Proposed Commercial Development
Cranston, Rhode Island

Trolley Barn Plaza

July 2021
Revised November 2021

TRAFFIC IMPACT STUDY

BETA
701 George Washington Hwy
Lincoln, Rhode Island 02865
401.333.2382
www.BETA-Inc.com

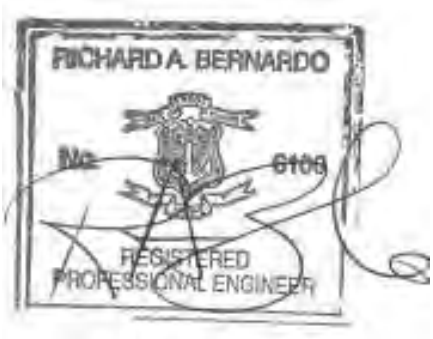
Trolley Barn Plaza
Cranston, Rhode Island

TRAFFIC IMPACT STUDY

Prepared by: BETA GROUP, INC.

Prepared for: Mr. Neil Ellis
Trolley Barn Associates, LLC
c/o First Hartford Realty Corp.
P.O. Box 1270
Manchester, Connecticut 06045

July 2021
Revised November 2021



July 30, 2021
Revised November 10, 2021

Mr. Neil Ellis
Trolley Barn Associates, LLC
c/o First Hartford Realty Corp.
P.O. Box 1270
Manchester, CT 06045

Re: Proposed Commercial Development
Trolley Barn Plaza
777 Cranston Street, Cranston, Rhode Island

Dear Mr. Ellis:

BETA Group, Inc., has completed a report update to our original July 2021 Traffic Impact Study in order to address review comments received from the City of Cranston and City of Providence as part of the Master Plan review process. Specifically, this updated report expands the project area and review periods to provide a comprehensive study of the immediate project area in order to define and address potential project related impacts. The proposed redevelopment project reviewed for this study is located on the northerly side of Cranston Street opposite of Garfield Avenue. The parcel is defined by Assessor's Plat 7, Lot 1, which contains approximately 6.91 acres of vacant, grassed land.

Based upon information provided by your office, and a review of the current site plan prepared by *DiPrete Engineering,* it is our understanding that the existing vacant lot known as the site of the former Trolley Barn building will be redeveloped to include an automobile parts sales facility, a convenience market/gas station, a fast-food restaurant with a drive-through, and a bank. The main site access is proposed at the signalized intersection of Cranston Street with Garfield Avenue that will be modified to create a four-way junction. Secondary access to the site is proposed at two new turn restricted driveways on Cranston Street east and west of the main access.

The study included herein, was conducted to determine the adequacy of the existing servicing roadways to accommodate anticipated traffic to be generated by the commercial redevelopment project. An analysis of potential impacts to the roadway capacity and safety has been completed and is discussed in the following report.

Very truly yours,
BETA Group, Inc.

Paul J. Bannon
Associate

BETA GROUP, INC.
701 George Washington Highway, Lincoln, RI 02865
P: 401.333.2382 | F: 401.333.9225 | W: www.BETA-Inc.com

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The objective of the following study is to assess the potential traffic impacts associated with a proposed commercial redevelopment project in the City of Cranston, Rhode Island. The subject property is situated on a parcel of land on the northerly side of Cranston Street immediately west of the Route 10 and Amtrak rail corridor. Refer to the Figure 1, Project Vicinity Map, on the following page for the project location within the city.

The development proposal consists of the construction of four separate buildings containing a 5,500 square foot convenience market/gasoline station with 16 vehicle fueling positions, a 2,500 square foot building to accommodate a fast-food restaurant with a drive-through window, a 4,000 square foot building for a bank branch with a single drive-through lane, and a 35,000 square foot building to accommodate an automobile parts retail store. Parking for the convenience store/gasoline station (28), restaurant (33), bank (33), and automobile parts store (90) will be provided adjacent to each building yielding a total of 184 parking spaces. Main access/egress will be provided at the signalized intersection of Cranston Street with Garfield Avenue that will modified to create a four-way junction. It should be noted that the traffic signal was designed and installed to include the proposed site access driveway at this location. In addition, secondary access to the plaza will be provided at two locations including a right turn in/out only driveway and a right turn out only driveway approximately 200 feet east and 150 feet west of the main access, respectively.

The study summarized herein focused on both traffic flow efficiency and safety along Cranston Street in the immediate vicinity of the subject property, and at the proposed driveways. The impacts associated with the site related traffic have been defined and evaluated in accordance with standard traffic engineering guidelines and procedures.

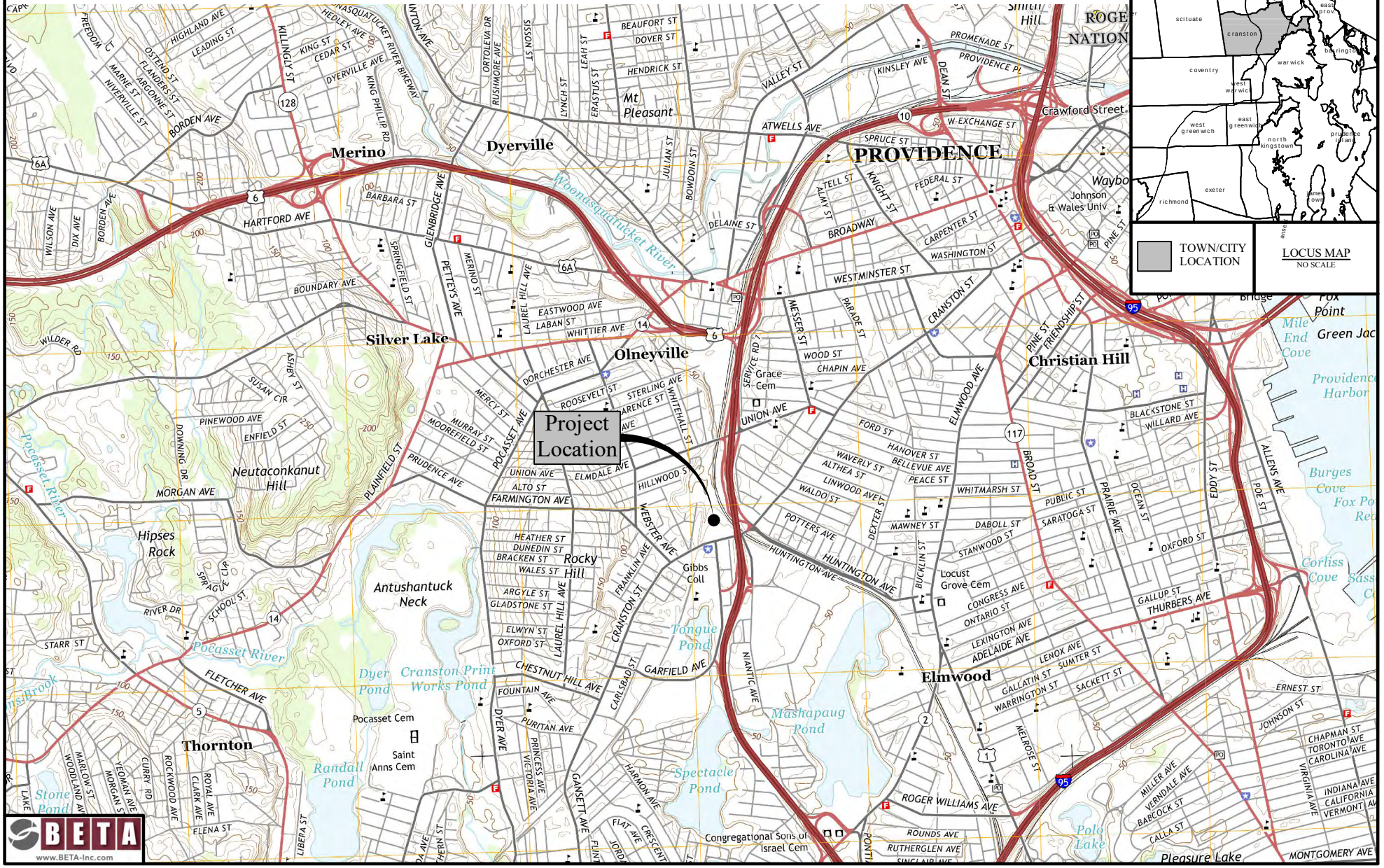
The traffic engineering study completed for this project included the following:

- A traffic counting program to define the existing traffic patterns and operational characteristics along the servicing roadways including Cranston Street and Garfield Avenue and review of historical counts from a previous study completed in the vicinity of the project area. The data collection included manual turning movement counts (TMCs) at the Cranston Street intersections with Webster Avenue, Garfield Avenue, Niantic Avenue, and Huntington Avenue.
- An inventory of the physical roadway characteristics of Cranston Street and Garfield Avenue in the project area to determine the adequacy of the existing roadway geometric features in reference to safety and operations.
- An analysis of crash records obtained from the Cranston and Providence Police Departments to determine if there are any safety concerns relative to the frequency, severity, or pattern of crashes in the project area.

Proposed Commercial Development

CRANSTON, RHODE ISLAND

Figure 1 - Project Vicinity Map



BETA
www.BETA-Inc.com

- An estimate of future traffic volumes for the proposed commercial development was calculated using data from the "Trip Generation" Manual, an informational report published by the Institute of Transportation Engineers (ITE).
- Evaluation and analysis of the traffic safety and operational issues for existing and future traffic conditions.
- Development of recommendations where necessary, that would be required to maintain safe and efficient traffic flow in the project area.

2.0 PROJECT AREA

As noted in the previous section, the subject property is situated on the northerly side of Cranston Street between Niantic Avenue and Lincoln Avenue. The site had previously contained the former Trolley Barn Building that had been vacant for some time, and which was razed over 15 years ago. Figure 2 on the following page depicts the general project area, and the boundary lines of the subject property.

Land use in the immediate area can be described as a mixture of commercial and high-density residential properties along Cranston Street and high-density residential properties off of intersecting side streets. Immediately abutting the property to the north and west are an industrial business, *ABC Supply Co.,* and residential properties, respectively. To the east is the Amtrak railroad and the Route 10 highway corridors. Along the southerly side of Cranston Street opposite the site, are residential properties and the Cranston Police Station.

Cranston Street will serve as the primary access route to the redeveloped property. Based upon the operating characteristics along the servicing roadways, and the estimated volume and type of traffic associated with the commercial development, a study impact area was defined for the project. The limits of our analysis included Cranston Street between Webster Avenue to the west and Huntington Avenue to the east with focus on the Cranston Street intersections with Webster Avenue, Garfield Avenue, Niantic Avenue, Huntington Avenue, and the site driveways.

3.0 EXISTING CONDITIONS

3.1 ROADWAYS

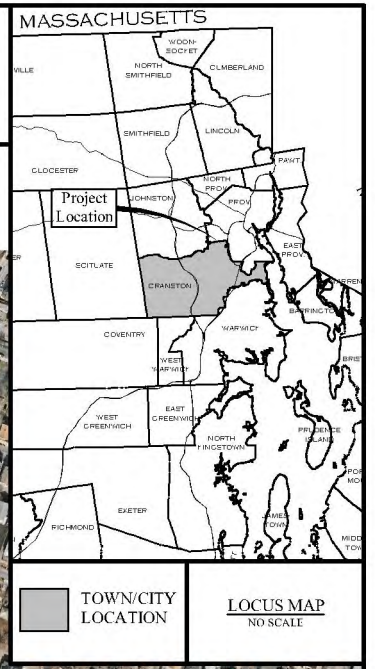
Cranston Street

Cranston Street is a primary north/south urban minor arterial through Cranston, extending from its southerly terminus at Haven Avenue to its northerly terminus in downtown Providence at its junction with Westminster Street, just west of the Route 95 corridor through the city. In the project area the roadway runs generally east/west, and for analysis purposes will be referenced as such in this study. It provides immediate local access to abutting properties but also links to higher order facilities including the Route 10 interchange to the east. In the project area, Cranston Street is approximately 56 feet wide consisting

Proposed Commercial Development

CRANSTON, RHODE ISLAND

Figure 2 - Project Area Map



BETA
www.BETA-Inc.com

of two 11-foot travel lanes and 1-foot shoulder in the eastbound direction, and three 11-foot lanes in the westbound direction including a separate left turn lane to Garfield Avenue.

Granite curbing with cement concrete sidewalks is provided on both sides of the road. Cobra-head light fixtures on utility pole are located along the corridor for nighttime illumination. The speed limit is posted at 25 mph in the vicinity of the site. In addition, the Rhode Island Public Transit Authority (RIPTA) provides both inbound and outbound bus service along this section of Cranston Street designated as Bus Route 30 with a bus stop located along the property frontage including a bus shelter along the southerly side of Cranston Street west of Garfield Avenue. The adjacent photograph depicts the typical characteristics of Cranston Street looking east with the subject property on the left.

Garfield Avenue

Garfield Avenue is classified as an urban collector road extending from Carolina Street in the south to Cranston Street in the north. It provides immediate local access to abutting properties but also links to higher order facilities including Route 10 to the east. The roadway was constructed in the late 1990's as part of the *Brewery Parkade* shopping center development linking these two roadways through the former Narragansett Brewery property.

In the project area, Garfield Avenue is approximately 50 feet wide consisting of two 12-foot travel lanes and 1-foot shoulder in each direction. Granite curbing is provided along both sides of the road, and off-set concrete sidewalks are provided on both sides of the road with the exception of a short section on the easterly side between W. Harry Street and the Stop & Shop driveway. The adjacent photograph depicts these features of Garfield Avenue looking north to Cranston Street in the vicinity of the Cranston Police Department facility.

The pavement condition can be classified as being in fair condition with visible joint cracking. Lighting is provided on ornamental light poles for night-time visibility along the roadway. The speed is posted at 25 mph in the project area. In addition, RIPTA Bus Route 31 runs along Garfield Avenue to Cranston Street and then northerly to the Kennedy Plaza downtown bus station.

Niantic Avenue

Niantic Avenue is classified as a minor arterial that runs generally north/south and parallels Route 10 to the east, extending from Reservoir Avenue (Route 2) to the south and Cranston Street to the north. The roadway is variable in width, but generally a two-lane road along its length. It provides direct access to a mixture of land uses including residential properties, a recreational park, and the industrial park. The city boundaries of Providence and Cranston run along the roadway.

Granite curbing and a combination of bituminous and cement concrete sidewalks are provided for its entire length on the easterly side of the road, while sidewalks are sporadic on the westerly side. The pavement can be classified as being in fair condition with visible alligator cracking and minor rutting. The speed limit is posted at 25 mph to the immediate south of the project area. On-street parking is prohibited on the easterly side with the applicable signed restrictions. In addition, cobra head lighting along the westerly side of the road is provided sporadically on utility poles for night-time visibility along the roadway. The above photograph depicts Niantic Avenue looking north to Cranston Street.

3.2 INTERSECTIONS

Cranston Street at Webster Avenue

Webster Avenue intersects Cranston Street to form a 3-Way, signalized "T" type intersection. The Cranston Street eastbound approach to the intersection provides a separate left turn lane and a through travel lane. The Cranston Street westbound approach provides a through travel lane and a separate right turn lane. The Webster Avenue southbound approach provides a single shared lane.

The traffic signal system appears to be in good operating condition. The layout of the equipment consists of mast arm mounted vehicle signal heads with in-road loop detection. The vehicle signal heads for both the Cranston eastbound and westbound approaches were recently upgraded to include new signal heads with backplates and reflective borders. A combination of mast arm pole and pedestal pole mounted pedestrian signal heads with pedestrian push buttons including decorative (brick pattern and color) crosswalks with curb ramps are provided on all legs of the intersection. It was also determined that some

of the pushbuttons appear to be ADA compliant as the city recently added new pedestrian signal heads with pushbuttons for the east leg crosswalk. In addition, the curb ramps were determined to not be ADA compliant. The adjacent aerial depicts the typical characteristics of the intersection

The intersection was determined to operate in a fully actuated mode consisting of two phases. Cranston Street eastbound and westbound movements are serviced under a single permitted phase. Webster Avenue is serviced under the second phase.

Cranston Street at Garfield Avenue

Garfield Avenue intersects Cranston Street to form a 3-Way, signalized "T" type intersection. The Cranston Street eastbound approach to the intersection provides a through lane and a shared through/right turn lane. The Cranston Street westbound approach provides a separate left turn lane and two through lanes. The Garfield Avenue northbound approach provides separate left and right turn lanes.

The traffic signal system appears to be in good operating condition. The layout of the equipment consists of ornamental mast arm mounted vehicle signal heads with in-road vehicle loop detection. It is important to note that an ornamental mast arm with inactive signal heads is provided for the subject site on the southwest corner of the intersection to accommodate future access to this property.

In addition, bracket mounted pedestrian signal heads on the mast arm poles with pedestrian push buttons including marked crosswalks with curb ramps are provided on all legs of the intersection with the exception of the eastern leg of the intersection. It was also determined that the pushbuttons and curb ramps are ADA compliant. The adjacent aerial depicts the typical characteristics of the intersection.

The intersection was determined to operate in a fully actuated mode consisting of three phases and is coordinated with the adjacent traffic signals to the east. Cranston Street movements are serviced in two phases including an advanced protected/permitted westbound left, followed by through/right concurrent movements. Garfield Avenue is serviced under the third phase. Pedestrians are serviced concurrently in Phase 2 and 3 with the appropriate vehicle phase.

Cranston Street at Niantic Avenue

Niantic Avenue intersects Cranston Street to form a 3-Way, signalized "T" type intersection. The Cranston Street eastbound approach to the intersection provides a through travel lane and a separate right turn lane. The Cranston Street westbound approach provides a shared left turn/through lane and a through travel lane. The Niantic Avenue northbound approach provides a single shared lane.

The traffic signal system appears to be in good operating condition. The layout of the equipment consists of ornamental mast arm mounted vehicle signal heads with vehicle video detection. A combination of mast arm pole and pedestal pole mounted pedestrian signal heads with pedestrian push buttons including marked crosswalks with curb ramps are provided on all legs of the intersection with the exception of the westbound approach. It was also determined that the pushbuttons and curb ramps are not ADA compliant. The adjacent aerial depicts the typical characteristics of the intersection including the Route 10 overpass.

The intersection was determined to operate in a fully actuated mode consisting of two phases and is coordinated with the adjacent signals to the east and west. Cranston Street eastbound and westbound movements are serviced under a single permitted phase and Niantic Avenue is serviced under the second phase each with concurrent pedestrian phasing.

Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

Huntington Avenue and the Route 10 northbound on-ramp intersect Cranston Street to form a 4-Way, signalized intersection. The Cranston Street eastbound approach provides a separate left turn lane and a shared thru/right turn lane with a channelized right turn. The Cranston Street westbound approach provides a separate left turn lane and a shared thru/right turn lane. The Huntington Avenue northbound approach provides a separate left turn lane, a thru lane to Route 10 NB on-ramp, and a separate right turn lane. The Huntington Avenue southbound approach provides a separate left turn lane, a thru lane, and a shared thru/right turn lane with a channelized right turn. Marked crosswalks with curb ramps, which most

appear to not be ADA compliant, are provided across all approaches to the intersection including at both channelized right turns. The adjacent aerial depicts the typical characteristics of the intersection.

The traffic signal system appears to be in good operating condition. The layout of the equipment consists of ornamental mast arm mounted vehicle signal heads with in-road loop detection. A combination of mast arm pole and pedestal pole mounted pedestrian signal heads with pedestrian push buttons including marked crosswalks with curb ramps are provided on all legs of the intersection. It was also determined that the pushbuttons and most of the curb ramps are not ADA compliant.

The intersection was determined to operate in a fully actuated mode consisting of four phases and is coordinated with the adjacent signals to the west. Cranston Street eastbound and westbound movements are serviced in two phases including an advanced protected eastbound and westbound left turns, followed by eastbound and westbound concurrent movements. The last two phases services Huntington Avenue including an advanced protected northbound and southbound left turns, followed by northbound and southbound concurrent movements.

3.3 Traffic Flow Data

Existing traffic flow characteristics for this area were developed from a traffic counting program conducted by BETA and review of historical data available from previous studies completed in the immediate area. The data collection originally included Manual Turning Movement Counts (TMC) at the signalized intersections of Cranston Street with Garfield Avenue and with Niantic Avenue during the weekday morning and afternoon peak periods between 7 to 9 AM and 4 to 6 PM, respectively, in June 2021. The project limits were expanded to include manual TMC's at the Cranston Street intersections with Webster Avenue and Huntington Avenue in October 2021. In addition to the weekday morning and afternoon peak periods, TMCs were collected during a Saturday midday peak hour between 11 AM and 1 PM in October 2021 at all of the study intersections. Record turning movement counts at the Cranston Street study intersections with Garfield Avenue, Niantic Avenue, and Huntington Avenue were also obtained from a previous study completed in the project area in August 2015 and were reviewed for consistency with the updated data.

It is important to note that although COVID-19-related restrictions have been lifted in Rhode Island since the end of May 2021, the traffic data specifically collected as part of this study was compared to record data to ensure volumes are fully representative of typical traffic conditions experienced along Cranston Street. As such, the June 2021 and October 2021 TMC data was reviewed against the August 2015 TMC

data during the morning and afternoon peak periods to determine the variation in traffic volumes along Cranston Street. Based on a comparison of the TMC data at the Cranston Street study intersections with Garfield Avenue, Niantic Avenue, and Huntington Avenue the traffic volume data collected in June 2021 and in October 2021 as part of this study generally had higher overall existing traffic volumes at the study intersections. Therefore, for this study the traffic data collected in June 2021 and October 2021 has been utilized as a basis of analysis. Reviewing RIDOT seasonal adjustment factors for urban arterials, October 2021 represents a higher-than-average period and June 2021 represents a lower-than-average period, though comparing the October 2021 and June 2021 traffic volumes along the Cranston Street study corridor, the June 2021 traffic volumes were slightly higher compared to the traffic volumes collected in October 2021, and therefore, to be conservative, traffic volumes adjustments were made to the base volumes to reflect the higher June 2021 traffic data obtained for this project.

The turning movement count data collected for this project, which was adjusted for a balanced network traffic volumes along the Cranston Street study corridor, found that Cranston Street along the property frontage services approximately 1,755 vehicles during the weekday morning peak hour between 7:30 and 8:30 AM with approximately 935 vehicles eastbound and 820 vehicles westbound. During this same period, Garfield Avenue services approximately 925 vehicles with 425 vehicles northbound and 500 vehicles southbound. During the weekday afternoon peak hour between 4:30 and 5:30 PM, Cranston Street was found to service 2,180 vehicles with approximately 935 vehicles eastbound and 1,245 vehicles westbound. During this same period, Garfield Avenue services approximately 1,115 vehicles with 355 vehicles northbound and 540 vehicles southbound. Reviewing the weekend period, on a Saturday midday the peak hour was determined to be between 12:00 and 1:00 PM, where Cranston Street was found to service 2,000 vehicles with approximately 955 vehicles eastbound and 1,045 vehicles westbound. During this same period, Garfield Avenue services approximately 1,070 vehicles with 530 vehicles northbound and 540 vehicles southbound. Figure 3 on the following page depicts the daily peak hour turning movement volumes at the study intersections. Complete count information can be found in the Appendix.

4.0 Safety Analysis

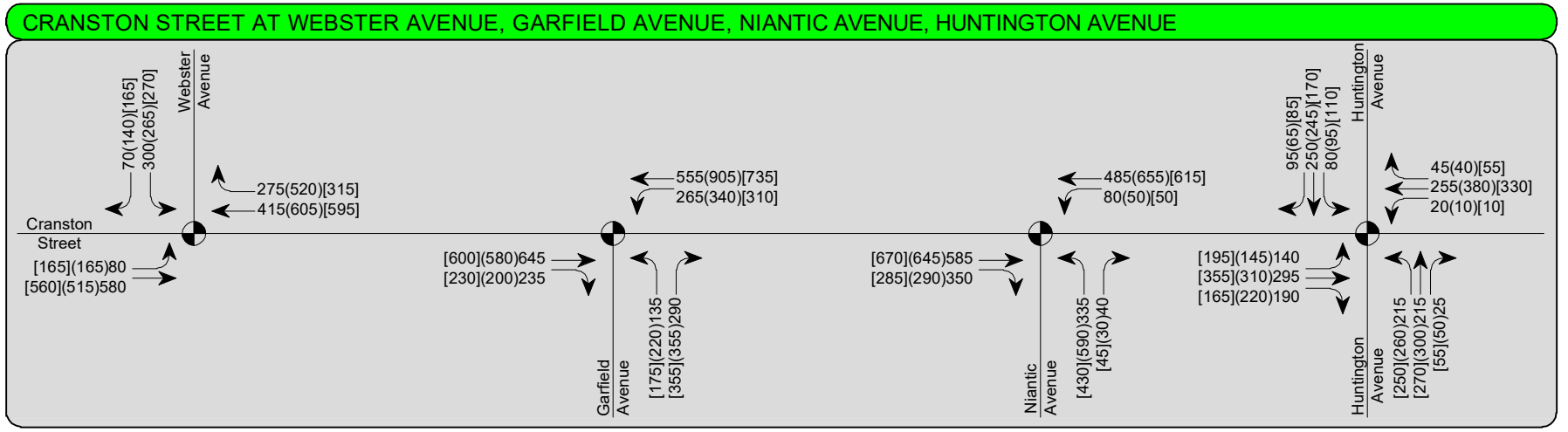
To determine if there are any limiting factors affecting safety relating to access to the proposed commercial project, the physical characteristics of Cranston Street were investigated. These limiting factors would potentially include horizontal or vertical alignment changes or roadside obstructions that limit sight distances for vehicles traveling along the road or entering the road from a side street or driveway location. In this instance, the sight distance standard is necessary to permit turning vehicles to safely enter and exit the site driveways.

The vertical and horizontal alignment of Cranston Street in the project area can be described as relatively level and straight, respectively along the subject property frontage, with a gradual horizontal curve east and west of the site. Based upon the existing roadway geometry as described, the available sight distance at the proposed right in/out site driveway location on Cranston Street was determined to be greater than 350 feet through the signalized junction with Niantic Avenue to the east. In addition, the available sight distance at the proposed right out only site driveway location on Cranston Street was determined to be greater than 500 feet through the signalized junction with Garfield Avenue to the east. These values are

Proposed Commercial Development

CRANSTON, RHODE ISLAND

Figure 3 - Existing Traffic Volumes



LEGEND:

- TURN LANE
- XXX WEEKDAY AM PEAK VOLUMES (7:30 AM TO 8:30 AM)
- (XXX) WEEKDAY PM PEAK VOLUMES (4:30 PM TO 5:30 PM)
- [XXX] SATURDAY MD PEAK VOLUMES (12:00 PM TO 1:00 PM)
- STUDY INTERSECTION
- TRAFFIC SIGNAL

BETA
www.BETA-Inc.com

greater than AASHTO's recommended minimum sight distance of 155 feet based on the posted speed limit of 25 mph and are sufficient for speeds in excess of 40 mph. It should be noted that speeds are highly variable due to the signal-controlled Garfield Avenue and Niantic Avenue junctions, where vehicles are turning onto Cranston Street at a low speed or slowing to the stop line at both traffic signals.

As a result of the preliminary evaluation of the existing roadway geometry and physical features, it does not appear that any significant physical roadway safety deficiencies exist within the defined study area. Also, as part of our analysis, a review of crash statistics was completed. Data was reviewed from the Cities of Cranston and Providence Police Departments for the latest three-year period available from January 2018 to December 2020 to determine if any location in the project area experienced a high frequency or pattern of crashes. It is important to note that although the site is within the City of Cranston, the border with the City of Providence is just east of the subject site that runs along Niantic Avenue. A summary of the crash data is depicted in Table 1 below, indicating the type and severity of the crashes that occurred within the study period.

TABLE 1 – Crash Data Summary

	INTERSECTIONS		CORRIDORS
	Cranston Street at Garfield Avenue	Cranston Street at Niantic Avenue	Cranston Street Lincoln Avenue to Niantic Avenue
Collision Type			
Rear-End	23	15	0
Angle	2	7	0
Sideswipe, Same Direction	4	7	2
Collision w/ Object	1	0	0
Other	0	1	1
Unknown	1	0	0
Crash Severity			
Property	28	26	3
Injury	3	4	0
TOTAL CRASHES	31	30	3

As can be seen in the table, a total of 64 crashes (avg. 21 per year) occurred in the project area over the three-year study period, with seven involving injuries. Summarizing the data, thirty-one of the crashes with three involving injuries occurred at the signalized intersection of Cranston Street with Garfield Avenue; thirty of the crashes with four involving injuries occurred at the signalized intersection of Cranston Street and Niantic Avenue; and three of the crashes with no reported injuries occurred along the segment of Cranston Street between Lincoln Avenue and Niantic Avenue.

All of the rear-end crashes occurred at both signalized study intersections, which is typical of signalized junctions due to the numerous starting and stopping movements required for the signal change intervals.

The angle crashes at both signalized study intersections can be attributed to a few factors, including running a red light, not yielding the right of way, and roadway conditions. The sideswipe collisions at the signalized intersection of Cranston Street with Garfield Avenue are attributed to vehicles attempting to drive around turning vehicles. In addition, the majority of the sideswipe collisions at the signalized intersection of Cranston Street with Niantic Avenue involved an eastbound vehicle going straight through the intersection on the right turn only lane and colliding with an eastbound through vehicle on the adjacent lane. Note that Cranston Street eastbound approach provides two travel lanes where the outside (right) lane transitions to a right turn only lane at the intersection with Niantic Avenue and the through lane at this intersection becomes a left turn only lane at the downstream intersection with the Route 10 NB On-Ramp/Huntington Avenue. Due to the travel lane configuration and the close proximity of the signalized intersections of Cranston Street with Garfield Avenue, Niantic Avenue, and with the Route 10 NB On-Ramp/Huntington Avenue to each other, vehicles, especially motorist not familiar with this area, get caught in the unintended travel lane resulting in prohibited maneuver or lane shifting through the junctions.

Based upon the historical crash data obtained from the local police, and a review of existing roadway geometry and operations, several roadway or traffic related safety enhancements could be investigated to improve safety within the project area. The city could review the following safety enhancements at the intersection of Cranston Street with Garfield Avenue:

1. The clearance intervals to determine if they require adjustment in an effort to reduce the number of rear-end collisions.
2. Addition of reflectorized yellow strips around the edge of the existing signal head backplates to enhance traffic signal visibility.
3. Addition of supplemental lane control signs along the Cranston Street eastbound travel lanes between Garfield Avenue and Niantic Avenue to emphasize the changing lane control when travelling east into Providence.

5.0 Impact Analysis

5.1 Trip Generation

To determine the traffic impact of a proposed development, estimates of anticipated traffic to be generated by a particular land use must be calculated. As previously discussed, the redevelopment proposal, *Trolley Barn Plaza*, consists of the construction of four separate buildings with three fronting Cranston Street; a 2,500 square foot building for a fast-food restaurant with drive-through, a 5,500 square foot building for a convenience store/gas station with 16 vehicle fueling positions; a 4,000 square foot building for a bank branch with a single drive-through lane; and a 35,000 square foot building for a large automobile parts sales store situated at the rear of the property. The larger retail auto parts store will allow the business to stock a much more diverse supply of vehicle parts that are not regularly kept in the smaller stores that stock the most commonly needed items for customers. This will allow quick distribution of items purchased by customers at other local stores, instead of having the purchased item shipped from out of state warehouse facilities that may take several days for delivery.

Main access/egress will be provided at the signalized intersection of Cranston Street with Garfield Avenue that will be modified to create a four-way junction. In addition, secondary access will be provided from a right turn in/out only driveway and a right turn out only driveway approximately 200 feet east and 150 feet west of the main access, respectively. Figure 4 on the following page depicts the site layout and access plan provided by *DiPrete Engineering.*

For this development, estimated traffic volumes for the commercial project were based on operational data obtained from the automobile parts store business component of the proposed land development project, and the use of trip generation factors. These factors are taken from the "Trip Generation" manual, an informational report published by the Institute of Transportation Engineers (ITE), a national professional organization for traffic and transportation engineers. The data provided in the ITE report are based on extensive traffic studies for various types of land uses (residential, commercial, industrial, etc.). This data has been found to be very reliable and provides a sound basis for estimating future trips to new development projects. For the proposed commercial project, Land Use Code 843 Automobile Parts Sales, Land Use Code 912 Drive-in Bank, Land Use Code 934 Fast-Food Restaurant with Drive-Through Window, and Land Use Code 960 Super Convenience Market/Gas Station were reviewed for applicability in developing an estimate of site related vehicles trips.

In addition to using the ITE data, estimated traffic volumes for the automobile parts supply element was based on operational data provided by the owner. As noted, the proposed automobile parts facility consists of the retail sales business for individual customers to come in and purchase automobile parts typical of their smaller stores but will also provide additional storage of automobile parts (not typically stocked in smaller stores) for order and delivery to the area local stores and regular customers such as vehicle service garages that commonly order parts. Based upon the operational data provided by the owner, the automobile parts supply component may have approximately ten delivery vans on site that will exit and enter the business multiple times per day for delivery of sold automobile parts to other stores and local automobile service customers. Delivery of sold items will vary over the course of the day, though the majority is anticipated to be more than one hour to multiple sites combined into a single trip.

The appropriate worksheets from the manual are included in the Appendix, along with the trip estimate calculations. Table 2 on Page 16 summarizes the estimated trip volumes calculated for this project for the weekday morning and afternoon, Saturday midday peak traffic conditions. It is important to note that the compatibility of uses, where a single site trip is generated for the multiple uses being proposed, is referred to as "internal-capture" where a driver would potentially visit two or more of the proposed uses within a development. Consequently, these internal trips capture would allow reduction of the total trips generated by a multiple use development.

Proposed Commercial Development

CRANSTON, RHODE ISLAND

Figure 4 - Site Layout

Site Plan provided by DiPrete Engineering

TABLE 2 – Trip Generation Estimate

	Description	Enter	Exit	Total
Weekday AM Peak Hour				
ITE Land Use Code 843	Automobile Parts Sales	12	9	21
Independent Study	Automobile Parts Supply	0	10	10
ITE Land Use Code 912	Drive-in Bank	23	16	39
ITE Land Use Code 934	Fast-Food Restaurant with Drive-Through Window	50	50	100
ITE Land Use Code 960	Super Convenience Market/Gas Station	170	170	340
	Total	255	255	510
Weekday PM Peak Hour				
ITE Land Use Code 843	Automobile Parts Sales	20	20	40
Independent Study	Automobile Parts Supply	10	0	10
ITE Land Use Code 912	Drive-in Bank	41	41	82
ITE Land Use Code 934	Fast-Food Restaurant with Drive-Through Window	44	39	83
ITE Land Use Code 960	Super Convenience Market/Gas Station	165	165	330
	Total	280	265	545
Saturday MD Peak Hour				
ITE Land Use Code 843	Automobile Parts Sales	47	46	93
Independent Study	Automobile Parts Supply	5	5	10
ITE Land Use Code 912	Drive-in Bank	53	52	105
ITE Land Use Code 934	Fast-Food Restaurant with Drive-Through Window	70	67	137
ITE Land Use Code 960	Super Convenience Market/Gas Station	150	150	300
	Total	325	320	645

In addition, to the internal capture potential, it is estimated that between 40% and 60% of trips generated by the proposed convenience store/gasoline station and fast-food restaurant will not be new to the servicing roadways. The ITE manual provides information on what is referred to as "pass-by" trips, or those trips associated with the site that are already on the servicing roadways and turn into and out of a business and continue to their destination. Therefore, these pass-by vehicles would not be "added" to the adjacent servicing roadway but would be diverted vehicles in to and out of the new development. However, to be conservative, no reduction for pass-by or internal-capture trips were considered in our analysis.

5.2 FUTURE TRAFFIC VOLUMES

In order to properly assess the impacts of a development, future traffic conditions of area roadways should be estimated for the period when the development is constructed and fully occupied. Typically, the expansion of base traffic is calculated when a project is to be constructed over an extended period (+3 to 5 years). In all instances, area growth that may affect capacity results should be considered. The traffic growth estimate was based on comparison of current traffic volumes to historical traffic volumes in the project area, which has seen a minor increase, and review of historical population trend in the City of Cranston and the adjacent City of Providence which has seen little to no growth in the past 10 years.

For this project, a conservative annual growth rate of 1.0 percent was utilized. This rate was applied to the existing volumes to establish a future 2024 No-Build traffic condition on the servicing roadways. The proposed commercial project was then added to the No-Build condition to establish the future 2024 Build traffic condition. Figure 5 on the following page depicts the estimated future build traffic volumes at the study intersections. Site distribution figures are also provided in the Appendix for reference.

In addition, the City of Cranston was contacted to determine if there are potential future developments in the vicinity of the area that may impact future traffic volumes along the servicing roadways. In coordination with the city, it was determined that no new developments affecting traffic in this highly developed area are currently under review or planned. The base one percent growth rate utilized in the study represents a conservative increase to base traffic.

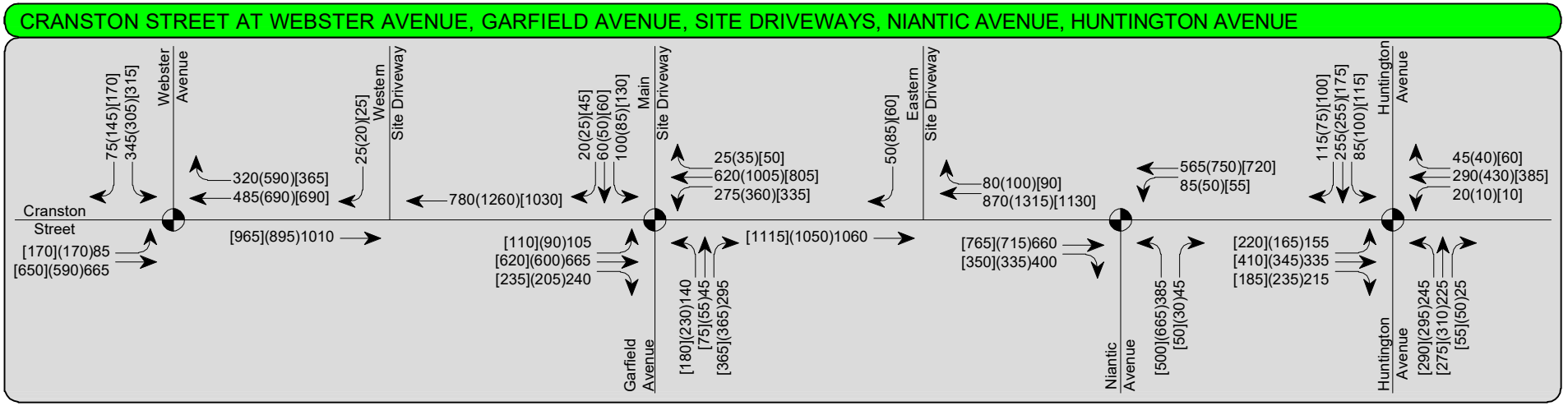
In developing the intersection volumes to be analyzed under build conditions, a directional distribution of the site traffic was estimated. The distribution was based on current traffic patterns along Cranston Street determined from the count data. For the automobile parts store and bank components of the proposed development, it is estimated that 40% of the site traffic will arrive from and depart to the east, 40% will arrive from and depart to the west, and 20% will arrive from and depart to the south during the weekday morning and afternoon peak hours. For the convenience store/gasoline station and fast-food restaurant with drive-through window components of the proposed development; during the weekday morning peak hour, it is estimated that 40% of the site traffic will arrive from the east with 25% departing to the west and 15% departing to south, 40% will arrive from the west with 30% departing to the east and 10% departing to the south, and 20% will arrive from the south with 15% departing to the east and 5% departing to the west. During the weekday afternoon peak hour, it is estimated that 50% of the site traffic will arrive from the east with 35% departing to the west and 15% departing to south, 30% will arrive from the west with 20% departing to the east and 10% departing to the south, and 20% will arrive from the south with 10% departing to the east and 10% departing to the west.

For the automobile parts store and bank components of the proposed development, it is estimated that 45% of the site traffic will arrive from and depart to the east, 35% will arrive from and depart to the west, and 20% will arrive from and depart to the south during the Saturday midday peak hour. For the convenience store/gasoline station and fast-food restaurant with drive-through window components of the proposed development it is estimated that 45% of the site traffic will arrive from the east with 30% departing to the west and 15% departing to south, 35% will arrive from the west with 25% departing to

Proposed Commercial Development

CRANSTON, RHODE ISLAND

Figure 5 - Future Traffic Volumes



LEGEND:

- TURN LANE
- XXX WEEKDAY AM PEAK VOLUMES (7:30 AM TO 8:30 AM)
- (XXX) WEEKDAY PM PEAK VOLUMES (4:30 PM TO 5:30 PM)
- [XXX] SATURDAY MD PEAK VOLUMES (12:00 PM TO 1:00 PM)
- STUDY INTERSECTION
- TRAFFIC SIGNAL

BETA
www.BETA-Inc.com

the east and 10% departing to the south, and 20% will arrive from the south with 15% departing to the east and 5% departing to the west during the Saturday midday peak hour.

5.3 Operational Analysis

The key to any traffic impact analysis is the evaluation of roadway operations during peak traffic periods on the servicing roadway system. This situation would occur when the site-generated traffic, combined with the traffic volumes on the main roadway, result in the highest one-hour volume serviced along a roadway segment, or through an intersection. Review of record traffic data found that the weekday AM and PM, and Saturday MD peak hours would represent this worst-case combination of site-generated traffic with the servicing roadway peak traffic period.

The Cranston Street intersections with Webster Avenue, Garfield Avenue, Niantic Avenue, and with Huntington Avenue were studied for the existing and future weekday morning and afternoon, and Saturday midday peak hours. A field review of the existing traffic operations found that generally under existing traffic conditions, through traffic movements along the project area roadways operate in an efficient manner during the weekday AM and PM, and Saturday MD peak periods. Only during the weekday PM and Saturday peak periods at two intersections on Cranston Street (Niantic Avenue and Huntington Avenue), extended delays and brief congestions can occur for the critical movements. This congestion is typically a result of intersection blocking due to the short distance between intersections in Providence, and vehicles not clearing the intersection on the assigned phase. When this does occur, it takes several efficient cycles to revert to average approach queues. This could potentially be mitigated through proper signing and striping relative to instructing vehicles to stay out of the intersection (do not block the box) with potential fines. Field reviews of Garfield Avenue including its signalized intersections with Cranston Street and the Route 10 Southbound Off-Ramp found that the junctions operate efficiently during the daily peak traffic conditions.

To document these operations and delays observed in the field, a capacity analysis for the signalized study intersections was completed. The Highway Capacity Manual methodology provides the most accurate means of evaluating traffic capacity and delays for roadways and intersections. The results of this procedure are expressed in terms of Level of Service (LOS). Level of Service is a qualitative measure of traffic flow efficiency based on anticipated vehicle delays. For example, LOS “A” represents the best condition with little or no delay, while LOS “F” indicates that the roadway/intersection is at full capacity resulting in extended vehicle delays and potential queuing. Table 3 outlines the Level of Service delay criteria presented in the Highway Capacity Manual for signalized and unsignalized intersections.

TABLE 3 – Highway Capacity Manual Criteria

Level of Service	Unsignalized Delay Per Vehicle (sec)	Signalized Delay Per Vehicle (sec)
A	<10	<10
B	>10 and <15	>10 and <20
C	>15 and <25	>20 and <35
D	>25 and <35	>35 and <55
E	>35 and <50	>55 and <80
F	>50	>80

The capacity analysis worksheets are included in the Appendix and Tables 4 through 6 summarize the results of the analyses using HCM delay output results utilizing the Syncrho software program. Table 4 depicts the current conditions at the study intersections. As can be seen in the table, the Cranston Street signalized intersections with Webster Avenue, Garfield Avenue, and Niantic Avenue operate overall at Level of Service (LOS) C or better during the weekday AM and PM, and Saturday MD peak hours with critical movements experiencing LOS D or better. The signalized intersection of Cranston Street with Huntington Avenue operates overall at an acceptable LOS C during the PM peak hour, though experiences greater delays overall at LOS E during the weekday AM and Saturday MD Peak hours. All critical movements at this intersection experiences LOS D or better with the exception of the Huntington Avenue northbound left turn movement where it experiences LOS F during the weekday AM and Saturday MD peak hours and LOE E during the weekday PM peak hour, and the Huntington Avenue southbound left turn movement at LOS E.

Table 5 represents the future design period taking into consideration base traffic growth as noted earlier along the servicing roadways. The subject development is not included in this "No-Build" analysis scenario. As can be seen, the signalized intersection of Cranston Street with Garfield Avenue continues to operate overall at a good LOS B or better during the morning and afternoon peak traffic conditions. Similar to existing conditions, the signalized intersections of Cranston Street with Webster Avenue, Garfield Avenue, and Niantic Avenue will continue to operate overall at Level of Service (LOS) C or better during the weekday AM and PM, and Saturday MD peak hours with critical movements experiencing LOS D or better. In addition, the signalized intersection of Cranston Street with Huntington Avenue will continue to operate at an acceptable manner at LOS D during the weekday PM peak hour and will continue to operate with greater delays overall at LOS E during the weekday AM and Saturday MD peak hours. All critical movements at this intersection will continue to operate at LOS D or better with the exception of the Huntington northbound and southbound left turn movements where it will operate with greater delays similar to existing conditions.

TABLE 4 – Level of Service Summary (Existing Conditions)

Location / Movement	2021 EXISTING CONDITIONS								
	AM Peak Hour			PM Peak Hour			Sat. MD Peak Hour		
	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)
Cranston Street at Webster Avenue									
Cranston Street EB Left	A	7.6	2	B	15.6	5	C	22.1	6
Cranston Street EB Thru	B	12.9	12	A	9.5	8	B	11.4	9
Cranston Street WB Thru	A	9.2	8	B	11.2	10	B	12.3	10
Cranston Street WB Right	A	7.3	2	A	7.7	2	A	7.7	2
Webster Avenue SB	B	13.8	8	B	16.9	11	B	17.6	13
OVERALL	B	11.1	-	B	11.3	-	B	13.3	-
Cranston Street at Garfield Avenue									
Cranston Street EB	B	19.1	10	C	20.8	9	C	22.6	9
Cranston Street WB Left	D	39.1	11	D	37.0	11	D	35.1	13
Cranston Street WB Thru	A	4.6	4	A	5.4	7	A	5.8	6
Garfield Avenue NB Left	D	40.1	5	D	38.3	7	D	40.4	6
Garfield Avenue NB Right	D	35.1	3	C	28.4	3	C	33.7	3
OVERALL	C	21.3	-	C	20.1	-	C	22.0	-
Cranston Street at Niantic Avenue									
Cranston Street EB Thru	B	11.3	18	C	21.0	15	B	15.3	20
Cranston Street EB Right	B	19.4	6	C	22.7	1	C	22.2	5
Cranston Street WB	B	11.7	6	C	29.6	9	B	18.5	6
Niantic Avenue NB	D	41.1	12	C	31.4	23	D	43.1	16
OVERALL	B	18.9	-	C	26.7	-	C	23.5	-
Cranston Street at Huntington Avenue									
Cranston Street EB Left	C	33.0	4	C	33.3	7	C	33.2	5
Cranston Street EB Thru/Right	B	17.4	10	B	19.0	5	B	13.7	19
Cranston Street WB Left	D	45.2	2	D	43.6	1	D	51.1	1
Cranston Street WB Thru/Right	C	23.8	10	D	40.6	15	C	32.9	19
Huntington Avenue NB Left	F	261.9	13	E	66.3	11	F	366.3	15
Huntington Avenue NB Thru	C	34.5	8	C	29.8	10	D	40.5	9
Huntington Avenue NB Right	C	28.8	1	C	22.6	1	C	28.7	1
Huntington Avenue SB Left	D	51.9	4	D	37.0	4	E	57.8	6
Huntington Avenue SB Thru/Right	C	33.4	5	C	29.0	4	C	30.6	3
OVERALL	E	55.5	-	C	34.0	-	E	70.7	-

(S) – Signalized
(U) – Unsignalized

TABLE 5 – Level of Service Summary (Future No-Build Conditions)

Location / Movement	FUTURE 2024 NO-BUILD CONDITIONS								
	AM Peak Hour			PM Peak Hour			Sat. MD Peak Hour		
	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)
Cranston Street at Webster Avenue									
Cranston Street EB Left	A	7.9	2	C	20.6	6	C	31.3	7
Cranston Street EB Thru	B	13.6	12	A	9.9	8	B	11.9	10
Cranston Street WB Thru	A	9.6	8	B	11.9	11	B	13.1	11
Cranston Street WB Right	A	7.5	2	A	7.9	2	A	7.9	2
Webster Avenue SB	B	14.6	8	B	18.0	12	B	18.8	13
OVERALL	B	11.6	-	B	12.3	-	B	14.6	-
Cranston Street at Garfield Avenue									
Cranston Street EB	B	19.9	10	C	21.6	10	C	23.3	9
Cranston Street WB Left	D	38.2	12	D	38.1	11	C	34.4	14
Cranston Street WB Thru	A	4.6	5	A	5.6	7	A	5.6	6
Garfield Avenue NB Left	D	40.4	6	D	38.8	8	D	40.7	6
Garfield Avenue NB Right	D	35.0	3	C	28.2	3	C	33.6	3
OVERALL	C	21.5	-	C	20.6	-	C	22.1	-
Cranston Street at Niantic Avenue									
Cranston Street EB Thru	B	11.8	18	C	20.8	16	B	16.9	20
Cranston Street EB Right	C	20.0	6	C	21.4	1	C	26.4	5
Cranston Street WB	B	12.8	6	C	29.4	5	B	19.0	7
Niantic Avenue NB	D	42.2	12	D	36.7	24	D	43.4	17
OVERALL	B	19.8	-	C	27.9	-	C	24.9	-
Cranston Street at Huntington Avenue									
Cranston Street EB Left	C	33.6	4	C	34.5	7	D	35.7	5
Cranston Street EB Thru/Right	B	17.3	17	C	20.2	5	B	13.3	19
Cranston Street WB Left	D	45.2	2	D	43.6	1	D	51.1	1
Cranston Street WB Thru/Right	C	24.8	11	D	45.2	15	D	35.2	19
Huntington Avenue NB Left	F	275.0	13	E	70.4	11	F	396.4	15
Huntington Avenue NB Thru	C	34.7	8	C	30.5	10	D	40.7	9
Huntington Avenue NB Right	C	28.4	1	C	22.6	1	C	28.6	1
Huntington Avenue SB Left	E	55.5	5	D	37.2	4	E	60.3	6
Huntington Avenue SB Thru/Right	C	33.0	5	C	28.9	4	C	30.4	3
OVERALL	E	57.0	-	D	35.9	-	E	75.4	-

Under the future build condition, the signalized intersection of Cranston Street with Garfield Avenue will be modified to include a new southbound approach from the site, in addition to a separate eastbound left turn lane for the proposed commercial development. It is important to note that the city anticipated future development of the subject site and included a mast arm with signal heads for the site driveway when the traffic signal at this intersection was reconstructed back in 2012.

As part of the future build condition analyses which takes into considerations both the base traffic growth along the servicing roadways and volumes generated by the proposed commercial development project, several alternatives at the intersection of Cranston Street with Garfield Avenue/Site Access Driveway were evaluated in reference to signal phasing and timing. As previously noted, the intersection was determined to operate in a fully actuated mode consisting of three phases and is coordinated with the adjacent signals to the east, limiting cycle length options. Cranston Street movements are serviced in two phases including an advanced protected/permitted westbound left, followed by through/right concurrent movements. Garfield Avenue is serviced under the third phase.

The first alternative evaluated included an unsignalized (permitted) Cranston Street eastbound left turn movement into the site, which would be from the proposed exclusive left turn lane, and an addition of a phase (split) for the site southbound movement, which provides a single all-purpose lane. The results of the Future Build Alternative 1 analysis found that the signalized intersection of Cranston Street with Garfield Avenue would operate overall at LOS C, LOS D, and LOS D during the weekday morning and afternoon, Saturday midday peak traffic conditions, respectively, with some critical movements experiencing greater delays.

The second alternative evaluated includes an unsignalized (permitted) Cranston Street eastbound left turn movement into the site, which will be in an exclusive left turn lane, and an advanced protected/permitted Garfield Avenue northbound left, followed by through/right Garfield Avenue northbound and site access driveway southbound concurrent movements. The results of the Future Build Alternative 2 analysis, when compared to Alternative 1, found that the signalized intersection of Cranston Street with Garfield Avenue will operate slightly better overall during the peak traffic conditions.

The third alternative evaluated includes a signalized (protected) Cranston Street eastbound left turn movement into the site from the exclusive left turn lane. This movement would run concurrent with the protected westbound left turn movement, and a new separate phase (split) for the site southbound movement would be added operating separate from Garfield Avenue. The results of the Future Build Alternative 3 analysis found that the signalized intersection of Cranston Street with Garfield Avenue will operate similarly to Alternative 1 and slightly worse when compared to Alternative 2.

The last alternative evaluated, which is the preferred option, is presented in Table 6 on the following page. Under this preferred design, the proposed Cranston Street eastbound left turn movement, which again would be serviced in an exclusive left turn lane and signalized, would operate under a protected phase running concurrent with the Cranston Street westbound left turn similar to Alternative 3. The Garfield Avenue northbound and main site access driveway southbound approach would operate under two phases with an advanced protected/permitted northbound movement from Garfield Avenue followed by concurrent northbound/southbound movements. A conceptual design of the intersection of Cranston

TABLE 6 – Level of Service Summary (Future Build Conditions – Preferred Alternative)

Location / Movement	FUTURE 2024 NO-BUILD CONDITIONS								
	AM Peak Hour			PM Peak Hour			Sat. MD Peak Hour		
	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)
Cranston Street at Webster Avenue [1]									
Cranston Street EB Left	A	8.3	2	D	35.2	7	C	28.7	7
Cranston Street EB Thru	B	16.3	15	B	10.7	10	B	12.3	14
Cranston Street WB Thru	B	10.5	9	B	13.2	12	B	13.3	15
Cranston Street WB Right	A	7.9	2	A	8.3	2	A	8.2	2
Webster Avenue SB	B	17.9	9	C	22.7	13	C	32.7	13
OVERALL	B	13.5	-	B	14.7	-	B	17.3	-
Cranston Street at Garfield Avenue [1]									
Cranston Street EB Left	D	45.8	5	D	43.0	4	D	49.3	5
Cranston Street EB Thru/Right	D	35.8	18	D	48.4	15	D	48.9	17
Cranston Street WB Left	D	46.6	10	D	44.5	11	D	44.5	11
Cranston Street WB Thru/Right	C	21.6	9	C	25.1	11	C	28.4	12
Garfield Avenue NB Left	C	24.8	5	C	26.8	8	C	24.0	7
Garfield Avenue NB Right	C	22.3	2	C	33.6	5	C	20.4	2
Site Driveway SB	D	47.0	7	D	46.1	7	D	52.3	9
OVERALL	C	32.3	-	D	36.1	-	D	37.3	-
Cranston Street at Niantic Avenue [1]									
Cranston Street EB Thru	B	16.5	20	B	18.7	16	C	21.7	21
Cranston Street EB Right	D	42.4	7	C	33.0	2	D	49.1	5
Cranston Street WB	B	17.4	10	C	27.9	10	C	23.1	10
Niantic Avenue NB	D	43.2	15	E	72.6	27	D	48.7	20
OVERALL	C	27.0	-	D	38.2	-	C	32.2	-
Cranston Street at Huntington Avenue [1]									
Cranston Street EB Left	D	38.4	6	D	37.5	6	D	43.7	8
Cranston Street EB Thru/Right	C	21.0	20	B	19.2	19	B	15.5	22
Cranston Street WB Left	E	78.8	2	E	74.4	1	D	52.9	1
Cranston Street WB Thru/Right	C	30.3	11	D	52.6	17	D	47.3	19
Huntington Avenue NB Left	D	44.9	9	D	54.1	12	D	46.2	10
Huntington Avenue NB Thru	C	30.0	8	C	29.7	10	D	39.7	10
Huntington Avenue NB Right	C	25.7	1	C	22.3	1	C	28.3	1
Huntington Avenue SB Left	D	42.4	4	D	44.2	4	D	41.1	5
Huntington Avenue SB Thru/Right	D	38.3	6	C	32.8	5	D	38.1	4
OVERALL	C	32.5	-	D	36.5	-	D	35.7	-

[1] *Optimized Timings*

Street with Garfield Avenue to accommodate the proposed site access driveway forming a four-way junction is provided in the Appendix.

The results of the preferred alternative analysis found that the Cranston Street signalized intersection with Garfield Avenue, which will be modified to form a four-way junction with the site access driveway as previously mentioned, with optimization is estimated to operate overall in an acceptable manner at LOS C, LOS D, and LOS C during the weekday morning and afternoon, Saturday midday peak hours, respectively, with critical movements experiencing LOS D or better. The signalized intersection of Cranston Street with Webster Avenue with optimization is estimated to operate overall at a good LOS B during all three peak hours analyzed with critical movements experiencing LOS D or better.

The signalized intersection of Cranston Street with Niantic Avenue with optimization is estimated to operate overall at LOS C, LOS D, and LOS C during the weekday morning and afternoon, Saturday midday peak hours, respectively, with minor additional delays realized as a result of increase in future traffic demands. The final intersection reviewed which is also located in Providence, the signalized intersection of Cranston Street with Huntington Avenue, with optimization is estimated to operate overall at LOS C, LOS D, and LOS D during the weekday morning and afternoon, Saturday midday peak hours, respectively, with critical movements experiencing LOS E or better.

Periodic review of the Niantic Avenue and Huntington Avenue intersections due to their influence on traffic along the Cranston Street corridor should be completed in the future as traffic growth continues in the general area. These intersections are the critical locations for delays along this segment of Cranston Street and should be evaluated periodically for operational improvements when needed. Potential optimization would include adjusting background cycles for improved coordination, along with phasing and split adjustments to account for the changes in movement volumes during the daily peak hours. Consideration of eliminating the Cranston Street eastbound left in the dedicated left turn lane could also be evaluated as access to northbound Route 10 is available from Niantic Avenue to the south. This movement would be made as a right turn with overlap at Niantic Avenue. The removal of this traffic volume and resultant green time dedicated to this protected phase could potentially improve peak hour operations at this junction and between intersections with Niantic Avenue.

It should be noted that the analysis completed for this project was conservative in base traffic growth and the generation of site related trips where no reduction of internal capture (multi-use trips) and pass-by (from the existing traffic stream) trips were factored into the future condition. If, or when these traffic demands are realized along the servicing roadways in the future, appropriate timing adjustments/optimization can easily be made to improve operations as needed. The signal timing optimization would be coordinated with the local communities of Cranston and Providence and the Rhode Island Department of Transportation (RIDOT) due to the multiple ownership of the signals, if future traffic conditions are realized and warrant consideration for improvements.

Specific to the new unsignalized site driveway intersections with Cranston Street, both will operate efficiently with minimal delays during the peak conditions reviewed in this study due to the estimated low volumes at both site driveways, coupled with the turning restriction to right turn in/out only at the eastern site driveway, and right turn out only at the western site driveway.

6.0 CONCLUSIONS AND RECOMMENDATIONS

In summary, the study has shown that the proposed commercial project access and circulation has been designed to provide a level of traffic safety and efficiency on the servicing roadway system. The safety of the proposed site driveway intersections on Cranston Street were reviewed for geometry and sight distances. The proposed driveway intersections were determined to provide sufficient sight distances in accordance with AASHTO criteria for visibility and decision making of drivers attempting to enter/exit main street traffic from the proposed driveways.

In reference to safety, as previously noted, the following safety enhancements at the signalized intersection of Cranston Street with Garfield Avenue could be implemented as part of the modifications needed to install the site driveway at the junction:

1. Evaluate the clearance intervals to determine if they require adjustment in an effort to reduce the number of rear-end collisions.
2. Install reflectorized yellow strip around the edge of the existing signal head backplates to enhance traffic signal visibility.
3. Install lane drop pavement markings supplemented with installation of lane control signs along the Cranston Street eastbound travel lanes between Garfield Avenue and Niantic Avenue to emphasize the changing lane usage between intersections.

The results of the operational analysis determined that the estimated increase in traffic during the peak periods resulting from the proposed commercial project will have a minor impact on overall traffic operations along Cranston Street in the project area, particularly during the weekday morning, afternoon, and Saturday midday peak hours when the site would service its greatest daily volumes.

In order to accommodate the new development at the signalized intersection, it is recommended that the following modifications be implemented at the Garfield Avenue junction;

1. Restripe the median area of the eastbound approach to provide an exclusive left turn lane for vehicles turning into the site.
2. Replace the existing mast arm on the southeast quadrant in order to install a separate traffic signal head for the eastbound left turn movement.
3. Install an arrow indication for the northbound Garfield Avenue right turn lane signal head for an overlap phase running concurrent with the westbound left turn from Cranston Street. This will help reduce delays on this approach and improve intersection efficiency.

The implementation of these measures will facilitate access and egress to the site without adversely impacting Cranston Street in the immediate project area. Therefore, based upon the data collected on the servicing roadways, the analysis completed as part of this study, along with the access design proposed, the commercial development project was determined to have adequate and safe access to a public street, and will not have an adverse impact on public safety and welfare in the study area.

APPENDIX

A. Traffic Volume Data

B. Traffic Crash Data

C. Trip Generation

D. Operational Analysis

E. Off-Site Improvement Concept Plan

APPENDIX A – Traffic Volume Data

Intersection Turning Movement Count

Cranston Street at Webster Avenue

Cranston Street at Garfield Avenue

Cranston Street at Niantic Avenue

Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

A

Intersection Turning Movement Count

Cranston Street at Webster Avenue

Cranston Street at Garfield Avenue

Cranston Street at Niantic Avenue

Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

Cranston Street at Webster Avenue

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Webster Ave / Cranston St
Weather: Sunny, 60s

File Name : 7578_Webster_Weekday
Site Code : 00757803
Start Date : 10/14/2021
Page No : 1

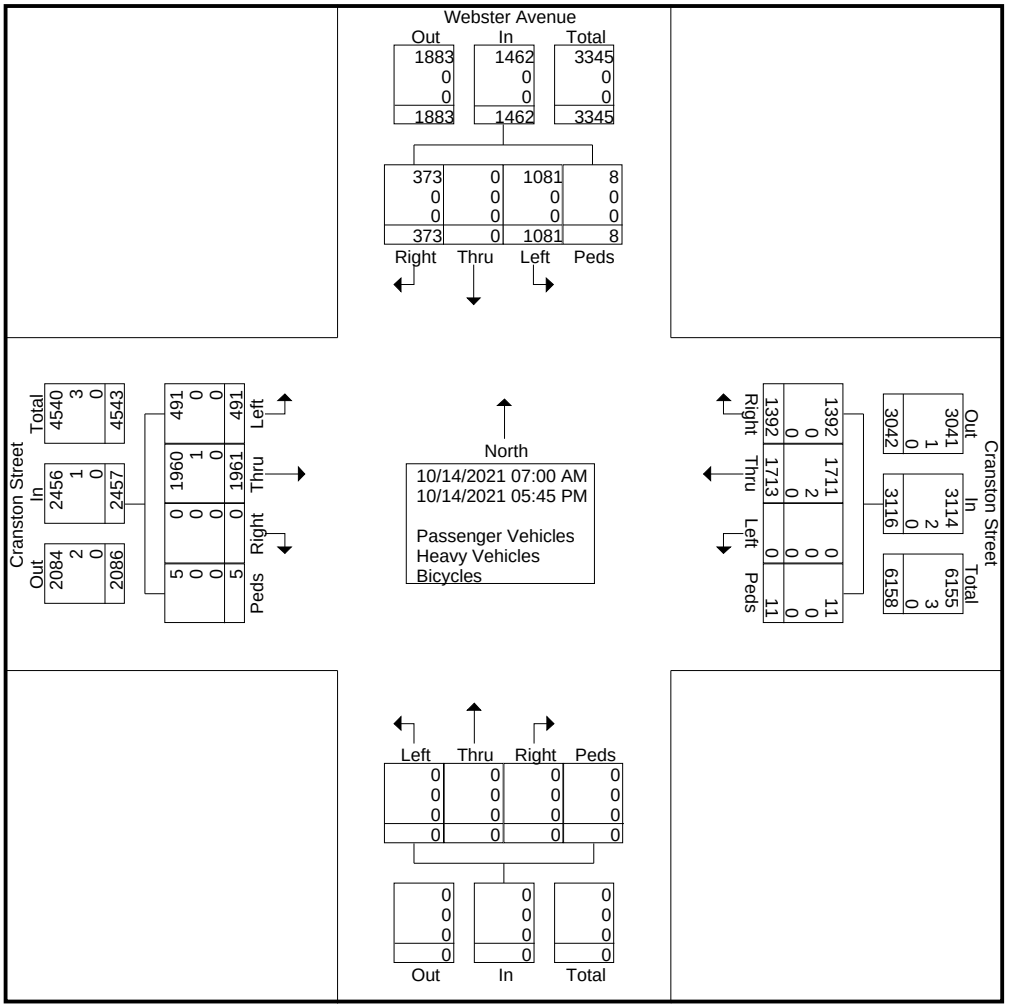
Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

	Webster Avenue Southbound				Cranston Street Westbound				Northbound				Cranston Street Eastbound				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	15	0	60	0	31	57	0	0	0	0	0	0	0	105	12	0	280
07:15 AM	20	0	76	0	58	53	0	0	0	0	0	0	0	121	16	0	344
07:30 AM	20	0	72	0	72	90	0	1	0	0	0	0	0	129	17	0	401
07:45 AM	18	0	82	0	60	106	0	0	0	0	0	0	0	134	24	0	424
Total	73	0	290	0	221	306	0	1	0	0	0	0	0	489	69	0	1449
08:00 AM	16	0	71	0	66	81	0	1	0	0	0	0	0	123	16	0	374
08:15 AM	13	0	55	1	59	104	0	1	0	0	0	0	0	148	21	0	402
08:30 AM	18	0	62	2	58	85	0	1	0	0	0	0	0	108	29	0	363
08:45 AM	14	0	71	1	65	80	0	2	0	0	0	0	0	109	17	1	360
Total	61	0	259	4	248	350	0	5	0	0	0	0	0	488	83	1	1499
*** BREAK ***																	
04:00 PM	14	0	77	0	110	133	0	0	0	0	0	0	0	119	45	1	499
04:15 PM	27	0	77	1	103	153	0	0	0	0	0	0	0	144	28	0	533
04:30 PM	26	0	66	0	129	122	0	0	0	0	0	0	0	141	53	0	537
04:45 PM	47	0	63	1	135	131	0	1	0	0	0	0	0	99	34	1	512
Total	114	0	283	2	477	539	0	1	0	0	0	0	0	503	160	2	2081
05:00 PM	38	0	58	0	106	137	0	0	0	0	0	0	0	128	49	0	516
05:15 PM	27	0	61	2	114	138	0	0	0	0	0	0	0	107	47	1	497
05:30 PM	25	0	67	0	133	125	0	2	0	0	0	0	0	118	47	0	517
05:45 PM	35	0	63	0	93	118	0	2	0	0	0	0	0	128	36	1	476
Total	125	0	249	2	446	518	0	4	0	0	0	0	0	481	179	2	2006
Grand Total	373	0	1081	8	1392	1713	0	11	0	0	0	0	0	1961	491	5	7035
Apprch %	25.5	0	73.9	0.5	44.7	55	0	0.4	0	0	0	0	0	79.8	20	0.2	
Total %	5.3	0	15.4	0.1	19.8	24.3	0	0.2	0	0	0	0	0	27.9	7	0.1	
Passenger Vehicles	373	0	1081	8	1392	1711	0	11	0	0	0	0	0	1960	491	5	7032
% Passenger Vehicles	100	0	100	100	100	99.9	0	100	0	0	0	0	0	99.9	100	100	100
Heavy Vehicles	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	3
% Heavy Vehicles	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0.1	0	0	0
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Webster Ave / Cranston St
Weather: Sunny, 60s

File Name : 7578_Webster_Weekday
Site Code : 00757803
Start Date : 10/14/2021

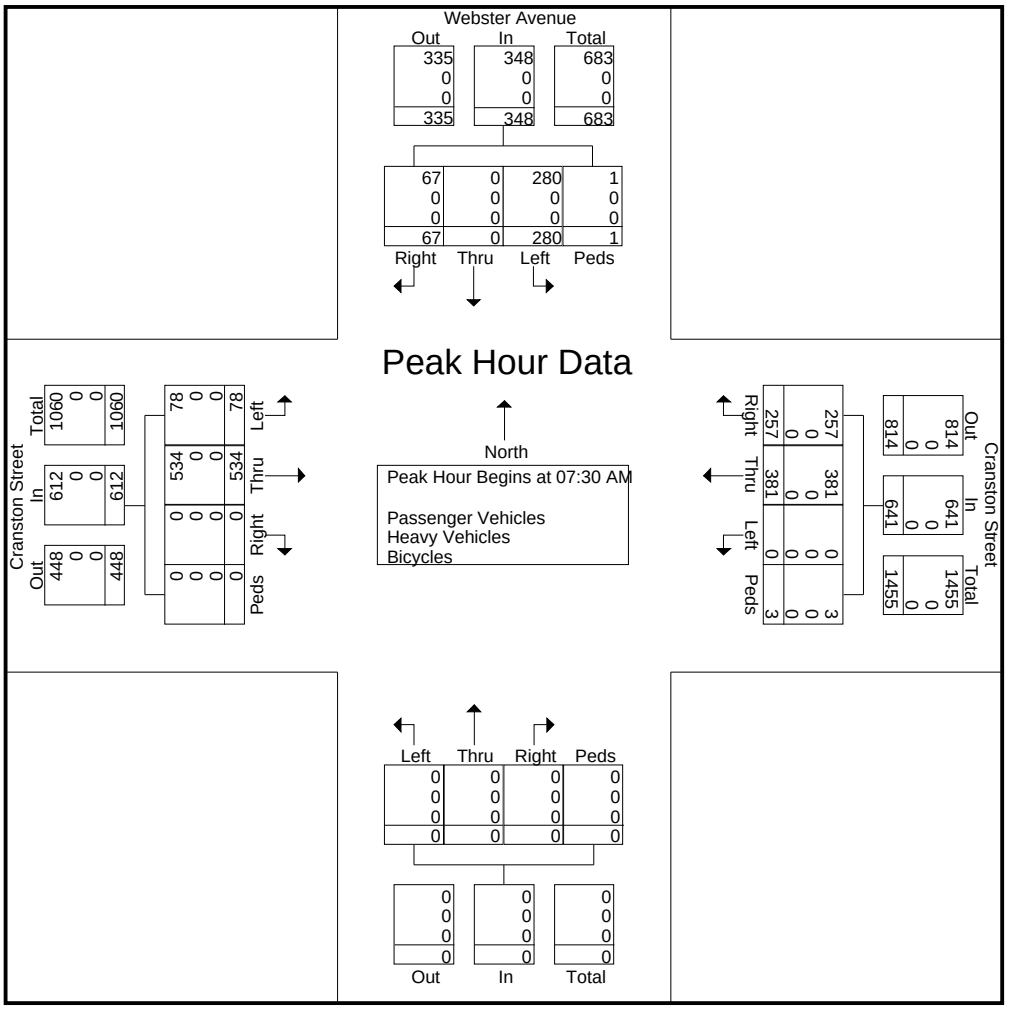


BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Webster Ave / Cranston St
Weather: Sunny, 60s

File Name : 7578_Webster_Weekday
Site Code : 00757803
Start Date : 10/14/2021
Page No : 3

	Webster Avenue Southbound					Cranston Street Westbound					Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	**20**	0	72	0	92	**72**	90	0	**1**	163	0	0	0	0	0	0	129	17	0	146	401
07:45 AM	18	0	**82**	0	**100**	60	**106**	0	0	**166**	0	0	0	0	0	0	134	**24**	0	158	**424**
08:00 AM	16	0	71	0	87	66	81	0	1	148	0	0	0	0	0	0	123	16	0	139	374
08:15 AM	13	0	55	**1**	69	59	104	0	1	164	0	0	0	0	0	0	**148**	21	0	**169**	402
Total Volume	67	0	280	1	348	257	381	0	3	641	0	0	0	0	0	0	534	78	0	612	1601
% App. Total	19.3	0	80.5	0.3		40.1	59.4	0	0.5		0	0	0	0		0	87.3	12.7	0		
PHF	.838	.000	.854	.250	.870	.892	.899	.000	.750	.965	.000	.000	.000	.000	.000	.000	.902	.813	.000	.905	.944
Passenger Vehicles	67	0	280	1	348	257	381	0	3	641	0	0	0	0	0	0	534	78	0	612	1601
% Passenger Vehicles	100	0	100	100	100	100	100	0	100	100	0	0	0	0	0	0	100	100	0	100	100
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



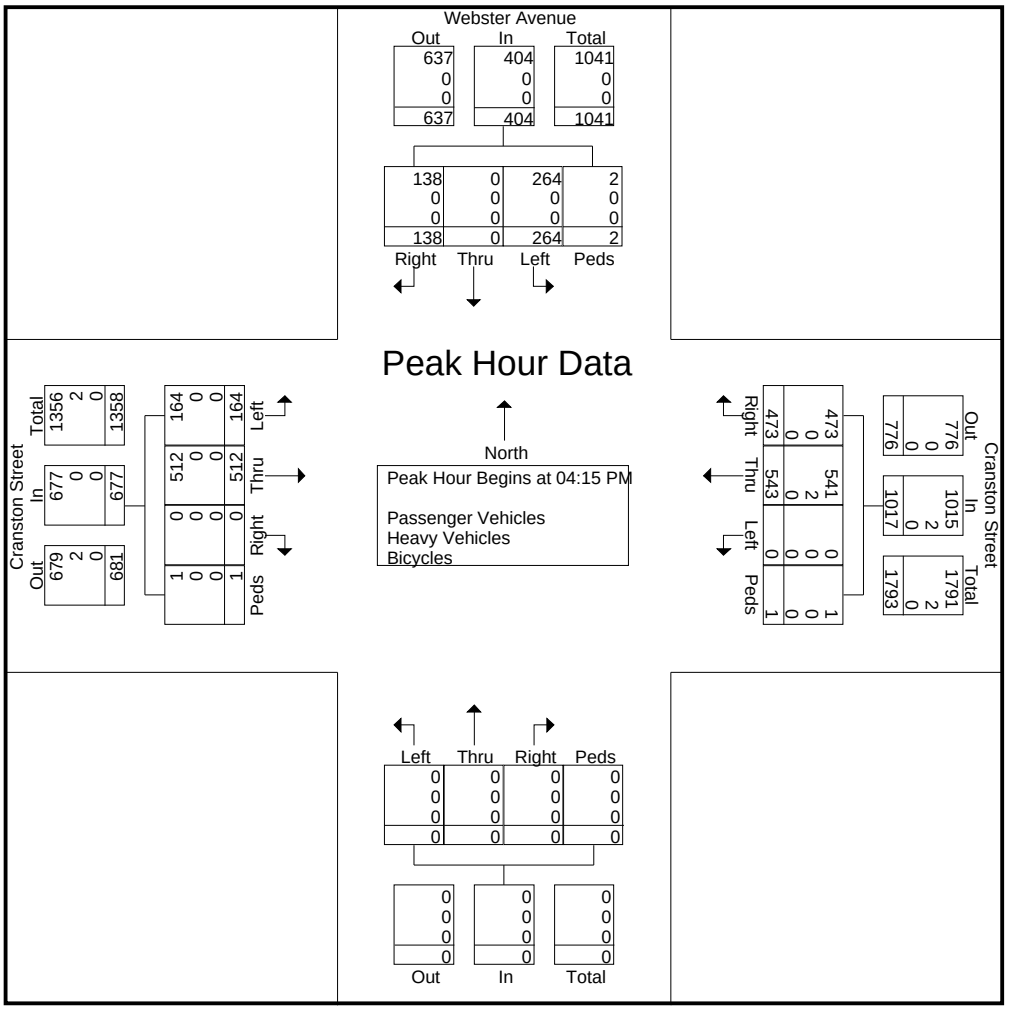
BETA Group, Inc.

