge times for all queue sizes, a reduction of greater than one second for queues of two cyclists to as much as about four seconds for queues of nine cyclists.

Similarly, given that the bike box at the Broadway approach was infrequently utilized, the queues that did not utilize any portion of the bike box were considered to have an approach width of 10 feet (7' bike lane + 3' buffer) rather than 21 feet that was available for queues that did utilize the bike box. It appears that the queues experienced a reduced discharge time when the area of the bike box was utilized, a reduction of as much as approximately two seconds for queues of 10 cyclists.

5.2.2 Per Bikeway Receiving Width

The queue discharge times based on the queue size and bikeway receiving width are tabulated in Table 10 and displayed in Figure 5-7 as a scatterplot with smoothed lines showing the conditional means associated with the various facility widths. The lines were plotted using R and the “+ stat_smooth(se=F)” option within the ggplot2 package.

Table 10: Average, Standard Deviation and Number of Observations of Queue Discharge based on Bikeway Receiving Width

Queue Size	6’ Wide			6.5’ Wide			10’ Wide		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	4.46	0.83	52	4.58	0.96	14	4.14	1.16	78
3	5.68	0.74	45	5.48	1.44	14	5.05	1.18	66
4	6.53	0.79	44	6.09	1.02	12	5.64	1.12	62
5	7.04	0.67	21	7.02	1.63	4	6.25	1.55	46
6	7.80	0.37	4	7.08	1.38	4	6.81	1.44	52
7	8.80	1.10	3	9.97	0.00	1	7.37	1.71	40
8	-	-	-	8.32	1.05	2	8.27	1.80	25
9	-	-	-	7.10	0.00	1	9.51	2.26	9
10	-	-	-	-	-	-	9.50	2.23	12
11	-	-	-	-	-	-	10.85	1.97	7
12	-	-	-	-	-	-	12.86	1.40	6
13	-	-	-	-	-	-	11.59	0.12	2
14	-	-	-	-	-	-	12.75	0.00	1
15	-	-	-	-	-	-	17.88	0.89	2
16	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	17.45	0.00	1
Total	-	-	169	-	-	52	-	-	409

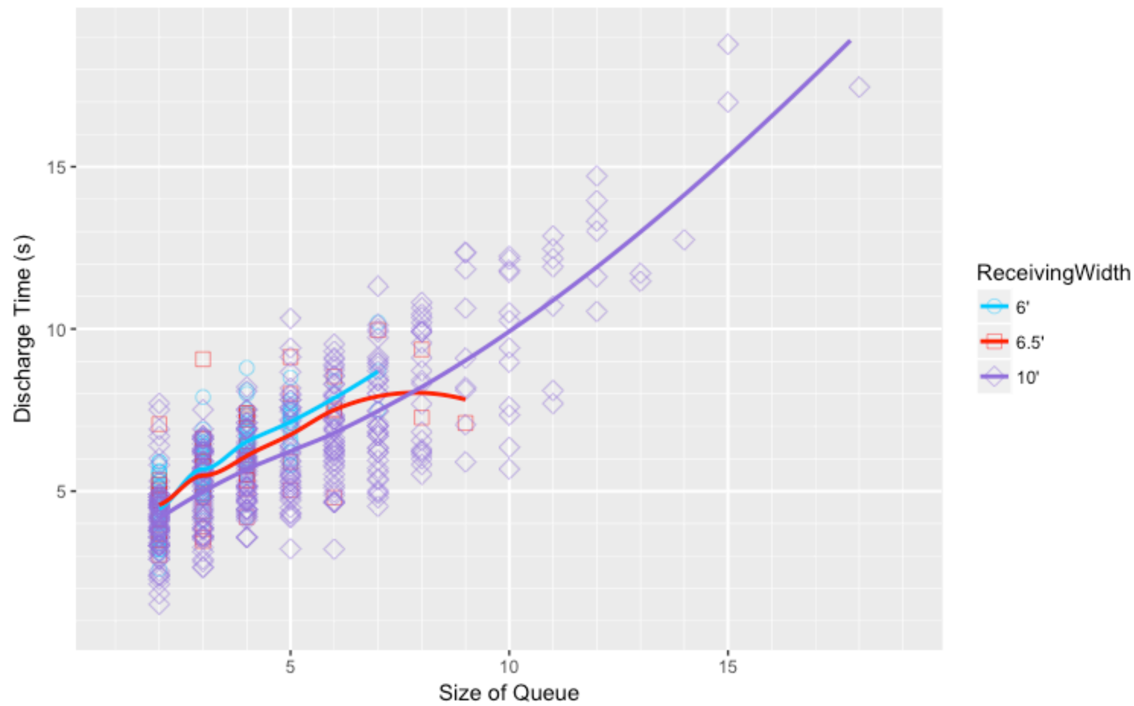

Figure 5-7 Queue Discharge Time based on Bikeway Receiving Width

The results appear to indicate that wider receiving bike facilities generally discharge queues of bicyclists into the intersection over a shorter amount of time as compared to narrower receiving facilities.

5.2.3 Per Crossing Distance

The queue discharge times based on the queue size and bikeway crossing distance are tabulated in Table 11 and displayed in Figure 5-8 as a scatterplot with smoothed lines showing the conditional means associated with the various facility distances. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 11: Average, Standard Deviation and Number of Observations of Queue Discharge based on Crossing Distance

Queue Size	46’			54’			56’			60’		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	4.63	1.13	39	3.65	0.96	39	4.58	0.96	14	4.46	0.83	52
3	5.39	0.99	32	4.72	1.24	34	5.48	1.44	14	5.68	0.74	45
4	6.21	0.99	21	5.35	1.07	41	6.09	1.02	12	6.53	0.79	44
5	6.91	1.45	8	6.11	1.54	38	7.02	1.63	4	7.04	0.67	21
6	7.48	1.02	12	6.60	1.49	40	7.08	1.38	4	7.80	0.37	4
7	8.20	1.32	11	7.05	1.73	29	9.97	0.00	1	8.80	1.10	3
8	8.90	1.42	9	7.91	1.90	16	8.32	1.05	2	-	-	-
9	-	-	-	9.51	2.26	9	7.10	0.00	1	-	-	-
10	9.41	0.00	1	9.51	2.32	11	-	-	-	-	-	-
11	11.92	0.00	1	10.67	2.07	6	-	-	-	-	-	-
12	13.02	0.00	1	12.83	1.54	5	-	-	-	-	-	-
13	11.72	0.00	1	11.47	0.00	1	-	-	-	-	-	-
14	-	-	-	12.75	0.00	1	-	-	-	-	-	-
15	-	-	-	17.88	0.89	2	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	17.45	0.00	1	-	-	-	-	-	-
Total	-	-	136	-	-	273	-	-	52	-	-	169

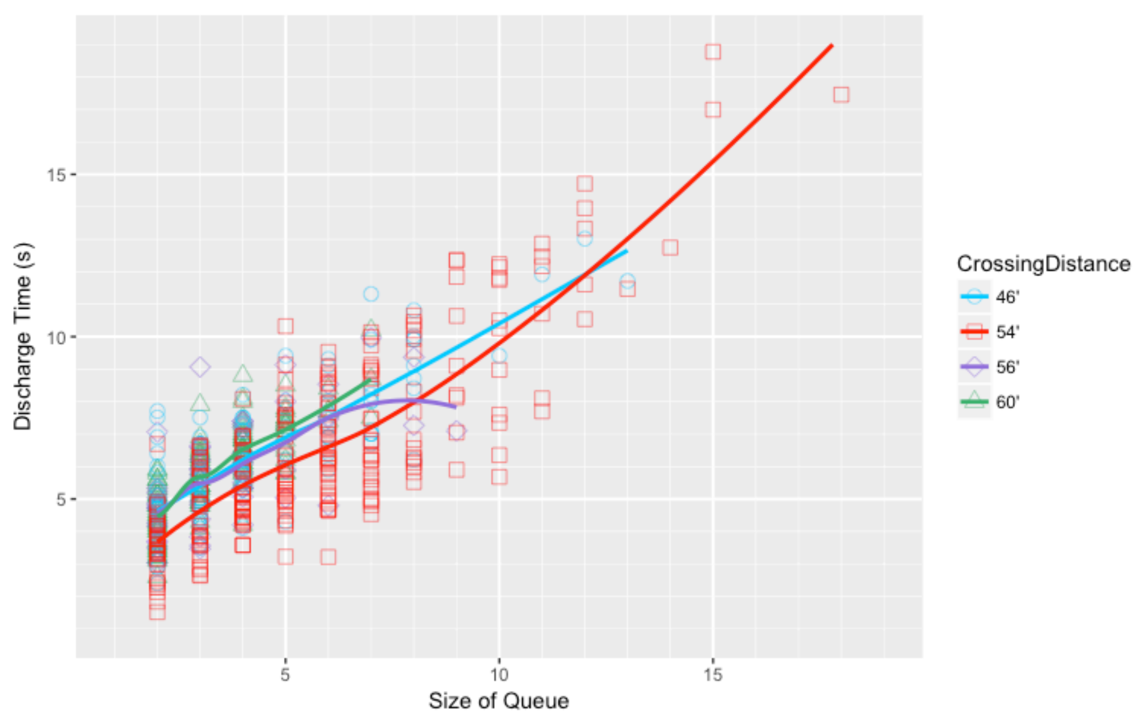

Figure 5-8 Queue Discharge Time based on Bikeway Crossing Distance

The results do not appear to indicate a relationship between crossing distance and queue discharge rates, given the largest crossing distance experiences a similar discharge rate as the shortest crossing distance.

5.2.4 Per Approach Grade

The queue discharge times based on the queue size and approach grade of the bikeway are tabulated in Table 12 and displayed in Figure 5-9 as a scatterplot with smoothed lines showing the conditional means associated with the various grades. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 12: Average, Standard Deviation and Number of Observations of Queue Discharge based on Approach Grade

Queue Size	-4%			+1%			+2%		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	4.61	1.09	53	4.46	0.83	52	3.65	0.96	39
3	5.42	1.15	46	5.68	0.74	45	4.72	1.24	34
4	6.16	1.00	33	6.53	0.79	44	5.35	1.07	41
5	6.95	1.52	12	7.04	0.67	21	6.11	1.54	38
6	7.38	1.14	16	7.80	0.37	4	6.60	1.49	40
7	8.35	1.35	12	8.80	1.10	3	7.05	1.73	29
8	8.79	1.38	11	-	-	-	7.91	1.90	16
9	7.10	0.00	1	-	-	-	9.51	2.26	9
10	9.41	0.00	1	-	-	-	9.51	2.32	11
11	11.92	0.00	1	-	-	-	10.67	2.07	6
12	13.02	0.00	1	-	-	-	12.83	1.54	5
13	11.72	0.00	1	-	-	-	11.47	0.00	1
14	-	-	-	-	-	-	12.75	0.00	1
15	-	-	-	-	-	-	17.88	0.89	2
16	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	17.45	0.00	1
Total	-	-	188	-	-	169	-	-	273

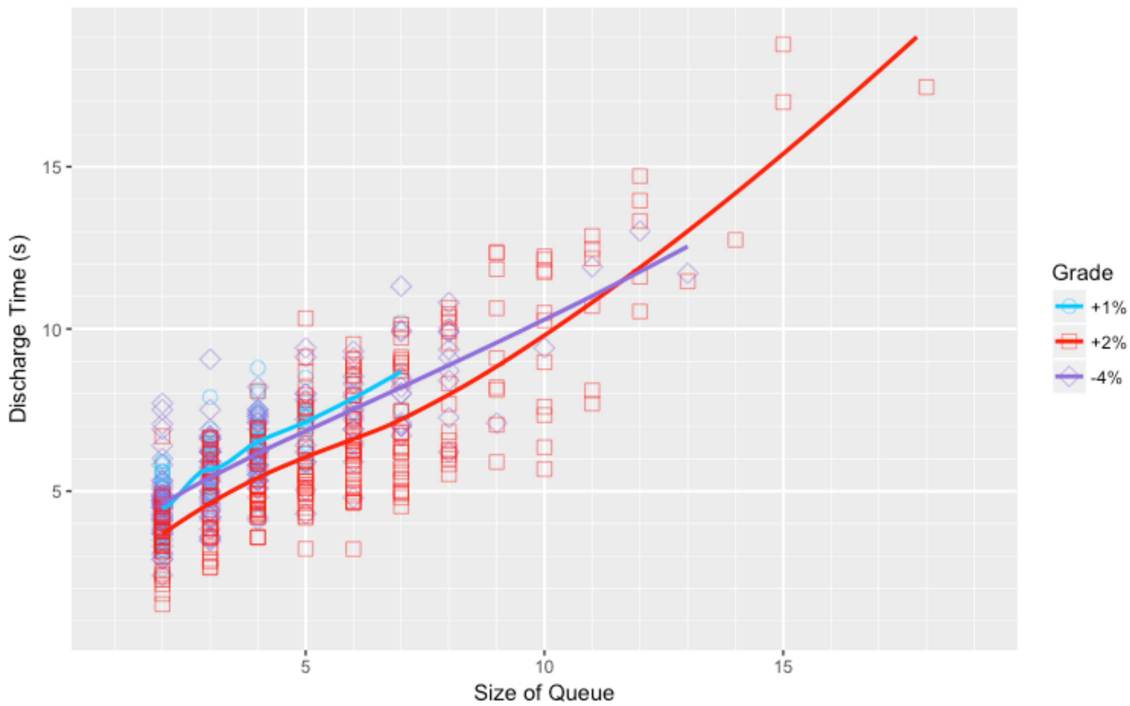

Figure 5-9 Queue Discharge Time based on Approach Grade

The results display very similar discharge rates for the +1% approach grade and the -4% approach grade, whereas the +2% approach grades consistently had lower discharge rates for queues of 10 or fewer cyclists. Therefore, there is no apparent relationship between queue discharge rates and uphill or downhill approaches.

5.2.5 Per Utilization of the Bike Box

The queue discharge times based on the queue size and utilization of the bike box at the intersection approach are tabulated in Table 13 and displayed in Figure 5-10 as a scatterplot with smoothed lines showing the conditional means and the 95 percent confidence interval as the shaded area. The lines were plotted using R and the "+ stat_smooth(se=T)" option within the ggplot2 package.

