

Proposed Commercial Development
Cranston, Rhode Island

Trolley Barn Plaza

July 2021

TRAFFIC IMPACT STUDY



BETA

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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



July 30, 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., in accordance with our scope of services, has completed a traffic impact study for a proposed commercial development project in the City of Cranston, Rhode Island. The project 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.

A handwritten signature in black ink, appearing to read "Paul J. Bannon", is written over a light gray circular graphic element.

Paul J. Bannon
Associate

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1.0 INTRODUCTION

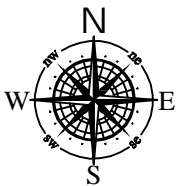
The objective of the following study is to assess the potential traffic impacts associated with a proposed commercial redevelopment project in the City of Cranston, Rhode Island. The subject property is situated on a parcel of land on the northerly side of Cranston Street immediately west of the Route 10 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 be 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:

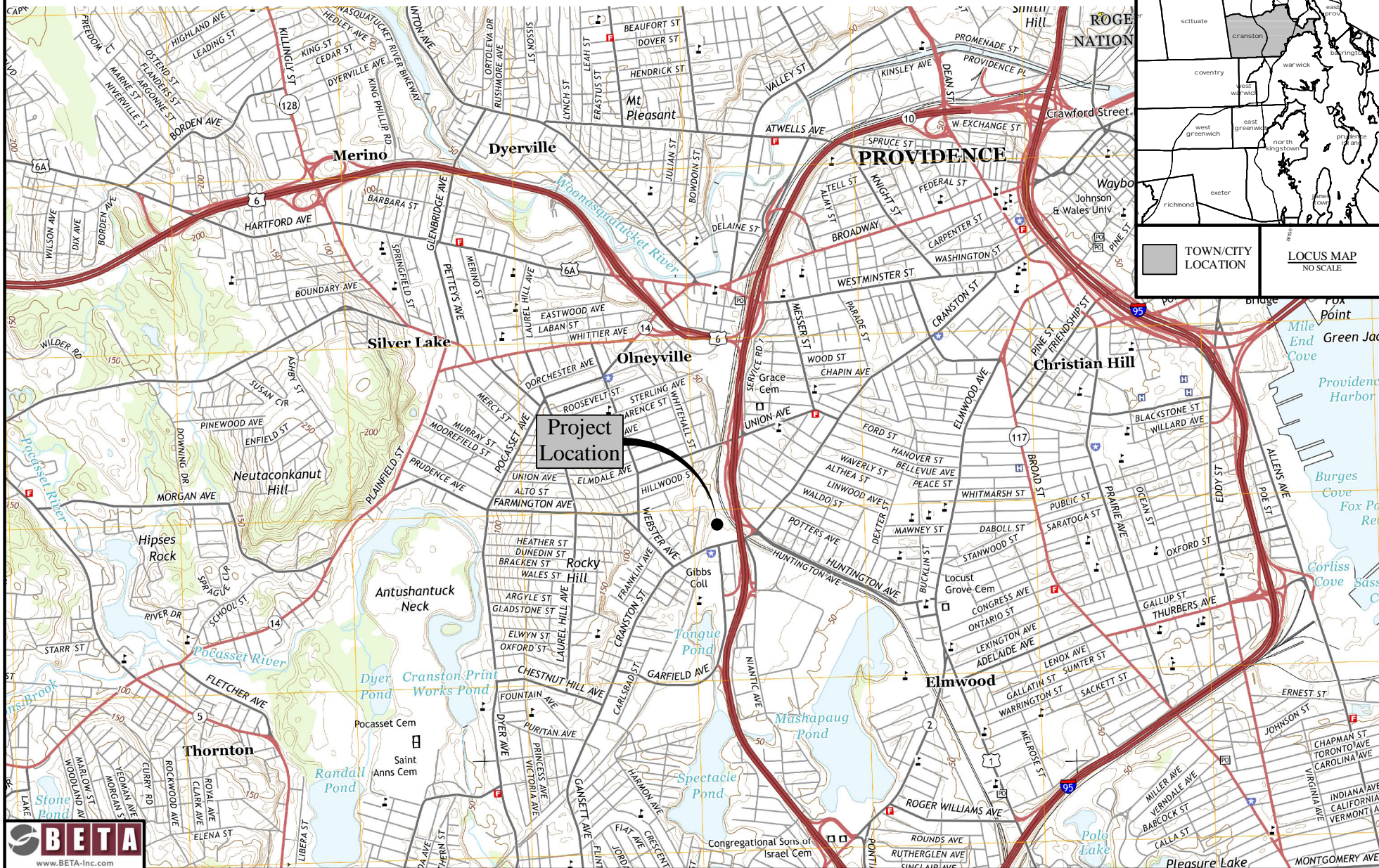
- A traffic counting program to define the existing traffic patterns and operational characteristics along the servicing roadways including Cranston Street and Garfield Avenue and review of historical counts from a previous study completed in the vicinity of the project area. The data collection included manual turning movement counts (TMCs) at the intersections of Cranston Street with Garfield Avenue and with Niantic Avenue.
- An inventory of the physical roadway characteristics of Cranston Street 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.



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Figure 1 - Project Vicinity Map



- 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 Natick 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 railway and the Route 10 highway corridors. Along the southerly side of Cranston Street opposite the site, are residential properties and the Cranston Police Station.

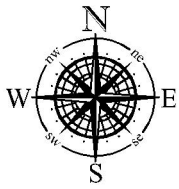
Cranston Street will serve as the primary access route to the redeveloped property. Based upon the operating characteristics along the servicing roadways, and the estimated volume and type of traffic associated with the commercial development, a study impact area was defined for the project. The limits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

3.0 EXISTING CONDITIONS

3.1 ROADWAYS

Cranston Street

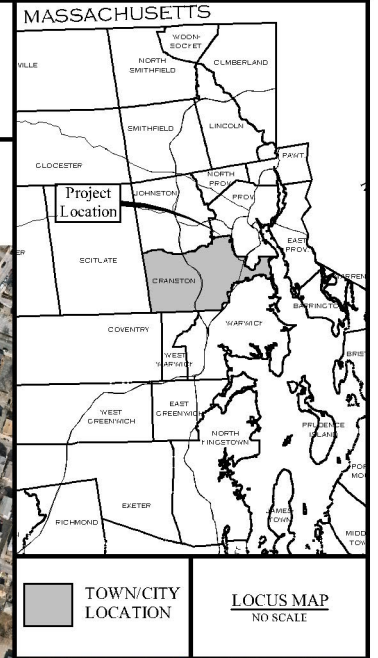
Cranston Street is a primary north/south urban minor arterial through Cranston, extending from its southerly terminus at Haven Avenue to its northerly terminus in downtown Providence at its junction with Westminster Street, just west of the Route 95 corridor through the city. In the project area the 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



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Figure 2 - Project Area Map



wide consisting 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 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 photograph depicts the typical characteristics of the intersection looking southeast along Cranston Street towards Garfield Avenue.



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.

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 eastern leg of the intersection. It was also determined that the pushbuttons and curb ramps are not ADA compliant. The adjacent photograph depicts the typical characteristics of the intersection looking north along Niantic Avenue towards Cranston Street and 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. Niantic Avenue is serviced under the second phase.

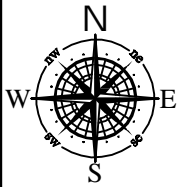
3.3 TRAFFIC FLOW DATA

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 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. In addition, record TMC at both study intersections were obtained from a previous study completed in the project area in August 2015.

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 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 both study intersections of Cranston Street with Garfield Avenue and with Niantic Avenue, the traffic volume data collected in June 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 has been utilized as a basis of analysis. Reviewing RIDOT seasonal adjustment factors for urban arterials, this month represents a higher than average period, and therefore, to be conservative, no adjustments were made to the base volumes obtained for this study.

The turning movement count data collected for this project found that Cranston Street along the property frontage services approximately 1,700 vehicles during the weekday morning peak hour between 7:30 and 8:30 AM with approximately 880 vehicles eastbound and 820 vehicles westbound. During this same period, Garfield Avenue services approximately 405 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 355 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.



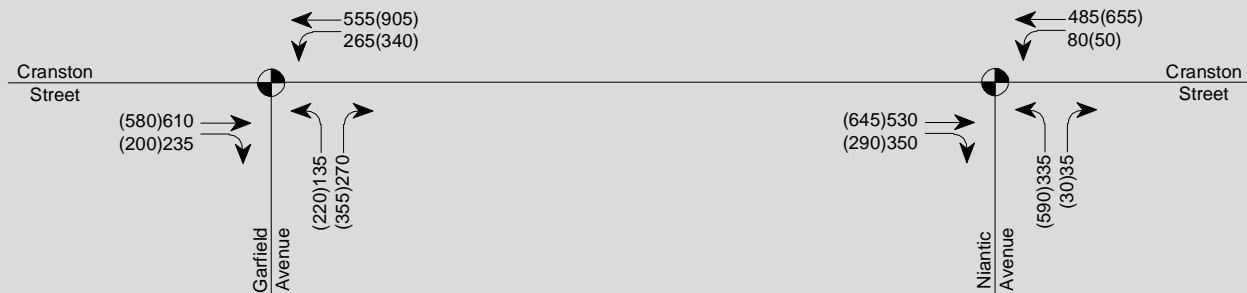
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Figure 3 - Existing Traffic Volumes



1/2 CRANSTON STREET/GARFIELD AVENUE/NIANTIC AVENUE



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)
- ① STUDY INTERSECTION
- ⊕ TRAFFIC SIGNAL

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 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 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. Table 1 on the following page summarizes the types and severity of the crashes that occurred within the study period in the project area.

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.

TABLE 1 – Crash Data Summary

	INTERSECTIONS		CORRIDORS
	Cranston Street at Garfield Avenue	Cranston Street at Niantic Avenue	Cranston Street Lincoln Avenue to Niantic Avenue
<i>Collision Type</i>			
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
<i>Crash Severity</i>			
Property	28	26	3
Injury	3	4	0
TOTAL CRASHES	31	30	3

Based upon the historical crash data obtained from the local police, and a review of existing roadway geometry and operations, 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.

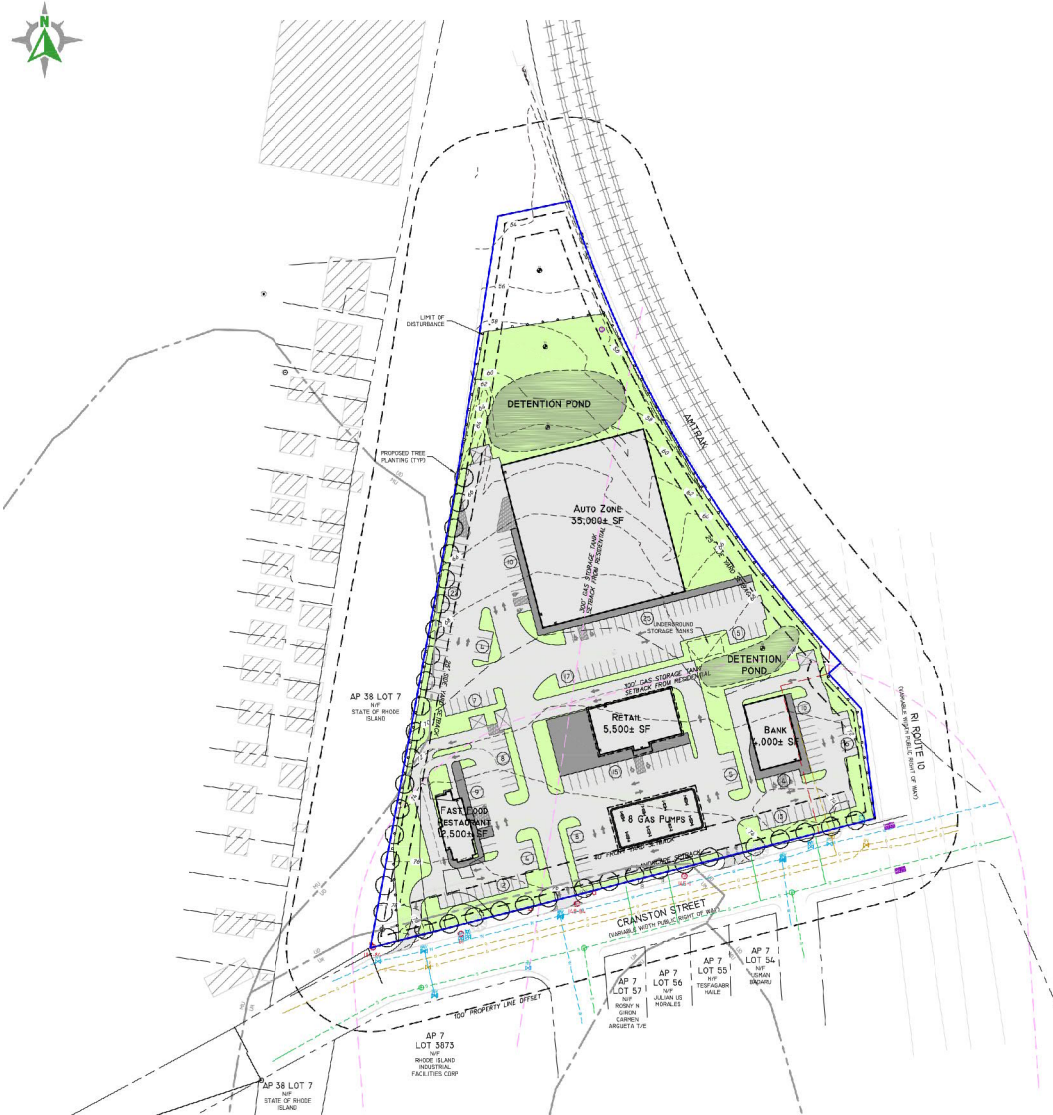
Main access/egress will be provided at the signalized intersection of Cranston Street with Garfield Avenue that will be modified to create a four-way junction. In addition, secondary access will be provided from a right turn in/out only driveway and a right turn out only driveway approximately 200 feet 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.

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Figure 4 - Site Layout



Site Plan provided by DiPrete Engineering

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 summarizes the estimated trip volumes calculated for this project for the morning and afternoon 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.

TABLE 2 – Trip Generation Estimate

<u>Description</u>		<u>Enter</u>	<u>Exit</u>	<u>Total</u>
<i>AM Peak Hour</i>				
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	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
ITE Land Use Code 960	Super Convenience Market/Gas Station	<u>170</u>	<u>170</u>	<u>340</u>
	Total	205	205	410
<i>PM Peak Hour</i>				
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	<u>165</u>	<u>165</u>	<u>330</u>
	Total	280	265	545

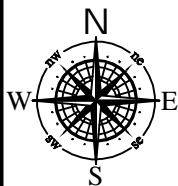
In addition, to the internal capture potential, it is estimated that between 40% and 60% of trips generated by the proposed convenience store/gasoline station and fast-food restaurant will not be new to the servicing roadways. The ITE manual provides information on what is referred to as “pass-by” trips, 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.

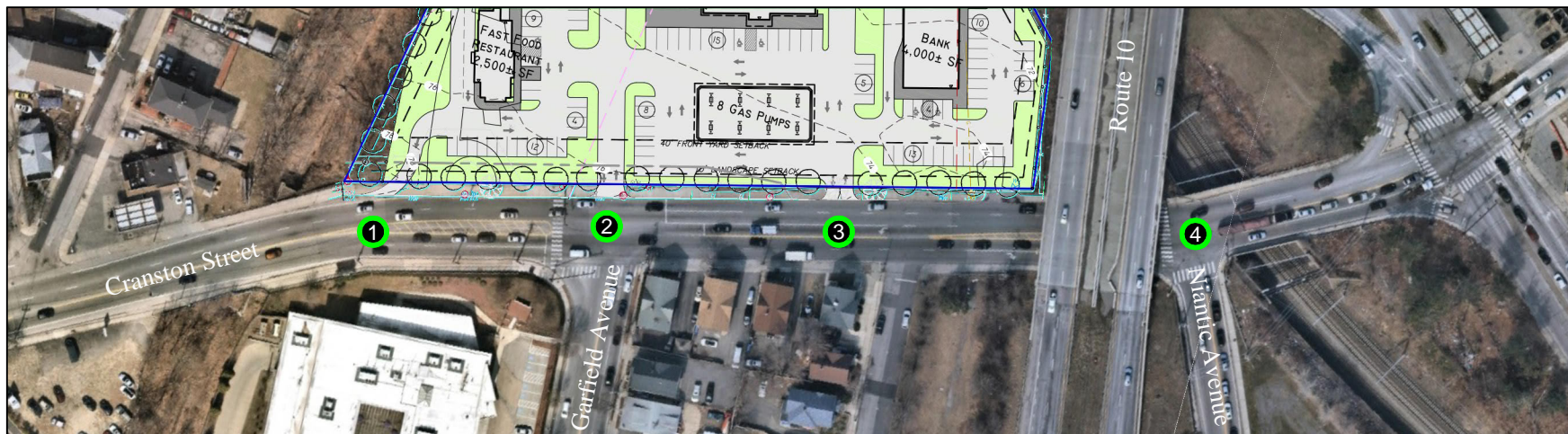
In developing the intersection volumes to be analyzed under build conditions, a directional distribution of the site traffic was estimated. The distribution was based on current traffic patterns along Cranston Street determined from the count data. For the automobile parts store and bank components of 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 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 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 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.



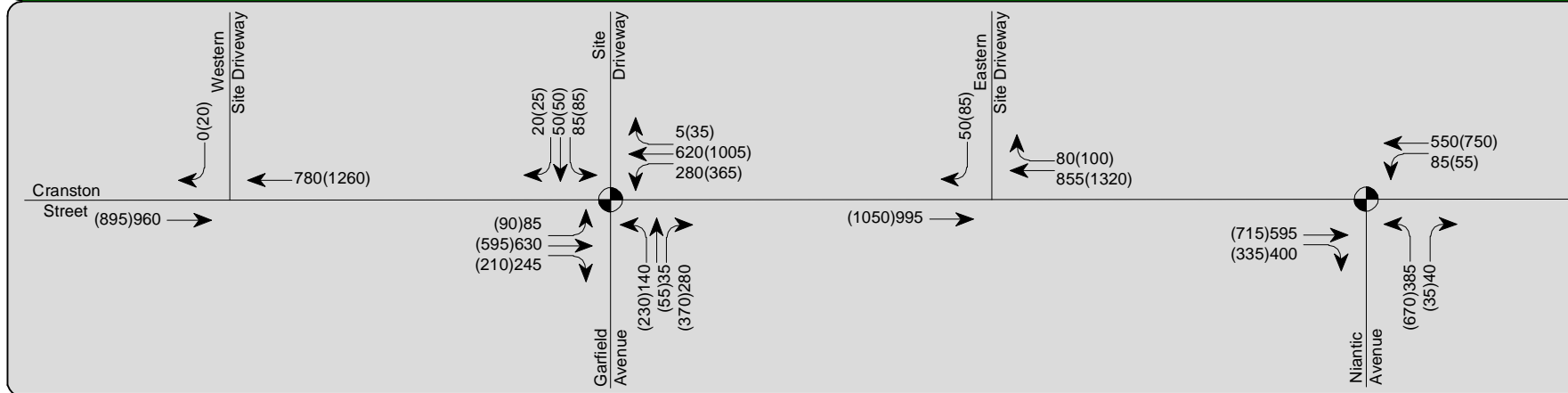
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Figure 5 - Future Traffic Volumes



1/2/3/4 CRANSTON STREET/GARFIELD AVENUE/NIANTIC AVENUE/SITE DRIVEWAYS



LEGEND:

- TURN LANE
- XXX AM PEAK VOLUMES (7:30 AM TO 8:30 AM)
- (XXX) PM PEAK VOLUMES (4:30 PM TO 5:30 PM)
- 1 STUDY INTERSECTION
- TRAFFIC SIGNAL

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 peak hours would represent this worst-case combination of site-generated traffic with the servicing roadway peak traffic period.

The Cranston Street intersections with Garfield Avenue and Niantic Avenue were studied for the existing and future weekday morning and afternoon 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 both the AM and PM peak periods. Only during the PM period 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, 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 altering 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. Table 4 depicts the current conditions at the study intersections. As can be seen in the table, the signalized intersection of Cranston Street with Garfield Avenue operates overall at a good Level of Service (LOS) B during both the AM and PM peak hours with critical movements experiencing LOS D or better. The signalized intersection of Cranston Street with Niantic Avenue was also found to operate overall at a good LOS B and at an acceptable LOS C during the AM and PM peak hours, respectively, with critical movements experiencing LOS D or better with the exception of the Niantic Avenue northbound movement during the afternoon peak hour. During the afternoon peak hour, the Niantic Avenue northbound movement operates with greater delays at LOS E where a maximum queue of 25 vehicles was observed, which is consistent with the analysis. This queueing can extend approximately 625 feet to the south for short periods during the afternoon peak traffic condition.

TABLE 4 – Level of Service Summary (Existing Conditions)

Location / Movement	2021 EXISTING CONDITIONS							
	AM Peak Hour				PM Peak Hour			
	LOS	Delay	95 th % Queue Length (veh.)	v/c	LOS	Delay	95 th % Queue Length (veh.)	v/c
<i>Cranston Street at Garfield Avenue</i>								
Cranston Street EB	B	17.7	10	0.54	C	21.2	10	0.61
Cranston Street WB Left	D	42.7	10	0.61	D	38.6	9	0.82
Cranston Street WB Thru	A	6.1	5	0.22	A	6.8	7	0.39
Garfield Avenue NB Left/Thru	D	46.9	5	0.60	D	44.1	8	0.73
Garfield Avenue NB Right	B	11.1	3	0.62	A	8.6	3	0.64
OVERALL	B	18.8	-	-	B	18.7	-	-
<i>Cranston Street at Niantic Avenue</i>								
Cranston Street EB Thru	B	11.5	15	0.49	C	33.4	17	0.76
Cranston Street EB Right	A	3.2	6	0.33	B	10.8	4	0.36
Cranston Street WB	B	17.9	7	0.36	B	17.3	3	0.59
Niantic Avenue NB	D	43.3	11	0.82	E	64.3	25	0.95
OVERALL	B	18.4	-	-	C	33.9	-	-

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 intersection of Cranston Street with Niantic Avenue will continue to operate overall in an acceptable manner at LOS D or better during the AM and PM peak hours with critical movements experiencing LOS C or better with the exception of the Niantic Avenue northbound movement during the afternoon peak hour, which will continue to operate with greater delays as described.

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

Location / Movement	FUTURE 2024 NO-BUILD CONDITIONS							
	AM Peak Hour				PM Peak Hour			
	LOS	Delay	95 th % Queue Length (veh.)	v/c	LOS	Delay	95 th % Queue Length (veh.)	v/c
Cranston Street at Garfield Avenue								
Cranston Street EB	B	18.6	10	0.58	C	22.1	10	0.64
Cranston Street WB Left	D	42.7	12	0.62	D	40.5	10	0.84
Cranston Street WB Thru	A	6.1	5	0.22	A	6.5	6	0.40
Garfield Avenue NB Left/Thru	D	47.0	6	0.61	D	45.2	8	0.75
Garfield Avenue NB Right	B	11.1	3	0.63	A	8.7	3	0.65
OVERALL	B	19.2	-	-	B	19.3	-	-
Cranston Street at Niantic Avenue								
Cranston Street EB Thru	B	12.3	16	0.52	C	20.8	17	0.77
Cranston Street EB Right	A	3.4	6	0.35	A	2.9	1	0.37
Cranston Street WB	B	17.9	7	0.39	D	37.6	9	0.62
Niantic Avenue NB	D	44.4	12	0.84	E	70.7	27	1.01
OVERALL	B	18.9	-	-	D	37.5	-	-

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 includes an unsignalized (permitted) Cranston Street eastbound left turn movement into the site, which will be from an 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 and LOS D during the morning and afternoon peak traffic conditions, respectively, with some critical movements experiencing greater delays. The signalized intersection of Cranston Street with Niantic Avenue will continue to operate overall at LOS B and LOS E during the AM and PM peak hours, respectively, with some critical movements during the afternoon peak period 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 both the signalized intersections of Cranston Street with Garfield Avenue and with Niantic Avenue will operate slightly better overall during the morning and afternoon peak traffic conditions.

The third alternative evaluated includes a signalized (protected) Cranston Street eastbound left turn movement into the site, which will be in an exclusive left turn lane and will run concurrent with the protected westbound left turn movement, and addition of a phase (split) for the site southbound movement. The results of the Future Build Alternative 3 analysis found that both the signalized intersections of Cranston Street with Garfield Avenue and with Niantic Avenue will operate similarly to Alternative 1 and slightly worse when compared to Alternative 2.

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

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 will operate overall in an acceptable manner at LOS C during both the morning and afternoon peak hours of traffic with critical movements experiencing LOS D or better.

The signalized intersection of Cranston Street with Niantic Avenue with optimization will operate overall at LOS C and LOS E during the morning and afternoon peak periods, respectively, with minor additional delays realized as a result of increase in future traffic demands. Periodic review of this intersection along with the Huntington Avenue intersection due to its close proximity should be completed in the future as traffic growth continues along the corridor. These intersections are the critical locations for delays along this segment of Cranston Street and should be evaluated for operational improvements when needed where the optimization would include background cycles, along with phasing and split adjustments to account for the changes in movement volumes during the daily peak hours.

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 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.

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

Location / Movement	FUTURE 2024 BUILD CONDITIONS							
	AM Peak Hour				PM Peak Hour			
	LOS	Delay	95 th % Queue Length (veh.)	v/c	LOS	Delay	95 th % Queue Length (veh.)	v/c
Cranston Street at Garfield Avenue ¹								
Cranston Street EB Left	B	11.0	2	0.20	D	46.0	4	0.54
Cranston Street EB Thru/Right	C	25.5	12	0.68	D	50.2	14	0.95
Cranston Street WB Left	C	27.8	7	0.73	D	47.9	10	0.91
Cranston Street WB Thru/Right	B	18.8	8	0.39	C	22.4	12	0.73
Garfield Avenue NB Left/Thru	C	26.2	6	0.42	C	29.4	8	0.67
Garfield Avenue NB Right	A	4.9	2	0.42	A	4.7	2	0.50
Site Driveway SB	D	53.8	6	0.74	D	53.6	7	0.77
OVERALL	C	23.1	-	-	C	33.4	-	-
Cranston Street at Niantic Avenue ¹								
Cranston Street EB Thru	B	14.7	17	0.58	C	23.3	17	0.84
Cranston Street EB Right	A	3.9	7	0.39	A	3.4	2	0.43
Cranston Street WB	B	17.6	7	0.45	E	79.9	11	0.73
Niantic Avenue NB	D	46.2	14	0.86	F	90.8	28	1.10
OVERALL	C	20.0	-	-	E	57.1	-	-

¹ Optimized Timings

In addition, the unsignalized intersections of Cranston Street with the eastern site driveway and with the western site driveway will operate efficiently with minimal delays during both the morning and afternoon peak conditions due to the estimated low volumes at both site driveways, coupled with the restriction to right turn in/out only at the eastern site driveway and right turn out only at the western site driveway, which does not require analysis. A conceptual design of the intersection of Cranston Street with Garfield Avenue to accommodate the proposed site access driveway to form a four-way junction is provided in the Appendix.