701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Webster Ave / Cranston St
Weather: Sunny, 60s

File Name : 7578_Webster_Weekday
Site Code : 00757803
Start Date : 10/14/2021
Page No : 4

	Webster Avenue Southbound					Cranston Street Westbound					Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	27	0	**77**	**1**	105	103	**153**	0	0	256	0	0	0	0	0	0	**144**	28	0	172	533
04:30 PM	26	0	66	0	92	129	122	0	0	251	0	0	0	0	0	0	141	**53**	0	**194**	**537**
04:45 PM	**47**	0	63	1	**111**	**135**	131	0	**1**	**267**	0	0	0	0	0	0	99	34	**1**	134	512
05:00 PM	38	0	58	0	96	106	137	0	0	243	0	0	0	0	0	0	128	49	0	177	516
Total Volume	138	0	264	2	404	473	543	0	1	1017	0	0	0	0	0	0	512	164	1	677	2098
% App. Total	34.2	0	65.3	0.5		46.5	53.4	0	0.1		0	0	0	0		0	75.6	24.2	0.1		
PHF	.734	.000	.857	.500	.910	.876	.887	.000	.250	.952	.000	.000	.000	.000	.000	.000	.889	.774	.250	.872	.977
Passenger Vehicles	138	0	264	2	404	473	541	0	1	1015	0	0	0	0	0	0	512	164	1	677	2096
% Passenger Vehicles	100	0	100	100	100	100	99.6	0	100	99.8	0	0	0	0	0	0	100	100	100	100	99.9
Heavy Vehicles	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	2
% Heavy Vehicles	0	0	0	0	0	0	0.4	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0.1
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Webster Ave / Cranston St
Weather: Cloudy, 70's

File Name : 7578_Webster_Weekend
Site Code : 00757804
Start Date : 10/16/2021
Page No : 1

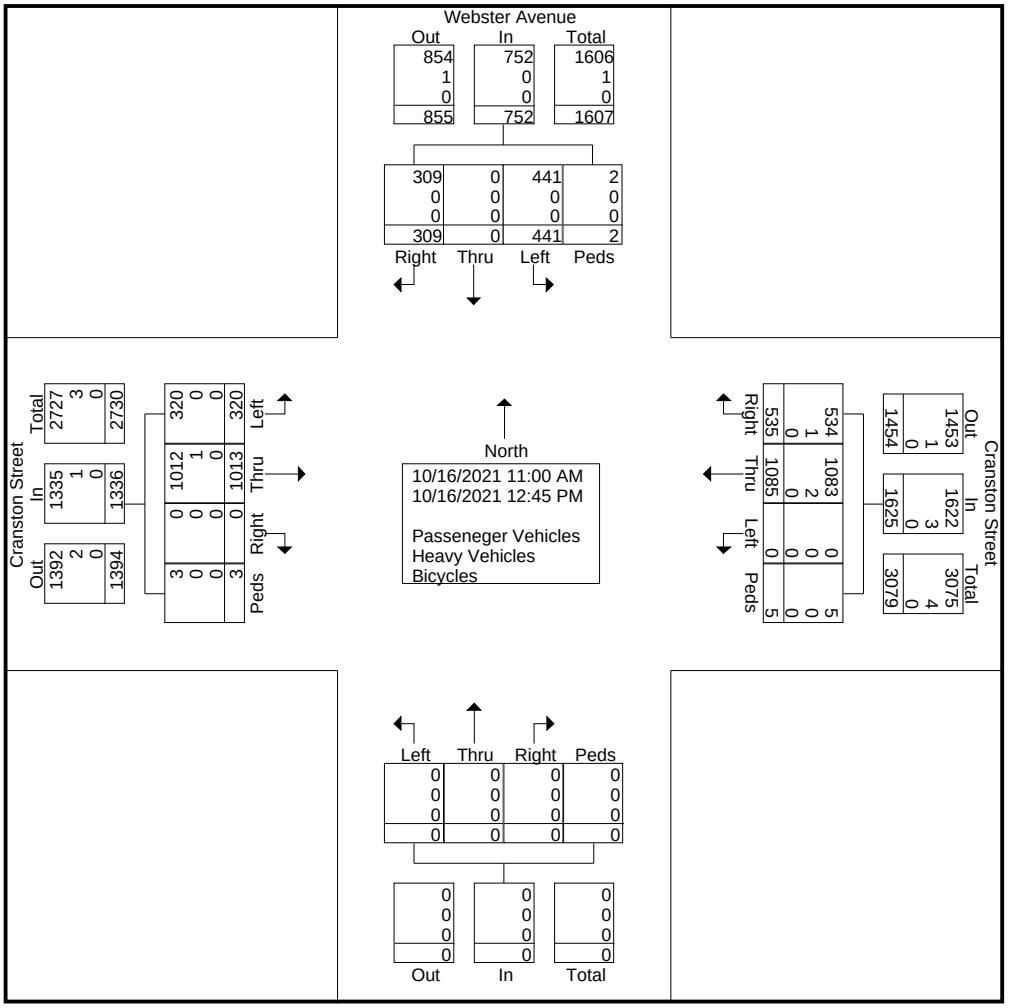
Groups Printed- Passeneger Vehicles - Heavy Vehicles - Bicycles

	Webster Avenue Southbound				Cranston Street Westbound				Northbound				Cranston Street Eastbound				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	41	0	46	0	59	130	0	0	0	0	0	0	0	127	36	0	439
11:15 AM	36	0	55	1	61	117	0	0	0	0	0	0	0	128	50	0	448
11:30 AM	34	0	48	0	43	119	0	2	0	0	0	0	0	133	31	1	411
11:45 AM	34	0	55	0	59	125	0	1	0	0	0	0	0	143	38	1	456
Total	145	0	204	1	222	491	0	3	0	0	0	0	0	531	155	2	1754
12:00 PM	37	0	62	0	68	163	0	1	0	0	0	0	0	117	44	0	492
12:15 PM	39	0	53	0	97	120	0	0	0	0	0	0	0	122	45	1	477
12:30 PM	50	0	59	1	71	179	0	0	0	0	0	0	0	113	48	0	521
12:45 PM	38	0	63	0	77	132	0	1	0	0	0	0	0	130	28	0	469
Total	164	0	237	1	313	594	0	2	0	0	0	0	0	482	165	1	1959
Grand Total	309	0	441	2	535	1085	0	5	0	0	0	0	0	1013	320	3	3713
Apprch %	41.1	0	58.6	0.3	32.9	66.8	0	0.3	0	0	0	0	0	75.8	24	0.2	
Total %	8.3	0	11.9	0.1	14.4	29.2	0	0.1	0	0	0	0	0	27.3	8.6	0.1	
Passeneger Vehicles	309	0	441	2	534	1083	0	5	0	0	0	0	0	1012	320	3	3709
% Passeneger Vehicles	100	0	100	100	99.8	99.8	0	100	0	0	0	0	0	99.9	100	100	99.9
Heavy Vehicles	0	0	0	0	1	2	0	0	0	0	0	0	0	1	0	0	4
% Heavy Vehicles	0	0	0	0	0.2	0.2	0	0	0	0	0	0	0	0.1	0	0	0.1
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Webster Ave / Cranston St
Weather: Cloudy, 70's

File Name : 7578_Webster_Weekend
Site Code : 00757804
Start Date : 10/16/2021



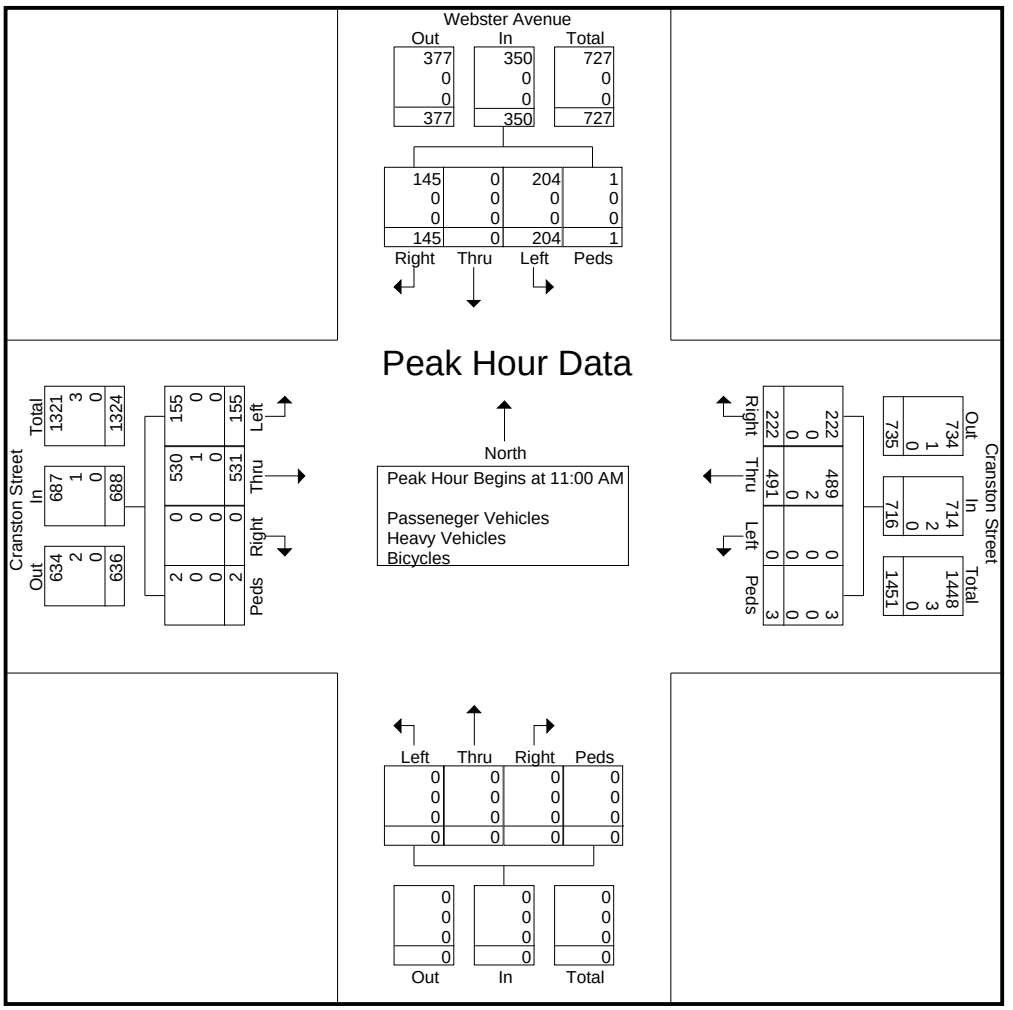
BETA Group, Inc.

701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Webster Ave / Cranston St
Weather: Cloudy, 70's

File Name : 7578_Webster_Weekend
Site Code : 00757804
Start Date : 10/16/2021
Page No : 3

	Webster Avenue Southbound					Cranston Street Westbound					Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:00 AM																					
11:00 AM	**41**	0	46	0	87	59	**130**	0	0	**189**	0	0	0	0	0	0	127	36	0	163	439
11:15 AM	36	0	**55**	**1**	**92**	**61**	117	0	0	178	0	0	0	0	0	0	128	**50**	0	178	448
11:30 AM	34	0	48	0	82	43	119	0	**2**	164	0	0	0	0	0	0	133	31	**1**	165	411
11:45 AM	34	0	55	0	89	59	125	0	1	185	0	0	0	0	0	0	**143**	38	1	**182**	**456**
Total Volume	145	0	204	1	350	222	491	0	3	716	0	0	0	0	0	0	531	155	2	688	1754
% App. Total	41.4	0	58.3	0.3		31	68.6	0	0.4		0	0	0	0		0	77.2	22.5	0.3		
PHF	.884	.000	.927	.250	.951	.910	.944	.000	.375	.947	.000	.000	.000	.000	.000	.000	.928	.775	.500	.945	.962
Passeneger Vehicles	145	0	204	1	350	222	489	0	3	714	0	0	0	0	0	0	530	155	2	687	1751
% Passeneger Vehicles	100	0	100	100	100	100	99.6	0	100	99.7	0	0	0	0	0	0	99.8	100	100	99.9	99.8
Heavy Vehicles	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	1	0	0	1	3
% Heavy Vehicles	0	0	0	0	0	0	0.4	0	0	0.3	0	0	0	0	0	0	0.2	0	0	0.1	0.2
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Cranston Street at Garfield Avenue

Accurate Counts

978-664-2565

N/S Street : Garfield Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780001
Site Code : 75780001
Start Date : 6/9/2021
Page No : 1

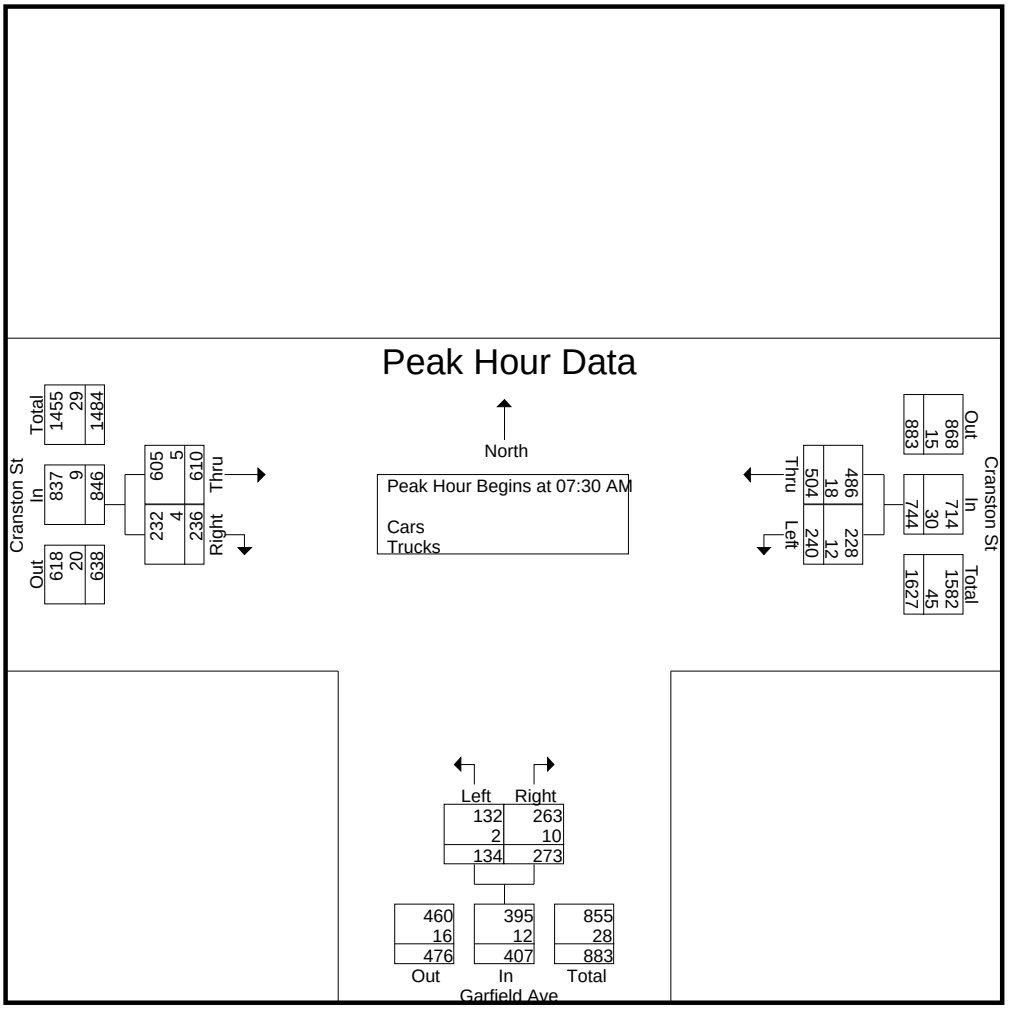
Groups Printed- Cars - Trucks

	Cranston St From East		Garfield Ave From South		Cranston St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	50	84	17	34	125	35	345
07:15 AM	58	75	17	48	141	62	401
07:30 AM	64	112	44	76	147	64	507
07:45 AM	66	127	44	64	156	57	514
Total	238	398	122	222	569	218	1767
08:00 AM	57	122	29	79	143	52	482
08:15 AM	53	143	17	54	164	63	494
08:30 AM	72	152	19	50	166	47	506
08:45 AM	70	159	17	59	155	48	508
Total	252	576	82	242	628	210	1990
Grand Total	490	974	204	464	1197	428	3757
Apprch %	33.5	66.5	30.5	69.5	73.7	26.3	
Total %	13	25.9	5.4	12.4	31.9	11.4	
Cars	465	943	199	445	1184	417	3653
% Cars	94.9	96.8	97.5	95.9	98.9	97.4	97.2
Trucks	25	31	5	19	13	11	104
% Trucks	5.1	3.2	2.5	4.1	1.1	2.6	2.8

	Cranston St From East			Garfield Ave From South			Cranston St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:30 AM										
07:30 AM	64	112	176	**44**	76	**120**	147	**64**	211	507
07:45 AM	**66**	127	193	44	64	108	156	57	213	**514**
08:00 AM	57	122	179	29	**79**	108	143	52	195	482
08:15 AM	53	**143**	**196**	17	54	71	**164**	63	**227**	494
Total Volume	240	504	744	134	273	407	610	236	846	1997
% App. Total	32.3	67.7		32.9	67.1		72.1	27.9		
PHF	.909	.881	.949	.761	.864	.848	.930	.922	.932	.971
Cars	228	486	714	132	263	395	605	232	837	1946
% Cars	95.0	96.4	96.0	98.5	96.3	97.1	99.2	98.3	98.9	97.4
Trucks	12	18	30	2	10	12	5	4	9	51
% Trucks	5.0	3.6	4.0	1.5	3.7	2.9	0.8	1.7	1.1	2.6

N/S Street : Garfield Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780001
Site Code : 75780001
Start Date : 6/9/2021
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00 AM			07:30 AM			07:45 AM		
+0 mins.	57	122	179	**44**	76	**120**	156	57	213
+15 mins.	53	143	196	44	64	108	143	52	195
+30 mins.	**72**	152	224	29	**79**	108	164	**63**	**227**
+45 mins.	70	**159**	**229**	17	54	71	**166**	47	213
Total Volume	252	576	828	134	273	407	629	219	848
% App. Total	30.4	69.6		32.9	67.1		74.2	25.8	
PHF	.875	.906	.904	.761	.864	.848	.947	.869	.934
Cars	240	561	801	132	263	395	625	213	838
% Cars	95.2	97.4	96.7	98.5	96.3	97.1	99.4	97.3	98.8
Trucks	12	15	27	2	10	12	4	6	10
% Trucks	4.8	2.6	3.3	1.5	3.7	2.9	0.6	2.7	1.2

Accurate Counts

978-664-2565

N/S Street : Garfield Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780001
Site Code : 75780001
Start Date : 6/9/2021
Page No : 1

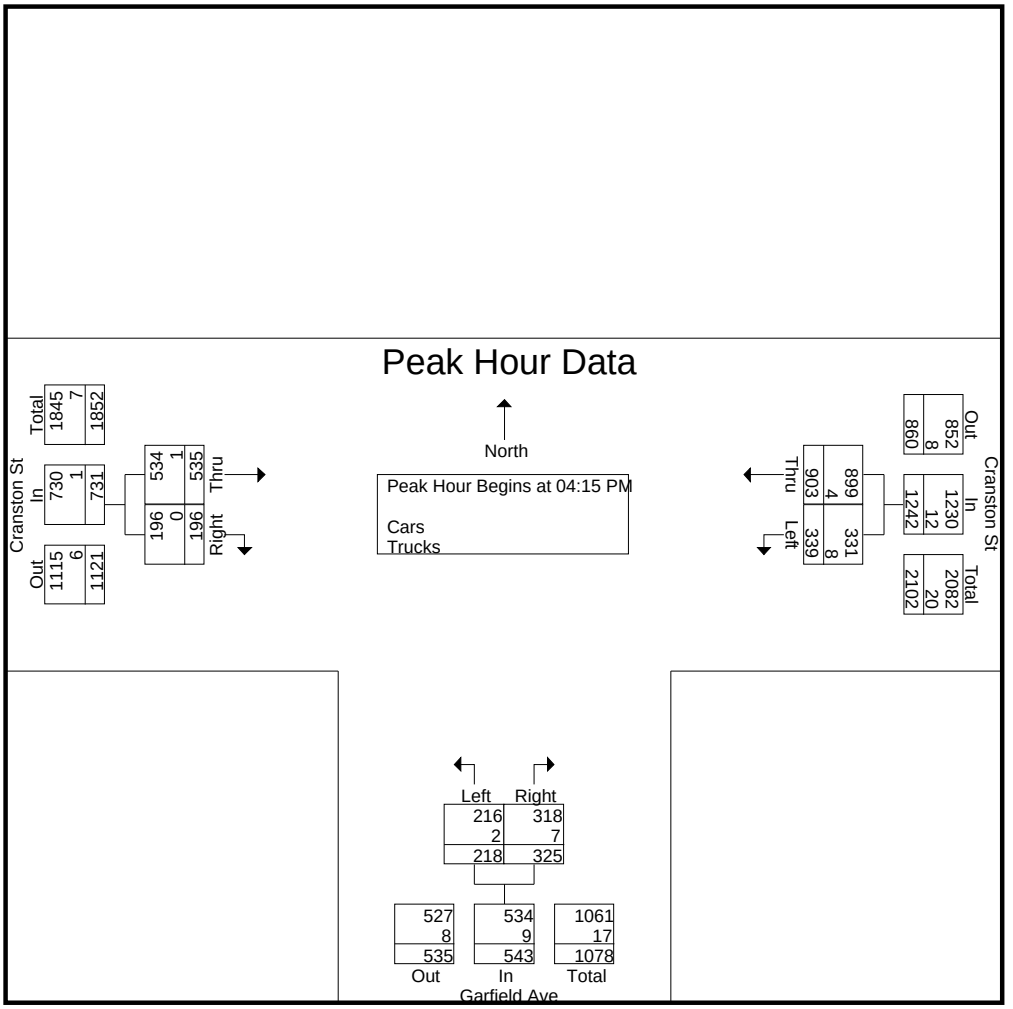
Groups Printed- Cars - Trucks

	Cranston St From East		Garfield Ave From South		Cranston St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	84	201	55	92	124	50	606
04:15 PM	83	230	52	73	126	54	618
04:30 PM	88	227	60	81	116	49	621
04:45 PM	88	208	47	78	145	51	617
Total	343	866	214	324	511	204	2462
05:00 PM	80	238	59	93	148	42	660
05:15 PM	78	179	47	96	145	57	602
05:30 PM	87	229	45	79	129	47	616
05:45 PM	84	205	41	84	118	53	585
Total	329	851	192	352	540	199	2463
Grand Total	672	1717	406	676	1051	403	4925
Apprch %	28.1	71.9	37.5	62.5	72.3	27.7	
Total %	13.6	34.9	8.2	13.7	21.3	8.2	
Cars	656	1707	402	664	1045	401	4875
% Cars	97.6	99.4	99	98.2	99.4	99.5	99
Trucks	16	10	4	12	6	2	50
% Trucks	2.4	0.6	1	1.8	0.6	0.5	1

	Cranston St From East			Garfield Ave From South			Cranston St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	83	230	313	52	73	125	126	**54**	180	618
04:30 PM	**88**	227	315	**60**	81	141	116	49	165	621
04:45 PM	88	208	296	47	78	125	145	51	**196**	617
05:00 PM	80	**238**	**318**	59	**93**	**152**	**148**	42	190	**660**
Total Volume	339	903	1242	218	325	543	535	196	731	2516
% App. Total	27.3	72.7		40.1	59.9		73.2	26.8		
PHF	.963	.949	.976	.908	.874	.893	.904	.907	.932	.953
Cars	331	899	1230	216	318	534	534	196	730	2494
% Cars	97.6	99.6	99.0	99.1	97.8	98.3	99.8	100	99.9	99.1
Trucks	8	4	12	2	7	9	1	0	1	22
% Trucks	2.4	0.4	1.0	0.9	2.2	1.7	0.2	0	0.1	0.9

N/S Street : Garfield Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780001
Site Code : 75780001
Start Date : 6/9/2021
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:15 PM			04:30 PM			04:45 PM		
+0 mins.	83	230	313	**60**	81	141	145	51	196
+15 mins.	**88**	227	315	47	78	125	**148**	42	190
+30 mins.	88	208	296	59	93	**152**	145	**57**	**202**
+45 mins.	80	**238**	**318**	47	**96**	143	129	47	176
Total Volume	339	903	1242	213	348	561	567	197	764
% App. Total	27.3	72.7		38	62		74.2	25.8	
PHF	.963	.949	.976	.888	.906	.923	.958	.864	.946
Cars	331	899	1230	212	342	554	563	197	760
% Cars	97.6	99.6	99	99.5	98.3	98.8	99.3	100	99.5
Trucks	8	4	12	1	6	7	4	0	4
% Trucks	2.4	0.4	1	0.5	1.7	1.2	0.7	0	0.5

File Name: C:\Users\Jen\Documents\Countpro Petra\75780001.ppd
Start Date: 6/9/2021
Start Time: 7:00:00 AM
Site Code: 75780001
Comment 1: N/S Street : Garfield Avenue
Comment 2: E/W Street : Cranston Street
Comment 3: City/State : Cranston, RI
Comment 4: Weather : Clear

	Cranston St From East			Garfield Ave From South			Cranston St From West		
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds
7:00:00 AM	0	1	0	0	0	0	0	0	0
7:15:00 AM	0	0	0	0	0	1	0	0	0
7:30:00 AM	0	0	0	0	0	0	0	0	0
7:45:00 AM	1	0	0	0	0	1	0	0	0
8:00:00 AM	0	0	0	0	0	1	0	0	0
8:15:00 AM	0	1	0	0	0	2	1	0	0
8:30:00 AM	0	0	0	0	0	0	0	0	1
8:45:00 AM	0	0	0	0	0	2	0	0	1
9:00:00 AM	0	0	0	0	0	0	0	0	0
4:00:00 PM	2	0	0	0	0	2	0	0	3
4:15:00 PM	1	0	0	0	2	0	1	0	0
4:30:00 PM	0	1	0	0	0	2	0	0	0
4:45:00 PM	0	0	0	0	0	2	0	0	0
5:00:00 PM	0	1	0	0	0	0	0	0	0
5:15:00 PM	2	0	0	0	0	0	2	0	0
5:30:00 PM	0	0	0	0	0	1	1	1	0
5:45:00 PM	0	0	0	0	0	0	0	0	0

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Garfield Ave/ Cranston St
Weather: Sunny, 70's

File Name : 7578_Garfield_Weekend
Site Code : 00757801
Start Date : 10/2/2021
Page No : 1

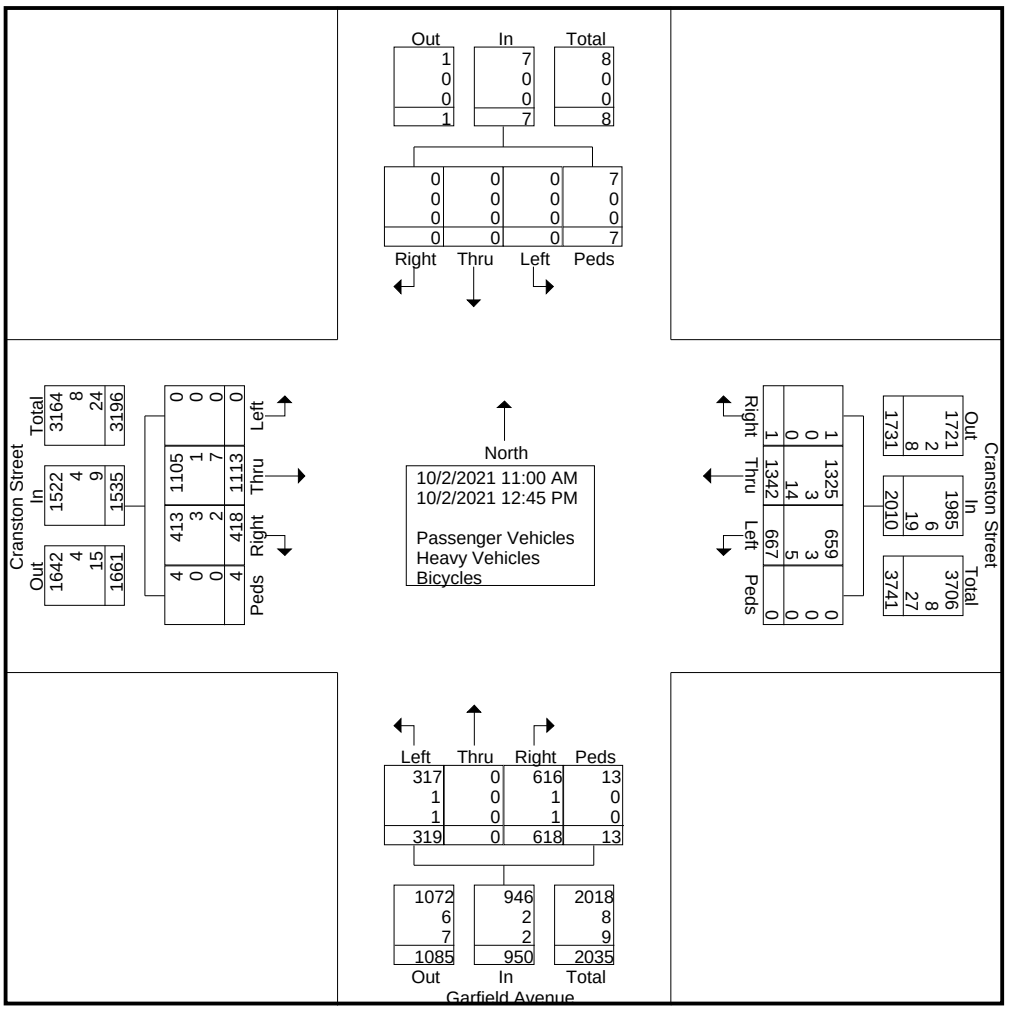
Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

	Southbound				Cranston Street Westbound				Garfield Avenue Northbound				Cranston Street Eastbound				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	0	0	1	1	183	85	0	68	0	40	3	37	148	0	0	566
11:15 AM	0	0	0	0	0	160	69	0	64	0	50	5	57	120	0	0	525
11:30 AM	0	0	0	2	0	178	82	0	74	0	34	1	37	128	0	1	537
11:45 AM	0	0	0	1	0	155	88	0	69	0	35	0	57	144	0	1	550
Total	0	0	0	4	1	676	324	0	275	0	159	9	188	540	0	2	2178
12:00 PM	0	0	0	1	0	171	82	0	85	0	47	1	51	146	0	2	586
12:15 PM	0	0	0	2	0	172	88	0	79	0	41	1	59	130	0	0	572
12:30 PM	0	0	0	0	0	171	88	0	82	0	33	1	54	155	0	0	584
12:45 PM	0	0	0	0	0	152	85	0	97	0	39	1	66	142	0	0	582
Total	0	0	0	3	0	666	343	0	343	0	160	4	230	573	0	2	2324
Grand Total	0	0	0	7	1	1342	667	0	618	0	319	13	418	1113	0	4	4502
Apprch %	0	0	0	100	0	66.8	33.2	0	65.1	0	33.6	1.4	27.2	72.5	0	0.3	
Total %	0	0	0	0.2	0	29.8	14.8	0	13.7	0	7.1	0.3	9.3	24.7	0	0.1	
Passenger Vehicles	0	0	0	7	1	1325	659	0	616	0	317	13	413	1105	0	4	4460
% Passenger Vehicles	0	0	0	100	100	98.7	98.8	0	99.7	0	99.4	100	98.8	99.3	0	100	99.1
Heavy Vehicles	0	0	0	0	0	3	3	0	1	0	1	0	3	1	0	0	12
% Heavy Vehicles	0	0	0	0	0	0.2	0.4	0	0.2	0	0.3	0	0.7	0.1	0	0	0.3
Bicycles	0	0	0	0	0	14	5	0	1	0	1	0	2	7	0	0	30
% Bicycles	0	0	0	0	0	1	0.7	0	0.2	0	0.3	0	0.5	0.6	0	0	0.7

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Garfield Ave/ Cranston St
Weather: Sunny, 70's

File Name : 7578_Garfield_Weekend
Site Code : 00757801
Start Date : 10/2/2021
Page No : 2

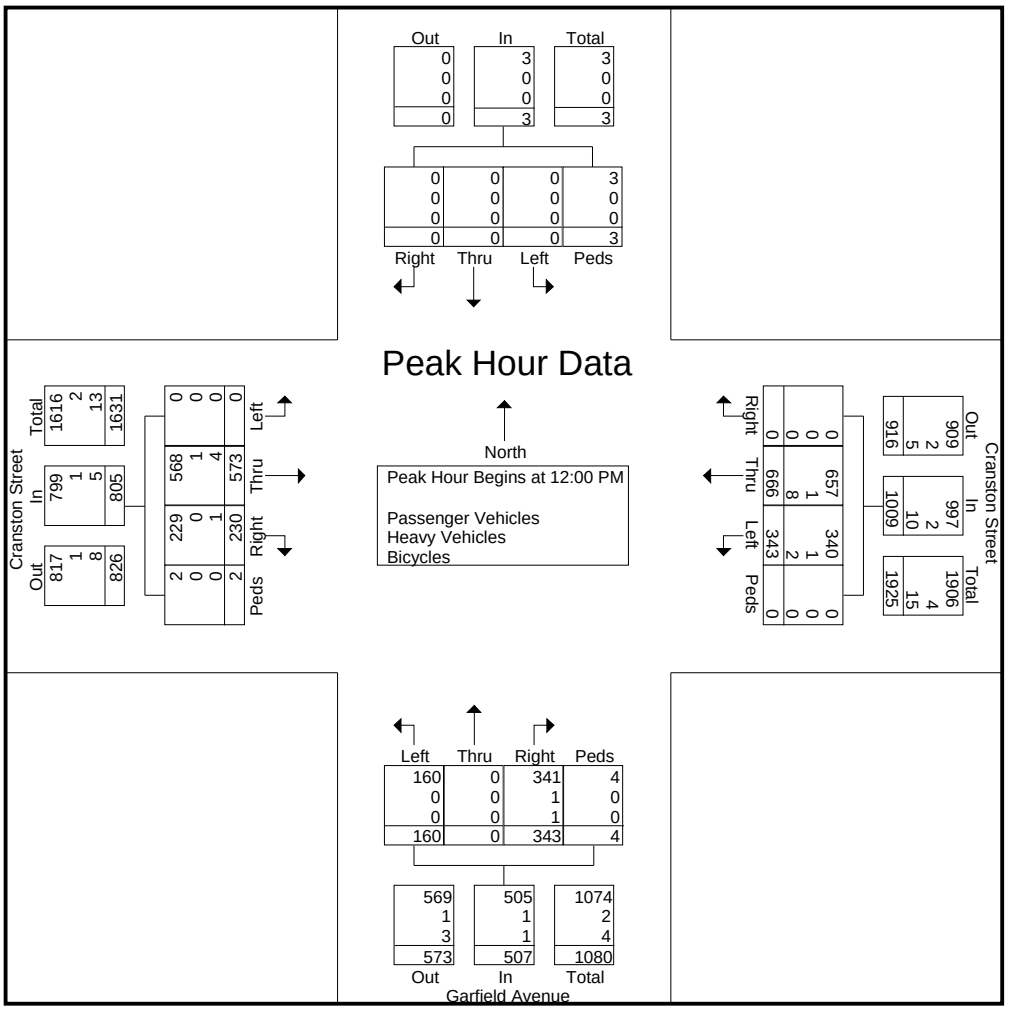


BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Garfield Ave/ Cranston St
Weather: Sunny, 70's

File Name : 7578_Garfield_Weekend
Site Code : 00757801
Start Date : 10/2/2021
Page No : 3

	Southbound					Cranston Street Westbound					Garfield Avenue Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	0	0	0	1	1	0	171	82	0	253	85	0	**47**	**1**	133	51	146	0	**2**	199	**586**
12:15 PM	0	0	0	**2**	**2**	0	**172**	**88**	0	**260**	79	0	41	1	121	59	130	0	0	189	572
12:30 PM	0	0	0	0	0	0	171	88	0	259	82	0	33	1	116	54	**155**	0	0	**209**	584
12:45 PM	0	0	0	0	0	0	152	85	0	237	**97**	0	39	1	**137**	**66**	142	0	0	208	582
Total Volume	0	0	0	3	3	0	666	343	0	1009	343	0	160	4	507	230	573	0	2	805	2324
% App. Total	0	0	0	100		0	66	34	0		67.7	0	31.6	0.8		28.6	71.2	0	0.2		
PHF	.000	.000	.000	.375	.375	.000	.968	.974	.000	.970	.884	.000	.851	1.00	.925	.871	.924	.000	.250	.963	.991
Passenger Vehicles	0	0	0	3	3	0	657	340	0	997	341	0	160	4	505	229	568	0	2	799	2304
% Passenger Vehicles	0	0	0	100	100	0	98.6	99.1	0	98.8	99.4	0	100	100	99.6	99.6	99.1	0	100	99.3	99.1
Heavy Vehicles	0	0	0	0	0	0	1	1	0	2	1	0	0	0	1	0	1	0	0	1	4
% Heavy Vehicles	0	0	0	0	0	0	0.2	0.3	0	0.2	0.3	0	0	0	0.2	0	0.2	0	0	0.1	0.2
Bicycles	0	0	0	0	0	0	8	2	0	10	1	0	0	0	1	1	4	0	0	5	16
% Bicycles	0	0	0	0	0	0	1.2	0.6	0	1.0	0.3	0	0	0	0.2	0.4	0.7	0	0	0.6	0.7



Cranston Street at Garfield Avenue

(Source; *Citizens Bank Campus* Traffic Study Report, dated August 2015, by *BETA Group, Inc.*)

Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Garfield Ave.
Weather: Sunny/70's

File Name : 513106 Volume
Site Code : 513106
Start Date : 8/13/2015
Page No : 1

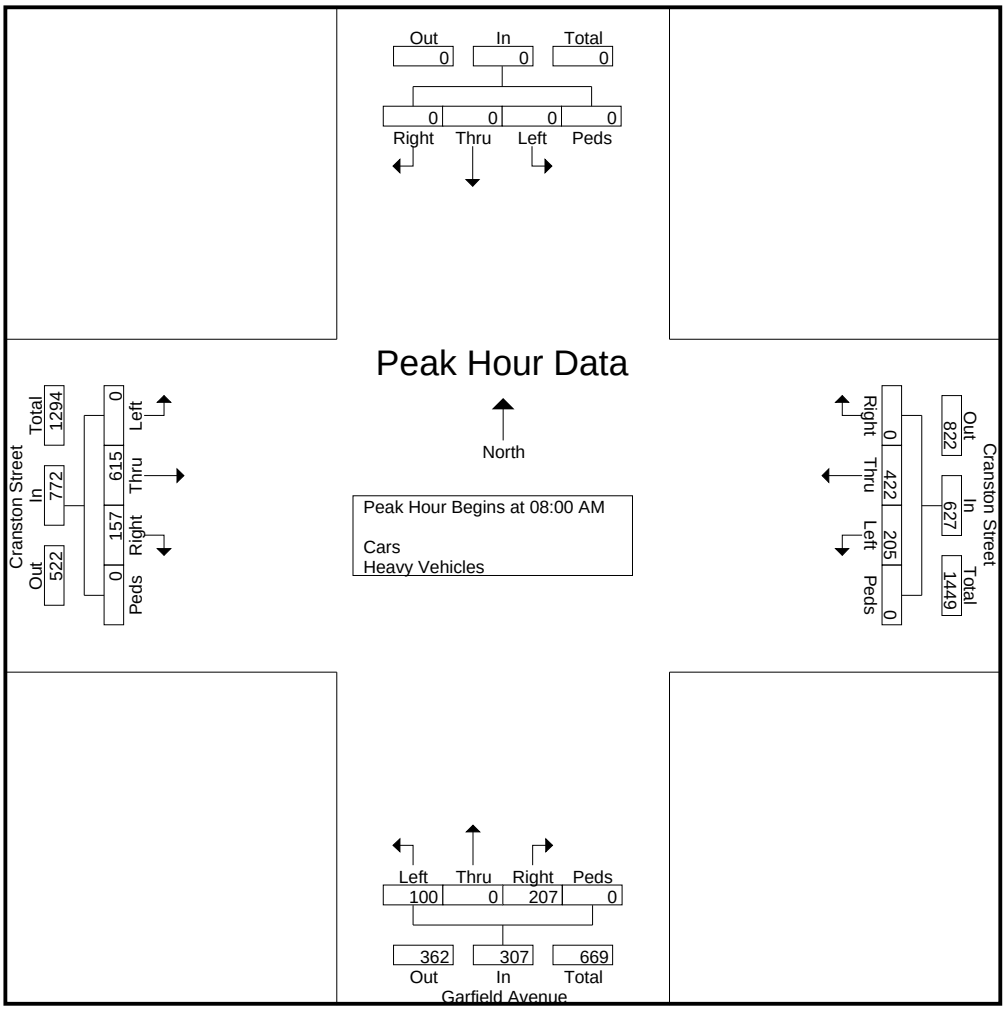
Groups Printed- Cars - Heavy Vehicles

	Southbound					Cranston Street Westbound					Garfield Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	28	89	0	0	117	15	0	35	0	50	0	105	31	0	136	303
07:15 AM	0	0	0	0	0	33	79	0	0	112	14	0	35	0	49	0	137	38	0	175	336
07:30 AM	0	0	0	0	0	37	71	0	0	108	25	0	54	0	79	0	152	55	0	207	394
07:45 AM	0	0	0	0	0	27	96	0	0	123	22	0	63	0	85	0	160	46	0	206	414
Total	0	0	0	0	0	125	335	0	0	460	76	0	187	0	263	0	554	170	0	724	1447
08:00 AM	0	0	0	0	0	46	105	0	0	151	30	0	51	0	81	0	143	40	0	183	415
08:15 AM	0	0	0	0	0	47	98	0	0	145	21	0	47	0	68	0	185	37	0	222	435
08:30 AM	0	0	0	0	0	49	107	0	0	156	19	0	52	0	71	0	152	44	0	196	423
08:45 AM	0	0	0	0	0	63	112	0	0	175	30	0	57	0	87	0	135	36	0	171	433
Total	0	0	0	0	0	205	422	0	0	627	100	0	207	0	307	0	615	157	0	772	1706
*** BREAK ***																					
04:00 PM	0	0	0	0	0	71	198	0	0	269	66	0	80	0	146	0	122	33	0	155	570
04:15 PM	0	0	0	0	0	80	170	0	0	250	62	0	85	0	147	0	125	41	0	166	563
04:30 PM	0	0	0	0	0	73	190	0	0	263	64	0	82	0	146	0	125	39	0	164	573
04:45 PM	0	0	0	0	0	74	198	0	0	272	61	0	74	0	135	0	128	42	0	170	577
Total	0	0	0	0	0	298	756	0	0	1054	253	0	321	0	574	0	500	155	0	655	2283
05:00 PM	0	0	0	0	0	75	215	0	0	290	43	0	79	0	122	0	117	40	0	157	569
05:15 PM	0	0	0	0	0	60	169	0	0	229	63	0	65	0	128	0	110	36	0	146	503
05:30 PM	0	0	0	0	0	71	181	0	0	252	48	0	70	0	118	0	112	53	0	165	535
05:45 PM	0	0	0	0	0	66	166	0	0	232	56	0	79	0	135	0	115	43	0	158	525
Total	0	0	0	0	0	272	731	0	0	1003	210	0	293	0	503	0	454	172	0	626	2132
Grand Total	0	0	0	0	0	900	2244	0	0	3144	639	0	1008	0	1647	0	2123	654	0	2777	7568
Apprch %	0	0	0	0		28.6	71.4	0	0		38.8	0	61.2	0		0	76.4	23.6	0		
Total %	0	0	0	0	0	11.9	29.7	0	0	41.5	8.4	0	13.3	0	21.8	0	28.1	8.6	0	36.7	
Cars	0	0	0	0	0	870	2241	0	0	3111	633	0	987	0	1620	0	2113	653	0	2766	7497
% Cars	0	0	0	0	0	96.7	99.9	0	0	99	99.1	0	97.9	0	98.4	0	99.5	99.8	0	99.6	99.1
Heavy Vehicles	0	0	0	0	0	30	3	0	0	33	6	0	21	0	27	0	10	1	0	11	71
% Heavy Vehicles	0	0	0	0	0	3.3	0.1	0	0	1	0.9	0	2.1	0	1.6	0	0.5	0.2	0	0.4	0.9

Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Garfield Ave.
Weather: Sunny/70's

File Name : 513106 Volume
Site Code : 513106
Start Date : 8/13/2015
Page No : 2

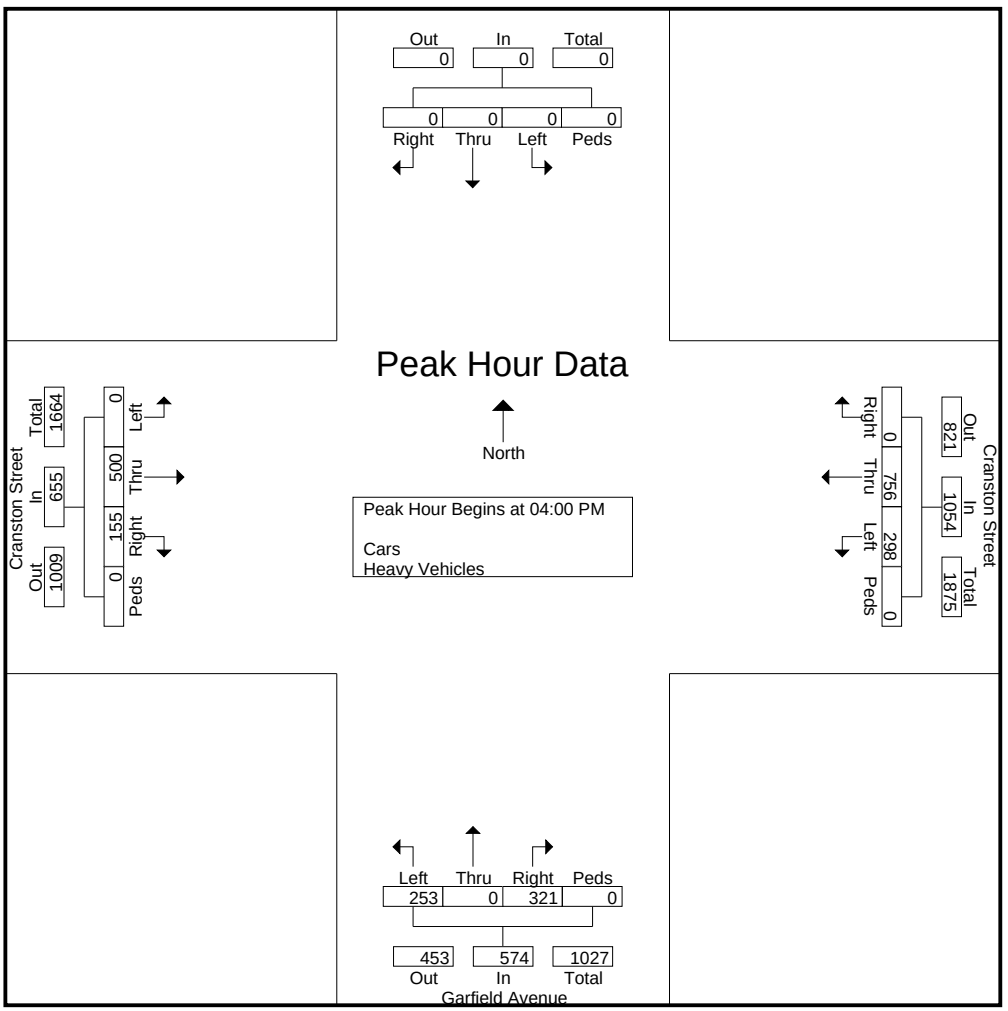
	Southbound					Cranston Street Westbound					Garfield Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	0	0	0	0	46	105	0	0	151	**30**	0	51	0	81	0	143	40	0	183	415
08:15 AM	0	0	0	0	0	47	98	0	0	145	21	0	47	0	68	0	**185**	37	0	**222**	**435**
08:30 AM	0	0	0	0	0	49	107	0	0	156	19	0	52	0	71	0	152	**44**	0	196	423
08:45 AM	0	0	0	0	0	**63**	**112**	0	0	**175**	30	0	**57**	0	**87**	0	135	36	0	171	433
Total Volume	0	0	0	0	0	205	422	0	0	627	100	0	207	0	307	0	615	157	0	772	1706
% App. Total	0	0	0	0		32.7	67.3	0	0		32.6	0	67.4	0		0	79.7	20.3	0		
PHF	.000	.000	.000	.000	.000	.813	.942	.000	.000	.896	.833	.000	.908	.000	.882	.000	.831	.892	.000	.869	.980



Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Garfield Ave.
Weather: Sunny/70's

File Name : 513106 Volume
Site Code : 513106
Start Date : 8/13/2015
Page No : 3

	Southbound					Cranston Street Westbound					Garfield Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:00 PM																					
04:00 PM	0	0	0	0	0	71	**198**	0	0	269	**66**	0	80	0	146	0	122	33	0	155	570
04:15 PM	0	0	0	0	0	**80**	170	0	0	250	62	0	**85**	0	**147**	0	125	41	0	166	563
04:30 PM	0	0	0	0	0	73	190	0	0	263	64	0	82	0	146	0	125	39	0	164	573
04:45 PM	0	0	0	0	0	74	198	0	0	**272**	61	0	74	0	135	0	**128**	**42**	0	**170**	**577**
Total Volume	0	0	0	0	0	298	756	0	0	1054	253	0	321	0	574	0	500	155	0	655	2283
% App. Total	0	0	0	0		28.3	71.7	0	0		44.1	0	55.9	0		0	76.3	23.7	0		
PHF	.000	.000	.000	.000	.000	.931	.955	.000	.000	.969	.958	.000	.944	.000	.976	.000	.977	.923	.000	.963	.989



Cranston Street at Niantic Avenue

Accurate Counts

978-664-2565

N/S Street : Niantic Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780002
Site Code : 75780002
Start Date : 6/9/2021
Page No : 1

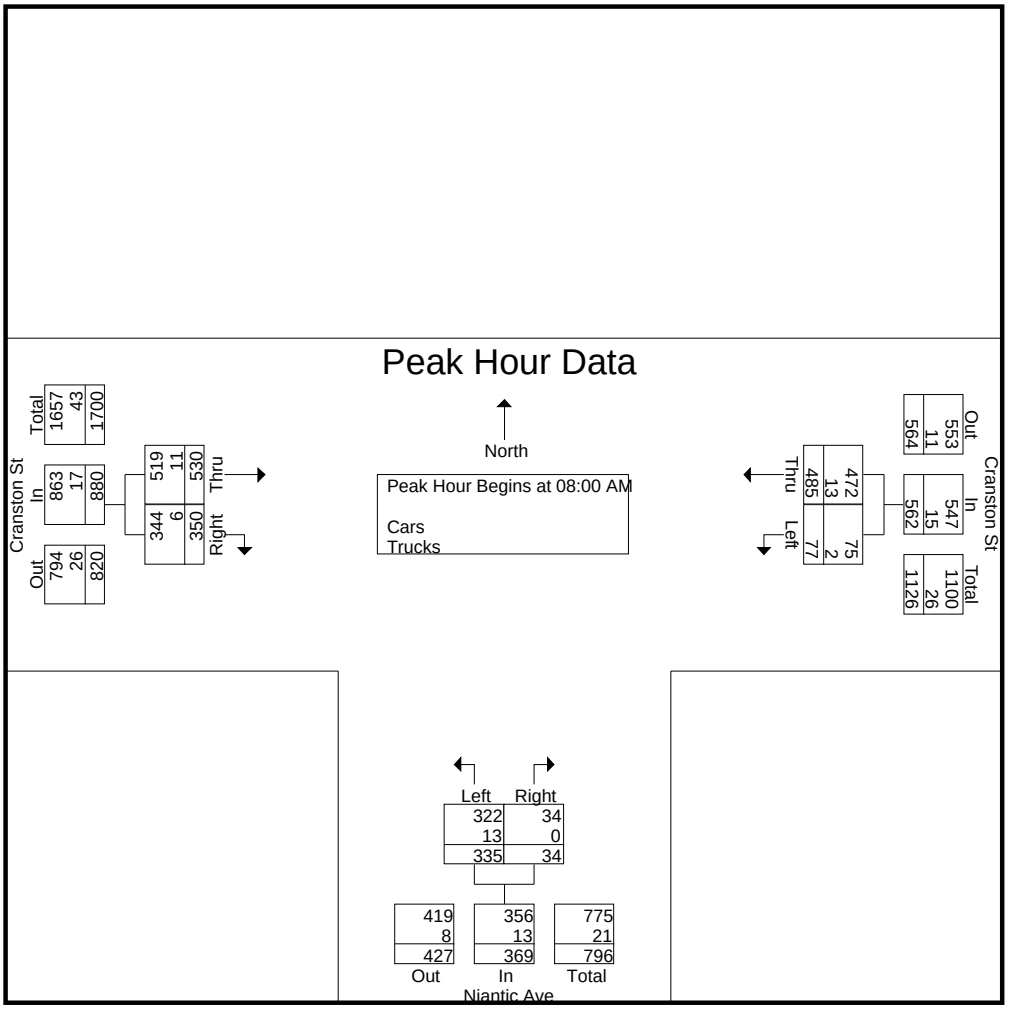
Groups Printed- Cars - Trucks

	Cranston St From East		Niantic Ave From South		Cranston St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	14	85	44	5	82	81	311
07:15 AM	10	77	54	9	97	94	341
07:30 AM	26	107	71	7	148	79	438
07:45 AM	9	98	97	10	137	89	440
Total	59	367	266	31	464	343	1530
08:00 AM	14	102	69	7	134	87	413
08:15 AM	27	118	82	4	125	94	450
08:30 AM	20	136	90	12	136	88	482
08:45 AM	16	129	94	11	135	81	466
Total	77	485	335	34	530	350	1811
Grand Total	136	852	601	65	994	693	3341
Apprch %	13.8	86.2	90.2	9.8	58.9	41.1	
Total %	4.1	25.5	18	1.9	29.8	20.7	
Cars	131	822	577	65	971	684	3250
% Cars	96.3	96.5	96	100	97.7	98.7	97.3
Trucks	5	30	24	0	23	9	91
% Trucks	3.7	3.5	4	0	2.3	1.3	2.7

	Cranston St From East			Niantic Ave From South			Cranston St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	14	102	116	69	7	76	134	87	221	413
08:15 AM	**27**	118	145	82	4	86	125	**94**	219	450
08:30 AM	20	**136**	**156**	90	**12**	102	**136**	88	**224**	**482**
08:45 AM	16	129	145	**94**	11	**105**	135	81	216	466
Total Volume	77	485	562	335	34	369	530	350	880	1811
% App. Total	13.7	86.3		90.8	9.2		60.2	39.8		
PHF	.713	.892	.901	.891	.708	.879	.974	.931	.982	.939
Cars	75	472	547	322	34	356	519	344	863	1766
% Cars	97.4	97.3	97.3	96.1	100	96.5	97.9	98.3	98.1	97.5
Trucks	2	13	15	13	0	13	11	6	17	45
% Trucks	2.6	2.7	2.7	3.9	0	3.5	2.1	1.7	1.9	2.5

N/S Street : Niantic Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780002
Site Code : 75780002
Start Date : 6/9/2021
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00 AM			07:45 AM			07:30 AM		
+0 mins.	14	102	116	**97**	10	**107**	**148**	79	**227**
+15 mins.	**27**	118	145	69	7	76	137	89	226
+30 mins.	20	**136**	**156**	82	4	86	134	87	221
+45 mins.	16	129	145	90	**12**	102	125	**94**	219
Total Volume	77	485	562	338	33	371	544	349	893
% App. Total	13.7	86.3		91.1	8.9		60.9	39.1	
PHF	.713	.892	.901	.871	.688	.867	.919	.928	.983
Cars	75	472	547	327	33	360	532	346	878
% Cars	97.4	97.3	97.3	96.7	100	97	97.8	99.1	98.3
Trucks	2	13	15	11	0	11	12	3	15
% Trucks	2.6	2.7	2.7	3.3	0	3	2.2	0.9	1.7

Accurate Counts

978-664-2565

N/S Street : Niantic Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780002
Site Code : 75780002
Start Date : 6/9/2021
Page No : 1

Groups Printed- Cars - Trucks

	Cranston St From East		Niantic Ave From South		Cranston St From West		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	7	139	142	12	147	64	511
04:15 PM	9	162	148	10	145	61	535
04:30 PM	10	166	144	8	142	59	529
04:45 PM	13	158	150	7	147	81	556
Total	39	625	584	37	581	265	2131
05:00 PM	8	155	145	8	171	70	557
05:15 PM	15	146	116	11	176	80	544
05:30 PM	11	165	151	5	149	56	537
05:45 PM	11	150	139	11	151	64	526
Total	45	616	551	35	647	270	2164
Grand Total	84	1241	1135	72	1228	535	4295
Apprch %	6.3	93.7	94	6	69.7	30.3	
Total %	2	28.9	26.4	1.7	28.6	12.5	
Cars	83	1226	1125	71	1217	528	4250
% Cars	98.8	98.8	99.1	98.6	99.1	98.7	99
Trucks	1	15	10	1	11	7	45
% Trucks	1.2	1.2	0.9	1.4	0.9	1.3	1

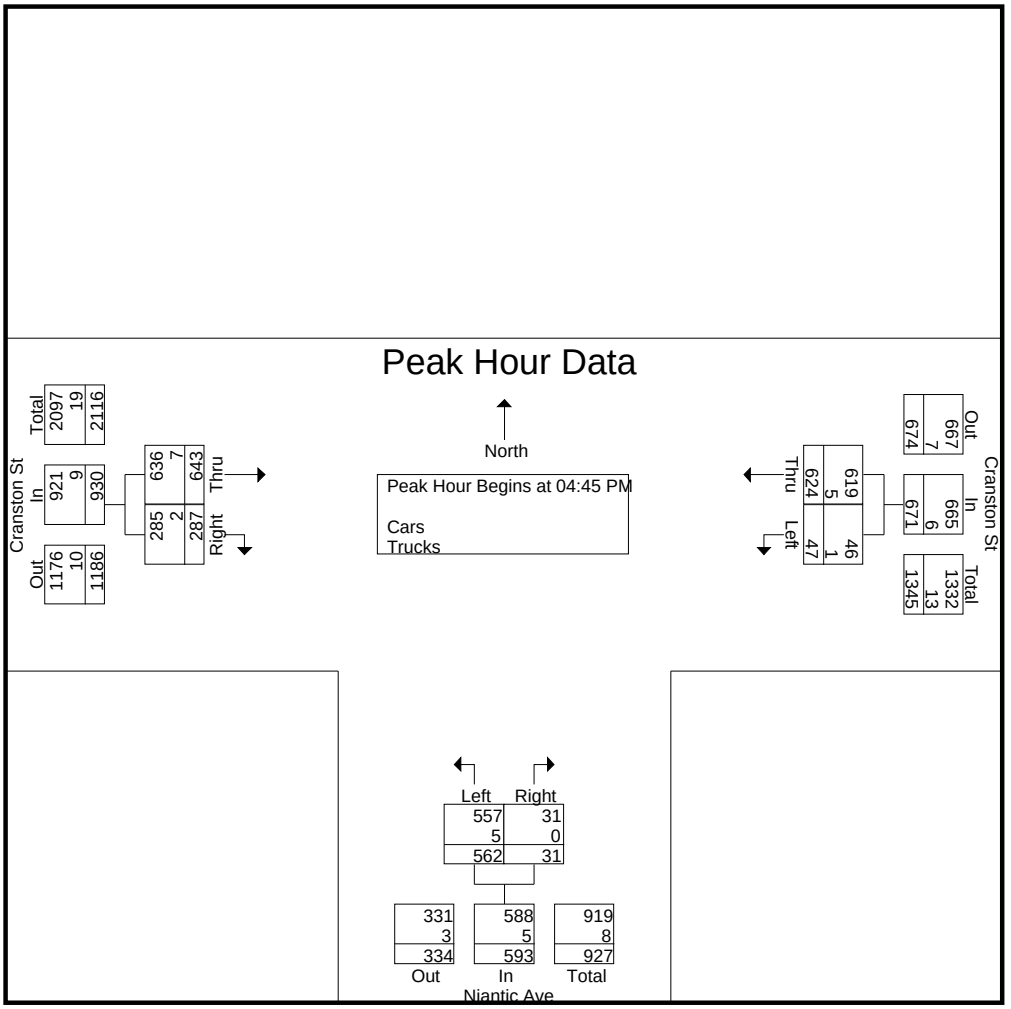
	Cranston St From East			Niantic Ave From South			Cranston St From West			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	13	158	171	150	7	**157**	147	**81**	228	556
05:00 PM	8	155	163	145	8	153	171	70	241	**557**
05:15 PM	**15**	146	161	116	**11**	127	**176**	80	**256**	544
05:30 PM	11	**165**	**176**	**151**	5	156	149	56	205	537
Total Volume	47	624	671	562	31	593	643	287	930	2194
% App. Total	7	93		94.8	5.2		69.1	30.9		
PHF	.783	.945	.953	.930	.705	.944	.913	.886	.908	.985
Cars	46	619	665	557	31	588	636	285	921	2174
% Cars	97.9	99.2	99.1	99.1	100	99.2	98.9	99.3	99.0	99.1
Trucks	1	5	6	5	0	5	7	2	9	20
% Trucks	2.1	0.8	0.9	0.9	0	0.8	1.1	0.7	1.0	0.9

File Name: C:\Users\Jen\Documents\Countpro Petra\75780002.ppd
Start Date: 6/9/2021
Start Time: 7:00:00 AM
Site Code: 75780002
Comment 1: N/S Street : Niantic Avenue
Comment 2: E/W Street : Cranston Street
Comment 3: City/State : Cranston, RI
Comment 4: Weather : Clear

	Cranston St From East			Niantic Ave From South			Cranston St From West		
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds
7:00:00 AM	1	5	0	0	0	0	0	0	0
7:15:00 AM	0	0	0	0	0	0	0	0	0
7:30:00 AM	0	0	0	0	0	1	0	0	1
7:45:00 AM	0	1	0	0	0	2	0	0	2
8:00:00 AM	0	0	0	0	0	2	1	0	2
8:15:00 AM	0	1	0	0	0	3	0	0	1
8:30:00 AM	0	1	0	0	0	0	0	0	2
8:45:00 AM	0	0	0	0	0	1	0	0	0
9:00:00 AM	0	0	0	0	0	0	0	0	0
4:00:00 PM	0	3	0	0	0	2	1	0	0
4:15:00 PM	0	0	0	1	1	1	1	1	0
4:30:00 PM	0	0	0	0	0	1	0	0	0
4:45:00 PM	0	0	0	0	0	3	0	0	0
5:00:00 PM	0	0	0	1	0	3	0	0	0
5:15:00 PM	0	1	0	1	0	4	1	1	0
5:30:00 PM	0	0	1	0	0	1	0	0	0
5:45:00 PM	0	1	0	0	1	0	0	0	0

N/S Street : Niantic Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

File Name : 75780002
Site Code : 75780002
Start Date : 6/9/2021
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:15 PM			04:00 PM			04:45 PM		
+0 mins.	9	162	171	142	**12**	154	147	**81**	228
+15 mins.	10	**166**	**176**	148	10	**158**	171	70	241
+30 mins.	**13**	158	171	144	8	152	**176**	80	**256**
+45 mins.	8	155	163	**150**	7	157	149	56	205
Total Volume	40	641	681	584	37	621	643	287	930
% App. Total	5.9	94.1		94	6		69.1	30.9	
PHF	.769	.965	.967	.973	.771	.983	.913	.886	.908
Cars	40	634	674	579	36	615	636	285	921
% Cars	100	98.9	99	99.1	97.3	99	98.9	99.3	99
Trucks	0	7	7	5	1	6	7	2	9
% Trucks	0	1.1	1	0.9	2.7	1	1.1	0.7	1

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Niantic Ave / Cranston St
Weather: Sunny, 70's

File Name : 7578_niantic_weekend
Site Code : 00757802
Start Date : 10/2/2021
Page No : 1

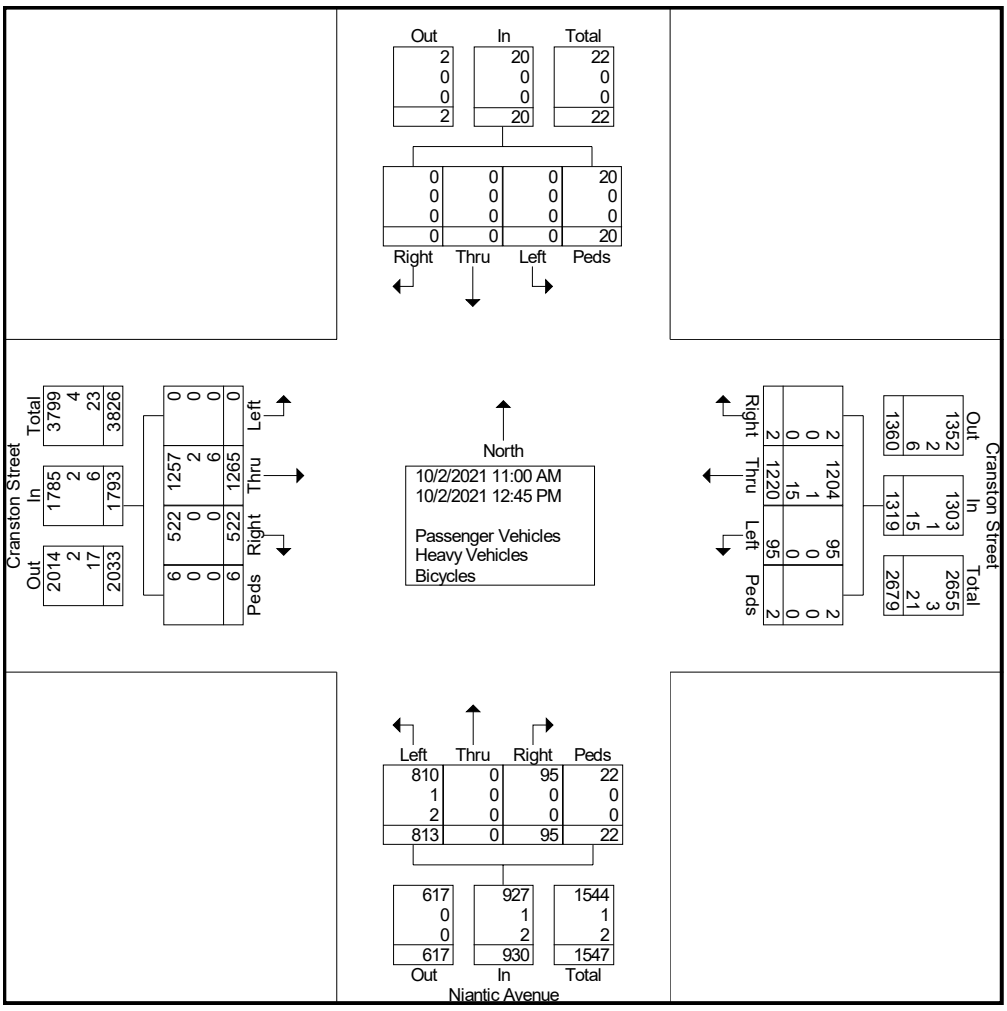
Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

	Southbound				Cranston Street Westbound				Niantic Avenue Northbound				Cranston Street Eastbound				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	0	0	0	4	1	150	15	0	17	0	92	2	61	145	0	0	487
11:15 AM	0	0	0	3	0	152	8	0	12	0	90	4	55	142	0	0	466
11:30 AM	0	0	0	3	0	168	13	0	9	0	103	6	52	147	0	2	503
11:45 AM	0	0	0	5	0	135	10	0	11	0	101	1	69	162	0	0	494
Total	0	0	0	15	1	605	46	0	49	0	386	13	237	596	0	2	1950
12:00 PM	0	0	0	5	0	150	17	1	10	0	115	1	75	152	0	0	526
12:15 PM	0	0	0	0	0	158	15	0	9	0	106	6	66	159	0	3	522
12:30 PM	0	0	0	0	0	156	10	1	12	0	106	2	60	183	0	1	531
12:45 PM	0	0	0	0	1	151	7	0	15	0	100	0	84	175	0	0	533
Total	0	0	0	5	1	615	49	2	46	0	427	9	285	669	0	4	2112
Grand Total	0	0	0	20	2	1220	95	2	95	0	813	22	522	1265	0	6	4062
Apprch %	0	0	0	100	0.2	92.5	7.2	0.2	10.2	0	87.4	2.4	29.1	70.6	0	0.3	
Total %	0	0	0	0.5	0	30	2.3	0	2.3	0	20	0.5	12.9	31.1	0	0.1	
Passenger Vehicles	0	0	0	20	2	1204	95	2	95	0	810	22	522	1257	0	6	4035
% Passenger Vehicles	0	0	0	100	100	98.7	100	100	100	0	99.6	100	100	99.4	0	100	99.3
Heavy Vehicles	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0	4
% Heavy Vehicles	0	0	0	0	0	0.1	0	0	0	0	0.1	0	0	0.2	0	0	0.1
Bicycles	0	0	0	0	0	15	0	0	0	0	2	0	0	6	0	0	23
% Bicycles	0	0	0	0	0	1.2	0	0	0	0	0.2	0	0	0.5	0	0	0.6

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Niantic Ave / Cranston St
Weather: Sunny, 70's

File Name : 7578_niantic_weekend
Site Code : 00757802
Start Date : 10/2/2021



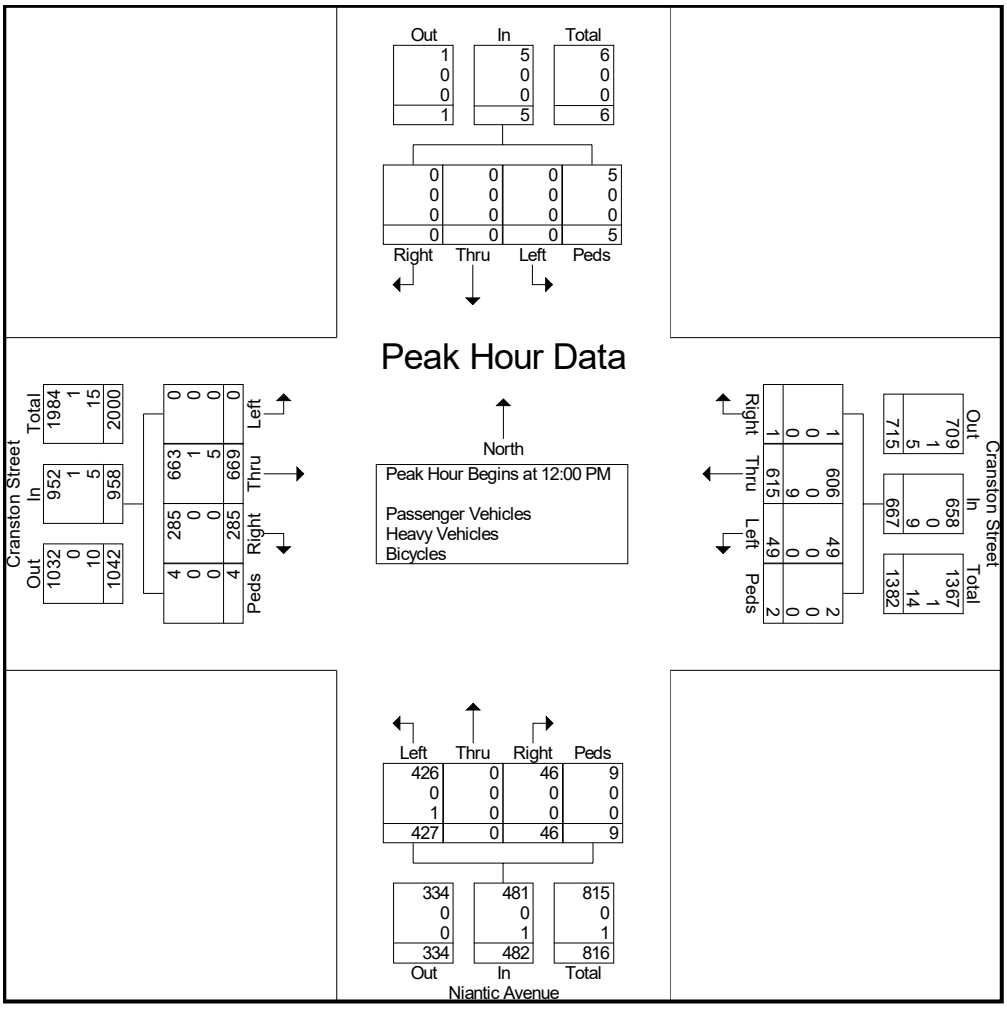
BETA Group, Inc.