Table 13: Average, Standard Deviation and Number of Observations of Queue Discharge based on Utilization of Bike Box

Queue Size	Bike Box Utilized			Bike Box Not Utilized		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	3.68	1.16	33	4.48	0.93	111
3	4.41	1.15	35	5.68	0.88	90
4	5.02	0.99	35	6.43	0.81	83
5	5.32	0.99	28	7.31	1.04	43
6	6.14	1.18	34	7.88	1.05	26
7	6.52	1.37	26	8.98	1.04	18
8	7.19	1.52	15	9.62	0.89	12
9	8.17	1.49	6	10.91	2.21	4
10	7.98	1.60	7	11.64	0.72	5
11	8.84	1.33	3	12.36	0.35	4
12	10.54	0.00	1	13.32	1.04	5
13	11.59	0.12	2	-	-	-
14	12.75	0.00	1	-	-	-
15	-	-	-	17.88	0.89	2
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18	-	-	-	17.45	0.00	1
Total	-	-	226	-	-	404

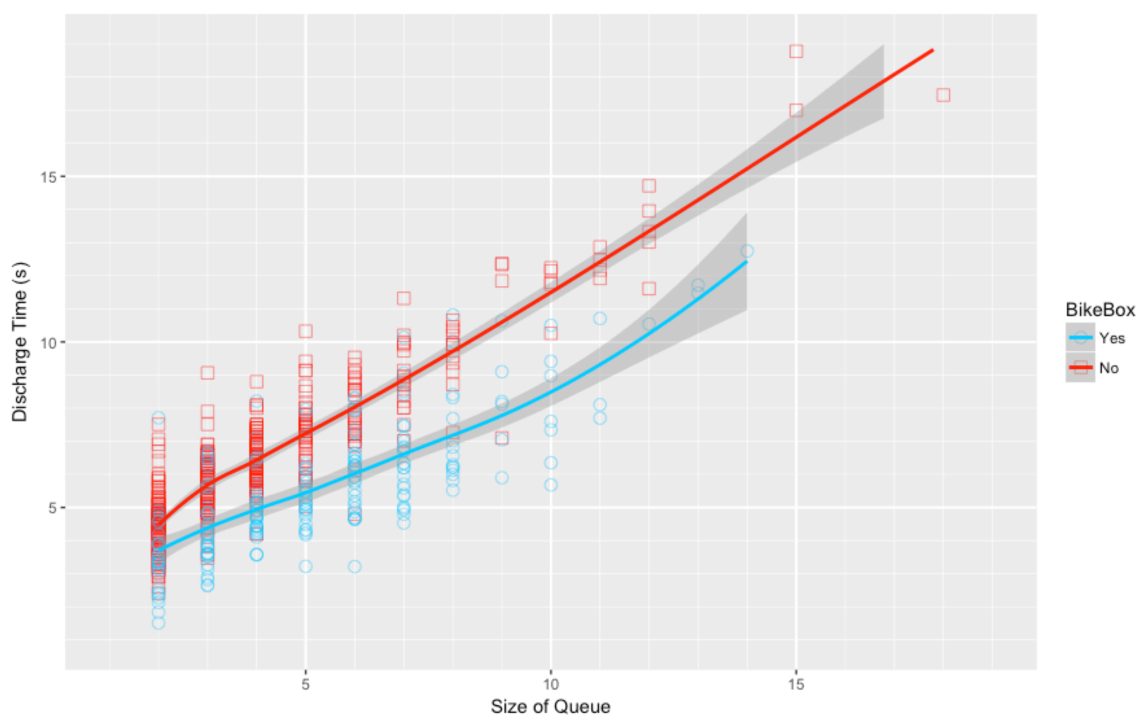

Figure 5-10 Queue Discharge Time based on Utilization of the Bike Box

The results appear to indicate that utilization of the bike box has a potential relationship with a reduced queue discharge time as compared to queues that do not utilize the bike box. The associated reduction in queue discharge time is greatest for queues of nine cyclists with a reduction of approximately three seconds.

5.2.6 Findings

The queue discharge results appear to potentially indicate that wider bike facilities approaching an intersection, wider receiving bike facilities, or utilization of a bike box generally discharge queues of bicyclists into the intersection over a shorter amount of time as compared to narrower features or underutilized facilities.

The installation of the bike box along the Madison approach, which increased the approach width from five to 15 feet, resulted in consistently lower average discharge times for all queue sizes, a reduction of greater than one second for queues of two cyclists to as much as about four seconds for queues of nine cyclists.

5.3 Intersection Clearance Times

This section presents detailed analysis of the intersection clearance times for queues of cyclists based on their respective size. All observed queues are tabulated in Table 14 and displayed in Figure 5-11 as a scatterplot with a smoothed line showing the mean and the 95 percent confidence interval as the shaded area. This line was plotted using R and the "+ stat_smooth(se=T)" option within the ggplot2 package.

Table 14: Average, Standard Deviation and Number of Observations of Intersection Clearance Time

Queue Size	All Observations		
	Avg (sec)	Std Dev (sec)	n
2	8.63	1.26	144
3	9.62	1.31	125
4	10.12	1.14	118
5	10.65	1.37	71
6	10.73	1.41	60
7	11.31	1.48	44
8	11.85	1.53	27
9	12.77	1.99	10
10	13.11	1.81	12
11	14.26	1.73	7
12	16.04	1.47	6
13	14.75	0.23	2
14	16.26	0.00	1
15	21.02	1.02	2
16	-	-	-
17	-	-	-
18	20.33	0.00	1
Total	-	-	630

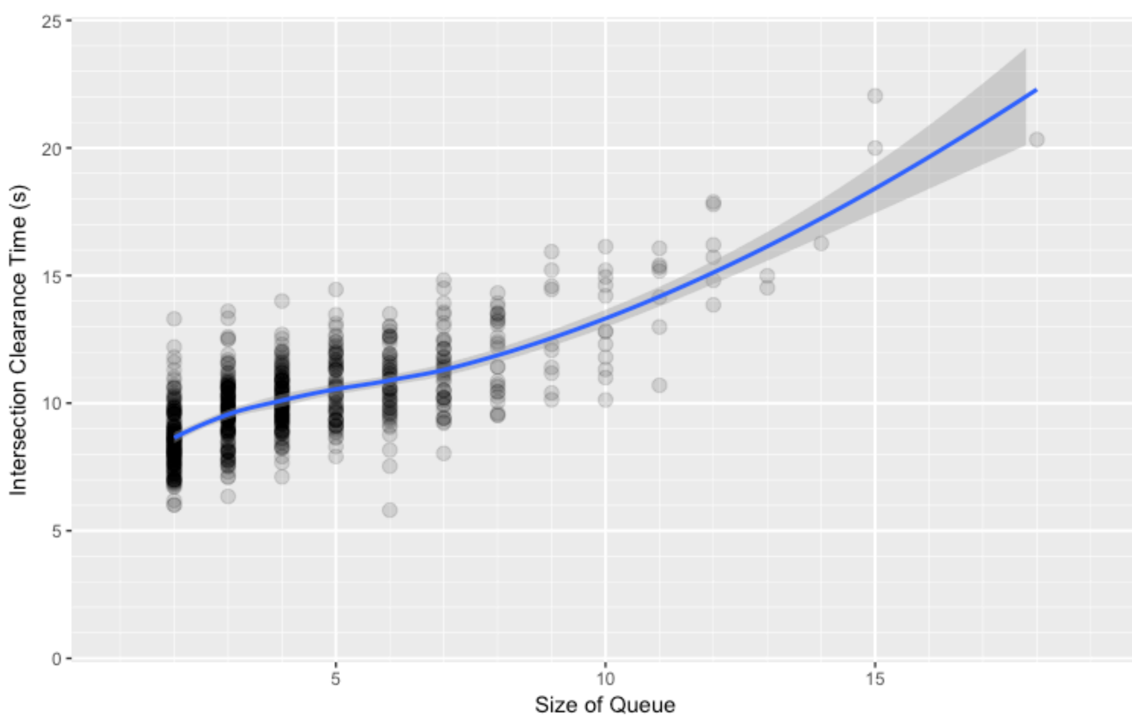

Figure 5-11 Intersection Clearance Time for All Observed Queues

The queue characteristics that were analyzed in detail with respect to queue size consist of bikeway approach width, bikeway receiving width, bikeway crossing distance, intersection grade, and whether a bike box was utilized.

5.3.1 Per Bikeway Approach Width

The intersection clearance times based on the queue size and bikeway approach width are tabulated in Table 15 and displayed in Figure 5-12 as a scatterplot with smoothed lines showing the conditional means associated with the various facility widths. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 15: Average, Standard Deviation and Number of Observations of Intersection Clearance Time based on Bikeway Approach Width

Queue Size	5' Wide			6' Wide			10' Wide			12' Wide			15' Wide			21' Wide		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	8.30	0.83	17	9.38	1.17	52	8.24	1.18	28	8.79	1.33	14	7.69	0.80	22	8.25	1.09	11
3	9.61	0.68	13	10.33	0.98	45	9.35	1.12	18	9.68	1.37	14	8.90	1.62	21	8.70	0.95	14
4	10.10	0.68	14	10.85	0.94	44	9.73	0.68	13	9.99	0.90	12	9.44	1.11	27	9.21	1.37	8
5	11.42	1.23	13	11.44	0.67	21	10.63	1.51	5	10.93	1.99	4	9.71	0.98	25	9.38	1.23	3
6	11.42	0.98	15	12.73	0.59	4	11.75	0.95	3	11.58	0.44	4	10.00	1.07	25	9.99	1.63	9
7	12.29	0.67	8	13.10	1.10	3	11.83	1.57	6	13.57	0.00	1	10.57	1.23	21	10.71	1.02	5
8	13.43	0.59	6	-	-	-	12.57	0.77	4	12.03	1.17	2	10.64	0.95	10	11.70	1.77	5
9	15.24	0.55	3	-	-	-	-	-	-	10.13	0.00	1	11.97	1.27	6	-	-	-
10	14.74	1.09	5	-	-	-	-	-	-	-	-	-	11.79	1.27	6	12.82	0.00	1
11	15.55	0.38	3	-	-	-	15.32	0.00	1	-	-	-	12.61	1.43	3	-	-	-
12	16.67	1.26	4	-	-	-	15.72	0.00	1	-	-	-	13.85	0.00	1	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	14.99	0.00	1	14.52	0.00	1
14	-	-	-	-	-	-	-	-	-	-	-	-	16.26	0.00	1	-	-	-
15	21.02	1.02	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	20.33	0.00	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	104	-	-	169	-	-	79	-	-	52	-	-	169	-	-	57

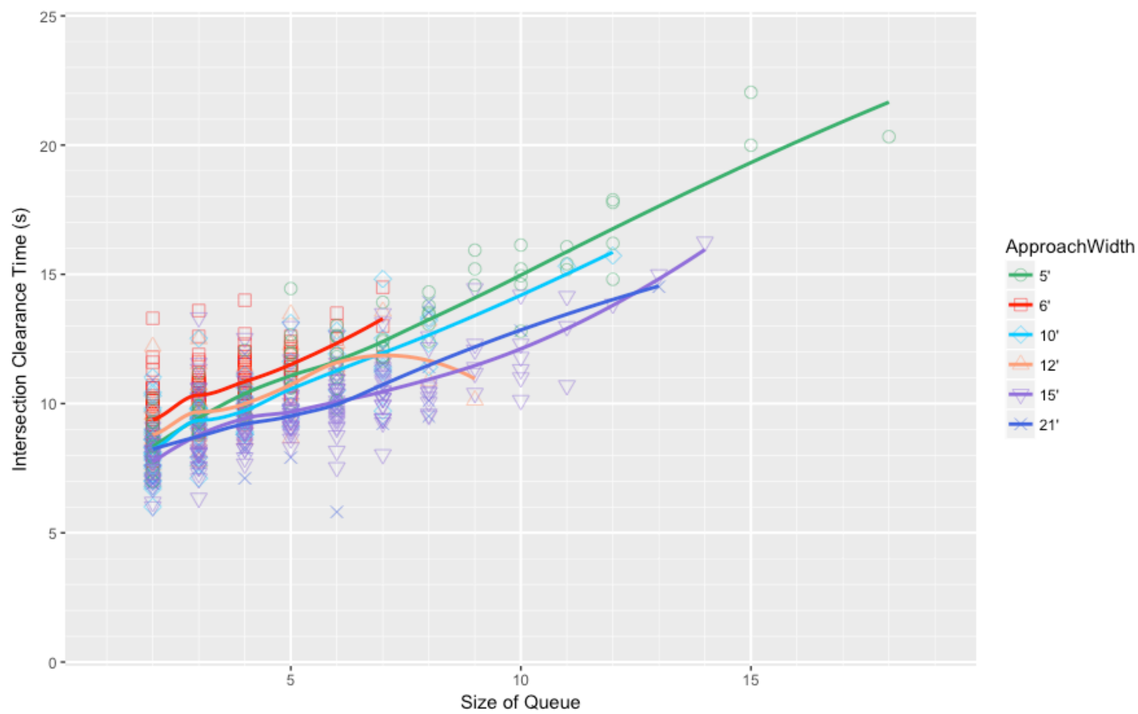

Figure 5-12 Intersection Clearance Time based on Bikeway Approach Width

The results appear to indicate that, in general, wider bike facilities approaching an intersection clear queues of bicyclists through the intersection over a shorter amount of time as compared to narrower approaches.

The installation of the bike box along the Madison approach, which increased the approach width from five to 15 feet, resulted in consistently lower clearance times for all queue sizes. For example, the reduction for queues of 10 cyclists was approximately three seconds.

Similarly, given that the bike box at the Broadway approach was infrequently utilized, the queues that did not utilize any portion of the bike box were considered to have an approach width of 10 feet (7' bike lane + 3' buffer) rather than 21 feet that was available for queues that did utilize the bike box. It appears that the queues experience a reduced clearance time when the area of the bike box was utilized, a reduction of as much as approximately two seconds for queues of 12 cyclists.