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 and afternoon 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 Garfield Avenue

Cranston Street at Niantic Avenue

A

Intersection Turning Movement Count

Cranston Street at Garfield Avenue

Cranston Street at Niantic Avenue

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

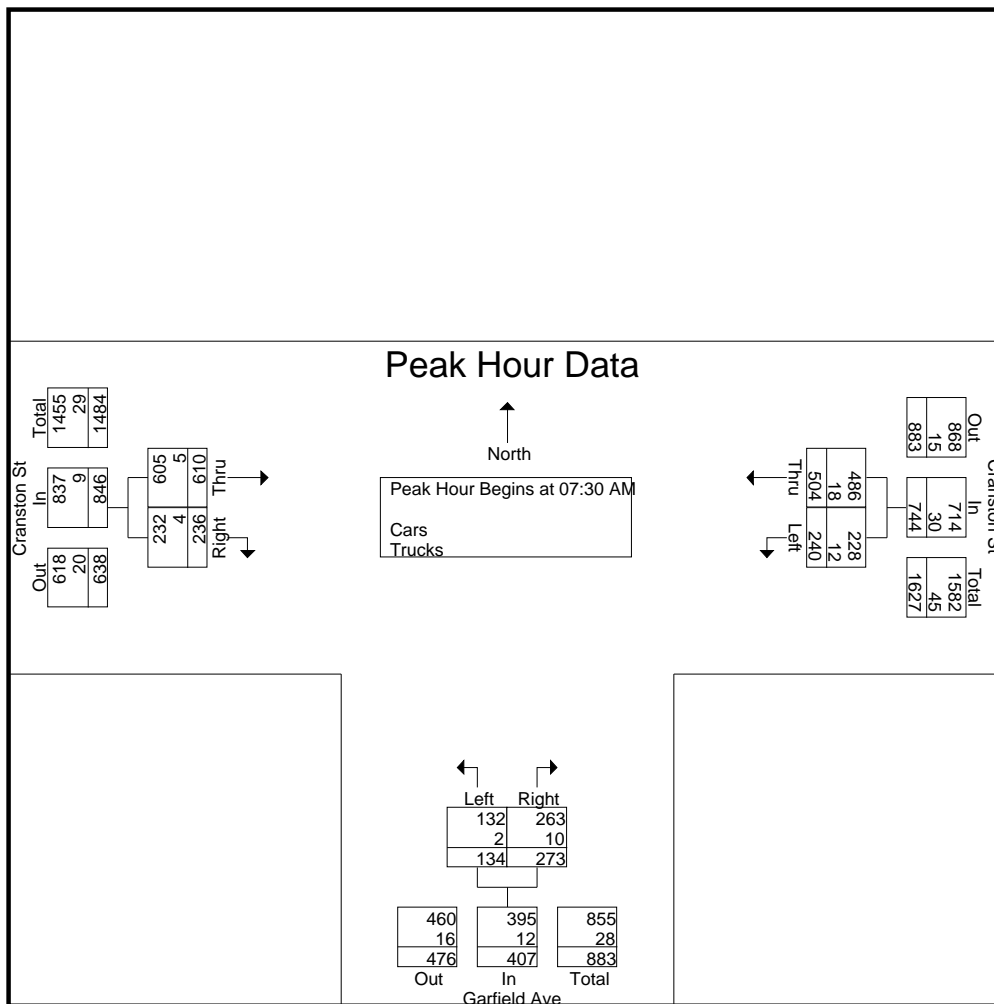
File Name : 75780001
 Site Code : 75780001
 Start Date : 6/9/2021
 Page No : 1

Groups Printed- Cars - Trucks

Start Time	Cranston St From East		Garfield Ave From South		Cranston St From West		Int. Total
	Left	Thru	Left	Right	Thru	Right	
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

Start Time	Cranston St From East			Garfield Ave From South			Cranston St From West			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. 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



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

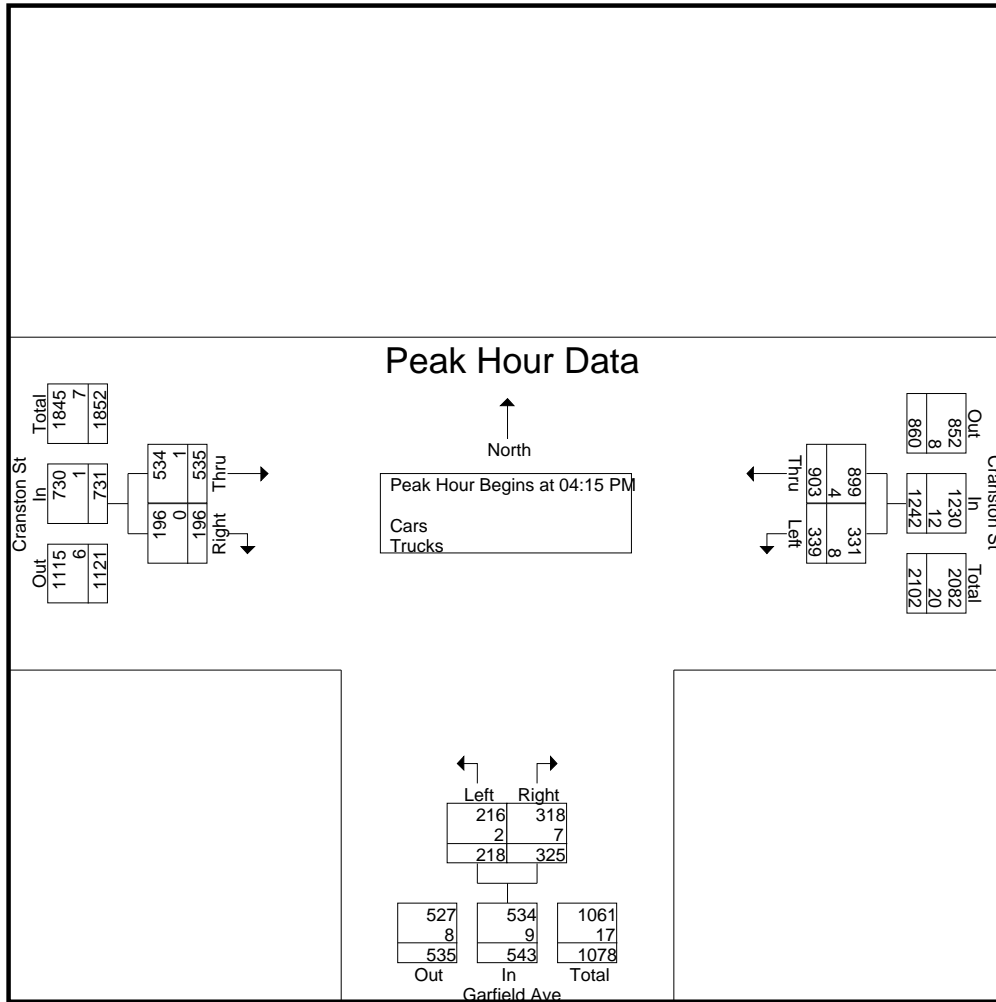
File Name : 75780001
 Site Code : 75780001
 Start Date : 6/9/2021
 Page No : 1

Groups Printed- Cars - Trucks

Start Time	Cranston St From East		Garfield Ave From South		Cranston St From West		Int. Total
	Left	Thru	Left	Right	Thru	Right	
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

Start Time	Cranston St From East			Garfield Ave From South			Cranston St From West			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. 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



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

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

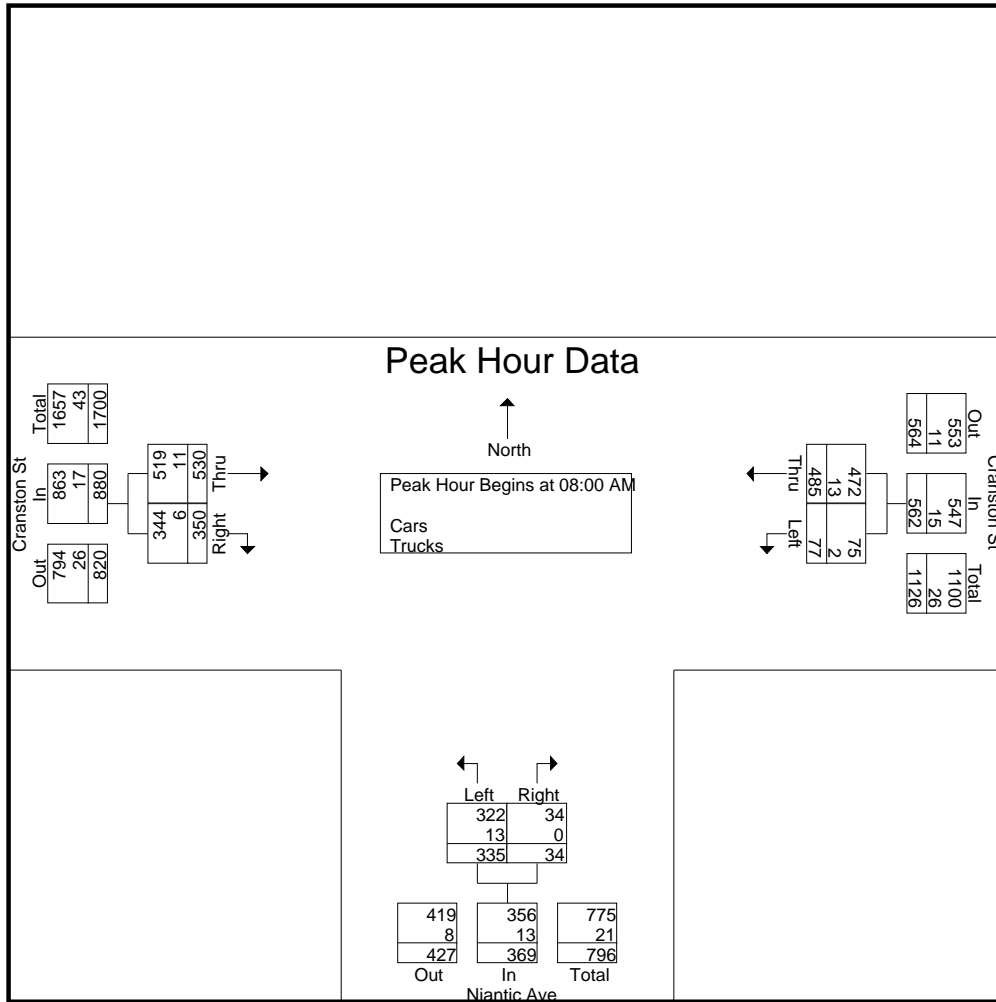
File Name : 75780002
 Site Code : 75780002
 Start Date : 6/9/2021
 Page No : 1

Groups Printed- Cars - Trucks

Start Time	Cranston St From East		Niantic Ave From South		Cranston St From West		Int. Total
	Left	Thru	Left	Right	Thru	Right	
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

Start Time	Cranston St From East			Niantic Ave From South			Cranston St From West			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. 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



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

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

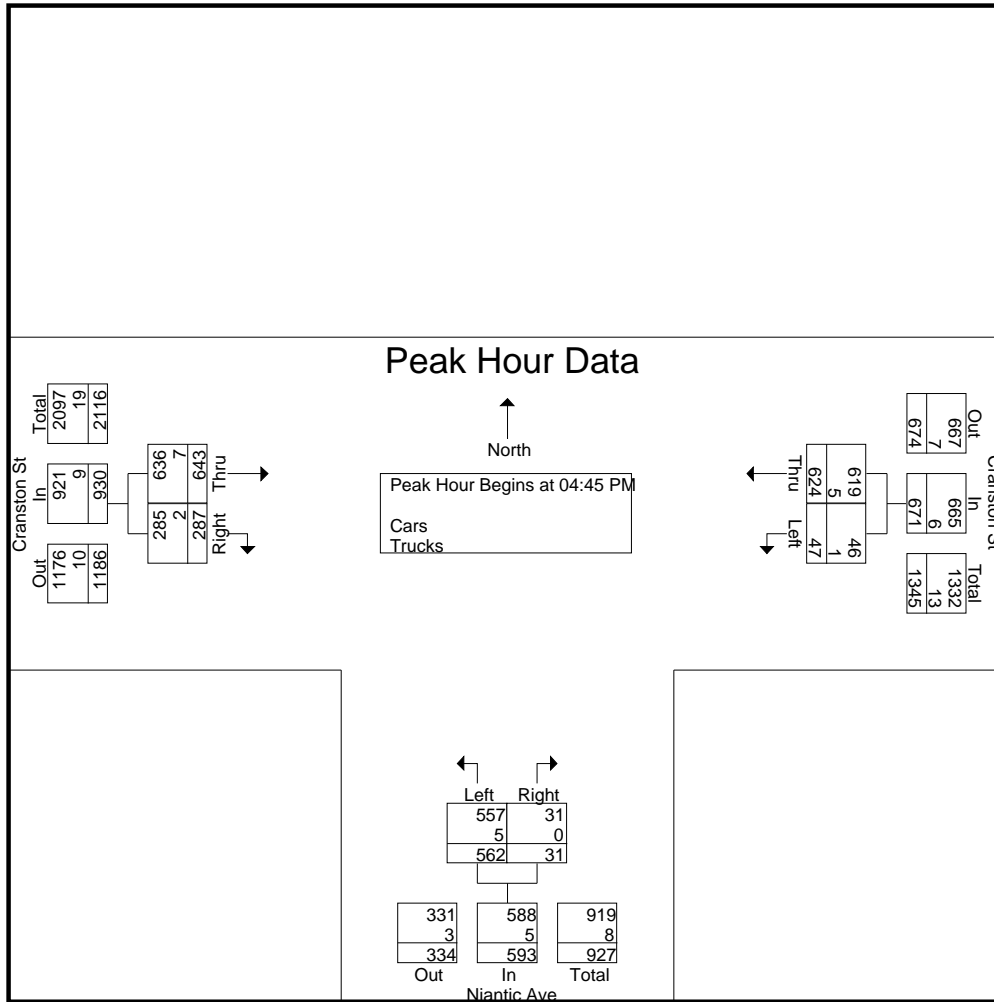
N/S Street : Niantic Avenue
E/W Street : Cranston Street
City/State : Cranston, RI
Weather : Clear

Groups Printed- Cars - Trucks

Start Time	Cranston St From East		Niantic Ave From South		Cranston St From West		Int. Total
	Left	Thru	Left	Right	Thru	Right	
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

Start Time	Cranston St From East			Niantic Ave From South			Cranston St From West			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. 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

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



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

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

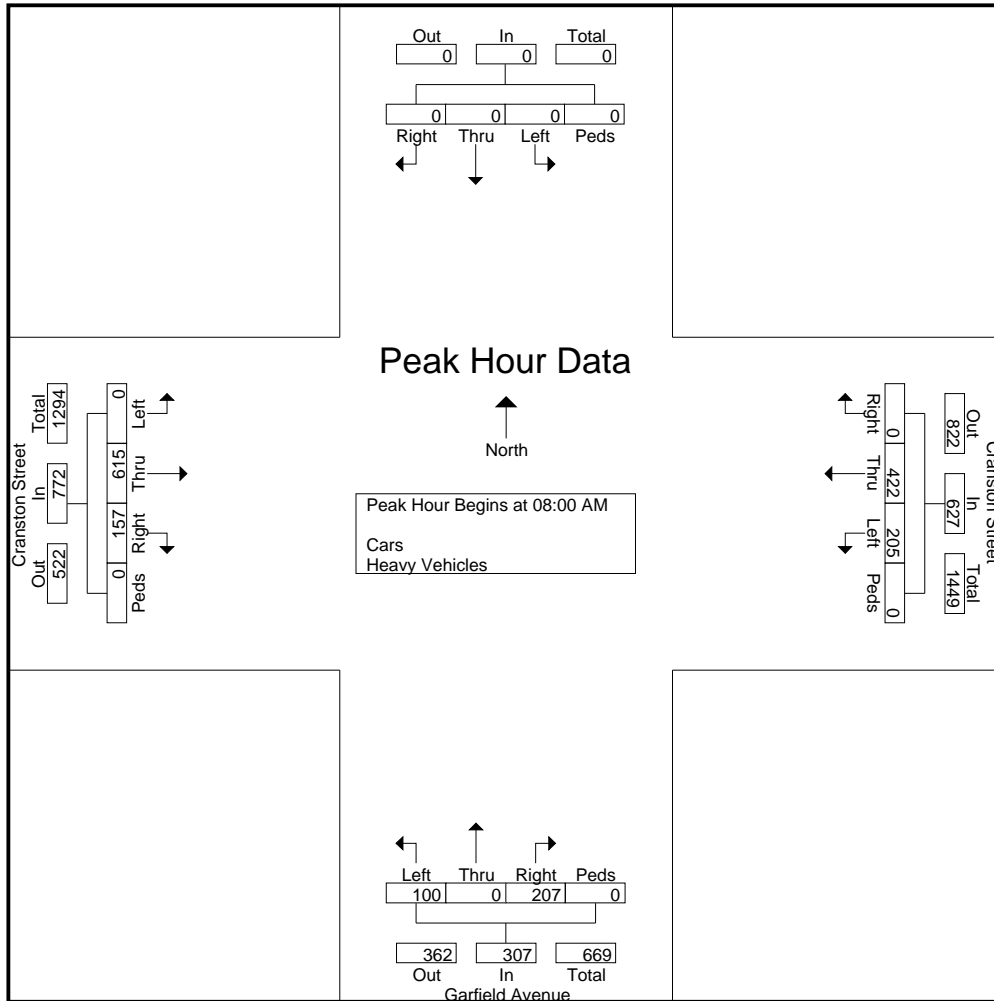
Start Time	Southbound					Cranston Street Westbound					Garfield Avenue Northbound					Cranston Street Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	28	89	0	0	117	15	0	35	0	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	0	28.6	71.4	0	0	28.6	38.8	0	61.2	0	38.8	0	76.4	23.6	0	76.4	
Total %	0	0	0	0	0	11.9	29.7	0	0	11.9	8.4	0	13.3	0	8.4	0	28.1	8.6	0	28.1	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	96.7	99.1	0	97.9	0	99.1	0	99.5	99.8	0	99.5	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	3.3	0.9	0	2.1	0	1.6	0	0.5	0.2	0	0.5	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

Start Time	Southbound					Cranston Street Westbound					Garfield Avenue Northbound					Cranston Street Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. 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	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



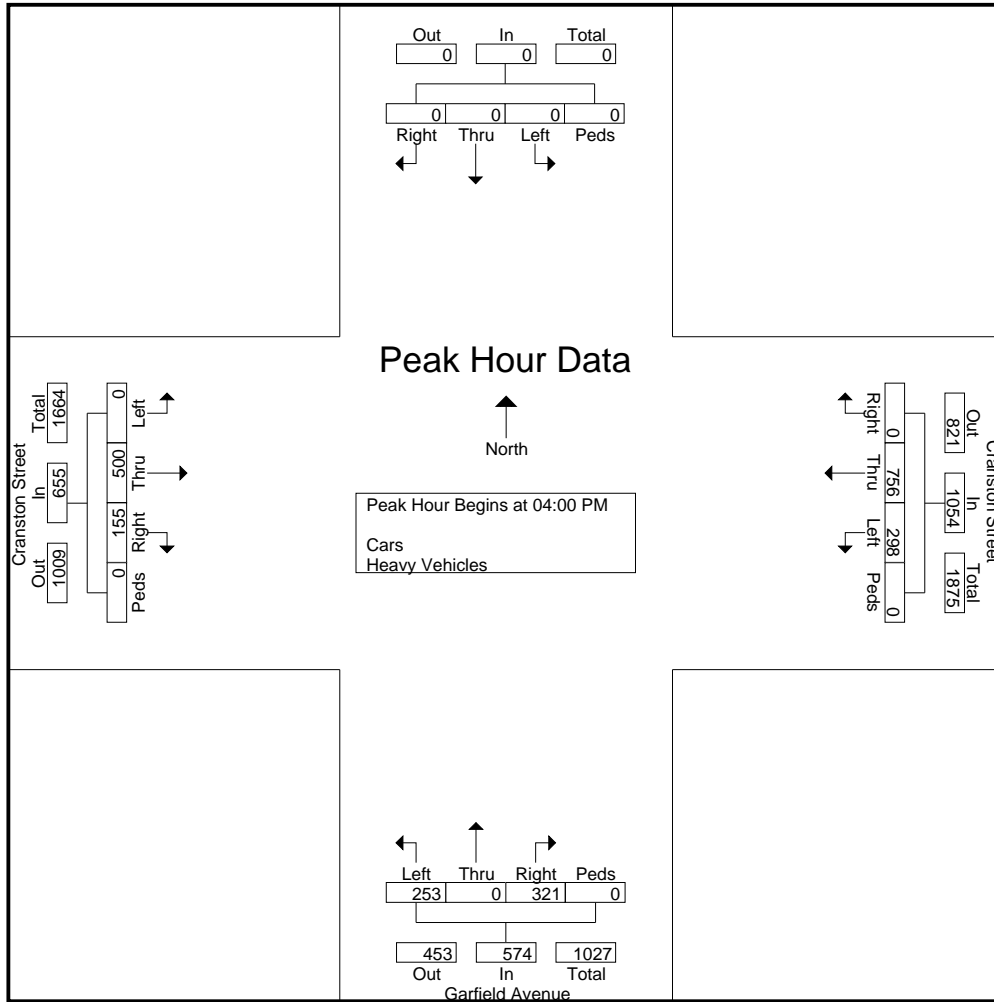


Project Name: Citizens Bank Headquarters
 Town/City: Cranston, RI
 Location: Cranston St. @ Garfield Ave.
 Weather: Sunny/70's

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

Start Time	Southbound					Cranston Street Westbound					Garfield Avenue Northbound					Cranston Street Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
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	0	28.3	71.7	0	0	96.9	44.1	0	55.9	0	97.6	0	76.3	23.7	0	96.3	98.9
PHF	.000	.000	.000	.000	.000	.931	.955	.000	.000	.969	.958	.000	.944	.000	.976	.000	.977	.923	.000	.963	.989

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



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

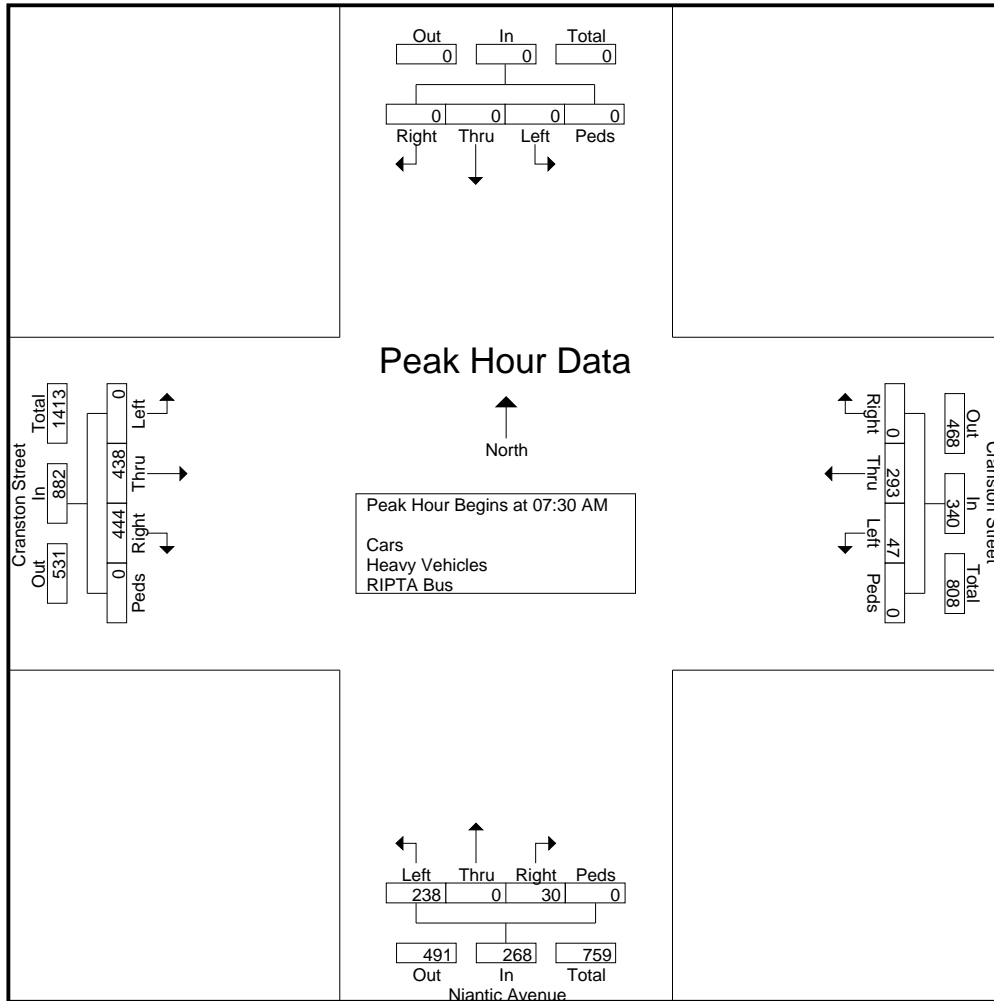
Start Time	Southbound					Cranston Street Westbound					Niantic Avenue Northbound					Cranston Street Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
07:00 AM	0	0	0	0	0	11	66	0	0	77	47	0	8	0	55	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	0	9.1	90.9	0	0	90.5	90.5	0	9.5	0	90.5	0	59.2	40.8	0	59.2	
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	28.3	
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

Start Time	Southbound					Cranston Street Westbound					Niantic Avenue Northbound					Cranston Street Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. 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	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



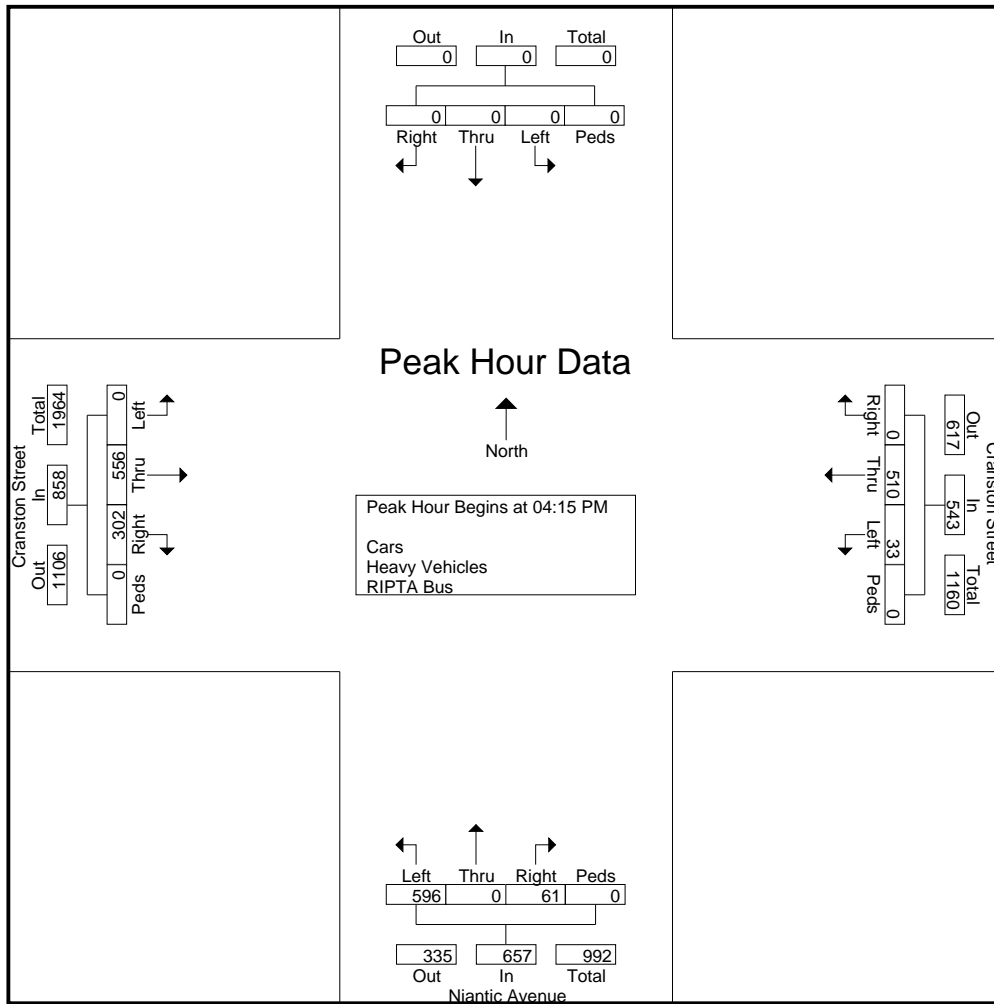


Project Name: Citizens Bank Headquarters
 Town/City: Cranston, RI
 Location: Cranston St. @ Niantic Ave.
 Weather: Sunny/80's

File Name : 513107 Volume
 Site Code : 513107
 Start Date : 8/19/2015
 Page No : 3

Start Time	Southbound					Cranston Street Westbound					Niantic Avenue Northbound					Cranston Street Eastbound					Int. Total
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	
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	0	6.1	93.9	0	0	90.7	90.7	0	9.3	0	93.9	0	64.8	35.2	0	92.9	97.6
PHF	.000	.000	.000	.000	.000	.750	.885	.000	.000	.881	.949	.000	.726	.000	.939	.000	.908	.858	.000	.929	.976

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



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	

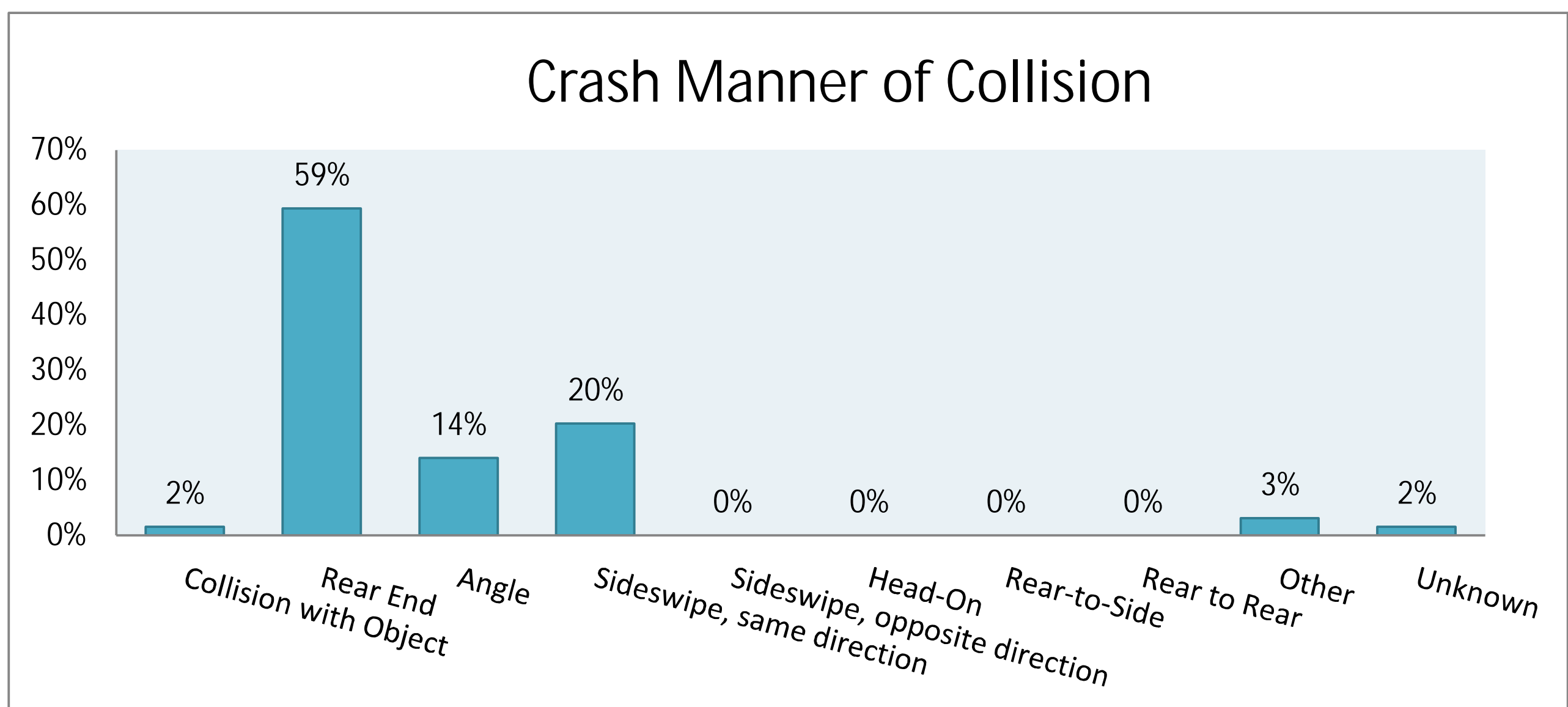
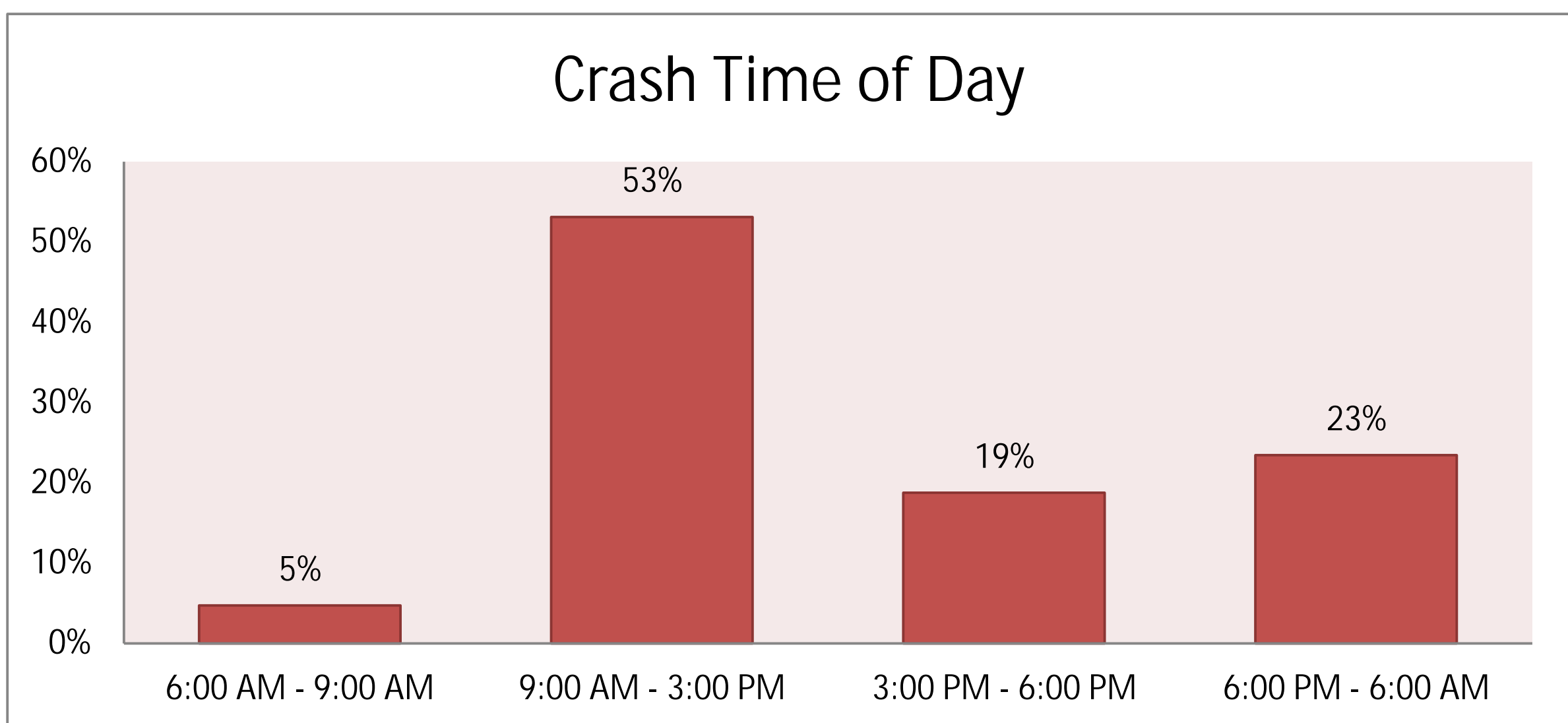
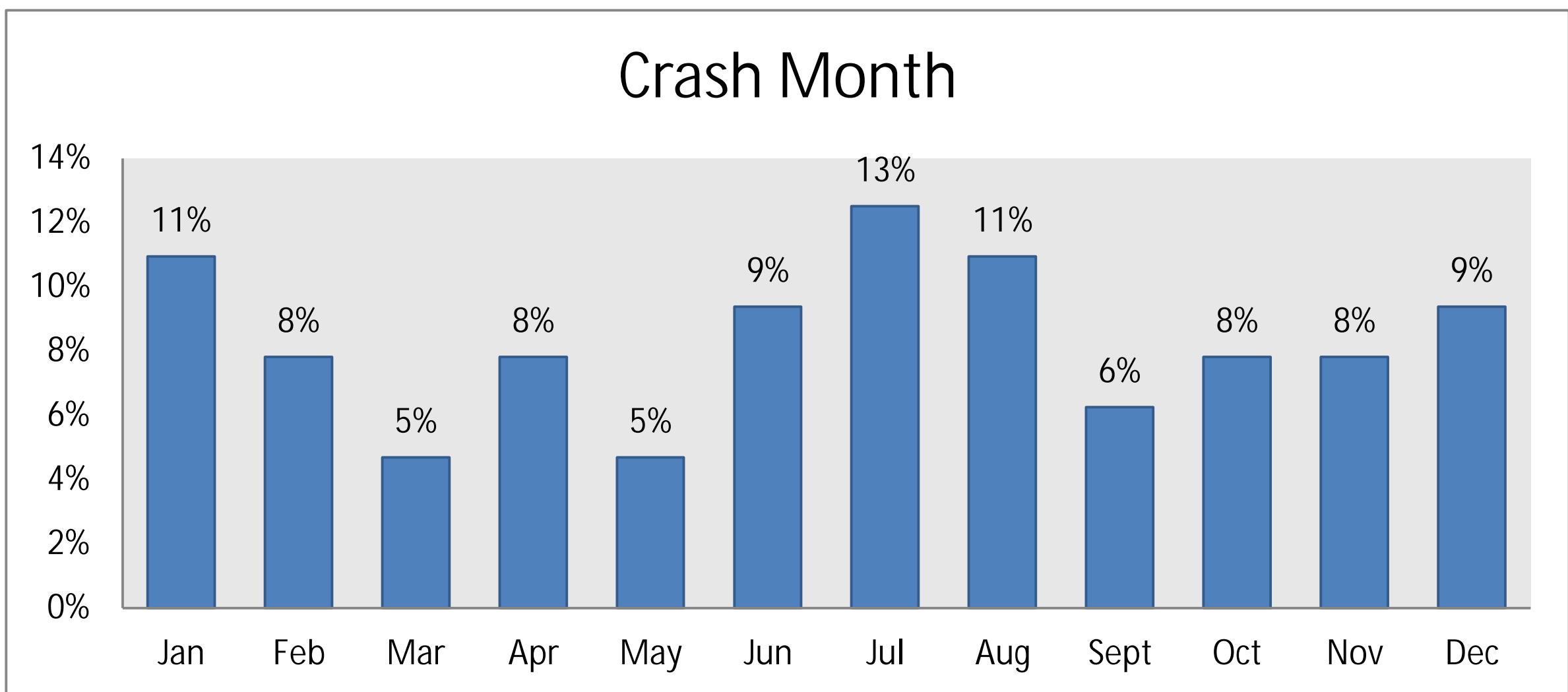
Cranston Street at Niantic Avenue