701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Niantic Ave / Cranston St
Weather: Sunny, 70's

File Name : 7578_niantic_weekend
Site Code : 00757802
Start Date : 10/2/2021
Page No : 3

	Southbound					Cranston Street Westbound					Niantic Avenue Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	0	0	0	**5**	**5**	0	150	**17**	**1**	168	10	0	**115**	1	**126**	75	152	0	0	227	526
12:15 PM	0	0	0	0	0	0	**158**	15	0	**173**	9	0	106	**6**	121	66	159	0	**3**	228	522
12:30 PM	0	0	0	0	0	0	156	10	1	167	12	0	106	2	120	60	**183**	0	1	244	531
12:45 PM	0	0	0	0	0	**1**	151	7	0	159	**15**	0	100	0	115	**84**	175	0	0	**259**	**533**
Total Volume	0	0	0	5	5	1	615	49	2	667	46	0	427	9	482	285	669	0	4	958	2112
% App. Total	0	0	0	100		0.1	92.2	7.3	0.3		9.5	0	88.6	1.9		29.7	69.8	0	0.4		
PHF	.000	.000	.000	.250	.250	.250	.973	.721	.500	.964	.767	.000	.928	.375	.956	.848	.914	.000	.333	.925	.991
Passenger Vehicles	0	0	0	5	5	1	606	49	2	658	46	0	426	9	481	285	663	0	4	952	2096
% Passenger Vehicles	0	0	0	100	100	100	98.5	100	100	98.7	100	0	99.8	100	99.8	100	99.1	0	100	99.4	99.2
Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
% Heavy Vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0.1	0.0
Bicycles	0	0	0	0	0	0	9	0	0	9	0	0	1	0	1	0	5	0	0	5	15
% Bicycles	0	0	0	0	0	0	1.5	0	0	1.3	0	0	0.2	0	0.2	0	0.7	0	0	0.5	0.7



Cranston Street at Niantic Avenue

(Source; *Citizens Bank Campus* Traffic Study Report, dated August 2015, by *BETA Group, Inc.*)

Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Niantic Ave.
Weather: Sunny/80's

File Name : 513107 Volume
Site Code : 513107
Start Date : 8/19/2015
Page No : 1

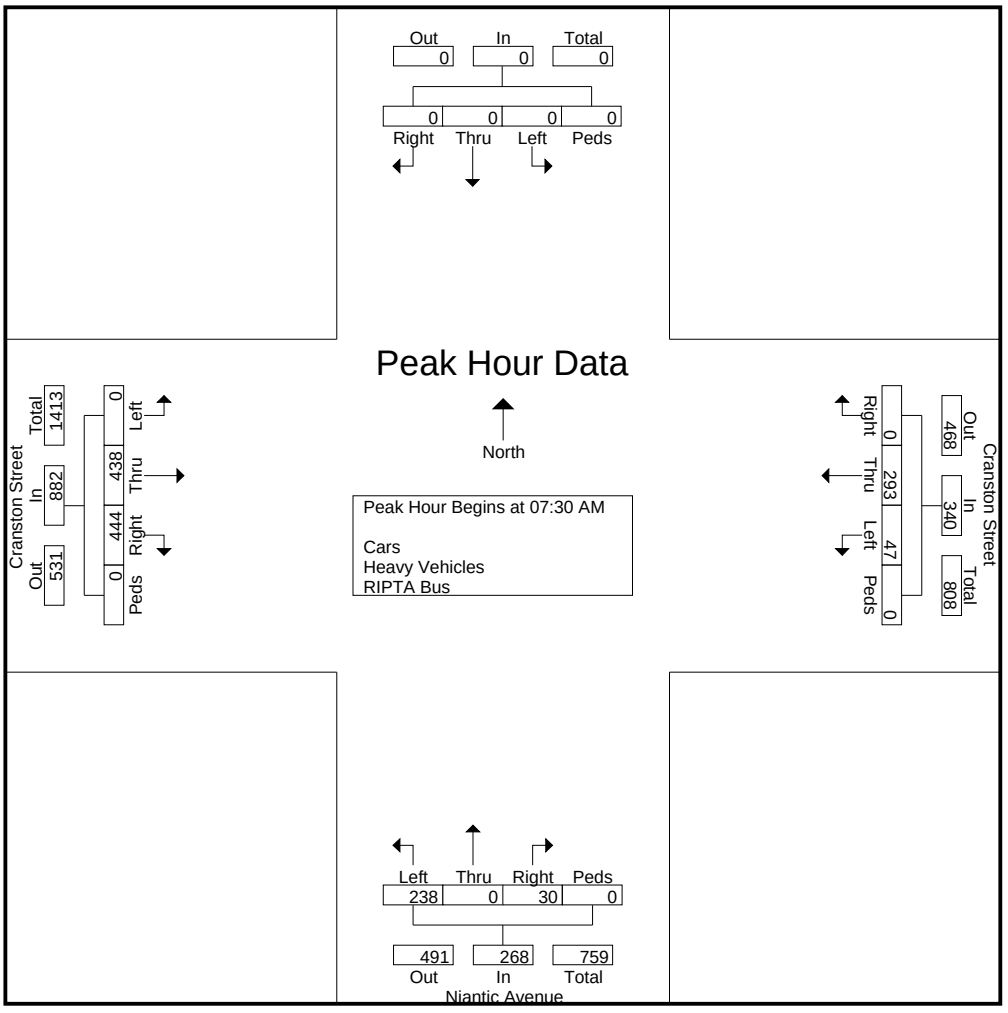
Groups Printed- Cars - Heavy Vehicles - RIPTA Bus

	Southbound					Cranston Street Westbound					Niantic Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	11	66	0	0	77	47	0	8	0	55	0	66	72	0	138	270
07:15 AM	0	0	0	0	0	6	67	0	0	73	54	0	7	0	61	0	87	106	0	193	327
07:30 AM	0	0	0	0	0	9	70	0	0	79	52	0	7	0	59	0	104	122	0	226	364
07:45 AM	0	0	0	0	0	18	73	0	0	91	55	0	8	0	63	0	104	106	0	210	364
Total	0	0	0	0	0	44	276	0	0	320	208	0	30	0	238	0	361	406	0	767	1325
08:00 AM	0	0	0	0	0	11	70	0	0	81	68	0	5	0	73	0	105	111	0	216	370
08:15 AM	0	0	0	0	0	9	80	0	0	89	63	0	10	0	73	0	125	105	0	230	392
08:30 AM	0	0	0	0	0	25	69	0	0	94	52	0	13	0	65	0	92	94	0	186	345
08:45 AM	0	0	0	0	0	9	81	0	0	90	54	0	10	0	64	0	112	67	0	179	333
Total	0	0	0	0	0	54	300	0	0	354	237	0	38	0	275	0	434	377	0	811	1440
*** BREAK ***																					
04:00 PM	0	0	0	0	0	9	119	0	0	128	118	0	16	0	134	0	149	64	1	214	476
04:15 PM	0	0	0	0	0	10	144	0	0	154	135	0	15	0	150	0	125	70	0	195	499
04:30 PM	0	0	0	0	0	8	128	0	0	136	157	0	11	0	168	0	144	66	0	210	514
04:45 PM	0	0	0	0	0	11	121	0	0	132	150	0	14	0	164	0	134	88	0	222	518
Total	0	0	0	0	0	38	512	0	0	550	560	0	56	0	616	0	552	288	1	841	2007
05:00 PM	0	0	0	0	0	4	117	0	0	121	154	0	21	0	175	0	153	78	0	231	527
05:15 PM	0	0	0	0	0	8	133	0	0	141	138	0	7	0	145	0	135	73	0	208	494
05:30 PM	0	0	0	0	0	8	137	0	0	145	163	0	9	0	172	0	129	49	0	178	495
05:45 PM	0	0	0	0	0	5	128	0	0	133	119	0	5	0	124	0	139	42	0	181	438
Total	0	0	0	0	0	25	515	0	0	540	574	0	42	0	616	0	556	242	0	798	1954
Grand Total	0	0	0	0	0	161	1603	0	0	1764	1579	0	166	0	1745	0	1903	1313	1	3217	6726
Apprch %	0	0	0	0		9.1	90.9	0	0		90.5	0	9.5	0		0	59.2	40.8	0		
Total %	0	0	0	0	0	2.4	23.8	0	0	26.2	23.5	0	2.5	0	25.9	0	28.3	19.5	0	47.8	
Cars	0	0	0	0	0	160	1592	0	0	1752	1570	0	163	0	1733	0	1888	1307	0	3195	6680
% Cars	0	0	0	0	0	99.4	99.3	0	0	99.3	99.4	0	98.2	0	99.3	0	99.2	99.5	0	99.3	99.3
Heavy Vehicles	0	0	0	0	0	1	3	0	0	4	9	0	2	0	11	0	5	2	0	7	22
% Heavy Vehicles	0	0	0	0	0	0.6	0.2	0	0	0.2	0.6	0	1.2	0	0.6	0	0.3	0.2	0	0.2	0.3
RIPTA Bus	0	0	0	0	0	0	8	0	0	8	0	0	1	0	1	0	10	4	1	15	24
% RIPTA Bus	0	0	0	0	0	0	0.5	0	0	0.5	0	0	0.6	0	0.1	0	0.5	0.3	100	0.5	0.4

Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Niantic Ave.
Weather: Sunny/80's

File Name : 513107 Volume
Site Code : 513107
Start Date : 8/19/2015
Page No : 2

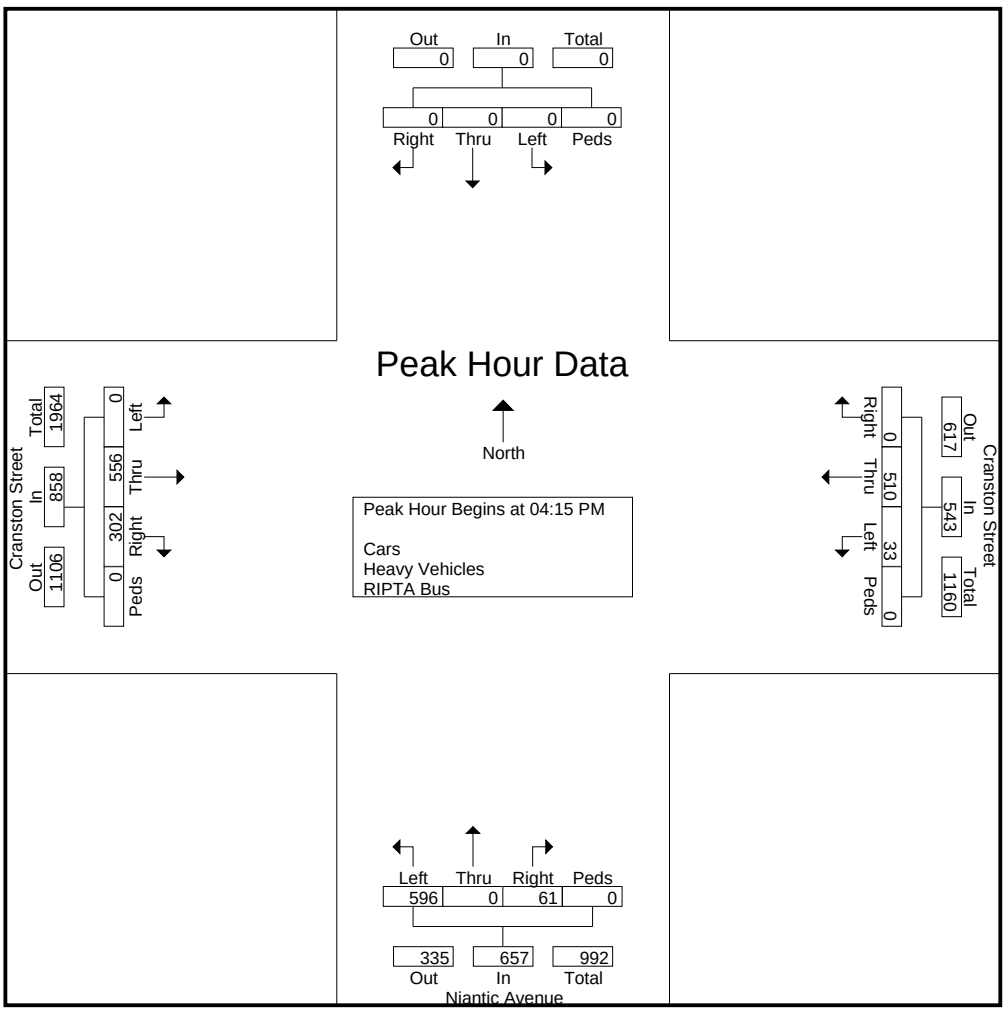
	Southbound					Cranston Street Westbound					Niantic Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	9	70	0	0	79	52	0	7	0	59	0	104	**122**	0	226	364
07:45 AM	0	0	0	0	0	**18**	73	0	0	**91**	55	0	8	0	63	0	104	106	0	210	364
08:00 AM	0	0	0	0	0	11	70	0	0	81	**68**	0	5	0	**73**	0	105	111	0	216	370
08:15 AM	0	0	0	0	0	9	**80**	0	0	89	63	0	**10**	0	73	0	**125**	105	0	**230**	**392**
Total Volume	0	0	0	0	0	47	293	0	0	340	238	0	30	0	268	0	438	444	0	882	1490
% App. Total	0	0	0	0		13.8	86.2	0	0		88.8	0	11.2	0		0	49.7	50.3	0		
PHF	.000	.000	.000	.000	.000	.653	.916	.000	.000	.934	.875	.000	.750	.000	.918	.000	.876	.910	.000	.959	.950



Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Niantic Ave.
Weather: Sunny/80's

File Name : 513107 Volume
Site Code : 513107
Start Date : 8/19/2015

	Southbound					Cranston Street Westbound					Niantic Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	0	0	0	0	10	**144**	0	0	**154**	135	0	15	0	150	0	125	70	0	195	499
04:30 PM	0	0	0	0	0	8	128	0	0	136	**157**	0	11	0	168	0	144	66	0	210	514
04:45 PM	0	0	0	0	0	**11**	121	0	0	132	150	0	14	0	164	0	134	**88**	0	222	518
05:00 PM	0	0	0	0	0	4	117	0	0	121	154	0	**21**	0	**175**	0	**153**	78	0	**231**	**527**
Total Volume	0	0	0	0	0	33	510	0	0	543	596	0	61	0	657	0	556	302	0	858	2058
% App. Total	0	0	0	0		6.1	93.9	0	0		90.7	0	9.3	0		0	64.8	35.2	0		
PHF	.000	.000	.000	.000	.000	.750	.885	.000	.000	.881	.949	.000	.726	.000	.939	.000	.908	.858	.000	.929	.976



Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Huntington Ave / Cranston St
Weather: Cloudy, 50s

File Name : 7578_huntington_weekday
Site Code : 00757800
Start Date : 10/28/2021
Page No : 1

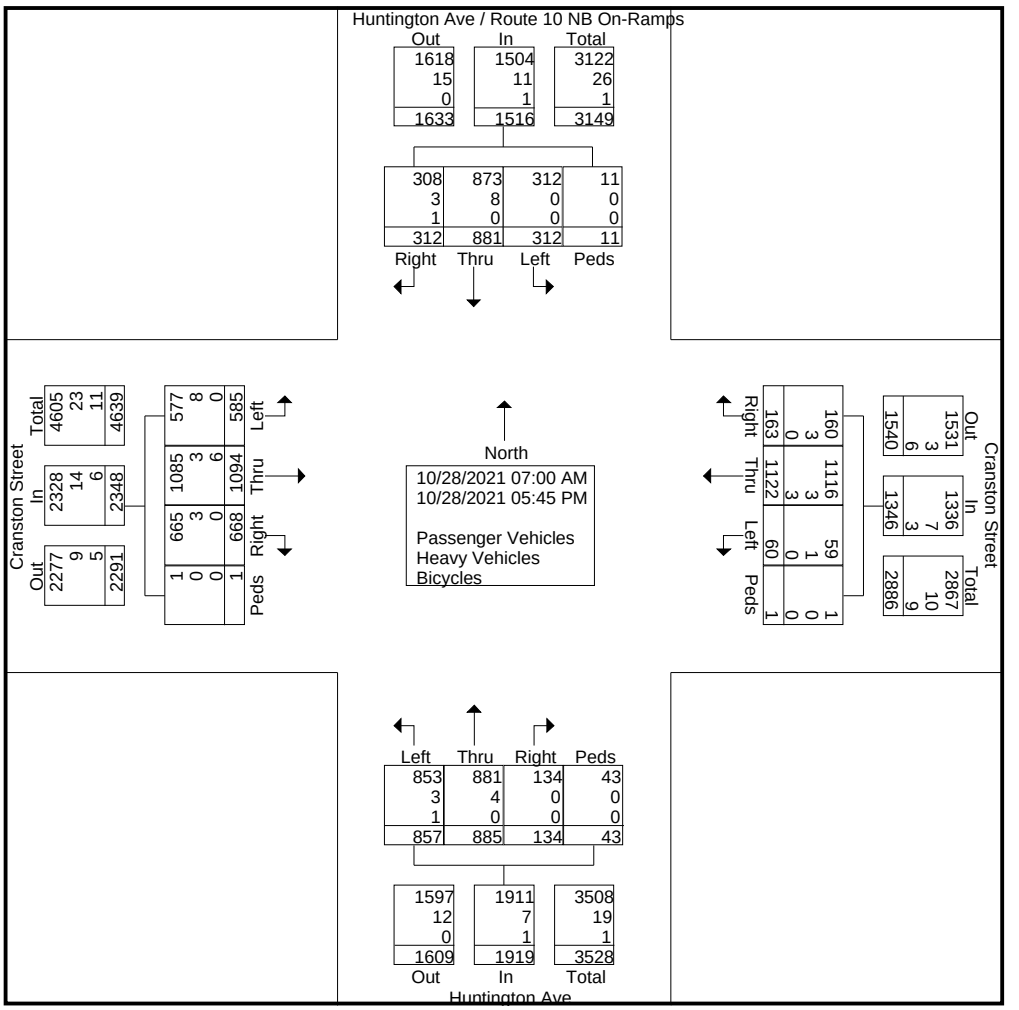
Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

	Huntington Ave / Route 10 NB On-Ramps Southbound				Cranston Street Westbound				Huntington Ave Northbound				Cranston Street Eastbound				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	18	48	8	1	8	42	4	0	5	25	24	2	18	59	29	0	291
07:15 AM	19	50	19	1	12	52	2	0	8	29	38	4	28	70	61	0	393
07:30 AM	23	72	16	0	14	52	3	0	5	43	42	0	50	79	49	0	448
07:45 AM	19	61	14	0	11	71	4	0	10	58	51	1	64	77	24	1	466
Total	79	231	57	2	45	217	13	0	28	155	155	7	160	285	163	1	1598
08:00 AM	25	75	23	1	8	58	9	0	3	67	64	0	32	71	34	0	470
08:15 AM	25	39	26	0	10	62	3	0	6	45	50	4	42	68	34	0	414
08:30 AM	29	46	10	0	6	53	4	0	3	46	39	1	36	48	36	0	357
08:45 AM	22	61	24	0	7	49	4	0	2	40	44	1	34	57	31	0	376
Total	101	221	83	1	31	222	20	0	14	198	197	6	144	244	135	0	1617
*** BREAK ***																	
04:00 PM	24	58	19	0	13	73	10	0	21	50	67	5	32	72	32	0	476
04:15 PM	14	63	27	0	11	102	3	0	12	74	55	4	44	85	29	0	523
04:30 PM	13	64	27	0	7	82	1	0	11	74	62	4	55	74	38	0	512
04:45 PM	13	60	23	2	11	98	1	1	13	71	74	3	59	53	28	0	510
Total	64	245	96	2	42	355	15	1	57	269	258	16	190	284	127	0	2021
05:00 PM	18	57	16	2	13	81	3	0	13	79	54	4	42	65	34	0	481
05:15 PM	18	44	18	2	7	85	3	0	6	61	62	2	40	86	44	0	478
05:30 PM	18	29	25	1	15	85	4	0	7	62	62	5	42	80	48	0	483
05:45 PM	14	54	17	1	10	77	2	0	9	61	69	3	50	50	34	0	451
Total	68	184	76	6	45	328	12	0	35	263	247	14	174	281	160	0	1893
Grand Total	312	881	312	11	163	1122	60	1	134	885	857	43	668	1094	585	1	7129
Apprch %	20.6	58.1	20.6	0.7	12.1	83.4	4.5	0.1	7	46.1	44.7	2.2	28.4	46.6	24.9	0	
Total %	4.4	12.4	4.4	0.2	2.3	15.7	0.8	0	1.9	12.4	12	0.6	9.4	15.3	8.2	0	
Passenger Vehicles	308	873	312	11	160	1116	59	1	134	881	853	43	665	1085	577	1	7079
% Passenger Vehicles	98.7	99.1	100	100	98.2	99.5	98.3	100	100	99.5	99.5	100	99.6	99.2	98.6	100	99.3
Heavy Vehicles	3	8	0	0	3	3	1	0	0	4	3	0	3	3	8	0	39
% Heavy Vehicles	1	0.9	0	0	1.8	0.3	1.7	0	0	0.5	0.4	0	0.4	0.3	1.4	0	0.5
Bicycles	1	0	0	0	0	3	0	0	0	0	1	0	0	6	0	0	11
% Bicycles	0.3	0	0	0	0	0.3	0	0	0	0	0.1	0	0	0.5	0	0	0.2

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Huntington Ave / Cranston St
Weather: Cloudy, 50s

File Name : 7578_huntington_weekday
Site Code : 00757800
Start Date : 10/28/2021
Page No : 2

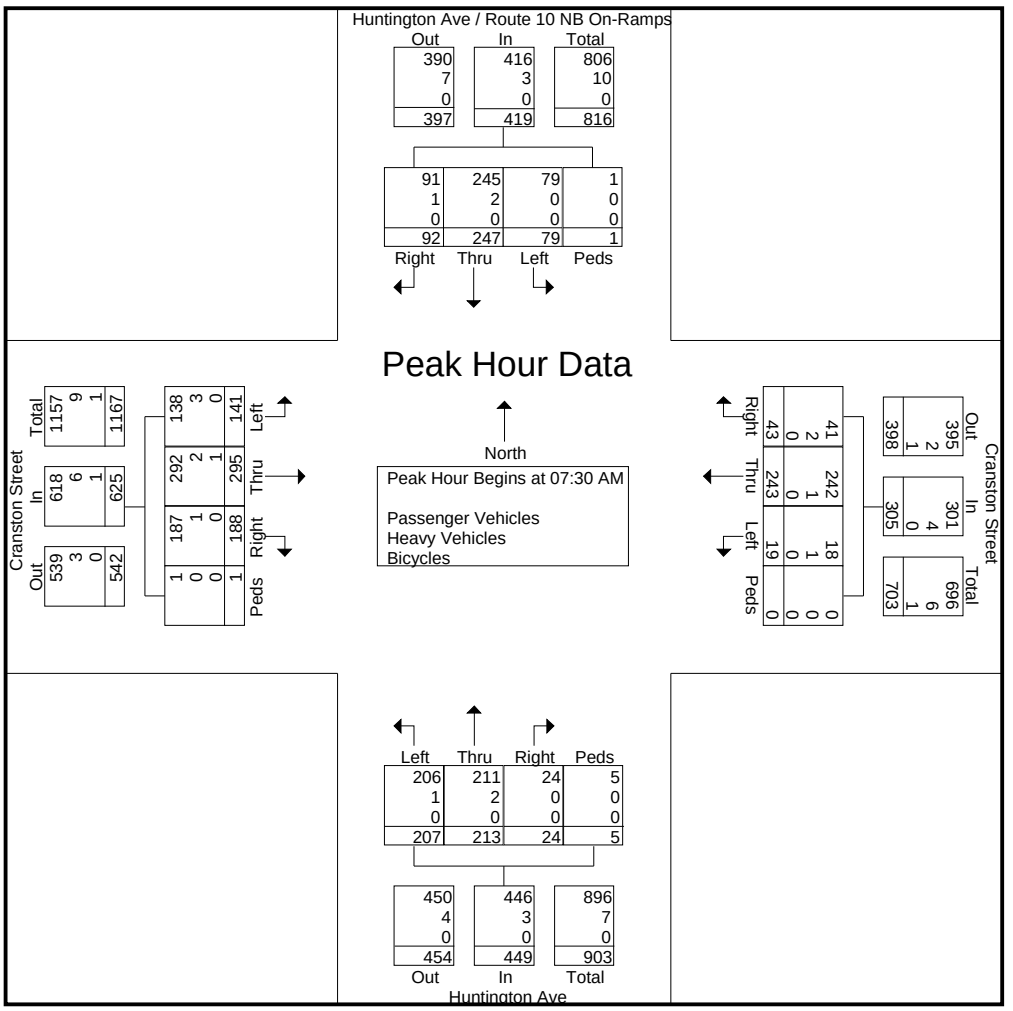


BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Huntington Ave / Cranston St
Weather: Cloudy, 50s

File Name : 7578_huntington_weekday
Site Code : 00757800
Start Date : 10/28/2021
Page No : 3

	Huntington Ave / Route 10 NB On-Ramps Southbound					Cranston Street Westbound					Huntington Ave Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	23	72	16	0	111	**14**	52	3	0	69	5	43	42	0	90	50	**79**	**49**	0	**178**	448
07:45 AM	19	61	14	0	94	11	**71**	4	0	**86**	**10**	58	51	1	120	**64**	77	24	**1**	166	466
08:00 AM	**25**	**75**	23	**1**	**124**	8	58	**9**	0	75	3	**67**	**64**	0	**134**	32	71	34	0	137	**470**
08:15 AM	25	39	**26**	0	90	10	62	3	0	75	6	45	50	**4**	105	42	68	34	0	144	414
Total Volume	92	247	79	1	419	43	243	19	0	305	24	213	207	5	449	188	295	141	1	625	1798
% App. Total	22	58.9	18.9	0.2		14.1	79.7	6.2	0		5.3	47.4	46.1	1.1		30.1	47.2	22.6	0.2		
PHF	.920	.823	.760	.250	.845	.768	.856	.528	.000	.887	.600	.795	.809	.313	.838	.734	.934	.719	.250	.878	.956
Passenger Vehicles	91	245	79	1	416	41	242	18	0	301	24	211	206	5	446	187	292	138	1	618	1781
% Passenger Vehicles	98.9	99.2	100	100	99.3	95.3	99.6	94.7	0	98.7	100	99.1	99.5	100	99.3	99.5	99.0	97.9	100	98.9	99.1
Heavy Vehicles	1	2	0	0	3	2	1	1	0	4	0	2	1	0	3	1	2	3	0	6	16
% Heavy Vehicles	1.1	0.8	0	0	0.7	4.7	0.4	5.3	0	1.3	0	0.9	0.5	0	0.7	0.5	0.7	2.1	0	1.0	0.9
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.3	0	0	0.2	0.1



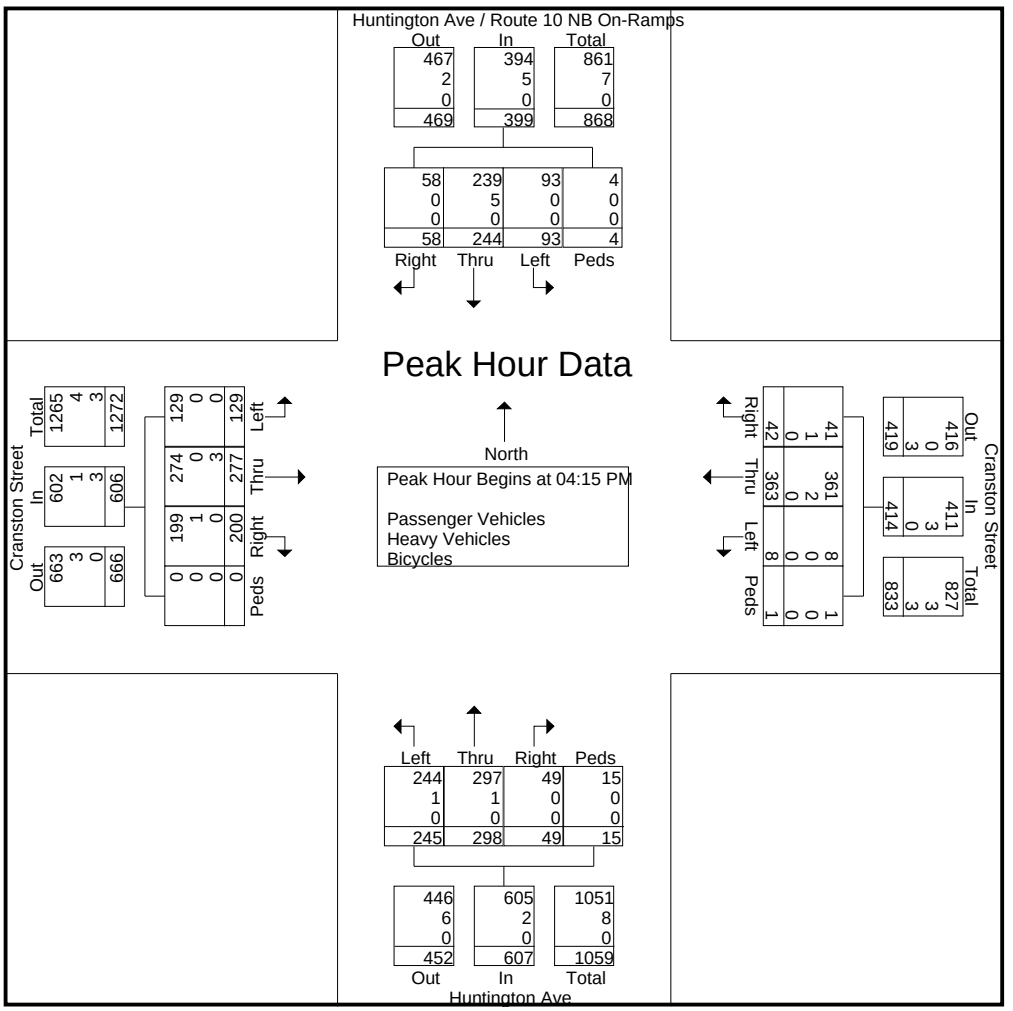
BETA Group, Inc.

701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Huntington Ave / Cranston St
Weather: Cloudy, 50s

File Name : 7578_huntington_weekday
Site Code : 00757800
Start Date : 10/28/2021
Page No : 4

	Huntington Ave / Route 10 NB On-Ramps Southbound					Cranston Street Westbound					Huntington Ave Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	14	63	**27**	0	**104**	11	**102**	**3**	0	**116**	12	74	55	**4**	145	44	**85**	29	0	158	**523**
04:30 PM	13	**64**	27	0	104	7	82	1	0	90	11	74	62	4	151	55	74	**38**	0	**167**	512
04:45 PM	13	60	23	**2**	98	11	98	1	**1**	111	**13**	71	**74**	3	**161**	**59**	53	28	0	140	510
05:00 PM	**18**	57	16	2	93	**13**	81	3	0	97	13	**79**	54	4	150	42	65	34	0	141	481
Total Volume	58	244	93	4	399	42	363	8	1	414	49	298	245	15	607	200	277	129	0	606	2026
% App. Total	14.5	61.2	23.3	1		10.1	87.7	1.9	0.2		8.1	49.1	40.4	2.5		33	45.7	21.3	0		
PHF	.806	.953	.861	.500	.959	.808	.890	.667	.250	.892	.942	.943	.828	.938	.943	.847	.815	.849	.000	.907	.968
Passenger Vehicles	58	239	93	4	394	41	361	8	1	411	49	297	244	15	605	199	274	129	0	602	2012
% Passenger Vehicles	100	98.0	100	100	98.7	97.6	99.4	100	100	99.3	100	99.7	99.6	100	99.7	99.5	98.9	100	0	99.3	99.3
Heavy Vehicles	0	5	0	0	5	1	2	0	0	3	0	1	1	0	2	1	0	0	0	1	11
% Heavy Vehicles	0	2.0	0	0	1.3	2.4	0.6	0	0	0.7	0	0.3	0.4	0	0.3	0.5	0	0	0	0.2	0.5
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1	0	0	0.5	0.1



BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Huntington Ave / Cranston St
Weather: Sunny, 50s

File Name : 7578_Huntington_Weekend
Site Code : 00757805
Start Date : 10/23/2021
Page No : 1

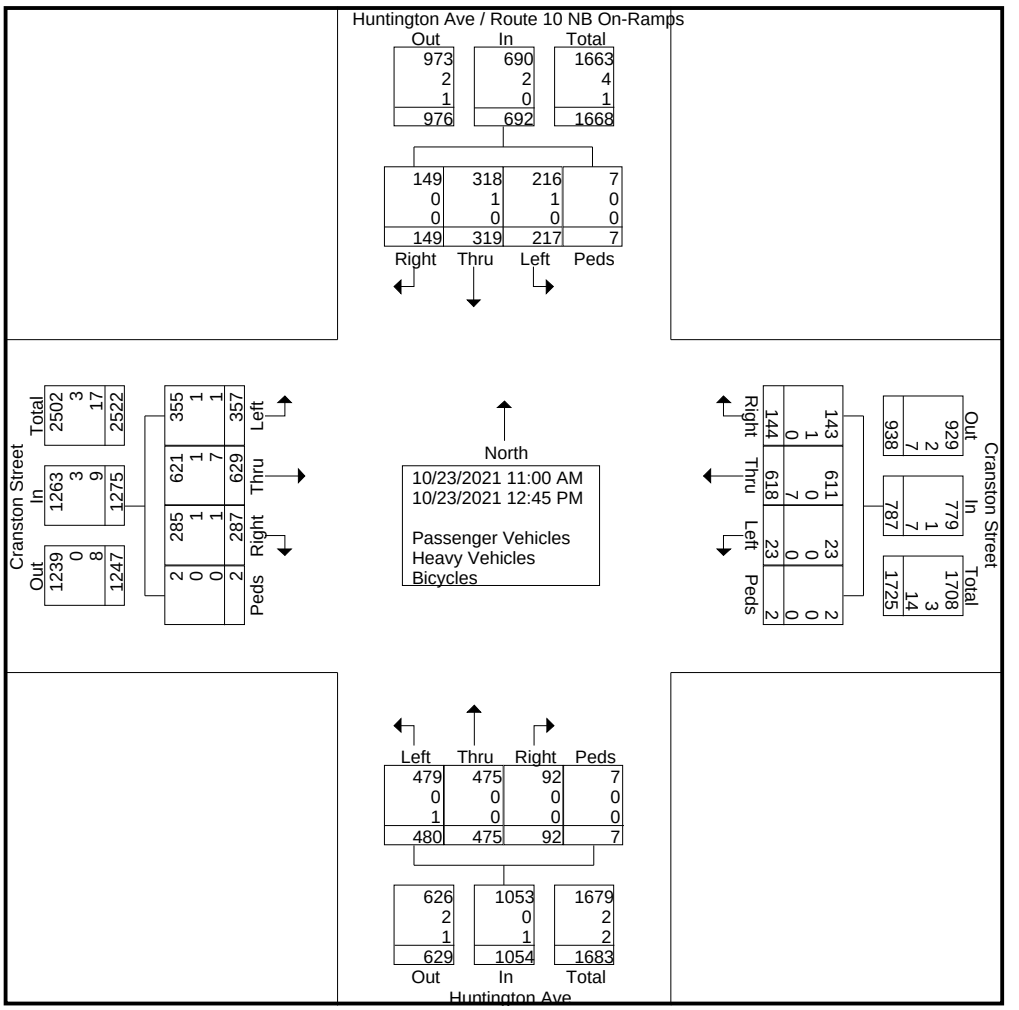
Groups Printed- Passenger Vehicles - Heavy Vehicles - Bicycles

	Huntington Ave / Route 10 NB On-Ramps Southbound				Cranston Street Westbound				Huntington Ave Northbound				Cranston Street Eastbound				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
11:00 AM	12	36	29	1	24	66	1	1	3	55	65	1	23	70	44	0	431
11:15 AM	15	40	28	0	19	72	2	0	17	52	51	0	31	77	52	0	456
11:30 AM	19	40	24	0	19	77	2	0	9	46	60	1	33	80	37	0	447
11:45 AM	24	31	28	1	28	80	6	0	11	51	58	0	46	76	43	0	483
Total	70	147	109	2	90	295	11	1	40	204	234	2	133	303	176	0	1817
12:00 PM	31	37	32	0	10	76	4	1	17	66	66	2	32	88	38	1	501
12:15 PM	18	45	20	1	19	76	2	0	9	63	57	2	46	76	44	1	479
12:30 PM	18	57	32	1	14	77	2	0	14	75	59	1	43	80	52	0	525
12:45 PM	12	33	24	3	11	94	4	0	12	67	64	0	33	82	47	0	486
Total	79	172	108	5	54	323	12	1	52	271	246	5	154	326	181	2	1991
Grand Total	149	319	217	7	144	618	23	2	92	475	480	7	287	629	357	2	3808
Apprch %	21.5	46.1	31.4	1	18.3	78.5	2.9	0.3	8.7	45.1	45.5	0.7	22.5	49.3	28	0.2	
Total %	3.9	8.4	5.7	0.2	3.8	16.2	0.6	0.1	2.4	12.5	12.6	0.2	7.5	16.5	9.4	0.1	
Passenger Vehicles	149	318	216	7	143	611	23	2	92	475	479	7	285	621	355	2	3785
% Passenger Vehicles	100	99.7	99.5	100	99.3	98.9	100	100	100	100	99.8	100	99.3	98.7	99.4	100	99.4
Heavy Vehicles	0	1	1	0	1	0	0	0	0	0	0	0	1	1	1	0	6
% Heavy Vehicles	0	0.3	0.5	0	0.7	0	0	0	0	0	0	0	0.3	0.2	0.3	0	0.2
Bicycles	0	0	0	0	0	7	0	0	0	0	1	0	1	7	1	0	17
% Bicycles	0	0	0	0	0	1.1	0	0	0	0	0.2	0	0.3	1.1	0.3	0	0.4

BETA Group, Inc.
701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Huntington Ave / Cranston St
Weather: Sunny, 50s

File Name : 7578_Huntington_Weekend
Site Code : 00757805
Start Date : 10/23/2021



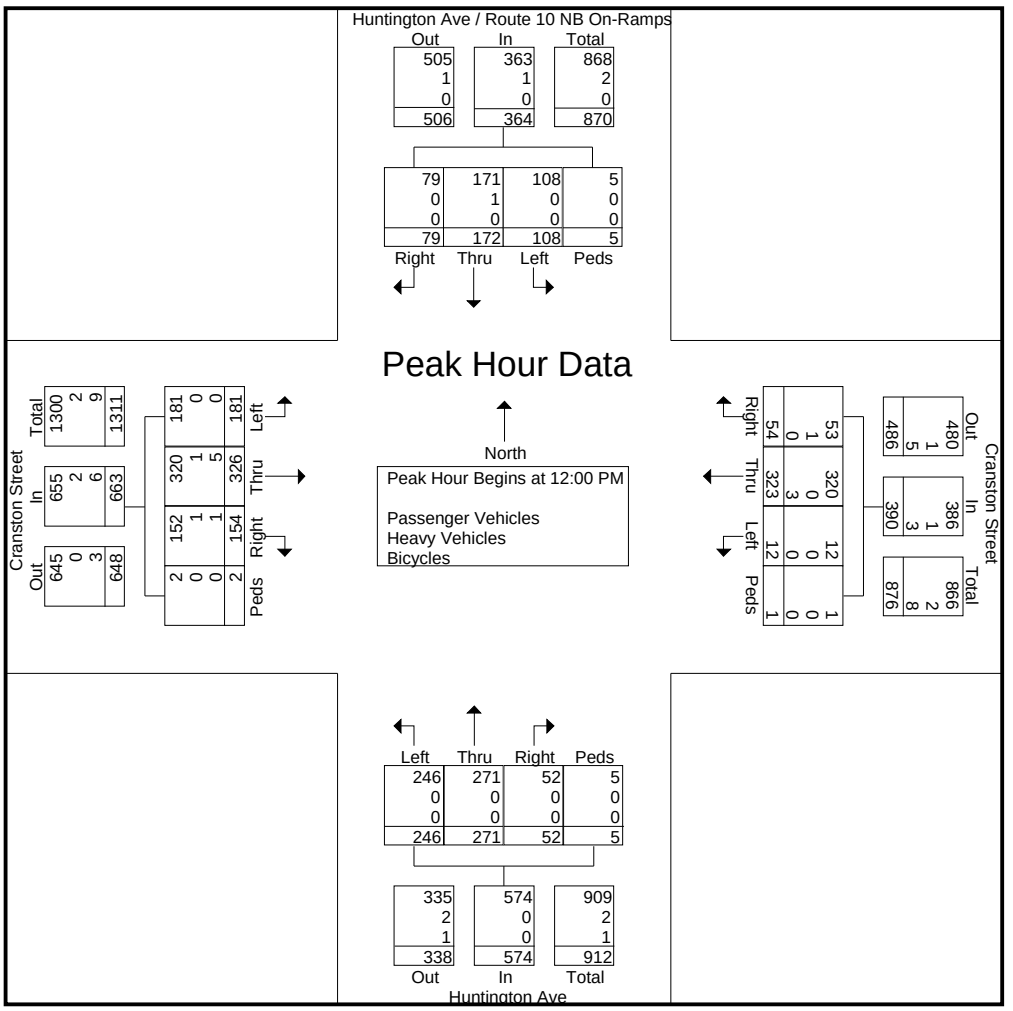
BETA Group, Inc.

701 George Washington Highway
Lincoln, Rhode Island, 02865
P:401.333.2382

Project: Trolley Barn Plaza
Town/City: Cranston, RI
Location: Huntington Ave / Cranston St
Weather: Sunny, 50s

File Name : 7578_Huntington_Weekend
Site Code : 00757805
Start Date : 10/23/2021
Page No : 3

	Huntington Ave / Route 10 NB On-Ramps Southbound					Cranston Street Westbound					Huntington Ave Northbound					Cranston Street Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 12:00 PM																					
12:00 PM	**31**	37	**32**	0	100	10	76	**4**	**1**	91	**17**	66	**66**	**2**	**151**	32	**88**	38	**1**	159	501
12:15 PM	18	45	20	1	84	**19**	76	2	0	97	9	63	57	2	131	**46**	76	44	1	167	479
12:30 PM	18	**57**	32	1	**108**	14	77	2	0	93	14	**75**	59	1	149	43	80	**52**	0	**175**	**525**
12:45 PM	12	33	24	**3**	72	11	**94**	4	0	**109**	12	67	64	0	143	33	82	47	0	162	486
Total Volume	79	172	108	5	364	54	323	12	1	390	52	271	246	5	574	154	326	181	2	663	1991
% App. Total	21.7	47.3	29.7	1.4		13.8	82.8	3.1	0.3		9.1	47.2	42.9	0.9		23.2	49.2	27.3	0.3		
PHF	.637	.754	.844	.417	.843	.711	.859	.750	.250	.894	.765	.903	.932	.625	.950	.837	.926	.870	.500	.947	.948
Passenger Vehicles	79	171	108	5	363	53	320	12	1	386	52	271	246	5	574	152	320	181	2	655	1978
% Passenger Vehicles	100	99.4	100	100	99.7	98.1	99.1	100	100	99.0	100	100	100	100	100	98.7	98.2	100	100	98.8	99.3
Heavy Vehicles	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	1	1	0	0	2	4
% Heavy Vehicles	0	0.6	0	0	0.3	1.9	0	0	0	0.3	0	0	0	0	0	0.6	0.3	0	0	0.3	0.2
Bicycles	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	1	5	0	0	6	9
% Bicycles	0	0	0	0	0	0	0.9	0	0	0.8	0	0	0	0	0	0.6	1.5	0	0	0.9	0.5



Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

(Source; *Citizens Bank Campus* Traffic Study Report, dated August 2015, by *BETA Group, Inc.*)

Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Huntington Ave.
Weather: Sunny/80's

File Name : 513108 Volume
Site Code : 513108
Start Date : 8/19/2015
Page No : 1

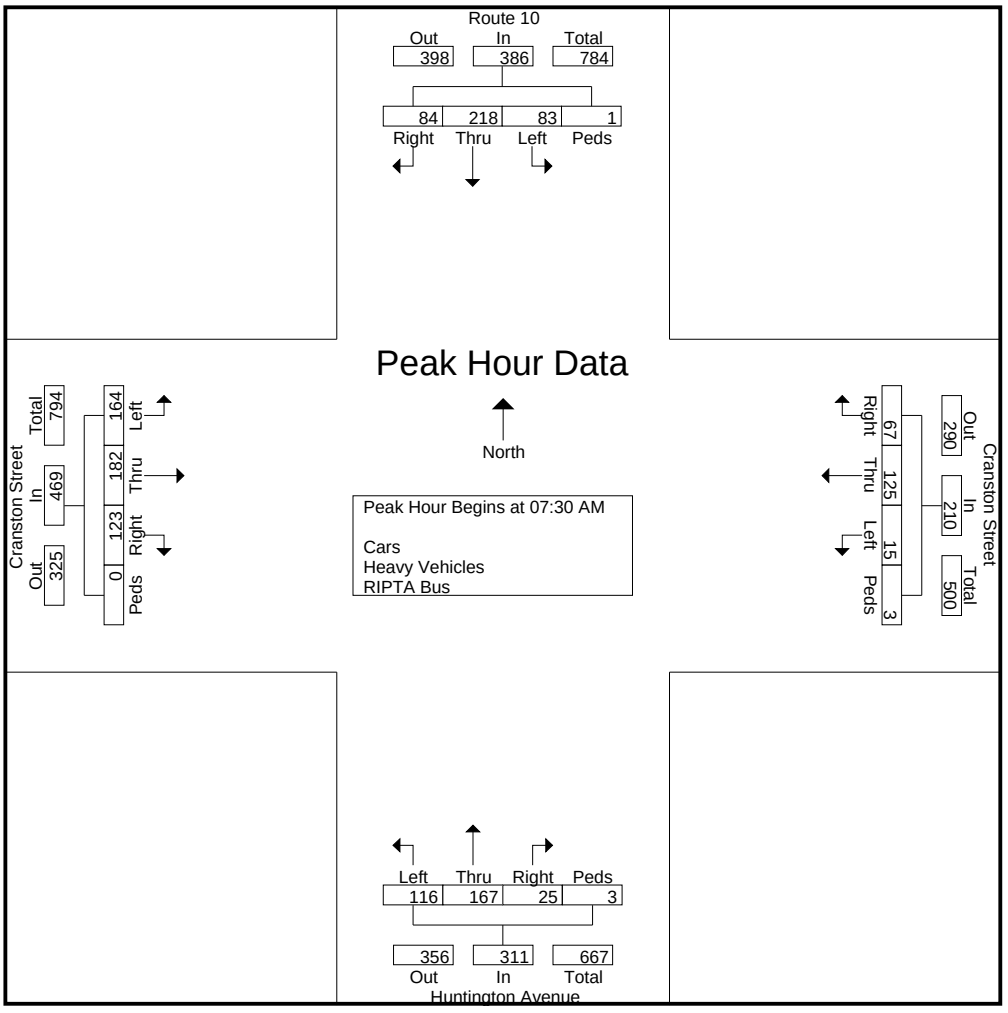
Groups Printed- Cars - Heavy Vehicles - RIPTA Bus

	Route 10 Southbound					Cranston Street Westbound					Huntington Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	23	37	21	0	81	6	28	12	0	46	22	17	10	0	49	26	31	16	0	73	249
07:15 AM	25	48	20	0	93	6	29	15	0	50	29	47	4	0	80	34	30	26	0	90	313
07:30 AM	22	52	24	1	99	4	27	16	1	48	29	36	2	1	68	46	33	34	0	113	328
07:45 AM	18	74	19	0	111	3	38	17	2	60	25	43	12	1	81	35	54	28	0	117	369
Total	88	211	84	1	384	19	122	60	3	204	105	143	28	2	278	141	148	104	0	393	1259
08:00 AM	22	48	17	0	87	7	33	13	0	53	29	41	6	0	76	38	41	28	0	107	323
08:15 AM	21	44	24	0	89	1	27	21	0	49	33	47	5	1	86	45	54	33	0	132	356
08:30 AM	13	49	17	0	79	5	46	12	0	63	21	32	6	0	59	36	48	26	0	110	311
08:45 AM	20	62	20	1	103	1	36	16	0	53	36	46	7	1	90	41	46	22	1	110	356
Total	76	203	78	1	358	14	142	62	0	218	119	166	24	2	311	160	189	109	1	459	1346
*** BREAK ***																					
04:00 PM	28	50	14	1	93	2	40	26	0	68	64	83	15	0	162	54	58	39	0	151	474
04:15 PM	24	70	25	8	127	0	75	16	0	91	62	64	10	0	136	39	68	31	0	138	492
04:30 PM	32	52	13	6	103	6	57	26	2	91	62	67	17	1	147	52	67	45	0	164	505
04:45 PM	27	69	16	2	114	0	51	13	0	64	71	87	19	1	178	48	69	34	0	151	507
Total	111	241	68	17	437	8	223	81	2	314	259	301	61	2	623	193	262	149	0	604	1978
05:00 PM	28	69	18	9	124	4	58	16	4	82	64	60	24	4	152	58	71	45	0	174	532
05:15 PM	39	55	17	0	111	2	55	16	1	74	78	83	12	0	173	43	70	32	0	145	503
05:30 PM	33	67	22	3	125	1	59	16	1	77	71	88	18	2	179	44	68	23	0	135	516
05:45 PM	37	63	17	1	118	3	63	15	3	84	70	73	14	3	160	46	58	34	0	138	500
Total	137	254	74	13	478	10	235	63	9	317	283	304	68	9	664	191	267	134	0	592	2051
Grand Total	412	909	304	32	1657	51	722	266	14	1053	766	914	181	15	1876	685	866	496	1	2048	6634
Apprch %	24.9	54.9	18.3	1.9		4.8	68.6	25.3	1.3		40.8	48.7	9.6	0.8		33.4	42.3	24.2	0		
Total %	6.2	13.7	4.6	0.5	25	0.8	10.9	4	0.2	15.9	11.5	13.8	2.7	0.2	28.3	10.3	13.1	7.5	0	30.9	
Cars	411	901	301	32	1645	51	721	265	14	1051	763	912	181	15	1871	682	863	496	1	2042	6609
% Cars	99.8	99.1	99	100	99.3	100	99.9	99.6	100	99.8	99.6	99.8	100	100	99.7	99.6	99.7	100	100	99.7	99.6
Heavy Vehicles	1	8	3	0	12	0	1	1	0	2	3	2	0	0	5	3	3	0	0	6	25
% Heavy Vehicles	0.2	0.9	1	0	0.7	0	0.1	0.4	0	0.2	0.4	0.2	0	0	0.3	0.4	0.3	0	0	0.3	0.4
RIPTA Bus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% RIPTA Bus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Huntington Ave.
Weather: Sunny/80's

File Name : 513108 Volume
Site Code : 513108
Start Date : 8/19/2015
Page No : 2

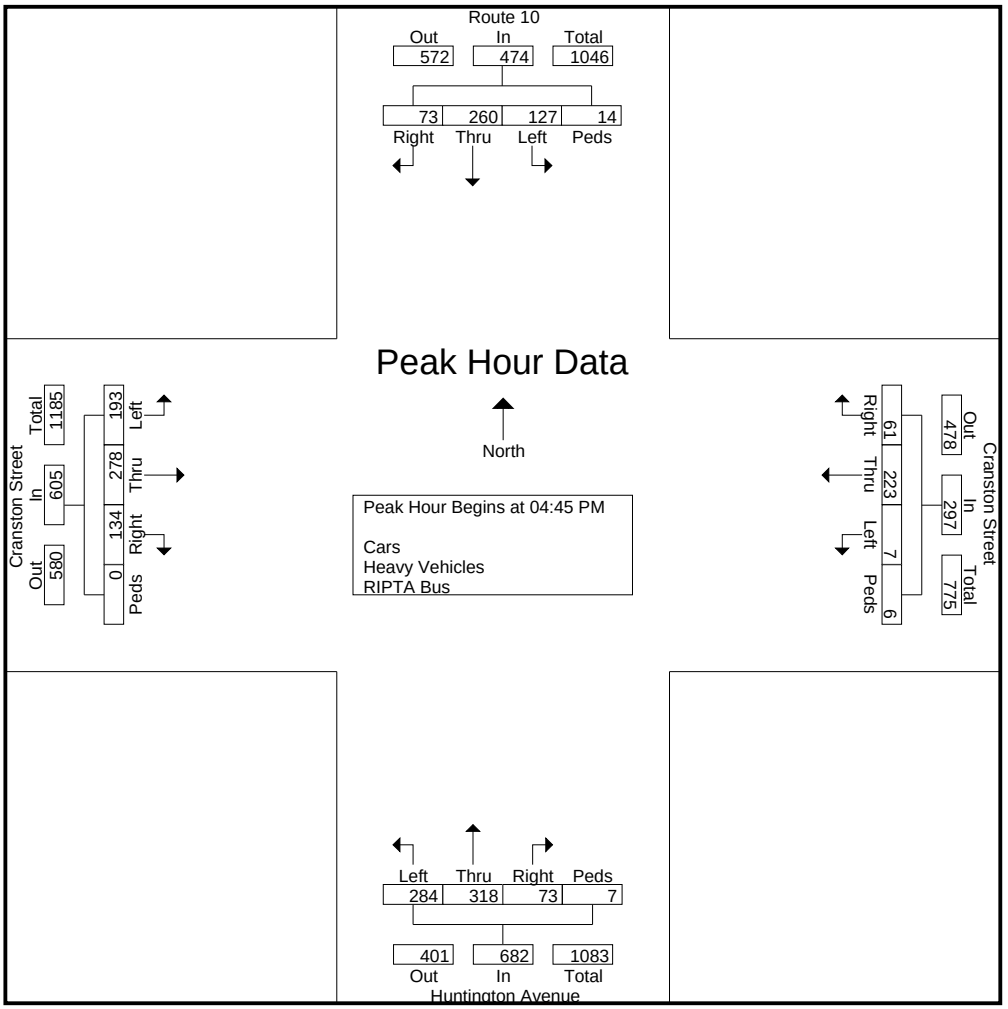
	Route 10 Southbound					Cranston Street Westbound					Huntington Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	**22**	52	**24**	**1**	99	4	27	16	1	48	29	36	2	**1**	68	**46**	33	**34**	0	113	328
07:45 AM	18	**74**	19	0	**111**	3	**38**	17	**2**	**60**	25	43	**12**	1	81	35	**54**	28	0	117	**369**
08:00 AM	22	48	17	0	87	**7**	33	13	0	53	29	41	6	0	76	38	41	28	0	107	323
08:15 AM	21	44	24	0	89	1	27	**21**	0	49	**33**	**47**	5	1	**86**	45	54	33	0	**132**	356
Total Volume	83	218	84	1	386	15	125	67	3	210	116	167	25	3	311	164	182	123	0	469	1376
% App. Total	21.5	56.5	21.8	0.3		7.1	59.5	31.9	1.4		37.3	53.7	8	1		35	38.8	26.2	0		
PHF	.943	.736	.875	.250	.869	.536	.822	.798	.375	.875	.879	.888	.521	.750	.904	.891	.843	.904	.000	.888	.932



Project Name: Citizens Bank Headquarters
Town/City: Cranston, RI
Location: Cranston St. @ Huntington Ave.
Weather: Sunny/80's

File Name : 513108 Volume
Site Code : 513108
Start Date : 8/19/2015
Page No : 3

	Route 10 Southbound					Cranston Street Westbound					Huntington Avenue Northbound					Cranston Street Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	27	**69**	16	2	114	0	51	13	0	64	71	87	19	1	178	48	69	34	0	151	507
05:00 PM	28	69	18	**9**	124	**4**	58	**16**	**4**	**82**	64	60	**24**	**4**	152	**58**	**71**	**45**	0	**174**	**532**
05:15 PM	**39**	55	17	0	111	2	55	16	1	74	**78**	83	12	0	173	43	70	32	0	145	503
05:30 PM	33	67	**22**	3	**125**	1	**59**	16	1	77	71	**88**	18	2	**179**	44	68	23	0	135	516
Total Volume	127	260	73	14	474	7	223	61	6	297	284	318	73	7	682	193	278	134	0	605	2058
% App. Total	26.8	54.9	15.4	3		2.4	75.1	20.5	2		41.6	46.6	10.7	1		31.9	46	22.1	0		
PHF	.814	.942	.830	.389	.948	.438	.945	.953	.375	.905	.910	.903	.760	.438	.953	.832	.979	.744	.000	.869	.967



APPENDIX B – Traffic Crash Data

January 2018 through December 2020

Cranston Street

Crash Data Summary

	Year			Total	Average per Year
	2018	2019	2020		
Intersections					
Cranston Street at Garfield Avenue	12	7	12	31	10
Cranston Street at Niantic Avenue	10	10	10	30	10
Corridor					
Cranston Street - Lincoln Avenue to Niantic Avenue	1	1	1	3	1
Total	23	18	23	64	21

Cranston Street at Garfield Avenue

		2018	2019	2020	Total	Percent
Collision Type						
	Rear End	10	4	9	23	74%
	Angle	1	1	0	2	6%
	Head-On	0	0	0	0	0%
	Pedestrian	0	0	0	0	0%
	Sideswipe, Same Direction	1	1	2	4	13%
	Sideswipe, Opposite Direction	0	0	0	0	0%
	Collision with Object	0	0	1	1	3%
	Other	0	0	0	0	0%
	Unknown	0	1	0	1	3%
Crash Severity						
	Property	11	6	11	28	90%
	Injury	1	1	1	3	10%
Light Condition						
	Daylight	7	6	10	23	74%
	Dawn	0	0	0	0	0%
	Dusk	1	0	0	1	3%
	Dark - Lighted	4	1	2	7	23%
	Dark - Not Lighted	0	0	0	0	0%
	Dark - Unknown Lighting	0	0	0	0	0%
Road Condition						
	Dry	10	6	10	26	84%
	Wet	2	0	2	4	13%
	Snow	0	0	0	0	0%
	Other	0	0	0	0	0%
	Unknown	0	1	0	1	3%
Hour of Day						
	6:00 AM - 9:00 AM	0	0	0	0	0%
	9:00 AM - 3:00 PM	5	4	8	17	55%
	3:00 PM - 6:00 PM	1	2	2	5	16%
	6:00 PM - 6:00 AM	6	1	2	9	29%
	Total Crashes:	12	7	12	31	

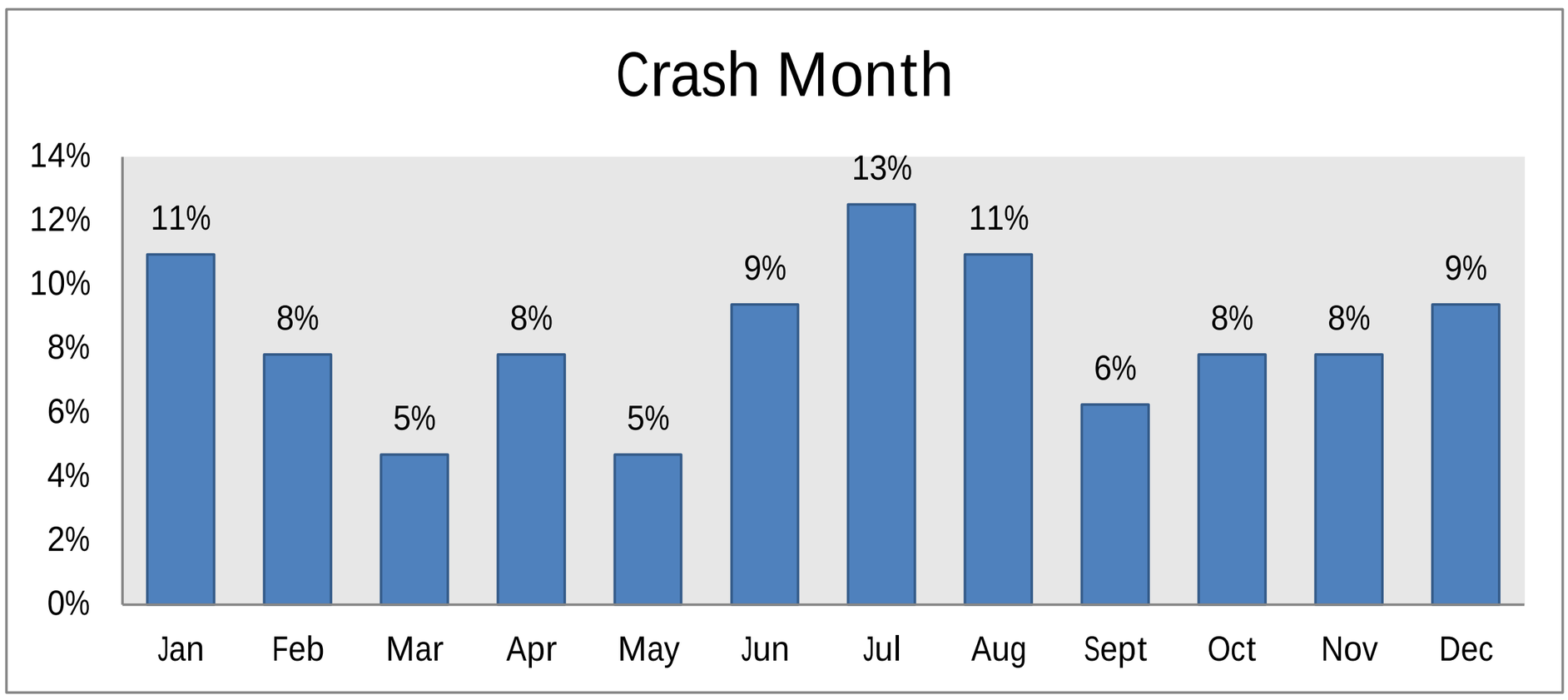
Cranston Street at Niantic Avenue

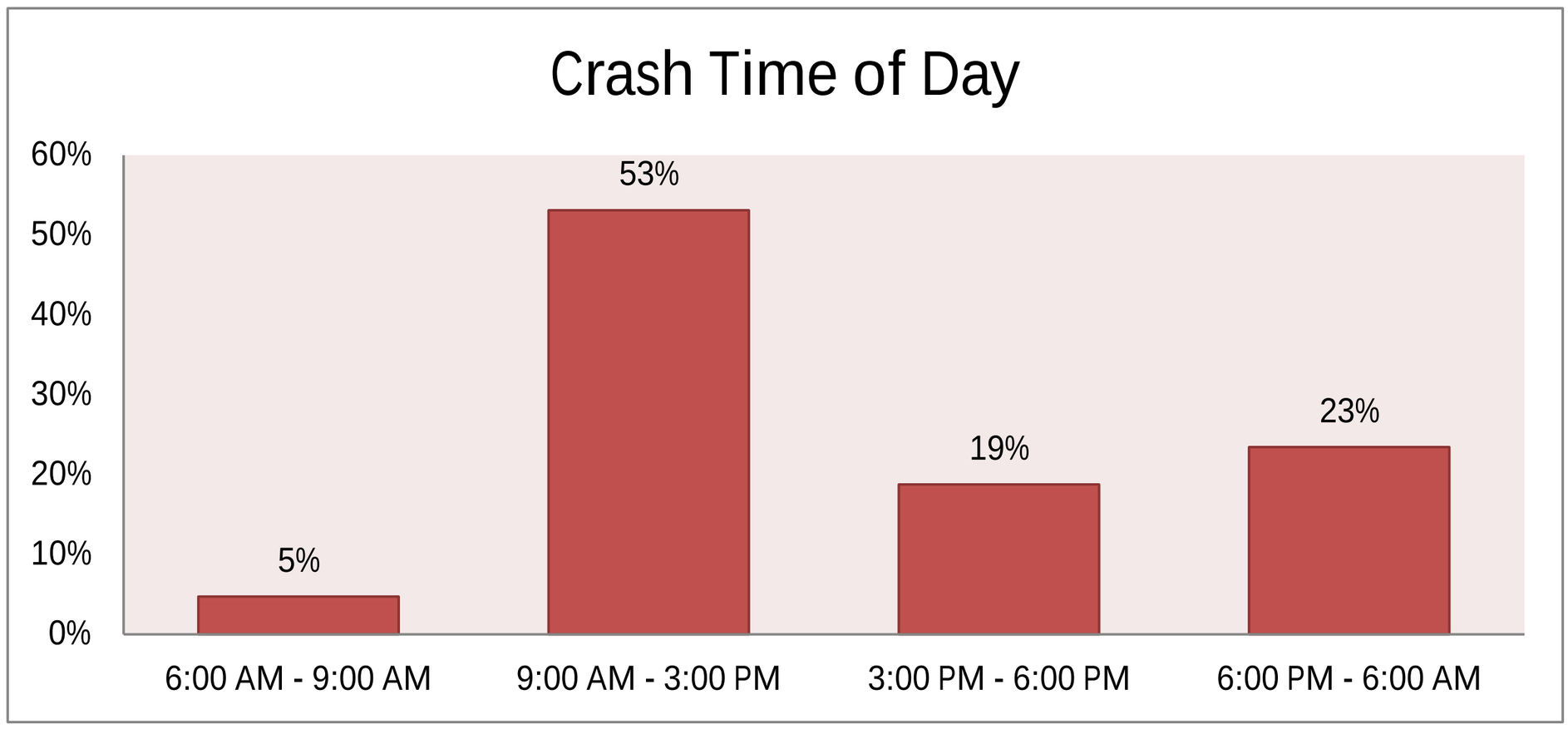
		2018	2019	2020	Total	Percent
Collision Type						
	Rear End	2	8	5	15	50%
	Angle	4	1	2	7	23%
	Head-On	0	0	0	0	0%
	Pedestrian	0	0	0	0	0%
	Sideswipe, Same Direction	4	1	2	7	23%
	Sideswipe, Opposite Direction	0	0	0	0	0%
	Collision with Object	0	0	0	0	0%
	Other	0	0	1	1	3%
	Unknown	0	0	0	0	0%
Crash Severity						
	Property	8	9	9	26	87%
	Injury	2	1	1	4	13%
Light Condition						
	Daylight	6	9	7	22	73%
	Dawn	0	0	0	0	0%
	Dusk	1	0	0	1	3%
	Dark - Lighted	3	1	3	7	23%
	Dark - Not Lighted	0	0	0	0	0%
	Dark - Unknown Lighting	0	0	0	0	0%
Road Condition						
	Dry	6	9	6	21	70%
	Wet	3	1	2	6	20%
	Snow	0	0	2	2	7%
	Other	0	0	0	0	0%
	Unknown	1	0	0	1	3%
Hour of Day						
	6:00 AM - 9:00 AM	0	1	1	2	7%
	9:00 AM - 3:00 PM	4	6	5	15	50%
	3:00 PM - 6:00 PM	4	1	2	7	23%
	6:00 PM - 6:00 AM	2	2	2	6	20%
	Total Crashes:	10	10	10	30	

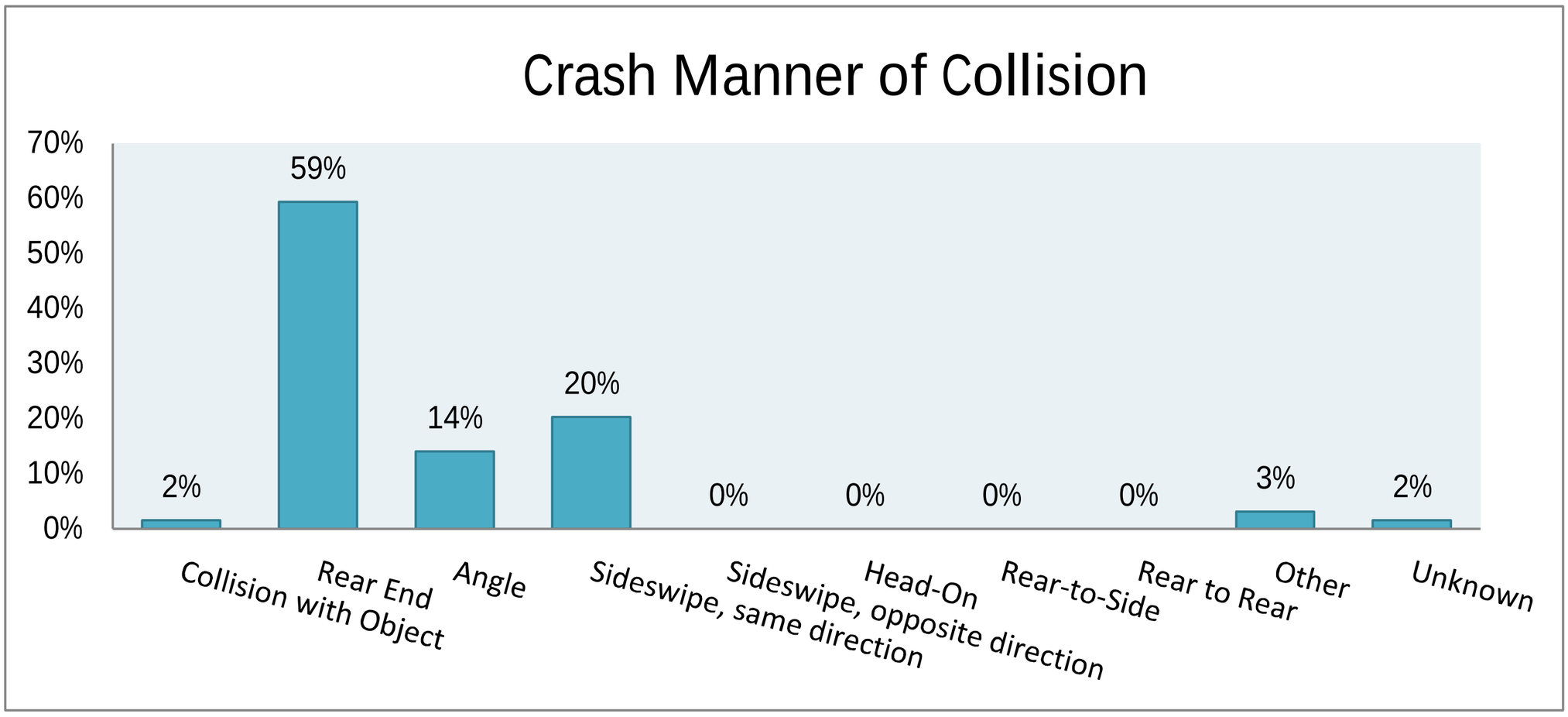
Cranston Street - Lincoln Avenue to Niantic Avenue

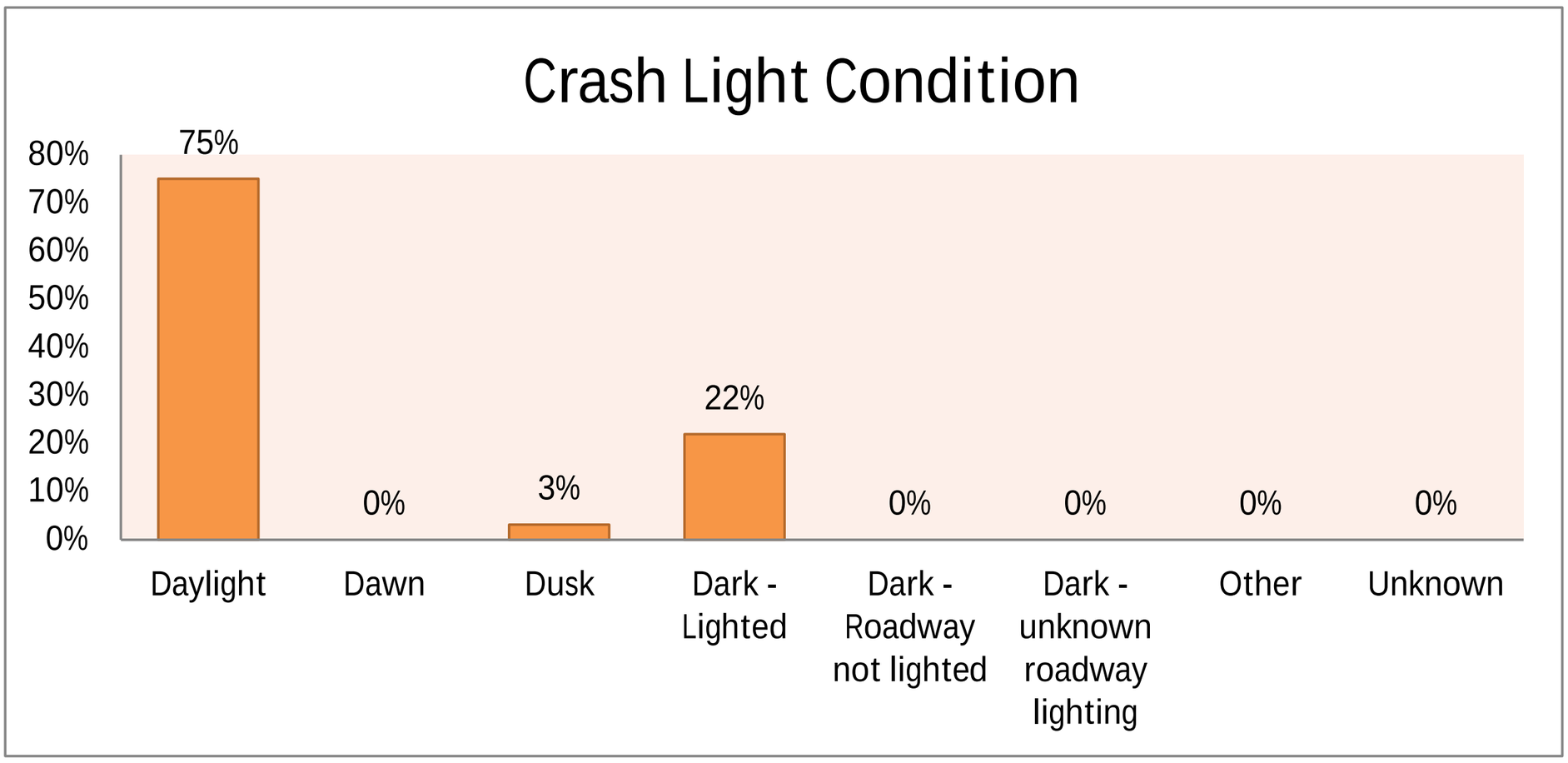
		2018	2019	2020	Total	Percent
Collision Type						
	Rear End	0	0	0	0	0%
	Angle	0	0	0	0	0%
	Head-On	0	0	0	0	0%
	Pedestrian	0	0	0	0	0%
	Sideswipe, Same Direction	1	1	0	2	67%
	Sideswipe, Opposite Direction	0	0	0	0	0%
	Collision with Object	0	0	0	0	0%
	Other	0	0	1	1	33%
	Unknown	0	0	0	0	0%
Crash Severity						
	Property	1	1	1	3	100%
	Injury	0	0	0	0	0%
Light Condition						
	Daylight	1	1	1	3	100%
	Dawn	0	0	0	0	0%
	Dusk	0	0	0	0	0%
	Dark - Lighted	0	0	0	0	0%
	Dark - Not Lighted	0	0	0	0	0%
	Dark - Unknown Lighting	0	0	0	0	0%
Road Condition						
	Dry	1	1	0	2	67%
	Wet	0	0	1	1	33%
	Snow	0	0	0	0	0%
	Other	0	0	0	0	0%
	Unknown	0	0	0	0	0%
Hour of Day						
	6:00 AM - 9:00 AM	0	0	1	1	33%
	9:00 AM - 3:00 PM	1	1	0	2	67%
	3:00 PM - 6:00 PM	0	0	0	0	0%
	6:00 PM - 6:00 AM	0	0	0	0	0%
	Total Crashes:	1	1	1	3	

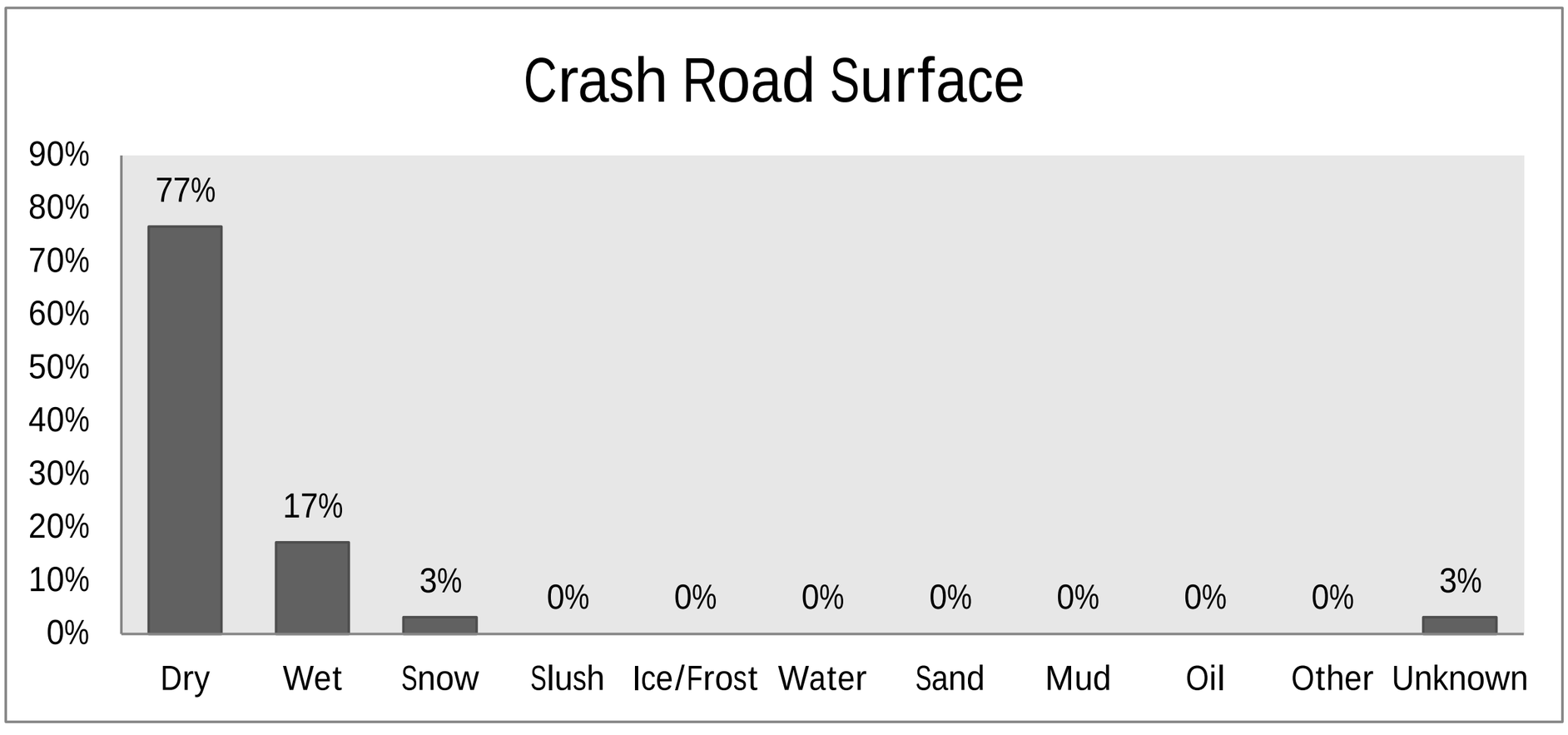
Crash Data Summary Charts








Crash Light Condition
80%
70%
60%
50%
40%
30%
20%
10%
0%
75%
0%
3%
22%
0%
0%
0%
0%
Daylight
Dawn
Dusk
Dark - Lighted
Dark - Roadway not lighted
Dark - unknown roadway lighting
Other
Unknown


Crash Road Surface
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
77%
17%
3%
0%
0%
0%
0%
0%
0%
0%
3%
Dry
Wet
Snow
Slush
Ice/Frost
Water
Sand
Mud
Oil
Other
Unknown

APPENDIX C – Trip Generation

ITE Trip Generation Summary

Site Trip Distribution

ITE Land Use Code

ITE Land Use Code 843 – Automobile Parts Sales

ITE Land Use Code 912 – Drive-in Bank

ITE Land Use Code 934 – Fast-Food Restaurant with Drive-Through Window

ITE Land Use Code 960 – Super Convenience Market/Gas Station

C

ITE Trip Generation Summary

Trip Generation Summary

Summary;

	Description	Enter	Exit	Total
Weekday AM Peak Hour				
ITE Land Use Code 843	Automobile Parts Sales	12	9	21
Independent Study	Automoblie Parts Distribution Warehouse	0	10	10
ITE Land Use Code 912	Drive-In Bank	23	16	39
ITE Land Use Code 934	Fast-Food Restaurant with Drive-Through Window	50	50	100
ITE Land Use Code 960	Super Convenience Market/Gas Station	170	170	340
	TOTAL	**255**	**255**	**510**
Weekday PM Peak Hour				
ITE Land Use Code 843	Automobile Parts Sales	20	20	40
Independent Study	Automoblie Parts Distribution Warehouse	10	0	10
ITE Land Use Code 912	Drive-In Bank	41	41	82
ITE Land Use Code 934	Fast-Food Restaurant with Drive-Through Window	44	39	83
ITE Land Use Code 960	Super Convenience Market/Gas Station	165	165	330
	TOTAL	**280**	**265**	**545**

Satruday MD Peak Hour

ITE Land Use Code 843	Automobile Parts Sales	47	46	93
Independent Study	Automoblie Parts Distribution Warehouse	5	5	10
ITE Land Use Code 912	Drive-In Bank	53	52	105
ITE Land Use Code 934	Fast-Food Restaurant with Drive-Through Window	70	67	137
ITE Land Use Code 960	Super Convenience Market/Gas Station	150	150	300
	TOTAL	**325**	**320**	**645**

Calculations;

ITE Land Use Code 843 Automobile Parts Sales (8,000 GFA)

Independent Variable (X) = Thousand Gross Floor Area (GFA) X = 8

AM Peak *Directional Distribution:* *56% Entering* *44% Exiting*

T	=	2.59	x (X)	Enter:	12
T	=	2.59	x 8	Exit:	9
T	=	21		Total:	21

PM Peak *Directional Distribution:* *48% Entering* *52% Exiting*

T	=	4.91	x (X)	Enter:	20
T	=	4.91	x 8	Exit:	20
T	=	40		Total:	40

Sat. MD Peak *Directional Distribution:* *51% Entering* *49% Exiting*

T	=	11.53	x (X)	Enter:	47
T	=	11.53	x 8	Exit:	46
T	=	93		Total:	93

ITE Land Use Code 912 Drive-In Bank (4,000 GFA)

Independent Variable (X) = Thousand Gross Floor Area (GFA) X = 4

AM Peak *Directional Distribution:* *59% Entering* *41% Exiting*

T	=	9.50	x (X)	Enter:	23
T	=	9.50	x 4	Exit:	16
T	=	39		Total:	39

PM Peak *Directional Distribution:* *50% Entering* *50% Exiting*

T	=	20.45	x (X)	Enter:	41
T	=	20.45	x 4	Exit:	41
T	=	82		Total:	82

Sat. MD Peak *Directional Distribution:* *51% Entering* *49% Exiting*

T	=	26.35	x (X)	Enter:	53
T	=	26.35	x 4	Exit:	52
T	=	105		Total:	105

ITE Land Use Code 934 Fast-Food Restaurant with Drive-Through Window (2,500 GFA)

Independent Variable (X) = Thousand Gross Floor Area (GFA) X = 2.5

AM Peak *Directional Distribution:* *51% Entering* *49% Exiting*

T = 40.19 x (X) Enter: 50
T = 40.19 x 2.5 Exit: 50
T = 100 Total: 100

PM Peak *Directional Distribution:* *52% Entering* *48% Exiting*

T = 32.67 x (X) Enter: 44
T = 32.67 x 2.5 Exit: 39
T = 83 Total: 83

Sat. MD Peak *Directional Distribution:* *51% Entering* *49% Exiting*

T = 54.86 x (X) Enter: 70
T = 54.86 x 2.5 Exit: 67
T = 137 Total: 137

ITE Land Use Code 960 Super Convenience Market/Gas Station

Independent Variable (X) = Peak Hour Traffic on Adjacent Street

X = 1700 AM
X = 2200 PM
X = 2000 MD

AM Peak *Directional Distribution:* *50% Entering* *50% Exiting*

T = 0.20 x (X) Enter: 170
T = 0.20 x 1700 Exit: 170
T = 340 Total: 340

PM Peak *Directional Distribution:* *50% Entering* *50% Exiting*

T = 0.15 x (X) Enter: 165
T = 0.15 x 2200 Exit: 165
T = 330 Total: 330

Sat. MD Peak *Directional Distribution:* *50% Entering* *50% Exiting*

T = 0.15 x (X) Enter: 150
T = 0.15 x 2000 Exit: 150
T = 300 Total: 300

Independent Study

Automobile Parts Hub;

- In addition to the retail component of the proposed 35,000 square foot building for the automobile parts facility, a distribution warehouse of automobile parts (not typically stocked in smaller stores will be maintained for delivery of ordered parts) to local satellite stores and vehicle service garages are proposed.
- The distribution warehouse is assumed to have 10 delivery vans kept on site that will exit and and enter the site multiple times per day for delivery of sold items.
- Delivery times will vary, though the majority will be more than one hour to mutiple sites combined into one trip.