5.3.2 Per Bikeway Receiving Width

The intersection clearance times based on the queue size and bikeway receiving width are tabulated in Table 16 and displayed in Figure 5-13 as a scatterplot with smoothed lines showing the conditional means associated with the various facility widths. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 16: Average, Standard Deviation and Number of Observations of Intersection Clearance Time based on Bikeway Receiving Width

Queue Size	6' Wide			6.5' Wide			10' Wide		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	9.38	1.17	52	8.79	1.33	14	8.10	1.03	78
3	10.33	0.98	45	9.68	1.37	14	9.12	1.26	66
4	10.85	0.94	44	9.99	0.90	12	9.62	1.04	62
5	11.44	0.67	21	10.93	1.99	4	10.27	1.38	46
6	12.73	0.59	4	11.58	0.44	4	10.51	1.36	52
7	13.10	1.10	3	13.57	0.00	1	11.12	1.38	40
8	-	-	-	12.03	1.17	2	11.83	1.56	25
9	-	-	-	10.13	0.00	1	13.06	1.89	9
10	-	-	-	-	-	-	13.11	1.81	12
11	-	-	-	-	-	-	14.26	1.73	7
12	-	-	-	-	-	-	16.04	1.47	6
13	-	-	-	-	-	-	14.75	0.23	2
14	-	-	-	-	-	-	16.26	0.00	1
15	-	-	-	-	-	-	21.02	1.02	2
16	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	20.33	0.00	1
Total	-	-	169	-	-	52	-	-	409

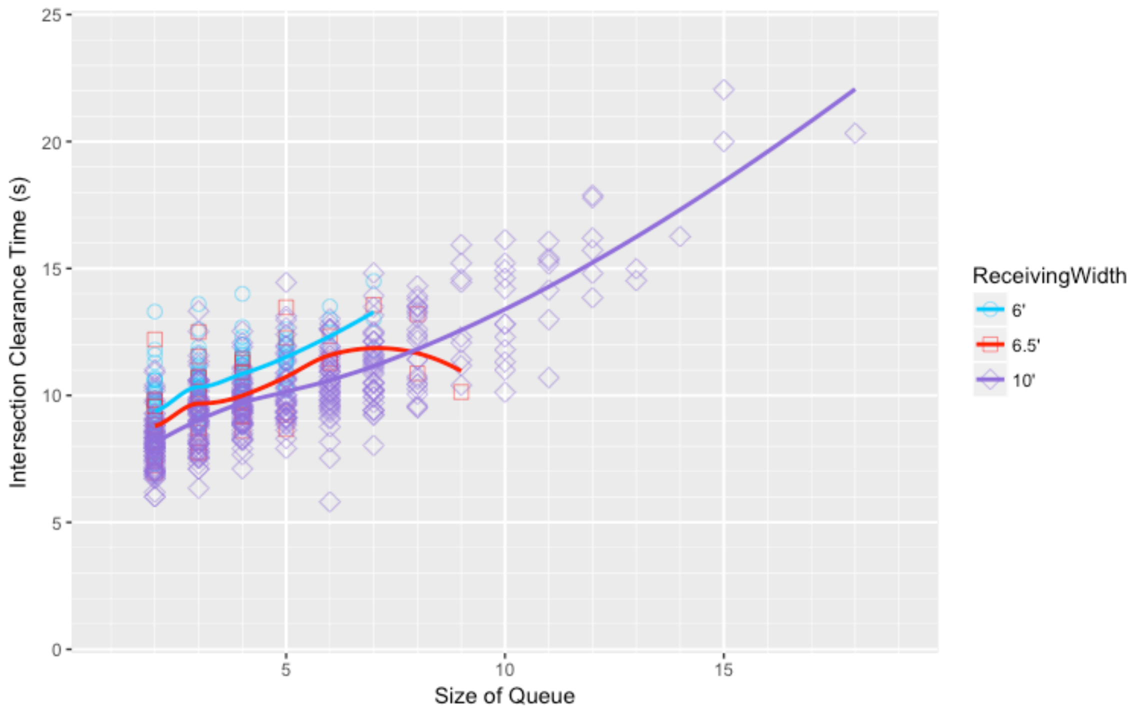

Figure 5-13 Intersection Clearance Time based on Bikeway Receiving Width

The results appear to indicate that wider receiving bike facilities generally clear queues of bicyclists through the intersection over a shorter amount of time as compared to narrower receiving facilities.

5.3.3 Per Crossing Distance

The intersection clearance times based on the queue size and bikeway crossing distance are tabulated in Table 17 and displayed in Figure 5-14 as a scatterplot with smoothed lines showing the conditional means associated with the various facility distances. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 17: Average, Standard Deviation and Number of Observations of Intersection Clearance Time based on Crossing Distance

Queue Size	46’			54’			56’			60’		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	8.24	1.16	39	7.96	0.87	39	8.79	1.33	14	9.38	1.17	52
3	9.07	1.10	32	9.17	1.38	34	9.68	1.37	14	10.33	0.98	45
4	9.53	1.03	21	9.66	1.03	41	9.99	0.90	12	10.85	0.94	44
5	10.16	1.54	8	10.30	1.34	38	10.93	1.99	4	11.44	0.67	21
6	10.43	1.67	12	10.53	1.24	40	11.58	0.44	4	12.73	0.59	4
7	11.32	1.45	11	11.04	1.34	29	13.57	0.00	1	13.10	1.10	3
8	12.08	1.48	9	11.69	1.58	16	12.03	1.17	2	-	-	-
9	-	-	-	13.06	1.89	9	10.13	0.00	1	-	-	-
10	12.82	0.00	1	13.13	1.89	11	-	-	-	-	-	-
11	15.32	0.00	1	14.08	1.80	6	-	-	-	-	-	-
12	15.72	0.00	1	16.11	1.60	5	-	-	-	-	-	-
13	14.52	0.00	1	14.99	0.00	1	-	-	-	-	-	-
14	-	-	-	16.26	0.00	1	-	-	-	-	-	-
15	-	-	-	21.02	1.02	2	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	20.33	0.00	1	-	-	-	-	-	-
Total	-	-	136	-	-	273	-	-	52	-	-	169

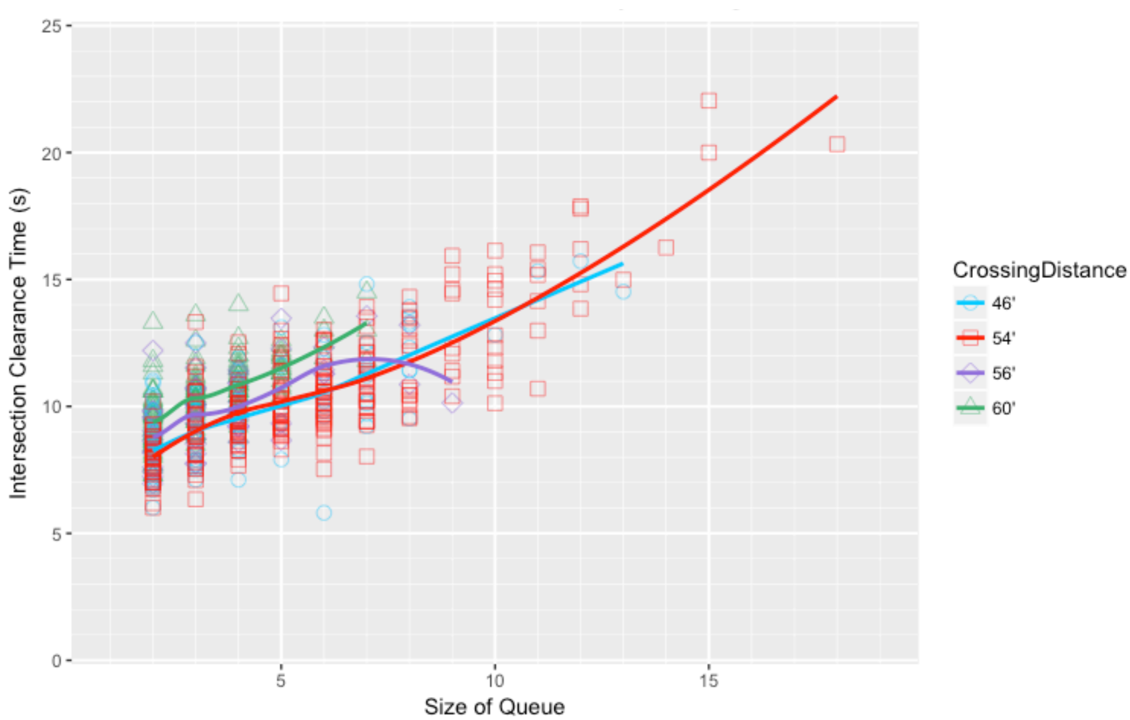

Figure 5-14 Intersection Clearance Time based on Bikeway Crossing Distance

The results do not appear to indicate a significant relationship between crossing distance and intersection clearance times, given the relative similarities in clearance times as compared to the differences in crossing widths.

5.3.4 Per Approach Grade

The intersection clearance times based on the queue size and approach grade of the bikeway are tabulated in Table 18 and displayed in Figure 5-15 as a scatterplot with smoothed lines showing the conditional means associated with the various grades. The lines were plotted using R and the "+ stat_smooth(se=F)" option within the ggplot2 package.

Table 18: Average, Standard Deviation and Number of Observations of Intersection Clearance Time based on Approach Grade

Queue Size	-4%			+1%			+2%		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	8.39	1.23	53	9.38	1.17	52	7.96	0.87	39
3	9.25	1.22	46	10.33	0.98	45	9.17	1.38	34
4	9.70	1.01	33	10.85	0.94	44	9.66	1.03	41
5	10.42	1.74	12	11.44	0.67	21	10.30	1.34	38
6	10.72	1.55	16	12.73	0.59	4	10.53	1.24	40
7	11.51	1.52	12	13.10	1.10	3	11.04	1.34	29
8	12.07	1.43	11	-	-	-	11.69	1.58	16
9	10.13	0.00	1	-	-	-	13.06	1.89	9
10	12.82	0.00	1	-	-	-	13.13	1.89	11
11	15.32	0.00	1	-	-	-	14.08	1.80	6
12	15.72	0.00	1	-	-	-	16.11	1.60	5
13	14.52	0.00	1	-	-	-	14.99	0.00	1
14	-	-	-	-	-	-	16.26	0.00	1
15	-	-	-	-	-	-	21.02	1.02	2
16	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	20.33	0.00	1
Total	-	-	188	-	-	169	-	-	273

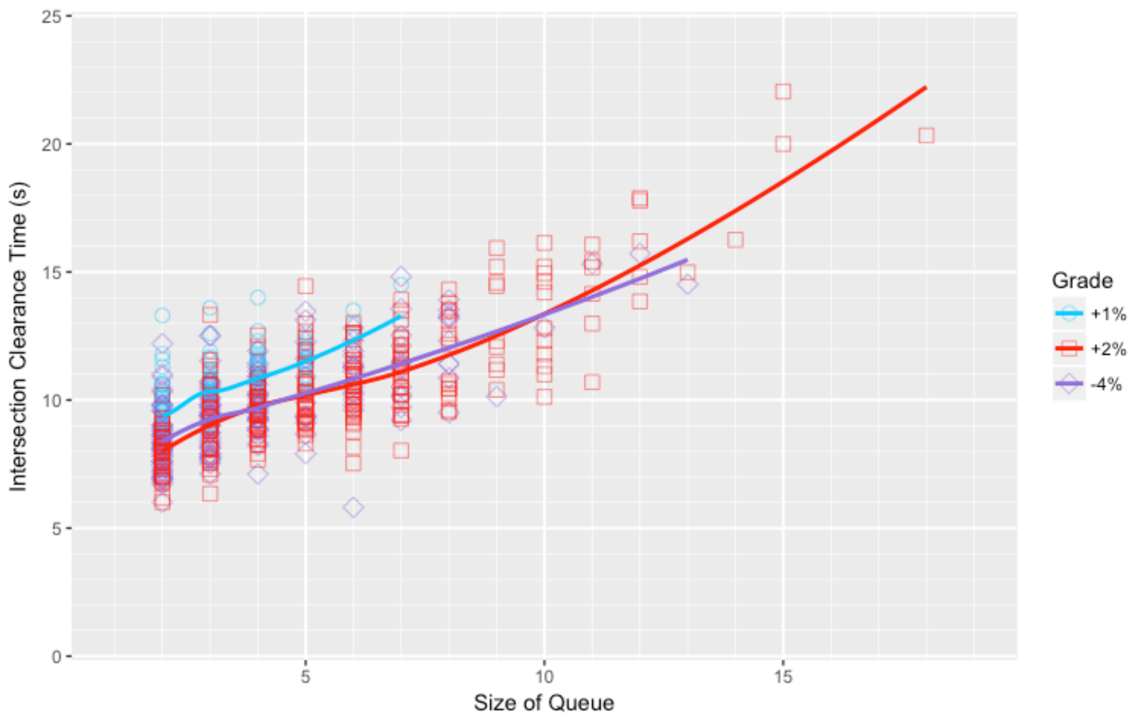

Figure 5-15 Intersection Clearance Time based on Approach Grade

The results display very similar clearance times for the queues along the +2% approach grade and the -4% approach grade, whereas the queues along the +1% approach grades consistently had higher clearance times. Therefore, there does not appear to be a strong relationship between intersection clearance times and uphill or downhill approaches for these short intersection crossing distances.

5.3.5 Per Utilization of the Bike Box

The intersection clearance times based on the queue size and utilization of the bike box at the intersection approach are tabulated in Table 19 and displayed in Figure 5-16 as a scatterplot with smoothed lines showing the conditional means and the 95 percent confidence interval as the shaded area. The lines were plotted using R and the "+ stat_smooth(se=T)" option within the ggplot2 package.