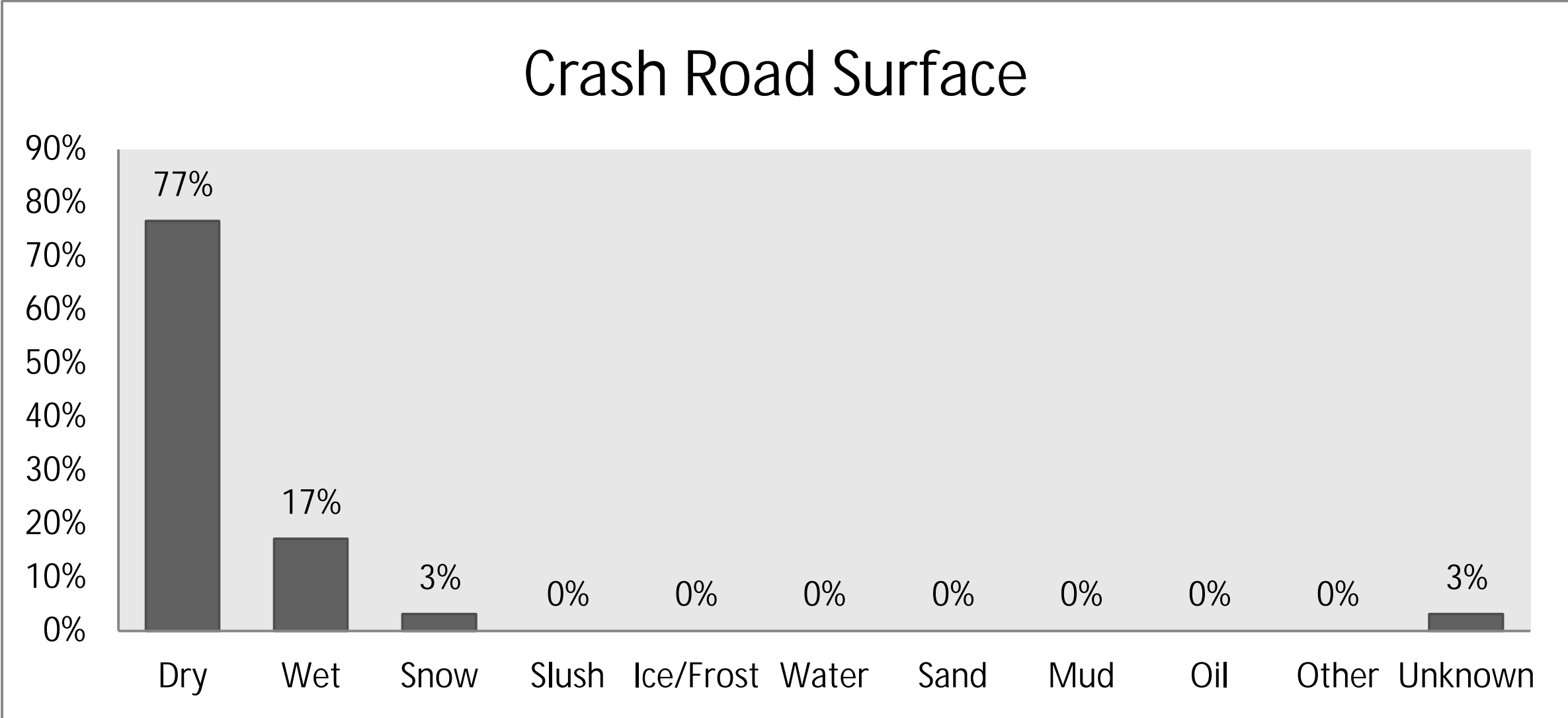
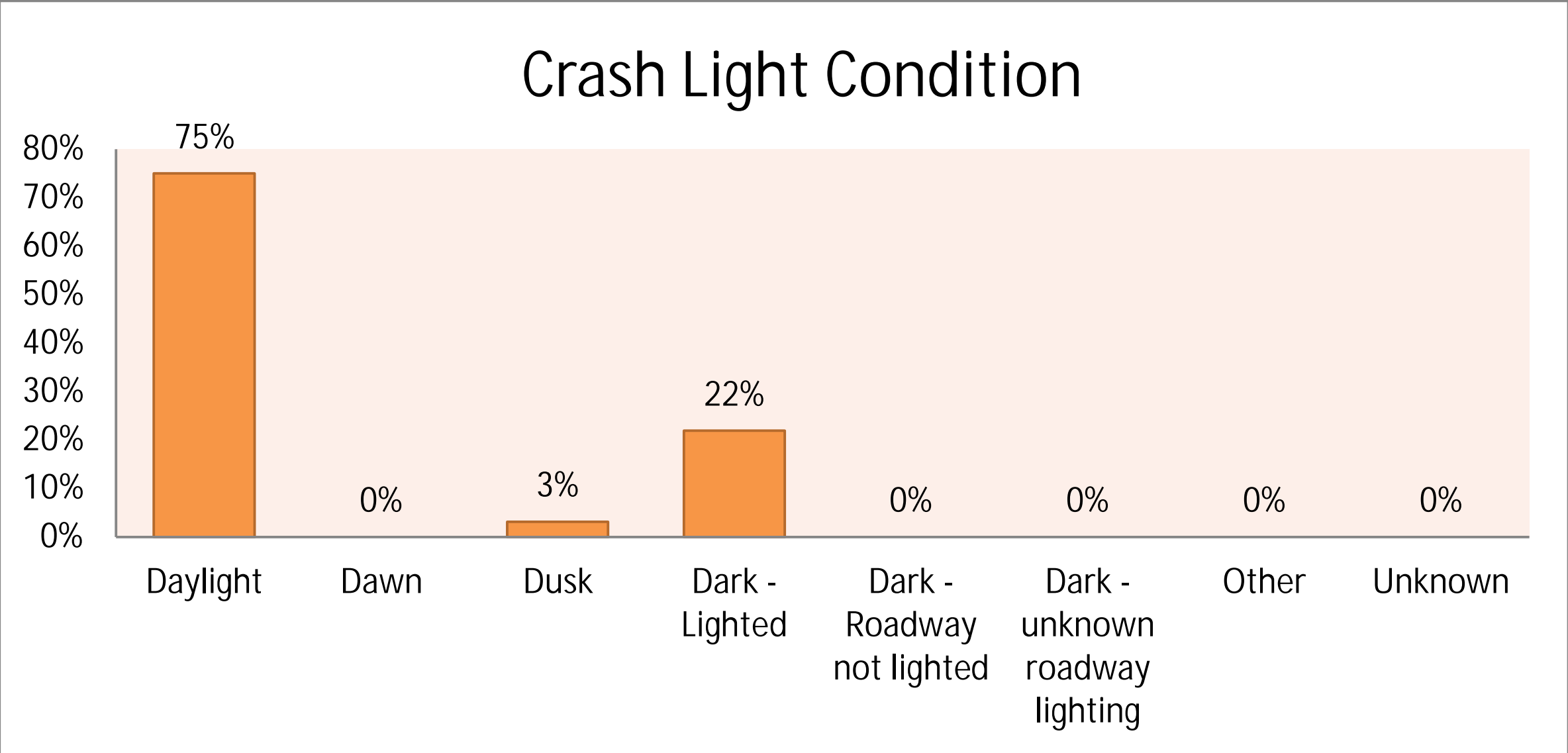
	2018	2019	2020	Total	Percent
Collision Type					
Rear End	2	8	5	15	50%
Angle	4	1	2	7	23%
Head-On	0	0	0	0	0%
Pedestrian	0	0	0	0	0%
Sideswipe, Same Direction	4	1	2	7	23%
Sideswipe, Opposite Direction	0	0	0	0	0%
Collision with Object	0	0	0	0	0%
Other	0	0	1	1	3%
Unknown	0	0	0	0	0%
Crash Severity					
Property	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





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;

	<u>Description</u>	<u>Enter</u>	<u>Exit</u>	Total
<u>Weekday AM Peak Hour</u>				
ITE Land Use Code 843	Automobile Parts Sales	12	9	21
Independent Study	Automobile 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	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
ITE Land Use Code 960	Super Convenience Market/Gas Station	170	170	340
	TOTAL	205	205	410

Weekday PM Peak Hour

ITE Land Use Code 843	Automobile Parts Sales	20	20	40
Independent Study	Automobile 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

Calculations;

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

Independent Variable (X) = Thousand Gross Floor Area (GFA)		X = 8
<u>AM Peak</u>	<i>Directional Distribution:</i>	56% Entering 44% Exiting
	T = 2.59 x (X)	Enter: 12
	T = 2.59 x 8	Exit: 9
	T = 21	Total: 21
<u>PM Peak</u>	<i>Directional Distribution:</i>	48% Entering 52% Exiting
	T = 4.91 x (X)	Enter: 20
	T = 4.91 x 8	Exit: 20
	T = 40	Total: 40

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

Independent Variable (X) = Thousand Gross Floor Area (GFA)		X = 4
<u>AM Peak</u>	<i>Directional Distribution:</i>	59% Entering 41% Exiting
	T = 9.50 x (X)	Enter: 23
	T = 9.50 x 4	Exit: 16
	T = 39	Total: 39
<u>PM Peak</u>	<i>Directional Distribution:</i>	50% Entering 50% Exiting
	T = 20.45 x (X)	Enter: 41
	T = 20.45 x 4	Exit: 41
	T = 82	Total: 82

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
<u>AM Peak</u>	n/a	
<u>PM Peak</u>	<i>Directional Distribution:</i>	52% Entering 48% Exiting
	T = 32.67 x (X)	Enter: 44
	T = 32.67 x 2.5	Exit: 39
	T = 83	Total: 83

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

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

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 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 multiple 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

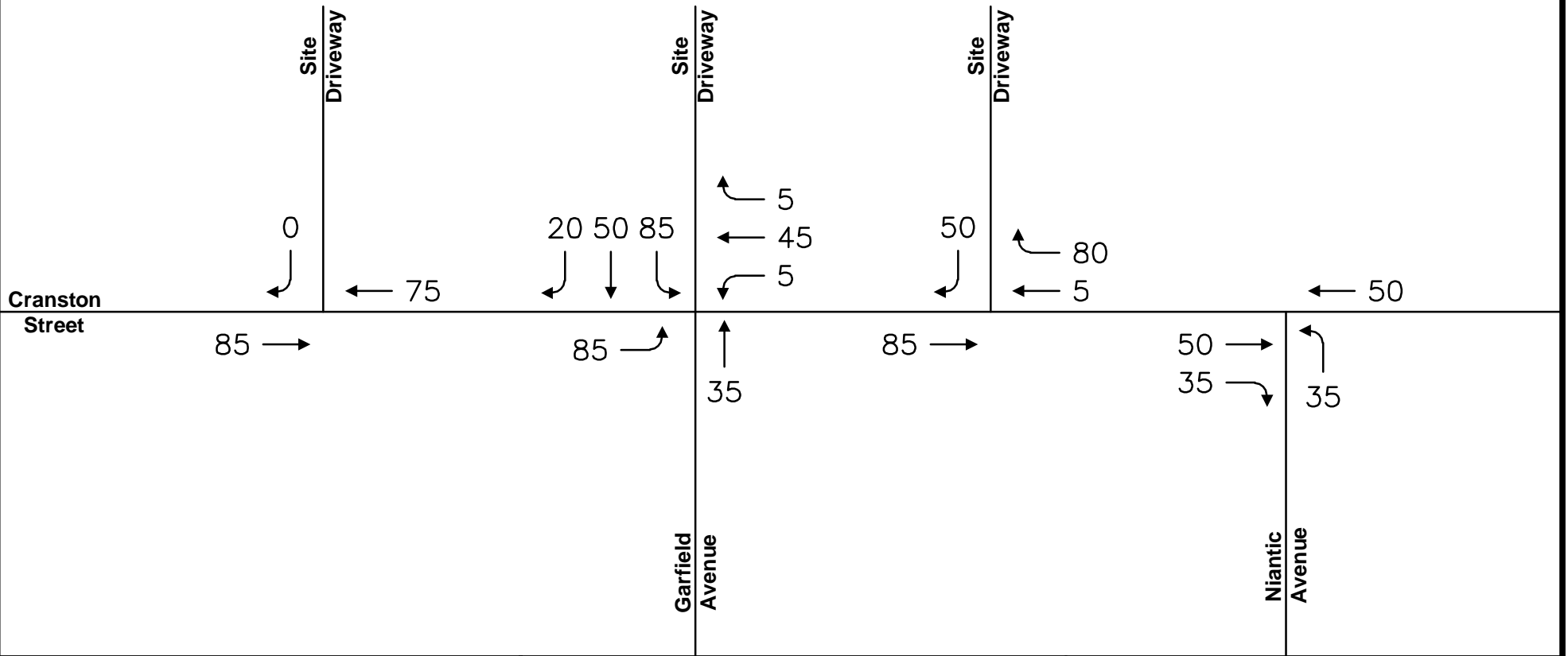
C

Site Trip Distribution

SITE

Site Trips:

Enter: 205
 Exit: 205
 Total: 410



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WEEKDAY TRAFFIC DISTRIBUTION
 AM PEAK HOUR

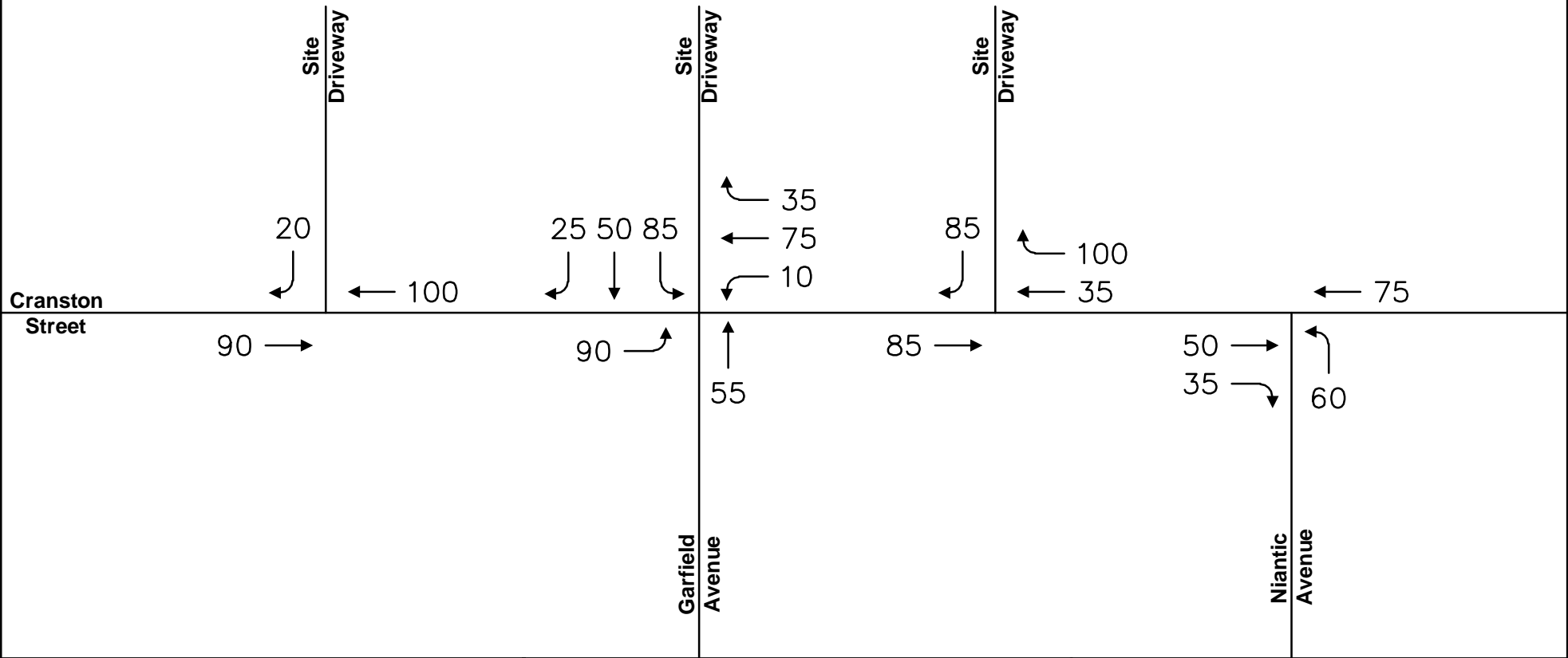
PROPOSED COMMERCIAL DEVELOPMENT
 CRANSTON, RHODE ISLAND

2024 Build Condition

SITE

Site Trips:

Enter: 280
 Exit: 265
 Total: 545



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WEEKDAY TRAFFIC DISTRIBUTION
 PM 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

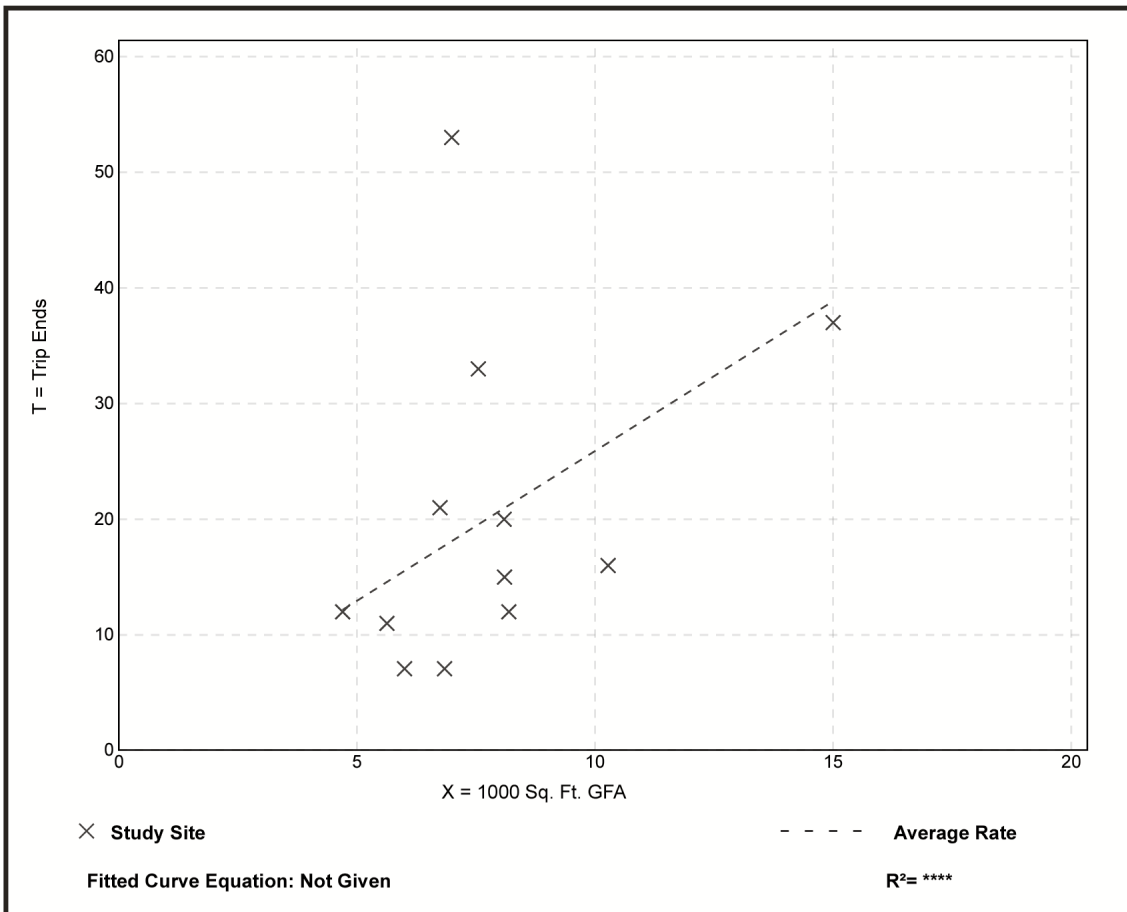
Automobile Parts Sales (843)

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



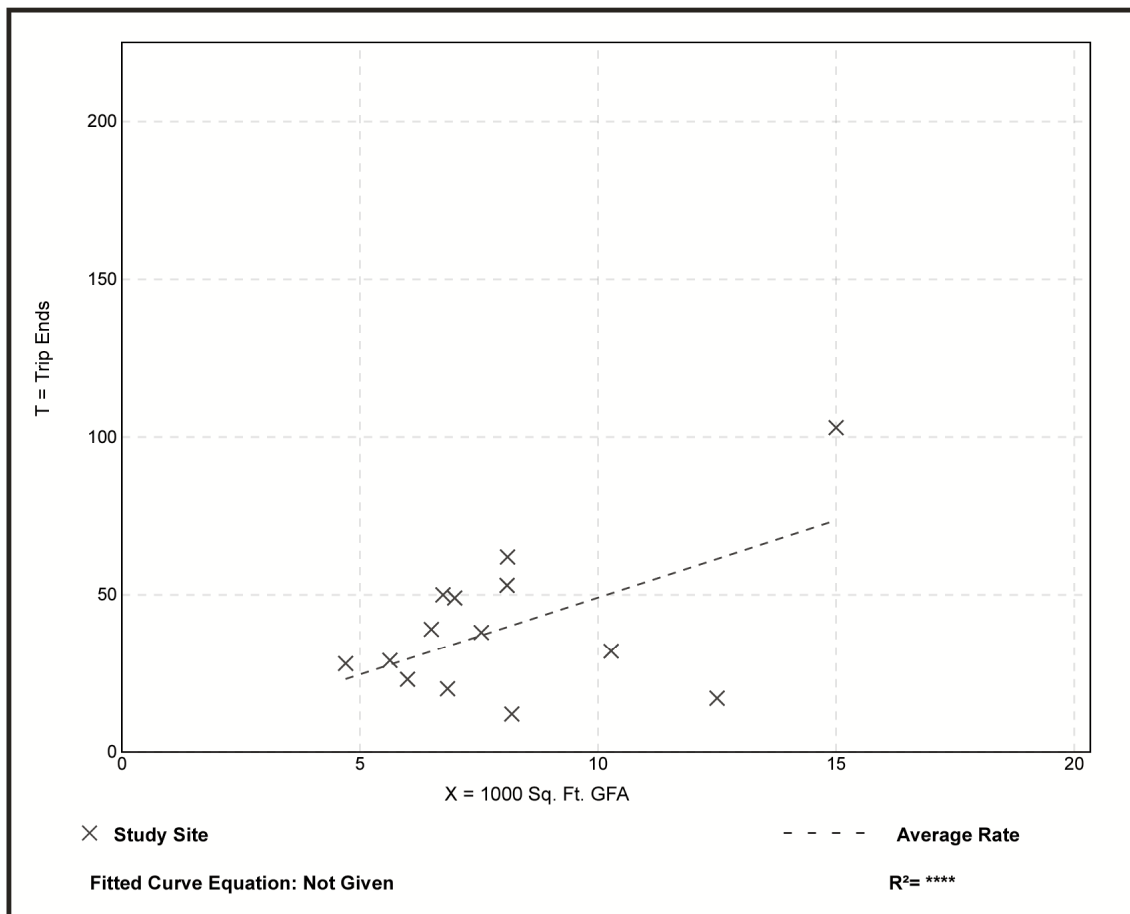
Automobile Parts Sales (843)

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



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

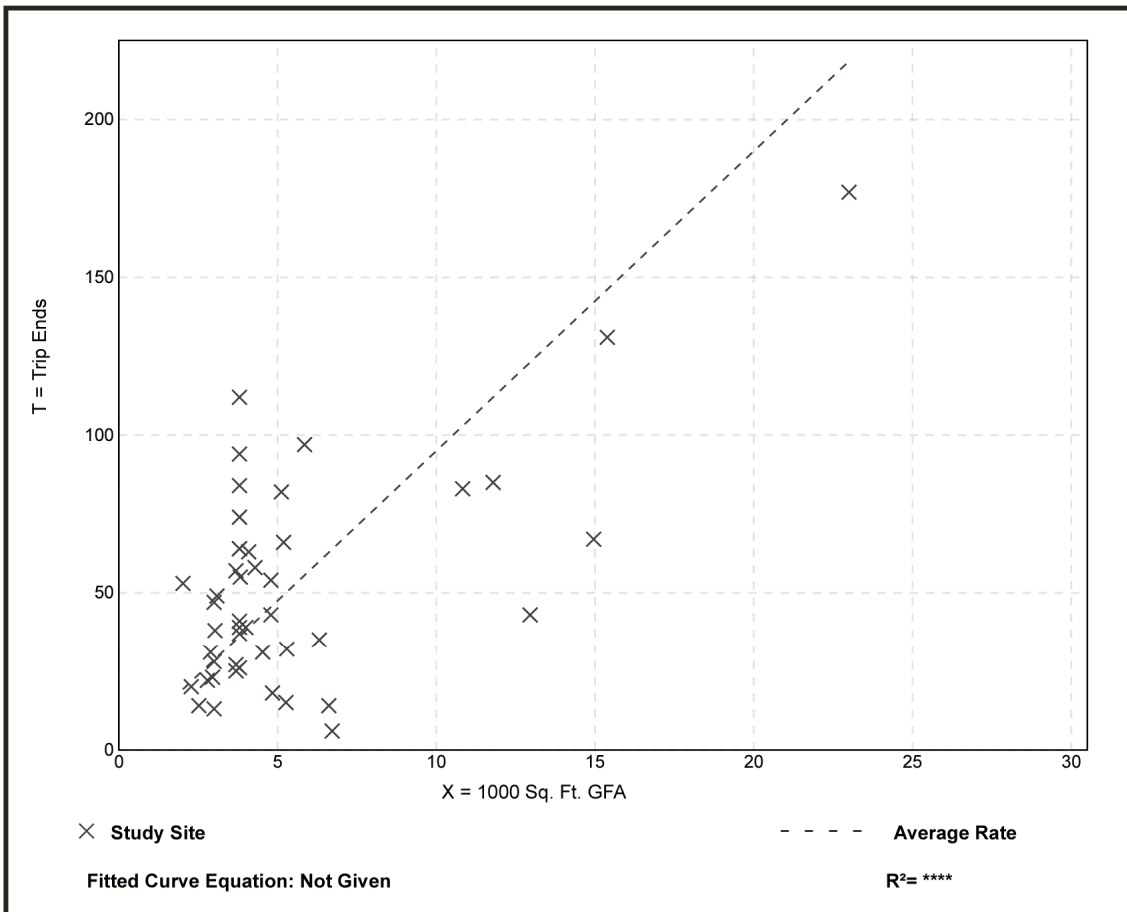
Drive-in Bank (912)