Calculation;

Weekday AM Peak Hour

Enter:	0
Exit:	10
Total:	10

Weekday PM Peak Hour

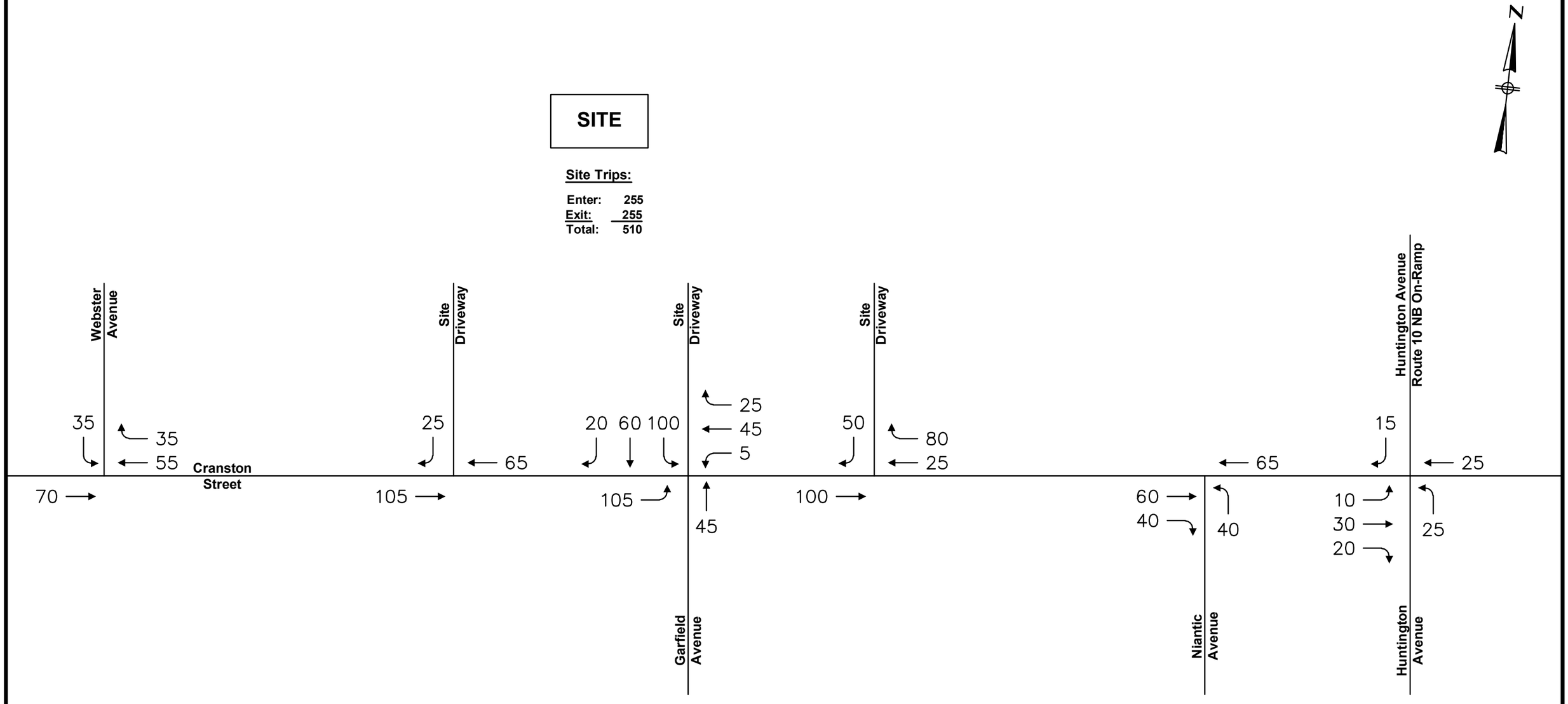
Enter:	10
Exit:	0
Total:	10

Saturday MD Peak Hour

Enter:	5
Exit:	5
Total:	10

C

Site Trip Distribution

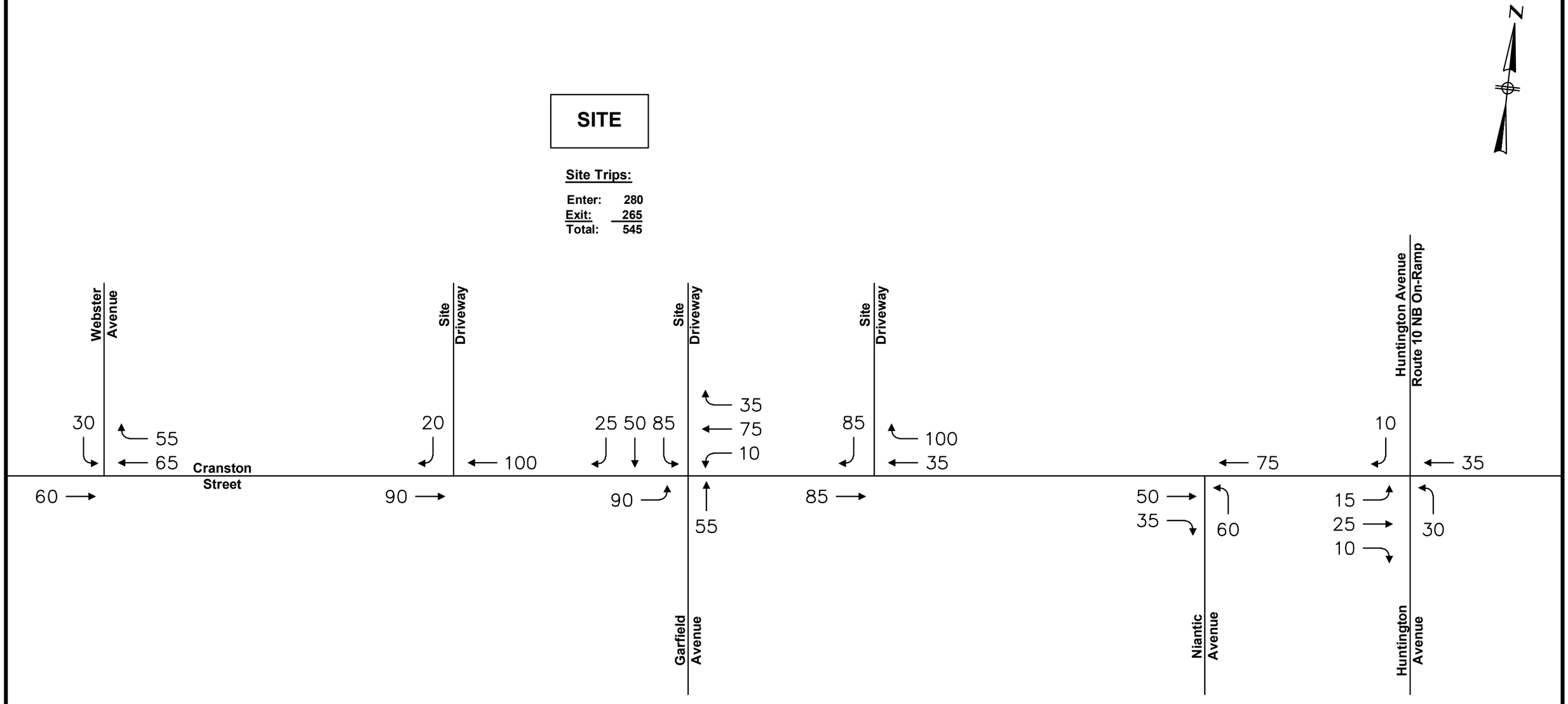


BETA
www.BETA-Inc.com

WEEKDAY TRAFFIC DISTRIBUTION
AM PEAK HOUR

PROPOSED COMMERCIAL DEVELOPMENT
CRANSTON, RHODE ISLAND

2024 Build Condition

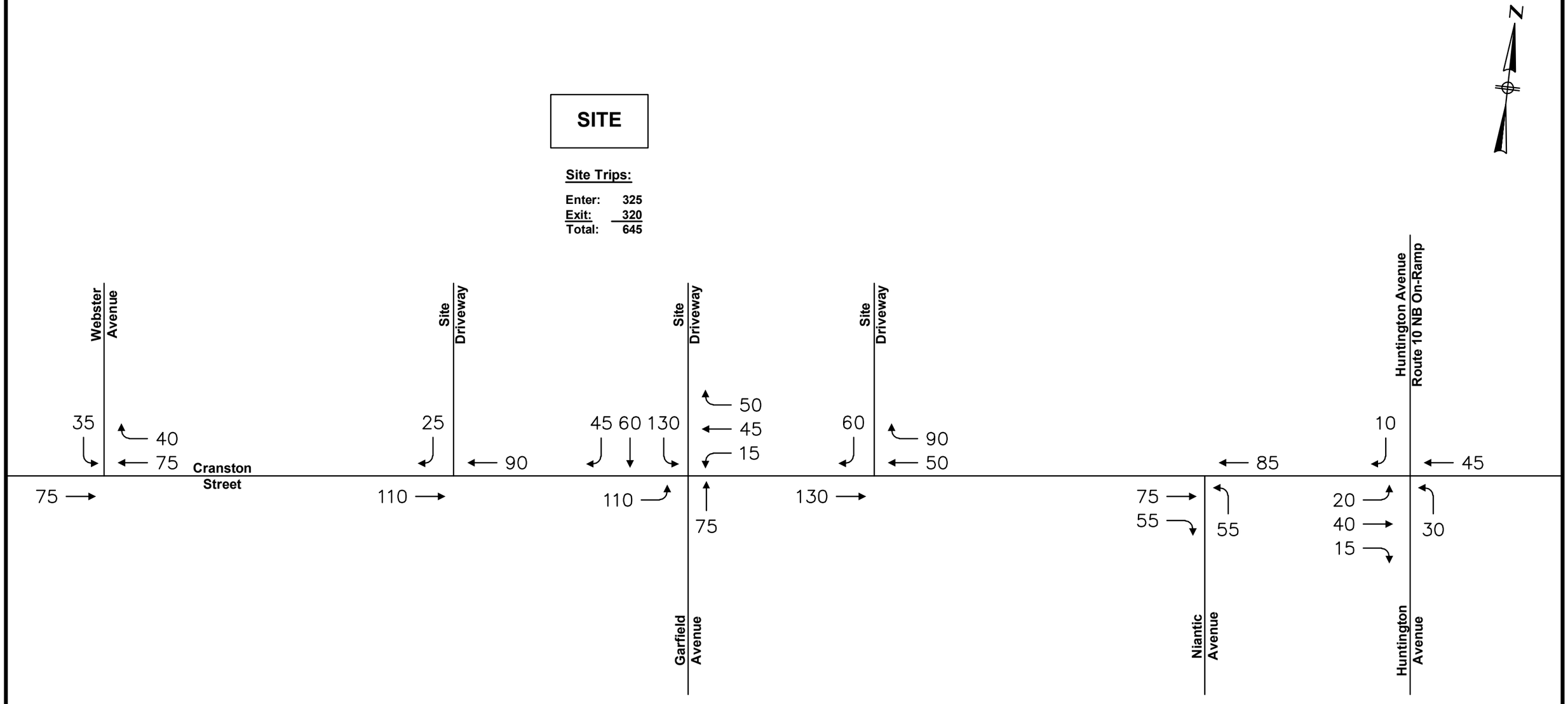


BETA
www.BETA-Inc.com

WEEKDAY TRAFFIC DISTRIBUTION
PM PEAK HOUR

PROPOSED COMMERCIAL DEVELOPMENT
CRANSTON, RHODE ISLAND

2024 Build Condition



BETA
www.BETA-Inc.com

SATURDAY TRAFFIC DISTRIBUTION
MD PEAK HOUR

PROPOSED COMMERCIAL DEVELOPMENT
CRANSTON, RHODE ISLAND

2024 Build Condition

C

ITE Land Use Code

ITE Land Use Code 843 – Automobile Parts Sales

ITE Land Use Code 912 – Drive-in Bank

ITE Land Use Code 934 – Fast-Food Restaurant with Drive-Through Window

ITE Land Use Code 960 – Super Convenience Market/Gas Station

ITE Land Use Code 843 – Automobile Parts Sales

Land Use: 843
Automobile Parts Sales

Description

An automobile parts sales facility specializes in the sale of automobile parts for maintenance and repair. Items sold at these facilities include spark plugs, oil, batteries, and a wide range of automobile parts. These facilities are not equipped for on-site vehicle repair. Tire store (Land Use 848), tire superstore (Land Use 849), and automobile parts and service center (Land Use 943) are related uses.

Additional Data

Time-of-day distribution data for this land use are presented in Appendix A. For the seven general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:15 a.m. and 12:15 p.m. and 12:45 and 1:45 p.m., respectively.

The sites were surveyed in the 1990s, the 2000s, and the 2010s in Alberta (CAN), Florida, New Hampshire, Texas, and Wisconsin.

Source Numbers

436, 439, 618, 881, 882, 959, 975

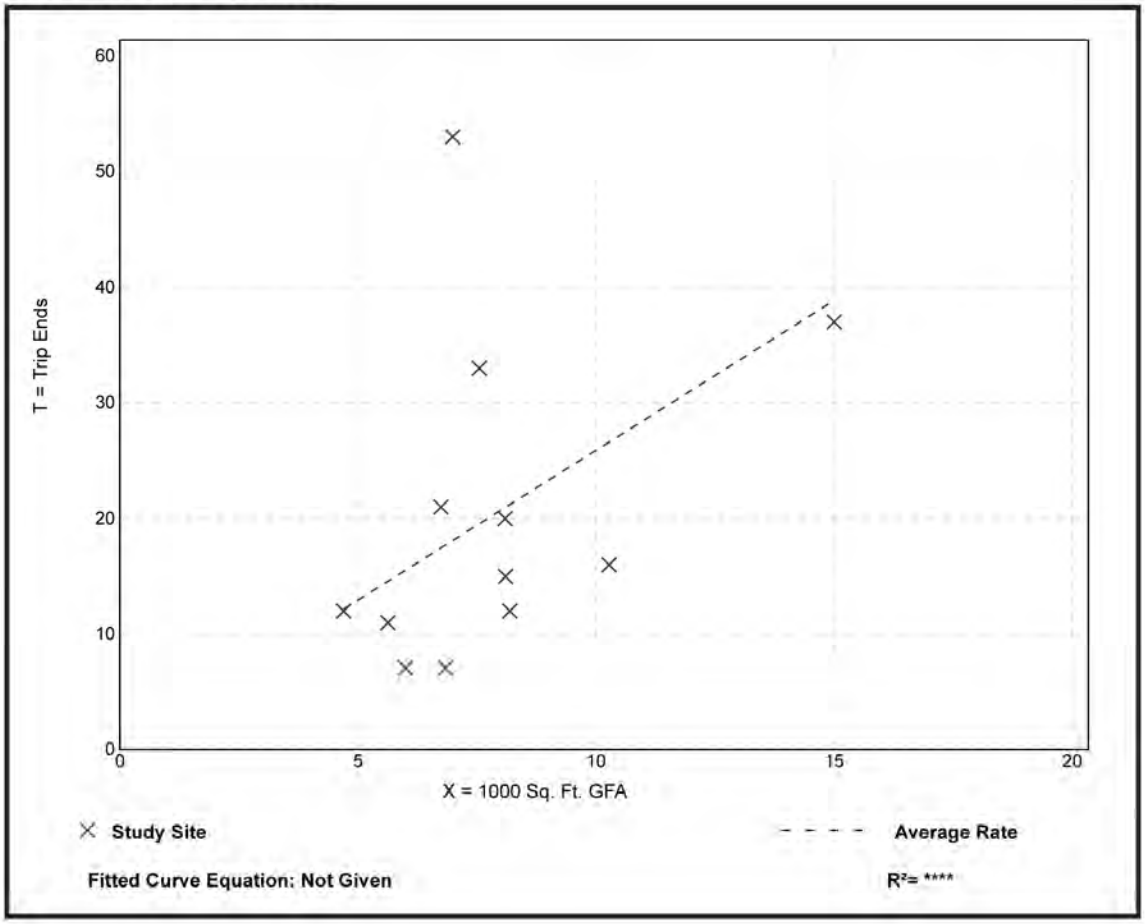
Automobile Parts Sales
(843)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 12
1000 Sq. Ft. GFA: 8
Directional Distribution: 55% entering, 45% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
2.59	1.02 - 7.58	1.73

Data Plot and Equation



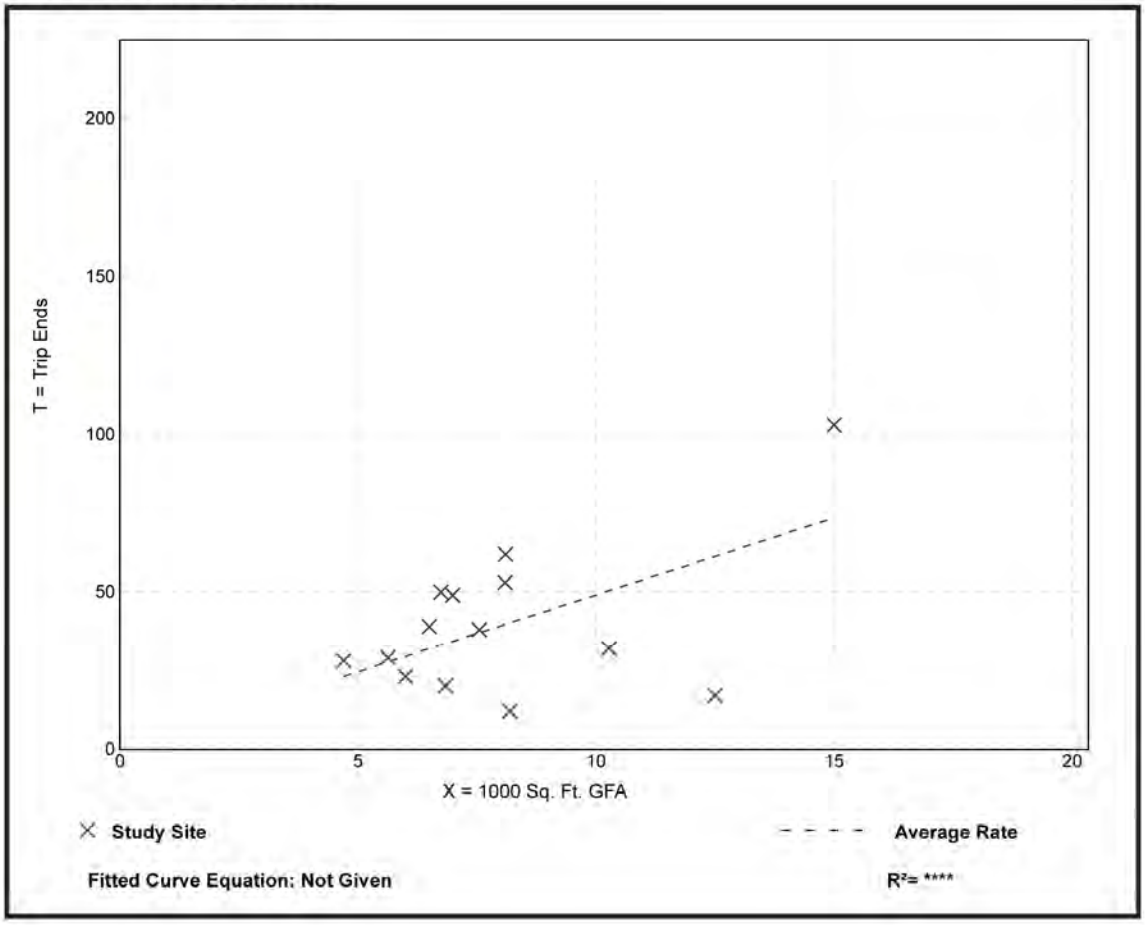
Automobile Parts Sales
(843)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 14
1000 Sq. Ft. GFA: 8
Directional Distribution: 48% entering, 52% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
4.91	1.36 - 7.65	2.29

Data Plot and Equation



Automobile Parts Sales
(843)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

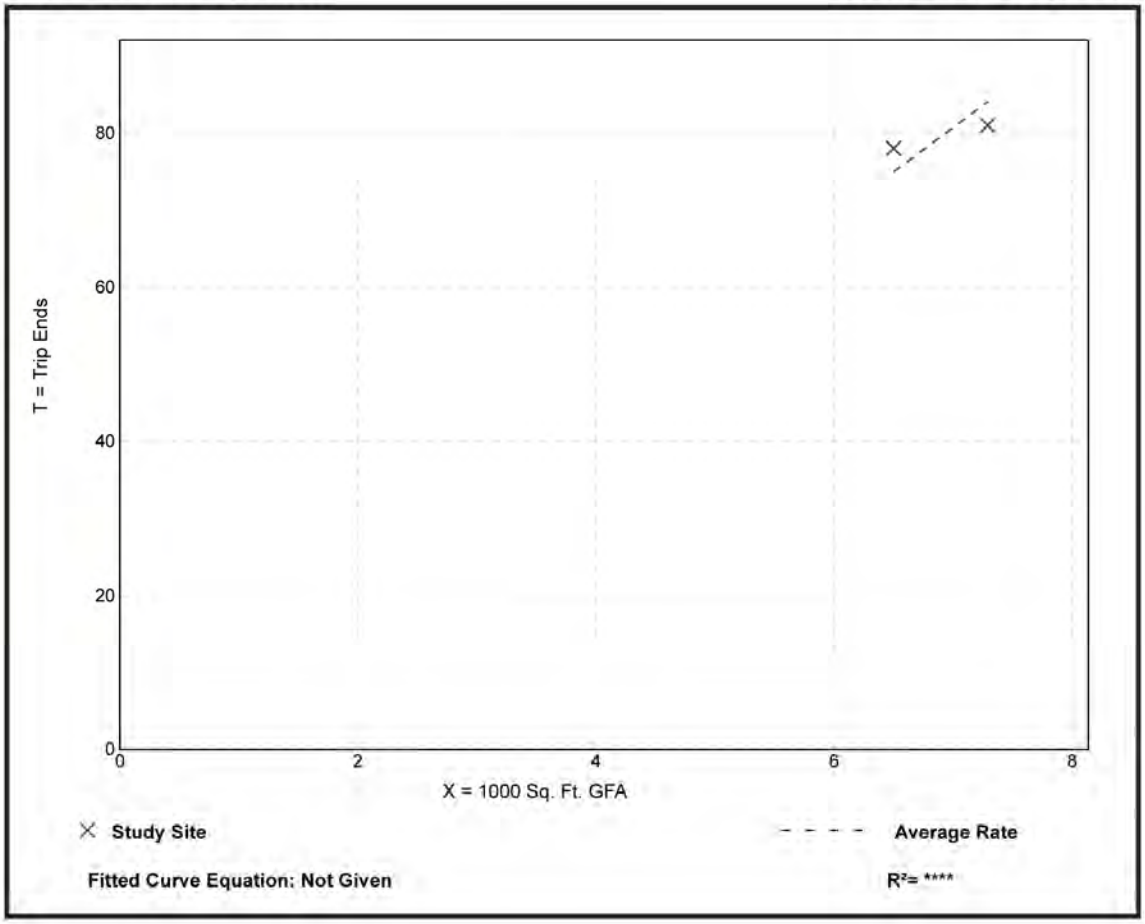
Setting/Location: **General Urban/Suburban**
Number of Studies: 2
1000 Sq. Ft. GFA: 7
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
11.53	11.11 - 12.00	*

Data Plot and Equation

Caution – Small Sample Size



ITE Land Use Code 912 – Drive-in Bank

Land Use: 912
Drive-in Bank

Description

A drive-in bank provides banking facilities for motorists who conduct financial transactions from their vehicles; many also serve patrons who walk into the building. The drive-in lanes may or may not provide automatic teller machines (ATMs). Walk-in bank (Land Use 911) is a related use.

Additional Data

The independent variable, drive-in lanes, refers to all lanes at a banking facility used for financial transactions, including ATM-only lanes.

Time-of-day distribution data for this land use are presented in Appendix A. For the 18 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:15 and 1:15 p.m., respectively. For the one center city core site with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:15 a.m. and 12:15 p.m. and 12:45 and 1:45 p.m., respectively.

The sites were surveyed in the 2000s and the 2010s in Colorado, Kentucky, Minnesota, Nebraska, New Jersey, New York, Oregon, Pennsylvania, Texas, Vermont, Virginia, Washington, and Wisconsin.

To assist in the future analysis of this land use, it is important that Friday data be collected and reported separately from weekday data. It is also important to specify the date and month of the data collection period and the number of drive-through lanes that are open at the time of the study.

Source Numbers

535, 539, 553, 555, 573, 577, 600, 624, 626, 629, 630, 637, 656, 657, 710, 724, 728, 866, 869, 883, 884, 927, 935, 961

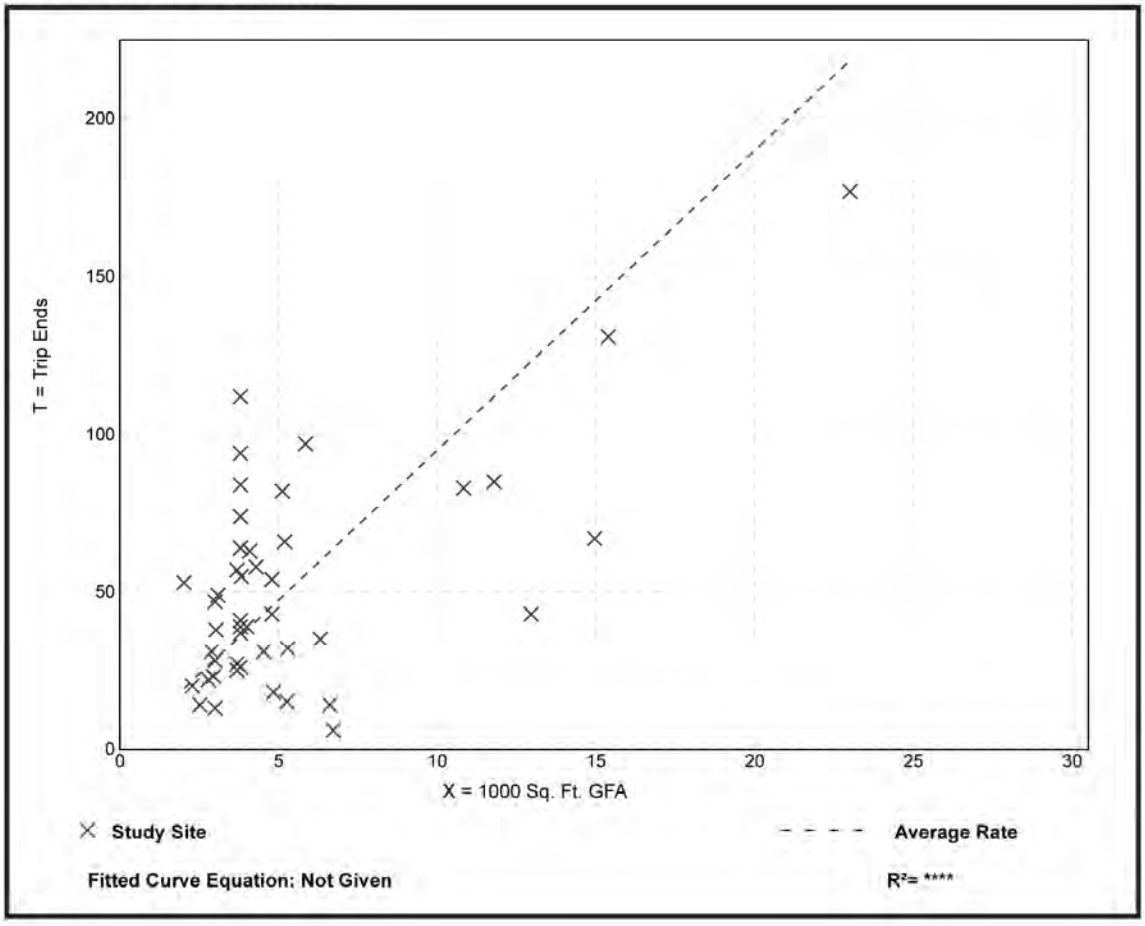
Drive-in Bank
(912)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 46
1000 Sq. Ft. GFA: 5
Directional Distribution: 58% entering, 42% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.50	0.89 - 29.47	5.85

Data Plot and Equation



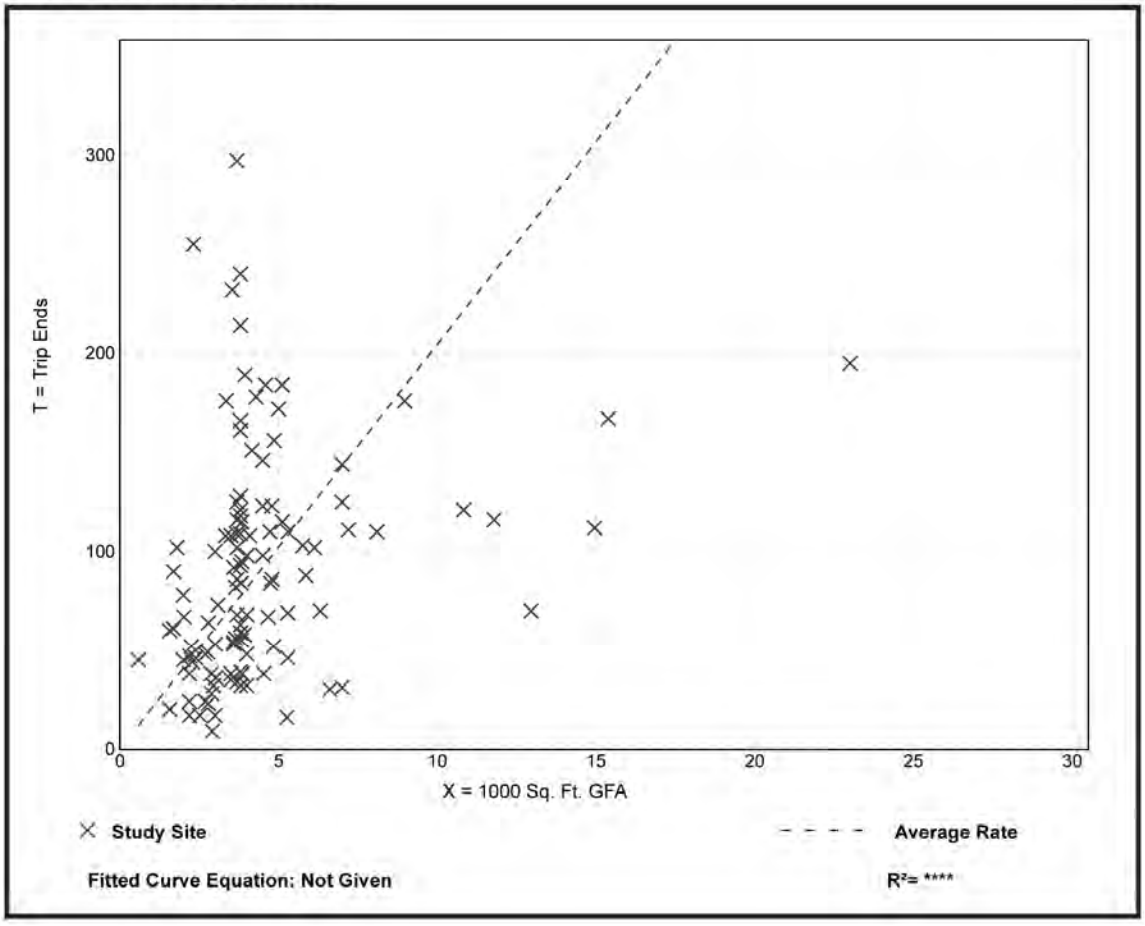
Drive-in Bank
(912)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 115
1000 Sq. Ft. GFA: 4
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
20.45	3.04 - 109.91	15.01

Data Plot and Equation



Drive-in Bank
(912)

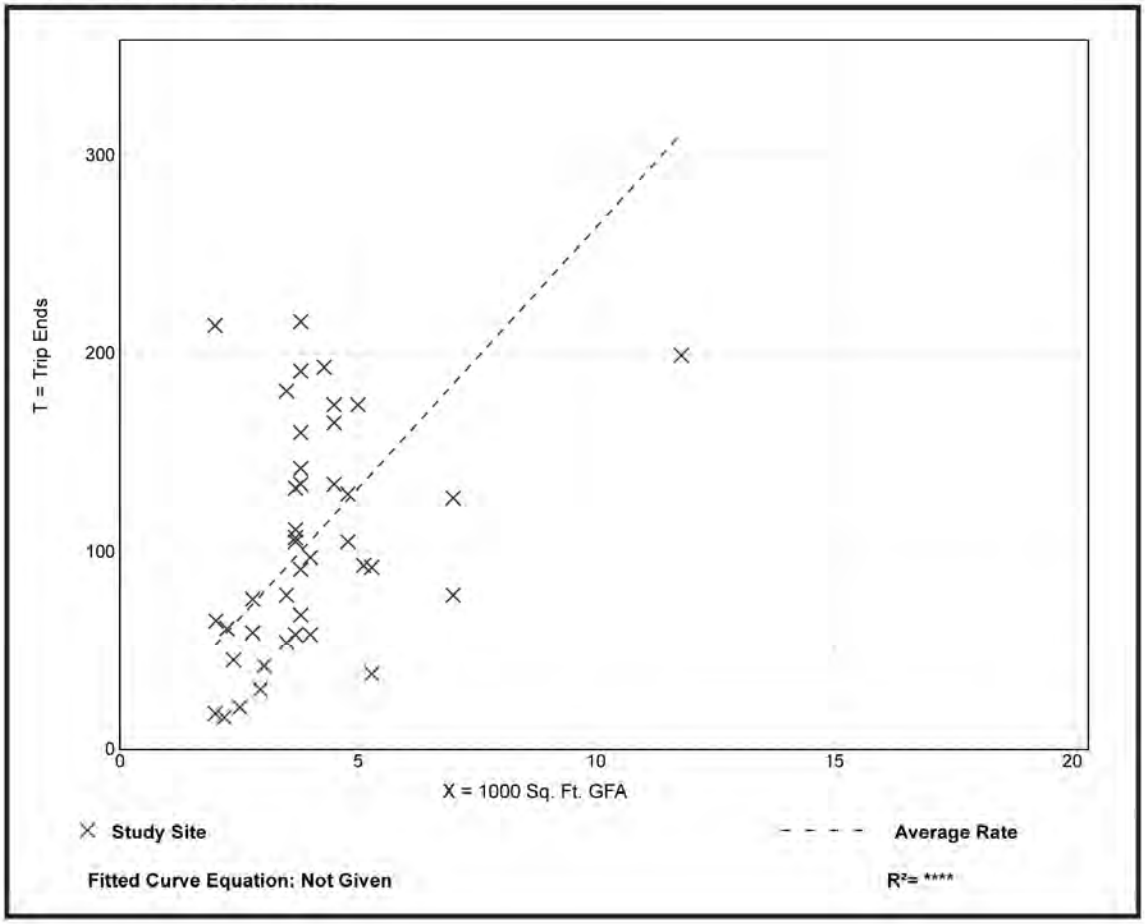
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 41
1000 Sq. Ft. GFA: 4
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
26.35	7.18 - 107.00	15.32

Data Plot and Equation



ITE Land Use Code 934 – Fast-Food Restaurant with Drive-Through Window

Land Use: 934
Fast-Food Restaurant with Drive-Through Window

Description

This category includes fast-food restaurants with drive-through windows. This type of restaurant is characterized by a large drive-through clientele, long hours of service (some are open for breakfast, all are open for lunch and dinner, some are open late at night or 24 hours a day) and high turnover rates for eat-in customers. These limited-service eating establishments do not provide table service. Non-drive-through patrons generally order at a cash register and pay before they eat. Fast casual restaurant (Land Use 930), high-turnover (sit-down) restaurant (Land Use 932), fast-food restaurant without drive-through window (Land Use 933), and fast-food restaurant with drive-through window and no indoor seating (Land Use 935) are related uses.

Additional Data

Users should exercise caution when applying statistics during the AM peak periods, as the sites contained in the database for this land use may or may not be open for breakfast. In cases where it was confirmed that the sites were not open for breakfast, data for the AM peak hour of the adjacent street traffic were removed from the database.

The outdoor seating area is not included in the overall gross floor area. Therefore, the number of seats may be a more reliable independent variable on which to establish trip generation rates for facilities having significant outdoor seating.

Time-of-day distribution data for this land use for a weekday, Saturday, and Sunday are presented in Appendix A. For the 46 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:00 and 1:00 p.m., respectively. For the one dense multi-use urban site with data, the same AM and PM peak hours were observed.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alaska, Alberta (CAN), California, Colorado, Florida, Indiana, Kentucky, Maryland, Massachusetts, Minnesota, Montana, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Dakota, Texas, Vermont, Virginia, Washington, and Wisconsin.

Source Numbers

163, 164, 168, 180, 181, 241, 245, 278, 294, 300, 301, 319, 338, 340, 342, 358, 389, 438, 502, 552, 577, 583, 584, 617, 640, 641, 704, 715, 728, 810, 866, 867, 869, 885, 886, 927, 935, 962, 977

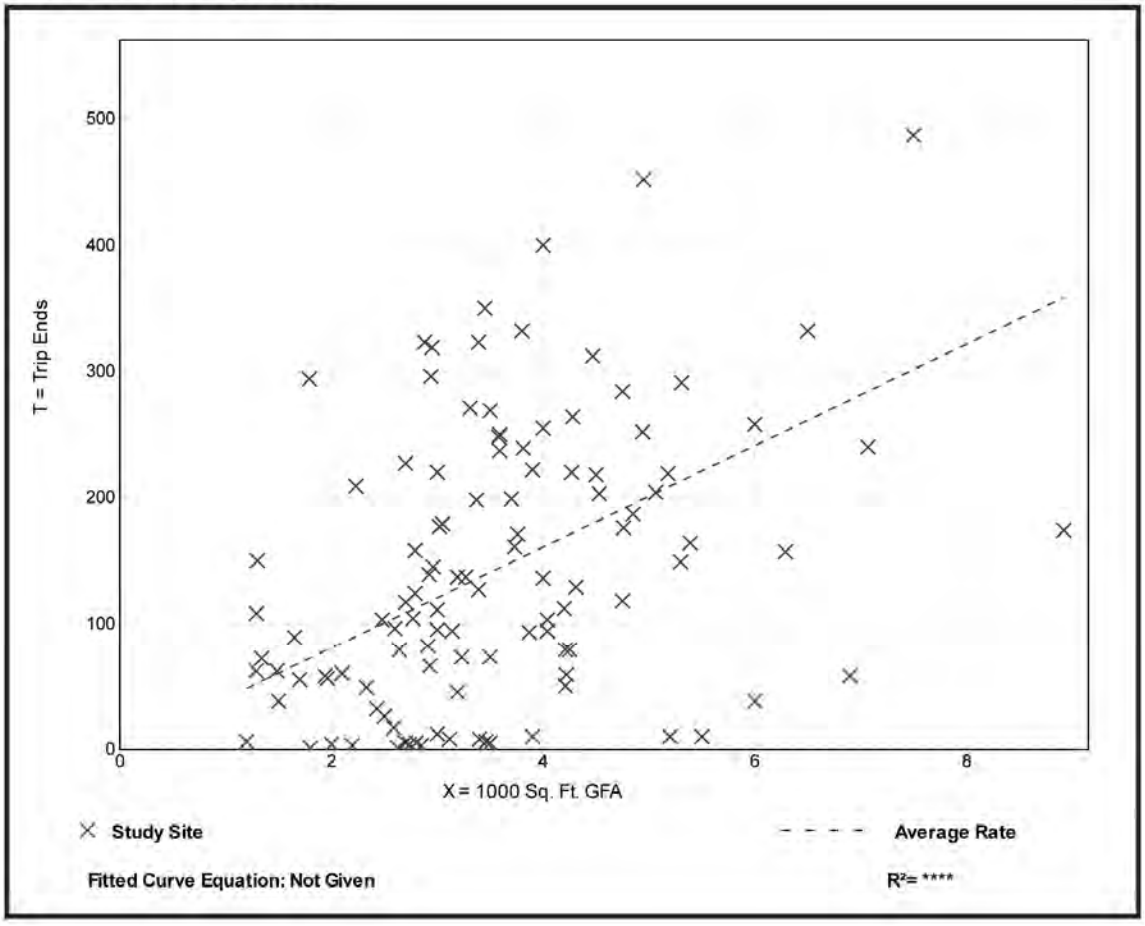
Fast-Food Restaurant with Drive-Through Window
(934)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 111
1000 Sq. Ft. GFA: 4
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
40.19	0.38 - 164.25	28.78

Data Plot and Equation



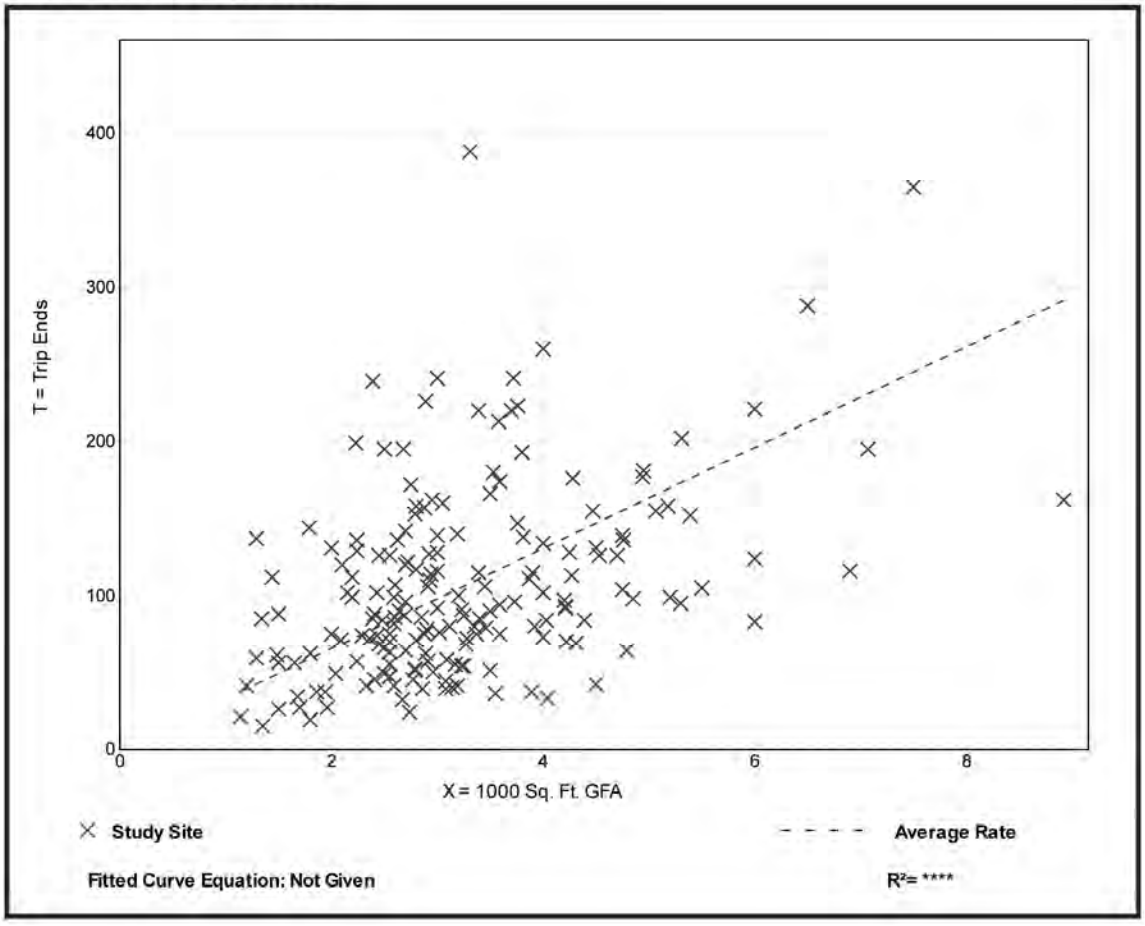
Fast-Food Restaurant with Drive-Through Window
(934)

Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 185
1000 Sq. Ft. GFA: 3
Directional Distribution: 52% entering, 48% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
32.67	8.17 - 117.22	17.87

Data Plot and Equation



Fast-Food Restaurant with Drive-Through Window
(934)

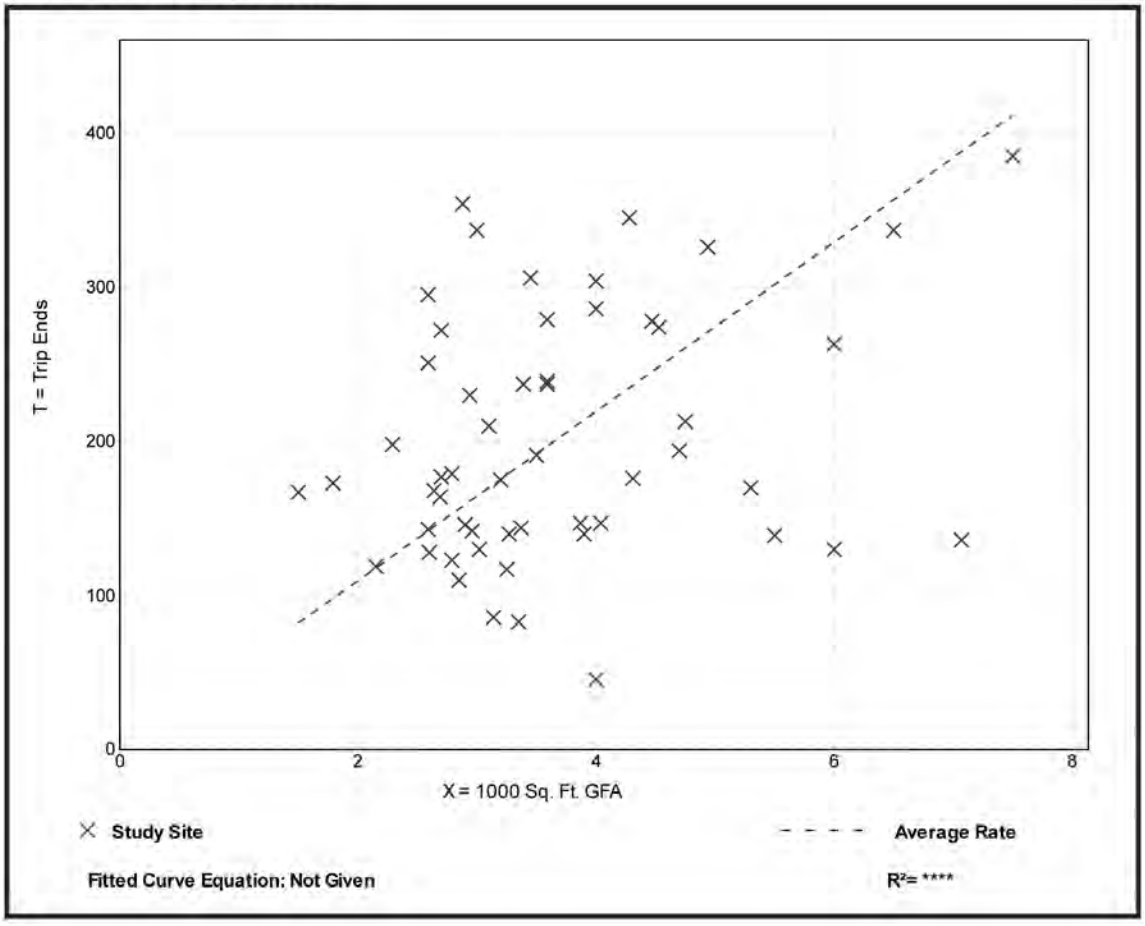
Vehicle Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Saturday, Peak Hour of Generator**

Setting/Location: **General Urban/Suburban**
Number of Studies: 54
1000 Sq. Ft. GFA: 4
Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
54.86	11.25 - 122.92	24.51

Data Plot and Equation



ITE Land Use Code 960 – Super Convenience Market/Gas Station

Land Use: 960
Super Convenience Market/Gas Station

Description

This land use includes gasoline/service stations with convenience markets where there is significant business related to the sale of convenience items and the fueling of motor vehicles. Some commonly sold convenience items include newspapers, freshly brewed coffee, daily-made donuts, bakery items, hot and cold beverages, breakfast items, dairy items, fresh fruits, soups, light meals, ready-to-go and freshly made sandwiches and wraps, and ready-to-go salads. Stores typically also had automated teller machines (ATMs), and public restrooms. The sites included in this land use category have the following two specific characteristics:

- The gross floor area of the convenience market is at least 3,000 gross square feet
- The number of vehicle fueling positions is at least 10

Convenience market with gasoline pumps (Land Use 853) and gasoline/service station with convenience market (Land Use 945) are related uses.

Additional Data

To reflect changing characteristics of the convenience market component of this land use, only data from the past two decades have been included in this land use.

The independent variable, vehicle fueling positions, is defined as the maximum number of vehicles that can be fueled simultaneously. Gasoline/service stations in this land use include "pay-at-the-pump" and traditional fueling stations.

A multi-variable regression analysis based on both the convenience market gross floor area (GFA) and the number of vehicle fueling positions (VFP) produced a series of fitted curve equations. The equations are in the form of:

Vehicle Trips = [(VFP Factor) x (Number of VFP)] + [(GFA Factor) x (GFA)] + (Constant)

The values for the VFP factor, GFA factor, and constant are presented in the following table for each time period for which a fitted curve equation could produce an R^2 value of at least 0.50.

Time Period	VFP Factor	GFA Factor	Constant	R^2
Weekday, AM Peak Hour of Generator	10.3	105	-290	0.62
Weekday, PM Peak Hour of Generator	6.91	76.0	-133	0.68
Weekday, AM Peak Hour of Adjacent Street	16.1	135	-483	0.66
Weekday, PM Peak Hour of Adjacent Street	11.5	82.9	-226	0.51

The sites were surveyed in the late 1990's, 2000s and the 2010s in Florida, Iowa, Maryland, Minnesota, New Hampshire, New Jersey, Pennsylvania, Texas, Utah, and Wisconsin.

Source Numbers

617, 813, 844, 850, 864, 865, 867, 869, 882, 888, 904, 938, 954, 960, 962

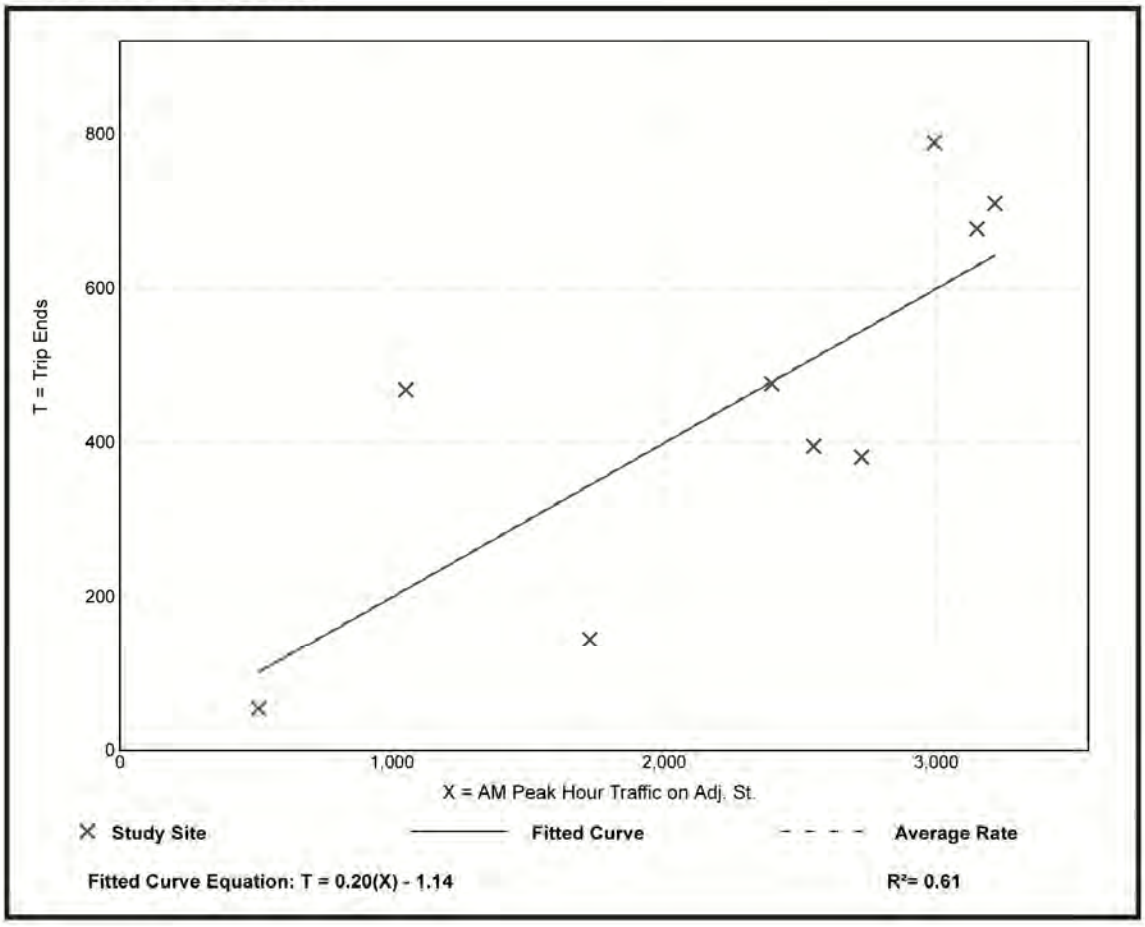
Super Convenience Market/Gas Station
(960)

Vehicle Trip Ends vs: **AM Peak Hour Traffic on Adj. St.**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 9
AM Peak Hour Traffic on Adj. St.: 2258
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per AM Peak Hour Traffic on Adj. St.

Average Rate	Range of Rates	Standard Deviation
0.20	0.08 - 0.45	0.08

Data Plot and Equation



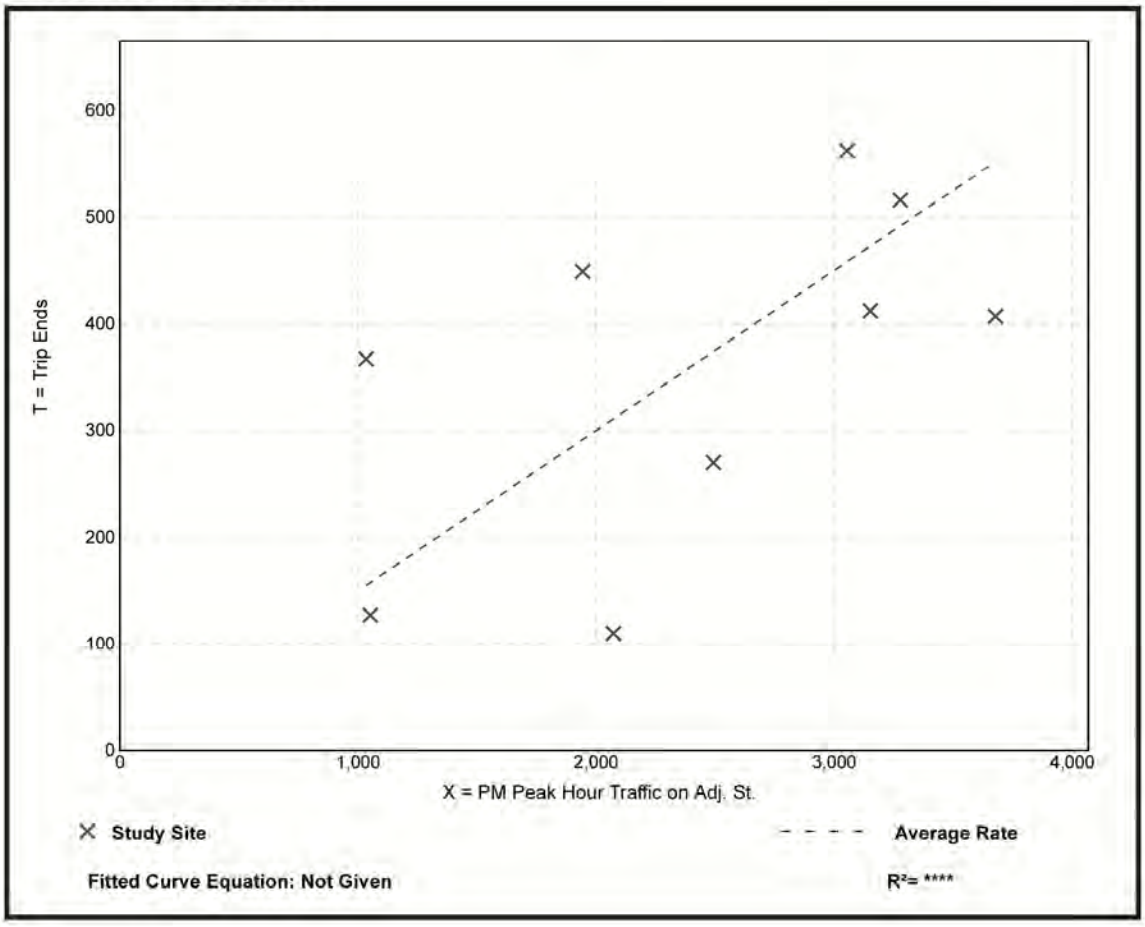
Super Convenience Market/Gas Station
(960)

Vehicle Trip Ends vs: **PM Peak Hour Traffic on Adj. St.**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 9
PM Peak Hour Traffic on Adj. St.: 2418
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per PM Peak Hour Traffic on Adj. St.

Average Rate	Range of Rates	Standard Deviation
0.15	0.05 - 0.35	0.07

Data Plot and Equation



APPENDIX D – Operational Analysis

Existing Conditions

Cranston Street at Webster Avenue
Cranston Street at Garfield Avenue
Cranston Street at Niantic Avenue
Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

Future No Build Conditions

Cranston Street at Webster Avenue
Cranston Street at Garfield Avenue
Cranston Street at Niantic Avenue
Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

Future Build Conditions (Preferred Alternative)

Cranston Street at Webster Avenue
Cranston Street at Garfield Avenue/Main Site Driveway
Cranston Street at Niantic Avenue
Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

Future Build Conditions (Alternatives)

Cranston Street at Garfield Avenue/Main Site Driveway

D

Existing Weekday AM / PM / Saturday MD Peak Hour

Cranston Street at Webster Avenue

Cranston Street at Garfield Avenue

Cranston Street at Niantic Avenue

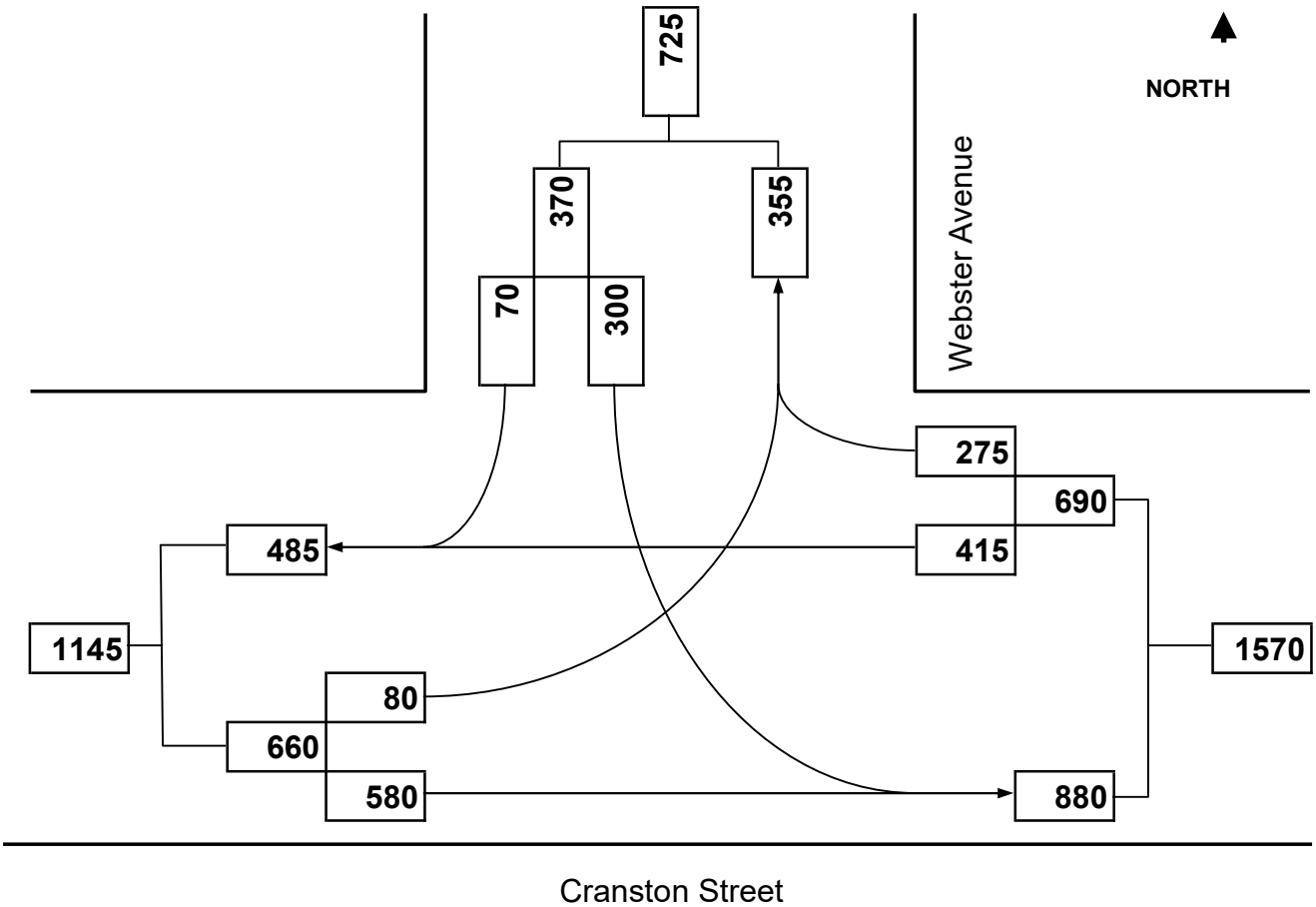
Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

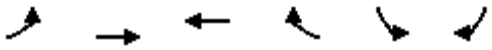
Cranston Street at Webster Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	7:30 AM - 8:30 AM
Existing:	AM Peak	**Future**:	n/a





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	80	580	415	275	300	70
Future Volume (vph)	80	580	415	275	300	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.97	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1805	1863	1827	1425	1765	
Flt Permitted	0.42	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	804	1863	1827	1425	1765	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	85	617	441	293	319	74
RTOR Reduction (vph)	0	0	0	161	14	0
Lane Group Flow (vph)	85	617	441	132	379	0
Heavy Vehicles (%)	0%	2%	4%	2%	1%	0%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	19.7	19.7	19.7	19.7	14.9	
Effective Green, g (s)	19.7	19.7	19.7	19.7	14.9	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.34	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	363	841	825	643	603	
v/s Ratio Prot		c0.33	0.24		c0.21	
v/s Ratio Perm	0.11			0.09		
v/c Ratio	0.23	0.73	0.53	0.21	0.63	
Uniform Delay, d1	7.3	9.8	8.6	7.2	12.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	3.1	0.5	0.1	1.8	
Delay (s)	7.6	12.9	9.2	7.3	13.8	
Level of Service	A	B	A	A	B	
Approach Delay (s)		12.3	8.4		13.8	
Approach LOS		B	A		B	

Intersection Summary			
HCM 2000 Control Delay	11.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	43.6	Sum of lost time (s)	9.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

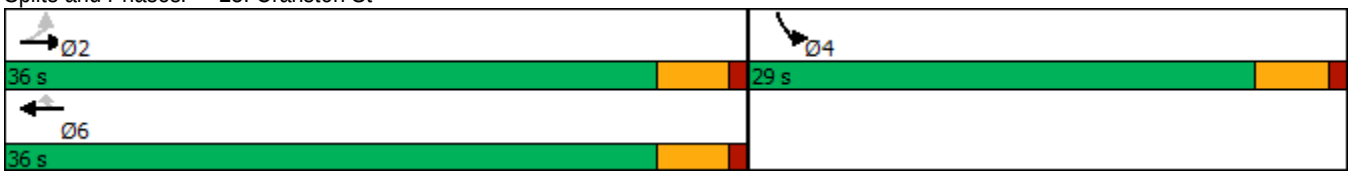
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	80	580	415	275	300
Future Volume (vph)	80	580	415	275	300
Lane Group Flow (vph)	85	617	441	293	393
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	36.0	36.0	36.0	36.0	29.0
Total Split (%)	55.4%	55.4%	55.4%	55.4%	44.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.24	0.75	0.55	0.37	0.65
Control Delay	10.6	17.4	12.5	2.9	18.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.6	17.4	12.5	2.9	18.6
Queue Length 50th (ft)	11	110	69	0	72
Queue Length 95th (ft)	44	286	183	35	194
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	599	1390	1363	1137	1073
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.14	0.44	0.32	0.26	0.37

Intersection Summary

Cycle Length: 65
Actuated Cycle Length: 44.5
Natural Cycle: 55
Control Type: Actuated-Uncoordinated

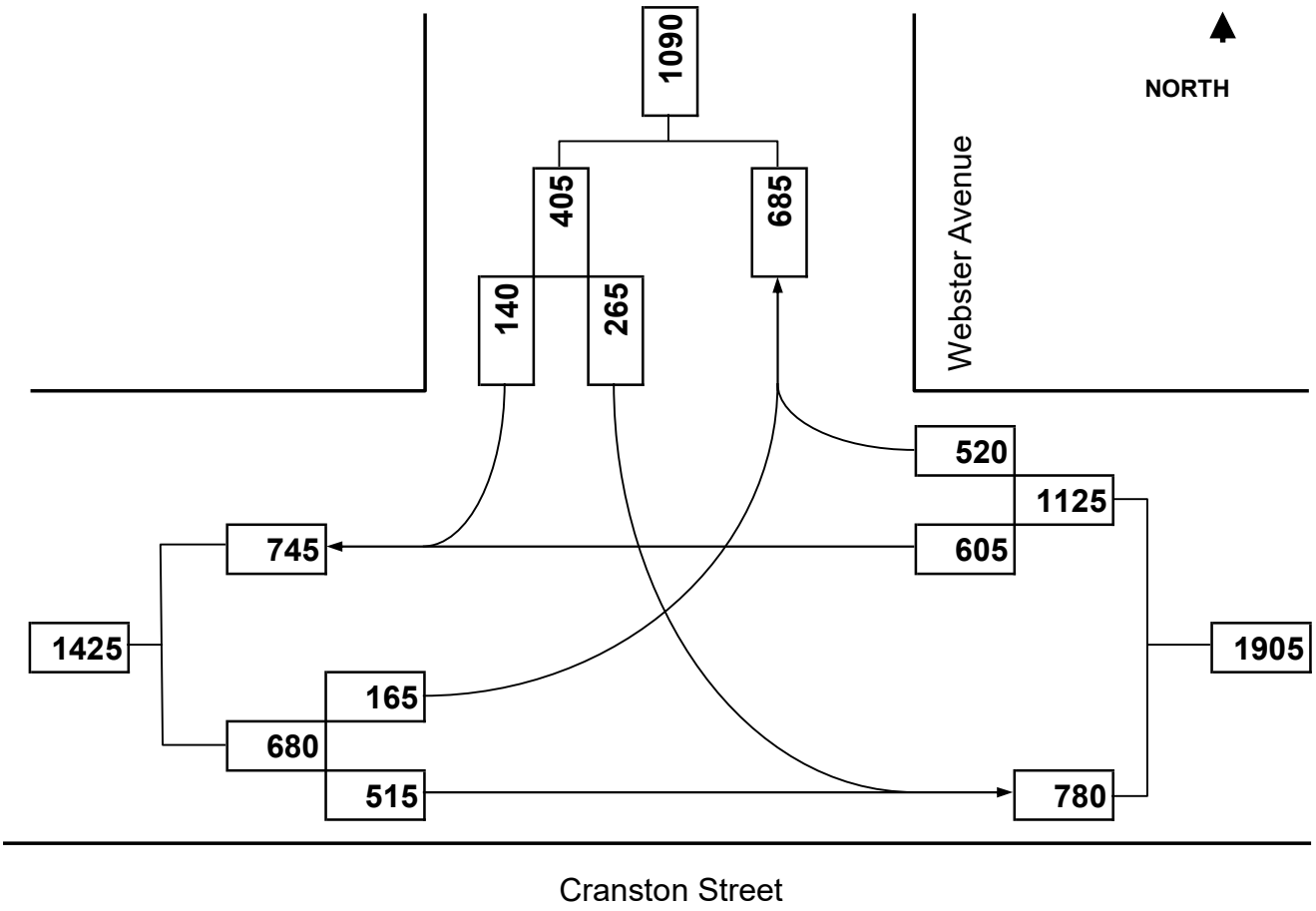
Splits and Phases: 23: Cranston St

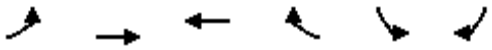


www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	4:30 PM - 5:30 PM
Existing:	PM Peak	**Future**:	n/a





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	165	515	605	520	265	140
Future Volume (vph)	165	515	605	520	265	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.95	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1787	1881	1881	1599	1736	
Flt Permitted	0.28	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	519	1881	1881	1599	1736	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	168	526	617	531	270	143
RTOR Reduction (vph)	0	0	0	275	26	0
Lane Group Flow (vph)	168	526	617	256	387	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	22.7	22.7	22.7	22.7	15.3	
Effective Green, g (s)	22.7	22.7	22.7	22.7	15.3	
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.33	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	250	908	908	772	565	
v/s Ratio Prot		0.28	c0.33		c0.22	
v/s Ratio Perm	0.32			0.16		
v/c Ratio	0.67	0.58	0.68	0.33	0.68	
Uniform Delay, d1	9.3	8.7	9.4	7.5	13.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	6.3	0.7	1.9	0.2	3.1	
Delay (s)	15.6	9.5	11.2	7.7	16.9	
Level of Service	B	A	B	A	B	
Approach Delay (s)		11.0	9.6		16.9	
Approach LOS		B	A		B	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	47.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	165	515	605	520	265
Future Volume (vph)	165	515	605	520	265
Lane Group Flow (vph)	168	526	617	531	413
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	44.0	44.0	44.0	44.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	62.9%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.69	0.59	0.69	0.51	0.71
Control Delay	26.5	12.3	14.6	2.8	23.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	26.5	12.3	14.6	2.8	23.1
Queue Length 50th (ft)	32	93	117	0	84
Queue Length 95th (ft)	111	197	247	37	#270
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	426	1545	1545	1408	877
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.39	0.34	0.40	0.38	0.47