Table 19: Average, Standard Deviation and Number of Observations of Intersection Clearance Time based on Utilization of Bike Box

Queue Size	Bike Box Utilized			Bike Box Not Utilized		
	Avg (sec)	Std Dev (sec)	n	Avg (sec)	Std Dev (sec)	n
2	7.87	0.95	33	8.85	1.26	111
3	8.82	1.39	35	9.93	1.12	90
4	9.39	1.18	35	10.42	0.98	83
5	9.68	1.01	28	11.29	1.18	43
6	10.00	1.24	34	11.69	0.97	26
7	10.60	1.19	26	12.34	1.22	18
8	10.99	1.37	15	12.91	0.95	12
9	11.97	1.27	6	13.97	2.26	4
10	11.94	1.23	7	14.74	1.09	5
11	12.61	1.43	3	15.49	0.34	4
12	13.85	0.00	1	16.48	1.19	5
13	14.75	0.23	2	-	-	-
14	16.26	0.00	1	-	-	-
15	-	-	-	21.02	1.02	2
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18	-	-	-	20.33	0.00	1
Total	-	-	226	-	-	404

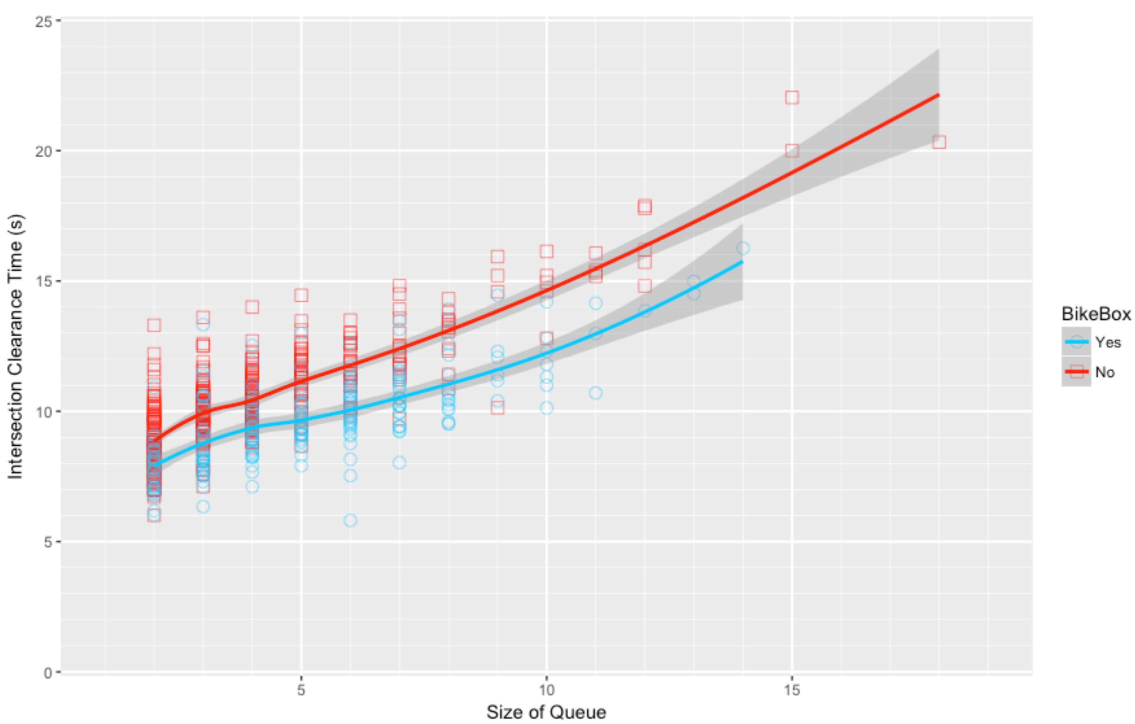

Figure 5-16 Intersection Clearance Time based on Utilization of the Bike Box

The results appear to indicate that utilization of the bike box has a relationship with a reduced intersection clearance time as compared to queues that do not utilize the bike box. The associated reduction in intersection clearance time is greatest for queues of ten cyclists with a reduction of approximately 2.5 seconds.

5.3.6 Findings

The intersection clearance results appear to potentially indicate that wider bike facilities approaching an intersection, wider receiving bike facilities, or utilization of a bike box generally clear queues of bicyclists through the intersection over a shorter amount of time as compared to narrower features or underutilized facilities.

5.4 Limitations

Limitations encountered within the results and findings presented above consist of:

- Comparisons intended to analyze performance characteristics of different types of bike facilities relied on study approaches that also had varying degrees of roadway grade.
- The analysis of intersection clearance time is limited by the lack of direct comparisons, as the distance required to clear the intersection was different for each intersection.
- The Williams Avenue approach occasionally had cars parked alongside the bike lane, likely affecting the natural flow of bicycles through the intersection.
- Although this research assists in the greater understanding of performance characteristics associated with groups of cyclists stopped at signalized

intersections, the precise effect that such revisions to bike facilities would have on overall intersection operations could also be affected by 1) additional bike demand that would be associated with an improved bike facility, 2) a change in the number of motorized vehicles along a revised roadway, and/or 3) different arrival patterns of bicycle platoons.

5.5 Future Research

Future research identified from the above analysis consists of:

- The desire to analyze a specific roadway approach that has a bike lane (and single receiving lane) which routinely collects numerous cyclists at a red signal, capturing conditions 'before' and 'after' the introduction of a bike box at the intersection. While the study approach of SE Madison Street at SE Grand Avenue resulted in various time savings associated with the introduction of a bike box, it is unknown how much of a factor the existing second receiving lane had with the resulting improved time efficiencies.
- Adding to this data by performing similar research associated with a variety of other bikeway widths, types of facilities, and/or varying approach grades.
- Identifying typical intersection widths that would provide standardized 'clearance' distances when reducing data from intersection video footage and to allow for direct comparisons with other study intersections.
- Development of a relationship between bikeway revisions and the respective change in traffic demand for both bikes and motorized vehicles, to provide the ability to more accurately analyze 'before' and 'after' intersection operations.

Chapter 6 - Conclusions

The first aspect of bicyclist queue discharge characteristics that was analyzed in detail as part of this study was the mean of the average headways associated with each queue size.

For all observations, the lowest mean of the average headway within queues is approximately 0.8 seconds per cyclist and occurs for groups of seven cyclists. For queues larger than seven in size, the mean of the average headway remains stable until queues of 12 in size and starts to slightly increase toward approximately 1.0 seconds for queues larger than 12 cyclists.

Regarding the mean of the average headway based on utilization of a bike box, it appears that utilization of a bike box has a potential relationship with a reduced average headway as compared to queues that do not utilize a bike box. The associated reduction in the mean of the average headway was approximately 0.2 to 0.3 seconds per cyclist for queues of three or more in size.

The second aspect of bicyclist queue discharge characteristics that was analyzed in detail as part of this study was the queue discharge rates associated with the observed queues. The queue discharge results appear to potentially indicate that wider bike facilities approaching an intersection, wider receiving bike facilities, or utilization of a bike box generally discharge queues of bicyclists into the intersection over a shorter amount of time as compared to narrower features or underutilized facilities. The installation of the bike box along the Madison approach, which increased the approach width from five to 15 feet, resulted in consistently lower average discharge times for all queue sizes, a reduction of greater than one second for queues of two cyclists to as much as about four seconds for queues of nine cyclists.

The third aspect of bicyclist queue discharge characteristics that was analyzed in detail as part of this study was the intersection clearance time associated with the observed queues. The intersection clearance results appear to potentially indicate that wider bike facilities approaching an intersection, wider receiving bike facilities, or utilization of a bike box generally clear queues of bicyclists through the intersection over a shorter amount of time as compared to narrower features or underutilized facilities.

6.1 Implications for Design or Operation of Bicycle Facilities

The information provided within this document in combination with future research could allow for bicycle facility design and/or operational decisions to be made that would allow cyclists to travel more efficiently through a signalized intersection and potentially also improve motor vehicle operations.

Suitable locations for analysis would be intersections with: a relatively high amount of bicycle traffic located to the inside of turning motor vehicles, a significant amount of turning motor vehicles in a shared through/right lane, and/or limited existing intersection capacity.

For example, if an existing intersection routinely fails to clear all of the right-turning motor vehicles during the peak hour signal cycles due to relatively high bicycle traffic, it could be beneficial for motor vehicle operations to widen the bicycle facility to more efficiently accommodate a greater number of cyclists in the same amount of time.

Chapter 7 - References

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Chapter 8 - Appendix: Excel Spreadsheet of Video Footage Data

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
1	41506	17	30	54	535	0		2	2	574	584	620	10.0	6	6	60	1
1	41506	17	32	4	1233	1		6	6	1279	1310	1352	10.0	6	6	60	1
1	41506	17	33	14	1931	0		5	5	1963	2008	2051	10.0	6	6	60	1
1	41506	17	34	26	2650	0		7	7	2686	2737	2780	10.0	6	6	60	1
1	41506	17	35	34	3327	0		5	5	3345	3401	3444	10.0	6	6	60	1
1	41506	17	36	44	4025	0		4	4	4045	4113	4165	10.0	6	6	60	1
1	41506	17	37	56	4744	0		2	2	4784	4794	4850	10.0	6	6	60	1
1	41506	17	40	11	6093	0		2	2	6133	6151	6199	10.0	6	6	60	1
1	41506	17	41	21	6791	0		4	4	6821	6849	6890	10.0	6	6	60	1
1	41506	17	42	30	7489	0		4	4	7522	7553	7595	10.0	6	6	60	1
1	41506	17	43	42	8208	0		4	4	8236	8268	8307	10.0	6	6	60	1
1	41506	17	46	0	9582	0		3	3	9647	9661	9708	10.0	6	6	60	1
1	41506	17	47	10	10280	0		5	5	10309	10351	10393	10.0	6	6	60	1
1	41506	17	48	20	10978	1		4	4	11017	11051	11101	10.0	6	6	60	1
1	41506	17	49	30	11676	0		3	3	11705	11730	11775	10.0	6	6	60	1
1	41506	17	50	37	12350	0		2	2	12388	12395	12441	10.0	6	6	60	1
1	41506	17	54	7	14443	1		4	4	14483	14514	14555	10.0	6	6	60	1
1	41506	17	55	17	15141	1		6	6	15173	15218	15271	10.0	6	6	60	1
1	41506	17	56	27	15839	0		3	3	15868	15889	15941	10.0	6	6	60	1
1	41506	17	57	39	16558	0		2	2	16578	16592	16631	10.0	6	6	60	1
1	41506	17	58	47	17235	0		5	5	17264	17297	17337	10.0	6	6	60	1
1	41506	18	1	6	18630	0		3	3	18666	18682	18724	10.0	6	6	60	1
1	41506	18	2	18	19349	0		2	2	19377	19405	19451	10.0	6	6	60	1
1	41506	18	4	36	20724	0		5	5	20761	20797	20837	10.0	6	6	60	1
1	41506	18	8	5	22815	0		5	5	22860	22886	22930	10.0	6	6	60	1
1	41506	18	11	33	24888	0		2	2	24910	24931	24975	10.0	6	6	60	1
1	41506	18	17	22	28377	0		3	3	28404	28443	28485	10.0	6	6	60	1
1	41506	18	18	32	29076	0		3	3	29111	29135	29193	10.0	6	6	60	1
1	41506	18	19	44	29795	0		2	2	29829	29850	29897	10.0	6	6	60	1
1	41506	18	22	2	31170	1		2	2	31203	31212	31259	10.0	6	6	60	1
1	41506	18	23	12	31867	0		2	2	31899	31902	31961	10.0	6	6	60	1

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
1	41507	17	32	7	1269	0		4	4	1296	1334	1373	10.0	6	6	60	1
1	41507	17	34	27	2665	0		7	7	2729	2767	2810	10.0	6	6	60	1
1	41507	17	35	39	3383	0		3	3	3403	3442	3481	10.0	6	6	60	1
1	41507	17	36	46	4060	2		4	4	4082	4121	4158	10.0	6	6	60	1
1	41507	17	37	58	4779	0		3	3	4800	4841	4898	10.0	6	6	60	1
1	41507	17	40	18	6175	2		5	5	6198	6240	6279	10.0	6	6	60	1
1	41507	17	41	26	6852	0		4	4	6884	6924	6964	10.0	6	6	60	1
1	41507	17	42	33	7549	1		2	2	7592	7601	7650	10.0	6	6	60	1
1	41507	17	43	45	8268	1		5	5	8317	8346	8389	10.0	6	6	60	1
1	41507	17	44	51	8922	1		2	2	8954	8962	9008	10.0	6	6	60	1
1	41507	17	46	5	9641	0		3	3	9684	9704	9744	10.0	6	6	60	1
1	41507	17	48	23	11016	1		4	4	11056	11075	11115	10.0	6	6	60	1
1	41507	17	49	35	11735	1		3	3	11773	11791	11835	10.0	6	6	60	1
1	41507	17	50	43	12412	0		5	5	12456	12497	12536	10.0	6	6	60	1
1	41507	17	51	53	13110	0		6	6	13141	13184	13235	10.0	6	6	60	1
1	41507	17	53	3	13808	0		5	5	13835	13866	13911	10.0	6	6	60	1
1	41507	17	56	32	15901	1		6	6	15947	15985	16036	10.0	6	6	60	1
1	41507	17	57	42	16599	1		4	4	16640	16673	16714	10.0	6	6	60	1
1	41507	17	58	49	17271	1		3	3	17293	17320	17366	10.0	6	6	60	1
1	41507	18	0	1	17990	1		4	4	18030	18058	18103	10.0	6	6	60	1
1	41507	18	3	31	20083	0		2	2	20113	20120	20170	10.0	6	6	60	1
1	41507	18	8	8	22853	0		4	4	22876	22913	22952	10.0	6	6	60	1
1	41507	18	10	30	24270	0		4	4	24302	24312	24358	10.0	6	6	60	1
1	41507	18	12	48	25645	0		2	2	25689	25693	25743	10.0	6	6	60	1
1	41507	18	15	5	27016	1		4	4	27045	27084	27125	10.0	6	6	60	1
1	41507	18	20	55	30506	0		2	2	30540	30546	30624	10.0	6	6	60	1
1	41507	18	22	4	31204	0		4	4	31245	31267	31318	10.0	6	6	60	1
1	41507	18	23	14	31901	0		2	2	31940	31960	32014	10.0	6	6	60	1
1	41507	18	25	36	33318	0		4	4	33348	33379	33434	10.0	6	6	60	1
1	41508	16	32	56	1734	0		2	2	1770	1771	1826	10.0	6	6	60	1
1	41508	16	36	23	3803	0		3	3	3844	3867	3919	10.0	6	6	60	1
1	41508	16	44	32	8688	0		2	2	8721	8735	8784	10.0	6	6	60	1
1	41508	16	45	42	9386	0		3	3	9432	9450	9494	10.0	6	6	60	1