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



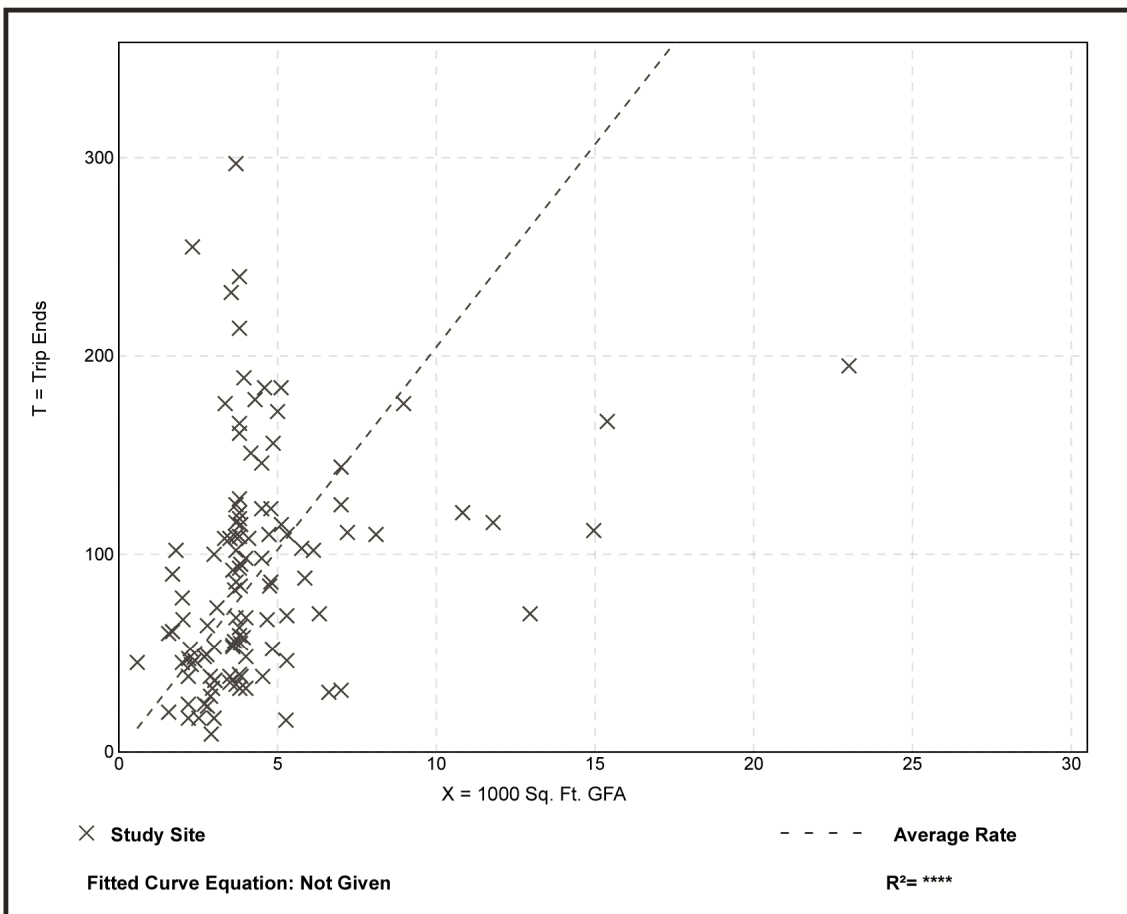
Drive-in Bank (912)

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



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

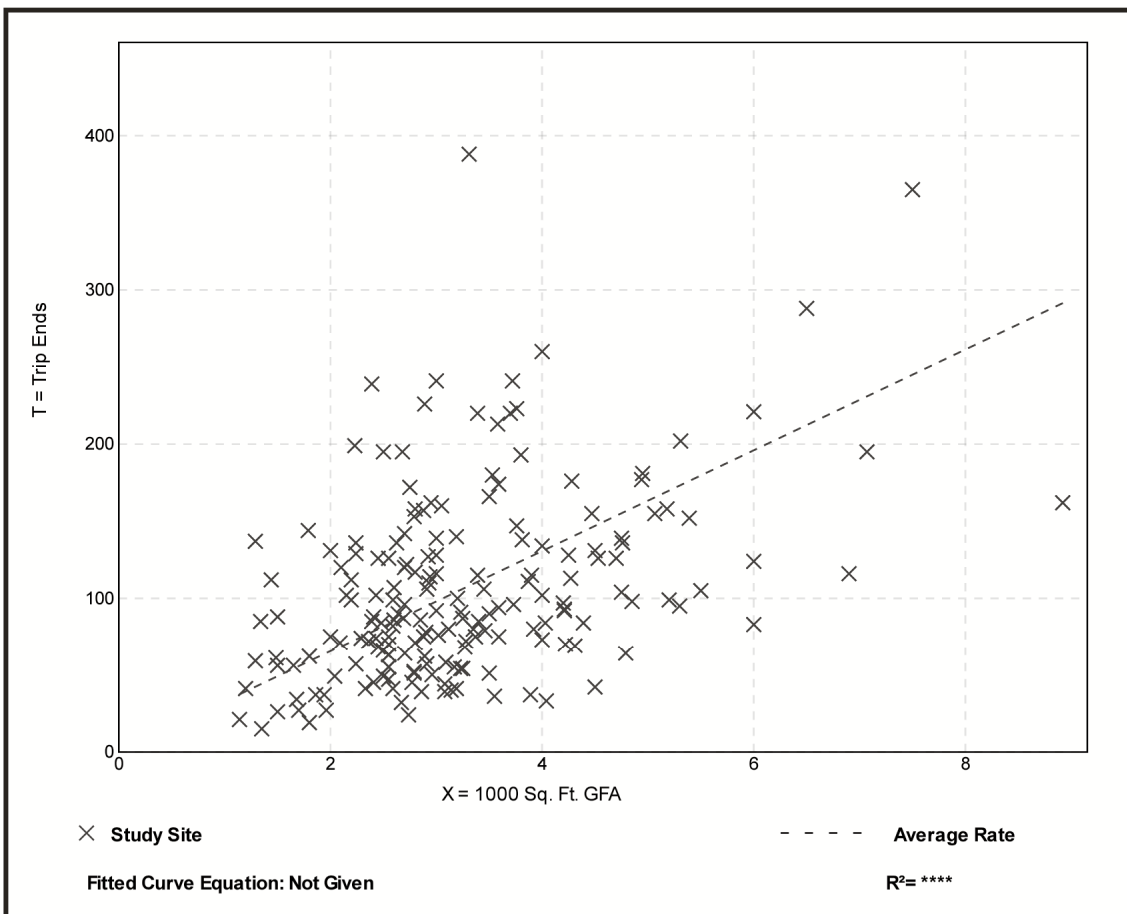
Fast-Food Restaurant with Drive-Through Window (934)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 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



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:

$$\text{Vehicle Trips} = [(\text{VFP Factor}) \times (\text{Number of VFP})] + [(\text{GFA Factor}) \times (\text{GFA})] + (\text{Constant})$$

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 R² 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

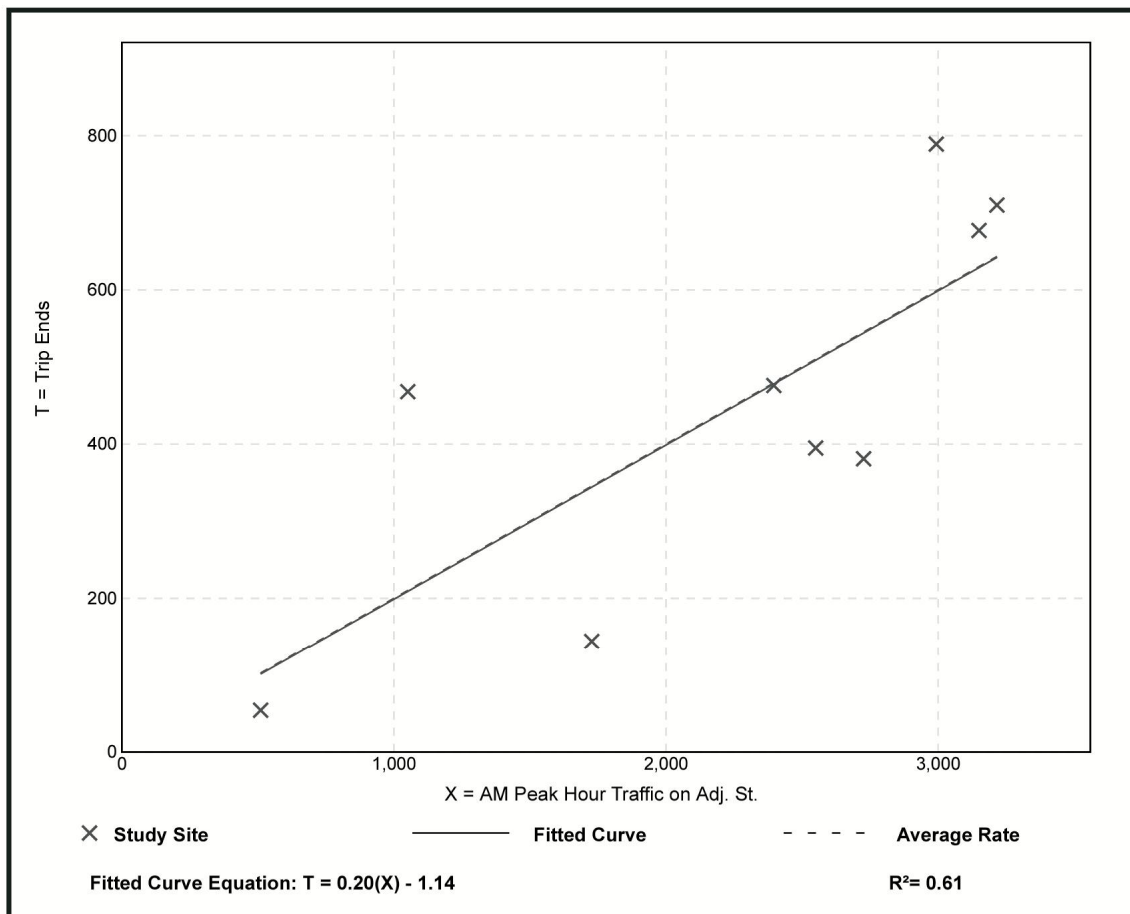
AM Peak Hour Traffic on Adj. St.: 2258

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

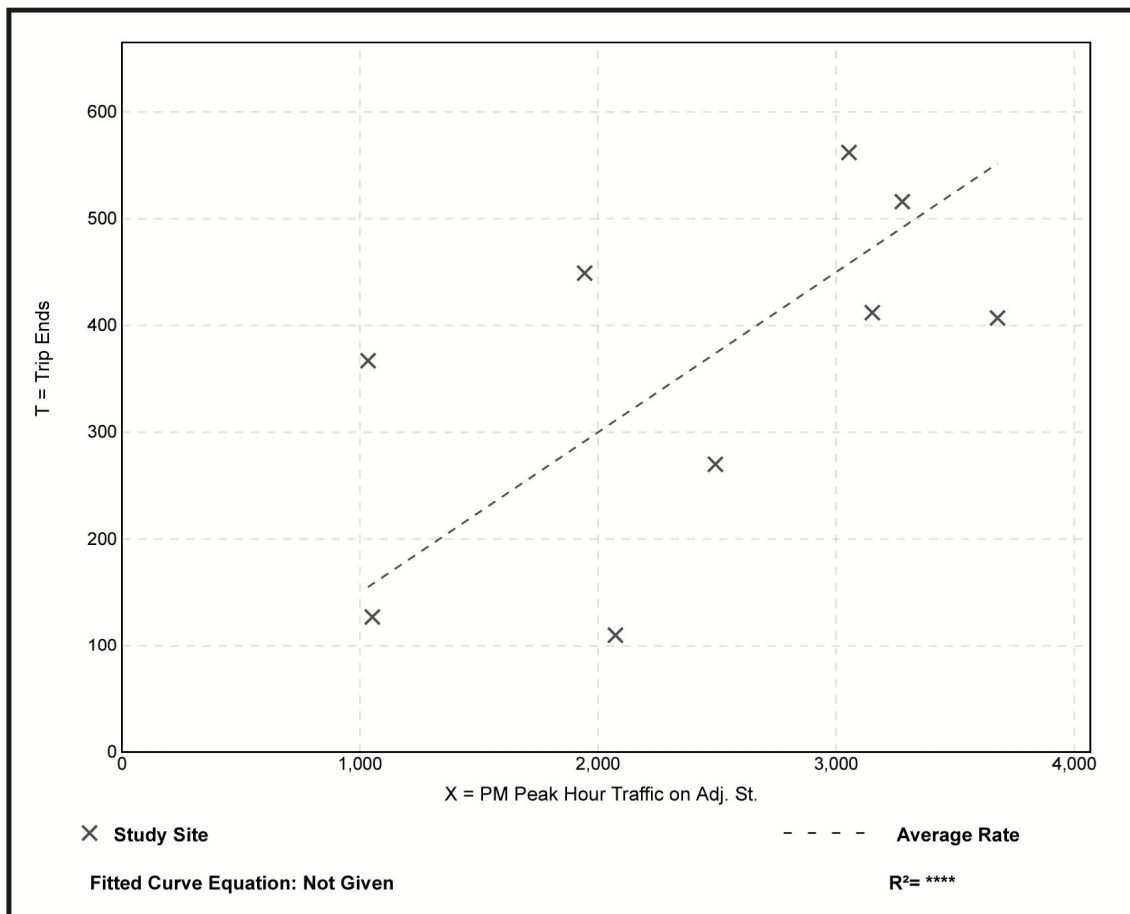
PM Peak Hour Traffic on Adj. St.: 2418

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 Garfield Avenue
- Cranston Street at Niantic Avenue

Future No Build Conditions

- Cranston Street at Garfield Avenue
- Cranston Street at Niantic Avenue

Future Build Conditions (Preferred Alternative)

- Cranston Street at Garfield Avenue/Main Site Access Driveway
- Cranston Street at Niantic Avenue

Future Build Conditions (Alternatives)

- Cranston Street at Garfield Avenue/Main Site Access Driveway
- Cranston Street at Niantic Avenue

D

Existing Weekday AM / PM Peak Hour

Cranston Street at Garfield Avenue
Cranston Street at Niantic Avenue

Cranston Street at Garfield Avenue



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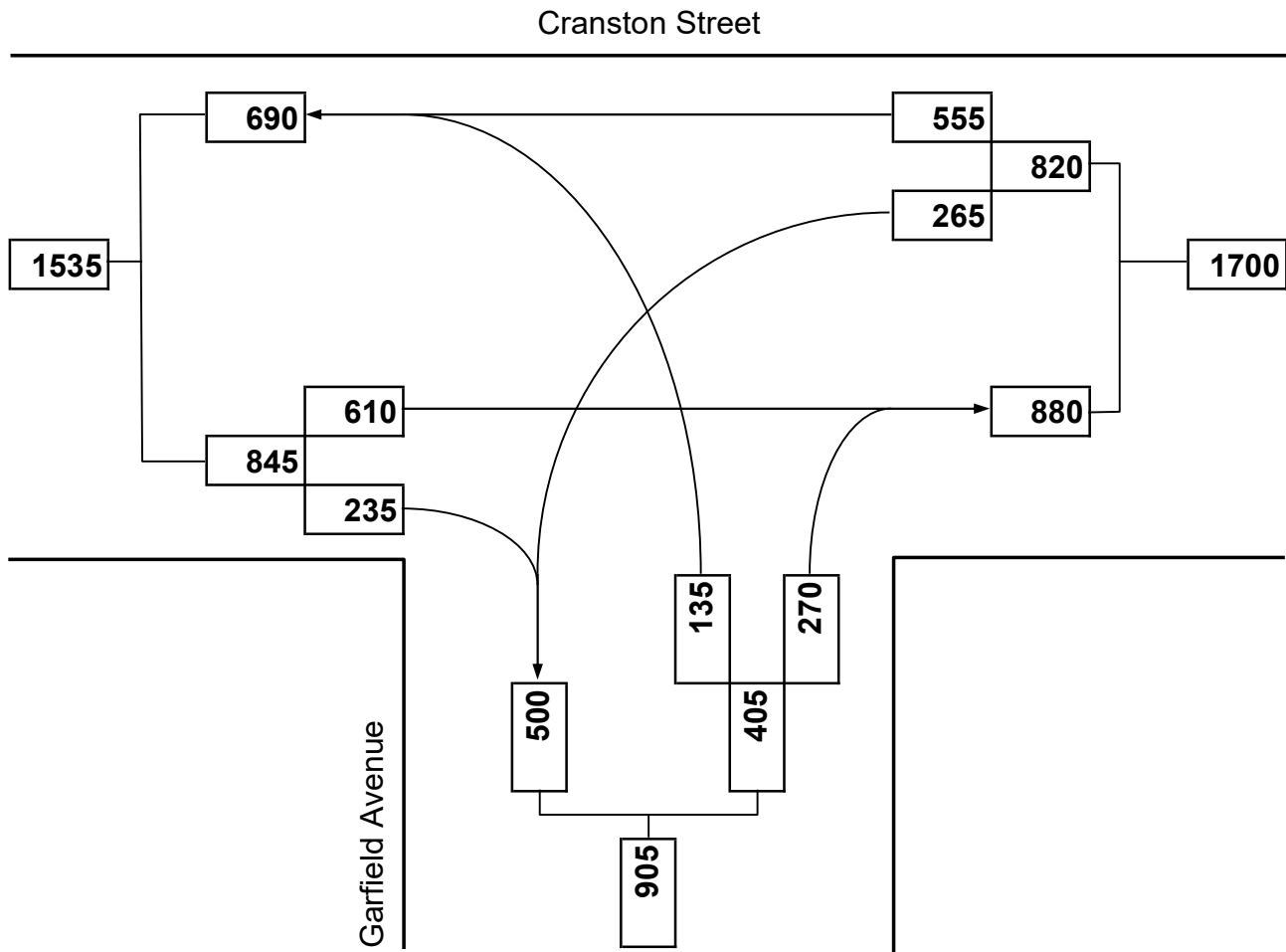
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: AM Peak

Minor Street: Garfield Avenue
Day of Week: Weekday
Peak Period: 7:30 AM - 8:30 AM
Future: n/a



NORTH



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↖
Traffic Volume (vph)	610	235	265	555	135	270
Future Volume (vph)	610	235	265	555	135	270
Satd. Flow (prot)	3415	0	1719	3471	1770	1553
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3415	0	1719	3471	1770	1553
Satd. Flow (RTOR)	95					278
Lane Group Flow (vph)	871	0	273	572	139	278
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases				2		3
Total Split (s)	52.0		18.0		20.0	20.0
Total Lost Time (s)	4.5		5.0		4.5	4.5
Act Effect Green (s)	40.8		23.3	68.6	11.9	11.9
Actuated g/C Ratio	0.45		0.26	0.76	0.13	0.13
v/c Ratio	0.54		0.61	0.22	0.60	0.62
Control Delay	17.7		42.7	6.1	46.9	11.0
Queue Delay	0.0		0.0	0.0	0.0	0.1
Total Delay	17.7		42.7	6.1	46.9	11.1
LOS	B		D	A	D	B
Approach Delay	17.7			17.9	23.0	
Approach LOS	B			B	C	
Queue Length 50th (ft)	162		169	70	76	0
Queue Length 95th (ft)	228		#248	113	127	65
Internal Link Dist (ft)	225			437	499	
Turn Bay Length (ft)			300			
Base Capacity (vph)	1847		445	2905	308	500
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	9
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.47		0.61	0.20	0.45	0.57

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.62
 Intersection Signal Delay: 18.8
 Intersection LOS: B
 Intersection Capacity Utilization 58.2%
 ICU Level of Service B
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Garfield Ave & Cranston St





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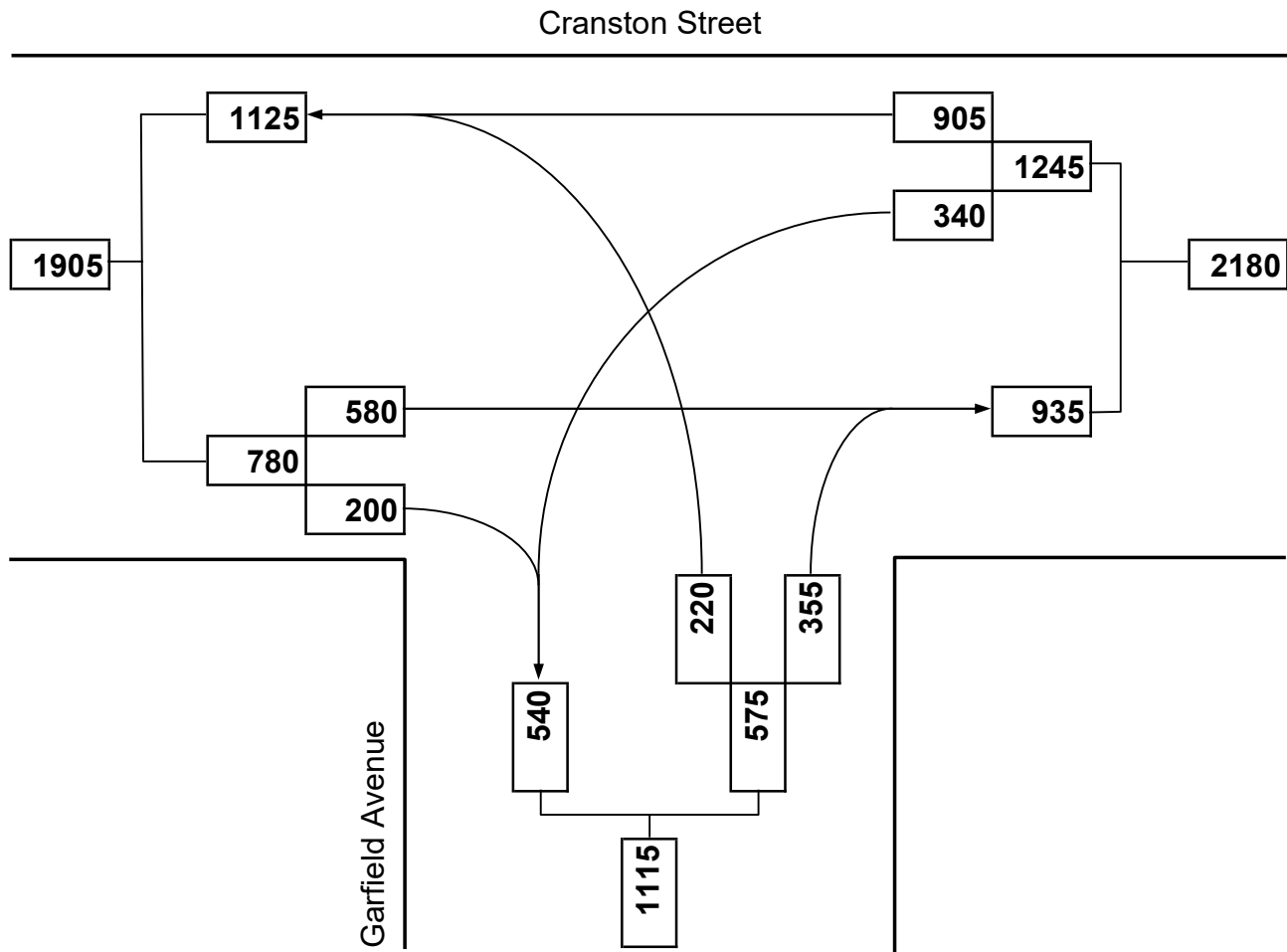
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: PM Peak

Minor Street: Garfield Avenue
Day of Week: Weekday
Peak Period: 4:30 PM - 5:30 PM
Future: n/a

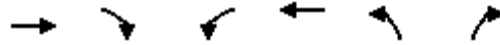


NORTH



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	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
Satd. Flow (prot)	3447	0	1770	3574	1787	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3447	0	1770	3574	1787	1583
Satd. Flow (RTOR)	65					382
Lane Group Flow (vph)	839	0	366	973	237	382
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Total Split (s)	32.0		26.0		22.0	22.0
Total Lost Time (s)	4.5		5.0		4.5	4.5
Act Effect Green (s)	31.2		20.2	56.0	14.5	14.5
Actuated g/C Ratio	0.39		0.25	0.70	0.18	0.18
v/c Ratio	0.61		0.82	0.39	0.73	0.64
Control Delay	21.2		38.6	6.8	44.1	8.5
Queue Delay	0.0		0.0	0.0	0.0	0.1
Total Delay	21.2		38.6	6.8	44.1	8.6
LOS	C		D	A	D	A
Approach Delay	21.2			15.5	22.2	
Approach LOS	C			B	C	
Queue Length 50th (ft)	172		151	107	111	0
Queue Length 95th (ft)	236		m214	m176	181	69
Internal Link Dist (ft)	225			437	499	
Turn Bay Length (ft)			300			
Base Capacity (vph)	1384		474	2459	390	644
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	1		0	0	0	11
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.61		0.77	0.40	0.61	0.60

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 18.7

Intersection LOS: B

Intersection Capacity Utilization 65.1%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St



Cranston Street at Niantic Avenue



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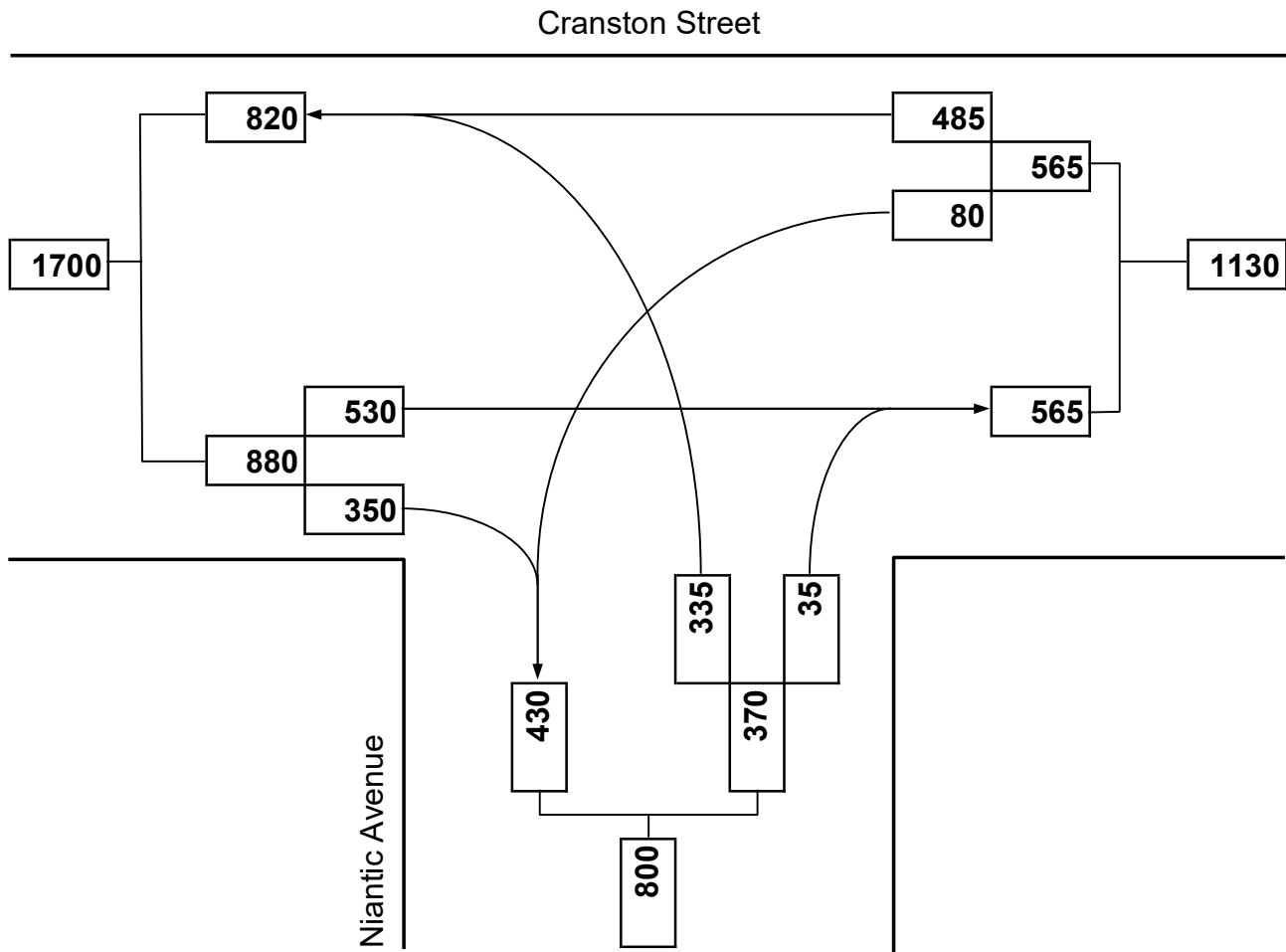
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: AM Peak

Minor Street: Niantic Avenue
Day of Week: Weekday
Peak Period: 7:30 AM - 8:30 AM
Future: n/a

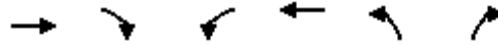


NORTH



Proposed Commercial Development
 Cranston Street at Niantic Avenue

Cranston, RI
 08/06/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	530	350	80	485	335	35
Future Volume (vph)	530	350	80	485	335	35
Satd. Flow (prot)	1863	1583	0	3480	1732	0
Flt Permitted				0.772	0.957	
Satd. Flow (perm)	1863	1583	0	2706	1732	0
Satd. Flow (RTOR)		372			6	
Lane Group Flow (vph)	564	372	0	601	393	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	54.0	54.0	54.0	54.0	36.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	55.2	55.2		55.2	24.8	
Actuated g/C Ratio	0.61	0.61		0.61	0.28	
v/c Ratio	0.49	0.33		0.36	0.82	
Control Delay	10.9	3.2		16.4	43.3	
Queue Delay	0.6	0.0		1.5	0.0	
Total Delay	11.5	3.2		17.9	43.3	
LOS	B	A		B	D	
Approach Delay	8.2			17.9	43.3	
Approach LOS	A			B	D	
Queue Length 50th (ft)	233	4		145	205	
Queue Length 95th (ft)	377	150		m166	277	
Internal Link Dist (ft)	437			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1147	1117		1666	605	
Starvation Cap Reductn	254	0		840	0	
Spillback Cap Reductn	87	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.63	0.33		0.73	0.65	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.82
 Intersection Signal Delay: 18.4
 Intersection LOS: B
 Intersection Capacity Utilization 76.8%
 ICU Level of Service D
 Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Niantic Ave & Cranston St