Intersection Summary

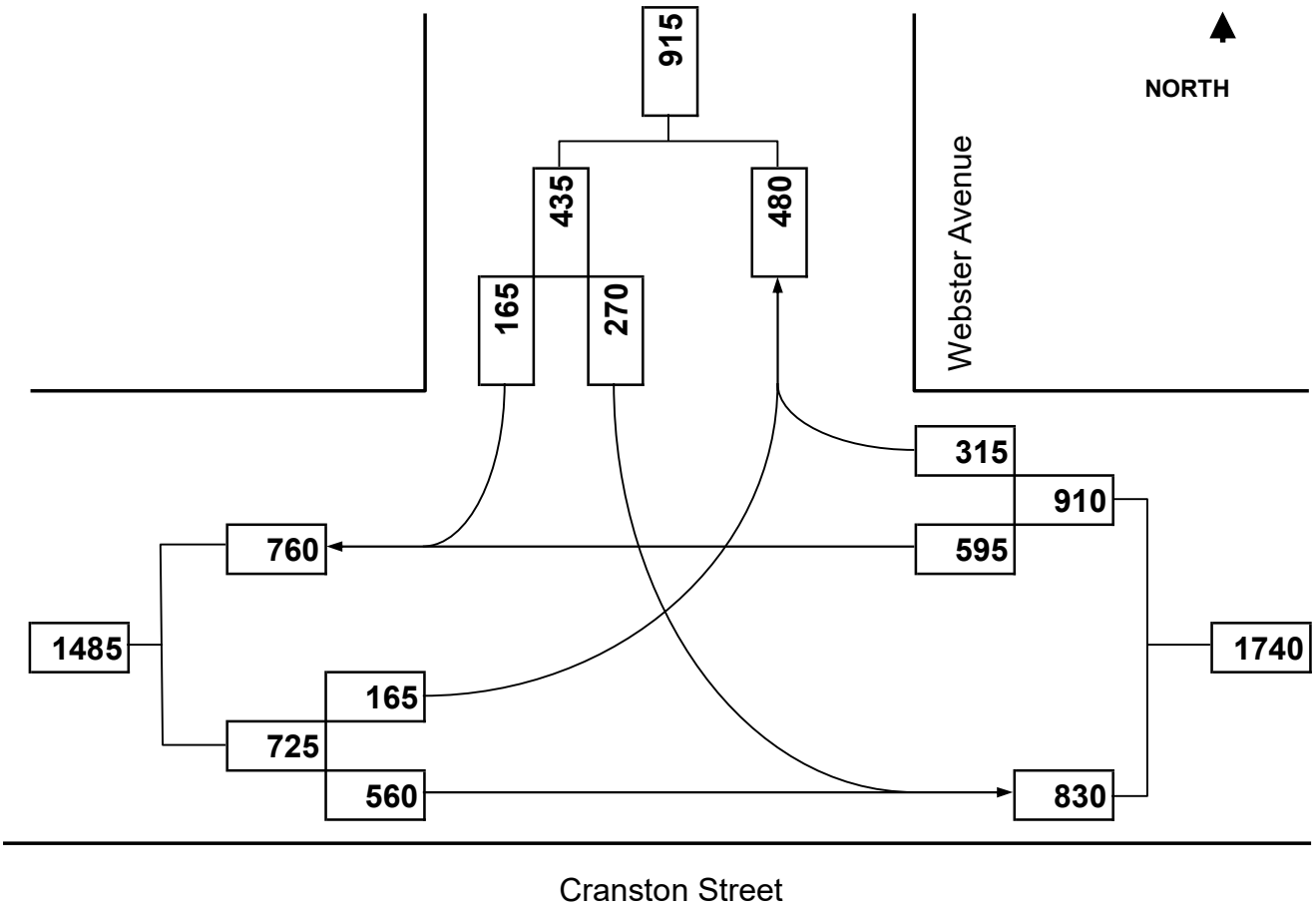
Cycle Length: 70
Actuated Cycle Length: 47.9
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

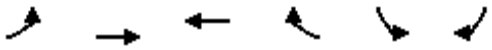
Splits and Phases: 23: Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	12:00 PM - 1:00 PM
Existing:	MD Peak	**Future**:	n/a





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	165	560	595	315	270	165
Future Volume (vph)	165	560	595	315	270	165
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.95	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1787	1881	1881	1439	1731	
Flt Permitted	0.26	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	491	1881	1881	1439	1731	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	172	583	620	328	281	172
RTOR Reduction (vph)	0	0	0	173	30	0
Lane Group Flow (vph)	172	583	620	155	423	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	22.8	22.8	22.8	22.8	16.6	
Effective Green, g (s)	22.8	22.8	22.8	22.8	16.6	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.34	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	231	886	886	677	593	
v/s Ratio Prot		0.31	0.33		c0.24	
v/s Ratio Perm	c0.35			0.11		
v/c Ratio	0.74	0.66	0.70	0.23	0.71	
Uniform Delay, d1	10.4	9.8	10.1	7.6	13.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	11.6	1.6	2.2	0.1	3.8	
Delay (s)	22.1	11.4	12.3	7.7	17.6	
Level of Service	C	B	B	A	B	
Approach Delay (s)		13.8	10.7		17.6	
Approach LOS		B	B		B	

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	48.4	Sum of lost time (s)	9.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	165	560	595	315	270
Future Volume (vph)	165	560	595	315	270
Lane Group Flow (vph)	172	583	620	328	453
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	44.0	44.0	44.0	44.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	62.9%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.76	0.67	0.71	0.39	0.74
Control Delay	34.7	14.6	15.7	2.6	24.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	14.6	15.7	2.6	24.0
Queue Length 50th (ft)	37	117	128	0	94
Queue Length 95th (ft)	#143	228	249	31	#310
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	398	1526	1526	1229	847
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.43	0.38	0.41	0.27	0.53

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 49.2
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 23: Cranston St

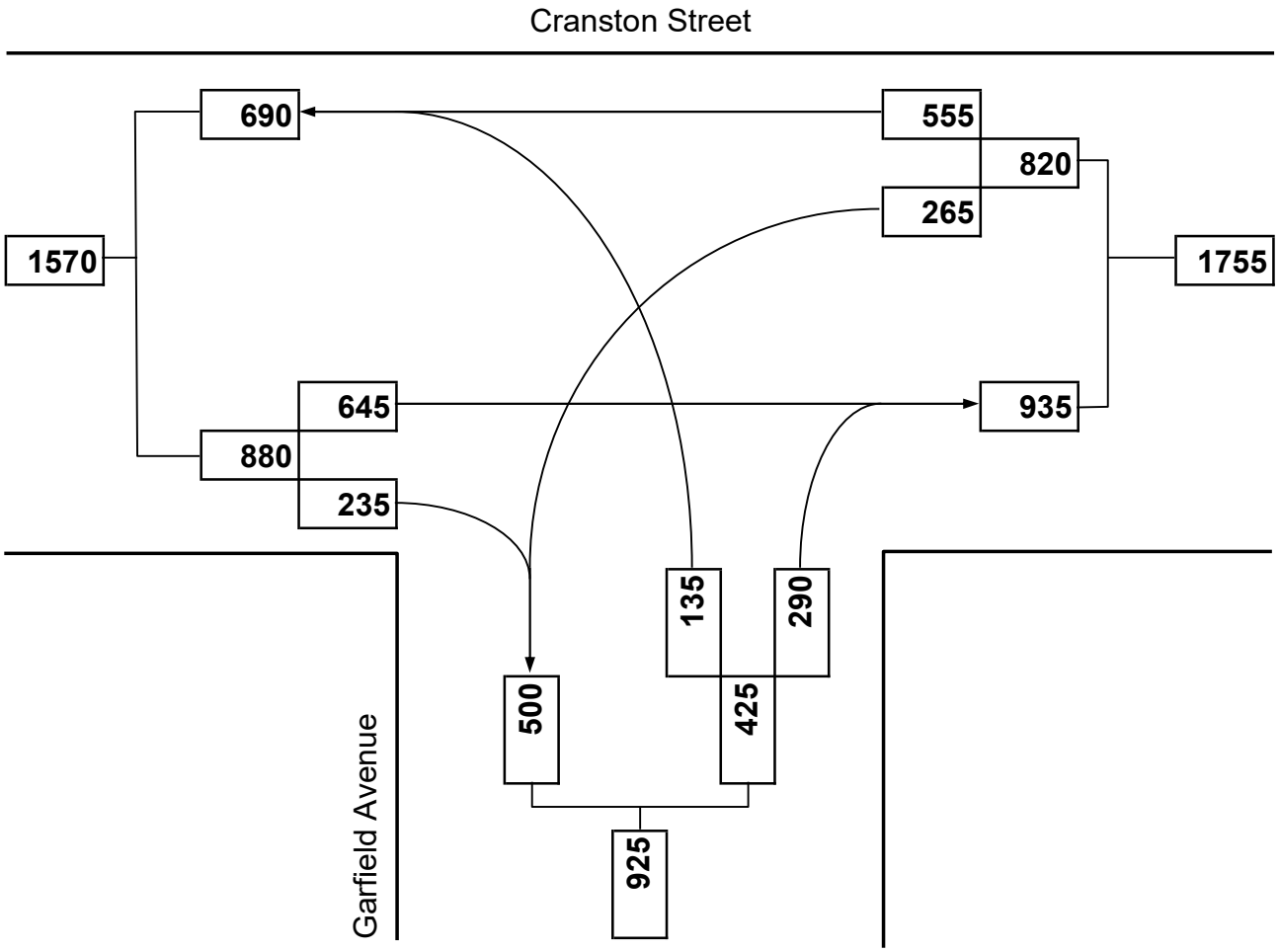
Cranston Street at Garfield Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	7:30 AM - 8:30 AM
Existing:	AM Peak	**Future**:	n/a

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	645	235	265	555	135	290
Future Volume (vph)	645	235	265	555	135	290
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		5.0	5.0	4.5	4.5
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3422		1719	3471	1770	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3422		1719	3471	1770	1553
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	665	242	273	572	139	299
RTOR Reduction (vph)	47	0	0	0	0	259
Lane Group Flow (vph)	860	0	273	572	139	40
Heavy Vehicles (%)	1%	2%	5%	4%	2%	4%
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Actuated Green, G (s)	41.1		23.0	69.1	11.9	11.9
Effective Green, g (s)	41.1		23.0	69.1	11.9	11.9
Actuated g/C Ratio	0.46		0.26	0.77	0.13	0.13
Clearance Time (s)	4.5		5.0		4.5	4.5
Vehicle Extension (s)	2.5		2.5		2.5	2.5
Lane Grp Cap (vph)	1562		439	2664	234	205
v/s Ratio Prot	c0.25		c0.16	0.16	c0.08	
v/s Ratio Perm						0.03
v/c Ratio	0.55		0.62	0.21	0.59	0.19
Uniform Delay, d1	17.7		29.7	2.9	36.8	34.8
Progression Factor	1.00		1.25	1.58	1.00	1.00
Incremental Delay, d2	1.4		2.1	0.0	3.4	0.3
Delay (s)	19.1		39.1	4.6	40.1	35.1
Level of Service	B		D	A	D	D
Approach Delay (s)	19.1			15.7	36.7	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	21.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Traffic Volume (vph)	645	265	555	135	290
Future Volume (vph)	645	265	555	135	290
Lane Group Flow (vph)	907	273	572	139	299
Turn Type	NA	Prot	NA	Prot	Perm
Protected Phases	2	1	1 2	3	
Permitted Phases					3
Detector Phase	2	1	1 2	3	3
Switch Phase					
Minimum Initial (s)	10.0	10.0		4.0	4.0
Minimum Split (s)	14.5	15.0		8.5	8.5
Total Split (s)	52.0	18.0		20.0	20.0
Total Split (%)	57.8%	20.0%		22.2%	22.2%
Yellow Time (s)	3.5	3.0		3.5	3.5
All-Red Time (s)	1.0	2.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	5.0		4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Min	Min		Min	Min
v/c Ratio	0.56	0.62	0.22	0.60	0.64
Control Delay	18.0	44.4	5.5	46.9	11.2
Queue Delay	0.0	0.0	0.0	0.0	0.3
Total Delay	18.0	44.4	5.5	46.9	11.5
Queue Length 50th (ft)	174	168	66	76	0
Queue Length 95th (ft)	234	#263	99	127	68
Internal Link Dist (ft)	225		437	499	
Turn Bay Length (ft)		300			
Base Capacity (vph)	1847	439	2892	308	517
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	17	0	0	0	25
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.62	0.20	0.45	0.61

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
Natural Cycle: 55
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

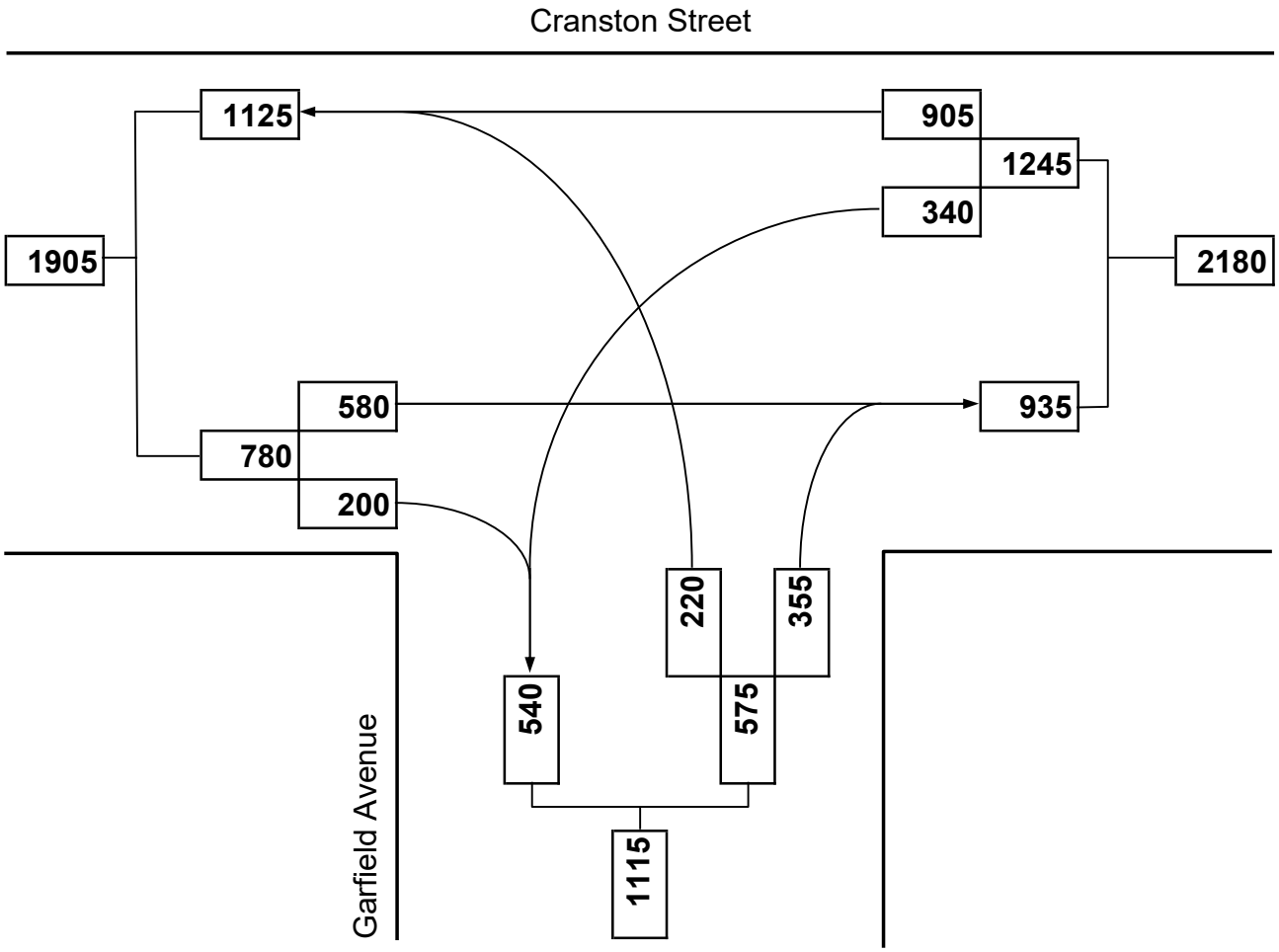
Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	4:30 PM - 5:30 PM
Existing:	PM Peak	**Future**:	n/a

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	580	200	340	905	220	355
Future Volume (vph)	580	200	340	905	220	355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		5.0	5.0	4.5	4.5
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3445		1770	3574	1787	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3445		1770	3574	1787	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	611	211	358	953	232	374
RTOR Reduction (vph)	39	0	0	0	0	307
Lane Group Flow (vph)	783	0	358	953	232	67
Heavy Vehicles (%)	1%	0%	2%	1%	1%	2%
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Actuated Green, G (s)	31.5		20.1	56.6	14.4	14.4
Effective Green, g (s)	31.5		20.1	56.6	14.4	14.4
Actuated g/C Ratio	0.39		0.25	0.71	0.18	0.18
Clearance Time (s)	4.5		5.0		4.5	4.5
Vehicle Extension (s)	2.5		2.5		2.5	2.5
Lane Grp Cap (vph)	1356		444	2528	321	284
v/s Ratio Prot	c0.23		c0.20	0.27	c0.13	
v/s Ratio Perm						0.04
v/c Ratio	0.58		0.81	0.38	0.72	0.24
Uniform Delay, d1	19.0		28.1	4.7	30.9	28.1
Progression Factor	1.00		1.03	1.14	1.00	1.00
Incremental Delay, d2	1.8		8.0	0.1	7.3	0.3
Delay (s)	20.8		37.0	5.4	38.3	28.4
Level of Service	C		D	A	D	C
Approach Delay (s)	20.8			14.0	32.2	
Approach LOS	C			B	C	

Intersection Summary			
HCM 2000 Control Delay	20.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	65.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Traffic Volume (vph)	580	340	905	220	355
Future Volume (vph)	580	340	905	220	355
Lane Group Flow (vph)	822	358	953	232	374
Turn Type	NA	Prot	NA	Prot	Perm
Protected Phases	2	1	1 2	3	
Permitted Phases					3
Detector Phase	2	1	1 2	3	3
Switch Phase					
Minimum Initial (s)	10.0	10.0		4.0	4.0
Minimum Split (s)	14.5	15.0		8.5	8.5
Total Split (s)	32.0	26.0		22.0	22.0
Total Split (%)	40.0%	32.5%		27.5%	27.5%
Yellow Time (s)	3.5	3.0		3.5	3.5
All-Red Time (s)	1.0	2.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	5.0		4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Min	None		None	None
v/c Ratio	0.59	0.80	0.38	0.72	0.63
Control Delay	20.8	41.3	6.5	43.6	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.1
Total Delay	20.8	41.3	6.5	43.6	8.6
Queue Length 50th (ft)	167	197	148	109	0
Queue Length 95th (ft)	230	m#263	m175	177	67
Internal Link Dist (ft)	225		437	499	
Turn Bay Length (ft)		300			
Base Capacity (vph)	1392	475	2468	390	638
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	10
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.59	0.75	0.39	0.59	0.60

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

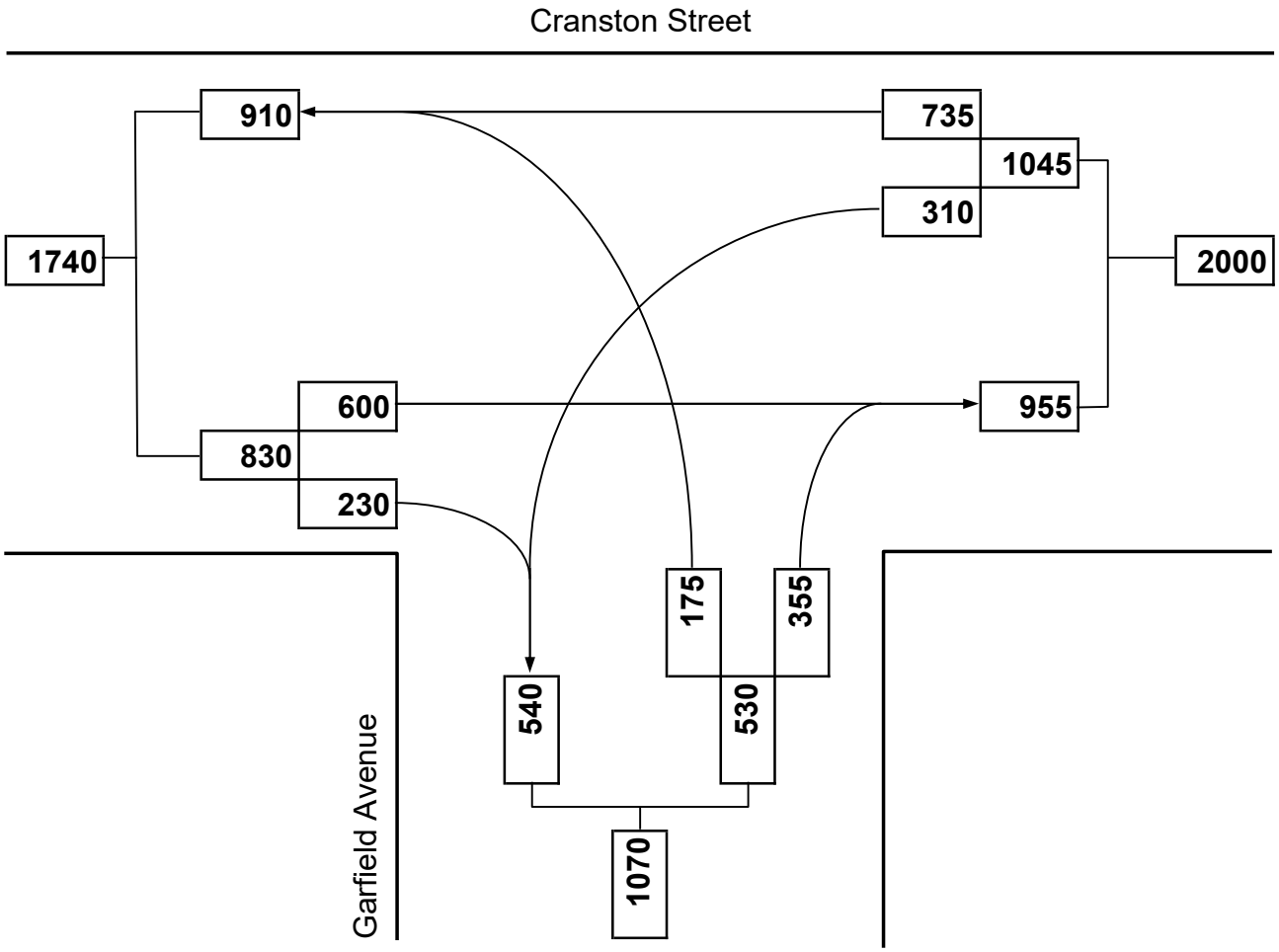
Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	12:00 PM - 1:00 PM
Existing:	MD Peak	**Future**:	n/a

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	600	230	310	735	175	355
Future Volume (vph)	600	230	310	735	175	355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		5.0	5.0	4.5	4.5
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3426		1787	3574	1787	1599
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3426		1787	3574	1787	1599
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	606	232	313	742	177	359
RTOR Reduction (vph)	56	0	0	0	0	304
Lane Group Flow (vph)	782	0	313	742	177	55
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Actuated Green, G (s)	36.1		26.1	67.2	13.8	13.8
Effective Green, g (s)	36.1		26.1	67.2	13.8	13.8
Actuated g/C Ratio	0.40		0.29	0.75	0.15	0.15
Clearance Time (s)	4.5		5.0		4.5	4.5
Vehicle Extension (s)	2.5		2.5		2.5	2.5
Lane Grp Cap (vph)	1374		518	2668	274	245
v/s Ratio Prot	c0.23		c0.18	0.21	c0.10	
v/s Ratio Perm						0.03
v/c Ratio	0.57		0.60	0.28	0.65	0.22
Uniform Delay, d1	20.9		27.5	3.6	35.8	33.4
Progression Factor	1.00		1.22	1.58	1.00	1.00
Incremental Delay, d2	1.7		1.4	0.0	4.6	0.3
Delay (s)	22.6		35.1	5.8	40.4	33.7
Level of Service	C		D	A	D	C
Approach Delay (s)	22.6			14.5	35.9	
Approach LOS	C			B	D	

Intersection Summary			
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Traffic Volume (vph)	600	310	735	175	355
Future Volume (vph)	600	310	735	175	355
Lane Group Flow (vph)	838	313	742	177	359
Turn Type	NA	Prot	NA	Prot	Perm
Protected Phases	2	1	1 2	3	
Permitted Phases					3
Detector Phase	2	1	1 2	3	3
Switch Phase					
Minimum Initial (s)	10.0	10.0		4.0	4.0
Minimum Split (s)	14.5	15.0		8.5	8.5
Total Split (s)	52.0	18.0		20.0	20.0
Total Split (%)	57.8%	20.0%		22.2%	22.2%
Yellow Time (s)	3.5	3.0		3.5	3.5
All-Red Time (s)	1.0	2.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	5.0		4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Min	Min		Min	Min
v/c Ratio	0.59	0.60	0.28	0.65	0.66
Control Delay	20.4	40.9	6.9	46.4	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.3
Total Delay	20.4	40.9	6.9	46.4	10.2
Queue Length 50th (ft)	170	194	121	96	0
Queue Length 95th (ft)	216	m#321	146	151	70
Internal Link Dist (ft)	225		437	499	
Turn Bay Length (ft)		300			
Base Capacity (vph)	1851	518	3100	325	584
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	65	0	0	0	33
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.47	0.60	0.24	0.54	0.65

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
Natural Cycle: 55
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St

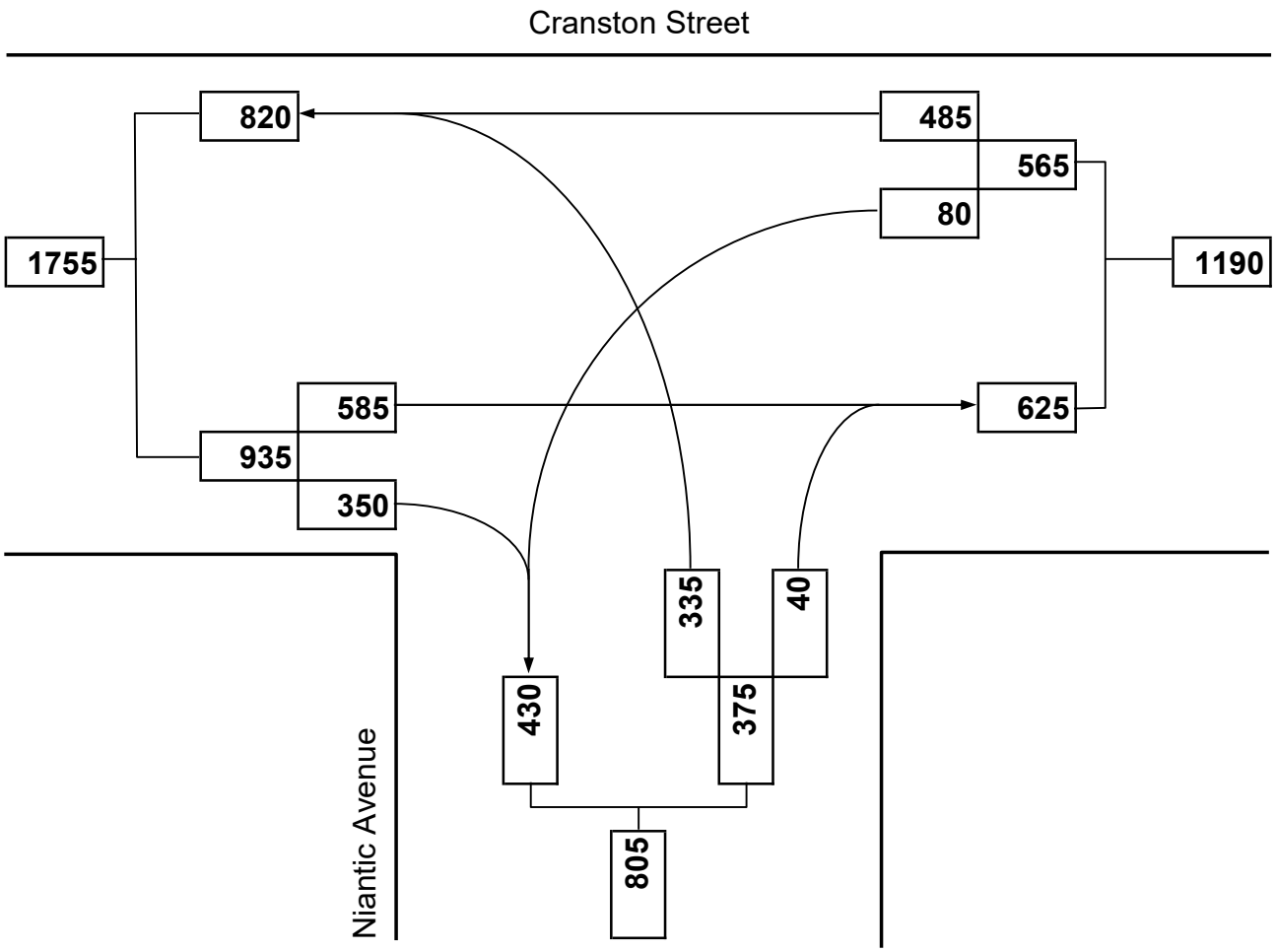
Cranston Street at Niantic Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	7:30 AM - 8:30 AM
Existing:	AM Peak	**Future**:	n/a

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	585	350	80	485	335	35
Future Volume (vph)	585	350	80	485	335	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		0.99	0.96	
Satd. Flow (prot)	1863	1583		3480	1732	
Flt Permitted	1.00	1.00		0.75	0.96	
Satd. Flow (perm)	1863	1583		2617	1732	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	622	372	85	516	356	37
RTOR Reduction (vph)	0	143	0	0	4	0
Lane Group Flow (vph)	622	229	0	601	389	0
Heavy Vehicles (%)	2%	2%	3%	3%	4%	0%
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	55.4	55.4		55.4	24.6	
Effective Green, g (s)	55.4	55.4		55.4	24.6	
Actuated g/C Ratio	0.62	0.62		0.62	0.27	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	1146	974		1610	473	
v/s Ratio Prot	c0.33				c0.22	
v/s Ratio Perm		0.14		0.23		
v/c Ratio	0.54	0.24		0.37	0.82	
Uniform Delay, d1	10.0	7.8		8.6	30.6	
Progression Factor	0.97	2.42		1.31	1.00	
Incremental Delay, d2	1.6	0.5		0.4	10.8	
Delay (s)	11.3	19.4		11.7	41.4	
Level of Service	B	B		B	D	
Approach Delay (s)	14.3			11.7	41.4	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	585	350	80	485	335
Future Volume (vph)	585	350	80	485	335
Lane Group Flow (vph)	622	372	0	601	393
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	54.0	54.0	54.0	54.0	36.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	None
v/c Ratio	0.54	0.33		0.37	0.82
Control Delay	12.8	3.6		13.1	44.5
Queue Delay	0.9	0.0		1.3	0.0
Total Delay	13.7	3.6		14.4	44.5
Queue Length 50th (ft)	276	15		128	205
Queue Length 95th (ft)	431	148		m135	284
Internal Link Dist (ft)	437			193	468
Turn Bay Length (ft)					
Base Capacity (vph)	1147	1117		1612	600
Starvation Cap Reductn	271	0		762	0
Spillback Cap Reductn	126	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.71	0.33		0.71	0.66

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

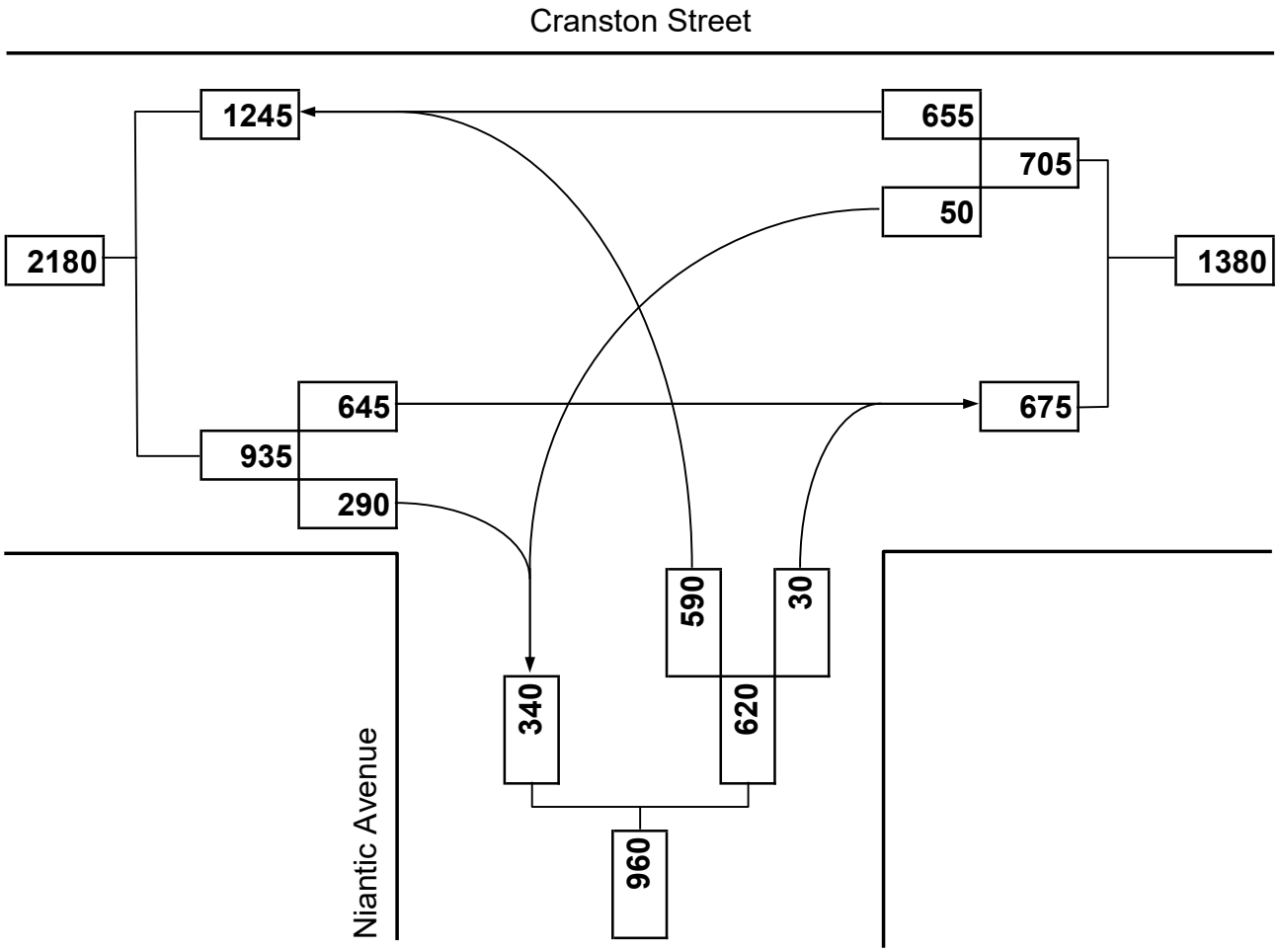
Splits and Phases: 18: Niantic Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	4:30 PM - 5:30 PM
Existing:	PM Peak	**Future**:	n/a

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	645	290	50	655	590	30
Future Volume (vph)	645	290	50	655	590	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		1.00	0.95	
Satd. Flow (prot)	1881	1439		3559	1785	
Flt Permitted	1.00	1.00		0.76	0.95	
Satd. Flow (perm)	1881	1439		2716	1785	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	652	293	51	662	596	30
RTOR Reduction (vph)	0	156	0	0	2	0
Lane Group Flow (vph)	652	137	0	713	624	0
Heavy Vehicles (%)	1%	1%	2%	1%	1%	0%
Parking (#/hr)		0				
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	37.4	37.4		37.4	32.6	
Effective Green, g (s)	37.4	37.4		37.4	32.6	
Actuated g/C Ratio	0.47	0.47		0.47	0.41	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	879	672		1269	727	
v/s Ratio Prot	c0.35				c0.35	
v/s Ratio Perm		0.10		0.26		
v/c Ratio	0.74	0.20		0.56	0.86	
Uniform Delay, d1	17.4	12.5		15.4	21.6	
Progression Factor	0.95	1.76		1.85	1.00	
Incremental Delay, d2	4.6	0.6		1.0	9.8	
Delay (s)	21.0	22.7		29.6	31.4	
Level of Service	C	C		C	C	
Approach Delay (s)	21.5			29.6	31.4	
Approach LOS	C			C	C	

Intersection Summary			
HCM 2000 Control Delay	26.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	645	290	50	655	590
Future Volume (vph)	645	290	50	655	590
Lane Group Flow (vph)	652	293	0	713	626
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	51.0	51.0	51.0	51.0	29.0
Total Split (%)	63.8%	63.8%	63.8%	63.8%	36.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	Min
v/c Ratio	0.74	0.35		0.56	0.86
Control Delay	20.3	3.1		28.2	38.9
Queue Delay	0.6	0.0		2.7	0.0
Total Delay	20.9	3.1		30.9	38.9
Queue Length 50th (ft)	324	16		206	281
Queue Length 95th (ft)	372	18		m211	#580
Internal Link Dist (ft)	437			193	468
Turn Bay Length (ft)					
Base Capacity (vph)	1081	951		1561	730
Starvation Cap Reductn	101	0		705	0
Spillback Cap Reductn	149	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.70	0.31		0.83	0.86

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 22 (28%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

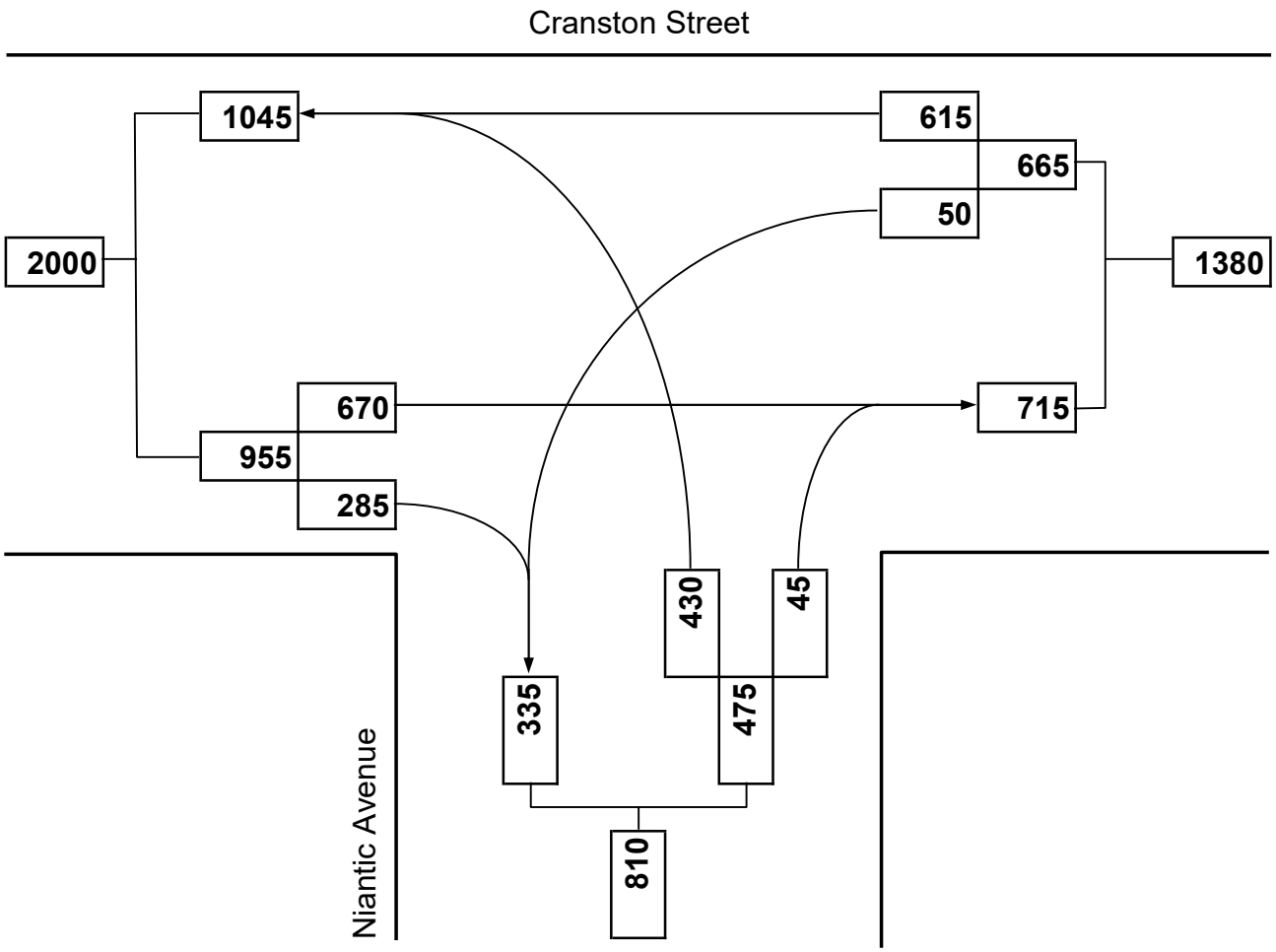
Splits and Phases: 18: Niantic Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	12:00 PM - 1:00 PM
Existing:	MD Peak	**Future**:	n/a

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	670	285	50	615	430	45
Future Volume (vph)	670	285	50	615	430	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		1.00	0.96	
Satd. Flow (prot)	1881	1599		3561	1777	
Flt Permitted	1.00	1.00		0.83	0.96	
Satd. Flow (perm)	1881	1599		2950	1777	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	677	288	51	621	434	45
RTOR Reduction (vph)	0	121	0	0	4	0
Lane Group Flow (vph)	677	167	0	672	475	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	52.3	52.3		52.3	27.7	
Effective Green, g (s)	52.3	52.3		52.3	27.7	
Actuated g/C Ratio	0.58	0.58		0.58	0.31	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	1093	929		1714	546	
v/s Ratio Prot	c0.36				c0.27	
v/s Ratio Perm		0.10		0.23		
v/c Ratio	0.62	0.18		0.39	0.87	
Uniform Delay, d1	12.3	8.8		10.2	29.4	
Progression Factor	1.06	2.47		1.79	1.00	
Incremental Delay, d2	2.3	0.4		0.2	13.7	
Delay (s)	15.3	22.2		18.5	43.1	
Level of Service	B	C		B	D	
Approach Delay (s)	17.4			18.5	43.1	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	23.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	90.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	670	285	50	615	430
Future Volume (vph)	670	285	50	615	430
Lane Group Flow (vph)	677	288	0	672	479
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	54.0	54.0	54.0	54.0	36.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	None
v/c Ratio	0.62	0.27		0.39	0.87
Control Delay	16.9	4.0		20.0	46.1
Queue Delay	1.2	0.0		4.0	0.0
Total Delay	18.1	4.0		24.0	46.1
Queue Length 50th (ft)	351	33		183	246
Queue Length 95th (ft)	490	107		m154	#390
Internal Link Dist (ft)	437			193	468
Turn Bay Length (ft)					
Base Capacity (vph)	1098	1053		1721	621
Starvation Cap Reductn	220	0		945	0
Spillback Cap Reductn	101	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.77	0.27		0.87	0.77

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

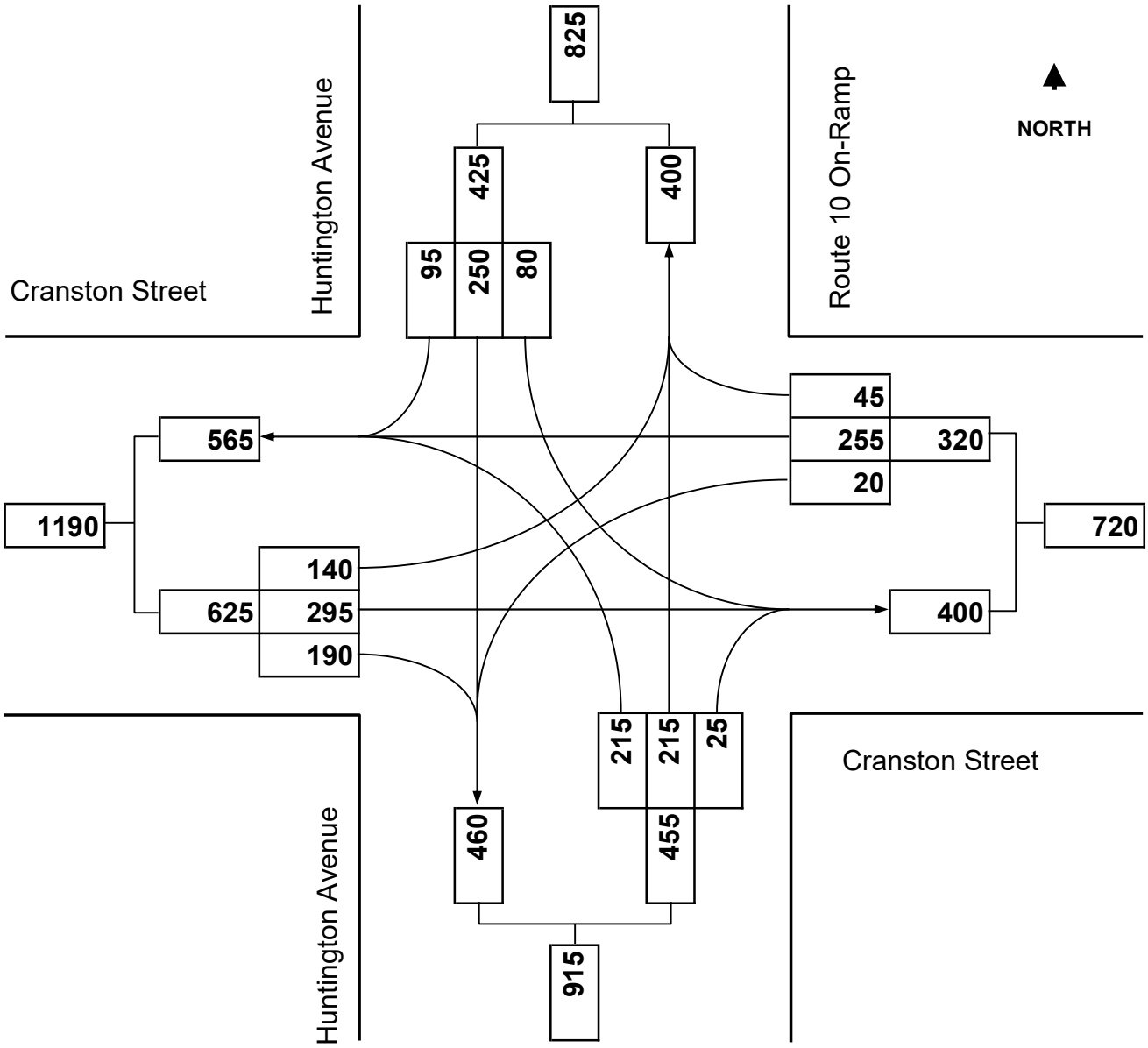
Splits and Phases: 18: Niantic Ave & Cranston St

Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	7:30 AM - 8:30 AM
Existing:	AM Peak	**Future**:	n/a



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	140	295	190	20	255	45	80	250	95	215	215	25
Future Volume (vph)	140	295	190	20	255	45	80	250	95	215	215	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.98		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1771		1805	1823		1787	3426		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1771		1805	1823		1787	3426		1787	1881	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	146	307	198	21	266	47	83	260	99	224	224	26
RTOR Reduction (vph)	0	16	0	0	6	0	0	50	0	0	0	21
Lane Group Flow (vph)	146	489	0	21	307	0	83	309	0	224	224	5
Heavy Vehicles (%)	1%	1%	1%	0%	2%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	12.3	42.6		2.9	33.2		6.3	16.5		8.0	18.2	18.2
Effective Green, g (s)	12.3	42.6		2.9	33.2		6.3	16.5		8.0	18.2	18.2
Actuated g/C Ratio	0.14	0.47		0.03	0.37		0.07	0.18		0.09	0.20	0.20
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	244	838		58	672		125	628		158	380	323
v/s Ratio Prot	c0.08	c0.28		0.01	0.17		0.05	0.09		c0.13	c0.12	
v/s Ratio Perm												0.00
v/c Ratio	0.60	0.58		0.36	0.46		0.66	0.49		1.42	0.59	0.02
Uniform Delay, d1	36.5	17.2		42.6	21.6		40.8	33.0		41.0	32.5	28.7
Progression Factor	0.82	0.86		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.9	2.5		2.5	2.2		11.0	0.4		220.9	2.0	0.0
Delay (s)	33.0	17.4		45.2	23.8		51.9	33.4		261.9	34.5	28.8
Level of Service	C	B		D	C		D	C		F	C	C
Approach Delay (s)		20.9			25.1			36.9			141.7	
Approach LOS		C			C			D			F	

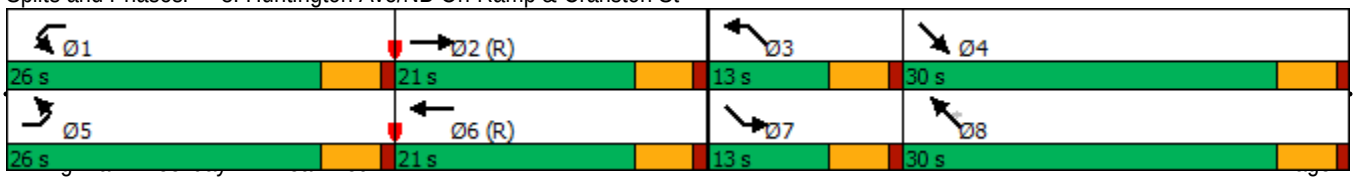
Intersection Summary			
HCM 2000 Control Delay	55.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	140	295	20	255	80	250	215	215	25
Future Volume (vph)	140	295	20	255	80	250	215	215	25
Lane Group Flow (vph)	146	505	21	313	83	359	224	224	26
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	26.0	21.0	26.0	21.0	13.0	30.0	13.0	30.0	30.0
Total Split (%)	28.9%	23.3%	28.9%	23.3%	14.4%	33.3%	14.4%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.60	0.54	0.17	0.45	0.57	0.56	1.42	0.59	0.06
Control Delay	38.5	16.6	42.4	25.2	55.3	30.8	254.3	39.6	0.2
Queue Delay	0.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.6	18.3	42.4	25.2	55.3	30.8	254.3	39.6	0.2
Queue Length 50th (ft)	65	272	12	127	46	81	~173	121	0
Queue Length 95th (ft)	m105	244	34	243	#94	116	#314	182	0
Internal Link Dist (ft)		193		360		327		664	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	416	931	421	698	158	996	158	522	548
Starvation Cap Reductn	14	259	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.75	0.05	0.45	0.53	0.36	1.42	0.43	0.05

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

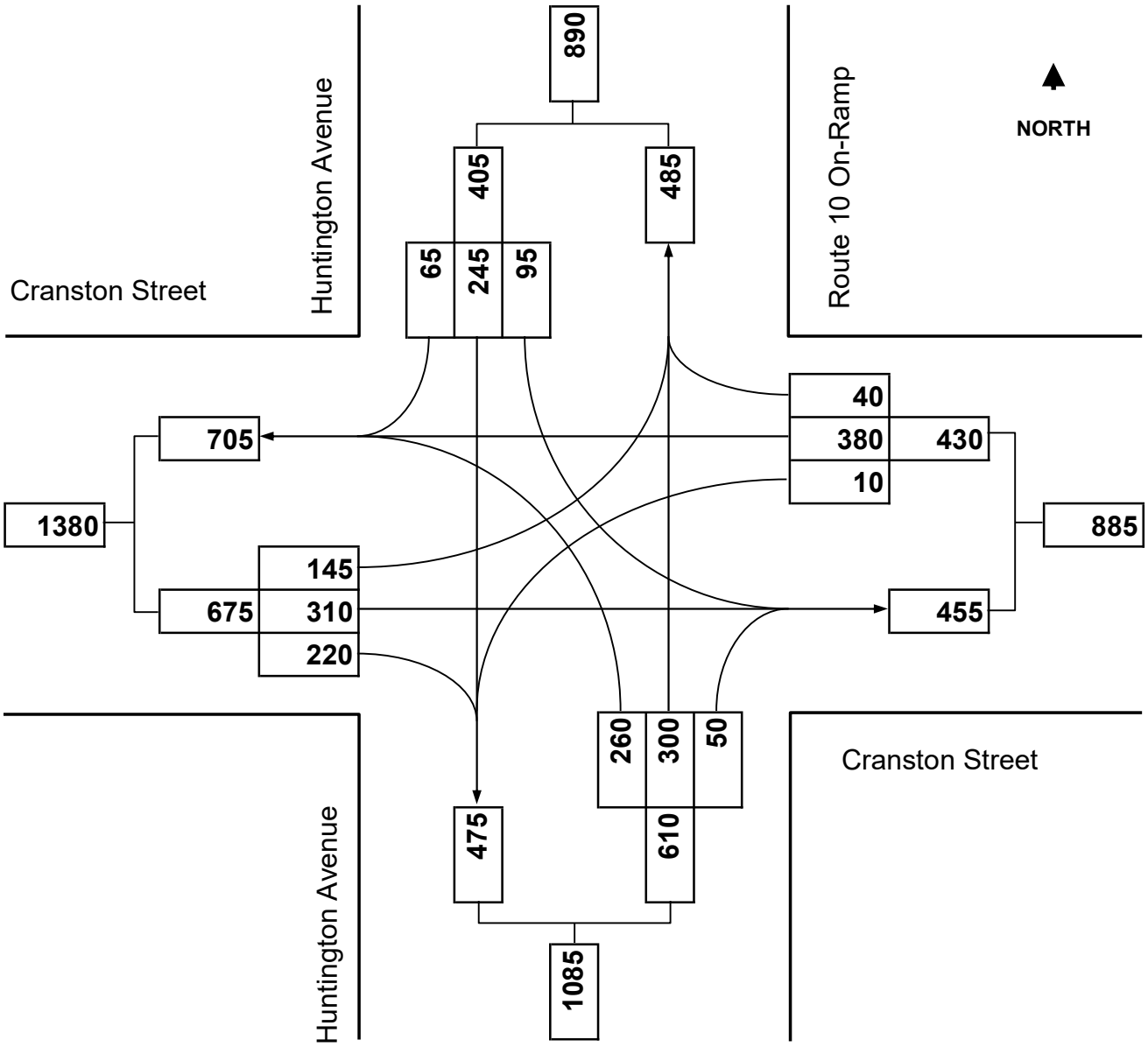
Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	4:30 PM - 5:30 PM
Existing:	PM Peak	**Future**:	n/a



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	145	310	220	10	380	40	95	245	65	260	300	50
Future Volume (vph)	145	310	220	10	380	40	95	245	65	260	300	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1764		1787	1854		1787	3462		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1764		1787	1854		1787	3462		1787	1881	1599
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	149	320	227	10	392	41	98	253	67	268	309	52
RTOR Reduction (vph)	0	27	0	0	4	0	0	32	0	0	0	39
Lane Group Flow (vph)	149	520	0	10	429	0	98	288	0	268	309	13
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	9.4	30.6		1.3	22.5		8.0	15.1		13.0	20.1	20.1
Effective Green, g (s)	9.4	30.6		1.3	22.5		8.0	15.1		13.0	20.1	20.1
Actuated g/C Ratio	0.12	0.38		0.02	0.28		0.10	0.19		0.16	0.25	0.25
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	209	674		29	521		178	653		290	472	401
v/s Ratio Prot	c0.08	c0.30		0.01	0.23		0.05	0.08		c0.15	c0.16	
v/s Ratio Perm												0.01
v/c Ratio	0.71	0.77		0.34	0.82		0.55	0.44		0.92	0.65	0.03
Uniform Delay, d1	34.0	21.6		38.9	26.9		34.3	28.7		33.0	26.8	22.6
Progression Factor	0.73	0.56		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	8.4	6.8		4.6	13.7		2.8	0.3		33.3	3.0	0.0
Delay (s)	33.3	19.0		43.6	40.6		37.0	29.0		66.3	29.8	22.6
Level of Service	C	B		D	D		D	C		E	C	C
Approach Delay (s)		22.0			40.6			30.9			44.8	
Approach LOS		C			D			C			D	

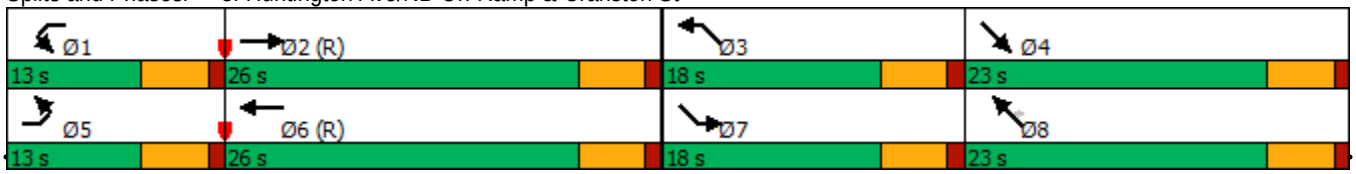
Intersection Summary			
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	145	310	10	380	95	245	260	300	50
Future Volume (vph)	145	310	10	380	95	245	260	300	50
Lane Group Flow (vph)	149	547	10	433	98	320	268	309	52
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	13.0	26.0	13.0	26.0	18.0	23.0	18.0	23.0	23.0
Total Split (%)	16.3%	32.5%	16.3%	32.5%	22.5%	28.8%	22.5%	28.8%	28.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Min	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.71	0.68	0.08	0.79	0.48	0.50	0.92	0.66	0.10
Control Delay	44.3	17.1	36.0	39.4	40.5	28.1	72.4	35.8	0.4
Queue Delay	0.0	4.6	0.0	0.0	0.0	1.4	47.4	0.0	0.0
Total Delay	44.3	21.8	36.0	39.5	40.5	29.5	119.8	35.8	0.4
Queue Length 50th (ft)	43	269	5	205	47	66	134	143	0
Queue Length 95th (ft)	m#158	m#120	20	#372	88	100	#273	#253	0
Internal Link Dist (ft)		193		360		327		664	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	209	809	178	549	290	809	290	483	532
Starvation Cap Reductn	0	191	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	1	0	306	54	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.89	0.06	0.79	0.34	0.64	1.14	0.64	0.10

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 55 (69%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

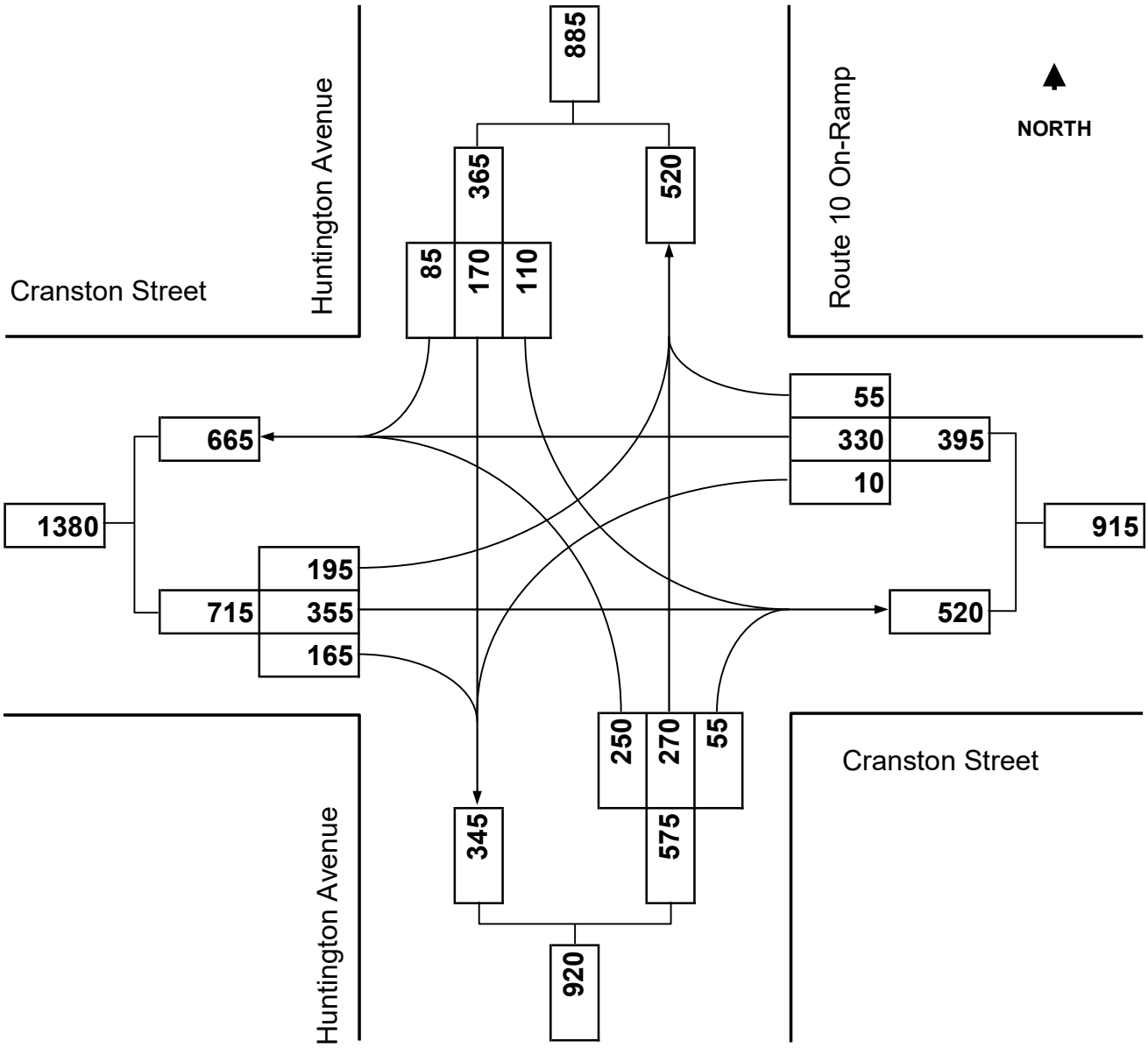
Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	12:00 PM - 1:00 PM
Existing:	MD Peak	**Future**:	n/a



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	195	355	165	10	330	55	110	170	85	250	270	55
Future Volume (vph)	195	355	165	10	330	55	110	170	85	250	270	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1792		1805	1841		1787	3396		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1792		1805	1841		1787	3396		1787	1881	1599
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	205	374	174	11	347	58	116	179	89	263	284	58
RTOR Reduction (vph)	0	12	0	0	5	0	0	71	0	0	0	46
Lane Group Flow (vph)	205	536	0	11	400	0	116	197	0	263	284	12
Heavy Vehicles (%)	1%	1%	1%	0%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	15.1	42.5		1.3	28.7		7.8	18.2		8.0	18.4	18.4
Effective Green, g (s)	15.1	42.5		1.3	28.7		7.8	18.2		8.0	18.4	18.4
Actuated g/C Ratio	0.17	0.47		0.01	0.32		0.09	0.20		0.09	0.20	0.20
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	299	846		26	587		154	686		158	384	326
v/s Ratio Prot	c0.11	c0.30		0.01	0.22		0.06	0.06		c0.15	c0.15	
v/s Ratio Perm												0.01
v/c Ratio	0.69	0.63		0.42	0.68		0.75	0.29		1.66	0.74	0.04
Uniform Delay, d1	35.2	17.9		44.0	26.7		40.2	30.4		41.0	33.6	28.7
Progression Factor	0.81	0.60		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.8	2.9		7.1	6.3		17.6	0.2		325.3	7.0	0.0
Delay (s)	33.2	13.7		51.1	32.9		57.8	30.6		366.3	40.5	28.7
Level of Service	C	B		D	C		E	C		F	D	C
Approach Delay (s)		19.0			33.4			38.8			181.0	
Approach LOS		B			C			D			F	

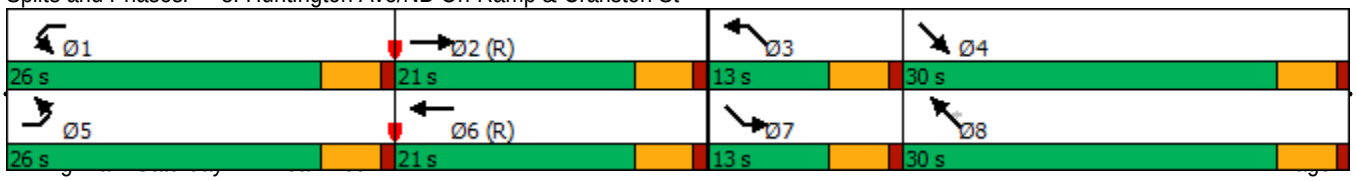
Intersection Summary			
HCM 2000 Control Delay	70.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	195	355	10	330	110	170	250	270	55
Future Volume (vph)	195	355	10	330	110	170	250	270	55
Lane Group Flow (vph)	205	548	11	405	116	268	263	284	58
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	26.0	21.0	26.0	21.0	13.0	30.0	13.0	30.0	30.0
Total Split (%)	28.9%	23.3%	28.9%	23.3%	14.4%	33.3%	14.4%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.68	0.59	0.10	0.69	0.75	0.35	1.66	0.74	0.13
Control Delay	37.5	14.0	41.3	37.2	70.4	20.5	354.6	44.8	0.6
Queue Delay	0.4	1.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	37.9	15.5	41.3	37.2	70.4	20.6	354.6	44.8	0.6
Queue Length 50th (ft)	72	295	6	196	65	45	~219	152	0
Queue Length 95th (ft)	m127	m#457	23	#457	#150	72	#370	218	0
Internal Link Dist (ft)		193		360		327		664	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	416	935	421	591	158	1007	158	522	548
Starvation Cap Reductn	39	211	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	161	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.76	0.03	0.69	0.73	0.32	1.66	0.54	0.11

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



D

Future 2024 No Build Weekday AM / PM / Saturday MD Peak Hour

Cranston Street at Webster Avenue

Cranston Street at Garfield Avenue

Cranston Street at Niantic Avenue

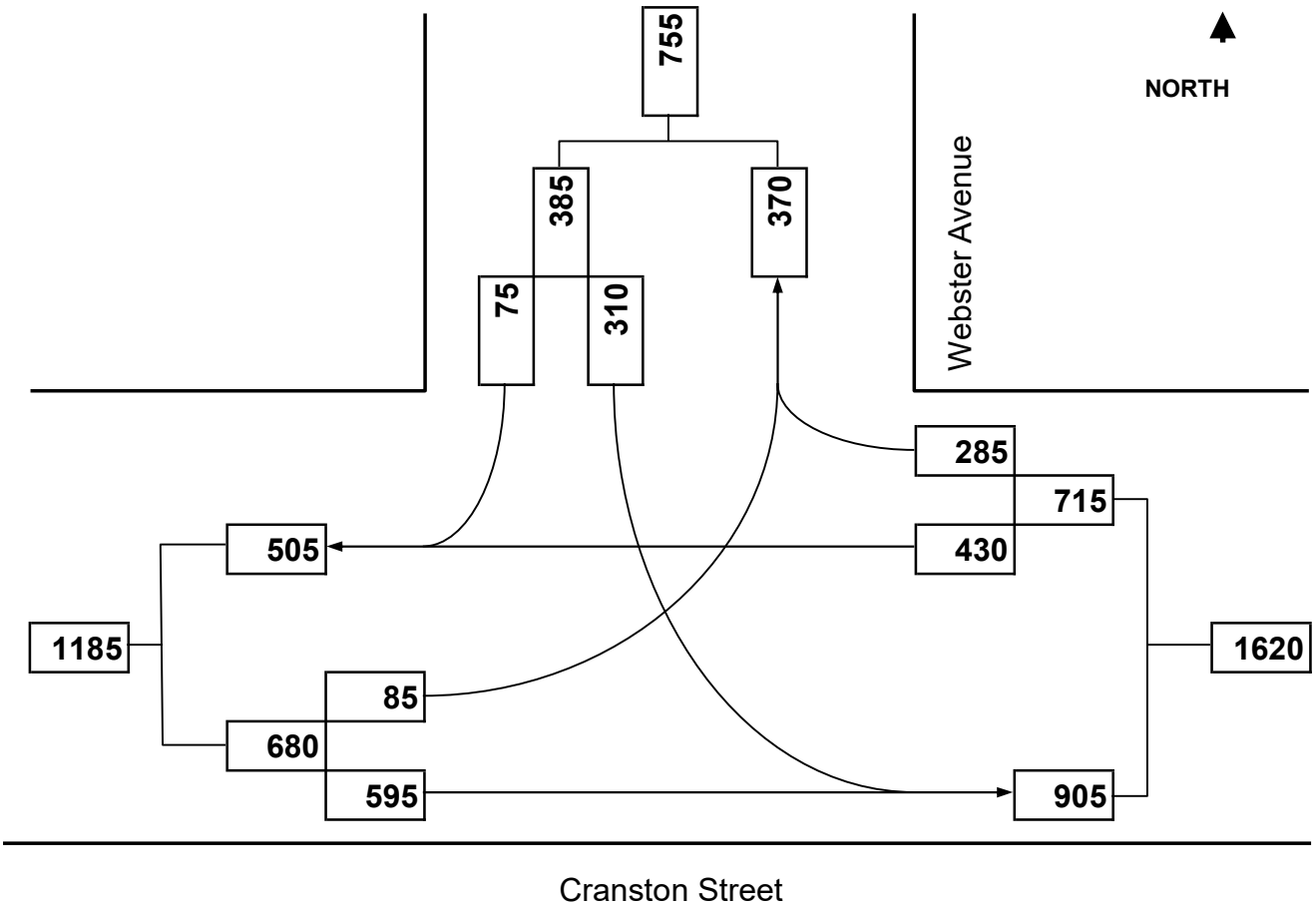
Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

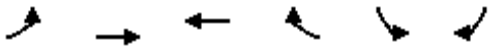
Cranston Street at Webster Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 No Build





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	85	595	430	285	310	75
Future Volume (vph)	85	595	430	285	310	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.97	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1805	1863	1827	1425	1764	
Flt Permitted	0.41	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	771	1863	1827	1425	1764	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	90	633	457	303	330	80
RTOR Reduction (vph)	0	0	0	165	14	0
Lane Group Flow (vph)	90	633	457	138	396	0
Heavy Vehicles (%)	0%	2%	4%	2%	1%	0%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	20.4	20.4	20.4	20.4	15.5	
Effective Green, g (s)	20.4	20.4	20.4	20.4	15.5	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.35	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	350	846	830	647	608	
v/s Ratio Prot		c0.34	0.25		c0.22	
v/s Ratio Perm	0.12			0.10		
v/c Ratio	0.26	0.75	0.55	0.21	0.65	
Uniform Delay, d1	7.6	10.1	8.9	7.4	12.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	3.5	0.6	0.1	2.2	
Delay (s)	7.9	13.6	9.6	7.5	14.6	
Level of Service	A	B	A	A	B	
Approach Delay (s)		12.9	8.7		14.6	
Approach LOS		B	A		B	

Intersection Summary			
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	44.9	Sum of lost time (s)	9.0
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		

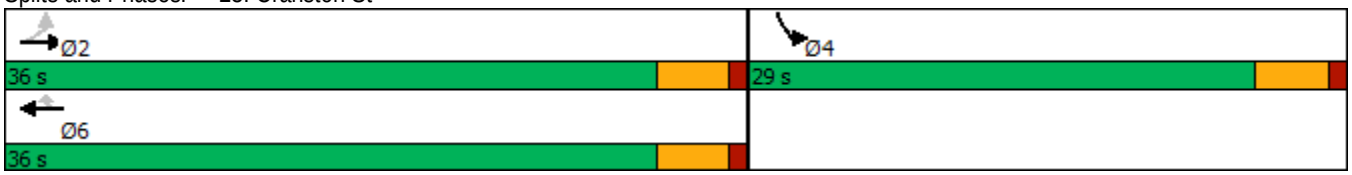
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	85	595	430	285	310
Future Volume (vph)	85	595	430	285	310
Lane Group Flow (vph)	90	633	457	303	410
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	36.0	36.0	36.0	36.0	29.0
Total Split (%)	55.4%	55.4%	55.4%	55.4%	44.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.26	0.76	0.56	0.38	0.67
Control Delay	11.2	18.2	13.0	2.9	19.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	11.2	18.2	13.0	2.9	19.4
Queue Length 50th (ft)	13	120	76	0	79
Queue Length 95th (ft)	46	297	192	35	204
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	562	1359	1333	1121	1044
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.47	0.34	0.27	0.39

Intersection Summary

Cycle Length: 65
Actuated Cycle Length: 45.7
Natural Cycle: 55
Control Type: Actuated-Uncoordinated

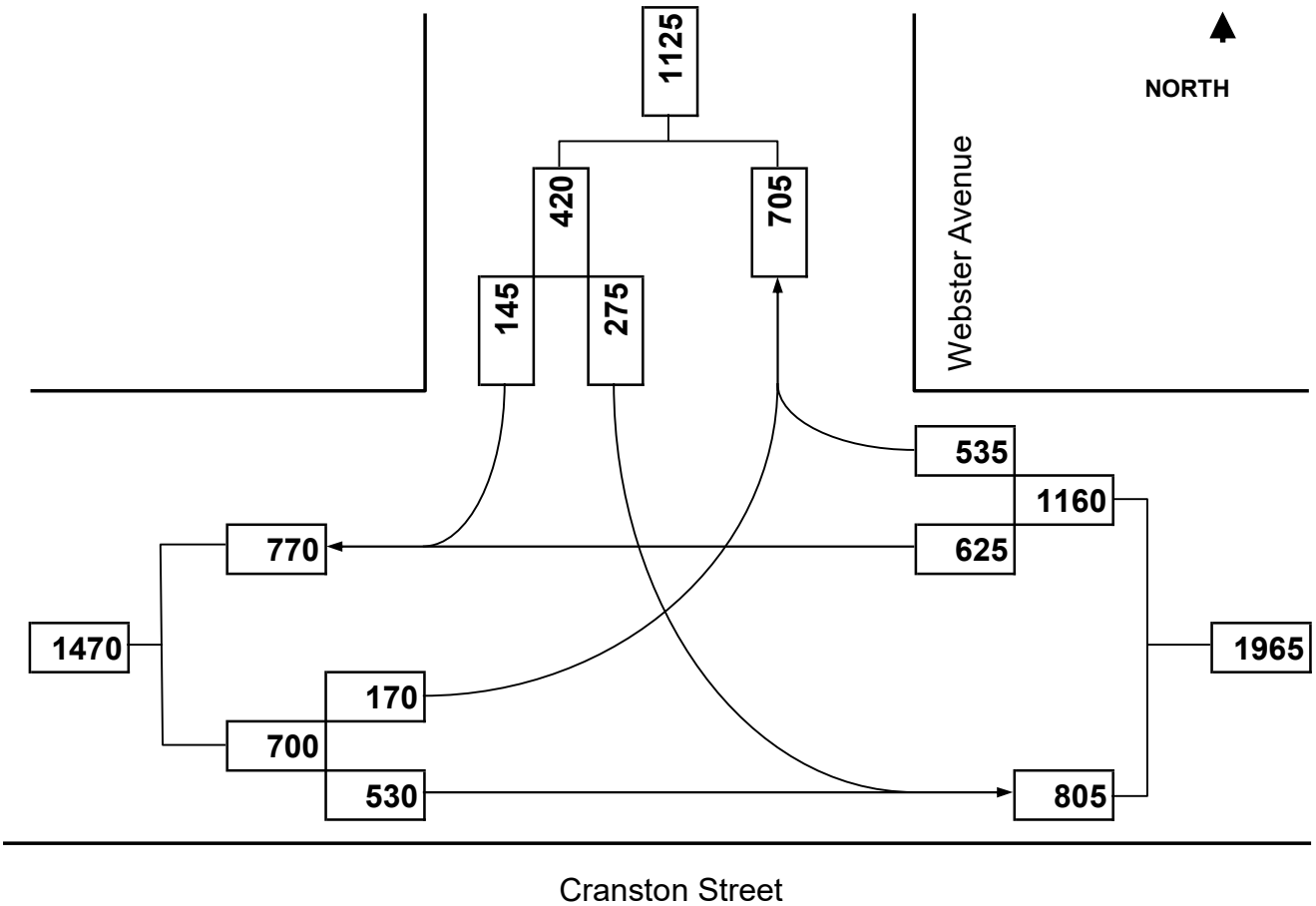
Splits and Phases: 23: Cranston St

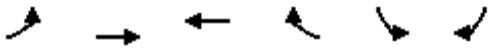


www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 No Build





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	170	530	625	535	275	145
Future Volume (vph)	170	530	625	535	275	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.95	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1787	1881	1881	1599	1737	
Flt Permitted	0.26	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	485	1881	1881	1599	1737	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	173	541	638	546	281	148
RTOR Reduction (vph)	0	0	0	280	26	0
Lane Group Flow (vph)	173	541	638	266	403	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	23.8	23.8	23.8	23.8	16.1	
Effective Green, g (s)	23.8	23.8	23.8	23.8	16.1	
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.33	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	236	915	915	778	571	
v/s Ratio Prot		0.29	0.34		c0.23	
v/s Ratio Perm	c0.36			0.17		
v/c Ratio	0.73	0.59	0.70	0.34	0.71	
Uniform Delay, d1	10.0	9.0	9.8	7.7	14.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.6	0.9	2.2	0.2	3.7	
Delay (s)	20.6	9.9	11.9	7.9	18.0	
Level of Service	C	A	B	A	B	
Approach Delay (s)		12.5	10.1		18.0	
Approach LOS		B	B		B	

Intersection Summary			
HCM 2000 Control Delay	12.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	48.9	Sum of lost time (s)	9.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	170	530	625	535	275
Future Volume (vph)	170	530	625	535	275
Lane Group Flow (vph)	173	541	638	546	429
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	44.0	44.0	44.0	44.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	62.9%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.75	0.60	0.71	0.52	0.73
Control Delay	33.4	12.8	15.3	2.8	24.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	33.4	12.8	15.3	2.8	24.2
Queue Length 50th (ft)	36	102	130	0	94
Queue Length 95th (ft)	#145	205	260	38	#287
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	391	1519	1519	1396	837
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.44	0.36	0.42	0.39	0.51