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
1	41508	16	49	12	11481	0		4	4	11517	11551	11597	10.0	6	6	60	1
1	41508	16	53	51	14272	0		3	3	14309	14334	14384	10.0	6	6	60	1
1	41508	16	56	11	15668	0		2	2	15690	15703	15745	10.0	6	6	60	1
1	41508	17	0	48	18439	0		5	5	18472	18505	18547	10.0	6	6	60	1
1	41508	17	3	8	19834	0		4	4	19863	19898	19944	10.0	6	6	60	1
1	41508	17	8	55	23302	0		3	3	23335	23361	23409	10.0	6	6	60	1
1	41508	17	10	5	23999	0		3	3	24030	24050	24096	10.0	6	6	60	1
1	41508	17	11	17	24718	0		2	2	24759	24772	24818	10.0	6	6	60	1
1	41508	17	13	35	26093	0		5	5	26122	26161	26200	10.0	6	6	60	1
1	41508	17	14	45	26791	0		4	4	26823	26865	26911	10.0	6	6	60	1
1	41508	17	15	54	27489	0		5	5	27517	27562	27611	10.0	6	6	60	1
1	41508	17	17	6	28208	0		4	4	28236	28272	28310	10.0	6	6	60	1
1	41508	17	18	14	28884	0		4	4	28920	28949	28992	10.0	6	6	60	1
1	41508	17	19	24	29582	1		3	3	29610	29633	29680	10.0	6	6	60	1
1	41508	17	20	34	30281	0		2	2	30318	30334	30378	10.0	6	6	60	1
1	41508	17	21	44	30978	0		5	5	31010	31050	31094	10.0	6	6	60	1
1	41508	17	22	54	31676	0		4	4	31704	31746	31788	10.0	6	6	60	1
1	41508	17	24	4	32374	0		3	3	32413	32437	32478	10.0	6	6	60	1
1	41508	17	25	11	33049	0		3	3	33078	33102	33149	10.0	6	6	60	1
1	41508	17	26	23	33768	1		3	3	33798	33817	33857	10.0	6	6	60	1
1	41508	17	27	31	34445	0		3	3	34470	34496	34539	10.0	6	6	60	1
1	41508	17	31	1	602	0		4	4	630	668	709	10.0	6	6	60	1
1	41508	17	32	10	1299	0		4	4	1330	1379	1417	10.0	6	6	60	1
1	41508	17	33	20	1997	0		5	5	2029	2072	2112	10.0	6	6	60	1
1	41508	17	35	40	3392	1		4	4	3426	3454	3498	10.0	6	6	60	1
1	41508	17	36	50	4089	0		2	2	4120	4137	4188	10.0	6	6	60	1
1	41508	17	39	10	5485	0		2	2	5518	5538	5581	10.0	6	6	60	1
1	41508	17	40	22	6205	1		3	3	6233	6269	6314	10.0	6	6	60	1
1	41508	17	43	49	8276	0		4	4	8309	8344	8382	10.0	6	6	60	1
1	41508	17	46	7	9651	0		3	3	9682	9705	9757	10.0	6	6	60	1
1	41508	17	47	17	10350	0		5	5	10380	10425	10476	10.0	6	6	60	1
1	41508	17	48	29	11069	1		2	2	11092	11101	11145	10.0	6	6	60	1
1	41508	17	49	37	11746	0		7	7	11768	11821	11864	10.0	6	6	60	1

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
1	41508	17	50	46	12444	1		4	4	12479	12508	12554	10.0	6	6	60	1
1	41508	17	51	56	13142	0		2	2	13175	13188	13231	10.0	6	6	60	1
1	41508	17	54	16	14538	0		3	3	14574	14596	14641	10.0	6	6	60	1
1	41508	17	55	26	15236	0		3	3	15274	15290	15338	10.0	6	6	60	1
1	41508	17	57	43	16608	0		2	2	16639	16650	16696	10.0	6	6	60	1
1	41508	17	58	55	17327	0		2	2	17363	17375	17424	10.0	6	6	60	1
1	41508	18	0	3	18003	1		3	3	18037	18052	18109	10.0	6	6	60	1
1	41508	18	1	13	18702	0		4	4	18728	18760	18803	10.0	6	6	60	1
1	41508	18	2	23	19400	1		3	3	19437	19469	19511	10.0	6	6	60	1
1	41508	18	3	35	20118	1		2	2	20150	20163	20215	10.0	6	6	60	1
1	41508	18	5	55	21514	0		4	4	21537	21579	21620	10.0	6	6	60	1
1	41508	18	10	34	24306	1		3	3	24334	24367	24405	10.0	6	6	60	1
1	41508	18	11	42	24984	0		3	3	25016	25040	25088	10.0	6	6	60	1
1	41508	18	12	50	25660	0		2	2	25673	25696	25741	10.0	6	6	60	1
1	41508	18	14	0	26358	1		2	2	26388	26407	26448	10.0	6	6	60	1
1	41508	18	15	9	27056	0		3	3	27073	27097	27141	10.0	6	6	60	1
1	41508	18	17	29	28452	1		2	2	28492	28503	28553	10.0	6	6	60	1
1	41508	18	18	39	29150	1		2	2	29178	29191	29239	10.0	6	6	60	1
1	41508	18	20	59	30546	0		5	5	30592	30620	30665	10.0	6	6	60	1
1	41508	18	22	9	31244	0		2	2	31274	31275	31340	10.0	6	6	60	1
1	41508	18	24	29	32641	0		3	3	32658	32689	32730	10.0	6	6	60	1
1	41508	18	25	39	33339	0		5	5	33364	33397	33453	10.0	6	6	60	1
1	41509	16	31	38	958	1		2	2	1000	1014	1061	10.0	6	6	60	1
1	41509	16	36	15	3723	0		2	2	3773	3782	3856	10.0	6	6	60	1
1	41509	16	37	25	4421	0		4	4	4441	4476	4521	10.0	6	6	60	1
1	41509	16	42	4	7211	0		2	2	7237	7254	7302	10.0	6	6	60	1
1	41509	16	46	44	10002	0		2	2	10034	10035	10084	10.0	6	6	60	1
1	41509	16	47	54	10700	0		3	3	10727	10767	10809	10.0	6	6	60	1
1	41509	16	49	6	11419	1		2	2	11468	11470	11518	10.0	6	6	60	1
1	41509	16	51	24	12795	0		2	2	12829	12843	12890	10.0	6	6	60	1
1	41509	16	53	41	14170	0		2	2	14192	14206	14247	10.0	6	6	60	1
1	41509	16	54	53	14889	0		3	3	14921	14950	14995	10.0	6	6	60	1
1	41509	16	57	11	16265	1		3	3	16296	16308	16354	10.0	6	6	60	1

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
1	41509	16	58	21	16963	0		3	3	16990	17013	17070	10.0	6	6	60	1
1	41509	17	0	41	18359	0		3	3	18394	18415	18460	10.0	6	6	60	1
1	41509	17	1	50	19057	0		4	4	19092	19138	19184	10.0	6	6	60	1
1	41509	17	4	10	20453	0		3	3	20487	20518	20561	10.0	6	6	60	1
1	41509	17	7	40	22546	0		5	5	22581	22616	22659	10.0	6	6	60	1
1	41509	17	11	7	24619	0		4	4	24651	24678	24720	10.0	6	6	60	1
1	41509	17	12	17	25317	0		3	3	25335	25366	25405	10.0	6	6	60	1
1	41509	17	13	29	26036	0		3	3	26065	26101	26172	10.0	6	6	60	1
1	41509	17	14	37	26712	0		2	2	26742	26755	26799	10.0	6	6	60	1
1	41509	17	15	47	27410	0		4	4	27429	27465	27514	10.0	6	6	60	1
1	41509	17	16	57	28109	0		4	4	28136	28165	28205	10.0	6	6	60	1
1	41509	17	18	7	28806	0		2	2	28834	28840	28890	10.0	6	6	60	1
1	41509	17	22	44	31576	0		4	4	31605	31637	31680	10.0	6	6	60	1
1	41509	17	23	54	32275	0		4	4	32303	32341	32384	10.0	6	6	60	1
1	41509	17	25	6	32994	0		4	4	33027	33057	33098	10.0	6	6	60	1
1	41509	17	26	14	33671	0		4	4	33696	33725	33763	10.0	6	6	60	1
1	41509	17	29	44	35765	0		4	4	35795	35831	35873	10.0	6	6	60	1
1	41509	17	30	53	527	0		2	2	555	568	611	10.0	6	6	60	1
1	41509	17	33	15	1944	1		3	3	1981	2007	2047	10.0	6	6	60	1
1	41509	17	34	23	2621	1		4	4	2654	2690	2736	10.0	6	6	60	1
1	41509	17	35	33	3319	0		3	3	3348	3367	3410	10.0	6	6	60	1
1	41509	17	37	53	4715	0		5	5	4738	4788	4835	10.0	6	6	60	1
1	41509	17	41	20	6786	0		4	4	6816	6851	6895	10.0	6	6	60	1
1	41509	17	43	40	8182	0		3	3	8216	8242	8292	10.0	6	6	60	1
1	41509	17	47	10	10276	0		3	3	10299	10330	10379	10.0	6	6	60	1
1	41509	17	49	29	11672	1		2	2	11713	11723	11779	10.0	6	6	60	1
1	41509	17	51	49	13068	1		2	2	13102	13112	13153	10.0	6	6	60	1
1	41509	17	52	59	13766	1		4	4	13809	13841	13883	10.0	6	6	60	1
1	41509	17	54	11	14485	0		4	4	14510	14554	14605	10.0	6	6	60	1
1	41509	17	57	39	16558	0		3	3	16595	16611	16661	10.0	6	6	60	1
1	41509	18	2	18	19349	0		3	3	19378	19403	19444	10.0	6	6	60	1
1	41509	18	4	36	20724	0		2	2	20765	20775	20820	10.0	6	6	60	1
1	41509	18	6	58	22141	0		2	2	22169	22173	22221	10.0	6	6	60	1

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
1	41509	18	10	25	24214	0		2	2	24247	24258	24300	10.0	6	6	60	1
1	41509	18	16	13	27683	0		5	5	27713	27743	27793	10.0	6	6	60	1
1	41509	18	17	25	28402	0		2	2	28446	28448	28508	10.0	6	6	60	1
1	41509	18	18	33	29079	0		2	2	29100	29111	29152	10.0	6	6	60	1
1	41509	18	20	52	30475	1		2	2	30498	30501	30568	10.0	6	6	60	1
1	41509	18	26	44	33988	0		2	2	34030	34044	34104	10.0	6	6	60	1
2	41925	16	<15	?	7139	1		2	2	7233	7280	7386	30.0	12	6.5	56	-4
2	41925	16	<18	?	2397	0		2	2	2508	2522	2656	30.0	12	6.5	56	-4
2	41925	16	<45	?	-12	0		3	3	103	174	287	30.0	12	6.5	56	-4
2	41925	16	<45	?	2086	0		4	4	2177	2260	2344	30.0	12	6.5	56	-4
2	41925	16	<45	?	4185	1		2	2	4325	4341	4480	30.0	12	6.5	56	-4
2	41925	16	<45	?	6284	0		3	3	6351	6453	6574	30.0	12	6.5	56	-4
2	41925	16	<45	?	12581	0		2	2	12657	12723	12875	30.0	12	6.5	56	-4
2	41925	16	<45	?	18849	0		4	4	18908	18975	19126	30.0	12	6.5	56	-4
2	41925	16	<45	?	27240	0		2	2	27353	27400	27527	30.0	12	6.5	56	-4
2	41925	16	<45	?	29338	0		2	2	29450	29482	29609	30.0	12	6.5	56	-4
2	41925	16	<45	?	31437	0		2	2	31541	31583	31702	30.0	12	6.5	56	-4
2	41925	16	<45	?	33539	0		6	6	33641	33765	33877	30.0	12	6.5	56	-4
2	41925	16	<45	?	37734	0		3	3	37782	37849	37967	30.0	12	6.5	56	-4
2	41925	16	<45	?	39833	0		2	2	39870	39924	40042	30.0	12	6.5	56	-4
2	41925	16	<45	?	41932	1		5	5	41983	42083	42192	30.0	12	6.5	56	-4
2	41925	16	<45	?	44031	1		2	2	44103	44136	44254	30.0	12	6.5	56	-4
2	41925	16	<45	?	46130	0		3	3	46171	46328	46451	30.0	12	6.5	56	-4
2	41925	17	<12	?	3437	0		3	3	3551	3610	3739	30.0	12	6.5	56	-4
2	41925	17	<12	?	5536	1		6	6	5585	5680	5879	30.0	12	6.5	56	-4
2	41925	17	<12	?	11833	0		2	2	11917	11961	12078	30.0	12	6.5	56	-4
2	41925	17	<12	?	16030	0		2	2	16124	16181	16317	30.0	12	6.5	56	-4
2	41925	17	<12	?	18129	0		3	3	18236	18307	18432	30.0	12	6.5	56	-4
2	41925	17	<12	?	24424	0		5	5	24502	24601	24704	30.0	12	6.5	56	-4
2	41925	17	<12	?	26523	1		2	2	26588	26634	26740	30.0	12	6.5	56	-4
2	41925	17	<12	?	28620	0		4	4	28709	28836	28963	30.0	12	6.5	56	-4
2	41925	17	<12	?	30718	0		6	6	30812	30942	31057	30.0	12	6.5	56	-4
2	41925	17	<12	?	32817	0		4	4	32888	32977	33092	30.0	12	6.5	56	-4