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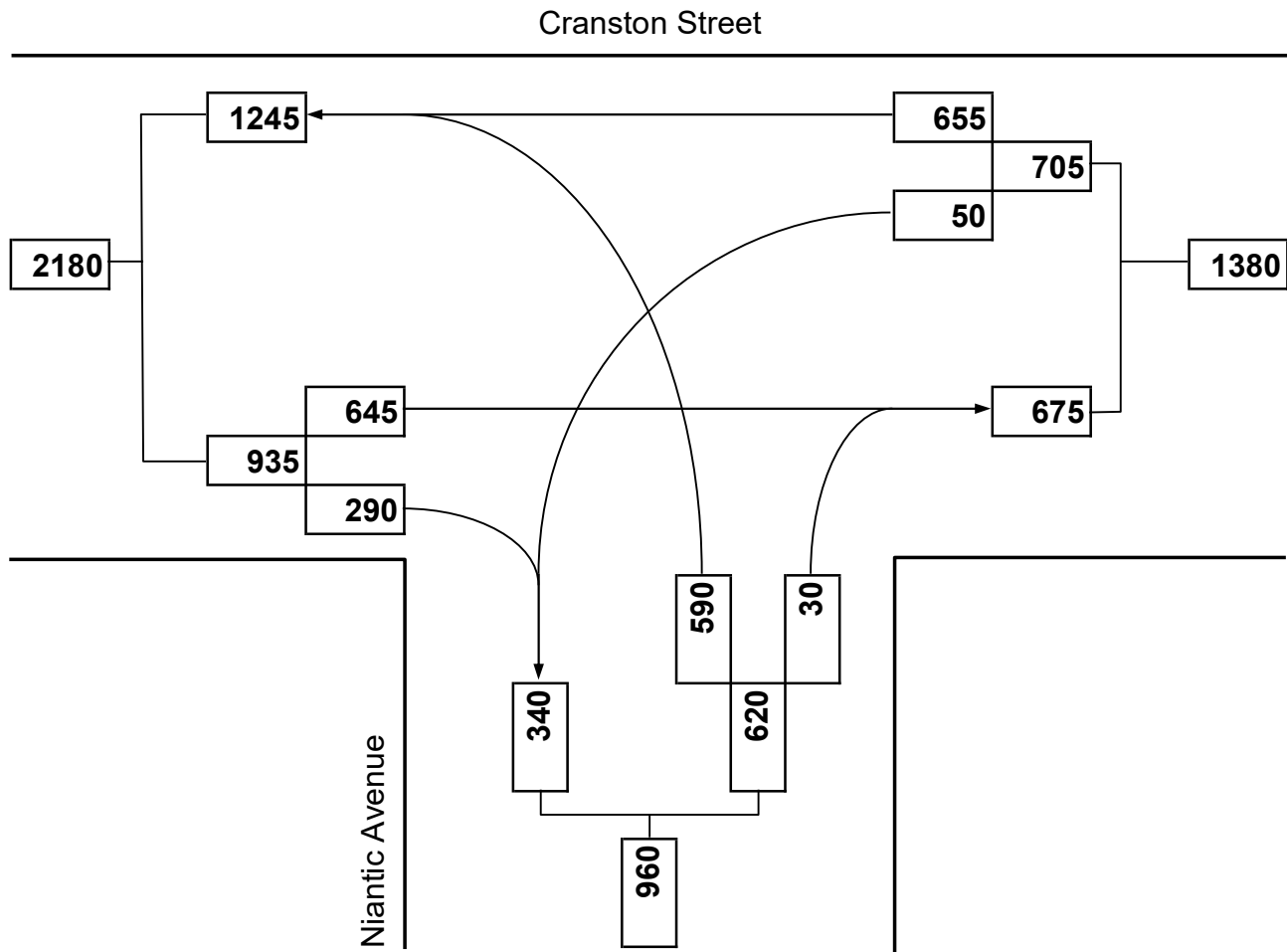
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: PM Peak

Minor Street: Niantic Avenue
Day of Week: Weekday
Peak Period: 4:30 PM - 5:30 PM
Future: n/a



NORTH



Proposed Commercial Development
Cranston Street at Niantic Avenue

Cranston, RI
08/06/2021



Lane Group	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
Satd. Flow (prot)	1881	1439	0	3557	1787	0
Flt Permitted				0.742	0.955	
Satd. Flow (perm)	1881	1439	0	2650	1787	0
Satd. Flow (RTOR)		312			3	
Lane Group Flow (vph)	694	312	0	758	666	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	51.0	51.0	51.0	51.0	29.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	38.8	38.8		38.8	31.2	
Actuated g/C Ratio	0.48	0.48		0.48	0.39	
v/c Ratio	0.76	0.36		0.59	0.95	
Control Delay	32.4	10.8		16.5	53.1	
Queue Delay	1.0	0.0		0.7	11.2	
Total Delay	33.4	10.8		17.3	64.3	
LOS	C	B		B	E	
Approach Delay	26.4			17.3	64.3	
Approach LOS	C			B	E	
Queue Length 50th (ft)	345	66		107	-326	
Queue Length 95th (ft)	424	104		m68	#627	
Internal Link Dist (ft)	437			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1081	960		1523	698	
Starvation Cap Reductn	174	0		421	0	
Spillback Cap Reductn	37	0		0	39	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.77	0.33		0.69	1.01	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 51 (64%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.95
 Intersection Signal Delay: 33.9 Intersection LOS: C
 Intersection Capacity Utilization 99.0% ICU Level of Service F
 Analysis Period (min) 15
 ~ 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



Existing Conditions
 Timing Plan: PM Peak Hour

D

Future 2024 No Build Weekday AM / PM Peak Hour

Cranston Street at Garfield Avenue
Cranston Street at Niantic Avenue

Cranston Street at Garfield Avenue



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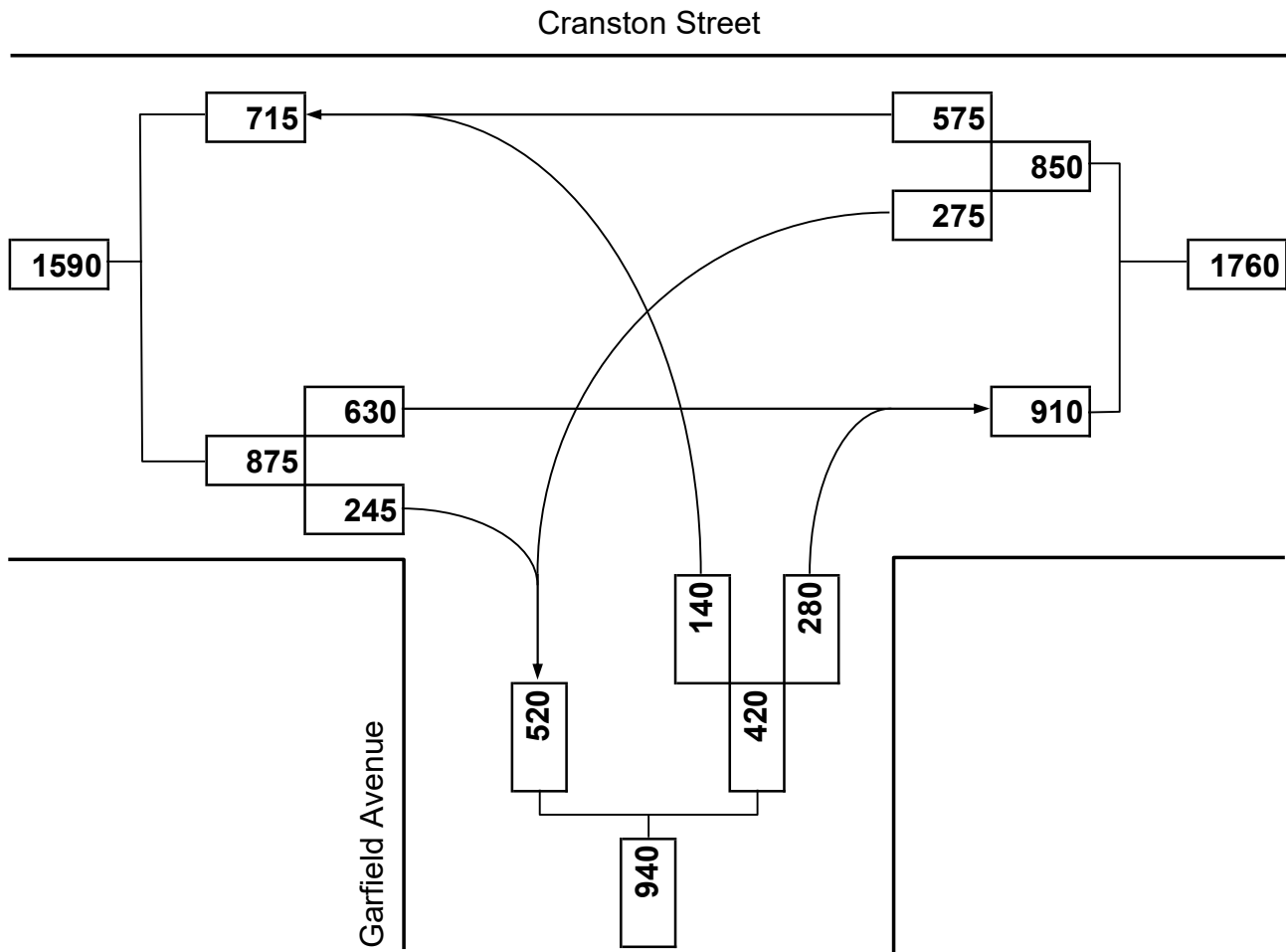
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue
Day of Week: Weekday
Peak Period: AM Peak
Future: 2024 No Build



NORTH



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↗
Traffic Volume (vph)	630	245	275	575	140	280
Future Volume (vph)	630	245	275	575	140	280
Satd. Flow (prot)	3415	0	1719	3471	1770	1553
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3415	0	1719	3471	1770	1553
Satd. Flow (RTOR)	97					289
Lane Group Flow (vph)	902	0	284	593	144	289
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases				2		3
Total Split (s)	52.0		18.0		20.0	20.0
Total Lost Time (s)	4.5		5.0		4.5	4.5
Act Effect Green (s)	39.8		24.2	68.4	12.1	12.1
Actuated g/C Ratio	0.44		0.27	0.76	0.13	0.13
v/c Ratio	0.58		0.62	0.22	0.61	0.63
Control Delay	18.6		42.7	6.1	47.0	11.0
Queue Delay	0.0		0.0	0.0	0.0	0.1
Total Delay	18.6		42.7	6.1	47.0	11.1
LOS	B		D	A	D	B
Approach Delay	18.6			17.9	23.0	
Approach LOS	B			B	C	
Queue Length 50th (ft)	175		174	76	78	0
Queue Length 95th (ft)	232		#282	111	131	67
Internal Link Dist (ft)	225			437	499	
Turn Bay Length (ft)			300			
Base Capacity (vph)	1848		461	2937	309	510
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	14
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.49		0.62	0.20	0.47	0.58

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.63
 Intersection Signal Delay: 19.2 Intersection LOS: B
 Intersection Capacity Utilization 59.9% ICU Level of Service B
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Garfield Ave & Cranston St





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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

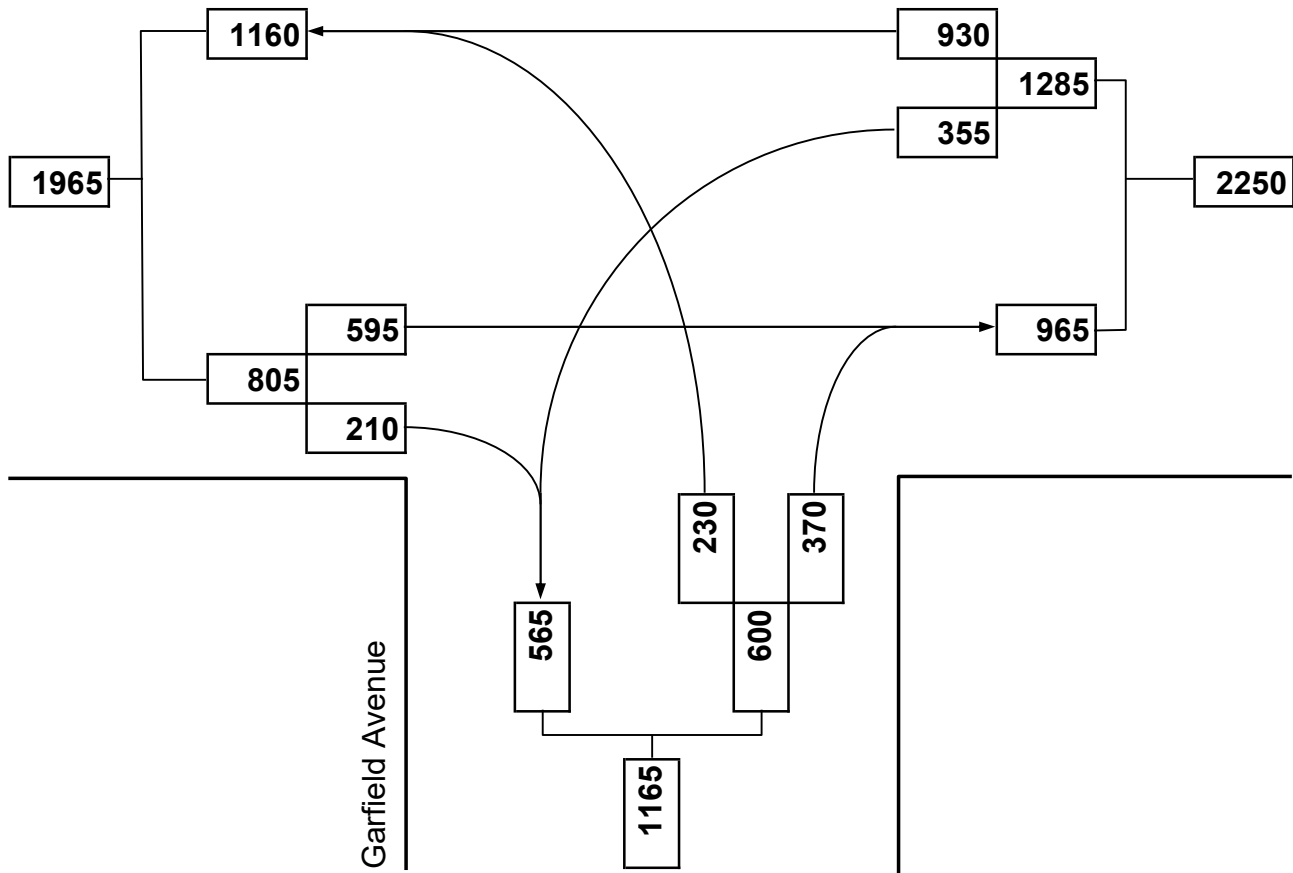
Existing: n/a

Future: 2024 No Build



NORTH

Cranston Street





Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	595	210	355	930	230	370
Future Volume (vph)	595	210	355	930	230	370
Satd. Flow (prot)	3444	0	1770	3574	1787	1583
Flt Permitted			0.950		0.950	
Satd. Flow (perm)	3444	0	1770	3574	1787	1583
Satd. Flow (RTOR)	67					398
Lane Group Flow (vph)	866	0	382	1000	247	398
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	1 2	3	
Permitted Phases						3
Total Split (s)	32.0		26.0		22.0	22.0
Total Lost Time (s)	4.5		5.0		4.5	4.5
Act Effect Green (s)	30.6		20.7	55.7	14.8	14.8
Actuated g/C Ratio	0.38		0.26	0.70	0.18	0.18
v/c Ratio	0.64		0.84	0.40	0.75	0.65
Control Delay	22.1		40.5	6.5	45.2	8.5
Queue Delay	0.0		0.0	0.0	0.0	0.2
Total Delay	22.1		40.5	6.5	45.2	8.7
LOS	C		D	A	D	A
Approach Delay	22.1			15.9	22.7	
Approach LOS	C			B	C	
Queue Length 50th (ft)	179		211	162	116	0
Queue Length 95th (ft)	245		m255	m151	188	70
Internal Link Dist (ft)	225			437	499	
Turn Bay Length (ft)			300			
Base Capacity (vph)	1356		477	2486	390	657
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	1		0	0	0	25
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.64		0.80	0.40	0.63	0.63

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 19.3 Intersection LOS: B
 Intersection Capacity Utilization 67.2% ICU Level of Service C
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St



Cranston Street at Niantic Avenue



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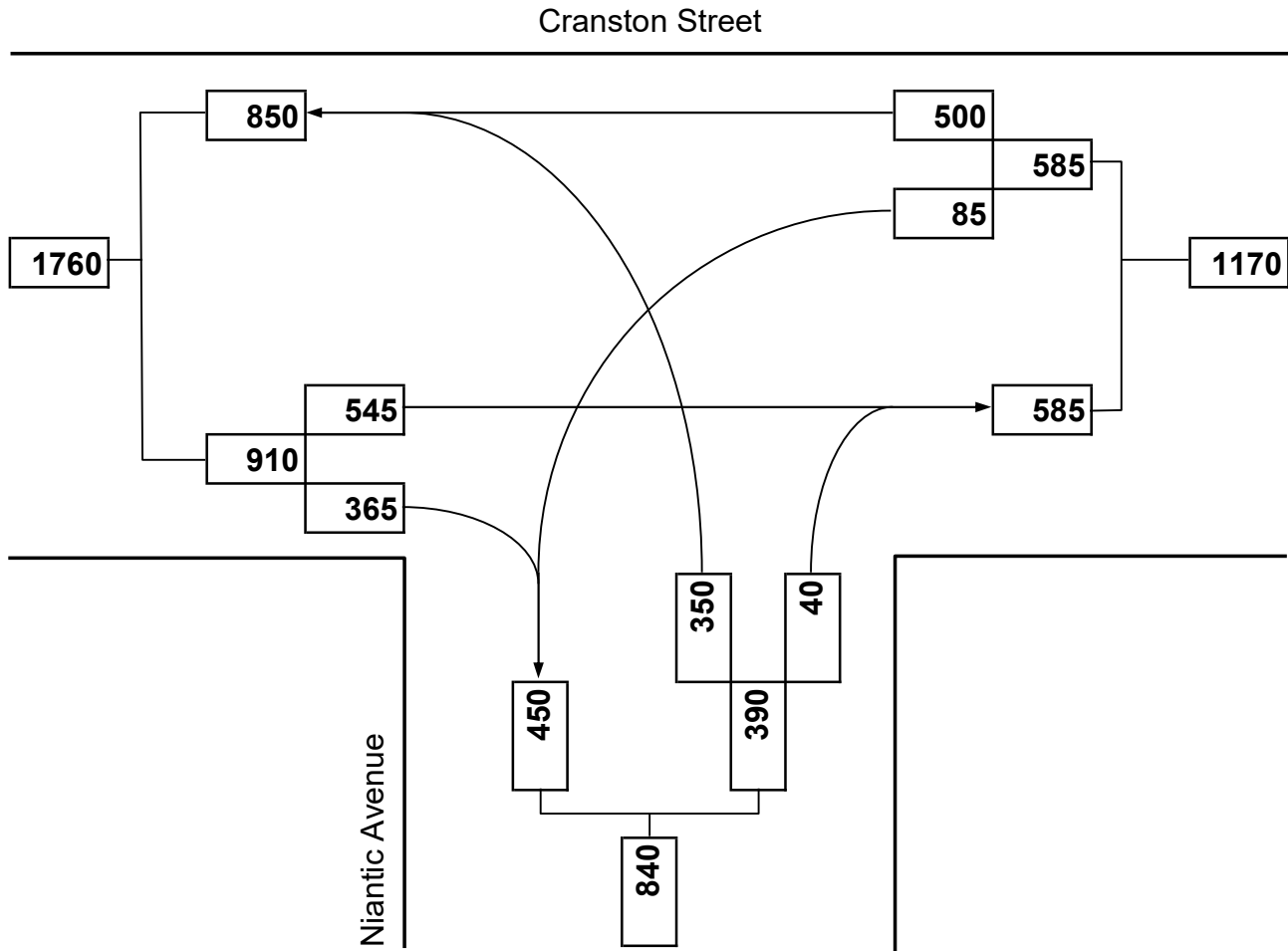
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Niantic Avenue
Day of Week: Weekday
Peak Period: AM Peak
Future: 2024 No Build



NORTH



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	545	365	85	500	350	40
Future Volume (vph)	545	365	85	500	350	40
Satd. Flow (prot)	1863	1583	0	3480	1731	0
Flt Permitted				0.750	0.957	
Satd. Flow (perm)	1863	1583	0	2629	1731	0
Satd. Flow (RTOR)		388			7	
Lane Group Flow (vph)	580	388	0	622	415	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	54.0	54.0	54.0	54.0	36.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	54.4	54.4		54.4	25.6	
Actuated g/C Ratio	0.60	0.60		0.60	0.28	
v/c Ratio	0.52	0.35		0.39	0.84	
Control Delay	11.6	3.4		16.1	44.4	
Queue Delay	0.7	0.0		1.8	0.0	
Total Delay	12.3	3.4		17.9	44.4	
LOS	B	A		B	D	
Approach Delay	8.7			17.9	44.4	
Approach LOS	A			B	D	
Queue Length 50th (ft)	249	4		142	215	
Queue Length 95th (ft)	387	154		m161	299	
Internal Link Dist (ft)	437			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1130	1112		1594	604	
Starvation Cap Reductn	255	0		772	0	
Spillback Cap Reductn	68	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.66	0.35		0.76	0.69	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.84
 Intersection Signal Delay: 18.9
 Intersection Capacity Utilization 79.3%
 Analysis Period (min) 15

Intersection LOS: B

ICU Level of Service D

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Niantic Ave & Cranston St





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Turning Movement Diagram

Major Street: Cranston Street

Minor Street: Niantic Avenue

City/Town: Cranston, RI

Day of Week: Weekday

Reference No.: 7578

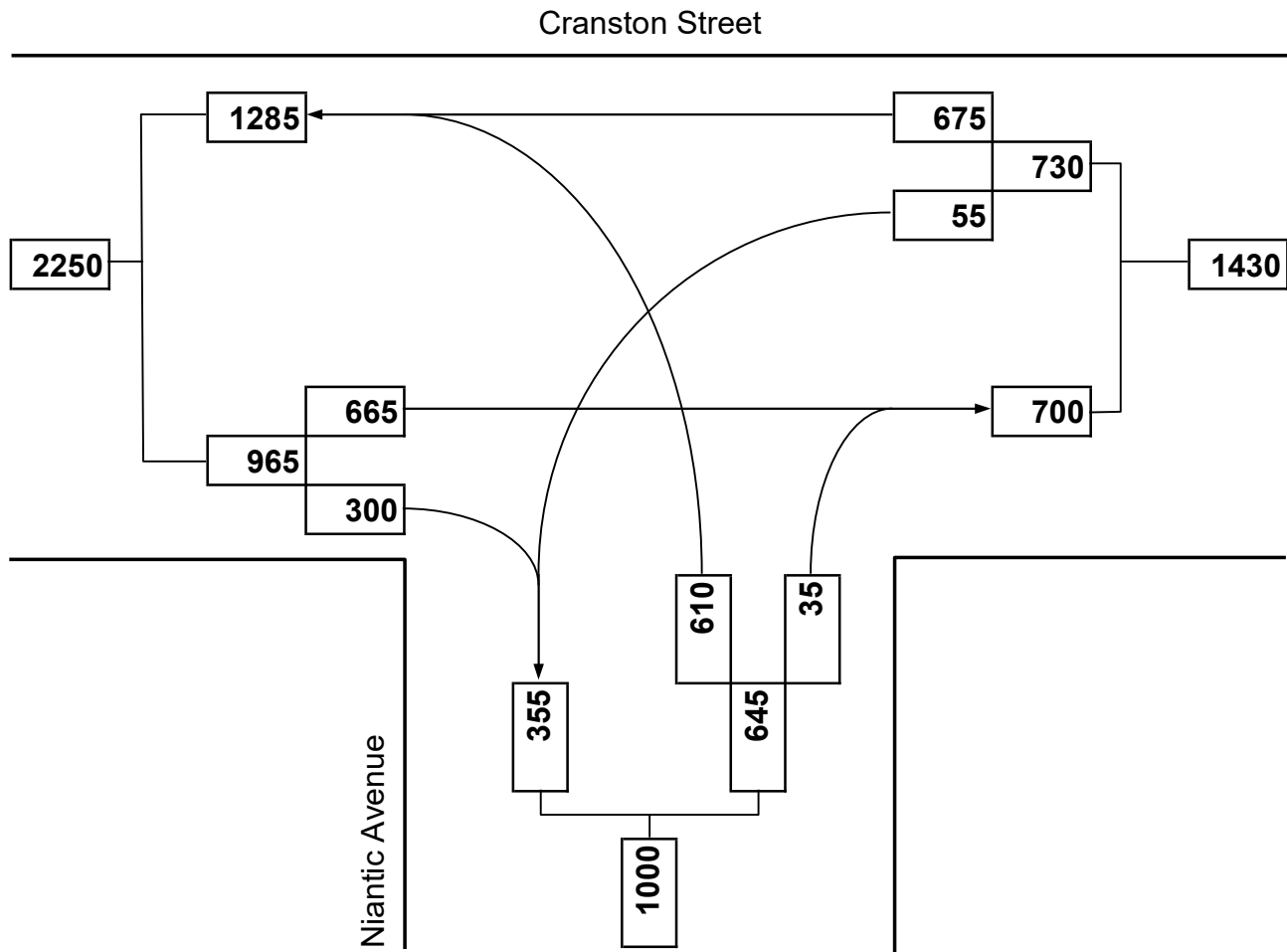
Peak Period: PM Peak

Existing: n/a

Future: 2024 No Build



NORTH





Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↗		↖	↙	
Traffic Volume (vph)	665	300	55	675	610	35
Future Volume (vph)	665	300	55	675	610	35
Satd. Flow (prot)	1881	1439	0	3557	1785	0
Flt Permitted				0.725	0.955	
Satd. Flow (perm)	1881	1439	0	2589	1785	0
Satd. Flow (RTOR)		323			4	
Lane Group Flow (vph)	715	323	0	785	694	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	51.0	51.0	51.0	51.0	29.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	39.8	39.8		39.8	30.2	
Actuated g/C Ratio	0.50	0.50		0.50	0.38	
v/c Ratio	0.77	0.37		0.61	1.03	
Control Delay	20.1	2.9		24.5	70.7	
Queue Delay	0.7	0.0		13.1	0.0	
Total Delay	20.8	2.9		37.6	70.7	
LOS	C	A		D	E	
Approach Delay	15.2			37.6	70.7	
Approach LOS	B			D	E	
Queue Length 50th (ft)	353	14		218	-396	
Queue Length 95th (ft)	418	19		m214	#661	
Internal Link Dist (ft)	437			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1081	964		1488	677	
Starvation Cap Reductn	129	0		688	0	
Spillback Cap Reductn	127	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.75	0.34		0.98	1.03	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 22 (28%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.03
 Intersection Signal Delay: 37.5 Intersection LOS: D
 Intersection Capacity Utilization 103.7% ICU Level of Service G
 Analysis Period (min) 15

- ~ 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



D

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

Cranston Street at Garfield Avenue/Main Site Access Driveway
Cranston Street at Niantic Avenue

Cranston Street at Garfield Avenue/Main Site Access Driveway

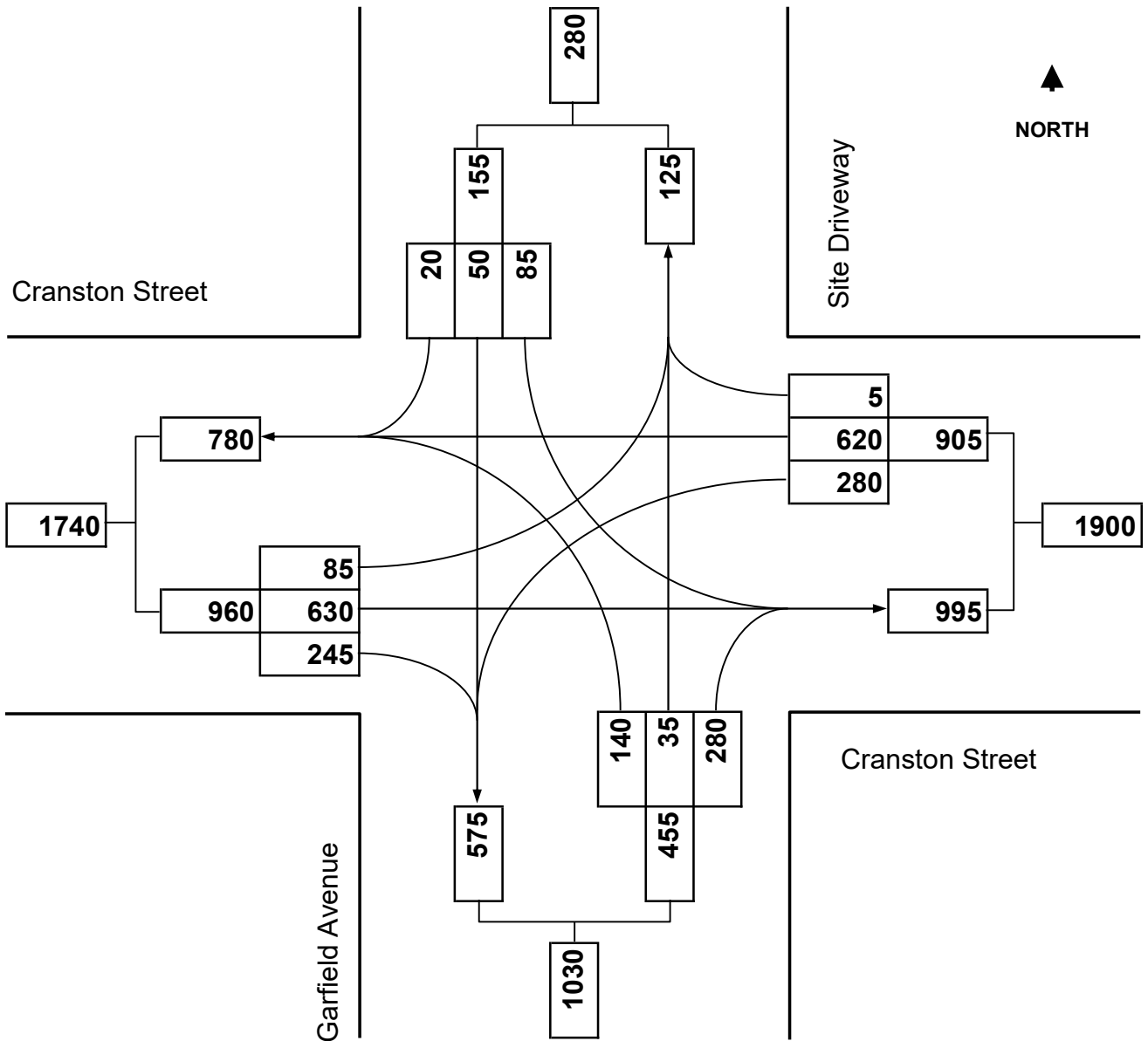


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: AM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Future Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Satd. Flow (prot)	1805	3415	0	1770	3469	0	0	1799	1553	0	1815	0
Flt Permitted	0.407			0.152				0.627			0.733	
Satd. Flow (perm)	773	3415	0	283	3469	0	0	1173	1553	0	1368	0
Satd. Flow (RTOR)		70			1				289		8	
Lane Group Flow (vph)	91	902	0	289	644	0	0	182	289	0	167	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6		3	3 8				4
Permitted Phases	2			6			3 8		3 8	4		
Total Split (s)	12.5	35.5		20.0	43.0		12.5			22.0	22.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5							4.5
Act Effect Green (s)	42.1	34.1		52.7	42.7			28.3	28.3			14.5
Actuated g/C Ratio	0.47	0.38		0.59	0.47			0.31	0.31			0.16
v/c Ratio	0.20	0.68		0.73	0.39			0.42	0.42			0.74
Control Delay	11.0	25.5		27.8	18.8			26.2	4.8			53.0
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.1			0.8
Total Delay	11.0	25.5		27.8	18.8			26.2	4.9			53.8
LOS	B	C		C	B			C	A			D
Approach Delay		24.2			21.6			13.1				53.8
Approach LOS		C			C			B				D
Queue Length 50th (ft)	23	225		93	125			73	0			86
Queue Length 95th (ft)	43	288		m171	183			130	53			151
Internal Link Dist (ft)		185			168			499				144
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	452	1353		421	1661			461	716			272
Starvation Cap Reductn	0	0		0	0			0	0			0
Spillback Cap Reductn	0	1		0	0			0	34			17
Storage Cap Reductn	0	0		0	0			0	0			0
Reduced v/c Ratio	0.20	0.67		0.69	0.39			0.39	0.42			0.65