Intersection Summary

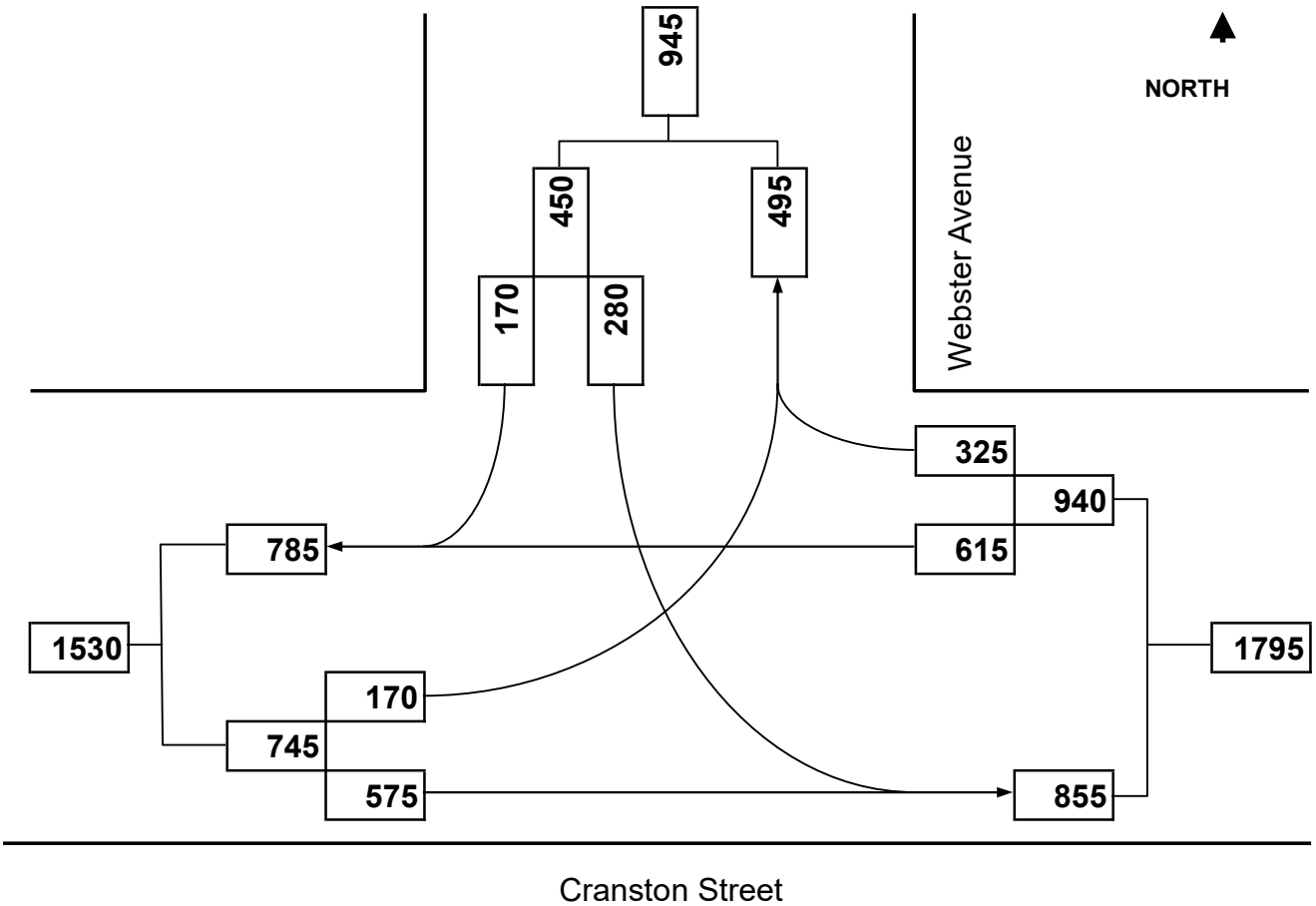
Cycle Length: 70
Actuated Cycle Length: 49.6
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

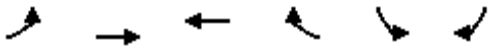
Splits and Phases: 23: Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 No Build





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	170	575	615	325	280	170
Future Volume (vph)	170	575	615	325	280	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.95	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1787	1881	1881	1439	1731	
Flt Permitted	0.24	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	458	1881	1881	1439	1731	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	177	599	641	339	292	177
RTOR Reduction (vph)	0	0	0	178	29	0
Lane Group Flow (vph)	177	599	641	161	440	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	23.8	23.8	23.8	23.8	17.3	
Effective Green, g (s)	23.8	23.8	23.8	23.8	17.3	
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.35	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	217	893	893	683	597	
v/s Ratio Prot		0.32	0.34		c0.25	
v/s Ratio Perm	c0.39			0.11		
v/c Ratio	0.82	0.67	0.72	0.24	0.74	
Uniform Delay, d1	11.3	10.1	10.5	7.8	14.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	20.0	1.8	2.6	0.1	4.4	
Delay (s)	31.3	11.9	13.1	7.9	18.8	
Level of Service	C	B	B	A	B	
Approach Delay (s)		16.4	11.3		18.8	
Approach LOS		B	B		B	

Intersection Summary			
HCM 2000 Control Delay	14.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	50.1	Sum of lost time (s)	9.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	170	575	615	325	280
Future Volume (vph)	170	575	615	325	280
Lane Group Flow (vph)	177	599	641	339	469
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	44.0	44.0	44.0	44.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	62.9%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.82	0.68	0.73	0.40	0.76
Control Delay	44.8	15.0	16.4	2.6	25.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	44.8	15.0	16.4	2.6	25.5
Queue Length 50th (ft)	43	130	144	0	103
Queue Length 95th (ft)	#157	237	262	31	#327
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	362	1485	1485	1207	816
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.49	0.40	0.43	0.28	0.57

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 50.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 23: Cranston St

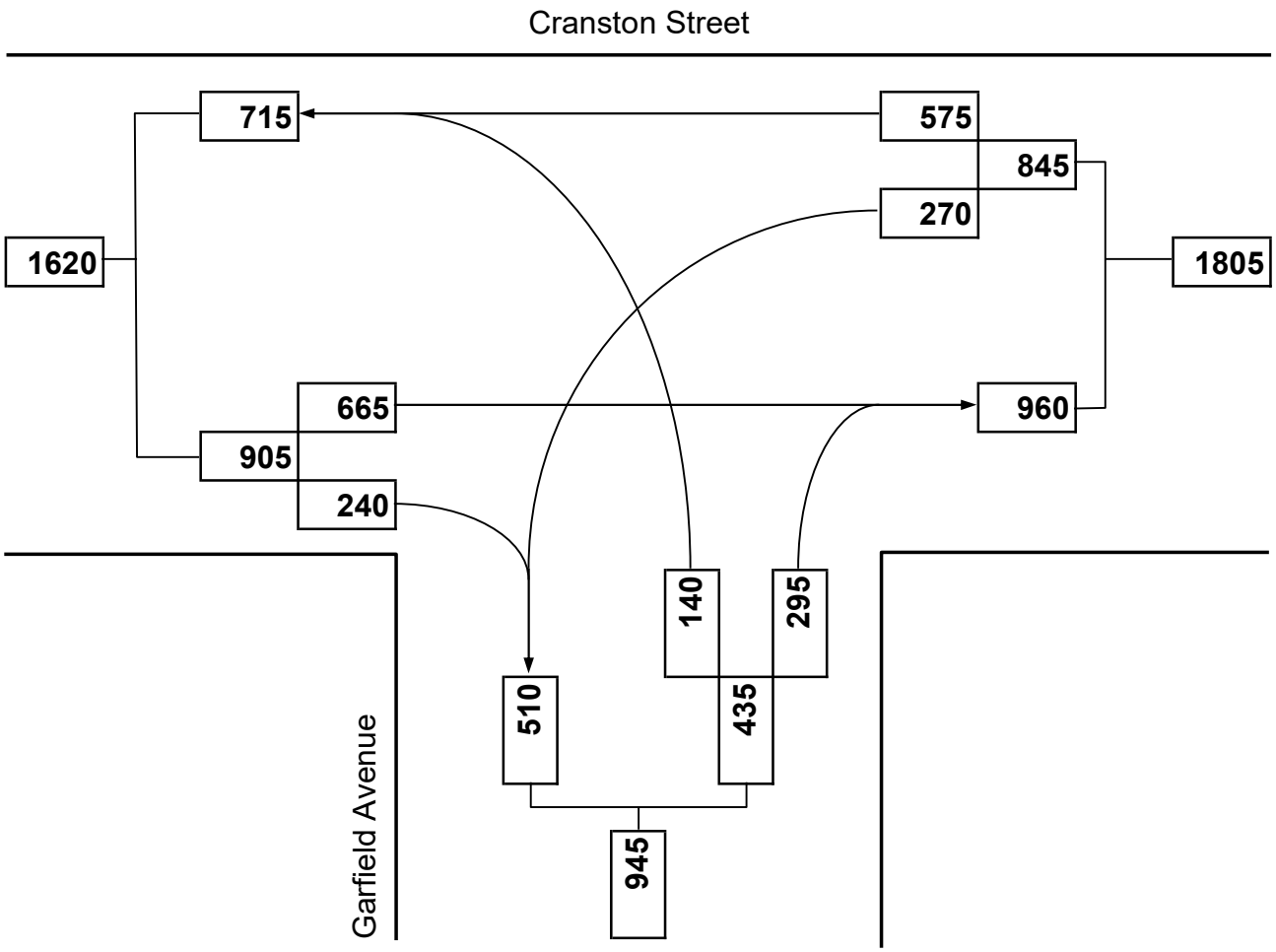
Cranston Street at Garfield Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 No Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	665	240	270	575	140	295
Future Volume (vph)	665	240	270	575	140	295
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		5.0	5.0	4.5	4.5
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3423		1719	3471	1770	1553
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3423		1719	3471	1770	1553
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	686	247	278	593	144	304
RTOR Reduction (vph)	47	0	0	0	0	263
Lane Group Flow (vph)	886	0	278	593	144	41
Heavy Vehicles (%)	1%	2%	5%	4%	2%	4%
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Actuated Green, G (s)	40.5		23.4	68.9	12.1	12.1
Effective Green, g (s)	40.5		23.4	68.9	12.1	12.1
Actuated g/C Ratio	0.45		0.26	0.77	0.13	0.13
Clearance Time (s)	4.5		5.0		4.5	4.5
Vehicle Extension (s)	2.5		2.5		2.5	2.5
Lane Grp Cap (vph)	1540		446	2657	237	208
v/s Ratio Prot	c0.26		c0.16	0.17	c0.08	
v/s Ratio Perm						0.03
v/c Ratio	0.58		0.62	0.22	0.61	0.20
Uniform Delay, d1	18.4		29.4	3.0	36.7	34.6
Progression Factor	1.00		1.23	1.54	1.00	1.00
Incremental Delay, d2	1.6		2.0	0.0	3.7	0.3
Delay (s)	19.9		38.2	4.6	40.4	35.0
Level of Service	B		D	A	D	C
Approach Delay (s)	19.9			15.3	36.7	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	21.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Traffic Volume (vph)	665	270	575	140	295
Future Volume (vph)	665	270	575	140	295
Lane Group Flow (vph)	933	278	593	144	304
Turn Type	NA	Prot	NA	Prot	Perm
Protected Phases	2	1	1 2	3	
Permitted Phases					3
Detector Phase	2	1	1 2	3	3
Switch Phase					
Minimum Initial (s)	10.0	10.0		4.0	4.0
Minimum Split (s)	14.5	15.0		8.5	8.5
Total Split (s)	52.0	18.0		20.0	20.0
Total Split (%)	57.8%	20.0%		22.2%	22.2%
Yellow Time (s)	3.5	3.0		3.5	3.5
All-Red Time (s)	1.0	2.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	5.0		4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Min	Min		Min	Min
v/c Ratio	0.59	0.62	0.22	0.61	0.65
Control Delay	18.6	43.8	5.5	47.0	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.3
Total Delay	18.7	43.8	5.5	47.0	11.3
Queue Length 50th (ft)	184	165	71	78	0
Queue Length 95th (ft)	240	m#280	107	131	69
Internal Link Dist (ft)	225		437	499	
Turn Bay Length (ft)		300			
Base Capacity (vph)	1846	446	2906	309	523
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	47	0	0	0	26
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.52	0.62	0.20	0.47	0.61

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
Natural Cycle: 55
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

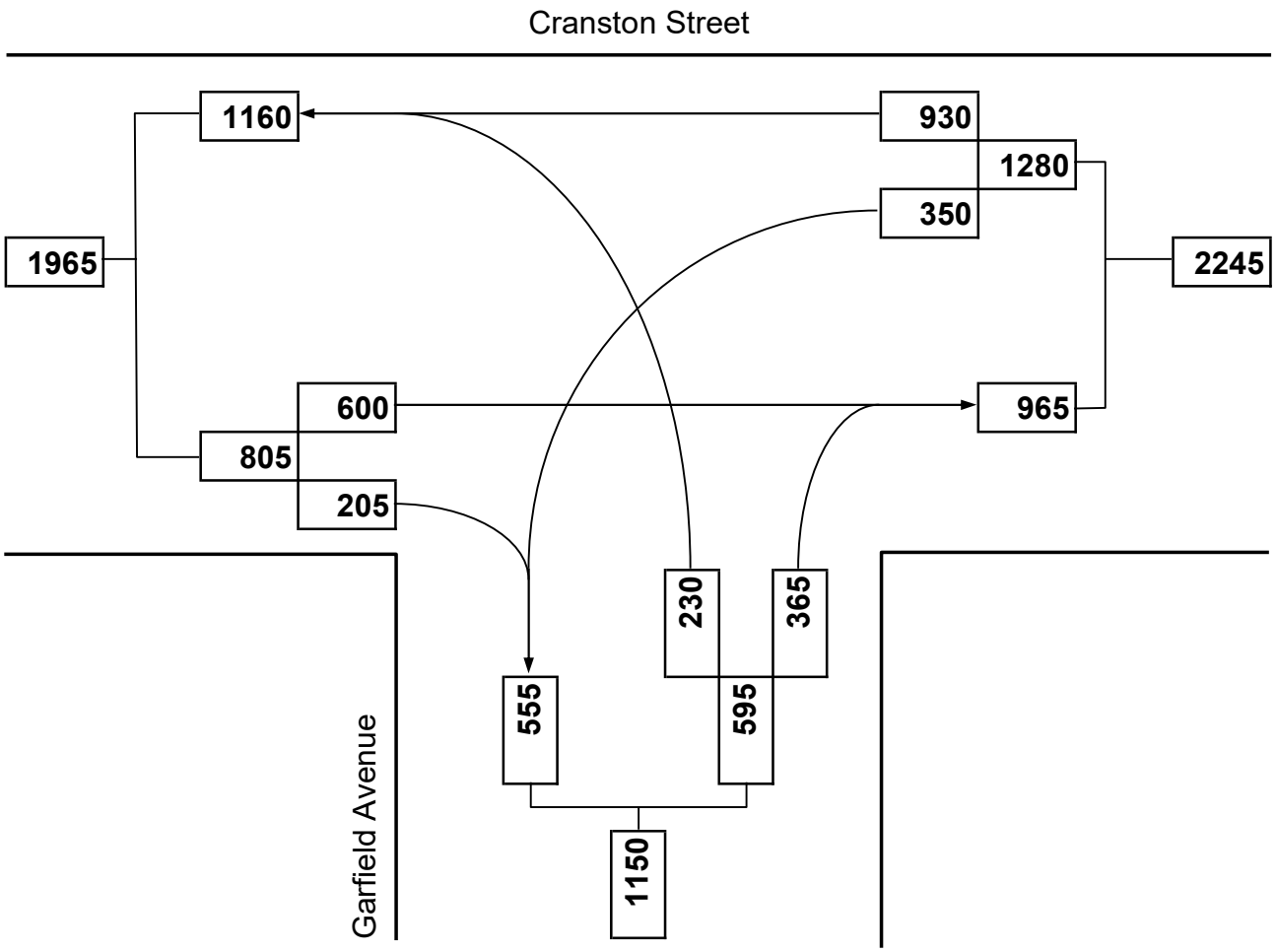
Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 No Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	600	205	350	930	230	365
Future Volume (vph)	600	205	350	930	230	365
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		5.0	5.0	4.5	4.5
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3446		1770	3574	1787	1583
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3446		1770	3574	1787	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	632	216	368	979	242	384
RTOR Reduction (vph)	39	0	0	0	0	313
Lane Group Flow (vph)	809	0	368	979	242	71
Heavy Vehicles (%)	1%	0%	2%	1%	1%	2%
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Actuated Green, G (s)	31.1		20.2	56.3	14.7	14.7
Effective Green, g (s)	31.1		20.2	56.3	14.7	14.7
Actuated g/C Ratio	0.39		0.25	0.70	0.18	0.18
Clearance Time (s)	4.5		5.0		4.5	4.5
Vehicle Extension (s)	2.5		2.5		2.5	2.5
Lane Grp Cap (vph)	1339		446	2515	328	290
v/s Ratio Prot	c0.23		c0.21	0.27	c0.14	
v/s Ratio Perm						0.04
v/c Ratio	0.60		0.83	0.39	0.74	0.24
Uniform Delay, d1	19.5		28.2	4.8	30.8	27.9
Progression Factor	1.00		1.03	1.15	1.00	1.00
Incremental Delay, d2	2.0		9.0	0.1	7.9	0.3
Delay (s)	21.6		38.1	5.6	38.8	28.2
Level of Service	C		D	A	D	C
Approach Delay (s)	21.6			14.5	32.3	
Approach LOS	C			B	C	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Traffic Volume (vph)	600	350	930	230	365
Future Volume (vph)	600	350	930	230	365
Lane Group Flow (vph)	848	368	979	242	384
Turn Type	NA	Prot	NA	Prot	Perm
Protected Phases	2	1	1 2	3	
Permitted Phases					3
Detector Phase	2	1	1 2	3	3
Switch Phase					
Minimum Initial (s)	10.0	10.0		4.0	4.0
Minimum Split (s)	14.5	15.0		8.5	8.5
Total Split (s)	32.0	26.0		22.0	22.0
Total Split (%)	40.0%	32.5%		27.5%	27.5%
Yellow Time (s)	3.5	3.0		3.5	3.5
All-Red Time (s)	1.0	2.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	5.0		4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Min	None		None	None
v/c Ratio	0.62	0.82	0.39	0.74	0.64
Control Delay	21.4	42.3	6.7	44.6	8.5
Queue Delay	0.0	0.0	0.0	0.0	0.1
Total Delay	21.4	42.3	6.7	44.6	8.6
Queue Length 50th (ft)	175	203	158	114	0
Queue Length 95th (ft)	240	m#265	m176	185	69
Internal Link Dist (ft)	225		437	499	
Turn Bay Length (ft)		300			
Base Capacity (vph)	1378	473	2453	390	646
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	15
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.62	0.78	0.40	0.62	0.61

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

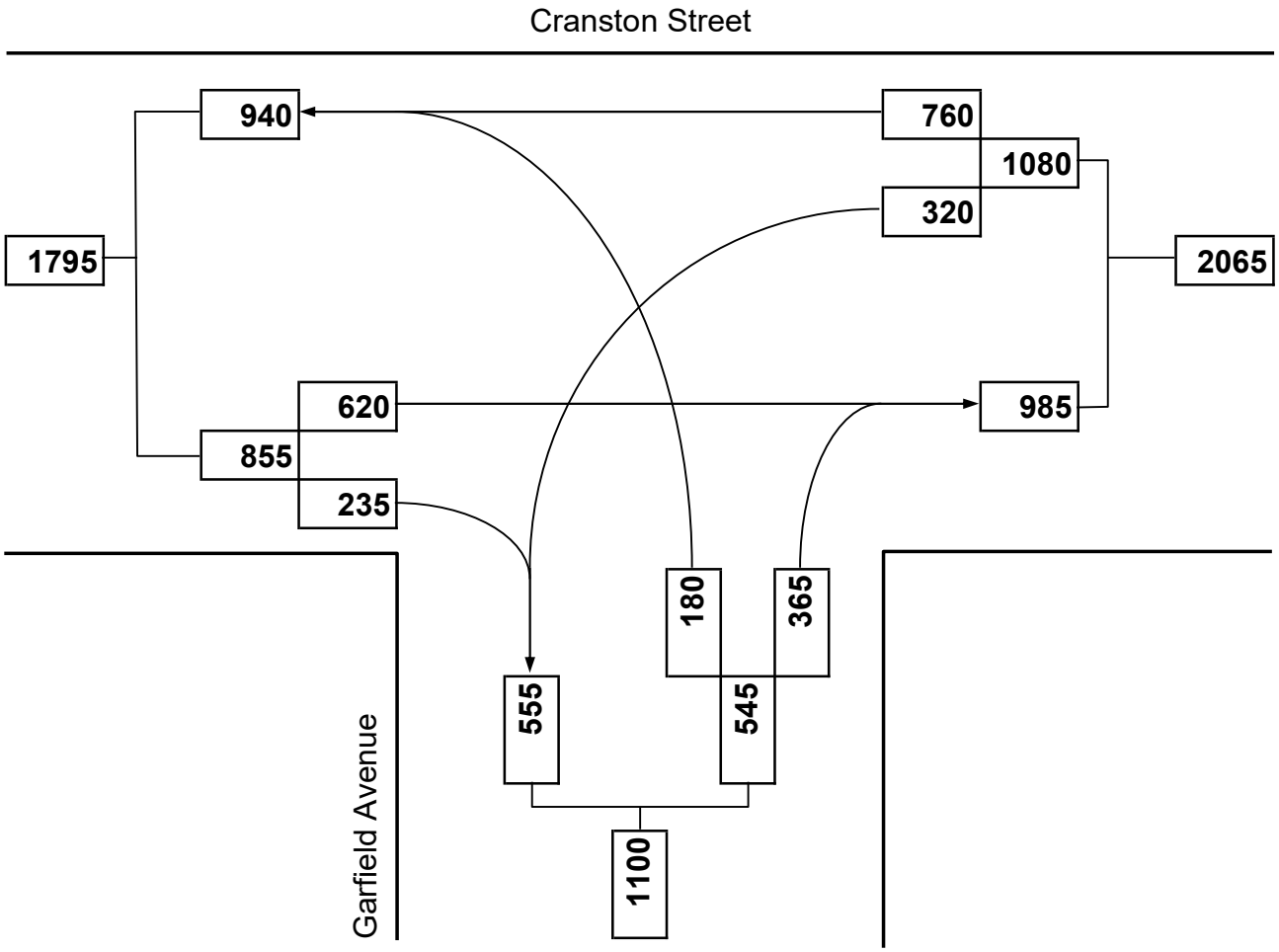
Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 No Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	620	235	320	760	180	365
Future Volume (vph)	620	235	320	760	180	365
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		5.0	5.0	4.5	4.5
Lane Util. Factor	0.95		1.00	0.95	1.00	1.00
Frt	0.96		1.00	1.00	1.00	0.85
Flt Protected	1.00		0.95	1.00	0.95	1.00
Satd. Flow (prot)	3427		1787	3574	1787	1599
Flt Permitted	1.00		0.95	1.00	0.95	1.00
Satd. Flow (perm)	3427		1787	3574	1787	1599
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	626	237	323	768	182	369
RTOR Reduction (vph)	56	0	0	0	0	312
Lane Group Flow (vph)	807	0	323	768	182	57
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Actuated Green, G (s)	35.7		26.3	67.0	14.0	14.0
Effective Green, g (s)	35.7		26.3	67.0	14.0	14.0
Actuated g/C Ratio	0.40		0.29	0.74	0.16	0.16
Clearance Time (s)	4.5		5.0		4.5	4.5
Vehicle Extension (s)	2.5		2.5		2.5	2.5
Lane Grp Cap (vph)	1359		522	2660	277	248
v/s Ratio Prot	c0.24		c0.18	0.21	c0.10	
v/s Ratio Perm						0.04
v/c Ratio	0.59		0.62	0.29	0.66	0.23
Uniform Delay, d1	21.4		27.5	3.7	35.7	33.3
Progression Factor	1.00		1.20	1.48	1.00	1.00
Incremental Delay, d2	1.9		1.5	0.0	4.9	0.3
Delay (s)	23.3		34.4	5.6	40.7	33.6
Level of Service	C		C	A	D	C
Approach Delay (s)	23.3			14.1	36.0	
Approach LOS	C			B	D	

Intersection Summary			
HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBL	WBT	NBL	NBR
Lane Configurations					
Traffic Volume (vph)	620	320	760	180	365
Future Volume (vph)	620	320	760	180	365
Lane Group Flow (vph)	863	323	768	182	369
Turn Type	NA	Prot	NA	Prot	Perm
Protected Phases	2	1	1 2	3	
Permitted Phases					3
Detector Phase	2	1	1 2	3	3
Switch Phase					
Minimum Initial (s)	10.0	10.0		4.0	4.0
Minimum Split (s)	14.5	15.0		8.5	8.5
Total Split (s)	52.0	18.0		20.0	20.0
Total Split (%)	57.8%	20.0%		22.2%	22.2%
Yellow Time (s)	3.5	3.0		3.5	3.5
All-Red Time (s)	1.0	2.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	5.0		4.5	4.5
Lead/Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes			
Recall Mode	C-Min	Min		Min	Min
v/c Ratio	0.61	0.62	0.29	0.65	0.66
Control Delay	21.0	40.9	6.7	46.4	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.3
Total Delay	21.0	40.9	6.7	46.4	10.1
Queue Length 50th (ft)	182	195	119	99	0
Queue Length 95th (ft)	219	m#346	147	154	71
Internal Link Dist (ft)	225		437	499	
Turn Bay Length (ft)		300			
Base Capacity (vph)	1853	522	3109	327	594
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	73	0	0	0	31
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.48	0.62	0.25	0.56	0.66

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
Natural Cycle: 55
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St

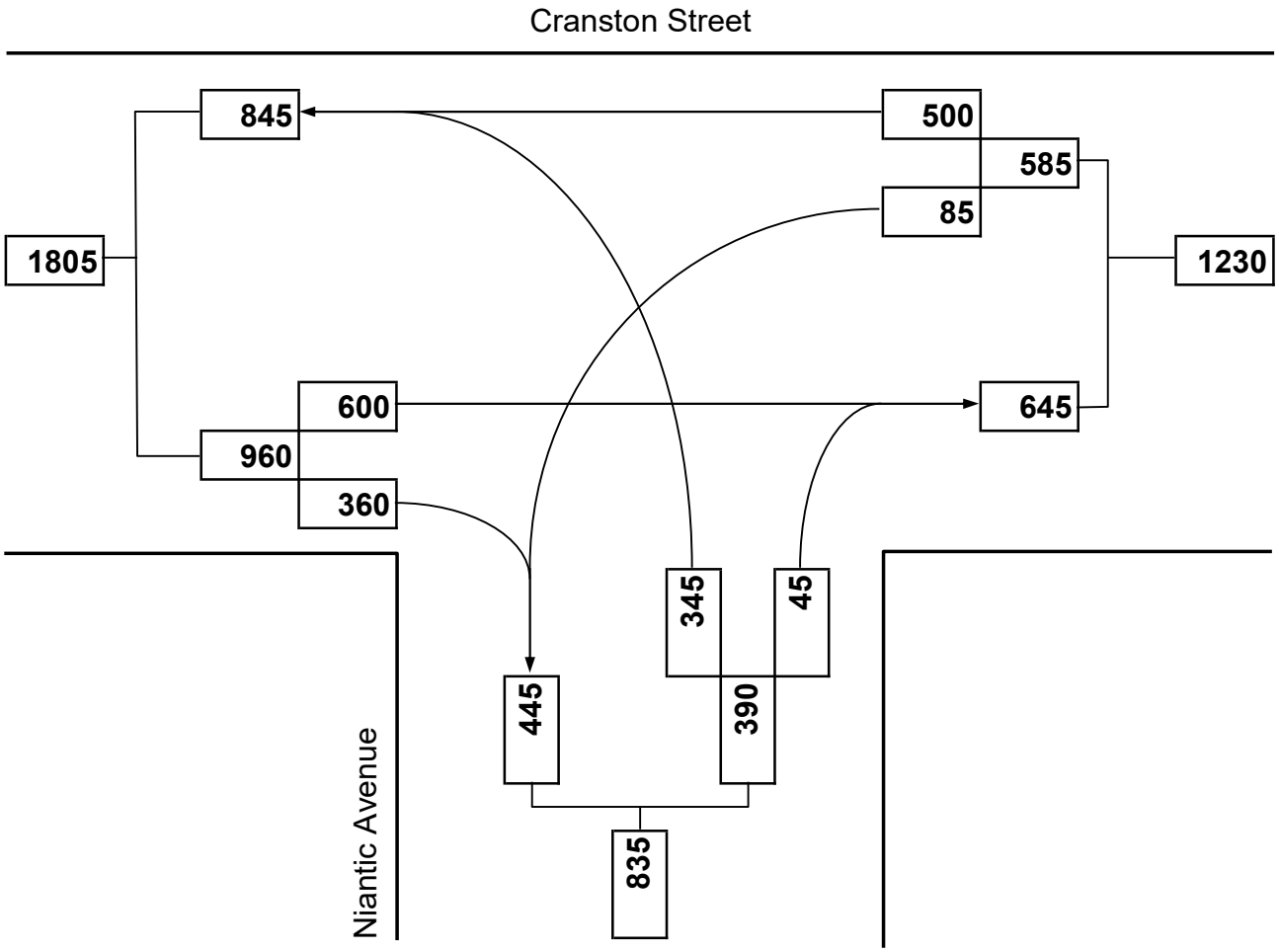
Cranston Street at Niantic Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 No Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	600	360	85	500	345	45
Future Volume (vph)	600	360	85	500	345	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.98	
Flt Protected	1.00	1.00		0.99	0.96	
Satd. Flow (prot)	1863	1583		3480	1730	
Flt Permitted	1.00	1.00		0.72	0.96	
Satd. Flow (perm)	1863	1583		2538	1730	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	638	383	90	532	367	48
RTOR Reduction (vph)	0	151	0	0	6	0
Lane Group Flow (vph)	638	232	0	622	409	0
Heavy Vehicles (%)	2%	2%	3%	3%	4%	0%
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	54.6	54.6		54.6	25.4	
Effective Green, g (s)	54.6	54.6		54.6	25.4	
Actuated g/C Ratio	0.61	0.61		0.61	0.28	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	1130	960		1539	488	
v/s Ratio Prot	c0.34				c0.24	
v/s Ratio Perm		0.15		0.25		
v/c Ratio	0.56	0.24		0.40	0.84	
Uniform Delay, d1	10.6	8.2		9.2	30.4	
Progression Factor	0.95	2.39		1.34	1.00	
Incremental Delay, d2	1.8	0.5		0.5	11.8	
Delay (s)	11.8	20.0		12.8	42.2	
Level of Service	B	C		B	D	
Approach Delay (s)	14.9			12.8	42.2	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	19.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	82.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	600	360	85	500	345
Future Volume (vph)	600	360	85	500	345
Lane Group Flow (vph)	638	383	0	622	415
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	54.0	54.0	54.0	54.0	36.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	None
v/c Ratio	0.56	0.34		0.40	0.84
Control Delay	13.2	3.6		14.2	45.1
Queue Delay	1.0	0.0		1.6	0.0
Total Delay	14.3	3.6		15.8	45.1
Queue Length 50th (ft)	291	13		130	215
Queue Length 95th (ft)	443	152		m145	303
Internal Link Dist (ft)	437			193	468
Turn Bay Length (ft)					
Base Capacity (vph)	1130	1111		1540	601
Starvation Cap Reductn	254	0		704	0
Spillback Cap Reductn	118	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.73	0.34		0.74	0.69

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated
m Volume for 95th percentile queue is metered by upstream signal.

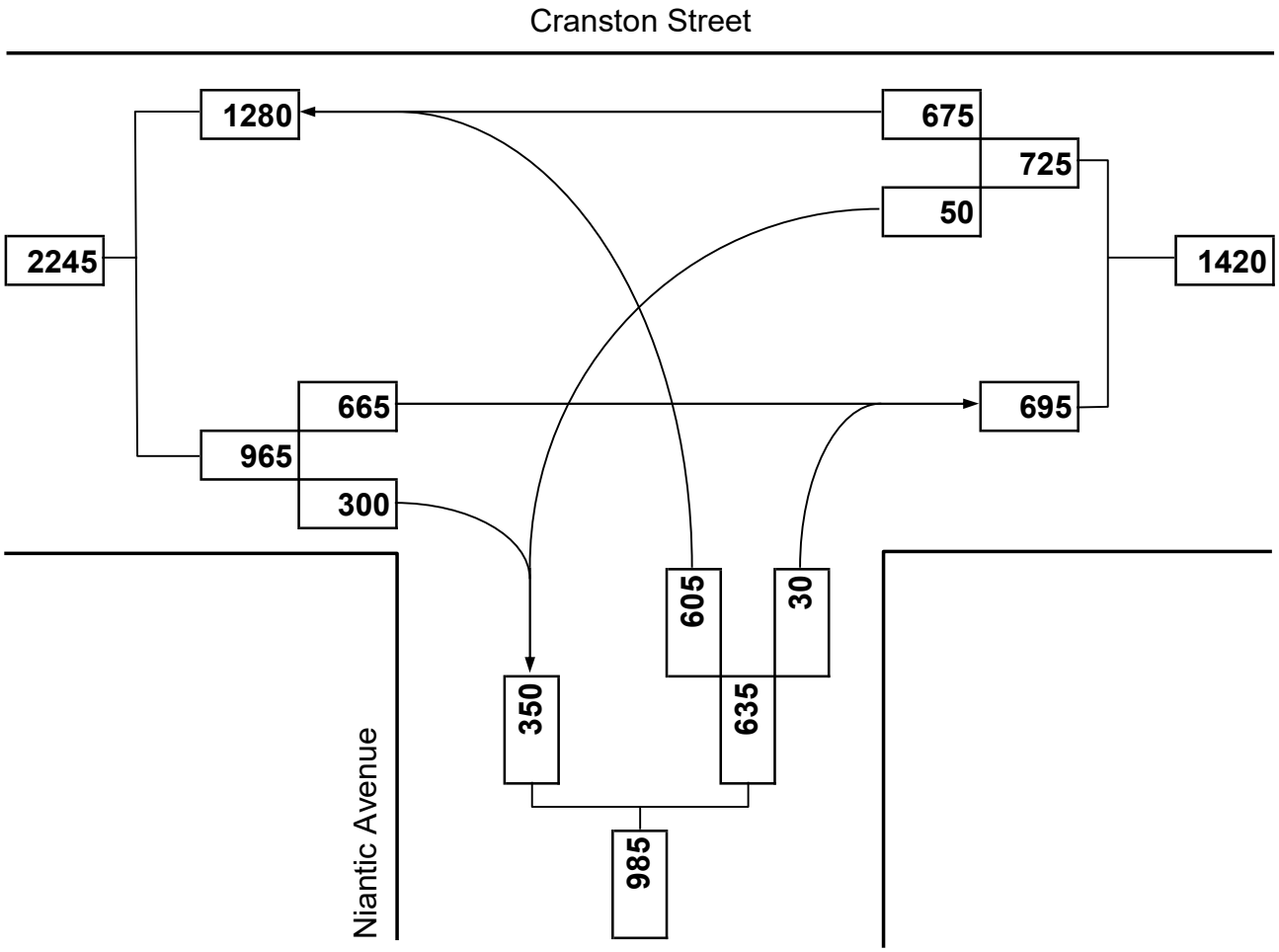
Splits and Phases: 18: Niantic Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 No Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	665	300	50	675	605	30
Future Volume (vph)	665	300	50	675	605	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		1.00	0.95	
Satd. Flow (prot)	1881	1439		3559	1785	
Flt Permitted	1.00	1.00		0.76	0.95	
Satd. Flow (perm)	1881	1439		2704	1785	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	672	303	51	682	611	30
RTOR Reduction (vph)	0	159	0	0	2	0
Lane Group Flow (vph)	672	144	0	733	639	0
Heavy Vehicles (%)	1%	1%	2%	1%	1%	0%
Parking (#/hr)		0				
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	38.1	38.1		38.1	31.9	
Effective Green, g (s)	38.1	38.1		38.1	31.9	
Actuated g/C Ratio	0.48	0.48		0.48	0.40	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	895	685		1287	711	
v/s Ratio Prot	c0.36				c0.36	
v/s Ratio Perm		0.10		0.27		
v/c Ratio	0.75	0.21		0.57	0.90	
Uniform Delay, d1	17.1	12.2		15.1	22.5	
Progression Factor	0.95	1.71		1.89	1.00	
Incremental Delay, d2	4.6	0.6		1.0	14.1	
Delay (s)	20.8	21.4		29.4	36.7	
Level of Service	C	C		C	D	
Approach Delay (s)	21.0			29.4	36.7	
Approach LOS	C			C	D	

Intersection Summary			
HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	100.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	665	300	50	675	605
Future Volume (vph)	665	300	50	675	605
Lane Group Flow (vph)	672	303	0	733	641
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	51.0	51.0	51.0	51.0	29.0
Total Split (%)	63.8%	63.8%	63.8%	63.8%	36.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	Min
v/c Ratio	0.75	0.36		0.57	0.90
Control Delay	20.1	3.0		28.1	43.7
Queue Delay	0.7	0.0		4.4	0.0
Total Delay	20.9	3.0		32.5	43.7
Queue Length 50th (ft)	334	13		212	301
Queue Length 95th (ft)	384	18		m209	#597
Internal Link Dist (ft)	437			193	468
Turn Bay Length (ft)					
Base Capacity (vph)	1081	956		1554	714
Starvation Cap Reductn	109	0		728	0
Spillback Cap Reductn	155	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.73	0.32		0.89	0.90

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 22 (28%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

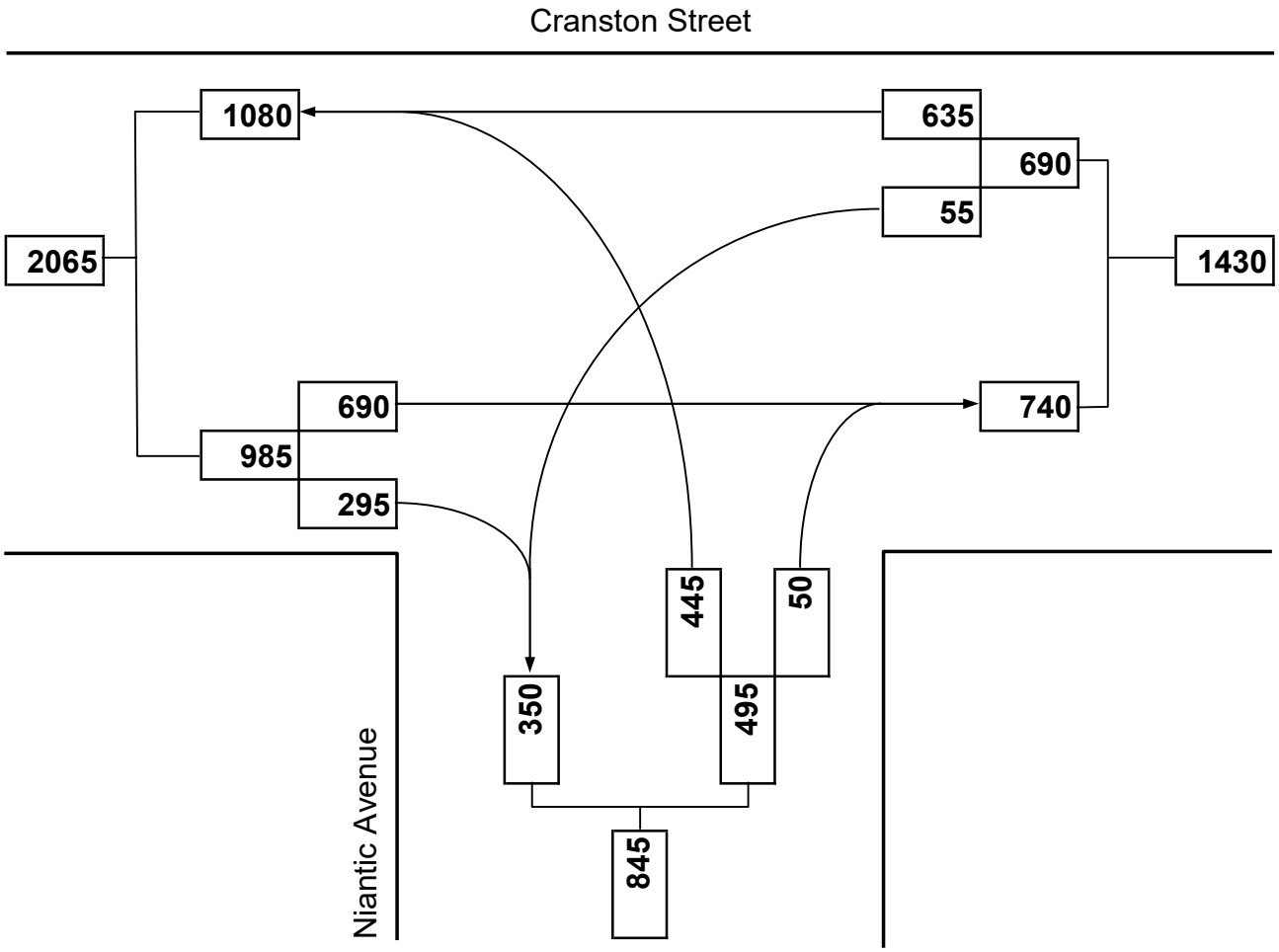
Splits and Phases: 18: Niantic Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 No Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	690	295	55	635	445	50
Future Volume (vph)	690	295	55	635	445	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		1.00	0.96	
Satd. Flow (prot)	1881	1599		3560	1776	
Flt Permitted	1.00	1.00		0.79	0.96	
Satd. Flow (perm)	1881	1599		2822	1776	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	697	298	56	641	449	51
RTOR Reduction (vph)	0	128	0	0	5	0
Lane Group Flow (vph)	697	170	0	697	495	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	51.4	51.4		51.4	28.6	
Effective Green, g (s)	51.4	51.4		51.4	28.6	
Actuated g/C Ratio	0.57	0.57		0.57	0.32	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	1074	913		1611	564	
v/s Ratio Prot	c0.37				c0.28	
v/s Ratio Perm		0.11		0.25		
v/c Ratio	0.65	0.19		0.43	0.88	
Uniform Delay, d1	13.2	9.3		11.0	29.0	
Progression Factor	1.09	2.81		1.72	1.00	
Incremental Delay, d2	2.6	0.4		0.1	14.3	
Delay (s)	16.9	26.4		19.0	43.4	
Level of Service	B	C		B	D	
Approach Delay (s)	19.8			19.0	43.4	
Approach LOS	B			B	D	

Intersection Summary			
HCM 2000 Control Delay	24.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	690	295	55	635	445
Future Volume (vph)	690	295	55	635	445
Lane Group Flow (vph)	697	298	0	697	500
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	54.0	54.0	54.0	54.0	36.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	None
v/c Ratio	0.65	0.29		0.43	0.88
Control Delay	18.5	4.5		20.4	46.5
Queue Delay	1.7	0.0		4.7	0.0
Total Delay	20.1	4.5		25.1	46.5
Queue Length 50th (ft)	380	45		177	256
Queue Length 95th (ft)	501	108		m159	#419
Internal Link Dist (ft)	437			193	468
Turn Bay Length (ft)					
Base Capacity (vph)	1082	1046		1623	623
Starvation Cap Reductn	219	0		838	0
Spillback Cap Reductn	82	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.81	0.28		0.89	0.80

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

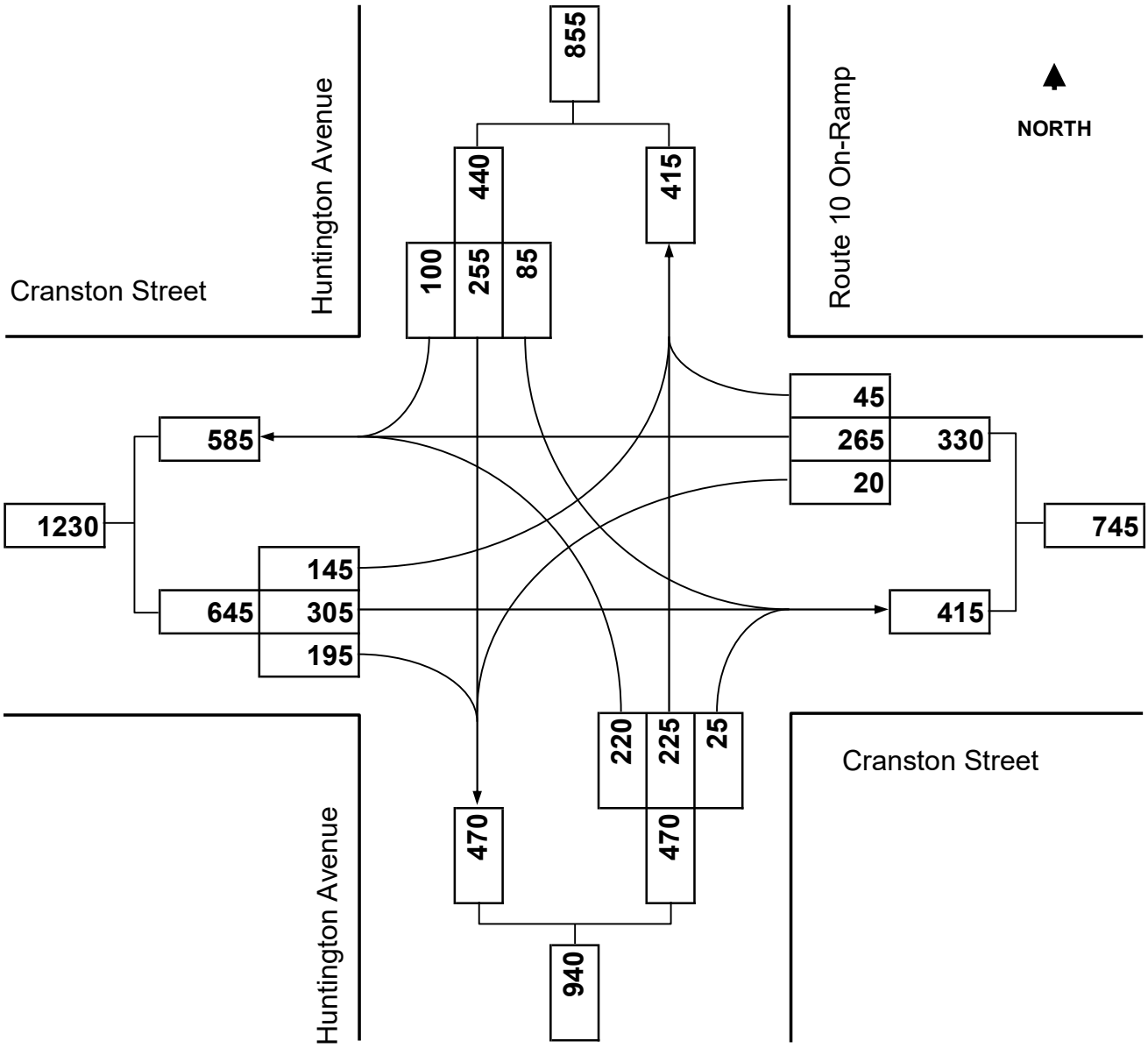
Splits and Phases: 18: Niantic Ave & Cranston St

Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 No Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	145	305	195	20	265	45	85	255	100	220	225	25
Future Volume (vph)	145	305	195	20	265	45	85	255	100	220	225	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.98		1.00	0.96		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1771		1805	1825		1787	3424		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1771		1805	1825		1787	3424		1787	1881	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	151	318	203	21	276	47	89	266	104	229	234	26
RTOR Reduction (vph)	0	16	0	0	5	0	0	51	0	0	0	21
Lane Group Flow (vph)	151	505	0	21	318	0	89	319	0	229	234	5
Heavy Vehicles (%)	1%	1%	1%	0%	2%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	12.5	42.1		2.9	32.5		6.4	17.0		8.0	18.6	18.6
Effective Green, g (s)	12.5	42.1		2.9	32.5		6.4	17.0		8.0	18.6	18.6
Actuated g/C Ratio	0.14	0.47		0.03	0.36		0.07	0.19		0.09	0.21	0.21
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	248	828		58	659		127	646		158	388	330
v/s Ratio Prot	c0.08	c0.28		0.01	0.17		0.05	0.09		c0.13	c0.12	
v/s Ratio Perm												0.00
v/c Ratio	0.61	0.61		0.36	0.48		0.70	0.49		1.45	0.60	0.02
Uniform Delay, d1	36.5	17.8		42.6	22.2		40.9	32.7		41.0	32.4	28.4
Progression Factor	0.84	0.82		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.0	2.8		2.5	2.5		14.6	0.4		234.0	2.3	0.0
Delay (s)	33.6	17.3		45.2	24.8		55.5	33.0		275.0	34.7	28.4
Level of Service	C	B		D	C		E	C		F	C	C
Approach Delay (s)		21.0			26.0			37.4			146.9	
Approach LOS		C			C			D			F	

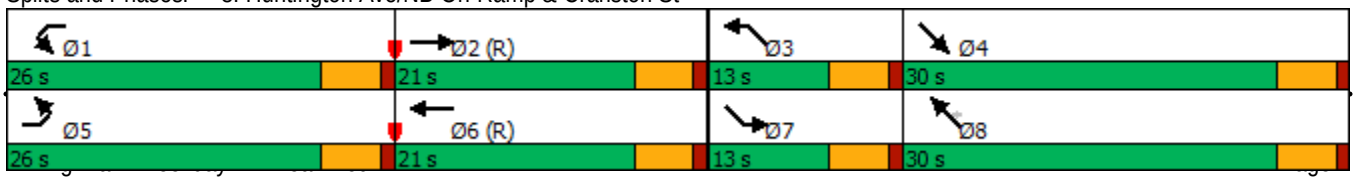
Intersection Summary			
HCM 2000 Control Delay	57.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	145	305	20	265	85	255	220	225	25
Future Volume (vph)	145	305	20	265	85	255	220	225	25
Lane Group Flow (vph)	151	521	21	323	89	370	229	234	26
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	26.0	21.0	26.0	21.0	13.0	30.0	13.0	30.0	30.0
Total Split (%)	28.9%	23.3%	28.9%	23.3%	14.4%	33.3%	14.4%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.61	0.56	0.17	0.47	0.60	0.56	1.45	0.60	0.06
Control Delay	38.9	16.7	42.4	26.3	57.2	30.5	266.8	39.6	0.2
Queue Delay	0.1	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.9	18.6	42.4	26.3	57.2	30.5	266.8	39.6	0.2
Queue Length 50th (ft)	60	281	12	134	49	83	~179	126	0
Queue Length 95th (ft)	m105	#411	34	256	#106	118	#320	188	0
Internal Link Dist (ft)		193		360		327		664	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	416	923	421	683	158	996	158	522	548
Starvation Cap Reductn	15	246	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	0.77	0.05	0.47	0.56	0.37	1.45	0.45	0.05

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

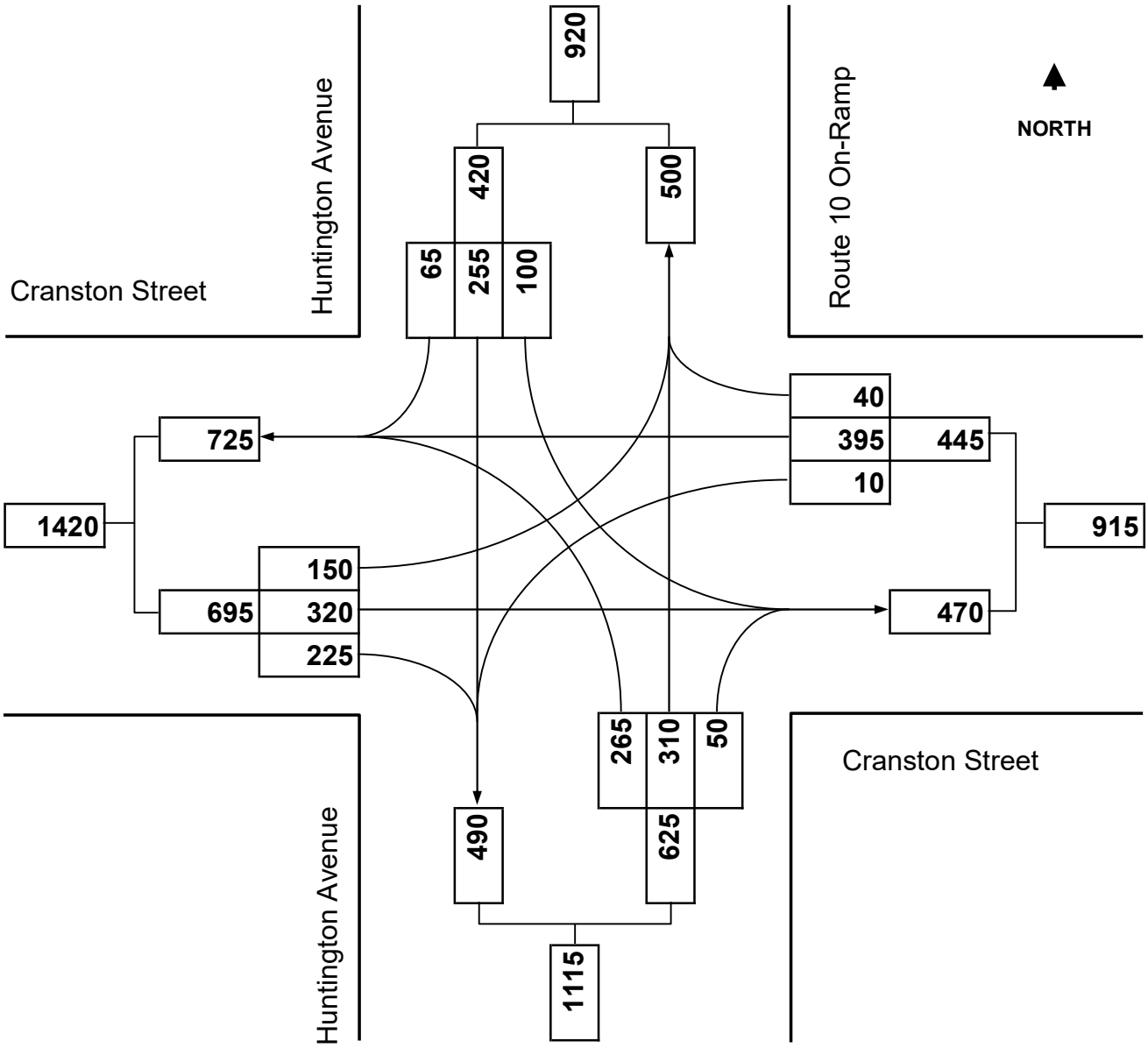
Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 No Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	150	320	225	10	395	40	100	255	65	265	310	50
Future Volume (vph)	150	320	225	10	395	40	100	255	65	265	310	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1765		1787	1855		1787	3465		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1765		1787	1855		1787	3465		1787	1881	1599
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	155	330	232	10	407	41	103	263	67	273	320	52
RTOR Reduction (vph)	0	27	0	0	4	0	0	29	0	0	0	39
Lane Group Flow (vph)	155	535	0	10	444	0	103	301	0	273	320	13
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	9.5	30.3		1.3	22.1		8.2	15.4		13.0	20.2	20.2
Effective Green, g (s)	9.5	30.3		1.3	22.1		8.2	15.4		13.0	20.2	20.2
Actuated g/C Ratio	0.12	0.38		0.02	0.28		0.10	0.19		0.16	0.25	0.25
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	212	668		29	512		183	667		290	474	403
v/s Ratio Prot	c0.09	c0.30		0.01	0.24		0.06	0.09		c0.15	c0.17	
v/s Ratio Perm												0.01
v/c Ratio	0.73	0.80		0.34	0.87		0.56	0.45		0.94	0.68	0.03
Uniform Delay, d1	34.0	22.2		38.9	27.5		34.2	28.6		33.1	26.9	22.5
Progression Factor	0.74	0.56		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	9.3	7.8		4.6	17.6		3.0	0.3		37.3	3.5	0.0
Delay (s)	34.5	20.2		43.6	45.2		37.2	28.9		70.4	30.5	22.6
Level of Service	C	C		D	D		D	C		E	C	C
Approach Delay (s)		23.3			45.2			30.9			46.7	
Approach LOS		C			D			C			D	

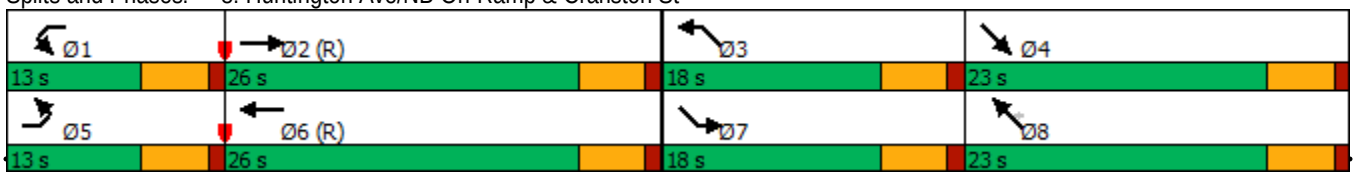
Intersection Summary			
HCM 2000 Control Delay	35.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	150	320	10	395	100	255	265	310	50
Future Volume (vph)	150	320	10	395	100	255	265	310	50
Lane Group Flow (vph)	155	562	10	448	103	330	273	320	52
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	13.0	26.0	13.0	26.0	18.0	23.0	18.0	23.0	23.0
Total Split (%)	16.3%	32.5%	16.3%	32.5%	22.5%	28.8%	22.5%	28.8%	28.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Min	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.73	0.70	0.08	0.83	0.50	0.51	0.94	0.68	0.10
Control Delay	45.7	17.8	36.0	43.2	40.7	28.4	75.8	36.6	0.4
Queue Delay	0.0	4.9	0.0	0.1	0.0	1.6	46.1	0.0	0.0
Total Delay	45.7	22.7	36.0	43.2	40.7	30.0	121.9	36.6	0.4
Queue Length 50th (ft)	49	278	5	214	49	69	136	148	0
Queue Length 95th (ft)	m#161	m#129	20	#390	92	103	#280	#268	0
Internal Link Dist (ft)		193		360		327		664	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	213	802	178	539	290	807	290	483	532
Starvation Cap Reductn	0	174	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	1	0	309	69	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.89	0.06	0.83	0.36	0.66	1.24	0.66	0.10

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 55 (69%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

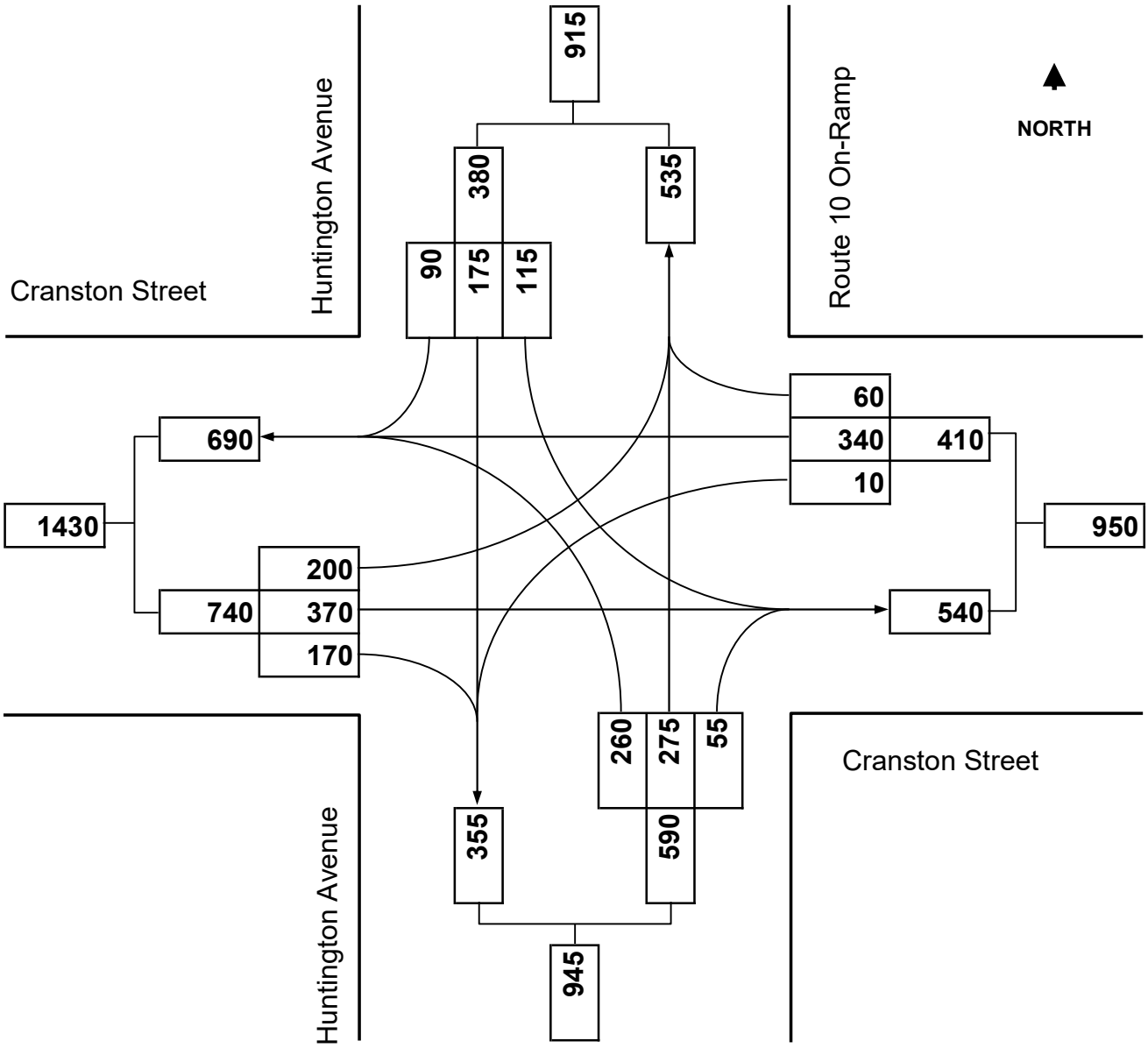
Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 No Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	200	370	170	10	340	60	115	175	90	260	275	55
Future Volume (vph)	200	370	170	10	340	60	115	175	90	260	275	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1792		1805	1839		1787	3392		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1792		1805	1839		1787	3392		1787	1881	1599
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	211	389	179	11	358	63	121	184	95	274	289	58
RTOR Reduction (vph)	0	12	0	0	6	0	0	75	0	0	0	46
Lane Group Flow (vph)	211	556	0	11	415	0	121	204	0	274	289	12
Heavy Vehicles (%)	1%	1%	1%	0%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	15.4	42.2		1.3	28.1		7.9	18.5		8.0	18.6	18.6
Effective Green, g (s)	15.4	42.2		1.3	28.1		7.9	18.5		8.0	18.6	18.6
Actuated g/C Ratio	0.17	0.47		0.01	0.31		0.09	0.21		0.09	0.21	0.21
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	305	840		26	574		156	697		158	388	330
v/s Ratio Prot	c0.12	0.31		0.01	c0.23		0.07	0.06		c0.15	c0.15	
v/s Ratio Perm												0.01
v/c Ratio	0.69	0.66		0.42	0.72		0.78	0.29		1.73	0.74	0.04
Uniform Delay, d1	35.1	18.4		44.0	27.5		40.2	30.2		41.0	33.5	28.5
Progression Factor	0.88	0.55		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.9	3.2		7.1	7.7		20.1	0.2		355.4	7.3	0.0
Delay (s)	35.7	13.3		51.1	35.2		60.3	30.4		396.4	40.7	28.6
Level of Service	D	B		D	D		E	C		F	D	C
Approach Delay (s)		19.4			35.6			39.4			196.5	
Approach LOS		B			D			D			F	

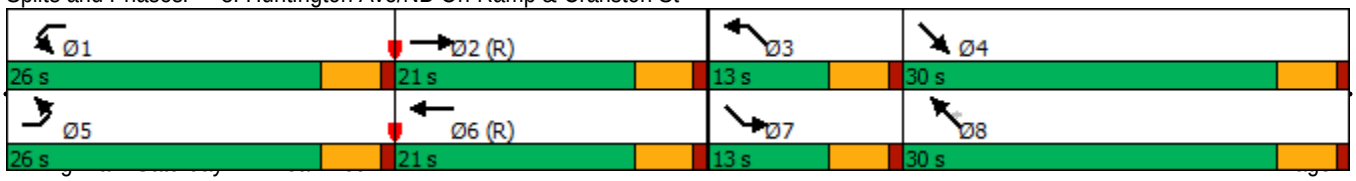
Intersection Summary			
HCM 2000 Control Delay	75.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	200	370	10	340	115	175	260	275	55
Future Volume (vph)	200	370	10	340	115	175	260	275	55
Lane Group Flow (vph)	211	568	11	421	121	279	274	289	58
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	26.0	21.0	26.0	21.0	13.0	30.0	13.0	30.0	30.0
Total Split (%)	28.9%	23.3%	28.9%	23.3%	14.4%	33.3%	14.4%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.69	0.61	0.10	0.73	0.78	0.36	1.73	0.74	0.13
Control Delay	39.7	13.9	41.3	39.4	73.3	20.2	383.8	44.8	0.6
Queue Delay	0.5	1.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	40.2	15.2	41.3	39.4	73.3	20.3	383.8	44.8	0.6
Queue Length 50th (ft)	77	156	6	208	69	46	~233	155	0
Queue Length 95th (ft)	m132	m#481	23	#484	#158	74	#384	221	0
Internal Link Dist (ft)		193		360		327		664	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	416	930	421	580	158	1010	158	522	548
Starvation Cap Reductn	42	181	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	1	0	142	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.76	0.03	0.73	0.77	0.32	1.73	0.55	0.11

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



D

Future 2024 Build Weekday AM / PM / Saturday MD Peak Hour (Preferred Build Alternative)

Cranston Street at Garfield Avenue/Main Site Access Driveway

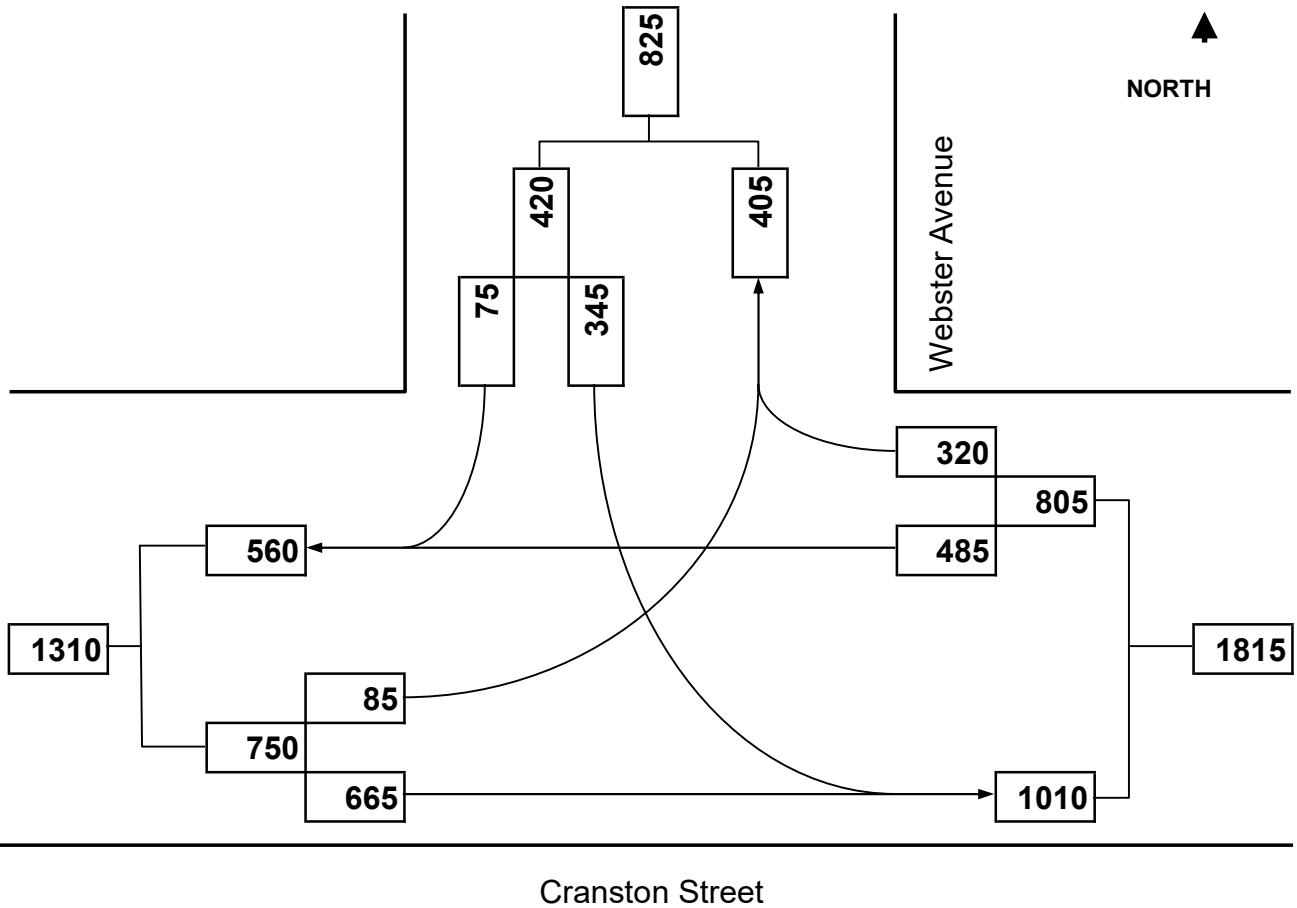
Cranston Street at Niantic Avenue

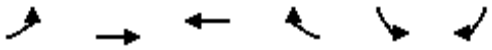
Cranston Street at Webster Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 Build





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	85	665	485	320	345	75
Future Volume (vph)	85	665	485	320	345	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.98	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	1805	1863	1827	1425	1766	
Flt Permitted	0.35	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	669	1863	1827	1425	1766	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	90	707	516	340	367	80
RTOR Reduction (vph)	0	0	0	179	12	0
Lane Group Flow (vph)	90	707	516	161	435	0
Heavy Vehicles (%)	0%	2%	4%	2%	1%	0%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	23.6	23.6	23.6	23.6	17.2	
Effective Green, g (s)	23.6	23.6	23.6	23.6	17.2	
Actuated g/C Ratio	0.47	0.47	0.47	0.47	0.35	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	317	882	865	675	609	
v/s Ratio Prot		c0.38	0.28		c0.25	
v/s Ratio Perm	0.13			0.11		
v/c Ratio	0.28	0.80	0.60	0.24	0.71	
Uniform Delay, d1	8.0	11.1	9.6	7.8	14.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.4	5.1	0.9	0.1	3.7	
Delay (s)	8.3	16.3	10.5	7.9	17.9	
Level of Service	A	B	B	A	B	
Approach Delay (s)		15.4	9.5		17.9	
Approach LOS		B	A		B	

Intersection Summary			
HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	49.8	Sum of lost time (s)	9.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		

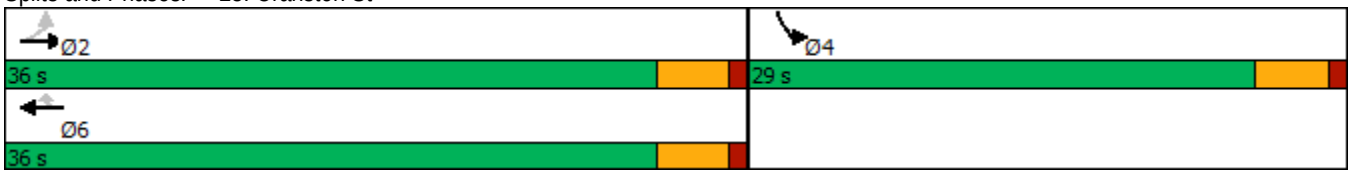
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	85	665	485	320	345
Future Volume (vph)	85	665	485	320	345
Lane Group Flow (vph)	90	707	516	340	447
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	36.0	36.0	36.0	36.0	29.0
Total Split (%)	55.4%	55.4%	55.4%	55.4%	44.6%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.29	0.81	0.60	0.40	0.73
Control Delay	12.3	21.4	14.1	2.9	22.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	12.3	21.4	14.1	2.9	22.9
Queue Length 50th (ft)	15	167	105	0	112
Queue Length 95th (ft)	49	#377	225	37	230
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	448	1249	1225	1067	933
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.20	0.57	0.42	0.32	0.48

Intersection Summary

Cycle Length: 65
Actuated Cycle Length: 50.6
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

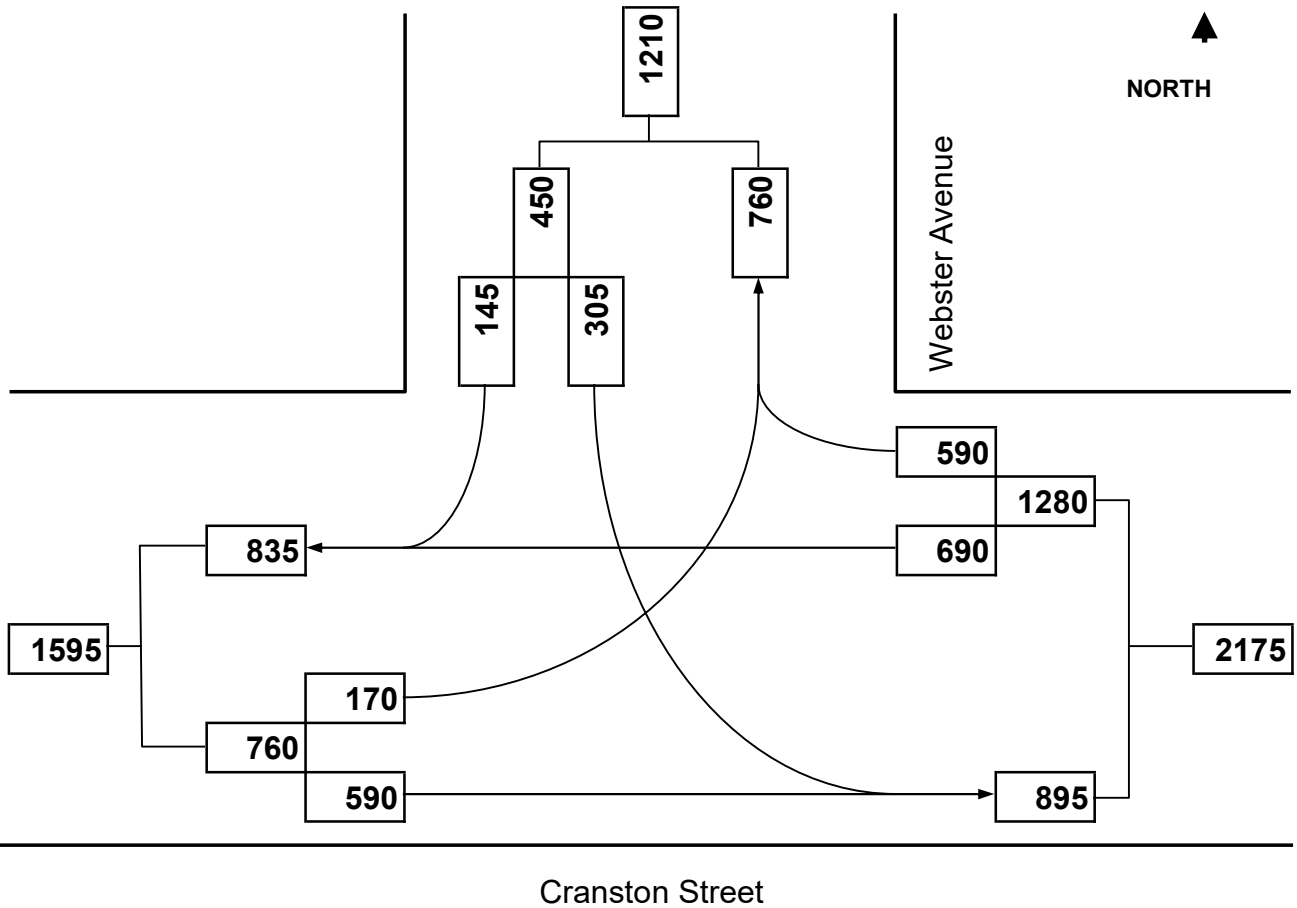
Splits and Phases: 23: Cranston St

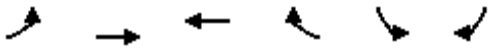


www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 Build





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	170	590	690	590	305	145
Future Volume (vph)	170	590	690	590	305	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.96	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1787	1881	1881	1599	1740	
Flt Permitted	0.22	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	407	1881	1881	1599	1740	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	173	602	704	602	311	148
RTOR Reduction (vph)	0	0	0	295	24	0
Lane Group Flow (vph)	173	602	704	307	435	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	27.6	27.6	27.6	27.6	17.6	
Effective Green, g (s)	27.6	27.6	27.6	27.6	17.6	
Actuated g/C Ratio	0.51	0.51	0.51	0.51	0.32	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	207	957	957	814	565	
v/s Ratio Prot		0.32	0.37		c0.25	
v/s Ratio Perm	c0.43			0.19		
v/c Ratio	0.84	0.63	0.74	0.38	0.77	
Uniform Delay, d1	11.4	9.6	10.4	8.1	16.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.9	1.1	2.8	0.2	6.2	
Delay (s)	35.2	10.7	13.2	8.3	22.7	
Level of Service	D	B	B	A	C	
Approach Delay (s)		16.2	11.0		22.7	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	54.2	Sum of lost time (s)	9.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	170	590	690	590	305
Future Volume (vph)	170	590	690	590	305
Lane Group Flow (vph)	173	602	704	602	459
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	44.0	44.0	44.0	44.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	62.9%	37.1%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.85	0.64	0.74	0.55	0.79
Control Delay	50.4	13.5	16.5	2.8	29.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	50.4	13.5	16.5	2.8	29.8
Queue Length 50th (ft)	47	138	175	0	121
Queue Length 95th (ft)	#166	238	303	39	#322
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	301	1394	1394	1341	754
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.57	0.43	0.51	0.45	0.61