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
2	41925	17<12	?		34915	0		2	2	34990	35025	35143	30.0	12	6.5	56	-4
2	41925	17<12	?		37014	0		4	4	37090	37197	37306	30.0	12	6.5	56	-4
2	41925	17<12	?		39112	0		5	5	39208	39386	39516	30.0	12	6.5	56	-4
2	41925	17<12	?		41211	0		8	8	41279	41492	41607	30.0	12	6.5	56	-4
2	41925	17<12	?		43310	0		3	3	43507	43582	43685	30.0	12	6.5	56	-4
2	41925	17<12	?		45408	0		3	3	45470	45553	45688	30.0	12	6.5	56	-4
2	41925	17<36	?		2719	0		6	6	2824	2975	3089	30.0	12	6.5	56	-4
2	41925	17<36	?		4818	2		3	3	4890	4949	5074	30.0	12	6.5	56	-4
2	41925	17<36	?		6914	0		3	3	6979	7021	7158	30.0	12	6.5	56	-4
2	41925	17<36	?		9012	1		4	4	9076	9177	9303	30.0	12	6.5	56	-4
2	41925	17<36	?		11111	0		4	4	11221	11333	11439	30.0	12	6.5	56	-4
2	41925	17<36	?		13210	0		5	5	13293	13450	13578	30.0	12	6.5	56	-4
2	41925	17<36	?		15309	0		7	7	15420	15608	15716	30.0	12	6.5	56	-4
2	41925	17<36	?		17408	0		4	4	17479	17627	17747	30.0	12	6.5	56	-4
2	41925	17<36	?		19510	0		9	9	19572	19723	19814	30.0	12	6.5	56	-4
2	41925	17<36	?		23708	1		4	4	23776	23868	23993	30.0	12	6.5	56	-4
2	41925	17<36	?		25804	1		3	3	25892	25981	26126	30.0	12	6.5	56	-4
2	41925	17<36	?		27861	0		2	2	27973	28073	28227	30.0	12	6.5	56	-4
2	41925	17<36	?		29957	0		4	4	30087	30179	30284	30.0	12	6.5	56	-4
2	41925	17<36	?		32056	1		4	4	32155	32248	32361	30.0	12	6.5	56	-4
2	41925	17<36	?		34156	0		8	8	34226	34374	34482	30.0	12	6.5	56	-4
2	41925	17<36	?		36255	1		3	3	36313	36359	36487	30.0	12	6.5	56	-4
2	41925	17<36	?		38353	1		3	3	38441	38501	38615	30.0	12	6.5	56	-4
2	41925	17<36	?		40455	1		3	3	40507	40654	40801	30.0	12	6.5	56	-4
2	41925	17<36	?		42554	0		4	4	42647	42706	42831	30.0	12	6.5	56	-4
3	41499	6	36	46	4036	0	0	2	2	4065	4077	4116	10.0	10	10	46	-4
3	41499	6	40	46	6433	0	0	2	2	6477	6493	6530	10.0	10	10	46	-4
3	41499	6	45	46	9430	1	0	2	2	9452	9477	9510	10.0	10	10	46	-4
3	41499	6	50	47	12426	0	0	2	2	12464	12484	12524	10.0	10	10	46	-4
3	41499	7	17	46	28601	0	0	2	2	28622	28642	28679	10.0	10	10	46	-4
3	41499	7	19	46	29800	0	0	4	4	29831	29851	29888	10.0	10	10	46	-4
3	41499	7	31	46	1057	0	0	2	2	1094	1100	1136	10.0	10	10	46	-4
3	41499	7	38	47	5252	0	0	4	4	5291	5321	5354	10.0	10	10	46	-4

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
3	41499	7	44	47	8847	1	1	2	3	8889	8913	8953	10.0	21	10	46	-4
3	41499	7	45	46	9446	0	2	8	10	9462	9540	9574	10.0	21	10	46	-4
3	41499	7	46	46	10045	0	0	3	3	10063	10101	10135	10.0	10	10	46	-4
3	41499	7	47	46	10644	0	1	1	2	10664	10691	10722	10.0	21	10	46	-4
3	41499	7	48	46	11243	1	2	2	4	11264	11284	11314	10.0	21	10	46	-4
3	41499	7	49	46	11842	0	0	3	3	11879	11904	11940	10.0	10	10	46	-4
3	41499	7	58	46	17233	0	0	2	2	17267	17279	17314	10.0	10	10	46	-4
3	41499	8	2	46	19629	0	1	3	4	19648	19677	19711	10.0	21	10	46	-4
3	41499	8	3	46	20228	0	1	3	4	20245	20285	20311	10.0	21	10	46	-4
3	41499	8	6	46	22026	0	0	2	2	22052	22059	22093	10.0	10	10	46	-4
3	41499	8	11	46	25024	0	0	5	5	25051	25083	25115	10.0	10	10	46	-4
3	41499	8	12	46	25620	1	0	3	3	25637	25676	25714	10.0	10	10	46	-4
3	41499	8	15	46	27417	0	0	12	12	27450	27547	27574	10.0	10	10	46	-4
3	41499	8	16	46	28016	0	0	4	4	28045	28078	28111	10.0	10	10	46	-4
3	41499	8	25	46	33410	0	0	3	3	33444	33460	33505	10.0	10	10	46	-4
3	41499	8	29	46	35807	0	1	3	4	35839	35889	35926	10.0	21	10	46	-4
3	41499	8	32	46	1652	0	0	8	8	1679	1743	1775	10.0	10	10	46	-4
3	41499	8	35	46	3450	1	0	8	8	3487	3549	3582	10.0	10	10	46	-4
3	41499	8	36	46	4050	0	1	1	2	4076	4099	4133	10.0	21	10	46	-4
3	41499	8	37	46	4649	0	0	4	4	4683	4722	4755	10.0	10	10	46	-4
3	41499	8	41	46	7046	0	0	3	3	7076	7099	7144	10.0	10	10	46	-4
3	41499	8	42	46	7645	0	0	6	6	7688	7736	7764	10.0	10	10	46	-4
3	41499	8	50	46	12440	0	0	8	8	12477	12539	12573	10.0	10	10	46	-4
3	41499	8	51	46	13039	0	1	2	3	13068	13089	13129	10.0	21	10	46	-4
3	41499	8	55	46	15437	0	0	11	11	15474	15556	15590	10.0	10	10	46	-4
3	41499	8	56	46	16036	0	1	2	3	16059	16071	16114	10.0	21	10	46	-4
3	41499	8	59	46	17834	0	0	2	2	17869	17885	17922	10.0	10	10	46	-4
3	41500	6	41	48	7064	1	0	3	3	7090	7111	7143	10.0	10	10	46	-4
3	41500	6	50	48	12459	0	0	2	2	12479	12483	12529	10.0	10	10	46	-4
3	41500	6	51	48	13058	0	0	2	2	13083	13100	13134	10.0	10	10	46	-4
3	41500	7	4	47	20845	0	0	2	2	20875	20890	20928	10.0	10	10	46	-4
3	41500	7	10	48	24440	0	0	2	2	24467	24487	24526	10.0	10	10	46	-4
3	41500	7	21	47	31031	0	1	7	8	31050	31115	31145	10.0	21	10	46	-4

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
3	41500	7	24	47	32828	0	0	5	5	32870	32908	32944	10.0	10	10	46	-4
3	41500	7	28	48	35225	0	0	2	2	35269	35278	35314	10.0	10	10	46	-4
3	41500	7	38	47	5264	0	1	4	5	5284	5326	5357	10.0	21	10	46	-4
3	41500	7	43	47	8259	0	0	4	4	8298	8321	8361	10.0	10	10	46	-4
3	41500	7	44	47	8859	0	0	7	7	8900	8958	8984	10.0	10	10	46	-4
3	41500	7	52	47	13652	2	1	6	7	13684	13722	13754	10.0	21	10	46	-4
3	41500	8	1	47	19043	0	1	1	2	19073	19088	19133	10.0	21	10	46	-4
3	41500	8	13	47	26232	0	0	2	2	26282	26296	26335	10.0	10	10	46	-4
3	41500	8	14	47	26831	0	1	2	3	26863	26887	26925	10.0	21	10	46	-4
3	41500	8	15	47	27430	0	1	3	4	27460	27501	27533	10.0	21	10	46	-4
3	41500	8	21	47	31025	0	0	4	4	31051	31083	31113	10.0	10	10	46	-4
3	41500	8	25	47	33421	0	0	6	6	33462	33514	33549	10.0	10	10	46	-4
3	41500	8	26	47	34021	0	1	12	13	34052	34138	34166	10.0	21	10	46	-4
3	41500	8	30	47	468	0	0	7	7	507	548	580	10.0	10	10	46	-4
3	41500	8	38	47	5261	0	0	6	6	5285	5334	5366	10.0	10	10	46	-4
3	41500	8	43	47	8257	1	1	5	6	8280	8337	8370	10.0	21	10	46	-4
3	41500	8	45	47	9456	0	0	2	2	9483	9485	9524	10.0	10	10	46	-4
3	41500	8	49	47	11853	0	1	2	3	11877	11889	11930	10.0	21	10	46	-4
3	41500	8	52	47	13650	0	0	7	7	13679	13730	13764	10.0	10	10	46	-4
3	41500	8	55	47	15448	0	2	6	8	15478	15518	15549	10.0	21	10	46	-4
3	41500	8	59	47	17844	1	1	2	3	17887	17906	17937	10.0	21	10	46	-4
3	41500	9	5	50	21469	0	1	1	2	21499	21517	21553	10.0	21	10	46	-4
3	41500	9	14	50	26861	0	1	7	8	26883	26969	27000	10.0	21	10	46	-4
3	41501	7	15	49	27388	0	1	6	7	27416	27455	27480	10.0	21	10	46	-4
3	41501	7	20	49	30385	0	1	3	4	30410	30440	30474	10.0	21	10	46	-4
3	41501	7	23	49	32184	0	0	3	3	32209	32247	32281	10.0	10	10	46	-4
3	41501	7	26	49	33982	0	0	4	4	34005	34045	34075	10.0	10	10	46	-4
3	41501	7	30	48	483	0	0	7	7	531	596	631	10.0	10	10	46	-4
3	41501	7	34	48	2881	2	1	5	6	2909	2950	2977	10.0	21	10	46	-4
3	41501	7	39	49	5879	0	1	5	6	5913	5938	5937	10.0	21	10	46	-4
3	41501	7	40	49	6479	0	1	5	6	6505	6551	6582	10.0	21	10	46	-4
3	41501	7	43	49	8277	0	0	3	3	8305	8352	8402	10.0	10	10	46	-4
3	41501	7	44	49	8877	0	0	3	3	8909	8939	8971	10.0	10	10	46	-4

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
3	41501	7	51	49	13073	0	0	5	5	13122	13167	13204	10.0	10	10	46	-4
3	41501	7	52	49	13672	0	2	1	3	13697	13714	13747	10.0	21	10	46	-4
3	41501	7	55	49	15469	1	2	0	2	15509	15518	15550	10.0	21	10	46	-4
3	41501	7	56	49	16068	0	2	1	3	16092	16116	16152	10.0	21	10	46	-4
3	41501	7	59	49	17866	1	3	5	8	17880	17928	17961	10.0	21	10	46	-4
3	41501	8	0	49	18465	1	0	3	3	18501	18527	18560	10.0	10	10	46	-4
3	41501	8	1	49	19063	1	0	3	3	19084	19118	19150	10.0	10	10	46	-4
3	41501	8	7	49	22658	0	1	2	3	22695	22711	22741	10.0	21	10	46	-4
3	41501	8	8	49	23258	0	0	7	7	23284	23340	23371	10.0	10	10	46	-4
3	41501	8	9	49	23858	0	0	4	4	23907	23933	23958	10.0	10	10	46	-4
3	41501	8	10	49	24457	0	0	5	5	24477	24521	24551	10.0	10	10	46	-4
3	41501	8	11	49	25057	0	1	5	6	25079	25136	25174	10.0	21	10	46	-4
3	41501	8	15	49	27455	1	0	2	2	27492	27500	27531	10.0	10	10	46	-4
3	41501	8	16	49	28054	0	1	6	7	28077	28139	28169	10.0	21	10	46	-4
3	41501	8	17	49	28654	0	2	0	2	28683	28700	28739	10.0	21	10	46	-4
3	41501	8	28	48	35233	0	0	2	2	35277	35302	35337	10.0	10	10	46	-4
3	41501	8	32	48	1678	0	0	8	8	1693	1765	1792	10.0	10	10	46	-4
3	41501	8	33	48	2277	0	0	3	3	2312	2336	2371	10.0	10	10	46	-4
3	41501	8	34	48	2876	1	0	4	4	2908	2951	2987	10.0	10	10	46	-4
3	41501	8	35	48	3475	0	0	3	3	3493	3521	3546	10.0	10	10	46	-4
3	41501	8	36	48	4074	0	1	1	2	4104	4113	4143	10.0	21	10	46	-4
3	41501	8	41	48	7071	1	0	2	2	7100	7115	7146	10.0	10	10	46	-4
3	41501	8	42	48	7670	1	0	4	4	7707	7726	7763	10.0	10	10	46	-4
3	41501	8	43	48	8269	1	1	7	8	8300	8369	8404	10.0	21	10	46	-4
3	41501	8	44	48	8869	0	0	2	2	8887	8906	8942	10.0	10	10	46	-4
3	41501	8	46	48	10068	2	0	2	2	10090	10108	10140	10.0	10	10	46	-4
3	41501	8	52	48	13664	0	1	2	3	13689	13705	13746	10.0	21	10	46	-4
3	41501	8	56	48	16061	0	0	3	3	16107	16130	16165	10.0	10	10	46	-4
3	41501	8	58	48	17259	1	1	1	2	17286	17297	17328	10.0	21	10	46	-4
3	41501	9	10	51	24479	0	1	4	5	24522	24557	24588	10.0	21	10	46	-4
3	41501	9	11	51	25079	1	2	4	6	25107	25144	25179	10.0	21	10	46	-4
3	41501	9	15	51	27477	0	1	1	2	27515	27554	27586	10.0	21	10	46	-4
3	41501	9	21	51	31074	0	1	1	2	31104	31112	31145	10.0	21	10	46	-4