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.74

Intersection Signal Delay: 23.1

Intersection LOS: C

Intersection Capacity Utilization 67.2%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Garfield Ave & Cranston St



Lane Group	Ø8
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	8
Permitted Phases	
Total Split (s)	34.5
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

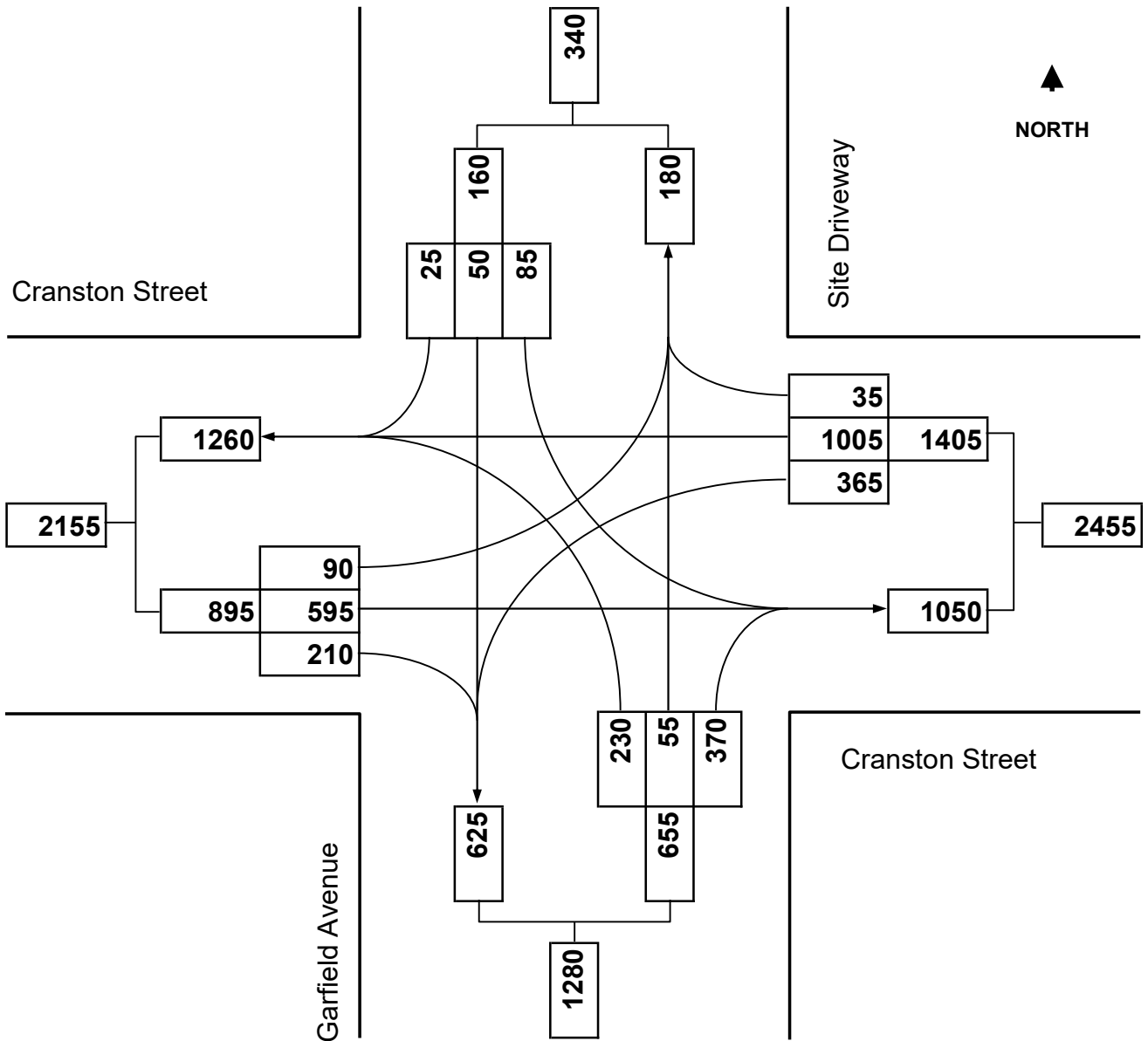


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↖	↗		↗	↖
Traffic Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Future Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Satd. Flow (prot)	1805	3444	0	1770	3558	0	0	1811	1583	0	1812	0
Flt Permitted	0.950			0.950				0.615				0.679
Satd. Flow (perm)	1805	3444	0	1770	3558	0	0	1159	1583	0	1263	0
Satd. Flow (RTOR)		58			5				398		10	
Lane Group Flow (vph)	97	866	0	392	1119	0	0	306	398	0	172	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
Total Split (s)	12.5	23.0		24.0	34.5		13.0			20.0	20.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5							4.5
Act Effect Green (s)	8.0	20.2		19.6	34.3			26.7	26.7			13.7
Actuated g/C Ratio	0.10	0.25		0.24	0.43			0.33	0.33			0.17
v/c Ratio	0.54	0.95		0.91	0.73			0.67	0.50			0.77
Control Delay	46.0	49.7		47.9	22.4			29.4	4.6			52.4
Queue Delay	0.0	0.4		0.0	0.0			0.0	0.2			1.2
Total Delay	46.0	50.2		47.9	22.4			29.4	4.7			53.6
LOS	D	D		D	C			C	A			D
Approach Delay		49.8			29.0			15.5				53.6
Approach LOS		D			C			B				D
Queue Length 50th (ft)	47	-234		215	251			116	0			76
Queue Length 95th (ft)	#97	#352		m#245	m293			189	55			#164
Internal Link Dist (ft)		185			168			499				144
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	180	914		441	1526			482	820			252
Starvation Cap Reductn	0	0		0	0			0	0			0
Spillback Cap Reductn	0	4		0	0			0	64			14
Storage Cap Reductn	0	0		0	0			0	0			0
Reduced v/c Ratio	0.54	0.95		0.89	0.73			0.63	0.53			0.72

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 2:EBT, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.95

Intersection Signal Delay: 33.4

Intersection LOS: C

Intersection Capacity Utilization 76.9%

ICU Level of Service D

Analysis Period (min) 15

~ 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



Lane Group	Ø8
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	8
Permitted Phases	
Total Split (s)	33.0
Total Lost Time (s)	
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Cranston Street at Niantic Avenue



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Turning Movement Diagram

Major Street: Cranston Street

Minor Street: Niantic Avenue

City/Town: Cranston, RI

Day of Week: Weekday

Reference No.: 7578

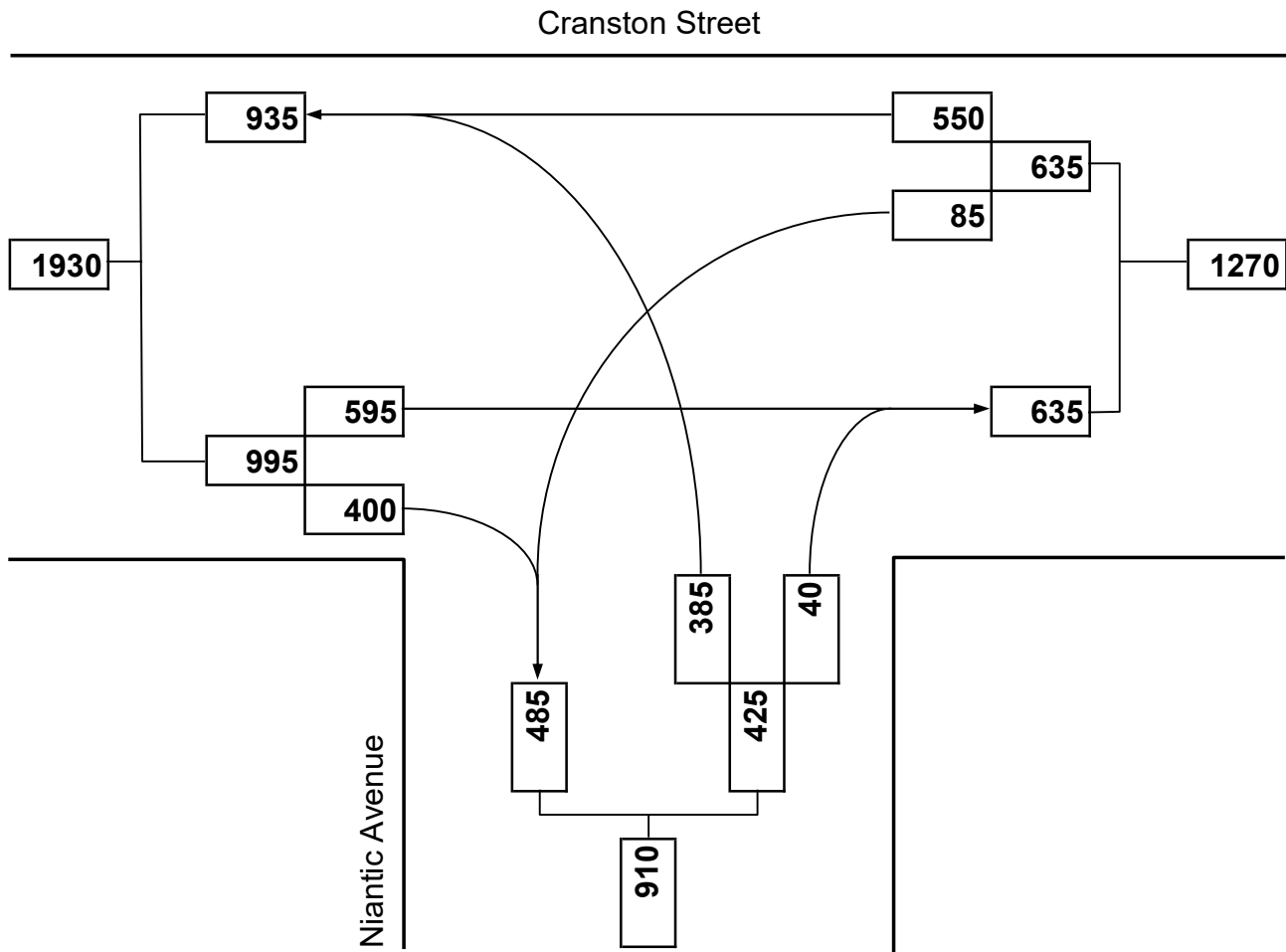
Peak Period: AM Peak

Existing: n/a

Future: 2024 Build

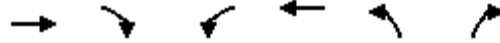


NORTH



Proposed Commercial Development
Cranston Street at Niantic Avenue

Cranston, RI
08/06/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	595	400	85	550	385	40
Future Volume (vph)	595	400	85	550	385	40
Satd. Flow (prot)	1863	1583	0	3480	1732	0
Flt Permitted				0.723	0.957	
Satd. Flow (perm)	1863	1583	0	2534	1732	0
Satd. Flow (RTOR)		426			6	
Lane Group Flow (vph)	633	426	0	675	453	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	54.0	54.0	54.0	54.0	36.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	52.9	52.9		52.9	27.1	
Actuated g/C Ratio	0.59	0.59		0.59	0.30	
v/c Ratio	0.58	0.39		0.45	0.86	
Control Delay	14.0	3.9		15.1	46.2	
Queue Delay	0.7	0.0		2.5	0.0	
Total Delay	14.7	3.9		17.6	46.2	
LOS	B	A		B	D	
Approach Delay	10.4			17.6	46.2	
Approach LOS	B			B	D	
Queue Length 50th (ft)	306	1		157	234	
Queue Length 95th (ft)	424	174		m168	#347	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1098	1107		1493	602	
Starvation Cap Reductn	197	0		666	0	
Spillback Cap Reductn	8	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.70	0.38		0.82	0.75	

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.86

Intersection Signal Delay: 20.0

Intersection LOS: C

Intersection Capacity Utilization 85.3%

ICU Level of Service E

Analysis Period (min) 15

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





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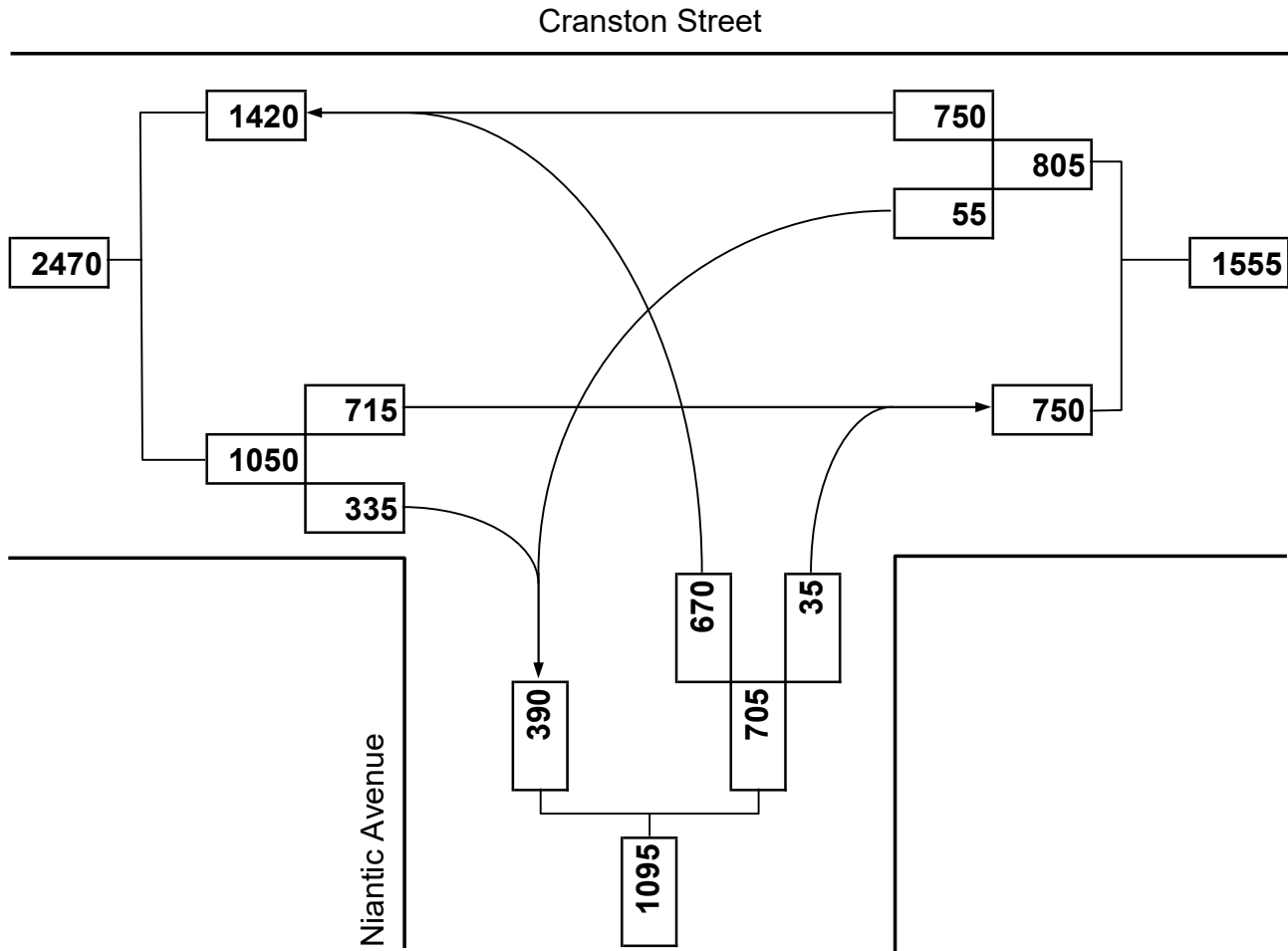
Turning Movement Diagram

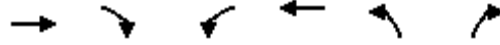
Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Niantic Avenue
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build



NORTH



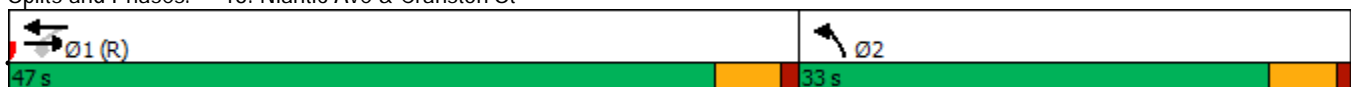


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	715	335	55	750	670	35
Future Volume (vph)	715	335	55	750	670	35
Satd. Flow (prot)	1881	1439	0	3561	1785	0
Flt Permitted				0.683	0.955	
Satd. Flow (perm)	1881	1439	0	2440	1785	0
Satd. Flow (RTOR)		360			4	
Lane Group Flow (vph)	769	360	0	865	758	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	47.0	47.0	47.0	47.0	33.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	39.1	39.1		39.1	30.9	
Actuated g/C Ratio	0.49	0.49		0.49	0.39	
v/c Ratio	0.84	0.41		0.73	1.10	
Control Delay	21.1	3.4		28.6	90.8	
Queue Delay	2.2	0.0		51.3	0.0	
Total Delay	23.3	3.4		79.9	90.8	
LOS	C	A		E	F	
Approach Delay	17.0			79.9	90.8	
Approach LOS	B			E	F	
Queue Length 50th (ft)	351	22		233	-469	
Queue Length 95th (ft)	m413	m35		m261	#686	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	987	926		1281	692	
Starvation Cap Reductn	48	0		568	0	
Spillback Cap Reductn	110	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.88	0.39		1.21	1.10	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 22 (28%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.10
 Intersection Signal Delay: 57.1 Intersection LOS: E
 Intersection Capacity Utilization 110.1% ICU Level of Service H
 Analysis Period (min) 15
 ~ 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



D

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

Cranston Street at Garfield Avenue/Main Site Access Driveway
Cranston Street at Niantic Avenue

Cranston Street at Garfield Avenue/Main Site Access Driveway

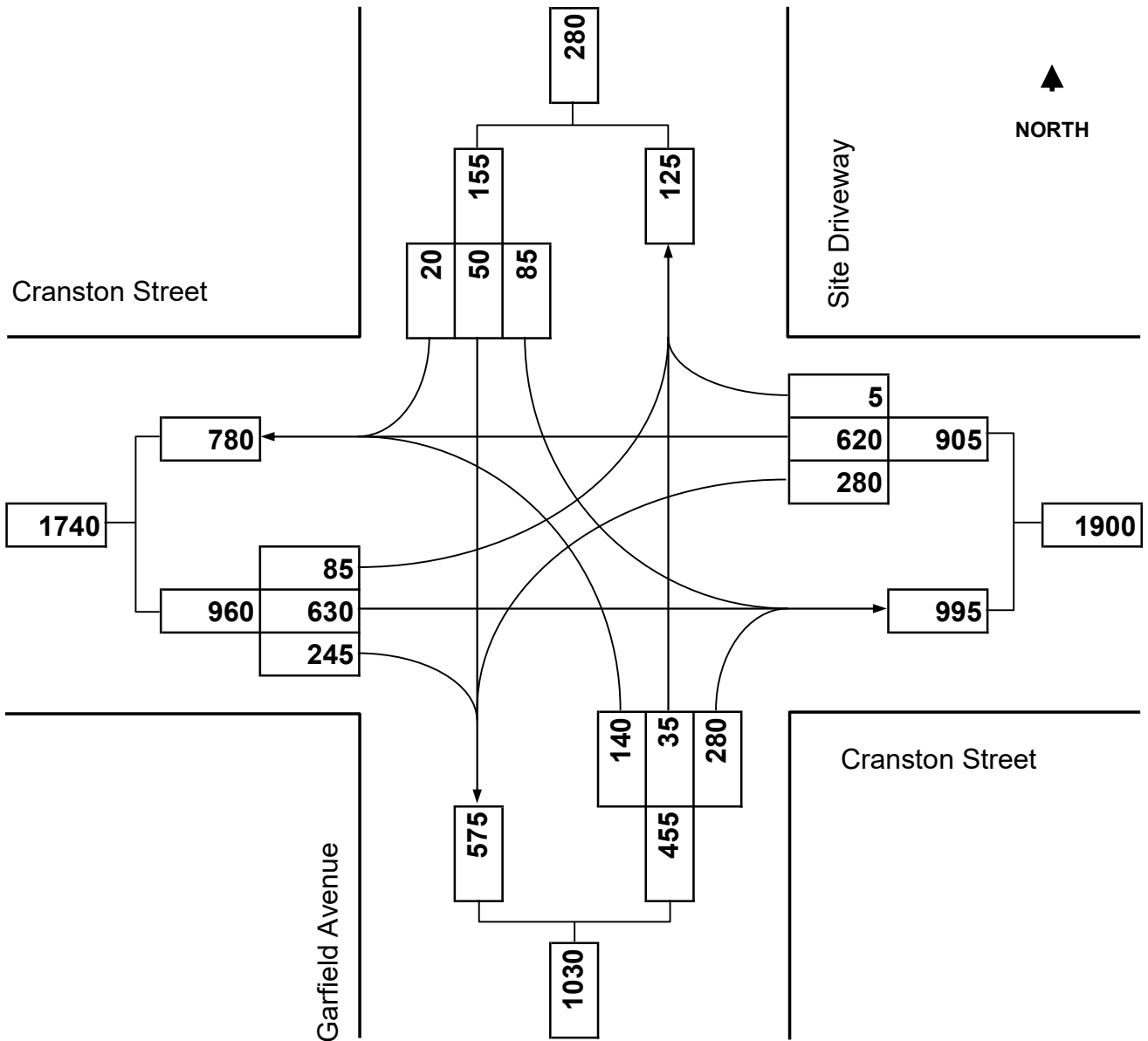


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: AM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↕		↖	↕			↕	↗		↕	↗
Traffic Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Future Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Satd. Flow (prot)	1805	3415	0	1770	3469	0	0	1799	1553	0	1815	0
Flt Permitted	0.407			0.950				0.962			0.973	
Satd. Flow (perm)	773	3415	0	1770	3469	0	0	1799	1553	0	1815	0
Satd. Flow (RTOR)		67			1				289		7	
Lane Group Flow (vph)	91	902	0	289	644	0	0	182	289	0	167	0
Turn Type	Perm	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases		2		1	1 2		3	3		4	4	
Permitted Phases	2				2				3			
Total Split (s)	33.0	33.0		24.0			17.0	17.0	17.0	16.0	16.0	
Total Lost Time (s)	4.5	4.5		4.5				4.5	4.5		4.5	
Act Effect Green (s)	31.3	31.3		18.1	53.9			11.7	11.7		10.9	
Actuated g/C Ratio	0.35	0.35		0.20	0.60			0.13	0.13		0.12	
v/c Ratio	0.34	0.73		0.81	0.31			0.78	0.64		0.74	
Control Delay	28.0	28.9		55.1	10.4			61.1	11.7		56.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.3		1.8	
Total Delay	28.0	28.9		55.1	10.4			61.1	12.0		58.7	
LOS	C	C		E	B			E	B		E	
Approach Delay		28.8			24.2			31.0			58.7	
Approach LOS		C			C			C			E	
Queue Length 50th (ft)	40	228		159	90			101	0		88	
Queue Length 95th (ft)	85	303		m#267	161			#197	72		#179	
Internal Link Dist (ft)		185			168			499			144	
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	268	1231		383	2051			249	464		238	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	1		0	0			0	20		16	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.34	0.73		0.75	0.31			0.73	0.65		0.75	

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 29.5

Intersection LOS: C

Intersection Capacity Utilization 67.2%

ICU Level of Service C

Analysis Period (min) 15

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



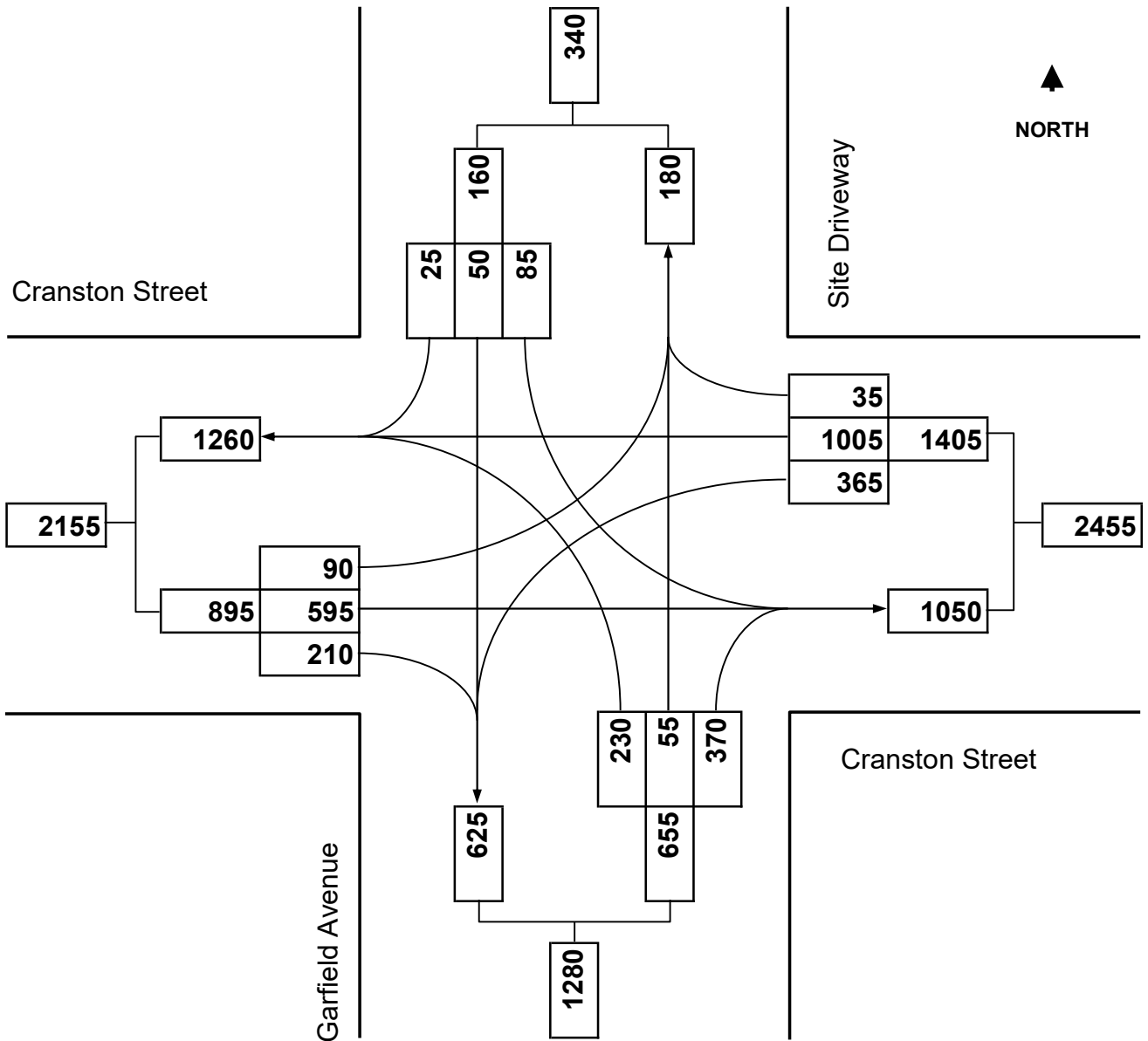


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↕		↖	↕			↕	↗		↕	↗
Traffic Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Future Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Satd. Flow (prot)	1805	3444	0	1770	3558	0	0	1811	1583	0	1812	0
Flt Permitted	0.255			0.950				0.961			0.974	
Satd. Flow (perm)	484	3444	0	1770	3558	0	0	1811	1583	0	1812	0
Satd. Flow (RTOR)		60			7				398		9	
Lane Group Flow (vph)	97	866	0	392	1119	0	0	306	398	0	172	0
Turn Type	Perm	NA		Prot	NA		Split	NA	Perm	Split	NA	
Protected Phases		2		1	1 2		3	3		4	4	
Permitted Phases	2								3			
Total Split (s)	25.5	25.5		23.0			19.0	19.0	19.0	12.5	12.5	
Total Lost Time (s)	4.5	4.5		4.5				4.5	4.5		4.5	
Act Effect Green (s)	21.0	21.0		18.5	44.0			14.5	14.5		8.0	
Actuated g/C Ratio	0.26	0.26		0.23	0.55			0.18	0.18		0.10	
v/c Ratio	0.76	0.91		0.96	0.57			0.93	0.65		0.91	
Control Delay	66.6	42.4		53.7	13.5			70.2	9.0		82.6	
Queue Delay	0.0	0.2		0.0	0.0			0.0	0.5		43.5	
Total Delay	66.6	42.6		53.7	13.5			70.2	9.6		126.1	
LOS	E	D		D	B			E	A		F	
Approach Delay		45.0			23.9			35.9			126.1	
Approach LOS		D			C			D			F	
Queue Length 50th (ft)	45	206		182	183			152	0		82	
Queue Length 95th (ft)	#128	#321		m#244	m205			#301	75		#199	
Internal Link Dist (ft)		185			168			499			144	
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	127	948		409	1960			328	612		189	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	3		0	0			0	43		30	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.76	0.92		0.96	0.57			0.93	0.70		1.08	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 37.7