Intersection Summary

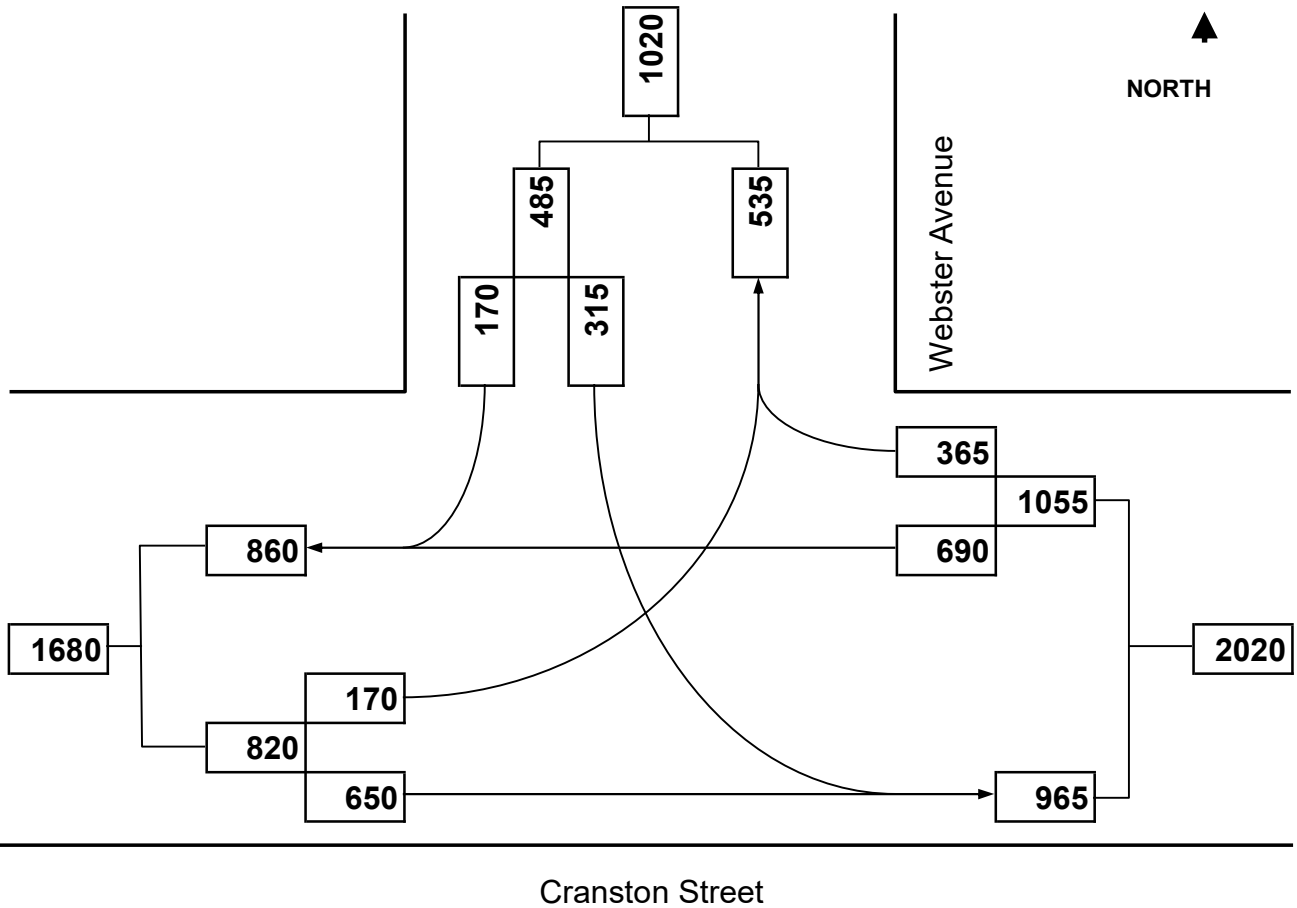
Cycle Length: 70
Actuated Cycle Length: 54.9
Natural Cycle: 55
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

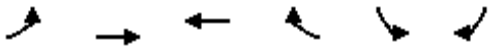
Splits and Phases: 23: Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Webster Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 Build





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	170	650	690	365	315	170
Future Volume (vph)	170	650	690	365	315	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5	4.5	4.5	4.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	1.00	0.85	0.95	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	1787	1881	1881	1439	1736	
Flt Permitted	0.22	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	415	1881	1881	1439	1736	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	177	677	719	380	328	177
RTOR Reduction (vph)	0	0	0	174	30	0
Lane Group Flow (vph)	177	677	719	206	475	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Parking (#/hr)				0		
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)	35.7	35.7	35.7	35.7	21.2	
Effective Green, g (s)	35.7	35.7	35.7	35.7	21.2	
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.32	
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	
Vehicle Extension (s)	2.5	2.5	2.5	2.5	2.5	
Lane Grp Cap (vph)	224	1018	1018	779	558	
v/s Ratio Prot		0.36	0.38		c0.27	
v/s Ratio Perm	c0.43			0.14		
v/c Ratio	0.79	0.67	0.71	0.26	0.85	
Uniform Delay, d1	12.1	10.8	11.2	8.1	20.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	16.6	1.5	2.1	0.1	11.8	
Delay (s)	28.7	12.3	13.3	8.2	32.7	
Level of Service	C	B	B	A	C	
Approach Delay (s)		15.7	11.5		32.7	
Approach LOS		B	B		C	

Intersection Summary			
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	65.9	Sum of lost time (s)	9.0
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		

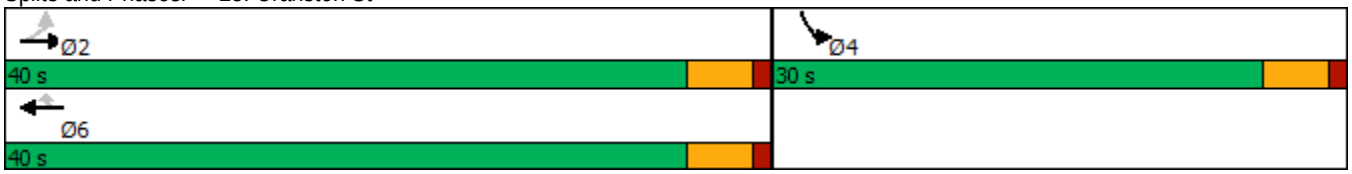
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL
Lane Configurations					
Traffic Volume (vph)	170	650	690	365	315
Future Volume (vph)	170	650	690	365	315
Lane Group Flow (vph)	177	677	719	380	505
Turn Type	Perm	NA	NA	Perm	Prot
Protected Phases		2	6		4
Permitted Phases	2			6	
Detector Phase	2	2	6	6	4
Switch Phase					
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.5	20.5	20.5	20.5	20.5
Total Split (s)	40.0	40.0	40.0	40.0	30.0
Total Split (%)	57.1%	57.1%	57.1%	57.1%	42.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	None	None	None	None	None
v/c Ratio	0.79	0.67	0.71	0.40	0.86
Control Delay	43.8	16.0	17.3	2.6	34.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	43.8	16.0	17.3	2.6	34.7
Queue Length 50th (ft)	56	193	213	0	171
Queue Length 95th (ft)	#179	332	366	38	#320
Internal Link Dist (ft)		283	553		305
Turn Bay Length (ft)	100				
Base Capacity (vph)	224	1016	1016	952	701
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.79	0.67	0.71	0.40	0.72

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 66
Natural Cycle: 65
Control Type: Actuated-Uncoordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 23: Cranston St

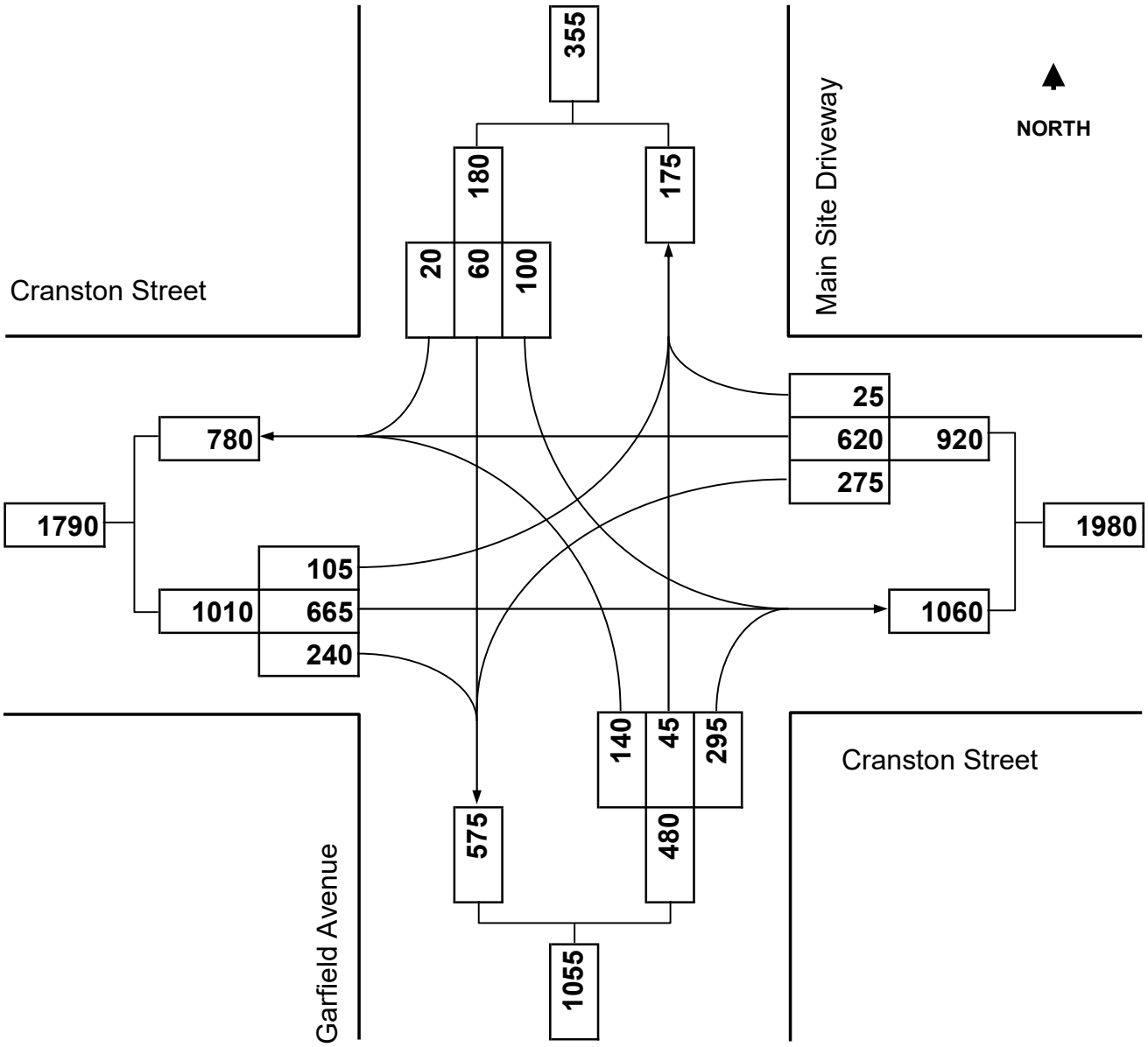


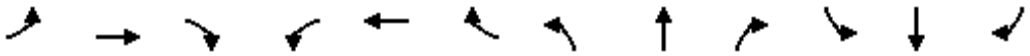
Cranston Street at Garfield Avenue/Main Site Access Driveway

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 Build





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Future Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3423		1719	3456			1803	1553		1821	
Flt Permitted	0.95	1.00		0.95	1.00			0.64	1.00		0.73	
Satd. Flow (perm)	1805	3423		1719	3456			1193	1553		1359	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	108	686	247	284	639	26	144	46	304	103	62	21
RTOR Reduction (vph)	0	36	0	0	3	0	0	0	206	0	6	0
Lane Group Flow (vph)	108	897	0	284	662	0	0	190	98	0	180	0
Heavy Vehicles (%)	0%	1%	2%	5%	4%	0%	2%	0%	4%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6		3	3 8			4	
Permitted Phases							3 8		3 8	4		
Actuated Green, G (s)	8.7	28.5		18.6	38.4			28.9	28.9		15.9	
Effective Green, g (s)	8.7	28.5		18.6	38.4			28.9	28.9		15.9	
Actuated g/C Ratio	0.10	0.32		0.21	0.43			0.32	0.32		0.18	
Clearance Time (s)	4.5	4.5		5.0	5.0						4.5	
Vehicle Extension (s)	3.0	2.5		2.5	2.5						2.5	
Lane Grp Cap (vph)	174	1083		355	1474			440	498		240	
v/s Ratio Prot	0.06	c0.26		c0.17	0.19			c0.04				
v/s Ratio Perm								0.10	0.06		c0.13	
v/c Ratio	0.62	0.83		0.80	0.45			0.43	0.20		0.75	
Uniform Delay, d1	39.1	28.5		33.9	18.3			24.1	22.1		35.2	
Progression Factor	1.00	1.00		1.08	1.13			1.00	1.00		1.00	
Incremental Delay, d2	6.7	7.3		10.0	0.8			0.7	0.2		11.9	
Delay (s)	45.8	35.8		46.6	21.6			24.8	22.3		47.0	
Level of Service	D	D		D	C			C	C		D	
Approach Delay (s)		36.9			29.0			23.3			47.0	
Approach LOS		D			C			C			D	

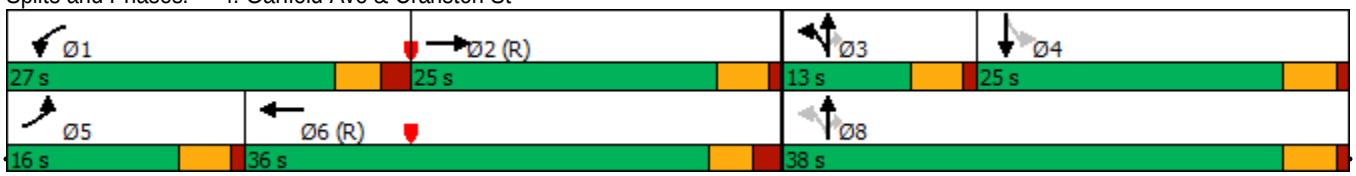
Intersection Summary			
HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	Ø8
Lane Configurations										
Traffic Volume (vph)	105	665	275	620	140	45	295	100	60	
Future Volume (vph)	105	665	275	620	140	45	295	100	60	
Lane Group Flow (vph)	108	933	284	665	0	190	304	0	186	
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	Perm	NA	
Protected Phases	5	2	1	6	3	3 8			4	8
Permitted Phases					3 8		3 8	4		
Detector Phase	5	2	1	6	3	3 8	3 8	4	4	
Switch Phase										
Minimum Initial (s)	8.0	10.0	10.0	10.0	8.0			8.0	8.0	8.0
Minimum Split (s)	12.5	14.5	15.0	15.0	12.5			15.0	15.0	12.5
Total Split (s)	16.0	25.0	27.0	36.0	13.0			25.0	25.0	38.0
Total Split (%)	17.8%	27.8%	30.0%	40.0%	14.4%			27.8%	27.8%	42%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					0.0	
Total Lost Time (s)	4.5	4.5	5.0	5.0					4.5	
Lead/Lag	Lead	Lag	Lead	Lag	Lead			Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes			Yes	Yes	
Recall Mode	None	C-Min	None	C-Min	None			None	None	None
v/c Ratio	0.52	0.84	0.80	0.44		0.43	0.43		0.76	
Control Delay	46.7	37.9	50.8	23.4		25.5	4.5		52.5	
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.1		1.7	
Total Delay	46.7	37.9	50.8	23.4		25.5	4.7		54.3	
Queue Length 50th (ft)	58	251	176	133		80	0		97	
Queue Length 95th (ft)	109	#441	m247	227		126	51		162	
Internal Link Dist (ft)		139		173		900			149	
Turn Bay Length (ft)	100		300							
Base Capacity (vph)	233	1117	421	1510		501	768		314	
Starvation Cap Reductn	0	0	0	0		0	0		0	
Spillback Cap Reductn	0	2	0	0		0	73		42	
Storage Cap Reductn	0	0	0	0		0	0		0	
Reduced v/c Ratio	0.46	0.84	0.67	0.44		0.38	0.44		0.68	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

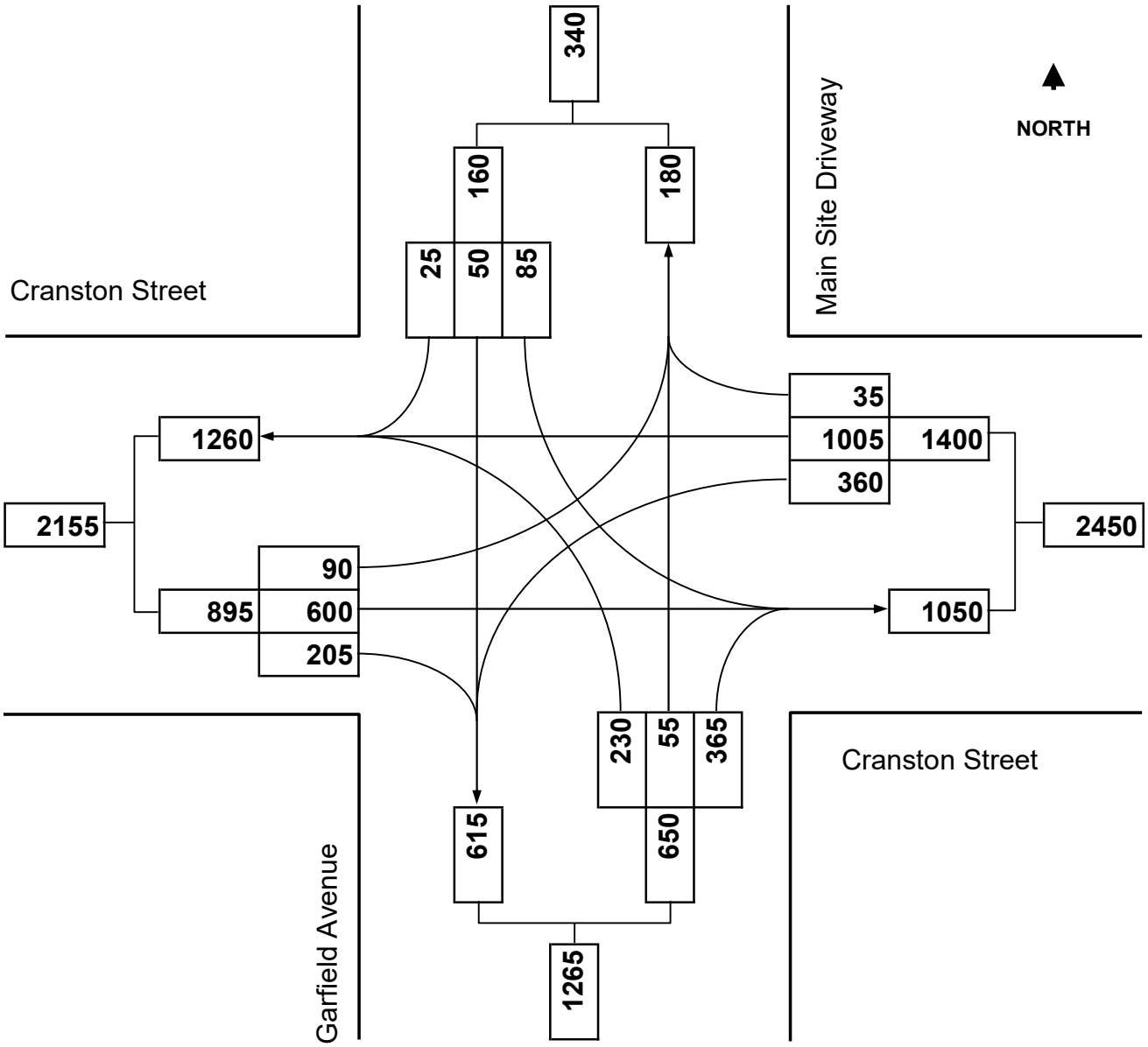
Splits and Phases: 4: Garfield Ave & Cranston St

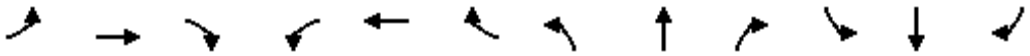


www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 Build





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Future Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3446		1770	3557			1812	1583		1812	
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.68	
Satd. Flow (perm)	1805	3446		1770	3557			1161	1583		1268	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	632	216	379	1058	37	242	58	384	89	53	26
RTOR Reduction (vph)	0	40	0	0	3	0	0	0	343	0	8	0
Lane Group Flow (vph)	95	808	0	379	1092	0	0	300	41	0	160	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	1%	0%	2%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA	custom	Perm	NA	
Protected Phases	5	2		1	6		3	3 8			4	
Permitted Phases							3 8		3	4		
Actuated Green, G (s)	6.8	20.0		19.7	32.9			26.3	8.5		13.3	
Effective Green, g (s)	6.8	20.0		19.7	32.9			26.3	8.5		13.3	
Actuated g/C Ratio	0.08	0.25		0.25	0.41			0.33	0.11		0.17	
Clearance Time (s)	4.5	4.5		5.0	5.0				4.5		4.5	
Vehicle Extension (s)	3.0	2.5		2.5	2.5				3.0		2.5	
Lane Grp Cap (vph)	153	861		435	1462			450	168		210	
v/s Ratio Prot	0.05	c0.23		c0.21	0.31			c0.07				
v/s Ratio Perm								c0.15	0.03		0.13	
v/c Ratio	0.62	0.94		0.87	0.75			0.67	0.24		0.76	
Uniform Delay, d1	35.4	29.4		28.9	20.0			23.1	32.8		31.8	
Progression Factor	1.00	1.00		1.10	1.13			1.00	1.00		1.00	
Incremental Delay, d2	7.6	19.0		12.8	2.5			3.7	0.8		14.3	
Delay (s)	43.0	48.4		44.5	25.1			26.8	33.6		46.1	
Level of Service	D	D		D	C			C	C		D	
Approach Delay (s)		47.8			30.1			30.6			46.1	
Approach LOS		D			C			C			D	

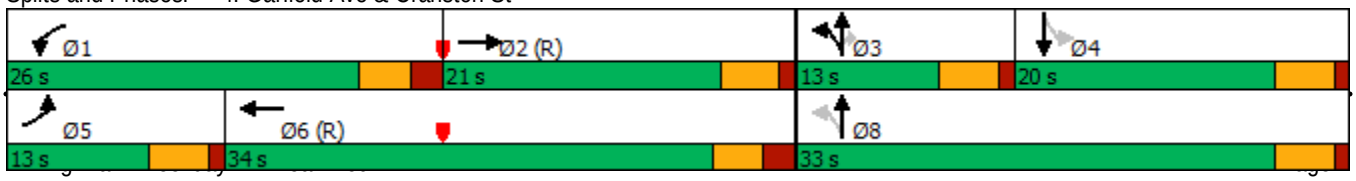
Intersection Summary			
HCM 2000 Control Delay	36.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	Ø8
Lane Configurations										
Traffic Volume (vph)	90	600	360	1005	230	55	365	85	50	
Future Volume (vph)	90	600	360	1005	230	55	365	85	50	
Lane Group Flow (vph)	95	848	379	1095	0	300	384	0	168	
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	custom	Perm	NA	
Protected Phases	5	2	1	6	3	3 8			4	8
Permitted Phases					3 8		3	4		
Detector Phase	5	2	1	6	3	3 8	3	4	4	
Switch Phase										
Minimum Initial (s)	8.0	10.0	10.0	10.0	8.0		8.0	8.0	8.0	8.0
Minimum Split (s)	12.5	14.5	15.0	15.0	12.5		12.5	12.5	12.5	12.5
Total Split (s)	13.0	21.0	26.0	34.0	13.0		13.0	20.0	20.0	33.0
Total Split (%)	16.3%	26.3%	32.5%	42.5%	16.3%		16.3%	25.0%	25.0%	41%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0		1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0			0.0		0.0	
Total Lost Time (s)	4.5	4.5	5.0	5.0			4.5		4.5	
Lead/Lag	Lead	Lag	Lead	Lag	Lead		Lead	Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	
Recall Mode	None	C-Min	None	C-Min	None		None	None	None	None
v/c Ratio	0.50	0.94	0.87	0.73		0.67	0.75		0.77	
Control Delay	43.7	50.3	48.4	26.5		29.5	14.7		52.7	
Queue Delay	0.0	0.1	0.0	0.0		0.0	0.5		1.5	
Total Delay	43.7	50.4	48.4	26.5		29.5	15.2		54.2	
Queue Length 50th (ft)	45	~251	208	244		115	0		74	
Queue Length 95th (ft)	93	#367	m256	m282		185	#110		#158	
Internal Link Dist (ft)		139		173		900			149	
Turn Bay Length (ft)	100		300							
Base Capacity (vph)	193	901	466	1504		482	511		253	
Starvation Cap Reductn	0	0	0	0		0	0		0	
Spillback Cap Reductn	0	1	0	0		0	15		19	
Storage Cap Reductn	0	0	0	0		0	0		0	
Reduced v/c Ratio	0.49	0.94	0.81	0.73		0.62	0.77		0.72	

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

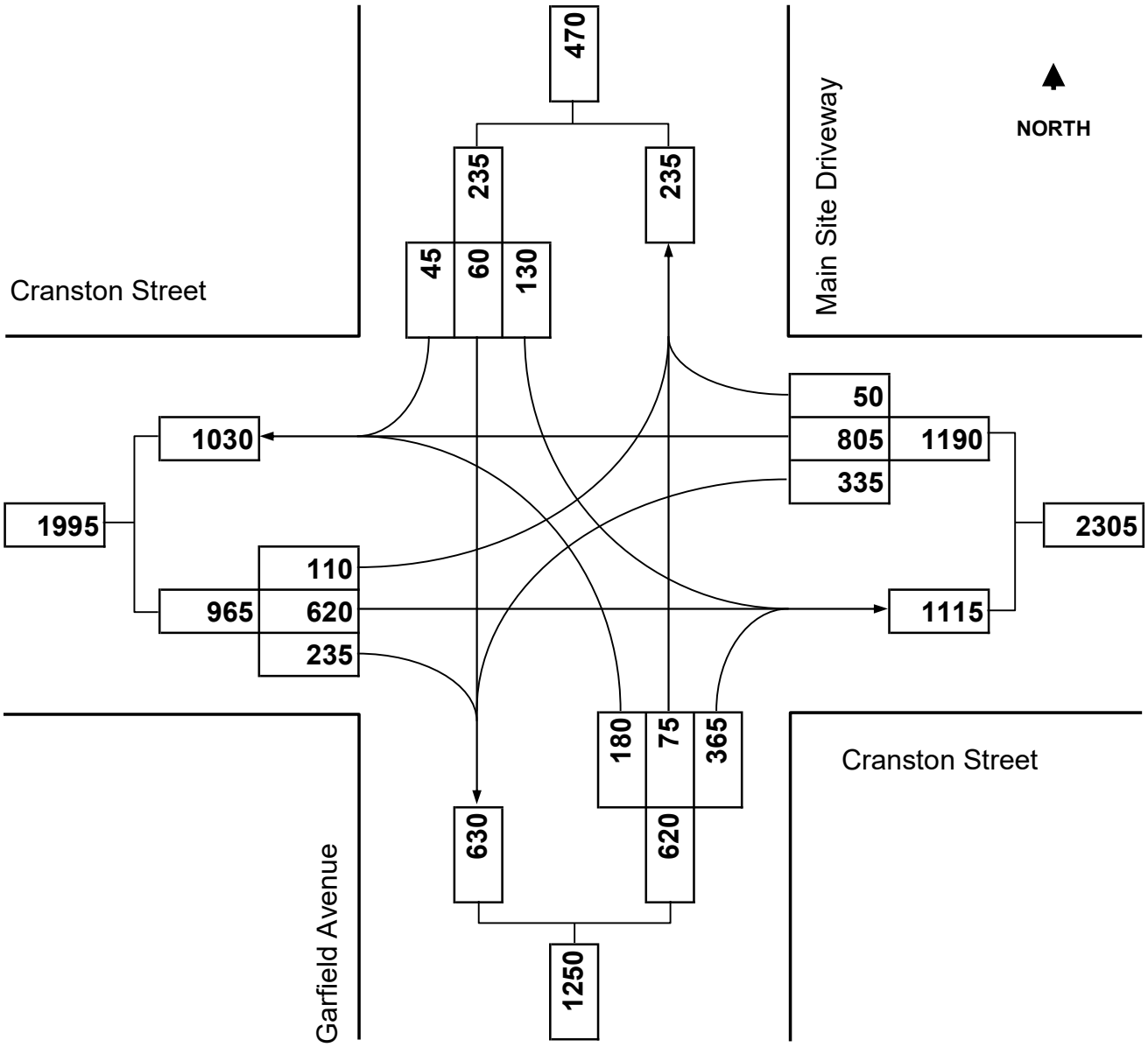
Splits and Phases: 4: Garfield Ave & Cranston St

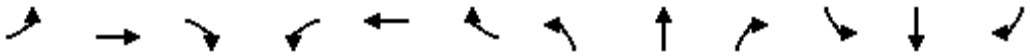


www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 Build





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Future Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1805	3427		1787	3543			1824	1599		1802	
Flt Permitted	0.95	1.00		0.95	1.00			0.65	1.00		0.69	
Satd. Flow (perm)	1805	3427		1787	3543			1220	1599		1278	
Peak-hour factor, PHF	0.93	0.99	0.99	0.99	0.99	0.93	0.99	0.93	0.99	0.99	0.99	0.99
Adj. Flow (vph)	118	626	237	338	813	54	182	81	369	131	61	45
RTOR Reduction (vph)	0	40	0	0	5	0	0	0	237	0	9	0
Lane Group Flow (vph)	118	823	0	338	862	0	0	263	132	0	228	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6		3	3 8			4	
Permitted Phases							3 8		3 8	4		
Actuated Green, G (s)	8.7	23.4		20.3	35.0			32.3	32.3		19.3	
Effective Green, g (s)	8.7	23.4		20.3	35.0			32.3	32.3		19.3	
Actuated g/C Ratio	0.10	0.26		0.23	0.39			0.36	0.36		0.21	
Clearance Time (s)	4.5	4.5		5.0	5.0						4.5	
Vehicle Extension (s)	3.0	2.5		2.5	2.5						2.5	
Lane Grp Cap (vph)	174	891		403	1377			494	573		274	
v/s Ratio Prot	0.07	c0.24		c0.19	0.24			c0.05				
v/s Ratio Perm								0.14	0.08		c0.18	
v/c Ratio	0.68	0.92		0.84	0.63			0.53	0.23		0.83	
Uniform Delay, d1	39.3	32.4		33.3	22.2			22.9	20.2		33.8	
Progression Factor	1.00	1.00		1.01	1.20			1.00	1.00		1.00	
Incremental Delay, d2	10.0	16.5		11.0	1.7			1.1	0.2		18.5	
Delay (s)	49.3	48.9		44.5	28.4			24.0	20.4		52.3	
Level of Service	D	D		D	C			C	C		D	
Approach Delay (s)		49.0			32.9			21.9			52.3	
Approach LOS		D			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	37.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	Ø8
Lane Configurations										
Traffic Volume (vph)	110	620	335	805	180	75	365	130	60	
Future Volume (vph)	110	620	335	805	180	75	365	130	60	
Lane Group Flow (vph)	118	863	338	867	0	263	369	0	237	
Turn Type	Prot	NA	Prot	NA	pm+pt	NA	Perm	Perm	NA	
Protected Phases	5	2	1	6	3	3 8			4	8
Permitted Phases					3 8		3 8	4		
Detector Phase	5	2	1	6	3	3 8	3 8	4	4	
Switch Phase										
Minimum Initial (s)	8.0	10.0	10.0	10.0	8.0			8.0	8.0	8.0
Minimum Split (s)	12.5	14.5	15.0	15.0	12.5			12.5	12.5	12.5
Total Split (s)	16.0	22.0	28.0	34.0	13.0			27.0	27.0	40.0
Total Split (%)	17.8%	24.4%	31.1%	37.8%	14.4%			30.0%	30.0%	44%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					0.0	
Total Lost Time (s)	4.5	4.5	5.0	5.0					4.5	
Lead/Lag	Lead	Lag	Lead	Lag	Lead			Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes			Yes	Yes	
Recall Mode	None	C-Min	Min	C-Min	None			None	None	None
v/c Ratio	0.57	0.93	0.84	0.61		0.53	0.46		0.84	
Control Delay	48.9	50.8	48.3	30.1		25.4	4.0		56.9	
Queue Delay	0.0	0.3	0.0	0.0		0.0	0.3		16.0	
Total Delay	48.9	51.1	48.3	30.1		25.4	4.3		73.0	
Queue Length 50th (ft)	64	~279	209	227		106	0		120	
Queue Length 95th (ft)	118	#428	m273	m306		167	53		#226	
Internal Link Dist (ft)		139		173		900			149	
Turn Bay Length (ft)	100		300							
Base Capacity (vph)	230	929	456	1418		538	854		328	
Starvation Cap Reductn	0	0	0	0		0	0		0	
Spillback Cap Reductn	0	4	0	0		0	125		77	
Storage Cap Reductn	0	0	0	0		0	0		0	
Reduced v/c Ratio	0.51	0.93	0.74	0.61		0.49	0.51		0.94	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St

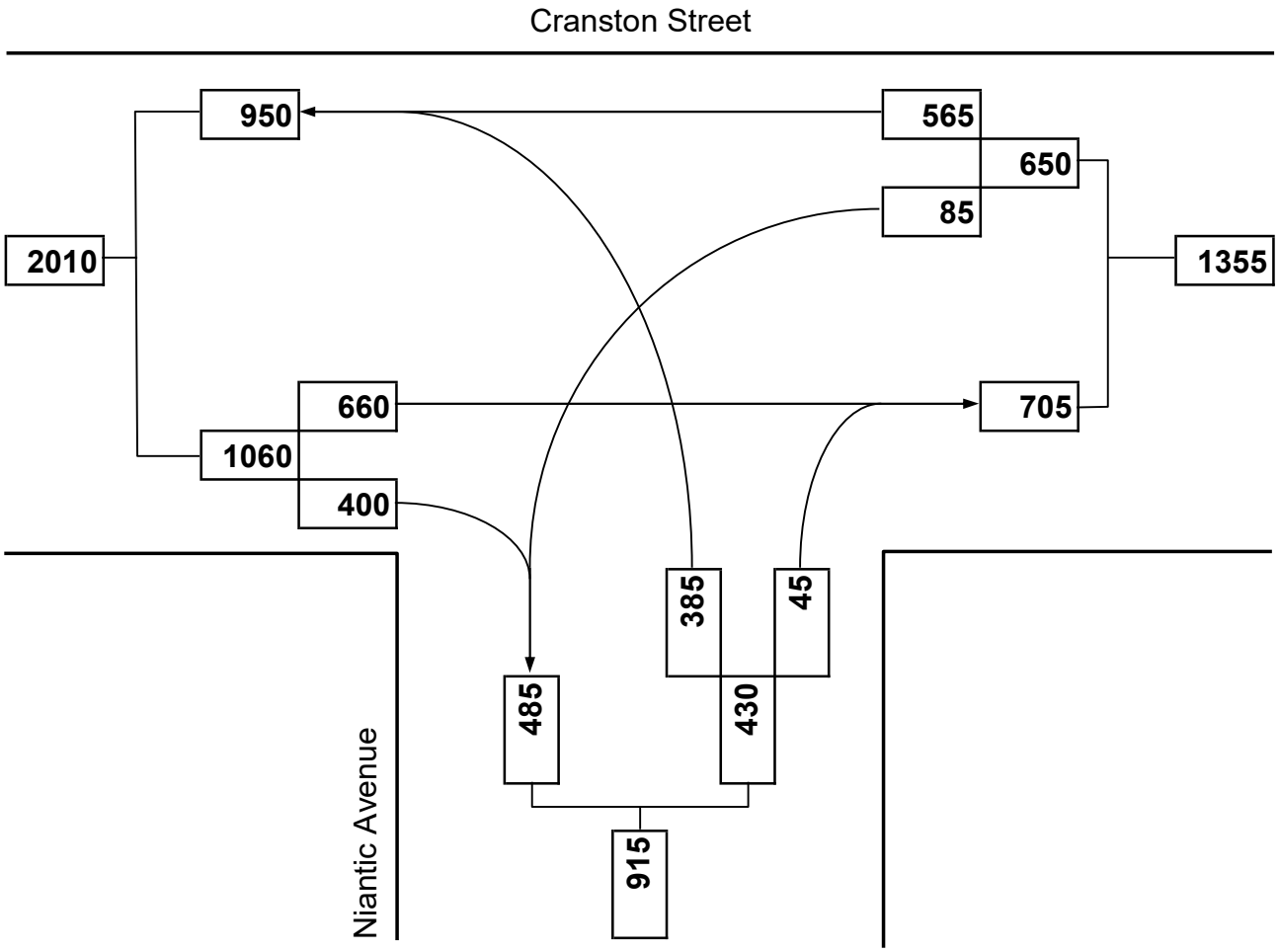
Cranston Street at Niantic Avenue

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	660	400	85	565	385	45
Future Volume (vph)	660	400	85	565	385	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		0.99	0.96	
Satd. Flow (prot)	1863	1583		3482	1731	
Flt Permitted	1.00	1.00		0.69	0.96	
Satd. Flow (perm)	1863	1583		2418	1731	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	702	426	90	601	410	48
RTOR Reduction (vph)	0	177	0	0	5	0
Lane Group Flow (vph)	702	249	0	691	453	0
Heavy Vehicles (%)	2%	2%	3%	3%	4%	0%
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	52.7	52.7		52.7	27.3	
Effective Green, g (s)	52.7	52.7		52.7	27.3	
Actuated g/C Ratio	0.59	0.59		0.59	0.30	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	1090	926		1415	525	
v/s Ratio Prot	c0.38				c0.26	
v/s Ratio Perm		0.16		0.29		
v/c Ratio	0.64	0.27		0.49	0.86	
Uniform Delay, d1	12.4	9.2		10.8	29.6	
Progression Factor	1.15	4.56		1.52	1.00	
Incremental Delay, d2	2.2	0.5		1.0	13.6	
Delay (s)	16.5	42.4		17.4	43.2	
Level of Service	B	D		B	D	
Approach Delay (s)	26.3			17.4	43.2	
Approach LOS	C			B	D	

Intersection Summary			
HCM 2000 Control Delay	27.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	660	400	85	565	385
Future Volume (vph)	660	400	85	565	385
Lane Group Flow (vph)	702	426	0	691	458
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	54.0	54.0	54.0	54.0	36.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	None
v/c Ratio	0.64	0.39		0.49	0.87
Control Delay	18.3	6.2		19.0	46.2
Queue Delay	1.1	0.0		6.8	0.0
Total Delay	19.4	6.2		25.8	46.2
Queue Length 50th (ft)	350	55		186	236
Queue Length 95th (ft)	m503	m175		232	#357
Internal Link Dist (ft)	184			193	475
Turn Bay Length (ft)					
Base Capacity (vph)	1094	1105		1420	603
Starvation Cap Reductn	187	0		671	0
Spillback Cap Reductn	156	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.77	0.39		0.92	0.76

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

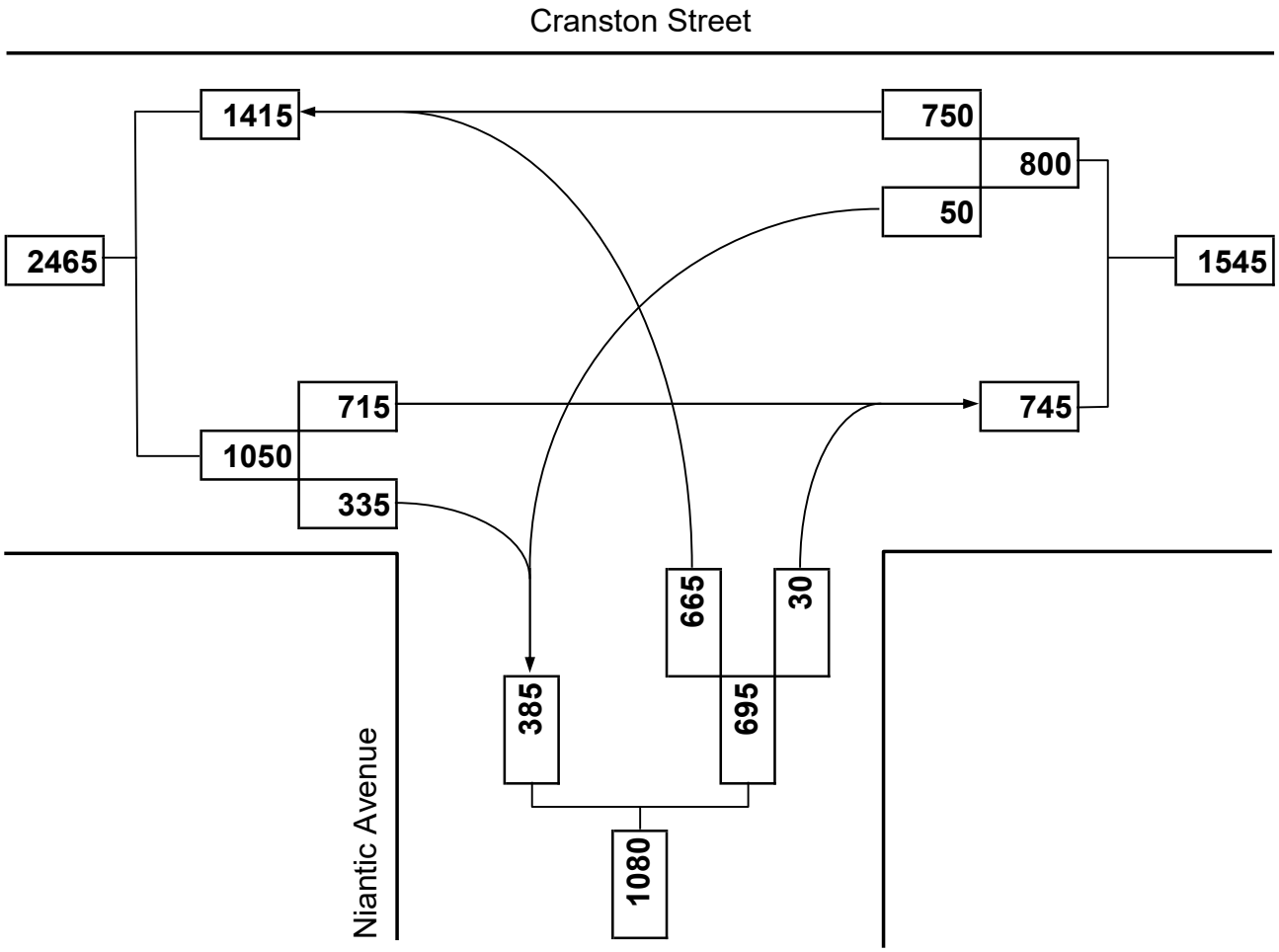
Splits and Phases: 18: Niantic Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	715	335	50	750	665	30
Future Volume (vph)	715	335	50	750	665	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		1.00	0.95	
Satd. Flow (prot)	1881	1439		3561	1786	
Flt Permitted	1.00	1.00		0.75	0.95	
Satd. Flow (perm)	1881	1439		2689	1786	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	722	338	51	758	672	30
RTOR Reduction (vph)	0	169	0	0	2	0
Lane Group Flow (vph)	722	169	0	809	700	0
Heavy Vehicles (%)	1%	1%	2%	1%	1%	0%
Parking (#/hr)		0				
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	40.0	40.0		40.0	30.0	
Effective Green, g (s)	40.0	40.0		40.0	30.0	
Actuated g/C Ratio	0.50	0.50		0.50	0.38	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	940	719		1344	669	
v/s Ratio Prot	c0.38				c0.39	
v/s Ratio Perm		0.12		0.30		
v/c Ratio	0.77	0.24		0.60	1.05	
Uniform Delay, d1	16.2	11.3		14.3	25.0	
Progression Factor	0.97	2.88		1.88	1.00	
Incremental Delay, d2	3.0	0.4		1.0	47.6	
Delay (s)	18.7	33.0		27.9	72.6	
Level of Service	B	C		C	E	
Approach Delay (s)	23.3			27.9	72.6	
Approach LOS	C			C	E	

Intersection Summary			
HCM 2000 Control Delay	38.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	105.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	715	335	50	750	665
Future Volume (vph)	715	335	50	750	665
Lane Group Flow (vph)	722	338	0	809	702
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	51.0	51.0	51.0	51.0	29.0
Total Split (%)	63.8%	63.8%	63.8%	63.8%	36.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	Min
v/c Ratio	0.77	0.38		0.60	1.04
Control Delay	18.3	3.8		26.9	76.5
Queue Delay	1.3	0.0		20.9	0.0
Total Delay	19.6	3.8		47.9	76.5
Queue Length 50th (ft)	326	27		226	~408
Queue Length 95th (ft)	m388	m40		m232	#670
Internal Link Dist (ft)	184			193	475
Turn Bay Length (ft)					
Base Capacity (vph)	1081	971		1546	672
Starvation Cap Reductn	175	0		749	0
Spillback Cap Reductn	141	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.80	0.35		1.02	1.04

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 22 (28%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

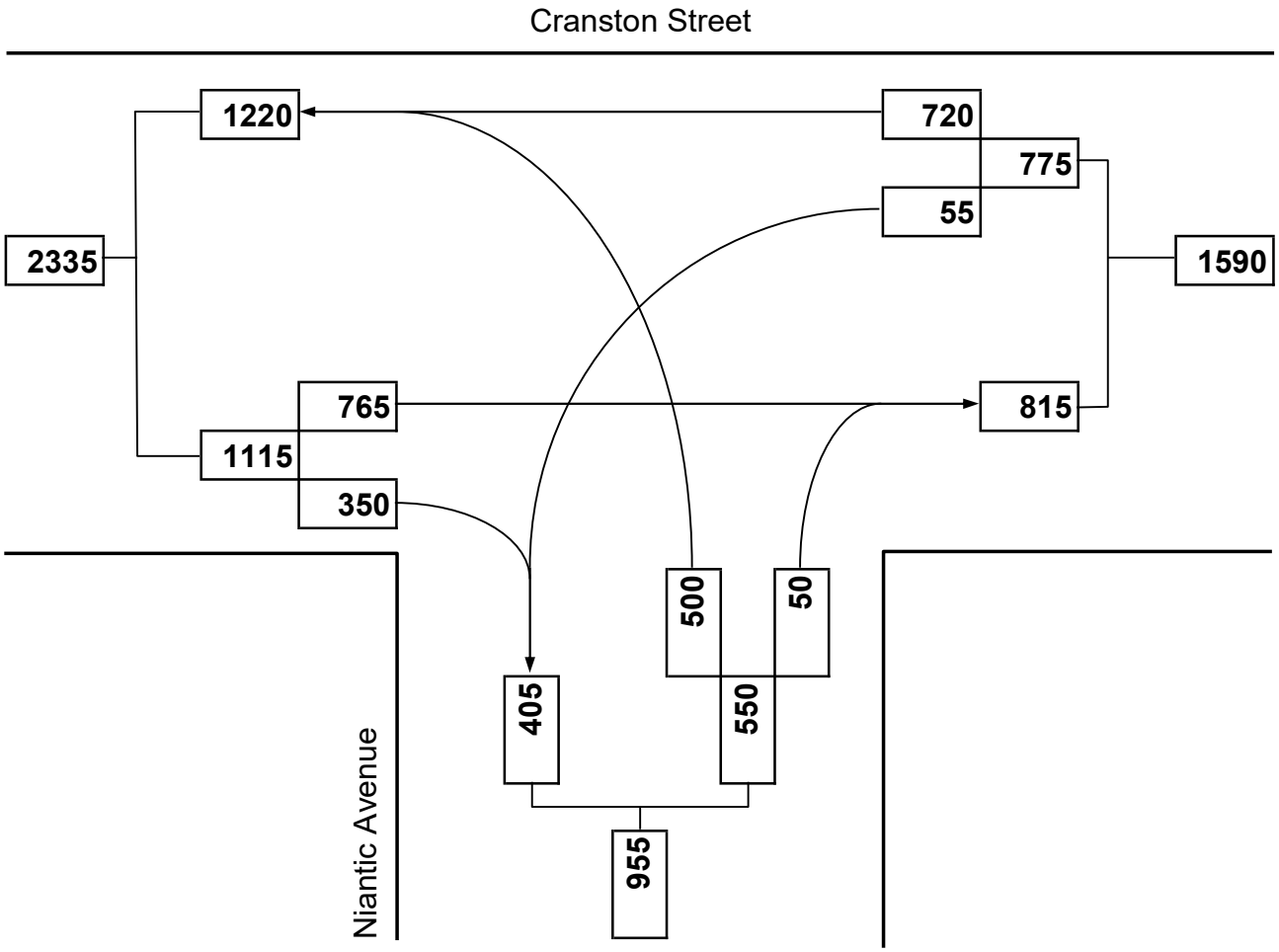
Splits and Phases: 18: Niantic Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Niantic Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 Build

NORTH



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	765	350	55	720	500	50
Future Volume (vph)	765	350	55	720	500	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		0.95	1.00	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	1.00	1.00		1.00	0.96	
Satd. Flow (prot)	1881	1599		3562	1777	
Flt Permitted	1.00	1.00		0.74	0.96	
Satd. Flow (perm)	1881	1599		2634	1777	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	773	354	56	727	505	51
RTOR Reduction (vph)	0	159	0	0	4	0
Lane Group Flow (vph)	773	195	0	783	552	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Actuated Green, G (s)	49.7	49.7		49.7	30.3	
Effective Green, g (s)	49.7	49.7		49.7	30.3	
Actuated g/C Ratio	0.55	0.55		0.55	0.34	
Clearance Time (s)	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	2.5	2.5		2.5	2.5	
Lane Grp Cap (vph)	1038	883		1454	598	
v/s Ratio Prot	c0.41				c0.31	
v/s Ratio Perm		0.12		0.30		
v/c Ratio	0.74	0.22		0.54	0.92	
Uniform Delay, d1	15.3	10.3		12.8	28.7	
Progression Factor	1.21	4.74		1.73	1.00	
Incremental Delay, d2	3.2	0.4		0.9	20.0	
Delay (s)	21.7	49.1		23.1	48.7	
Level of Service	C	D		C	D	
Approach Delay (s)	30.3			23.1	48.7	
Approach LOS	C			C	D	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	100.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	EBR	WBL	WBT	NBL
Lane Configurations					
Traffic Volume (vph)	765	350	55	720	500
Future Volume (vph)	765	350	55	720	500
Lane Group Flow (vph)	773	354	0	783	556
Turn Type	NA	Perm	Perm	NA	Prot
Protected Phases	1			1	2
Permitted Phases		1	1		
Detector Phase	1	1	1	1	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	15.0	15.0	15.0	15.0	15.0
Total Split (s)	54.0	54.0	54.0	54.0	36.0
Total Split (%)	60.0%	60.0%	60.0%	60.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0		5.0	5.0
Lead/Lag	Lead	Lead	Lead	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes
Recall Mode	C-Min	C-Min	C-Min	C-Min	None
v/c Ratio	0.74	0.34		0.54	0.92
Control Delay	23.1	6.6		24.1	51.6
Queue Delay	7.7	0.0		14.9	0.0
Total Delay	30.7	6.6		39.0	51.6
Queue Length 50th (ft)	435	86		205	283
Queue Length 95th (ft)	m521	m113		m238	#494
Internal Link Dist (ft)	184			193	475
Turn Bay Length (ft)					
Base Capacity (vph)	1047	1047		1467	624
Starvation Cap Reductn	234	0		676	0
Spillback Cap Reductn	64	0		0	0
Storage Cap Reductn	0	0		0	0
Reduced v/c Ratio	0.95	0.34		0.99	0.89

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

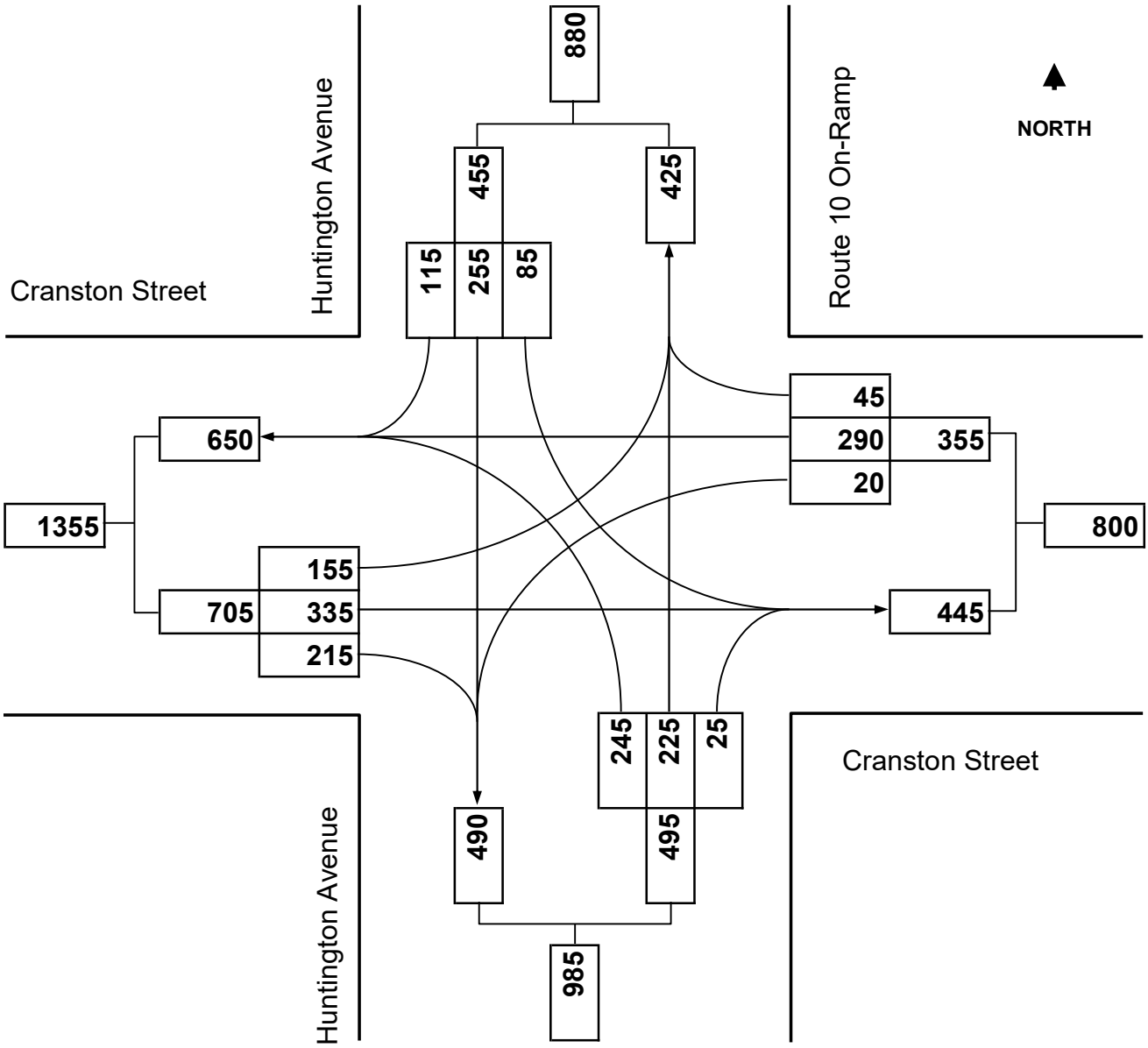
Splits and Phases: 18: Niantic Ave & Cranston St

Cranston Street at Huntington Avenue/Route 10 NB On-Ramp

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	155	335	215	20	290	45	85	255	115	245	225	25
Future Volume (vph)	155	335	215	20	290	45	85	255	115	245	225	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1771		1805	1828		1787	3408		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1771		1805	1828		1787	3408		1787	1881	1599
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	161	349	224	21	302	47	89	266	120	255	234	26
RTOR Reduction (vph)	0	23	0	0	5	0	0	58	0	0	0	20
Lane Group Flow (vph)	161	550	0	21	344	0	89	328	0	255	234	6
Heavy Vehicles (%)	1%	1%	1%	0%	2%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	11.3	38.2		1.6	28.5		8.1	13.5		16.7	22.1	22.1
Effective Green, g (s)	11.3	38.2		1.6	28.5		8.1	13.5		16.7	22.1	22.1
Actuated g/C Ratio	0.13	0.42		0.02	0.32		0.09	0.15		0.19	0.25	0.25
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	224	751		32	578		160	511		331	461	392
v/s Ratio Prot	c0.09	c0.31		0.01	0.19		0.05	c0.10		c0.14	0.12	
v/s Ratio Perm												0.00
v/c Ratio	0.72	0.73		0.66	0.59		0.56	0.64		0.77	0.51	0.02
Uniform Delay, d1	37.8	21.6		43.9	25.9		39.2	36.0		34.8	29.3	25.7
Progression Factor	0.81	0.75		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.7	4.8		34.9	4.5		3.1	2.4		10.1	0.7	0.0
Delay (s)	38.4	21.0		78.8	30.3		42.4	38.3		44.9	30.0	25.7
Level of Service	D	C		E	C		D	D		D	C	C
Approach Delay (s)		24.8			33.1			39.1			37.1	
Approach LOS		C			C			D			D	

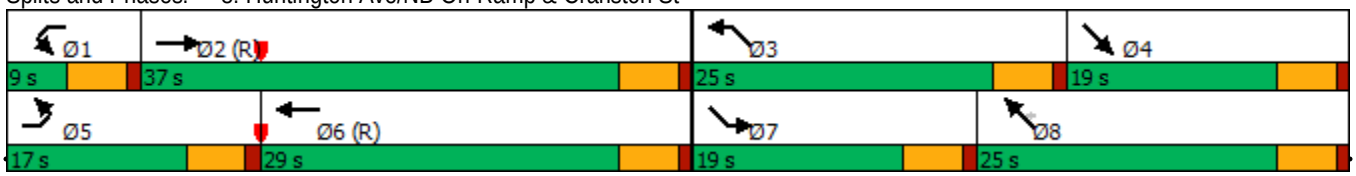
Intersection Summary			
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	155	335	20	290	85	255	245	225	25
Future Volume (vph)	155	335	20	290	85	255	245	225	25
Lane Group Flow (vph)	161	573	21	349	89	386	255	234	26
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	17.0	37.0	9.0	29.0	19.0	19.0	25.0	25.0	25.0
Total Split (%)	18.9%	41.1%	10.0%	32.2%	21.1%	21.1%	27.8%	27.8%	27.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.72	0.67	0.22	0.58	0.49	0.72	0.77	0.51	0.05
Control Delay	45.5	19.5	46.9	31.1	46.4	38.7	50.4	34.2	0.2
Queue Delay	0.0	5.1	0.0	0.0	0.0	9.4	0.4	0.0	0.0
Total Delay	45.5	24.7	46.9	31.1	46.4	48.1	50.8	34.2	0.2
Queue Length 50th (ft)	70	304	12	169	49	91	138	116	0
Queue Length 95th (ft)	m#141	#497	36	273	91	138	214	191	0
Internal Link Dist (ft)		193		360		327		296	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	243	851	96	604	277	587	397	466	551
Starvation Cap Reductn	0	212	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	167	14	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.90	0.22	0.58	0.32	0.92	0.67	0.50	0.05

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

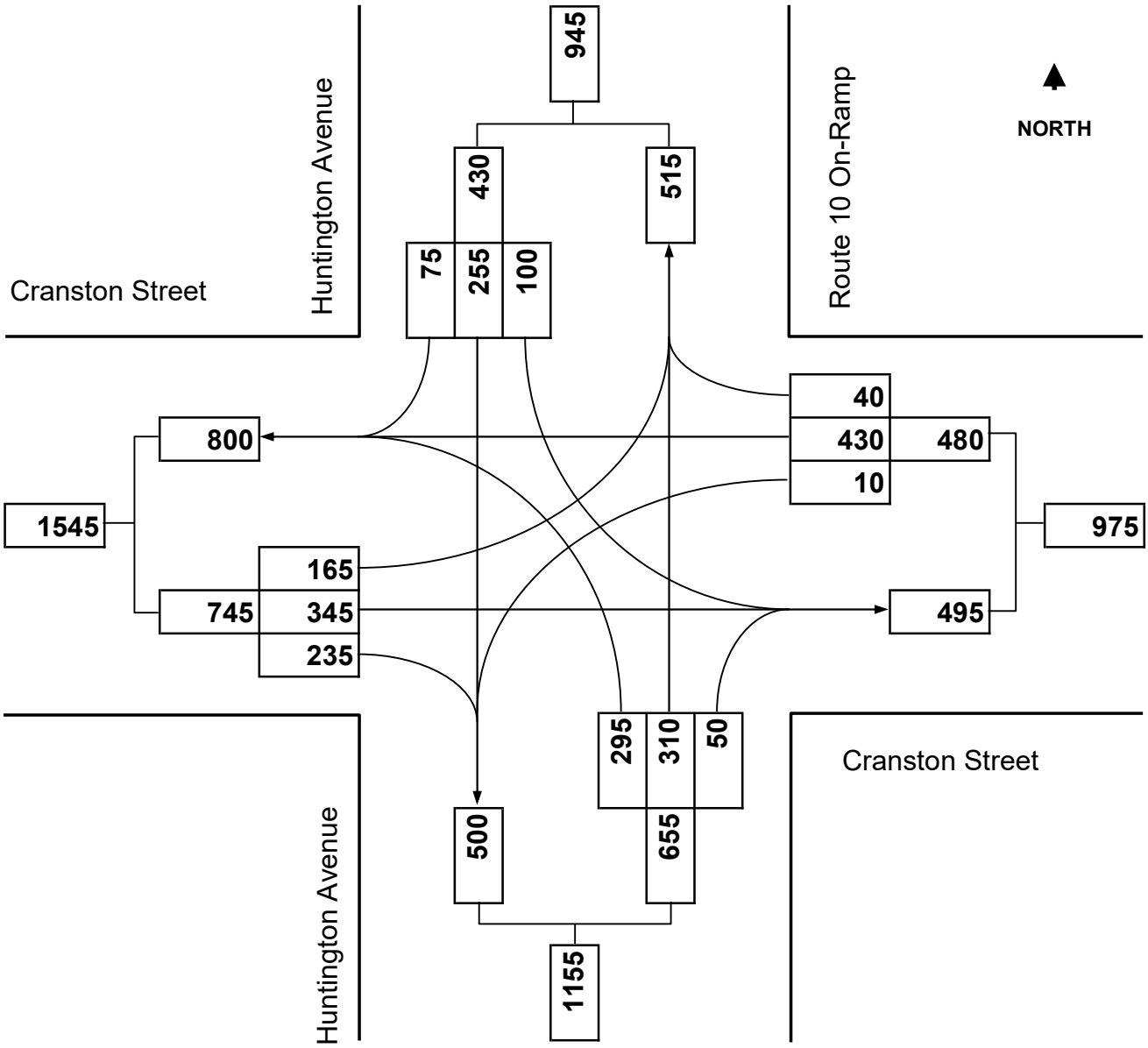
Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	165	345	235	10	430	40	100	255	75	295	310	50
Future Volume (vph)	165	345	235	10	430	40	100	255	75	295	310	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.99		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1767		1787	1857		1787	3453		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1767		1787	1857		1787	3453		1787	1881	1599
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	170	356	242	10	443	41	103	263	77	304	320	52
RTOR Reduction (vph)	0	28	0	0	4	0	0	34	0	0	0	39
Lane Group Flow (vph)	170	570	0	10	480	0	103	306	0	304	320	13
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	10.0	31.6		0.8	22.4		7.0	12.2		15.4	20.6	20.6
Effective Green, g (s)	10.0	31.6		0.8	22.4		7.0	12.2		15.4	20.6	20.6
Actuated g/C Ratio	0.12	0.40		0.01	0.28		0.09	0.15		0.19	0.26	0.26
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	223	697		17	519		156	526		343	484	411
v/s Ratio Prot	c0.10	c0.32		0.01	c0.26		0.06	0.09		c0.17	c0.17	
v/s Ratio Perm												0.01
v/c Ratio	0.76	0.82		0.59	0.92		0.66	0.58		0.89	0.66	0.03
Uniform Delay, d1	33.9	21.6		39.4	28.0		35.3	31.5		31.4	26.6	22.2
Progression Factor	0.80	0.53		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.4	7.8		35.0	24.6		8.8	1.3		22.7	3.1	0.0
Delay (s)	37.5	19.2		74.4	52.6		44.2	32.8		54.1	29.7	22.3
Level of Service	D	B		E	D		D	C		D	C	C
Approach Delay (s)		23.3			53.0			35.5			40.1	
Approach LOS		C			D			D			D	

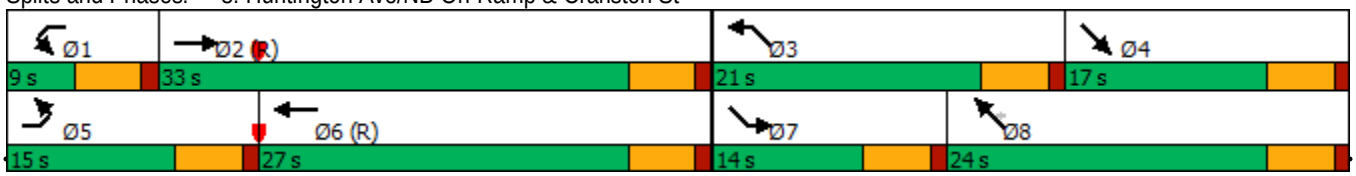
Intersection Summary			
HCM 2000 Control Delay	36.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	165	345	10	430	100	255	295	310	50
Future Volume (vph)	165	345	10	430	100	255	295	310	50
Lane Group Flow (vph)	170	598	10	484	103	340	304	320	52
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	15.0	33.0	9.0	27.0	14.0	17.0	21.0	24.0	24.0
Total Split (%)	18.8%	41.3%	11.3%	33.8%	17.5%	21.3%	26.3%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Min	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.77	0.72	0.10	0.88	0.57	0.66	0.88	0.66	0.09
Control Delay	46.2	15.5	38.7	47.9	47.0	35.2	59.6	35.4	0.3
Queue Delay	0.0	5.3	0.0	0.1	0.0	36.6	56.8	0.0	0.0
Total Delay	46.2	20.7	38.7	48.0	47.0	71.8	116.3	35.4	0.3
Queue Length 50th (ft)	62	279	5	233	49	74	148	148	0
Queue Length 95th (ft)	m#142	m#479	20	#420	98	117	#282	#255	0
Internal Link Dist (ft)		193		360		327		296	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	230	833	98	548	201	551	357	489	587
Starvation Cap Reductn	0	174	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	1	0	224	145	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.74	0.91	0.10	0.88	0.51	1.04	1.43	0.65	0.09

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 55 (69%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

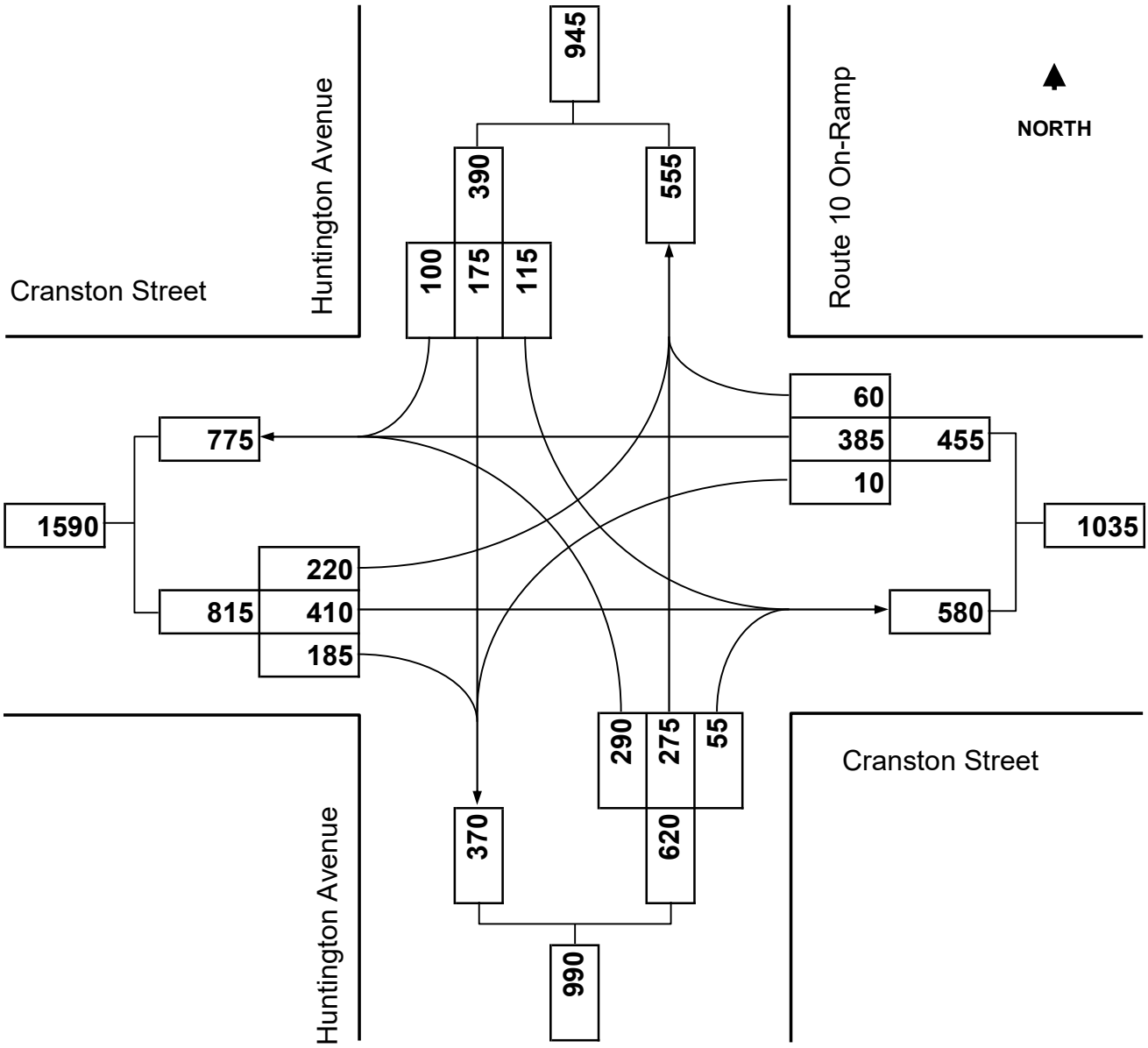
Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Route 10/Huntington Avenue
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	220	410	185	10	385	60	115	175	100	290	275	55
Future Volume (vph)	220	410	185	10	385	60	115	175	100	290	275	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.95		1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1787	1793		1805	1843		1787	3379		1787	1881	1599
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1787	1793		1805	1843		1787	3379		1787	1881	1599
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	232	432	195	11	405	63	121	184	105	305	289	58
RTOR Reduction (vph)	0	16	0	0	6	0	0	90	0	0	0	46
Lane Group Flow (vph)	232	611	0	11	462	0	121	199	0	305	289	12
Heavy Vehicles (%)	1%	1%	1%	0%	1%	1%	1%	1%	1%	1%	1%	1%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases												8
Actuated Green, G (s)	14.6	39.5		1.2	26.1		10.4	10.4		18.9	18.9	18.9
Effective Green, g (s)	14.6	39.5		1.2	26.1		10.4	10.4		18.9	18.9	18.9
Actuated g/C Ratio	0.16	0.44		0.01	0.29		0.12	0.12		0.21	0.21	0.21
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	5.0
Vehicle Extension (s)	2.6	2.6		2.4	2.6		2.4	2.4		2.4	2.6	2.6
Lane Grp Cap (vph)	289	786		24	534		206	390		375	395	335
v/s Ratio Prot	c0.13	0.34		0.01	c0.25		0.07	0.06		c0.17	c0.15	
v/s Ratio Perm												0.01
v/c Ratio	0.80	0.78		0.46	0.87		0.59	0.51		0.81	0.73	0.04
Uniform Delay, d1	36.3	21.5		44.1	30.3		37.8	37.4		33.9	33.2	28.3
Progression Factor	0.92	0.48		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.3	5.2		8.8	17.0		3.4	0.7		12.3	6.5	0.0
Delay (s)	43.7	15.5		52.9	47.3		41.1	38.1		46.2	39.7	28.3
Level of Service	D	B		D	D		D	D		D	D	C
Approach Delay (s)		23.1			47.4			39.0			41.7	
Approach LOS		C			D			D			D	

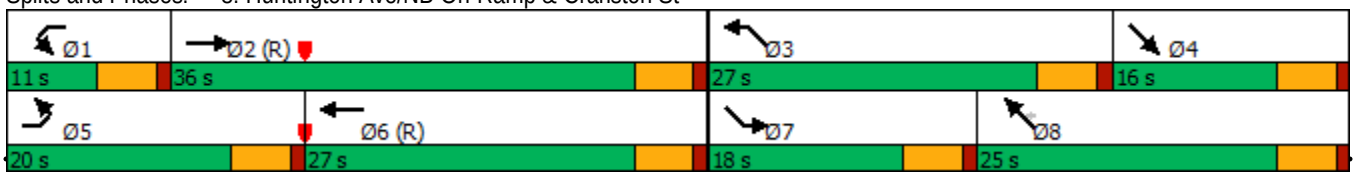
Intersection Summary			
HCM 2000 Control Delay	35.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	SEL	SET	NWL	NWT	NWR
Lane Configurations									
Traffic Volume (vph)	220	410	10	385	115	175	290	275	55
Future Volume (vph)	220	410	10	385	115	175	290	275	55
Lane Group Flow (vph)	232	627	11	468	121	289	305	289	58
Turn Type	Prot	NA	Prot	NA	Prot	NA	Prot	NA	Perm
Protected Phases	5	2	1	6	7	4	3	8	
Permitted Phases									8
Detector Phase	5	2	1	6	7	4	3	8	8
Switch Phase									
Minimum Initial (s)	4.0	10.0	4.0	10.0	4.0	10.0	4.0	10.0	10.0
Minimum Split (s)	9.0	15.0	9.0	15.0	9.0	15.0	9.0	15.0	15.0
Total Split (s)	20.0	36.0	11.0	27.0	18.0	16.0	27.0	25.0	25.0
Total Split (%)	22.2%	40.0%	12.2%	30.0%	20.0%	17.8%	30.0%	27.8%	27.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Min	None	C-Min	None	None	None	None	None
v/c Ratio	0.80	0.71	0.10	0.87	0.59	0.60	0.82	0.73	0.12
Control Delay	49.4	15.2	41.8	50.0	49.2	29.9	51.3	45.0	0.5
Queue Delay	4.2	1.7	0.0	0.1	0.0	21.3	1.7	0.0	0.0
Total Delay	53.6	16.9	41.8	50.1	49.2	51.2	53.1	45.0	0.5
Queue Length 50th (ft)	87	22	6	261	66	53	164	154	0
Queue Length 95th (ft)	m#190	m#548	23	#474	119	94	#251	#240	0
Internal Link Dist (ft)		193		360		327		296	
Turn Bay Length (ft)			50		100				50
Base Capacity (vph)	305	881	120	541	258	502	436	420	516
Starvation Cap Reductn	31	120	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	1	0	205	43	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.82	0.09	0.87	0.47	0.97	0.78	0.69	0.11