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
3	41501	9	28	51	35262	1	0	2	2	35279	35291	35322	10.0	10	10	46	-4
3	41502	6	41	52	7055	0	0	3	3	7081	7099	7131	10.0	10	10	46	-4
3	41502	6	56	52	16045	0	0	2	2	16075	16076	16115	10.0	10	10	46	-4
3	41502	7	7	52	22637	0	0	2	2	22677	22683	22723	10.0	10	10	46	-4
3	41502	7	23	52	32227	0	2	4	6	32250	32291	32325	10.0	21	10	46	-4
3	41502	7	37	51	4705	0	1	3	4	4724	4765	4798	10.0	21	10	46	-4
3	41502	7	45	52	9500	1	0	2	2	9527	9545	9581	10.0	10	10	46	-4
3	41502	7	46	52	10100	0	0	3	3	10126	10154	10194	10.0	10	10	46	-4
3	41502	7	51	52	13096	0	0	4	4	13126	13154	13185	10.0	10	10	46	-4
3	41502	7	53	52	14295	0	3	0	3	14320	14337	14374	10.0	21	10	46	-4
3	41502	7	54	52	14894	0	0	3	3	14919	14951	14986	10.0	10	10	46	-4
3	41502	7	55	52	15493	0	2	1	3	15519	15537	15574	10.0	21	10	46	-4
3	41502	7	57	52	16691	0	0	4	4	16717	16762	16789	10.0	10	10	46	-4
3	41502	8	0	52	18489	0	4	2	6	18510	18558	18591	10.0	21	10	46	-4
3	41502	8	2	52	19687	0	2	3	5	19706	19730	19766	10.0	21	10	46	-4
3	41502	8	5	52	21485	0	1	1	2	21515	21532	21572	10.0	21	10	46	-4
3	41502	8	6	52	22085	1	0	2	2	22149	22160	22195	10.0	10	10	46	-4
3	41502	8	11	52	25080	0	0	4	4	25102	25142	25178	10.0	10	10	46	-4
3	41502	8	13	52	26279	0	0	5	5	26315	26351	26378	10.0	10	10	46	-4
3	41502	8	27	52	34666	0	2	5	7	34694	34737	34771	10.0	21	10	46	-4
3	41502	8	28	52	35266	0	0	2	2	35298	35312	35356	10.0	10	10	46	-4
3	41502	8	30	51	508	0	0	7	7	540	578	605	10.0	10	10	46	-4
3	41502	8	31	51	1108	0	1	5	6	1140	1191	1219	10.0	21	10	46	-4
3	41502	8	36	51	4105	1	1	6	7	4135	4189	4226	10.0	21	10	46	-4
3	41502	8	49	52	11899	1	2	1	3	11944	11966	12004	10.0	21	10	46	-4
3	41502	8	51	52	13098	0	0	2	2	13139	13146	13181	10.0	10	10	46	-4
3	41502	8	54	52	14895	2	2	2	4	14917	14948	14991	10.0	21	10	46	-4
3	41502	9	11	52	25083	0	1	2	3	25123	25128	25173	10.0	21	10	46	-4
3	41502	9	12	52	25682	0	0	3	3	25703	25749	25780	10.0	10	10	46	-4
4	40444	8	0	7	140	0		5	5	247	418	533	30.3	5	10	54	2
4	40444	8	1	17	138	0		3	3	270	348	461	30.3	5	10	54	2
4	40444	8	2	27	168	0		6	6	261	473	593	30.3	5	10	54	2
4	40444	8	3	37	134	0		6	6	236	383	498	30.3	5	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
4	40444	8	4	47	162	0		7	7	275	469	560	30.3	5	10	54	2
4	40444	8	5	57	160	0		8	8	251	480	566	30.3	5	10	54	2
4	40444	8	7	6	128	1		2	2	249	293	439	30.3	5	10	54	2
4	40444	8	8	16	126	0		6	6	204	375	463	30.3	5	10	54	2
4	40444	8	9	26	124	0		4	4	227	331	441	30.3	5	10	54	2
4	40444	8	10	37	170	0		2	2	275	309	430	30.3	5	10	54	2
4	40444	8	12	56	166	0		2	2	259	311	439	30.3	5	10	54	2
4	40444	8	14	6	162	0		3	3	275	366	487	30.3	5	10	54	2
4	40444	8	15	16	160	0		3	3	309	381	483	30.3	5	10	54	2
4	40444	8	17	36	124	0		7	7	261	457	576	30.3	5	10	54	2
4	40444	8	18	46	150	0		3	3	282	327	463	30.3	5	10	54	2
4	40444	8	19	56	118	0		2	2	229	277	408	30.3	5	10	54	2
4	40444	8	21	5	174	0		12	12	263	608	695	30.3	5	10	54	2
4	40444	8	24	35	136	0		4	4	265	374	485	30.3	5	10	54	2
4	40444	8	25	45	164	0		4	4	253	378	501	30.3	5	10	54	2
4	40444	8	26	55	160	0		8	8	291	504	600	30.3	5	10	54	2
4	40444	8	28	5	156	1		10	10	239	497	574	30.3	5	10	54	2
4	40444	8	29	15	124	1		6	6	236	419	535	30.3	5	10	54	2
4	40444	8	30	25	120	0		3	3	257	330	451	30.3	5	10	54	2
4	40444	8	31	35	118	0		4	4	261	358	465	30.3	5	10	54	2
4	40444	8	32	44	176	0		8	8	309	507	614	30.3	5	10	54	2
4	40444	8	35	4	140	0		5	5	273	483	608	30.3	5	10	54	2
4	40444	8	36	14	138	1		4	4	269	358	457	30.3	5	10	54	2
4	40444	8	37	24	134	0		5	5	237	374	467	30.3	5	10	54	2
4	40444	8	38	34	162	0		3	3	289	350	461	30.3	5	10	54	2
4	40444	8	39	44	128	0		2	2	239	295	398	30.3	5	10	54	2
4	40444	8	40	53	154	0		6	6	265	443	542	30.3	5	10	54	2
4	40444	8	43	43	148	0		11	11	275	568	665	30.3	5	10	54	2
4	40444	8	44	23	146	0		3	3	282	336	447	30.3	5	10	54	2
4	40444	8	45	33	174	0		4	4	316	449	570	30.3	5	10	54	2
4	40444	8	47	52	140	0		2	2	251	285	394	30.3	5	10	54	2
4	40444	8	49	2	107	0		6	6	190	354	469	30.3	5	10	54	2
4	40444	8	52	32	192	0		2	2	315	371	489	30.3	5	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
4	40444	8	53	42	160	0		2	2	261	307	402	30.3	5	10	54	2
4	40444	8	58	22	124	0		2	2	234	300	406	30.3	5	10	54	2
4	40444	8	59	31	119	0		2	2	243	296	431	30.3	5	10	54	2
4	40444	9	0	48	178	0		2	2	279	322	420	30.3	5	10	54	2
4	40444	9	4	17	140	0		2	2	257	297	429	30.3	5	10	54	2
4	40444	9	7	47	164	0		3	3	293	396	533	30.3	5	10	54	2
4	40444	9	10	7	99	0		4	4	225	340	453	30.3	5	10	54	2
4	40444	9	12	27	146	0		2	2	279	379	485	30.3	5	10	54	2
4	40444	9	13	37	144	1		3	3	243	335	441	30.3	5	10	54	2
4	40444	9	14	47	142	0		2	2	258	302	425	30.3	5	10	54	2
4	40444	9	17	7	168	0		3	3	331	398	519	30.3	5	10	54	2
4	40444	9	18	17	136	0		3	3	277	338	453	30.3	5	10	54	2
4	40444	9	28	46	146	0		2	2	275	300	416	30.3	5	10	54	2
4	40444	9	29	55	174	0		2	2	257	305	445	30.3	5	10	54	2
4	40445	8	1	16	126	0		10	10	249	527	645	30.3	5	10	54	2
4	40445	8	2	26	122	1		7	7	227	420	509	30.3	5	10	54	2
4	40445	8	5	55	146	0		4	4	263	360	467	30.3	5	10	54	2
4	40445	8	8	15	142	0		4	4	263	351	479	30.3	5	10	54	2
4	40445	8	9	25	140	0		2	2	239	297	445	30.3	5	10	54	2
4	40445	8	10	35	136	0		7	7	233	430	525	30.3	5	10	54	2
4	40445	8	12	55	132	0		5	5	231	425	538	30.3	5	10	54	2
4	40445	8	14	5	136	0		5	5	241	378	487	30.3	5	10	54	2
4	40445	8	15	15	134	0		5	5	239	392	493	30.3	5	10	54	2
4	40445	8	16	25	132	1		8	8	243	485	596	30.3	5	10	54	2
4	40445	8	18	44	126	0		6	6	260	392	507	30.3	5	10	54	2
4	40445	8	19	54	124	0		5	5	268	384	515	30.3	5	10	54	2
4	40445	8	22	14	118	0		5	5	229	342	441	30.3	5	10	54	2
4	40445	8	23	23	146	1		4	4	274	379	483	30.3	5	10	54	2
4	40445	8	24	34	174	0		9	9	289	578	665	30.3	5	10	54	2
4	40445	8	25	43	170	0		6	6	301	470	562	30.3	5	10	54	2
4	40445	8	26	56	138	0		5	5	216	398	511	30.3	5	10	54	2
4	40445	8	29	13	132	0		5	5	257	439	546	30.3	5	10	54	2
4	40445	8	30	23	132	1		3	3	263	318	429	30.3	5	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
4	40445	8	32	42	128	0		6	6	202	370	479	30.3	5	10	54	2
4	40445	8	33	52	126	0		15	15	265	671	762	30.3	5	10	54	2
4	40445	8	35	2	124	0		9	9	249	513	596	30.3	5	10	54	2
4	40445	8	37	22	118	1		11	11	227	517	608	30.3	5	10	54	2
4	40445	8	38	32	146	0		5	5	273	402	499	30.3	5	10	54	2
4	40445	8	40	52	140	0		4	4	253	352	467	30.3	5	10	54	2
4	40445	8	42	1	168	0		4	4	263	376	487	30.3	5	10	54	2
4	40445	8	47	51	126	0		4	4	243	336	441	30.3	5	10	54	2
4	40445	8	52	30	120	0		6	6	214	418	533	30.3	5	10	54	2
4	40445	8	53	40	178	0		4	4	322	418	511	30.3	5	10	54	2
4	40445	8	58	20	140	0		6	6	269	378	467	30.3	5	10	54	2
4	40445	9	4	15	95	0		5	5	208	342	447	30.3	5	10	54	2
4	40445	9	28	43	144	1		3	3	295	360	475	30.3	5	10	54	2
4	40449	7	6	18	148	0		7	7	281	433	531	30.3	5	10	54	2
4	40449	7	8	37	176	0		8	8	309	523	624	30.3	5	10	54	2
4	40449	7	9	47	53	0		7	7	158	354	451	30.3	5	10	54	2
4	40449	7	20	15	91	0		10	10	238	479	564	30.3	5	10	54	2
4	40449	7	23	44	85	1		6	6	235	404	497	30.3	5	10	54	2
4	40449	7	24	54	83	0		6	6	184	354	451	30.3	5	10	54	2
4	40449	7	27	14	77	0		11	11	202	485	574	30.3	5	10	54	2
4	40449	7	28	24	47	0		18	18	170	606	693	30.3	5	10	54	2
4	40449	7	31	54	132	0		12	12	269	608	701	30.3	5	10	54	2
4	40449	7	33	4	130	0		15	15	265	729	828	30.3	5	10	54	2
4	40449	7	34	14	67	0		12	12	186	520	639	30.3	5	10	54	2
4	40449	7	35	23	93	0		7	7	263	418	501	30.3	5	10	54	2
4	40449	7	36	33	61	1		8	8	198	400	487	30.3	5	10	54	2
4	40449	7	37	43	120	0		6	6	234	410	497	30.3	5	10	54	2
4	40449	7	38	53	176	0		10	10	283	562	659	30.3	5	10	54	2
4	40449	7	41	13	114	0		7	7	229	416	520	30.3	5	10	54	2
4	40449	7	47	2	73	0		10	10	176	471	564	30.3	5	10	54	2
4	40449	7	48	12	69	0		5	5	188	336	445	30.3	5	10	54	2
4	40449	7	52	52	122	0		6	6	200	338	459	30.3	5	10	54	2
4	40449	7	57	31	85	0		9	9	198	490	598	30.3	5	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
4	40449	8	2	16	77	0		12	12	186	459	556	30.3	5	10	54	2
5	40948	6	29	26	83	0	1	1	2	158	214	330	30.4	15	10	54	2
5	40948	6	31	46	138	0	2	1	3	255	364	572	30.3	15	10	54	2
5	40948	6	34	6	166	0	4	0	4	280	353	481	30.4	15	10	54	2
5	40948	6	37	35	101	0	2	1	3	196	241	346	30.3	15	10	54	2
5	40948	6	38	45	132	0	1	1	2	225	227	370	30.3	15	10	54	2
5	40948	6	43	25	126	0	1	2	3	261	277	426	30.3	15	10	54	2
5	40948	6	44	35	124	0	2	2	4	240	310	461	30.3	15	10	54	2
5	40948	6	45	45	122	0	2	0	2	166	208	340	30.3	15	10	54	2
5	40948	6	52	44	114	0	2	0	2	217	263	377	30.3	15	10	54	2
5	40948	6	58	34	132	0	3	2	5	233	311	457	30.3	15	10	54	2
5	40948	7	0	59	95	0	2	1	3	182	233	370	30.3	15	10	54	2
5	40948	7	4	29	122	0	1	1	2	237	291	420	30.3	15	10	54	2
5	40948	7	9	9	146	0	2	0	2	174	279	402	30.3	15	10	54	2
5	40948	7	11	29	112	0	1	2	3	217	223	422	30.3	15	10	54	2
5	40948	7	12	39	170	0	2	0	2	278	327	457	30.3	15	10	54	2
5	40948	7	14	58	138	0	2	2	4	237	303	437	30.3	15	10	54	2
5	40948	7	16	8	136	0	1	5	6	188	389	481	30.3	15	10	54	2