Intersection LOS: D

Intersection Capacity Utilization 76.9%

ICU Level of Service D

Analysis Period (min) 15

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



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Turning Movement Diagram

Major Street: Cranston Street

Minor Street: Niantic Avenue

City/Town: Cranston, RI

Day of Week: Weekday

Reference No.: 7578

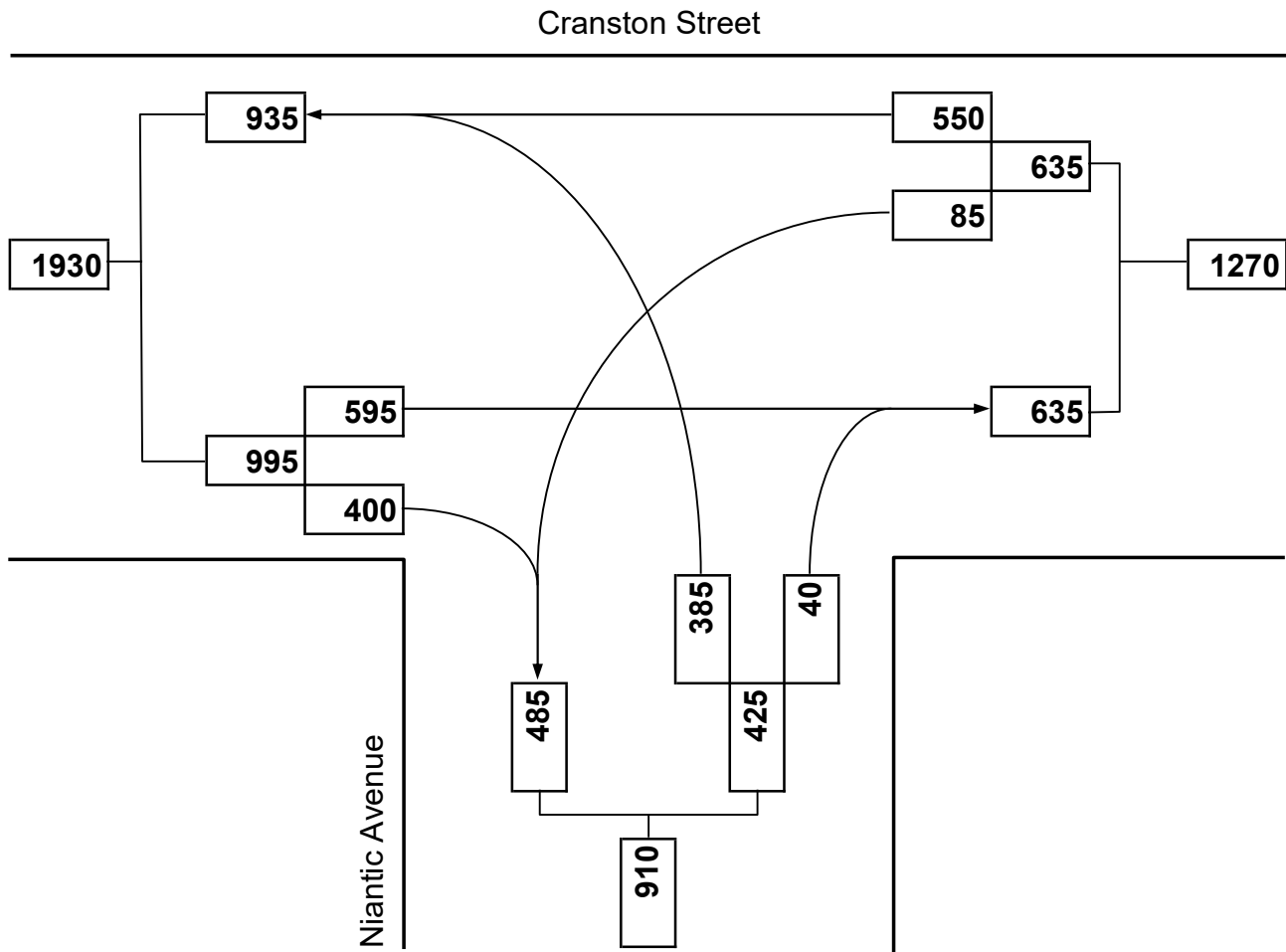
Peak Period: AM Peak

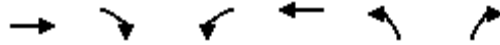
Existing: n/a

Future: 2024 Build



NORTH





Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	595	400	85	550	385	40
Future Volume (vph)	595	400	85	550	385	40
Satd. Flow (prot)	1863	1583	0	3480	1732	0
Flt Permitted				0.722	0.957	
Satd. Flow (perm)	1863	1583	0	2531	1732	0
Satd. Flow (RTOR)		426			7	
Lane Group Flow (vph)	633	426	0	675	453	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	52.0	52.0	52.0	52.0	38.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	52.7	52.7		52.7	27.3	
Actuated g/C Ratio	0.59	0.59		0.59	0.30	
v/c Ratio	0.58	0.39		0.46	0.85	
Control Delay	13.3	3.7		16.0	44.5	
Queue Delay	1.0	0.0		2.8	0.0	
Total Delay	14.3	3.7		18.7	44.5	
LOS	B	A		B	D	
Approach Delay	10.0			18.7	44.5	
Approach LOS	B			B	D	
Queue Length 50th (ft)	188	0		160	234	
Queue Length 95th (ft)	435	174		m178	327	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1089	1102		1480	639	
Starvation Cap Reductn	227	0		665	0	
Spillback Cap Reductn	10	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.73	0.39		0.83	0.71	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.85
 Intersection Signal Delay: 19.9
 Intersection LOS: B
 Intersection Capacity Utilization 85.3%
 ICU Level of Service E
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Niantic Ave & Cranston St





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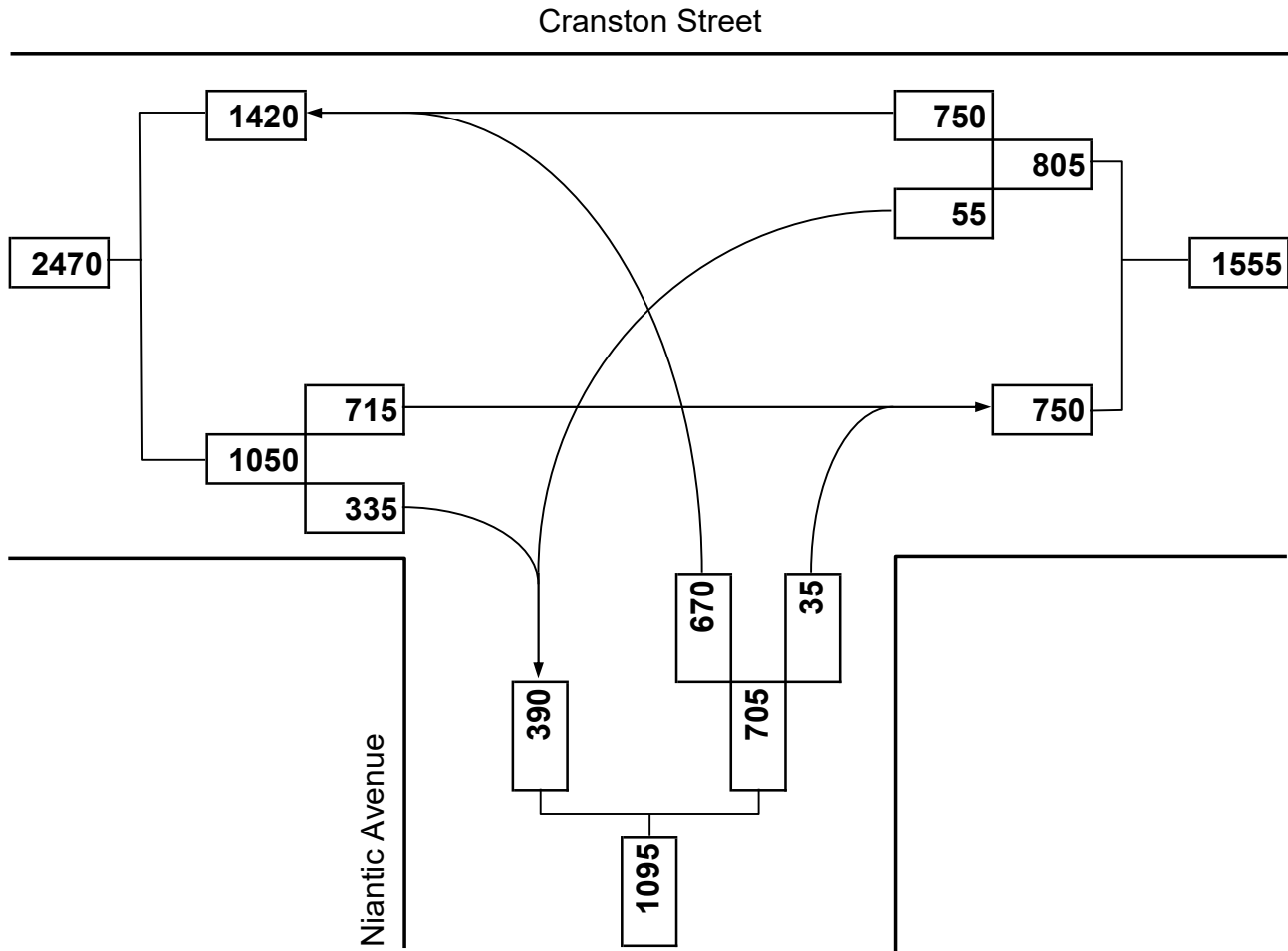
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Niantic Avenue
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build



NORTH



Proposed Commercial Development
Cranston Street at Niantic Avenue

Cranston, RI
08/06/2021



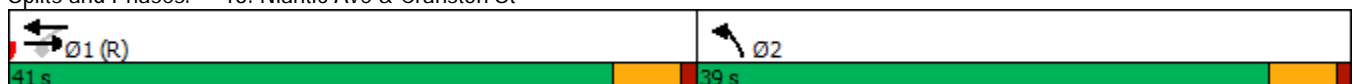
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	715	335	55	750	670	35
Future Volume (vph)	715	335	55	750	670	35
Satd. Flow (prot)	1881	1439	0	3561	1785	0
Flt Permitted				0.624	0.955	
Satd. Flow (perm)	1881	1439	0	2229	1785	0
Satd. Flow (RTOR)		360			4	
Lane Group Flow (vph)	769	360	0	865	758	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	41.0	41.0	41.0	41.0	39.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	35.4	35.4		35.4	34.6	
Actuated g/C Ratio	0.44	0.44		0.44	0.43	
v/c Ratio	0.93	0.43		0.88	0.98	
Control Delay	40.8	10.4		37.0	52.5	
Queue Delay	20.9	0.0		49.5	0.0	
Total Delay	61.8	10.4		86.5	52.5	
LOS	E	B		F	D	
Approach Delay	45.4			86.5	52.5	
Approach LOS	D			F	D	
Queue Length 50th (ft)	404	79		246	364	
Queue Length 95th (ft)	m#507	m98		m275	#612	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	846	845		1003	774	
Starvation Cap Reductn	69	0		343	0	
Spillback Cap Reductn	100	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	1.03	0.43		1.31	0.98	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 45 (56%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.98
 Intersection Signal Delay: 60.3
 Intersection LOS: E
 Intersection Capacity Utilization 110.1%
 ICU Level of Service H
 Analysis Period (min) 15

- # 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



D

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

Cranston Street at Garfield Avenue/Main Site Access Driveway
Cranston Street at Niantic Avenue

Cranston Street at Garfield Avenue/Main Site Access Driveway

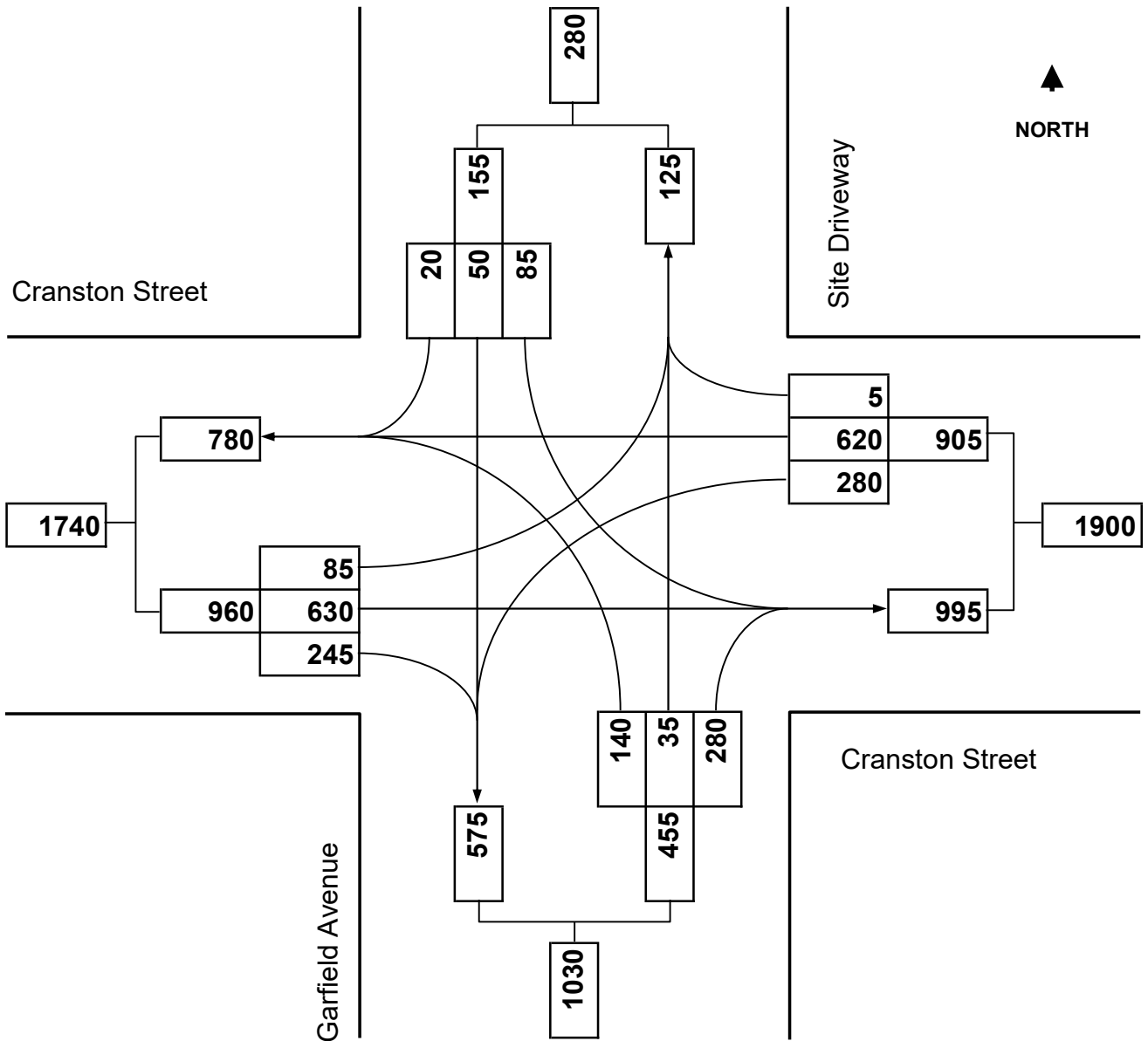


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: AM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Future Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Satd. Flow (prot)	1805	3415	0	1770	3469	0	0	1799	1553	0	1815	0
Flt Permitted	0.407			0.950				0.642			0.733	
Satd. Flow (perm)	773	3415	0	1770	3469	0	0	1201	1553	0	1368	0
Satd. Flow (RTOR)		68			1				289		7	
Lane Group Flow (vph)	91	902	0	289	644	0	0	182	289	0	167	0
Turn Type	Perm	NA		Prot	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases		2		1	1 2		3	3 4				4
Permitted Phases	2				2		3 4		3 4	4		
Total Split (s)	34.0	34.0		24.0			13.0			19.0	19.0	
Total Lost Time (s)	4.5	4.5		4.5							4.5	
Act Effect Green (s)	31.7	31.7		18.1	54.3			22.2	26.7		13.4	
Actuated g/C Ratio	0.35	0.35		0.20	0.60			0.25	0.30		0.15	
v/c Ratio	0.33	0.72		0.81	0.31			0.51	0.44		0.80	
Control Delay	27.3	28.1		55.0	10.0			30.7	5.3		63.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.1		3.4	
Total Delay	27.3	28.1		55.0	10.0			30.7	5.4		66.4	
LOS	C	C		E	A			C	A		E	
Approach Delay		28.0			23.9			15.2			66.4	
Approach LOS		C			C			B			E	
Queue Length 50th (ft)	39	223		159	84			79	0		88	
Queue Length 95th (ft)	83	298		m#267	157			136	56		#186	
Internal Link Dist (ft)		185			168			499			144	
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	272	1247		383	2067			371	668		226	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	1		0	0			0	39		19	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.33	0.72		0.75	0.31			0.49	0.46		0.81	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.81
 Intersection Signal Delay: 26.7 Intersection LOS: C
 Intersection Capacity Utilization 67.2% ICU Level of Service C
 Analysis Period (min) 15
 # 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



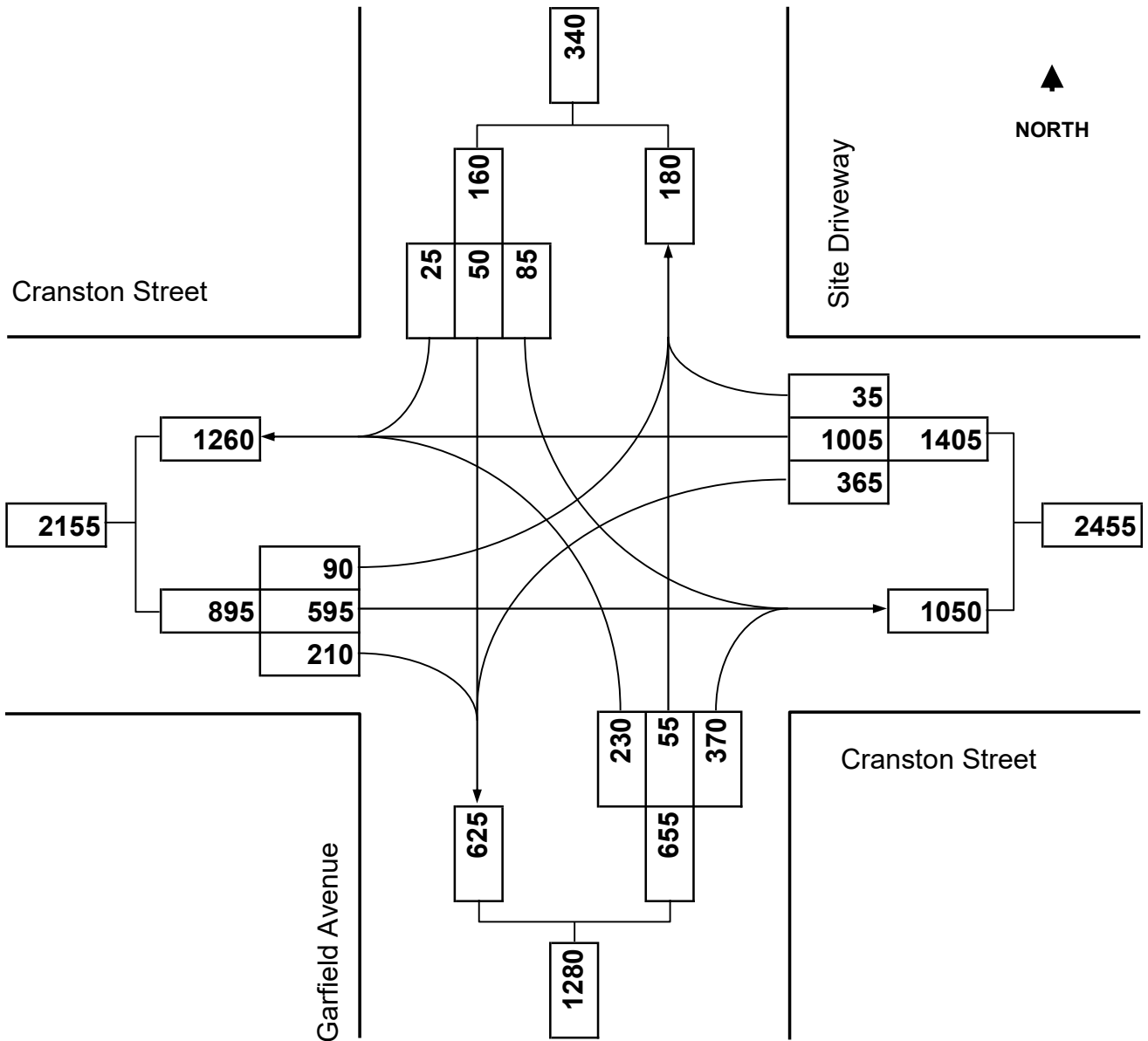


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Future Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Satd. Flow (prot)	1805	3444	0	1770	3558	0	0	1811	1583	0	1812	0
Flt Permitted	0.255			0.950				0.638			0.679	
Satd. Flow (perm)	484	3444	0	1770	3558	0	0	1202	1583	0	1263	0
Satd. Flow (RTOR)		60			7				398		10	
Lane Group Flow (vph)	97	866	0	392	1119	0	0	306	398	0	172	0
Turn Type	Perm	NA		Prot	NA		pm+pt	NA	Perm	Perm	NA	
Protected Phases		2		1	1 2		3	3 4				4
Permitted Phases	2						3 4		3 4	4		
Total Split (s)	26.0	26.0		23.0			13.0			18.0	18.0	
Total Lost Time (s)	4.5	4.5		4.5							4.5	
Act Effect Green (s)	21.7	21.7		19.0	45.2			21.3	25.8		12.8	
Actuated g/C Ratio	0.27	0.27		0.24	0.56			0.27	0.32		0.16	
v/c Ratio	0.74	0.88		0.93	0.56			0.80	0.51		0.82	
Control Delay	62.0	38.6		53.0	11.8			40.9	4.9		61.6	
Queue Delay	0.0	0.3		0.0	0.0			0.0	0.2		1.2	
Total Delay	62.0	38.9		53.0	11.8			40.9	5.0		62.7	
LOS	E	D		D	B			D	A		E	
Approach Delay		41.2			22.5			20.6			62.7	
Approach LOS		D			C			C			E	
Queue Length 50th (ft)	44	204		216	206			121	0		78	
Queue Length 95th (ft)	#127	#315		m#257	m213			#232	58		#181	
Internal Link Dist (ft)		185			168			499			144	
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	131	979		420	2015			395	790		221	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	9		0	0			0	55		6	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.74	0.89		0.93	0.56			0.77	0.54		0.80	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 29.6

Intersection LOS: C

Intersection Capacity Utilization 76.9%

ICU Level of Service D

Analysis Period (min) 15

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



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Turning Movement Diagram

Major Street: Cranston Street

Minor Street: Niantic Avenue

City/Town: Cranston, RI

Day of Week: Weekday

Reference No.: 7578

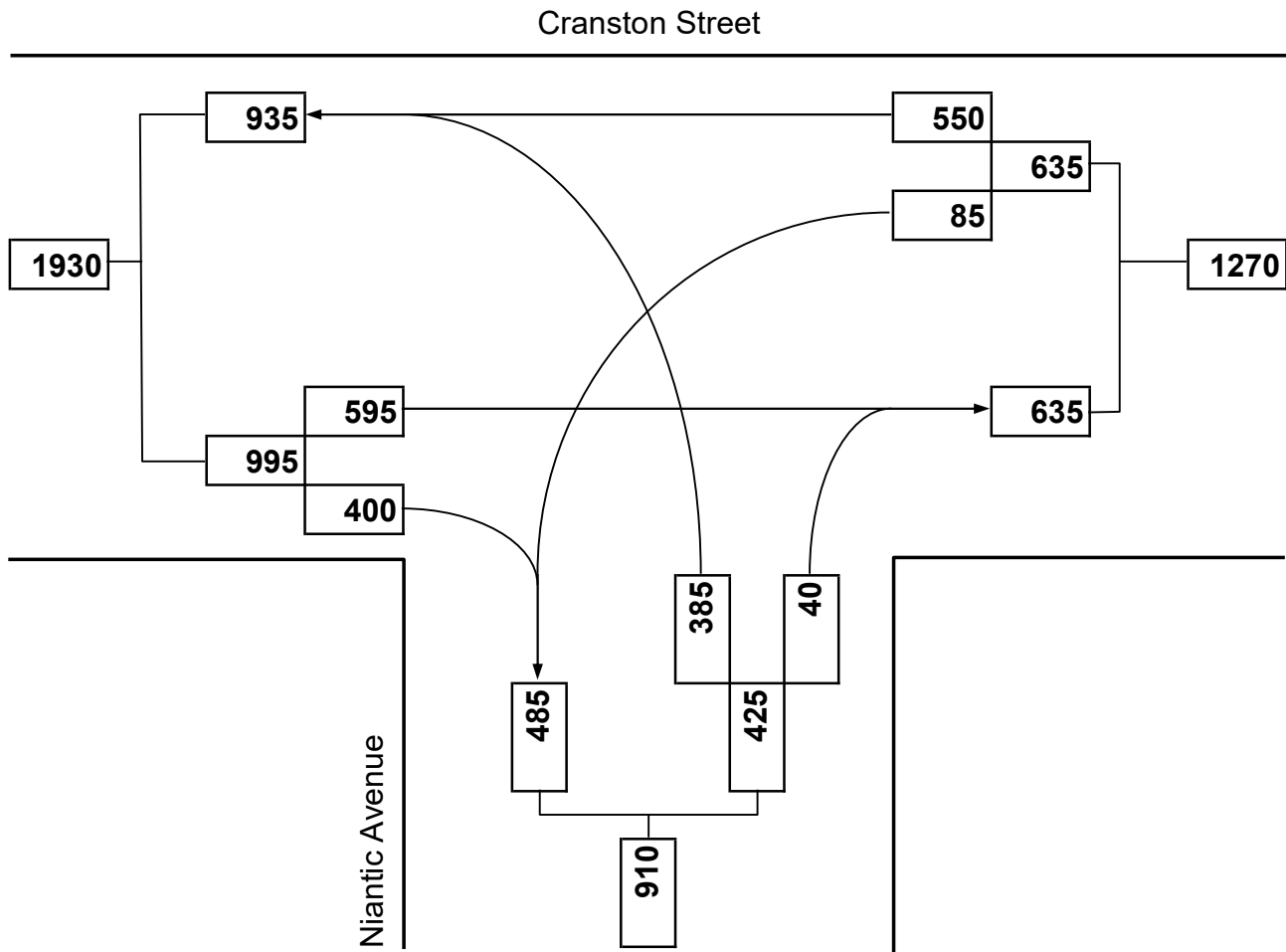
Peak Period: AM Peak

Existing: n/a

Future: 2024 Build



NORTH



Proposed Commercial Development
 Cranston Street at Niantic Avenue

Cranston, RI
 08/06/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	595	400	85	550	385	40
Future Volume (vph)	595	400	85	550	385	40
Satd. Flow (prot)	1863	1583	0	3480	1732	0
Flt Permitted				0.722	0.957	
Satd. Flow (perm)	1863	1583	0	2531	1732	0
Satd. Flow (RTOR)		426			7	
Lane Group Flow (vph)	633	426	0	675	453	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	52.0	52.0	52.0	52.0	38.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	52.7	52.7		52.7	27.3	
Actuated g/C Ratio	0.59	0.59		0.59	0.30	
v/c Ratio	0.58	0.39		0.46	0.85	
Control Delay	13.1	3.6		16.0	44.5	
Queue Delay	0.7	0.0		2.8	0.0	
Total Delay	13.8	3.6		18.7	44.5	
LOS	B	A		B	D	
Approach Delay	9.7			18.7	44.5	
Approach LOS	A			B	D	
Queue Length 50th (ft)	134	1		160	234	
Queue Length 95th (ft)	438	174		m178	327	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1089	1102		1480	639	
Starvation Cap Reductn	191	0		665	0	
Spillback Cap Reductn	9	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.70	0.39		0.83	0.71	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.85
 Intersection Signal Delay: 19.7
 Intersection LOS: B
 Intersection Capacity Utilization 85.3%
 ICU Level of Service E
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Niantic Ave & Cranston St





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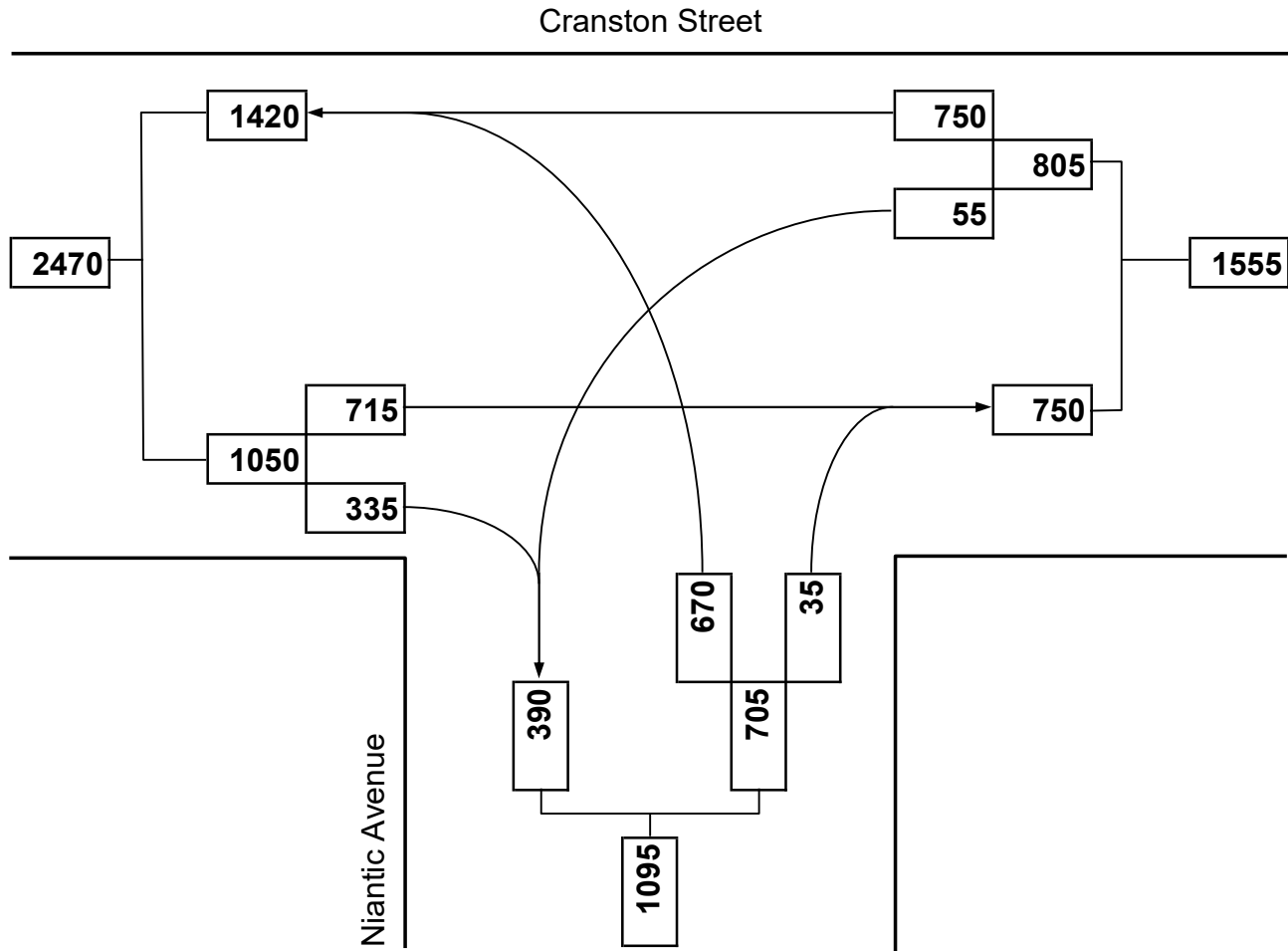
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Niantic Avenue
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build