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 67 (74%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Huntington Ave/NB On-Ramp & Cranston St



D

Future 2024 Build Weekday AM / PM / Saturday MD Peak Hour (Build Alternative 1)

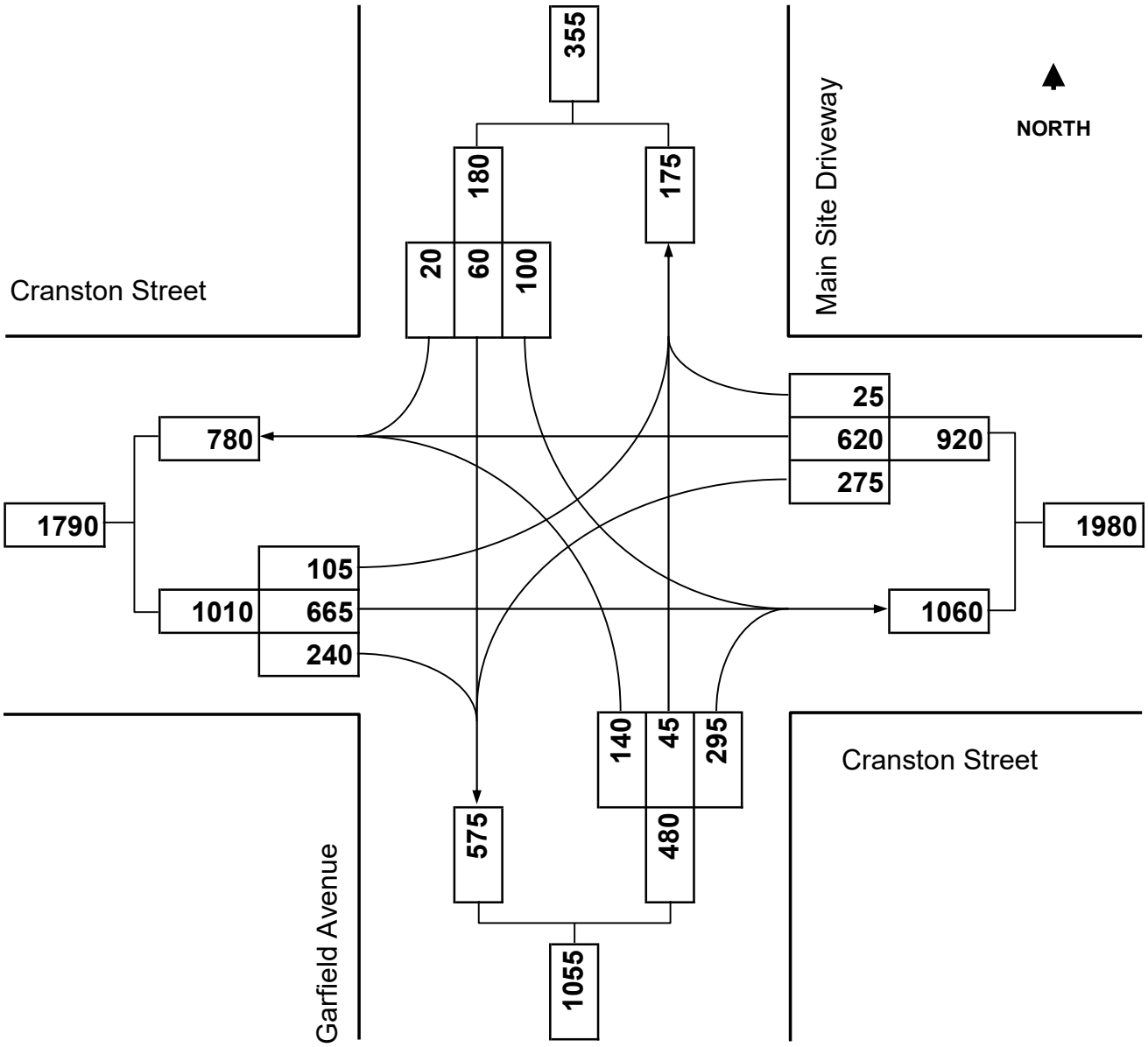
Cranston Street at Garfield Avenue/Main Site Access Driveway

Cranston Street at Garfield Avenue/Main Site Access Driveway

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Future Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3423		1719	3456			1803	1553		1821	
Flt Permitted	0.40	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (perm)	758	3423		1719	3456			1803	1553		1821	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	108	686	247	284	639	26	144	46	304	103	62	21
RTOR Reduction (vph)	0	39	0	0	3	0	0	0	262	0	5	0
Lane Group Flow (vph)	108	894	0	284	662	0	0	190	42	0	181	0
Heavy Vehicles (%)	0%	1%	2%	5%	4%	0%	2%	0%	4%	0%	0%	0%
Turn Type	Perm	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases		2		1	6		8	8		4	4	
Permitted Phases	2								8			
Actuated Green, G (s)	30.8	30.8		17.1	52.4			12.4	12.4		11.2	
Effective Green, g (s)	30.8	30.8		17.1	52.4			12.4	12.4		11.2	
Actuated g/C Ratio	0.34	0.34		0.19	0.58			0.14	0.14		0.12	
Clearance Time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Vehicle Extension (s)	2.5	2.5		2.5	2.5			2.5	2.5		2.5	
Lane Grp Cap (vph)	259	1171		326	2012			248	213		226	
v/s Ratio Prot		c0.26		c0.17	0.19			c0.11			c0.10	
v/s Ratio Perm	0.14								0.03			
v/c Ratio	0.42	0.76		0.87	0.33			0.77	0.20		0.80	
Uniform Delay, d1	22.7	26.4		35.4	9.7			37.4	34.4		38.3	
Progression Factor	1.00	1.00		1.09	1.11			1.00	1.00		1.00	
Incremental Delay, d2	4.9	4.8		18.5	0.4			12.7	0.3		17.2	
Delay (s)	27.6	31.1		57.1	11.1			50.1	34.7		55.5	
Level of Service	C	C		E	B			D	C		E	
Approach Delay (s)		30.7			24.9			40.6			55.5	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Configurations							
Traffic Volume (vph)	105	665	275	620	45	295	60
Future Volume (vph)	105	665	275	620	45	295	60
Lane Group Flow (vph)	108	933	284	665	190	304	186
Turn Type	Perm	NA	Prot	NA	NA	Perm	NA
Protected Phases		2	1	6	8		4
Permitted Phases	2					8	
Detector Phase	2	2	1	6	8	8	4
Switch Phase							
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	15.0	15.0	12.5	12.5	15.0
Total Split (s)	33.0	33.0	23.0	56.0	18.0	18.0	16.0
Total Split (%)	36.7%	36.7%	25.6%	62.2%	20.0%	20.0%	17.8%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	5.0	5.0	4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	C-Min	C-Min	None	C-Min	None	None	None
v/c Ratio	0.42	0.77	0.87	0.33	0.77	0.64	0.80
Control Delay	30.4	30.9	61.7	11.5	57.9	11.1	63.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.4	8.7
Total Delay	30.4	31.0	61.7	11.5	57.9	11.5	72.0
Queue Length 50th (ft)	49	242	151	85	104	0	101
Queue Length 95th (ft)	101	#321	m#272	163	#197	73	#209
Internal Link Dist (ft)		139		173	900		149
Turn Bay Length (ft)	100		300				
Base Capacity (vph)	258	1206	343	2013	270	491	241
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	2	0	0	0	24	32
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.77	0.83	0.33	0.70	0.65	0.89

Intersection Summary

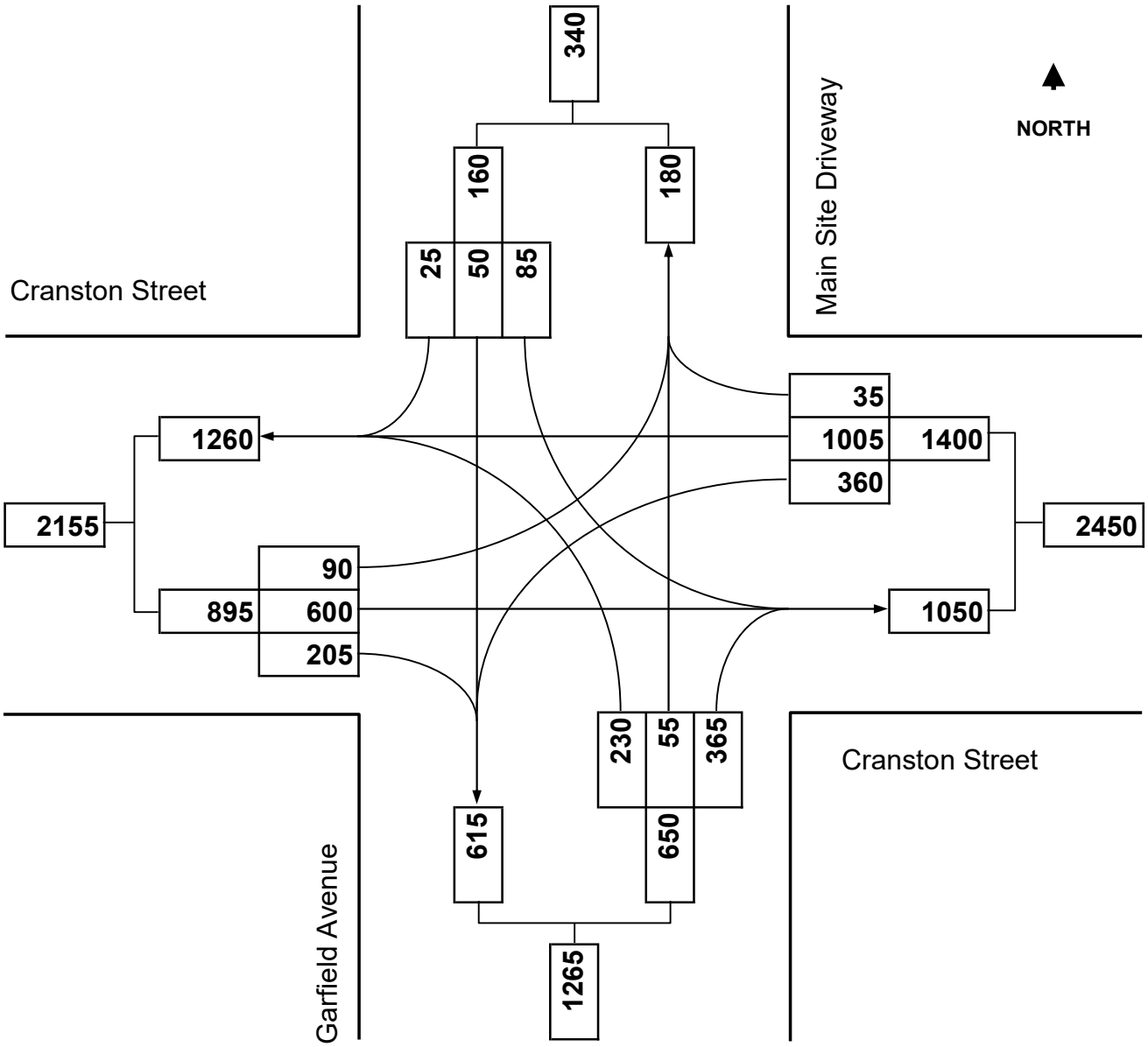
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Future Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3446		1770	3557			1812	1583		1812	
Flt Permitted	0.26	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (perm)	495	3446		1770	3557			1812	1583		1812	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	632	216	379	1058	37	242	58	384	89	53	26
RTOR Reduction (vph)	0	42	0	0	3	0	0	0	309	0	8	0
Lane Group Flow (vph)	95	806	0	379	1092	0	0	300	75	0	160	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	1%	0%	2%	0%	0%	0%
Turn Type	Perm	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases		2		1	6		8	8		4	4	
Permitted Phases	2								8			
Actuated Green, G (s)	19.3	19.3		18.1	41.9			15.6	15.6		8.5	
Effective Green, g (s)	19.3	19.3		18.1	41.9			15.6	15.6		8.5	
Actuated g/C Ratio	0.24	0.24		0.23	0.52			0.19	0.19		0.11	
Clearance Time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Vehicle Extension (s)	2.5	2.5		2.5	2.5			2.5	2.5		2.5	
Lane Grp Cap (vph)	119	831		400	1862			353	308		192	
v/s Ratio Prot		c0.23		c0.21	0.31			c0.17			c0.09	
v/s Ratio Perm	0.19								0.05			
v/c Ratio	0.80	0.97		0.95	0.59			0.85	0.24		0.83	
Uniform Delay, d1	28.5	30.1		30.5	13.1			31.1	27.2		35.1	
Progression Factor	1.00	1.00		1.14	1.20			1.00	1.00		1.00	
Incremental Delay, d2	41.2	24.8		25.2	1.0			16.9	0.3		25.1	
Delay (s)	69.7	54.8		60.0	16.7			48.0	27.5		60.1	
Level of Service	E	D		E	B			D	C		E	
Approach Delay (s)		56.3			27.8			36.5			60.1	
Approach LOS		E			C			D			E	

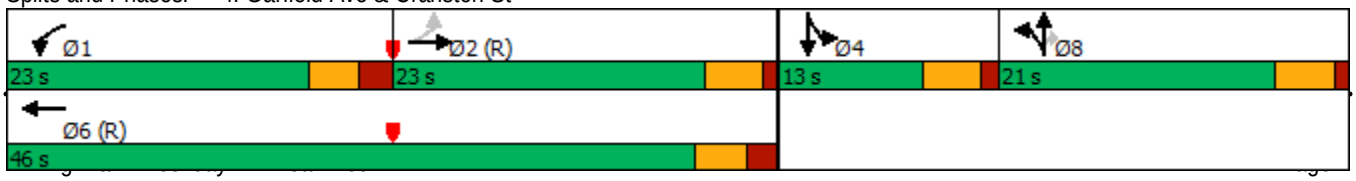
Intersection Summary			
HCM 2000 Control Delay	39.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Configurations							
Traffic Volume (vph)	90	600	360	1005	55	365	50
Future Volume (vph)	90	600	360	1005	55	365	50
Lane Group Flow (vph)	95	848	379	1095	300	384	168
Turn Type	Perm	NA	Prot	NA	NA	Perm	NA
Protected Phases		2	1	6	8		4
Permitted Phases	2					8	
Detector Phase	2	2	1	6	8	8	4
Switch Phase							
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	15.0	15.0	12.5	12.5	12.5
Total Split (s)	23.0	23.0	23.0	46.0	21.0	21.0	13.0
Total Split (%)	28.8%	28.8%	28.8%	57.5%	26.3%	26.3%	16.3%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	5.0	5.0	4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	C-Min	C-Min	None	C-Min	None	None	None
v/c Ratio	0.80	0.97	0.95	0.59	0.85	0.62	0.84
Control Delay	76.1	54.9	63.4	17.2	54.3	8.2	68.8
Queue Delay	0.0	0.2	0.0	0.0	0.0	0.2	0.7
Total Delay	76.1	55.1	63.4	17.2	54.3	8.4	69.5
Queue Length 50th (ft)	45	~215	209	223	144	0	79
Queue Length 95th (ft)	#133	#342	m#293	m238	#270	70	#188
Internal Link Dist (ft)		139		173	900		149
Turn Bay Length (ft)	100		300				
Base Capacity (vph)	119	872	401	1867	373	631	200
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	1	0	0	0	22	2
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.97	0.95	0.59	0.80	0.63	0.85

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

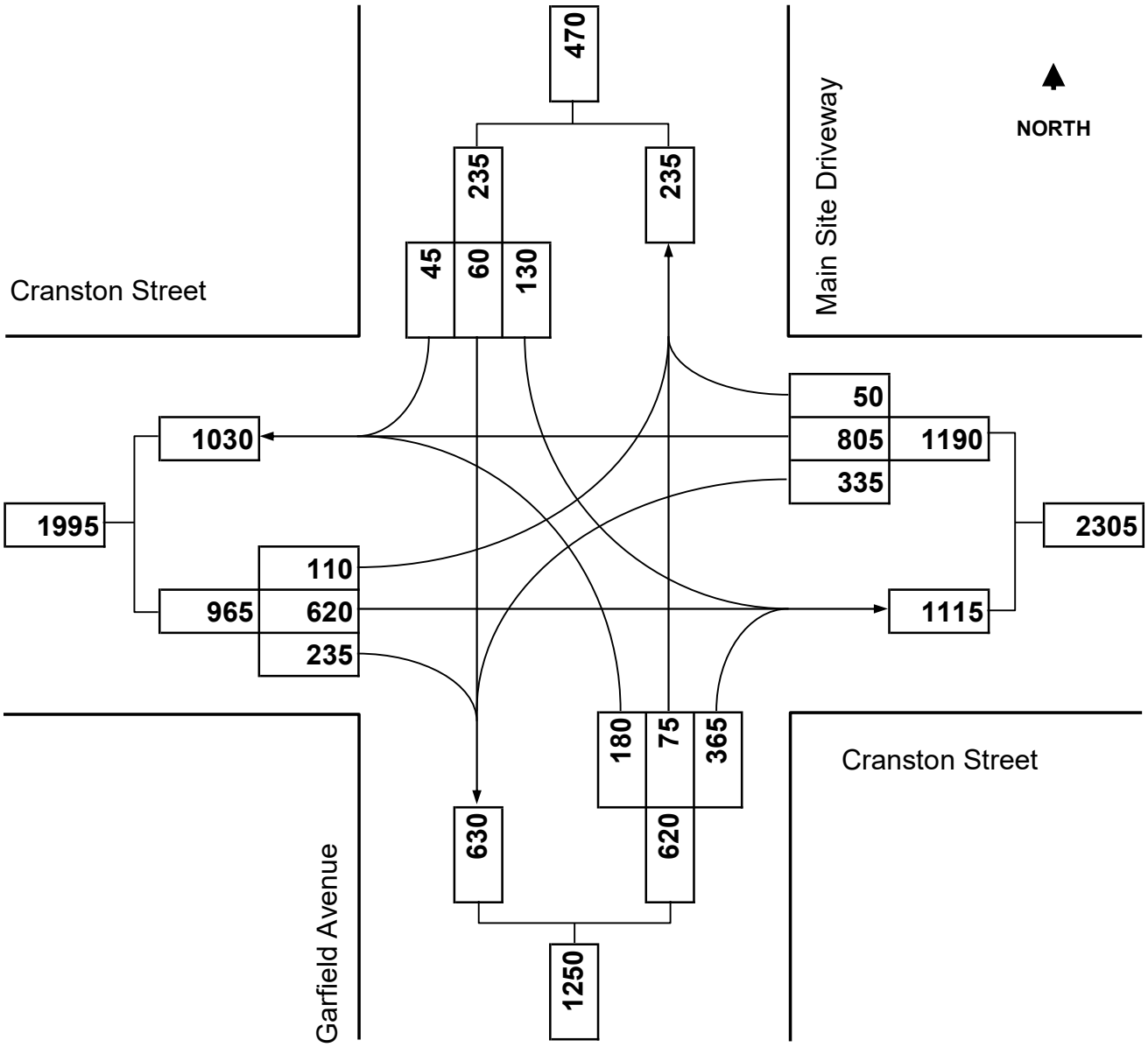
Splits and Phases: 4: Garfield Ave & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Future Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1805	3427		1787	3543			1824	1599		1802	
Flt Permitted	0.33	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (perm)	621	3427		1787	3543			1824	1599		1802	
Peak-hour factor, PHF	0.93	0.99	0.99	0.99	0.99	0.93	0.99	0.93	0.99	0.99	0.99	0.99
Adj. Flow (vph)	118	626	237	338	813	54	182	81	369	131	61	45
RTOR Reduction (vph)	0	44	0	0	5	0	0	0	309	0	9	0
Lane Group Flow (vph)	118	819	0	338	862	0	0	263	60	0	228	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type	Perm	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases		2		1	6		8	8		4	4	
Permitted Phases	2								8			
Actuated Green, G (s)	24.7	24.7		18.0	47.2			14.6	14.6		14.2	
Effective Green, g (s)	24.7	24.7		18.0	47.2			14.6	14.6		14.2	
Actuated g/C Ratio	0.27	0.27		0.20	0.52			0.16	0.16		0.16	
Clearance Time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Vehicle Extension (s)	2.5	2.5		2.5	2.5			2.5	2.5		2.5	
Lane Grp Cap (vph)	170	940		357	1858			295	259		284	
v/s Ratio Prot		c0.24		c0.19	0.24			c0.14			c0.13	
v/s Ratio Perm	0.19								0.04			
v/c Ratio	0.69	0.87		0.95	0.46			0.89	0.23		0.80	
Uniform Delay, d1	29.3	31.1		35.5	13.4			36.9	32.8		36.5	
Progression Factor	1.00	1.00		1.09	1.14			1.00	1.00		1.00	
Incremental Delay, d2	20.9	10.9		28.3	0.6			26.7	0.3		14.6	
Delay (s)	50.1	42.1		67.1	15.9			63.6	33.1		51.1	
Level of Service	D	D		E	B			E	C		D	
Approach Delay (s)		43.1			30.3			45.8			51.1	
Approach LOS		D			C			D			D	

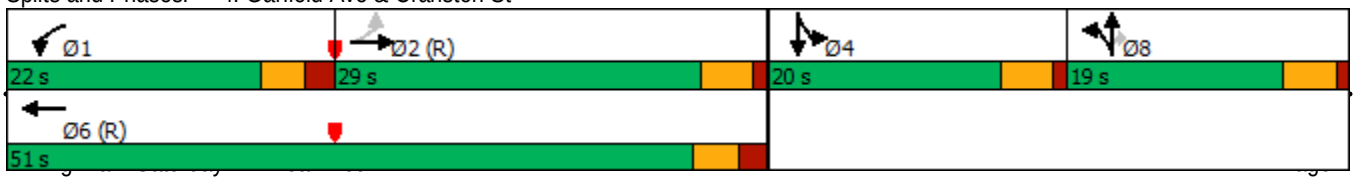
Intersection Summary			
HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Configurations							
Traffic Volume (vph)	110	620	335	805	75	365	60
Future Volume (vph)	110	620	335	805	75	365	60
Lane Group Flow (vph)	118	863	338	867	263	369	237
Turn Type	Perm	NA	Prot	NA	NA	Perm	NA
Protected Phases		2	1	6	8		4
Permitted Phases	2					8	
Detector Phase	2	2	1	6	8	8	4
Switch Phase							
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	15.0	15.0	12.5	12.5	12.5
Total Split (s)	29.0	29.0	22.0	51.0	19.0	19.0	20.0
Total Split (%)	32.2%	32.2%	24.4%	56.7%	21.1%	21.1%	22.2%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	5.0	5.0	4.5	4.5	4.5
Lead/Lag	Lag	Lag	Lead				
Lead-Lag Optimize?	Yes	Yes	Yes				
Recall Mode	C-Min	C-Min	Min	C-Min	Min	Min	None
v/c Ratio	0.69	0.88	0.95	0.47	0.89	0.65	0.81
Control Delay	53.0	40.7	71.9	16.3	69.2	9.9	56.3
Queue Delay	0.0	0.2	0.0	0.0	0.0	1.1	22.4
Total Delay	53.0	40.9	71.9	16.3	69.2	10.9	78.6
Queue Length 50th (ft)	60	231	~191	160	148	0	123
Queue Length 95th (ft)	#148	#341	m#338	m229	#289	79	#231
Internal Link Dist (ft)		139		173	900		149
Turn Bay Length (ft)	100		300				
Base Capacity (vph)	170	984	356	1862	300	571	319
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	5	0	0	0	63	77
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.88	0.95	0.47	0.88	0.73	0.98

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St



D

Future 2024 Build Weekday AM / PM / Saturday MD Peak Hour (Build Alternative 2)

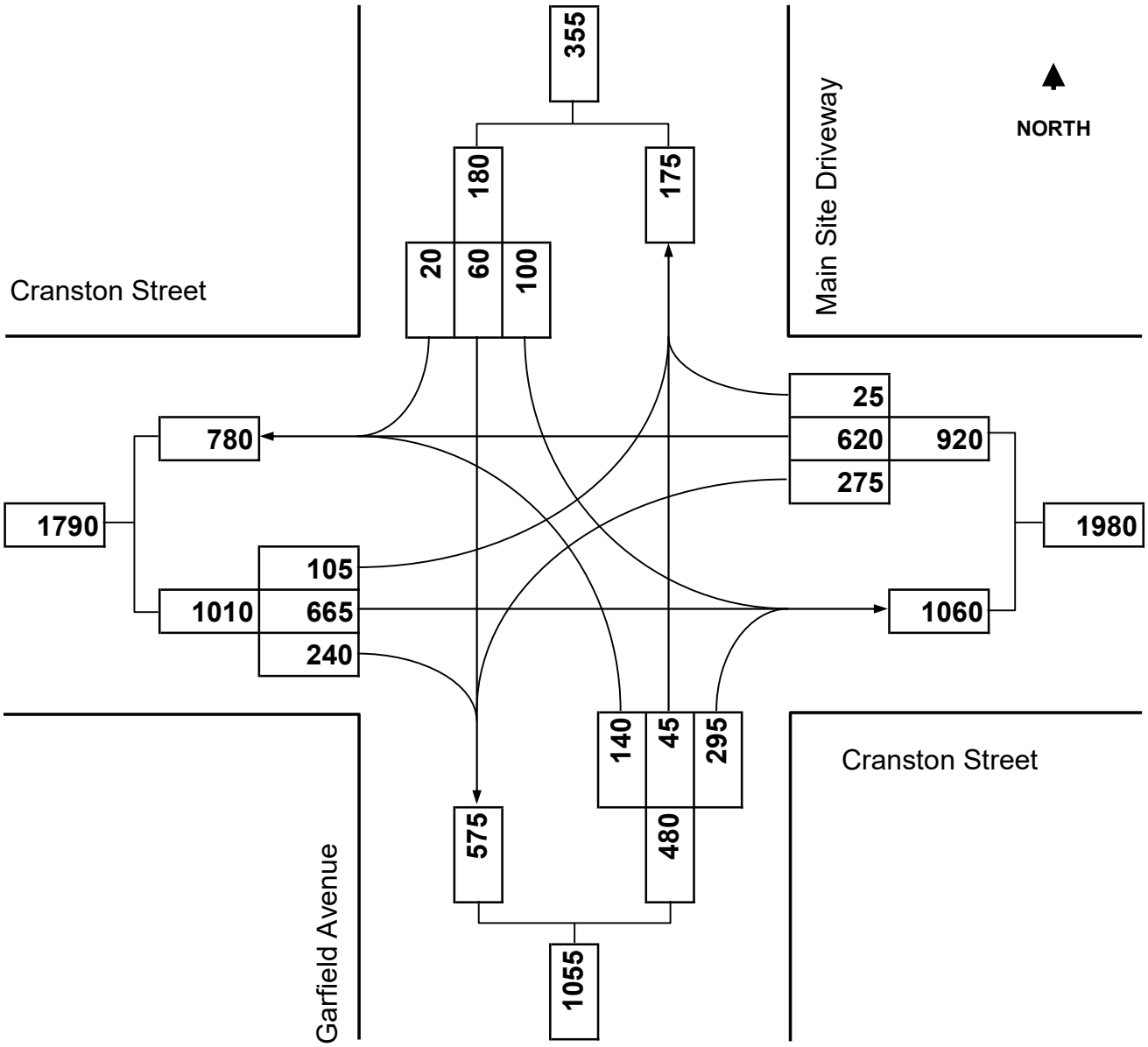
Cranston Street at Garfield Avenue/Main Site Access Driveway

Cranston Street at Garfield Avenue/Main Site Access Driveway

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Future Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3423		1719	3456			1803	1553		1821	
Flt Permitted	0.40	1.00		0.95	1.00			0.64	1.00		0.73	
Satd. Flow (perm)	758	3423		1719	3456			1193	1553		1359	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	108	686	247	284	639	26	144	46	304	103	62	21
RTOR Reduction (vph)	0	36	0	0	3	0	0	0	206	0	6	0
Lane Group Flow (vph)	108	897	0	284	662	0	0	190	98	0	180	0
Heavy Vehicles (%)	0%	1%	2%	5%	4%	0%	2%	0%	4%	0%	0%	0%
Turn Type	Perm	NA		Prot	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases		2		1	6		3	3 8			4	
Permitted Phases	2						3 8		3 8	4		
Actuated Green, G (s)	28.3	28.3		18.8	51.6			28.9	28.9		15.9	
Effective Green, g (s)	28.3	28.3		18.8	51.6			28.9	28.9		15.9	
Actuated g/C Ratio	0.31	0.31		0.21	0.57			0.32	0.32		0.18	
Clearance Time (s)	4.5	4.5		5.0	5.0						4.5	
Vehicle Extension (s)	2.5	2.5		2.5	2.5						2.5	
Lane Grp Cap (vph)	238	1076		359	1981			440	498		240	
v/s Ratio Prot		c0.26		c0.17	0.19			c0.04				
v/s Ratio Perm	0.14							0.10	0.06		c0.13	
v/c Ratio	0.45	0.83		0.79	0.33			0.43	0.20		0.75	
Uniform Delay, d1	24.7	28.7		33.7	10.1			24.1	22.1		35.2	
Progression Factor	1.00	1.00		1.10	1.17			1.00	1.00		1.00	
Incremental Delay, d2	6.1	7.6		9.3	0.4			0.7	0.2		11.9	
Delay (s)	30.8	36.3		46.2	12.3			24.8	22.3		47.0	
Level of Service	C	D		D	B			C	C		D	
Approach Delay (s)		35.7			22.4			23.3			47.0	
Approach LOS		D			C			C			D	

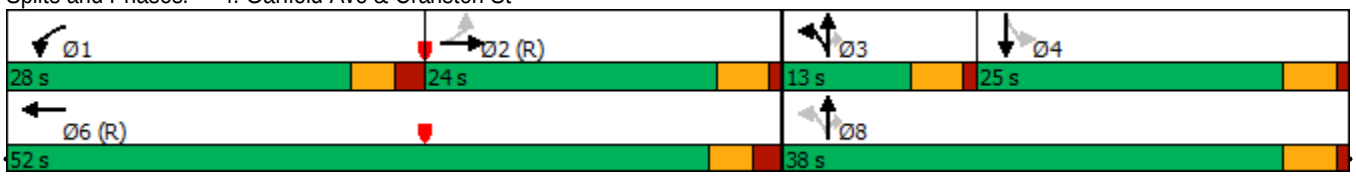
Intersection Summary			
HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	Ø8
Lane Configurations										
Traffic Volume (vph)	105	665	275	620	140	45	295	100	60	
Future Volume (vph)	105	665	275	620	140	45	295	100	60	
Lane Group Flow (vph)	108	933	284	665	0	190	304	0	186	
Turn Type	Perm	NA	Prot	NA	pm+pt	NA	Perm	Perm	NA	
Protected Phases		2	1	6	3	3 8			4	8
Permitted Phases	2				3 8		3 8	4		
Detector Phase	2	2	1	6	3	3 8	3 8	4	4	
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0			8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	15.0	15.0	12.5			15.0	15.0	12.5
Total Split (s)	24.0	24.0	28.0	52.0	13.0			25.0	25.0	38.0
Total Split (%)	26.7%	26.7%	31.1%	57.8%	14.4%			27.8%	27.8%	42%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					0.0	
Total Lost Time (s)	4.5	4.5	5.0	5.0					4.5	
Lead/Lag	Lag	Lag	Lead		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes		Yes			Yes	Yes	
Recall Mode	C-Min	C-Min	None	C-Min	None			None	None	None
v/c Ratio	0.46	0.84	0.79	0.34		0.43	0.43		0.76	
Control Delay	37.1	38.5	50.3	13.1		25.5	4.5		52.5	
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.1		1.8	
Total Delay	37.1	38.6	50.3	13.1		25.5	4.7		54.4	
Queue Length 50th (ft)	50	251	157	96		80	0		97	
Queue Length 95th (ft)	#134	#453	m237	195		126	51		162	
Internal Link Dist (ft)		139		173		900			149	
Turn Bay Length (ft)	100		300							
Base Capacity (vph)	237	1109	439	1982		501	768		314	
Starvation Cap Reductn	0	0	0	0		0	0		0	
Spillback Cap Reductn	0	2	0	0		0	75		44	
Storage Cap Reductn	0	0	0	0		0	0		0	
Reduced v/c Ratio	0.46	0.84	0.65	0.34		0.38	0.44		0.69	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

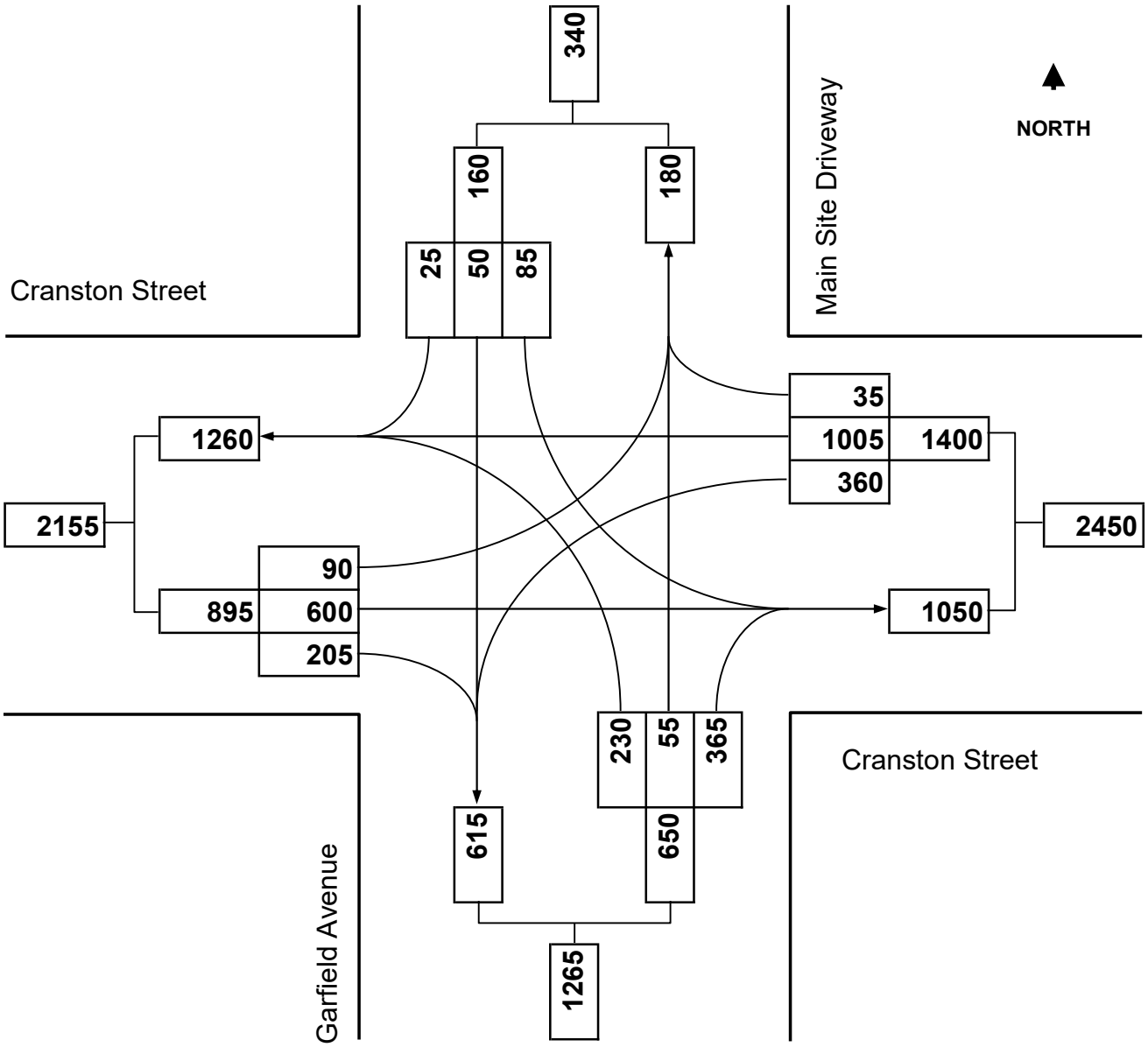
Splits and Phases: 4: Garfield Ave & Cranston St



www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Future Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3446		1770	3557			1812	1583		1812	
Flt Permitted	0.26	1.00		0.95	1.00			0.61	1.00		0.68	
Satd. Flow (perm)	495	3446		1770	3557			1152	1583		1268	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	632	216	379	1058	37	242	58	384	89	53	26
RTOR Reduction (vph)	0	42	0	0	3	0	0	0	263	0	9	0
Lane Group Flow (vph)	95	806	0	379	1092	0	0	300	121	0	159	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	1%	0%	2%	0%	0%	0%
Turn Type	Perm	NA		Prot	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases		2		1	6		3	3 8			4	
Permitted Phases	2						3 8		3 8	4		
Actuated Green, G (s)	21.5	21.5		19.2	45.2			25.3	25.3		11.9	
Effective Green, g (s)	21.5	21.5		19.2	45.2			25.3	25.3		11.9	
Actuated g/C Ratio	0.27	0.27		0.24	0.57			0.32	0.32		0.15	
Clearance Time (s)	4.5	4.5		5.0	5.0						4.5	
Vehicle Extension (s)	2.5	2.5		2.5	2.5						2.5	
Lane Grp Cap (vph)	133	926		424	2009			437	500		188	
v/s Ratio Prot		c0.23		c0.21	0.31			c0.08				
v/s Ratio Perm	0.19							0.14	0.08		c0.13	
v/c Ratio	0.71	0.87		0.89	0.54			0.69	0.24		0.85	
Uniform Delay, d1	26.5	27.9		29.4	10.9			23.9	20.3		33.2	
Progression Factor	1.00	1.00		1.14	1.20			1.00	1.00		1.00	
Incremental Delay, d2	27.8	11.0		15.7	0.8			4.4	0.3		27.8	
Delay (s)	54.3	38.9		49.2	13.9			28.3	20.5		61.0	
Level of Service	D	D		D	B			C	C		E	
Approach Delay (s)		40.5			22.9			23.9			61.0	
Approach LOS		D			C			C			E	

Intersection Summary			
HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	Ø8
Lane Configurations										
Traffic Volume (vph)	90	600	360	1005	230	55	365	85	50	
Future Volume (vph)	90	600	360	1005	230	55	365	85	50	
Lane Group Flow (vph)	95	848	379	1095	0	300	384	0	168	
Turn Type	Perm	NA	Prot	NA	pm+pt	NA	Perm	Perm	NA	
Protected Phases		2	1	6	3	3 8			4	8
Permitted Phases	2				3 8		3 8	4		
Detector Phase	2	2	1	6	3	3 8	3 8	4	4	
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0			8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	15.0	15.0	12.5			12.5	12.5	12.5
Total Split (s)	25.0	25.0	25.0	50.0	13.0			17.0	17.0	30.0
Total Split (%)	31.3%	31.3%	31.3%	62.5%	16.3%			21.3%	21.3%	38%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					0.0	
Total Lost Time (s)	4.5	4.5	5.0	5.0					4.5	
Lead/Lag	Lag	Lag	Lead		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes		Yes			Yes	Yes	
Recall Mode	C-Min	C-Min	None	C-Min	None			None	None	None
v/c Ratio	0.71	0.88	0.89	0.54		0.68	0.50		0.85	
Control Delay	59.8	38.9	53.0	14.1		32.1	5.0		68.3	
Queue Delay	0.0	0.0	0.0	0.0		0.0	0.1		2.9	
Total Delay	59.8	38.9	53.0	14.1		32.1	5.1		71.2	
Queue Length 50th (ft)	44	203	208	212		121	0		77	
Queue Length 95th (ft)	#126	#316	m#268	m224		#200	58		#184	
Internal Link Dist (ft)		139		173		900			149	
Turn Bay Length (ft)	100		300							
Base Capacity (vph)	133	966	442	2011		440	766		206	
Starvation Cap Reductn	0	0	0	0		0	0		0	
Spillback Cap Reductn	0	1	0	0		0	31		9	
Storage Cap Reductn	0	0	0	0		0	0		0	
Reduced v/c Ratio	0.71	0.88	0.86	0.54		0.68	0.52		0.85	

Intersection Summary

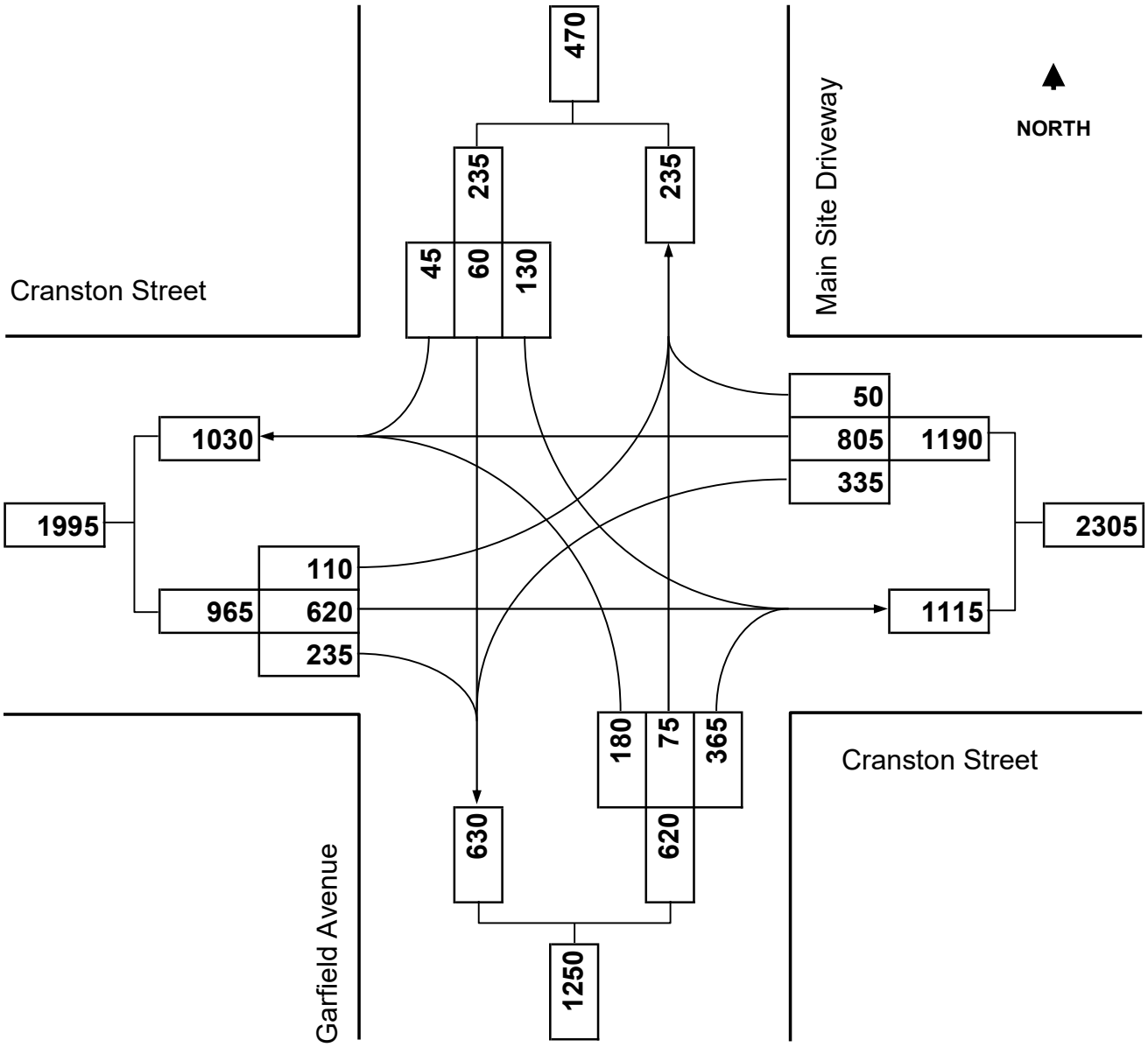
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Future Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1805	3427		1787	3543			1824	1599		1802	
Flt Permitted	0.33	1.00		0.95	1.00			0.65	1.00		0.69	
Satd. Flow (perm)	621	3427		1787	3543			1220	1599		1278	
Peak-hour factor, PHF	0.93	0.99	0.99	0.99	0.99	0.93	0.99	0.93	0.99	0.99	0.99	0.99
Adj. Flow (vph)	118	626	237	338	813	54	182	81	369	131	61	45
RTOR Reduction (vph)	0	41	0	0	5	0	0	0	238	0	9	0
Lane Group Flow (vph)	118	822	0	338	862	0	0	263	131	0	228	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type	Perm	NA		Prot	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases		2		1	6		3	3 8			4	
Permitted Phases	2						3 8		3 8	4		
Actuated Green, G (s)	23.9	23.9		20.1	48.5			32.0	32.0		19.0	
Effective Green, g (s)	23.9	23.9		20.1	48.5			32.0	32.0		19.0	
Actuated g/C Ratio	0.27	0.27		0.22	0.54			0.36	0.36		0.21	
Clearance Time (s)	4.5	4.5		5.0	5.0						4.5	
Vehicle Extension (s)	2.5	2.5		2.5	2.5						2.5	
Lane Grp Cap (vph)	164	910		399	1909			490	568		269	
v/s Ratio Prot		c0.24		c0.19	0.24			c0.05				
v/s Ratio Perm	0.19							0.14	0.08		c0.18	
v/c Ratio	0.72	0.90		0.85	0.45			0.54	0.23		0.85	
Uniform Delay, d1	30.0	31.9		33.5	12.6			23.1	20.4		34.1	
Progression Factor	1.00	1.00		1.10	1.18			1.00	1.00		1.00	
Incremental Delay, d2	23.7	14.0		11.9	0.6			1.1	0.2		20.7	
Delay (s)	53.7	45.9		48.6	15.5			24.2	20.6		54.8	
Level of Service	D	D		D	B			C	C		D	
Approach Delay (s)		46.8			24.8			22.1			54.8	
Approach LOS		D			C			C			D	

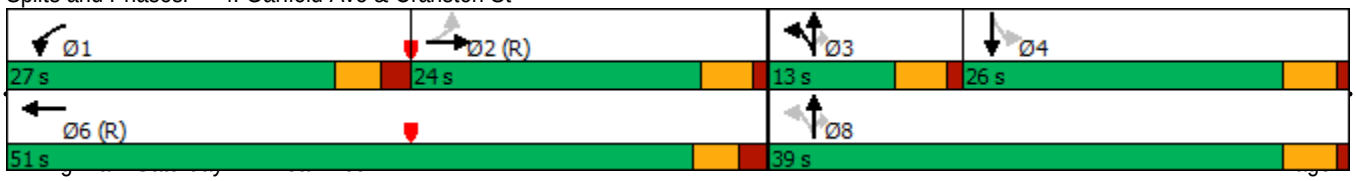
Intersection Summary			
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	Ø8
Lane Configurations										
Traffic Volume (vph)	110	620	335	805	180	75	365	130	60	
Future Volume (vph)	110	620	335	805	180	75	365	130	60	
Lane Group Flow (vph)	118	863	338	867	0	263	369	0	237	
Turn Type	Perm	NA	Prot	NA	pm+pt	NA	Perm	Perm	NA	
Protected Phases		2	1	6	3	3 8			4	8
Permitted Phases	2				3 8		3 8	4		
Detector Phase	2	2	1	6	3	3 8	3 8	4	4	
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0			8.0	8.0	8.0
Minimum Split (s)	14.5	14.5	15.0	15.0	12.5			12.5	12.5	12.5
Total Split (s)	24.0	24.0	27.0	51.0	13.0			26.0	26.0	39.0
Total Split (%)	26.7%	26.7%	30.0%	56.7%	14.4%			28.9%	28.9%	43%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5			3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0			1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0					0.0	
Total Lost Time (s)	4.5	4.5	5.0	5.0					4.5	
Lead/Lag	Lag	Lag	Lead		Lead			Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes		Yes			Yes	Yes	
Recall Mode	C-Min	C-Min	Min	C-Min	None			None	None	None
v/c Ratio	0.72	0.91	0.85	0.45		0.54	0.46		0.85	
Control Delay	60.2	47.1	52.8	16.2		25.9	4.2		59.2	
Queue Delay	0.0	0.2	0.0	0.0		0.0	0.3		17.1	
Total Delay	60.2	47.3	52.8	16.2		25.9	4.4		76.4	
Queue Length 50th (ft)	65	~282	190	179		106	0		120	
Queue Length 95th (ft)	#168	#403	m#276	m250		170	54		#234	
Internal Link Dist (ft)		139		173		900			149	
Turn Bay Length (ft)	100		300							
Base Capacity (vph)	164	951	436	1914		525	840		314	
Starvation Cap Reductn	0	0	0	0		0	0		0	
Spillback Cap Reductn	0	3	0	0		0	113		66	
Storage Cap Reductn	0	0	0	0		0	0		0	
Reduced v/c Ratio	0.72	0.91	0.78	0.45		0.50	0.51		0.96	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St



D

Future 2024 Build Weekday AM / PM / Saturday MD Peak Hour (Build Alternative 3)

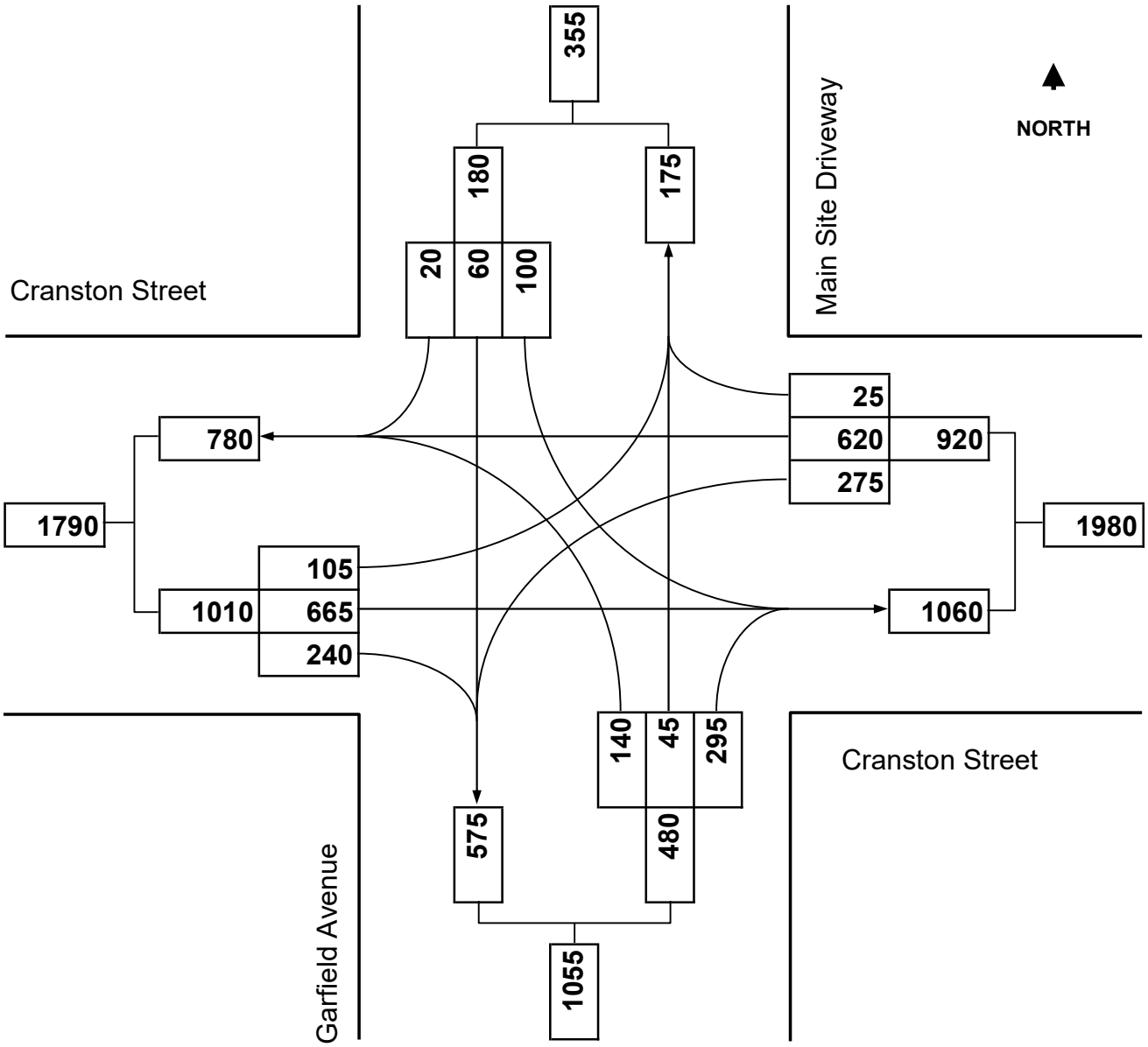
Cranston Street at Garfield Avenue/Main Site Access Driveway

Cranston Street at Garfield Avenue/Main Site Access Driveway

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Future Volume (vph)	105	665	240	275	620	25	140	45	295	100	60	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3423		1719	3456			1803	1553		1821	
Flt Permitted	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (perm)	1805	3423		1719	3456			1803	1553		1821	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	108	686	247	284	639	26	144	46	304	103	62	21
RTOR Reduction (vph)	0	38	0	0	3	0	0	0	264	0	5	0
Lane Group Flow (vph)	108	895	0	284	662	0	0	190	40	0	181	0
Heavy Vehicles (%)	0%	1%	2%	5%	4%	0%	2%	0%	4%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)	8.5	30.5		17.5	39.5			11.9	11.9		11.6	
Effective Green, g (s)	8.5	30.5		17.5	39.5			11.9	11.9		11.6	
Actuated g/C Ratio	0.09	0.34		0.19	0.44			0.13	0.13		0.13	
Clearance Time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Vehicle Extension (s)	3.0	2.5		2.5	2.5			2.5	2.5		2.5	
Lane Grp Cap (vph)	170	1160		334	1516			238	205		234	
v/s Ratio Prot	0.06	c0.26		c0.17	0.19			c0.11			c0.10	
v/s Ratio Perm									0.03			
v/c Ratio	0.64	0.77		0.85	0.44			0.80	0.20		0.77	
Uniform Delay, d1	39.3	26.6		35.0	17.5			37.9	34.8		37.9	
Progression Factor	1.00	1.00		1.10	1.03			1.00	1.00		1.00	
Incremental Delay, d2	7.5	5.0		15.5	0.8			16.3	0.3		14.1	
Delay (s)	46.8	31.6		54.0	18.7			54.2	35.1		52.0	
Level of Service	D	C		D	B			D	D		D	
Approach Delay (s)		33.2			29.3			42.5			52.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	34.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Configurations							
Traffic Volume (vph)	105	665	275	620	45	295	60
Future Volume (vph)	105	665	275	620	45	295	60
Lane Group Flow (vph)	108	933	284	665	190	304	186
Turn Type	Prot	NA	Prot	NA	NA	Perm	NA
Protected Phases	5	2	1	6	8		4
Permitted Phases						8	
Detector Phase	5	2	1	6	8	8	4
Switch Phase							
Minimum Initial (s)	8.0	10.0	10.0	10.0	8.0	8.0	8.0
Minimum Split (s)	12.5	14.5	15.0	15.0	12.5	12.5	12.5
Total Split (s)	13.0	32.0	24.0	43.0	17.0	17.0	17.0
Total Split (%)	14.4%	35.6%	26.7%	47.8%	18.9%	18.9%	18.9%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	5.0	5.0	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			
Recall Mode	None	C-Min	None	C-Min	None	None	None
v/c Ratio	0.63	0.78	0.85	0.44	0.80	0.65	0.78
Control Delay	57.0	31.8	58.6	19.3	62.8	11.6	58.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.4	5.2
Total Delay	57.0	31.8	58.6	19.3	62.8	12.1	63.9
Queue Length 50th (ft)	60	246	147	130	106	0	99
Queue Length 95th (ft)	#130	#354	m#260	192	#209	74	#196
Internal Link Dist (ft)		139		173	900		149
Turn Bay Length (ft)	100		300				
Base Capacity (vph)	173	1194	362	1518	250	477	258
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	2	0	0	0	24	34
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.78	0.78	0.44	0.76	0.67	0.83

Intersection Summary

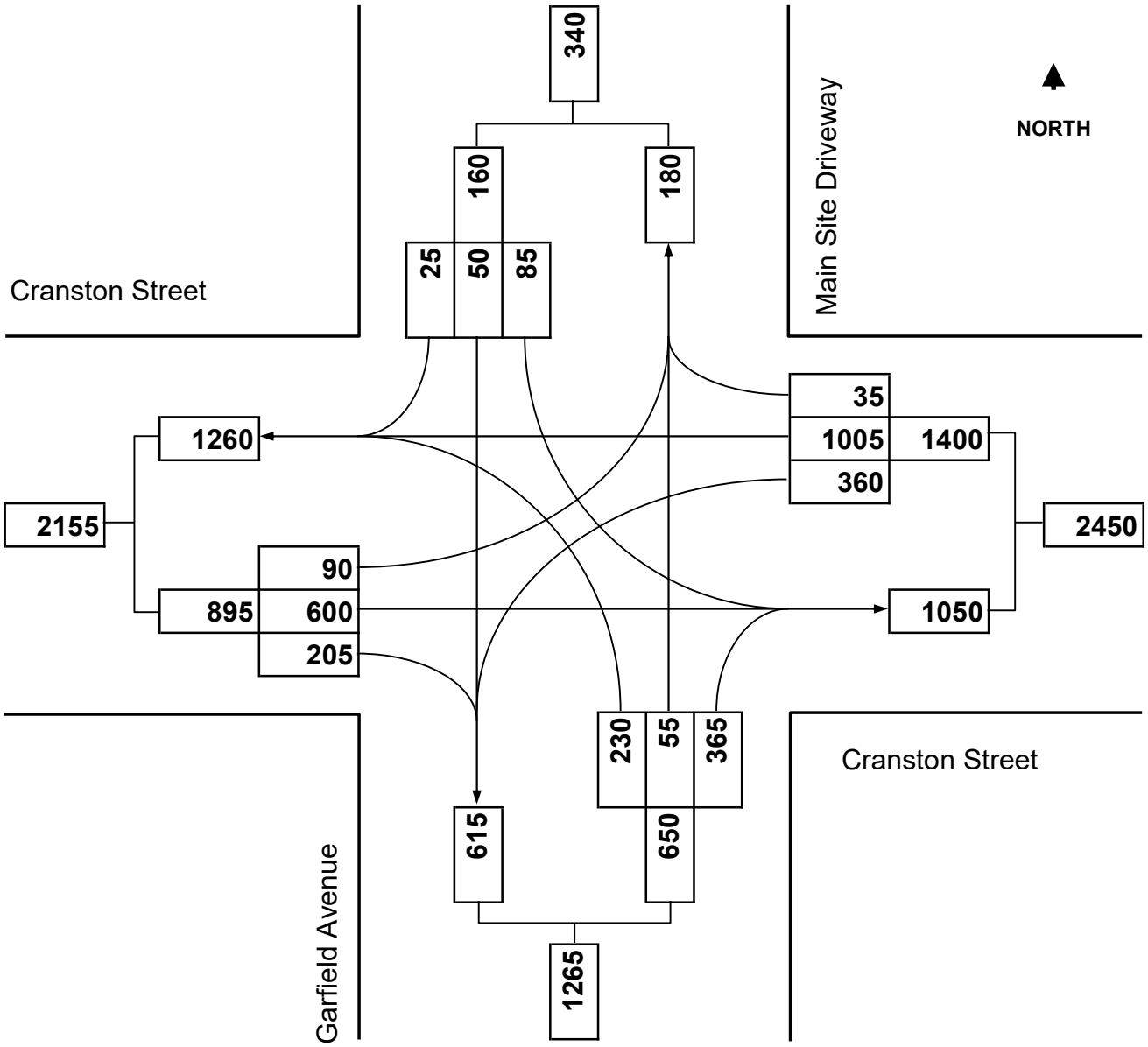
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 75
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

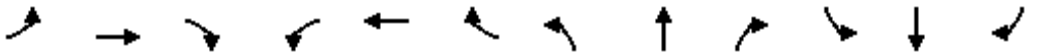
Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Weekday
Reference No.:	7578	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2024 Build





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Future Volume (vph)	90	600	205	360	1005	35	230	55	365	85	50	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (prot)	1805	3446		1770	3557			1812	1583		1812	
Flt Permitted	0.95	1.00		0.95	1.00			0.96	1.00		0.97	
Satd. Flow (perm)	1805	3446		1770	3557			1812	1583		1812	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	632	216	379	1058	37	242	58	384	89	53	26
RTOR Reduction (vph)	0	42	0	0	3	0	0	0	315	0	8	0
Lane Group Flow (vph)	95	806	0	379	1092	0	0	300	69	0	160	0
Heavy Vehicles (%)	0%	1%	0%	2%	1%	0%	1%	0%	2%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)	6.7	20.5		18.1	31.9			14.4	14.4		8.5	
Effective Green, g (s)	6.7	20.5		18.1	31.9			14.4	14.4		8.5	
Actuated g/C Ratio	0.08	0.26		0.23	0.40			0.18	0.18		0.11	
Clearance Time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Vehicle Extension (s)	3.0	2.5		2.5	2.5			2.5	2.5		2.5	
Lane Grp Cap (vph)	151	883		400	1418			326	284		192	
v/s Ratio Prot	0.05	c0.23		c0.21	0.31			c0.17			c0.09	
v/s Ratio Perm									0.04			
v/c Ratio	0.63	0.91		0.95	0.77			0.92	0.24		0.83	
Uniform Delay, d1	35.4	28.9		30.5	20.9			32.2	28.1		35.1	
Progression Factor	1.00	1.00		1.14	1.07			1.00	1.00		1.00	
Incremental Delay, d2	8.0	15.3		25.2	2.9			30.2	0.3		25.1	
Delay (s)	43.4	44.2		59.9	25.2			62.4	28.5		60.1	
Level of Service	D	D		E	C			E	C		E	
Approach Delay (s)		44.1			34.1			43.3			60.1	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Configurations							
Traffic Volume (vph)	90	600	360	1005	55	365	50
Future Volume (vph)	90	600	360	1005	55	365	50
Lane Group Flow (vph)	95	848	379	1095	300	384	168
Turn Type	Prot	NA	Prot	NA	NA	Perm	NA
Protected Phases	5	2	1	6	8		4
Permitted Phases						8	
Detector Phase	5	2	1	6	8	8	4
Switch Phase							
Minimum Initial (s)	8.0	10.0	10.0	10.0	8.0	8.0	8.0
Minimum Split (s)	12.5	14.5	15.0	15.0	12.5	12.5	12.5
Total Split (s)	13.0	25.0	23.0	35.0	19.0	19.0	13.0
Total Split (%)	16.3%	31.3%	28.8%	43.8%	23.8%	23.8%	16.3%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	5.0	5.0	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			
Recall Mode	None	C-Min	None	C-Min	None	None	None
v/c Ratio	0.51	0.92	0.95	0.75	0.92	0.64	0.84
Control Delay	44.0	43.3	64.1	25.6	67.6	8.9	68.8
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.2	1.9
Total Delay	44.0	43.4	64.1	25.6	67.6	9.1	70.7
Queue Length 50th (ft)	46	203	209	224	149	0	79
Queue Length 95th (ft)	93	#316	m#293	m256	#294	74	#188
Internal Link Dist (ft)		139		173	900		149
Turn Bay Length (ft)	100		300				
Base Capacity (vph)	191	926	399	1460	328	601	200
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	1	0	0	0	16	5
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.92	0.95	0.75	0.91	0.66	0.86

Intersection Summary

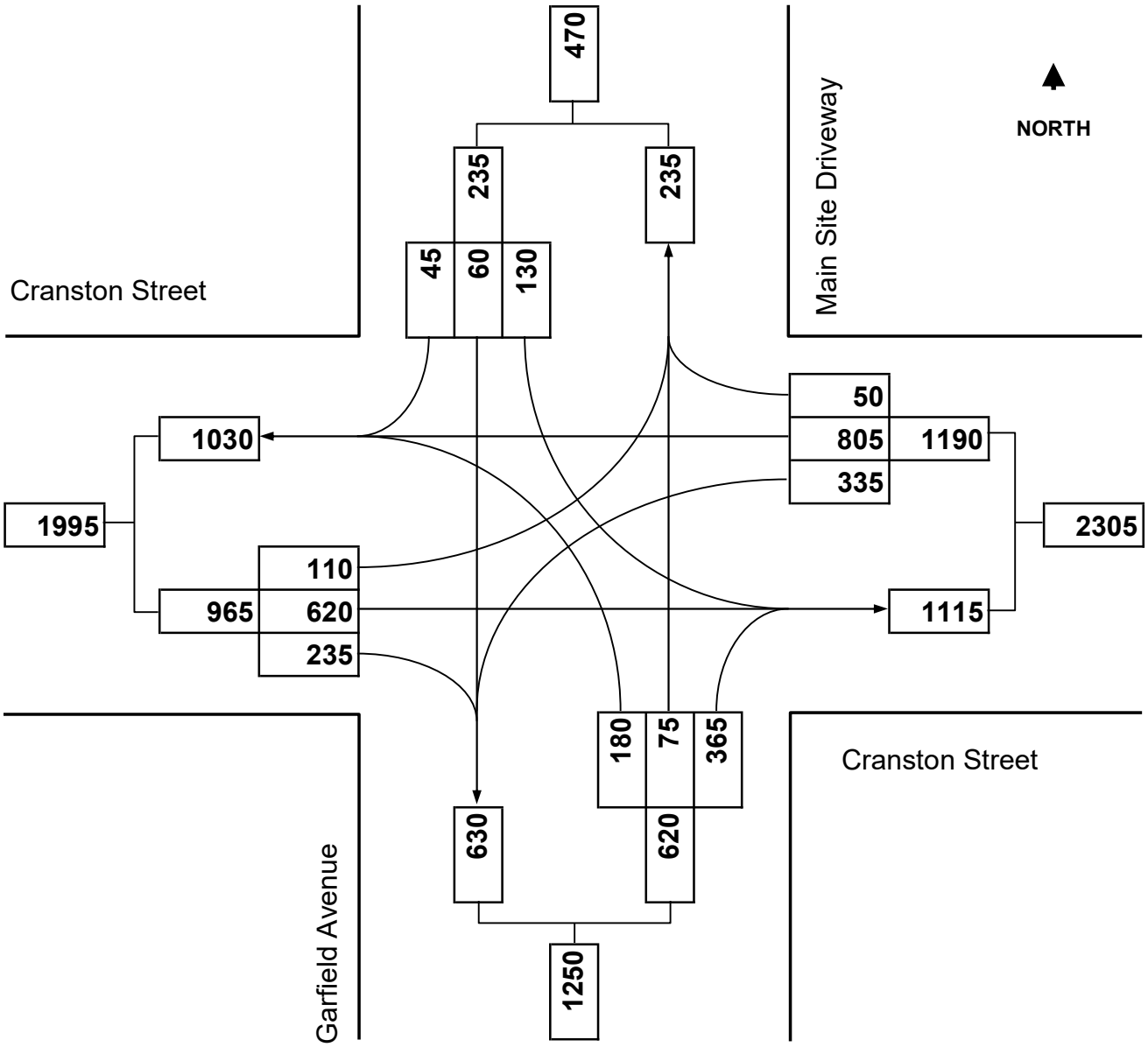
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 90
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St

www.BETA-Inc.com

Turning Movement Diagram

Major Street:	Cranston Street	**Minor Street**:	Garfield Ave./Main Site Dwy.
City/Town:	Cranston, RI	**Day of Week**:	Saturday
Reference No.:	7578	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2024 Build



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Future Volume (vph)	110	620	235	335	805	50	180	75	365	130	60	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00	1.00		1.00	
Frt	1.00	0.96		1.00	0.99			1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (prot)	1805	3427		1787	3543			1824	1599		1802	
Flt Permitted	0.95	1.00		0.95	1.00			0.97	1.00		0.97	
Satd. Flow (perm)	1805	3427		1787	3543			1824	1599		1802	
Peak-hour factor, PHF	0.93	0.99	0.99	0.99	0.99	0.93	0.99	0.93	0.99	0.99	0.99	0.99
Adj. Flow (vph)	118	626	237	338	813	54	182	81	369	131	61	45
RTOR Reduction (vph)	0	44	0	0	5	0	0	0	310	0	9	0
Lane Group Flow (vph)	118	819	0	338	862	0	0	263	59	0	228	0
Heavy Vehicles (%)	0%	1%	1%	1%	1%	0%	1%	0%	1%	0%	0%	0%
Turn Type	Prot	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases									8			
Actuated Green, G (s)	8.4	26.3		18.0	35.9			14.3	14.3		12.9	
Effective Green, g (s)	8.4	26.3		18.0	35.9			14.3	14.3		12.9	
Actuated g/C Ratio	0.09	0.29		0.20	0.40			0.16	0.16		0.14	
Clearance Time (s)	4.5	4.5		5.0	5.0			4.5	4.5		4.5	
Vehicle Extension (s)	3.0	2.5		2.5	2.5			2.5	2.5		2.5	
Lane Grp Cap (vph)	168	1001		357	1413			289	254		258	
v/s Ratio Prot	0.07	c0.24		c0.19	0.24			c0.14			c0.13	
v/s Ratio Perm									0.04			
v/c Ratio	0.70	0.82		0.95	0.61			0.91	0.23		0.88	
Uniform Delay, d1	39.6	29.6		35.5	21.5			37.2	33.0		37.8	
Progression Factor	1.00	1.00		1.10	1.07			1.00	1.00		1.00	
Incremental Delay, d2	12.5	7.4		28.3	1.5			30.7	0.3		27.6	
Delay (s)	52.1	37.1		67.3	24.5			67.9	33.4		65.4	
Level of Service	D	D		E	C			E	C		E	
Approach Delay (s)		38.9			36.5			47.7			65.4	
Approach LOS		D			D			D			E	

Intersection Summary			
HCM 2000 Control Delay	41.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	18.5
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	WBL	WBT	NBT	NBR	SBT
Lane Configurations							
Traffic Volume (vph)	110	620	335	805	75	365	60
Future Volume (vph)	110	620	335	805	75	365	60
Lane Group Flow (vph)	118	863	338	867	263	369	237
Turn Type	Prot	NA	Prot	NA	NA	Perm	NA
Protected Phases	5	2	1	6	8		4
Permitted Phases						8	
Detector Phase	5	2	1	6	8	8	4
Switch Phase							
Minimum Initial (s)	8.0	10.0	10.0	10.0	8.0	8.0	8.0
Minimum Split (s)	12.5	14.5	15.0	15.0	12.5	12.5	12.5
Total Split (s)	13.0	31.0	23.0	41.0	19.0	19.0	17.0
Total Split (%)	14.4%	34.4%	25.6%	45.6%	21.1%	21.1%	18.9%
Yellow Time (s)	3.5	3.5	3.0	3.0	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	2.0	2.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	4.5	5.0	5.0	4.5	4.5	4.5
Lead/Lag	Lead	Lag	Lead	Lag			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			
Recall Mode	None	C-Min	Min	C-Min	Min	Min	None
v/c Ratio	0.70	0.83	0.95	0.61	0.91	0.65	0.88
Control Delay	62.9	35.7	70.6	24.7	72.5	10.0	70.3
Queue Delay	0.0	0.1	0.0	0.0	0.0	1.2	52.0
Total Delay	62.9	35.8	70.6	24.7	72.5	11.2	122.3
Queue Length 50th (ft)	66	223	191	195	148	0	129
Queue Length 95th (ft)	#147	298	m#326	m251	#289	79	#268
Internal Link Dist (ft)		139		173	900		149
Turn Bay Length (ft)	100		300				
Base Capacity (vph)	170	1057	357	1432	294	567	268
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	5	0	0	0	67	54
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.82	0.95	0.61	0.89	0.74	1.11

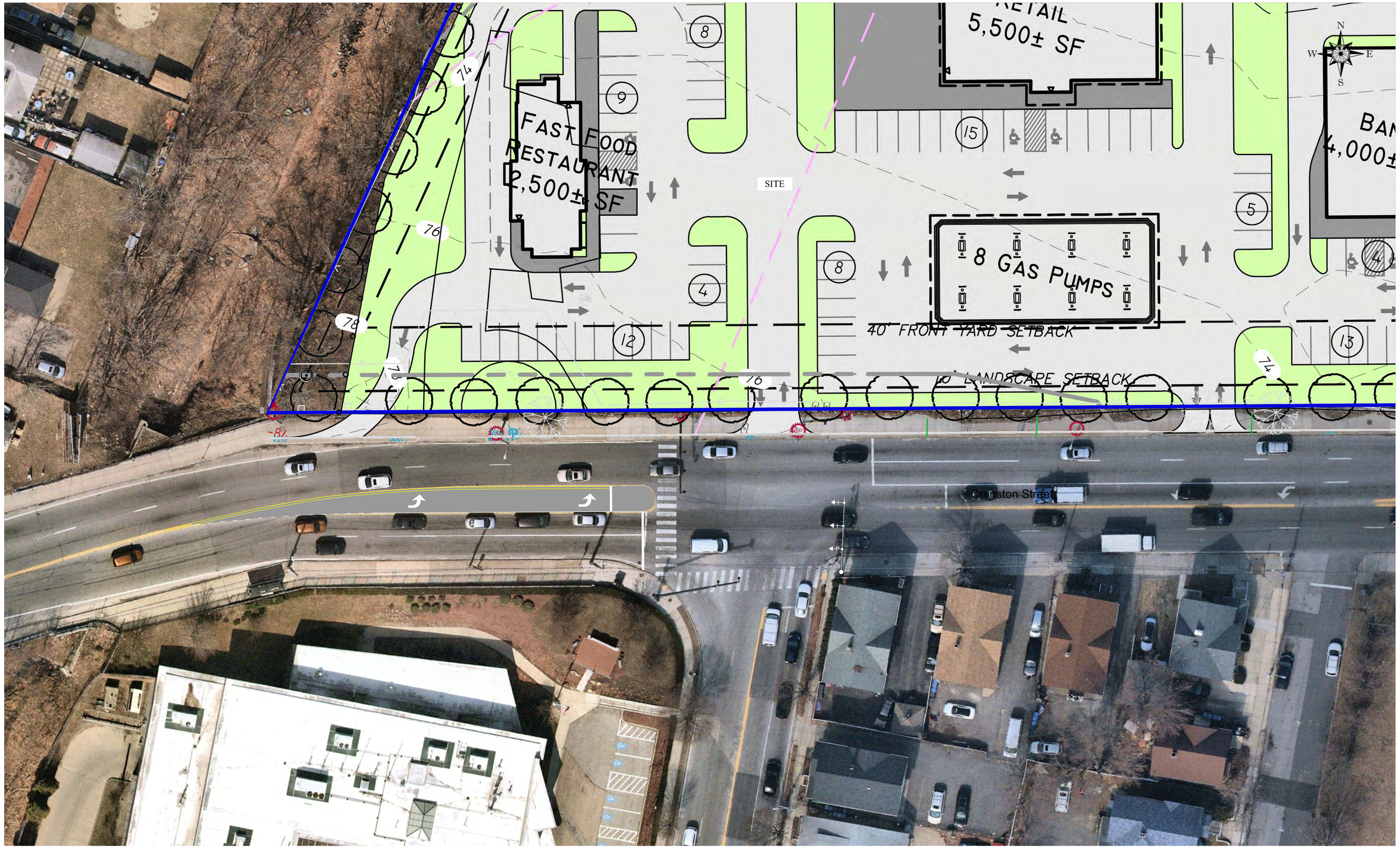
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green, Master Intersection
Natural Cycle: 80
Control Type: Actuated-Coordinated
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St

APPENDIX E – Off-Site Improvement Concept Plan

Cranston Street at Garfield Avenue/Main Site Access Driveway



NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY:

DESIGNED BY:

CHECKED BY:

REGISTERED PROFESSIONAL

For Review Only

PREPARED BY

BETA

www.BETA-Inc.com

SUBCONSULTANT

SCALE

20 0 20 40

SCALE IN FEET: 1"=20'

UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

TITLE

Proposed Commercial Development Off-Site Improvement Concept Plan

Cranston, RI

BETA JOB NO. 7578

ISSUE DATE 7/30/2021 12:54 PM

SHEET NO.

8/6/2021 10:14 AM N:\7500\S\7578 - TROLLEY BARN PLAZA\DRAWING FILES\CONCEPT\CONCEPT FIGURE.DWG (BETA STB BW.STB)