5	40948	7	17	18	134	0	2	1	3	258	281	437	30.3	15	10	54	2
5	40948	7	19	38	130	0	2	0	2	221	264	420	30.3	15	10	54	2
5	40948	7	20	48	99	0	2	1	3	220	276	437	30.3	15	10	54	2
5	40948	7	21	58	128	0	2	1	3	250	305	479	30.3	15	10	54	2
5	40948	7	23	8	126	0	2	1	3	215	242	392	30.3	15	10	54	2
5	40948	7	25	27	122	0	4	1	5	188	279	420	30.3	15	10	54	2
5	40948	7	26	37	120	0	1	1	2	194	251	386	30.3	15	10	54	2
5	40948	7	27	47	118	0	1	1	2	264	275	424	30.3	15	10	54	2
5	40948	7	28	57	116	0	2	2	4	228	295	418	30.3	15	10	54	2
5	40948	7	35	56	130	0	2	0	2	236	278	402	30.3	15	10	54	2
5	40948	7	37	6	128	1	4	0	4	248	292	443	30.3	15	10	54	2
5	40948	7	38	16	126	0	4	1	5	206	348	481	30.3	15	10	54	2
5	40948	7	39	26	124	0	2	0	2	215	262	403	30.3	15	10	54	2
5	40948	7	41	46	118	0	2	0	2	215	239	374	30.3	15	10	54	2
5	40948	7	44	5	142	0	5	3	8	247	363	477	30.3	15	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
5	40948	7	48	45	132	1	2	2	4	183	297	464	30.3	15	10	54	2
5	40948	7	49	55	130	1	7	4	11	231	406	554	30.3	15	10	54	2
5	40948	7	51	5	128	0	2	4	6	208	309	424	30.3	15	10	54	2
5	40948	7	55	44	120	0	5	0	5	220	317	447	30.3	15	10	54	2
5	40948	8	0	29	110	0	2	0	2	214	214	388	30.2	15	10	54	2
5	40948	8	1	39	138	0	2	1	3	238	285	396	30.2	15	10	54	2
5	40948	8	2	49	138	0	3	2	5	210	318	471	30.2	15	10	54	2
5	40948	8	3	59	136	0	3	1	4	241	315	545	30.2	15	10	54	2
5	40948	8	5	9	134	0	3	0	3	203	259	385	30.2	15	10	54	2
5	40948	8	6	19	132	0	4	1	5	220	330	475	30.2	15	10	54	2
5	40948	8	7	29	130	0	2	1	3	180	248	389	30.2	15	10	54	2
5	40948	8	8	39	130	0	4	2	6	233	301	498	30.2	15	10	54	2
5	40948	8	9	49	128	0	2	1	3	235	275	407	30.2	15	10	54	2
5	40948	8	12	8	124	1	1	2	3	233	324	435	30.2	15	10	54	2
5	40948	8	13	18	124	1	2	2	4	169	281	427	30.2	15	10	54	2
5	40948	8	14	28	122	0	2	2	4	226	294	402	30.2	15	10	54	2
5	40948	8	15	38	118	0	3	2	5	214	291	423	30.3	15	10	54	2
5	40948	8	16	48	118	0	1	1	2	206	244	392	30.2	15	10	54	2
5	40948	8	17	58	116	0	3	2	5	199	282	422	30.2	15	10	54	2
5	40948	8	19	8	113	0	3	1	4	205	271	398	30.2	15	10	54	2
5	40948	8	20	18	142	0	3	1	4	236	329	469	30.2	15	10	54	2
5	40948	8	21	27	140	0	1	1	2	256	265	417	30.2	15	10	54	2
5	40948	8	23	47	134	0	1	1	2	192	233	376	30.2	15	10	54	2
5	40948	8	24	57	132	0	3	0	3	229	352	505	30.2	15	10	54	2
5	40948	8	26	7	130	0	2	1	3	242	291	469	30.2	15	10	54	2
5	40948	8	27	17	128	0	4	3	7	203	350	495	30.2	15	10	54	2
5	40948	8	28	27	126	0	2	2	4	184	286	406	30.2	15	10	54	2
5	40948	8	29	37	124	0	3	0	3	253	327	475	30.2	15	10	54	2
5	40948	8	30	47	122	0	4	2	6	249	309	453	30.2	15	10	54	2
5	40948	8	33	6	118	0	2	0	2	241	257	404	30.2	15	10	54	2
5	40948	8	34	17	116	0	4	2	6	172	287	393	30.2	15	10	54	2
5	40948	8	35	26	114	1	2	0	2	170	190	326	30.2	15	10	54	2
5	40948	8	37	46	138	0	4	1	5	254	322	451	30.2	15	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
5	40948	8	38	56	136	0	1	1	2	235	243	402	30.2	15	10	54	2
5	40948	8	40	6	134	0	2	2	4	194	272	396	30.2	15	10	54	2
5	40948	8	41	15	132	0	6	4	10	246	334	519	30.2	15	10	54	2
5	40948	8	42	25	130	0	3	8	11	227	484	588	30.2	15	10	54	2
5	40948	8	43	35	128	0	2	1	3	208	257	402	30.2	15	10	54	2
5	40948	8	44	45	124	0	4	2	6	184	338	479	30.2	15	10	54	2
5	40948	8	45	55	122	0	1	1	2	228	253	366	30.2	15	10	54	2
5	40948	8	48	14	118	0	2	1	3	197	257	394	30.2	15	10	54	2
5	40948	8	50	34	112	0	1	2	3	170	222	334	30.2	15	10	54	2
5	40948	8	52	54	138	1	2	1	3	227	283	414	30.2	15	10	54	2
5	40948	8	54	4	136	1	1	1	2	225	238	370	30.2	15	10	54	2
5	40948	8	57	33	128	0	3	2	5	211	324	449	30.2	15	10	54	2
5	40948	8	58	43	124	0	3	1	4	192	297	422	30.2	15	10	54	2
5	40949	6	53	53	130	1	3	1	4	239	361	511	30.3	15	10	54	2
5	40949	7	25	25	132	0	3	1	4	211	305	449	30.4	15	10	54	2
5	40949	7	38	14	116	0	1	3	4	186	299	386	30.3	15	10	54	2
5	40949	7	42	53	136	0	4	0	4	218	307	437	30.3	15	10	54	2
5	40949	7	45	13	101	0	3	1	4	200	287	449	30.3	15	10	54	2
5	40949	7	48	43	126	0	3	2	5	209	254	418	30.3	15	10	54	2
5	40949	7	51	2	122	1	4	2	6	221	293	437	30.3	15	10	54	2
5	40949	7	52	12	120	0	2	2	4	217	294	429	30.3	15	10	54	2
5	40949	7	53	22	118	0	2	2	4	192	280	410	30.3	15	10	54	2
5	40949	7	58	2	140	0	3	2	5	253	331	483	30.3	15	10	54	2
5	40949	7	59	12	138	0	3	4	7	270	371	513	30.2	15	10	54	2
5	40949	8	6	17	124	0	3	2	5	230	334	508	30.2	15	10	54	2
5	40949	8	7	27	122	0	2	2	4	243	301	445	30.3	15	10	54	2
5	40949	8	9	47	120	0	3	4	7	190	301	469	30.3	15	10	54	2
5	40949	8	12	7	114	1	1	4	5	206	299	420	30.3	15	10	54	2
5	40949	8	16	46	108	0	4	0	4	206	336	473	30.3	15	10	54	2
5	40949	8	19	6	134	0	3	1	4	234	273	422	30.3	15	10	54	2
5	40949	8	20	16	132	0	3	2	5	245	313	435	30.3	15	10	54	2
5	40949	8	21	26	130	0	2	2	4	204	269	465	30.3	15	10	54	2
5	40949	8	26	5	122	0	4	4	8	223	338	463	30.3	15	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
5	40949	8	27	15	120	0	2	2	4	200	285	426	30.3	15	10	54	2
5	40949	8	28	25	116	1	2	2	4	236	342	477	30.4	15	10	54	2
5	41453	6	58	58	42	0	3	2	5	70	95	145	9.9	15	10	54	2
5	41453	7	15	18	42	0	2	4	6	74	114	156	10.0	15	10	54	2
5	41453	7	26	59	40	0	3	4	7	79	112	144	10.0	15	10	54	2
5	41453	7	29	18	46	0	4	2	6	74	110	152	10.1	15	10	54	2
5	41453	7	35	7	40	1	4	2	6	68	98	140	9.9	15	10	54	2
5	41453	7	44	27	33	1	4	2	6	51	75	118	10.0	15	10	54	2
5	41453	7	46	47	40	1	4	4	8	66	118	157	10.0	15	10	54	2
5	41453	7	47	57	35	2	3	4	7	60	94	125	10.0	15	10	54	2
5	41453	7	50	17	41	1	2	5	7	75	152	182	10.0	15	10	54	2
5	41453	7	56	7	49	0	4	4	8	85	117	154	10.0	15	10	54	2
5	41453	7	58	28	39	0	4	4	8	65	104	153	10.0	15	10	54	2
5	41453	7	59	37	51	0	4	3	7	90	129	170	10.0	15	10	54	2
5	41453	8	0	48	46	0	4	3	7	72	106	150	10.0	15	10	54	2
5	41453	8	1	57	41	0	6	2	8	82	113	157	10.0	15	10	54	2
5	41453	8	6	38	38	1	4	3	7	73	111	150	10.0	15	10	54	2
5	41453	8	13	37	56	2	3	6	9	97	172	210	10.0	15	10	54	2
5	41453	8	20	37	27	0	4	2	6	61	92	142	10.0	15	10	54	2
5	41453	8	22	58	34	0	8	6	14	64	171	206	10.0	15	10	54	2
5	41453	8	24	8	45	0	4	8	12	82	160	193	10.0	15	10	54	2
5	41453	8	28	47	57	0	4	2	6	87	130	166	10.1	15	10	54	2
5	41453	8	38	7	29	1	4	2	6	67	101	147	9.9	15	10	54	2
5	41453	8	49	47	45	0	2	4	6	70	112	145	9.9	15	10	54	2
5	41453	8	50	57	41	0	3	4	7	77	104	155	9.9	15	10	54	2
5	41453	8	55	37	37	0	2	4	6	62	113	152	9.9	15	10	54	2
5	41453	8	59	7	38	0	2	4	6	81	113	142	9.9	15	10	54	2
5	41453	9	29	27	52	1	2	3	5	91	110	145	10.0	15	10	54	2
5	41456	6	49	39	28	0	5	2	7	50	95	140	10.0	15	10	54	2
5	41456	6	57	49	11	0	4	2	6	33	79	122	10.0	15	10	54	2
5	41456	7	5	59	56	0	4	1	5	96	120	163	9.9	15	10	54	2
5	41456	7	11	49	31	1	1	5	6	60	120	156	9.9	15	10	54	2
5	41456	7	26	59	31	0	1	4	5	66	93	130	10.0	15	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
5	41456	7	28	9	10	1	4	5	9	37	111	143	10.0	15	10	54	2
5	41456	7	32	49	16	0	2	3	5	44	84	123	10.1	15	10	54	2
5	41456	7	39	49	18	0	4	3	7	54	88	128	10.1	15	10	54	2
5	41456	7	42	9	8	2	4	7	11	34	95	125	10.0	15	10	54	2
5	41456	7	45	38	8	1	2	5	7	29	80	120	10.0	15	10	54	2
5	41456	7	46	48	20	1	1	5	6	60	93	140	10.1	15	10	54	2
5	41456	7	47	58	14	0	3	6	9	53	104	143	9.9	15	10	54	2
5	41456	7	49	8	9	1	3	5	8	35	79	115	10.0	15	10	54	2
5	41456	7	51	28	15	1	4	3	7	56	99	140	9.9	15	10	54	2
5	41456	7	53	48	20	1	7	3	10	49	94	132	10.1	15	10	54	2
5	41456	7	56	8	10	0	2	5	7	46	96	130	10.1	15	10	54	2
5	41456	7	57	18	5	1	5	0	5	35	69	115	10.2	15	10	54	2
5	41456	7	58	28	16	1	5	5	10	40	100	140	10.1	15	10	54	2
5	41456	7	59	38	10	0	4	5	9	51	102	134	10.0	15	10	54	2
5	41456	8	1	58	16	0	4	3	7	49	81	124	9.9	15	10	54	2
5	41456	8	11	18	23	0	2	6	8	56	115	153	9.9	15	10	54	2
5	41456	8	12	28	34	0	5	4	9	69	114	155	9.9	15	10	54	2
5	41456	8	17	8	45	1	5	2	7	73	100	147	9.9	15	10	54	2
5	41456	8	19	28	18	3	2	3	5	61	83	119	9.8	15	10	54	2
5	41456	8	20	38	-3	0	4	3	7	31	55	101	10.0	15	10	54	2
5	41456	8	27	38	16	0	3	3	6	54	90	123	10.0	15	10	54	2
5	41456	8	31	9	9	1	3	7	10	46	95	129	10.0	15	10	54	2
5	41456	8	32	19	19	0	3	2	5	61	108	158	9.9	15	10	54	2
5	41456	8	38	9	12	1	4	4	8	41	97	145	9.8	15	10	54	2
5	41456	8	41	39	14	0	4	4	8	50	88	126	9.8	15	10	54	2
5	41456	8	42	49	9	2	5	8	13	67	133	168	9.9	15	10	54	2
5	41456	8	45	9	15	0	4	3	7	50	78	134	9.9	15	10	54	2
5	41456	8	47	29	6	1	4	5	9	47	75	120	10.0	15	10	54	2
5	41456	8	49	49	61	1	4	1	5	87	113	162	9.9	15	10	54	2
5	41456	8	50	59	8	0	5	2	7	48	86	131	10.0	15	10	54	2
5	41456	8	53	19	15	0	3	3	6	46	76	121	10.0	15	10	54	2
5	41456	8	54	29	11	0	3	7	10	41	110	143	9.9	15	10	54	2
5	41456	8	56	49	17	0	3	7	10	47	132	169	10.0	15	10	54	2

Intersection	Date	Hour	Minute	Second	FrameGreen	InCross	InBox	InLane	InQueue	FrameFirstBikeFirstLine	FrameLastBikeFirstLine	FrameLastBikeClear	FPS	Width1	Width2	CXWidth	Grade
5	41456	8	57	59	13	0	4	2	6	45	70	116	10.0	15	10	54	2
5	41456	9	0	19	19	0	3	2	5	59	89	129	9.8	15	10	54	2
5	41456	9	3	49	21	0	3	3	6	50	90	136	9.9	15	10	54	2
5	41456	9	6	9	11	0	1	6	7	51	111	155	9.9	15	10	54	2
5	41456	9	55	9	73	0	1	5	6	116	165	208	9.9	15	10	54	2