NORTH



Proposed Commercial Development
Cranston Street at Niantic Avenue

Cranston, RI
08/06/2021

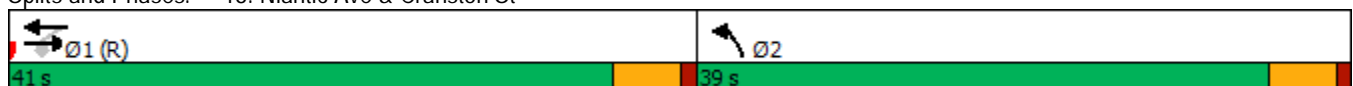


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	715	335	55	750	670	35
Future Volume (vph)	715	335	55	750	670	35
Satd. Flow (prot)	1881	1439	0	3561	1785	0
Flt Permitted				0.624	0.955	
Satd. Flow (perm)	1881	1439	0	2229	1785	0
Satd. Flow (RTOR)		360			4	
Lane Group Flow (vph)	769	360	0	865	758	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	41.0	41.0	41.0	41.0	39.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	35.4	35.4		35.4	34.6	
Actuated g/C Ratio	0.44	0.44		0.44	0.43	
v/c Ratio	0.93	0.43		0.88	0.98	
Control Delay	31.7	3.1		37.0	52.5	
Queue Delay	20.9	0.0		49.5	0.0	
Total Delay	52.6	3.1		86.5	52.5	
LOS	D	A		F	D	
Approach Delay	36.8			86.5	52.5	
Approach LOS	D			F	D	
Queue Length 50th (ft)	381	21		246	364	
Queue Length 95th (ft)	m#522	m25		m275	#612	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	846	845		1003	774	
Starvation Cap Reductn	16	0		343	0	
Spillback Cap Reductn	100	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	1.03	0.43		1.31	0.98	

Intersection Summary

Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 22 (28%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.98
 Intersection Signal Delay: 56.7
 Intersection LOS: E
 Intersection Capacity Utilization 110.1%
 ICU Level of Service H
 Analysis Period (min) 15
 # 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



D

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

Cranston Street at Garfield Avenue/Main Site Access Driveway
Cranston Street at Niantic Avenue

Cranston Street at Garfield Avenue/Main Site Access Driveway

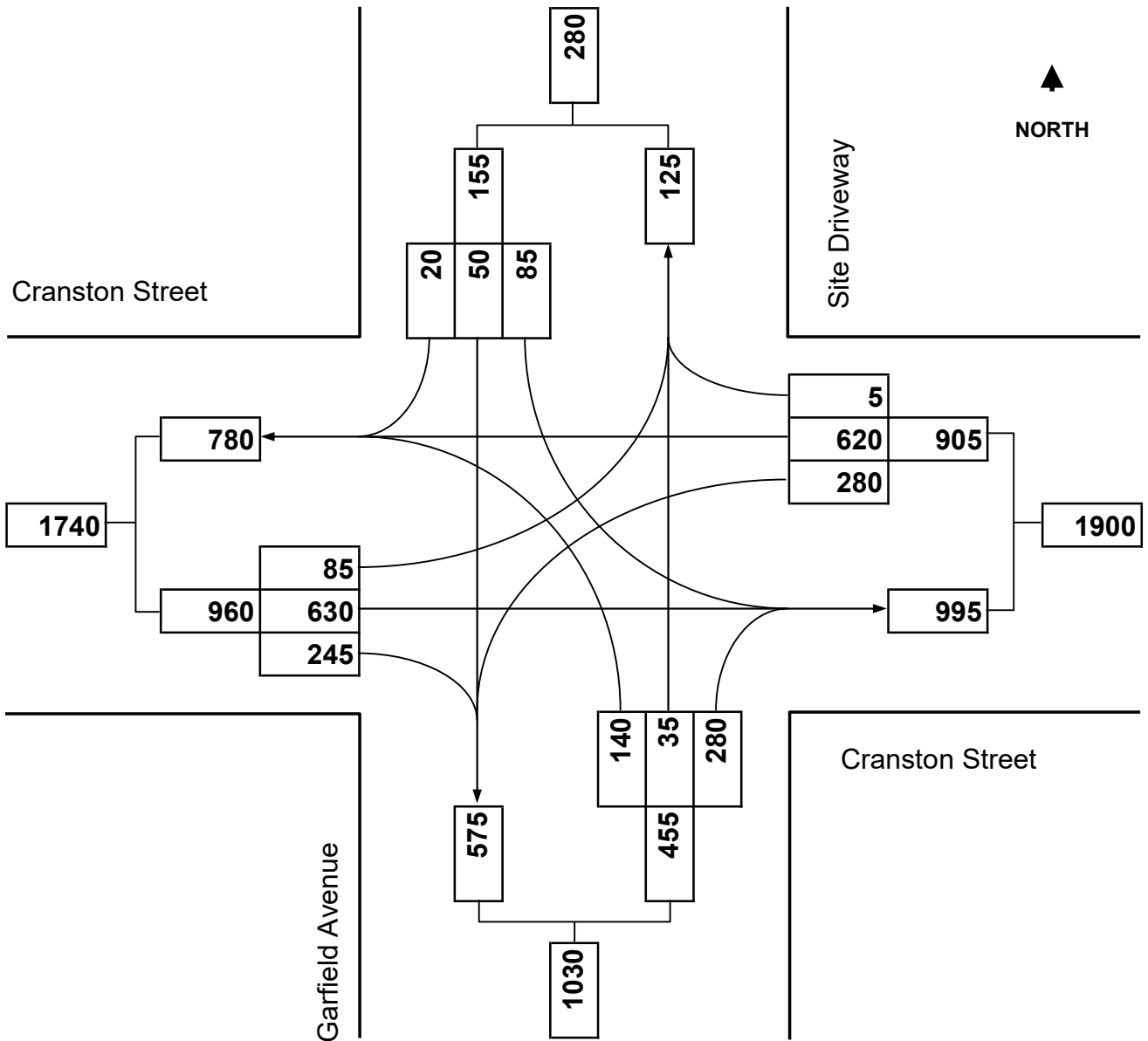


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: AM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Future Volume (vph)	85	630	245	280	620	5	140	35	280	85	50	20
Satd. Flow (prot)	1805	3415	0	1770	3469	0	0	1799	1553	0	1815	0
Flt Permitted	0.950			0.950				0.962			0.973	
Satd. Flow (perm)	1805	3415	0	1770	3469	0	0	1799	1553	0	1815	0
Satd. Flow (RTOR)		67			1				289		7	
Lane Group Flow (vph)	91	902	0	289	644	0	0	182	289	0	167	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			
Total Split (s)	15.0	33.0		24.0	42.0		17.0	17.0	17.0	16.0	16.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5			4.5	4.5		4.5	
Act Effect Green (s)	9.4	31.3		17.9	39.8			11.7	11.7		11.0	
Actuated g/C Ratio	0.10	0.35		0.20	0.44			0.13	0.13		0.12	
v/c Ratio	0.48	0.73		0.82	0.42			0.78	0.64		0.73	
Control Delay	46.7	28.8		56.8	19.2			61.1	11.7		55.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.3		0.9	
Total Delay	46.7	28.9		56.8	19.2			61.1	12.0		56.8	
LOS	D	C		E	B			E	B		E	
Approach Delay		30.5			30.8			31.0			56.8	
Approach LOS		C			C			C			E	
Queue Length 50th (ft)	49	231		159	122			101	0		88	
Queue Length 95th (ft)	97	303		m#267	190			#197	72		#179	
Internal Link Dist (ft)		185			168			499			144	
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	210	1238		383	1535			249	464		241	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	1		0	0			0	20		10	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.43	0.73		0.75	0.42			0.73	0.65		0.72	

Intersection Summary

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:EBT, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 32.4

Intersection LOS: C

Intersection Capacity Utilization 67.2%

ICU Level of Service C

Analysis Period (min) 15

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



Timing Plan: AM Peak Hour

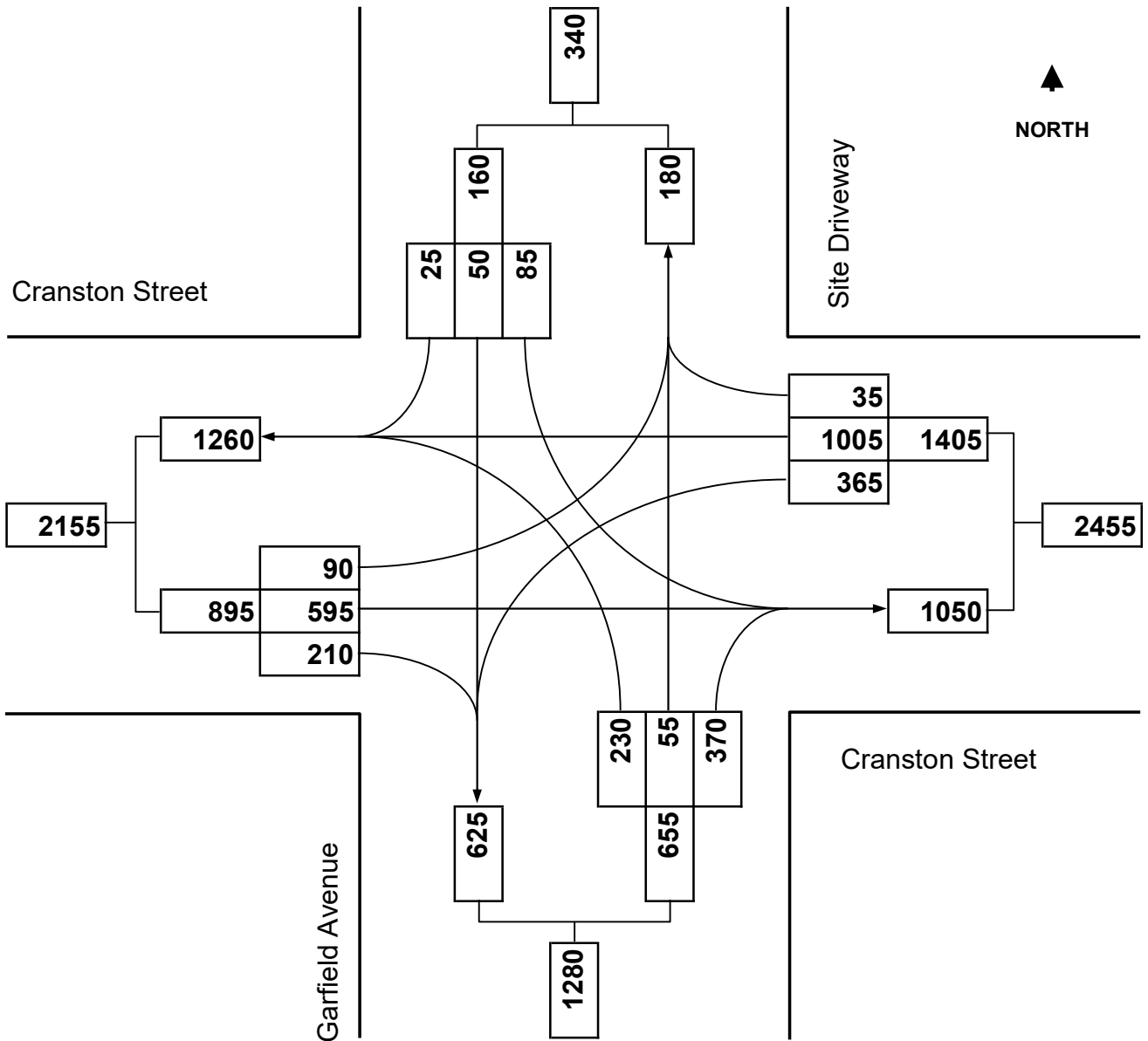


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Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Garfield Avenue/Site Drive
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build



Proposed Commercial Development
Cranston Street at Garfield Avenue

Cranston, RI
08/06/2021



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗		↖	↗			↖	↗		↕	
Traffic Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Future Volume (vph)	90	595	210	365	1005	35	230	55	370	85	50	25
Satd. Flow (prot)	1805	3444	0	1770	3558	0	0	1811	1583	0	1812	0
Flt Permitted	0.950			0.950				0.961			0.974	
Satd. Flow (perm)	1805	3444	0	1770	3558	0	0	1811	1583	0	1812	0
Satd. Flow (RTOR)		58			5				398		9	
Lane Group Flow (vph)	97	866	0	392	1119	0	0	306	398	0	172	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			
Total Split (s)	12.5	24.0		24.0	35.5		19.0	19.0	19.0	13.0	13.0	
Total Lost Time (s)	4.5	4.5		4.5	4.5			4.5	4.5		4.5	
Act Effect Green (s)	8.0	19.9		19.1	31.0			14.5	14.5		8.5	
Actuated g/C Ratio	0.10	0.25		0.24	0.39			0.18	0.18		0.11	
v/c Ratio	0.54	0.96		0.93	0.81			0.93	0.65		0.86	
Control Delay	46.1	51.7		51.5	24.5			70.2	9.0		71.7	
Queue Delay	0.0	0.3		0.0	0.0			0.0	0.3		30.6	
Total Delay	46.1	52.0		51.5	24.5			70.2	9.3		102.2	
LOS	D	D		D	C			E	A		F	
Approach Delay		51.4			31.5			35.8			102.2	
Approach LOS		D			C			D			F	
Queue Length 50th (ft)	47	213		215	244			152	0		82	
Queue Length 95th (ft)	#97	#340		m#245	m285			#301	75		#193	
Internal Link Dist (ft)		185			168			499			144	
Turn Bay Length (ft)	100			300								
Base Capacity (vph)	180	900		431	1381			328	612		200	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	2		0	0			0	29		32	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.54	0.96		0.91	0.81			0.93	0.68		1.02	

Intersection Summary

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 2:EBT, Start of Green, Master Intersection

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 41.8

Intersection LOS: D

Intersection Capacity Utilization 76.9%

ICU Level of Service D

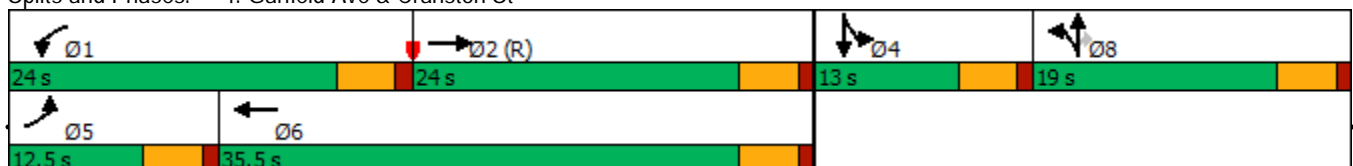
Analysis Period (min) 15

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



Timing Plan: PM Peak Hour

Cranston Street at Niantic Avenue



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Turning Movement Diagram

Major Street: Cranston Street

Minor Street: Niantic Avenue

City/Town: Cranston, RI

Day of Week: Weekday

Reference No.: 7578

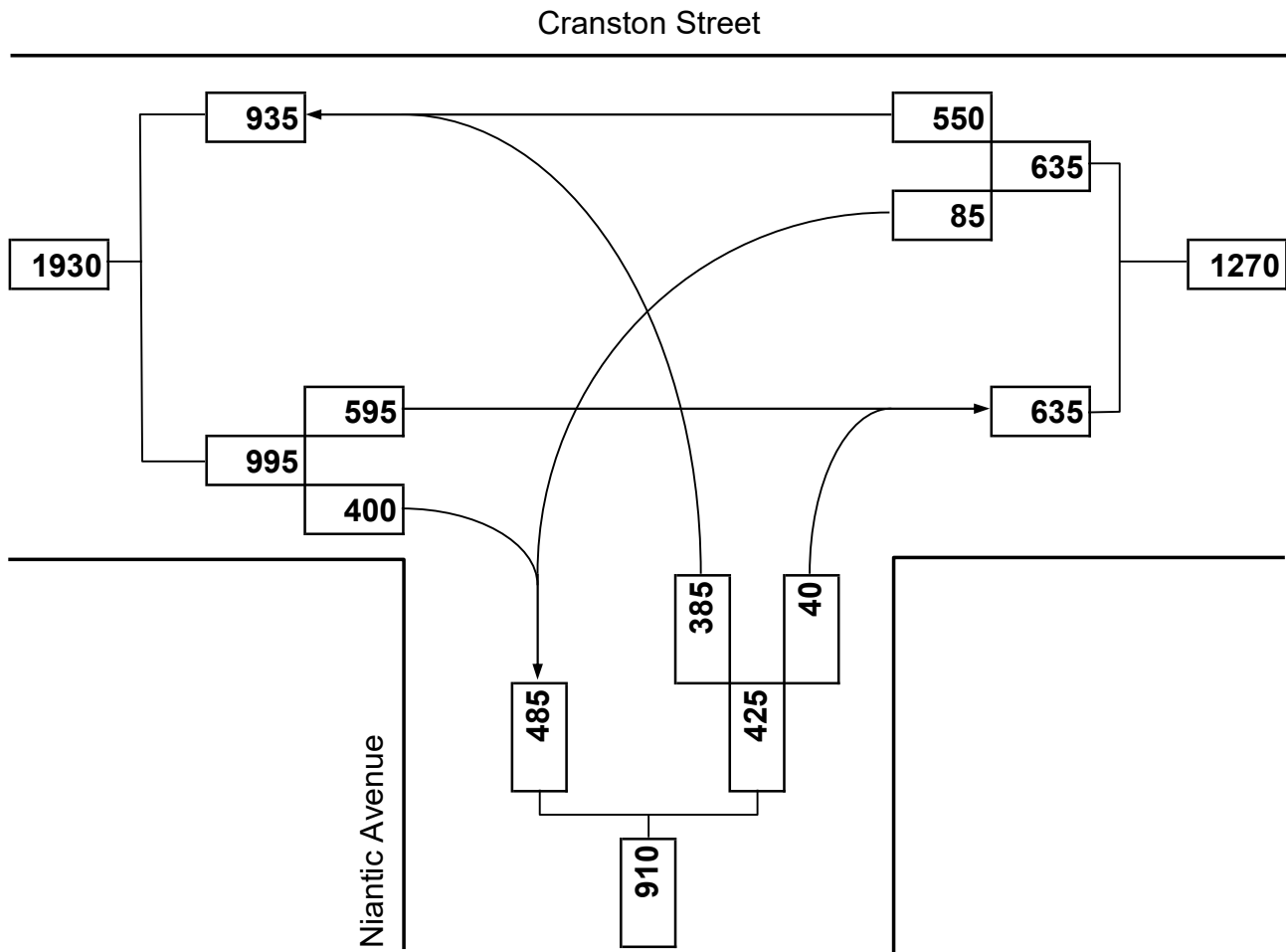
Peak Period: AM Peak

Existing: n/a

Future: 2024 Build

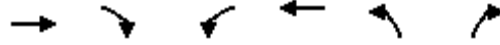


NORTH



Proposed Commercial Development
Cranston Street at Niantic Avenue

Cranston, RI
08/06/2021



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	595	400	85	550	385	40
Future Volume (vph)	595	400	85	550	385	40
Satd. Flow (prot)	1863	1583	0	3480	1732	0
Flt Permitted				0.722	0.957	
Satd. Flow (perm)	1863	1583	0	2531	1732	0
Satd. Flow (RTOR)		426			7	
Lane Group Flow (vph)	633	426	0	675	453	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	52.0	52.0	52.0	52.0	38.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	52.7	52.7		52.7	27.3	
Actuated g/C Ratio	0.59	0.59		0.59	0.30	
v/c Ratio	0.58	0.39		0.46	0.85	
Control Delay	12.2	3.6		16.0	44.5	
Queue Delay	1.1	0.0		2.8	0.0	
Total Delay	13.2	3.6		18.7	44.5	
LOS	B	A		B	D	
Approach Delay	9.4			18.7	44.5	
Approach LOS	A			B	D	
Queue Length 50th (ft)	58	0		160	234	
Queue Length 95th (ft)	436	174		m178	327	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	1089	1102		1480	639	
Starvation Cap Reductn	232	0		665	0	
Spillback Cap Reductn	9	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	0.74	0.39		0.83	0.71	

Intersection Summary

Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 35 (39%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.85
 Intersection Signal Delay: 19.5
 Intersection LOS: B
 Intersection Capacity Utilization 85.3%
 ICU Level of Service E
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 18: Niantic Ave & Cranston St





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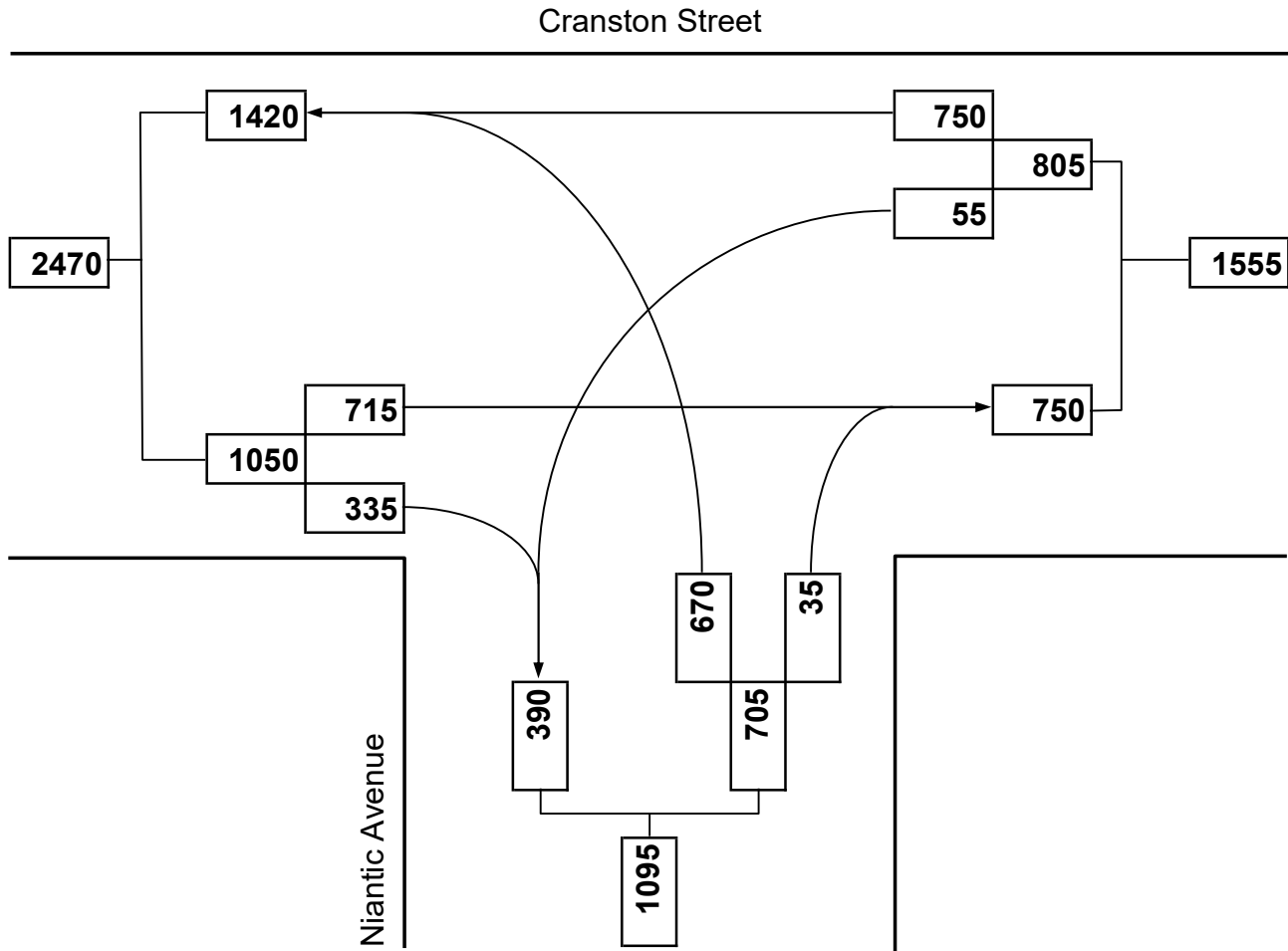
Turning Movement Diagram

Major Street: Cranston Street
City/Town: Cranston, RI
Reference No.: 7578
Existing: n/a

Minor Street: Niantic Avenue
Day of Week: Weekday
Peak Period: PM Peak
Future: 2024 Build

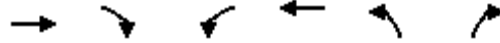


NORTH



Proposed Commercial Development
Cranston Street at Niantic Avenue

Cranston, RI
08/06/2021

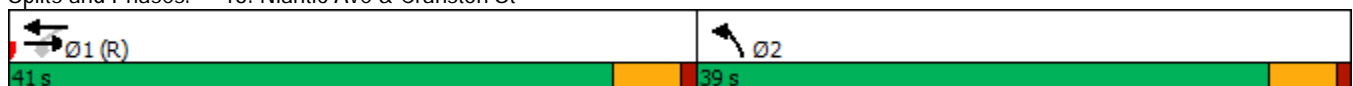


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑		↑↑	↑↑	
Traffic Volume (vph)	715	335	55	750	670	35
Future Volume (vph)	715	335	55	750	670	35
Satd. Flow (prot)	1881	1439	0	3561	1785	0
Flt Permitted				0.624	0.955	
Satd. Flow (perm)	1881	1439	0	2229	1785	0
Satd. Flow (RTOR)		360			4	
Lane Group Flow (vph)	769	360	0	865	758	0
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	1			1	2	
Permitted Phases		1	1			
Total Split (s)	41.0	41.0	41.0	41.0	39.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0	
Act Effect Green (s)	35.4	35.4		35.4	34.6	
Actuated g/C Ratio	0.44	0.44		0.44	0.43	
v/c Ratio	0.93	0.43		0.88	0.98	
Control Delay	28.3	3.1		37.0	52.5	
Queue Delay	21.4	0.0		49.5	0.0	
Total Delay	49.7	3.1		86.5	52.5	
LOS	D	A		F	D	
Approach Delay	34.8			86.5	52.5	
Approach LOS	C			F	D	
Queue Length 50th (ft)	404	21		246	364	
Queue Length 95th (ft)	m#444	m28		m275	#612	
Internal Link Dist (ft)	190			193	468	
Turn Bay Length (ft)						
Base Capacity (vph)	846	845		1003	774	
Starvation Cap Reductn	35	0		343	0	
Spillback Cap Reductn	101	0		0	0	
Storage Cap Reductn	0	0		0	0	
Reduced v/c Ratio	1.03	0.43		1.31	0.98	

Intersection Summary

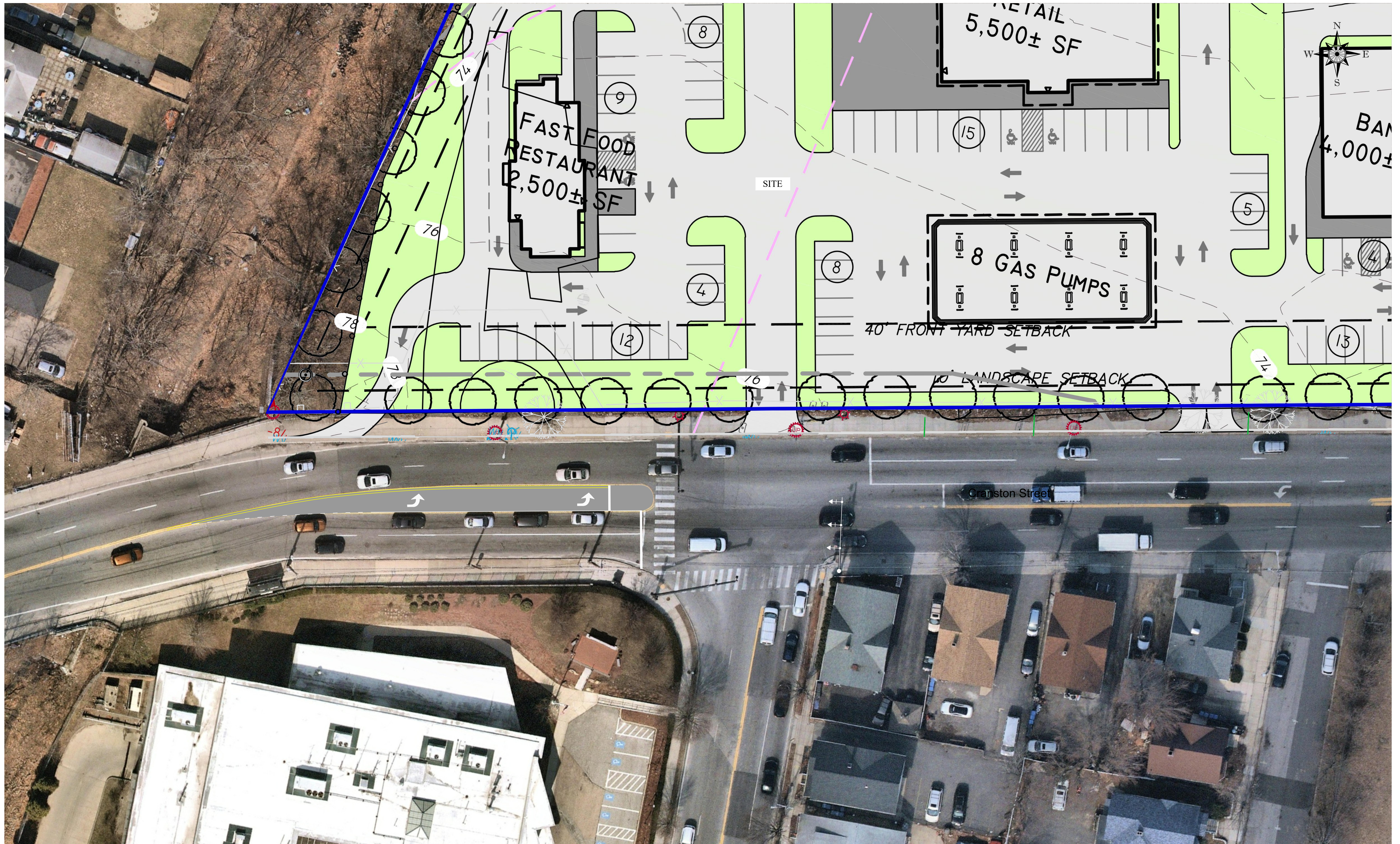
Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 22 (28%), Referenced to phase 1:EBWB, Start of Green
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.98
 Intersection Signal Delay: 55.9
 Intersection LOS: E
 Intersection Capacity Utilization 110.1%
 ICU Level of Service H
 Analysis Period (min) 15
 # 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



APPENDIX E – Off-Site Improvement Concept Plan

Cranston Street at Garfield Avenue/Main Site Access Driveway



8/6/2021 10:14 AM N:\175051\578 - TROLLEY BARN PLAZA\DRAWING FILES\CONCEPT\CONCEPT FIGURE.DWG (BETA STB BW.STB)

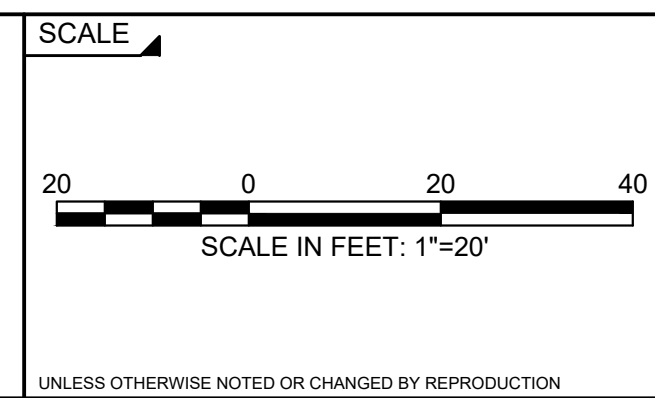
NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY:
DESIGNED BY:
CHECKED BY:

REGISTERED PROFESSIONAL
For Review Only

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TITLE
**Proposed Commercial Development Off-Site Improvement
Concept Plan**
Cranston, RI

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ISSUE DATE 7/30/2021 12:54 PM
SHEET NO.