Warwick, Rhode Island

Neon Marketplace and Car Wash

January 2021
Revised October 2021
Revised July 2022

TRAFFIC IMPACT STUDY

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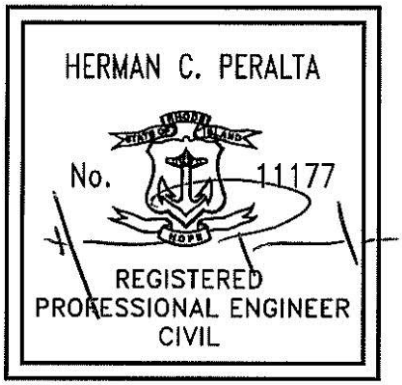
Neon Marketplace and Car Wash
Warwick, Rhode Island

TRAFFIC IMPACT STUDY

Prepared by: BETA GROUP, INC.

Prepared for: Mr. Nick Giacobbi
Director of Development
TPG Companies
1140 Reservoir Avenue
Cranston, Rhode Island 02920

January 2021
Revised October 2021
Revised July 2022



January 28, 2020
Revised October 22, 2021
Revised July 29, 2022

Mr. Nick Giacobbi
Director of Development, TPG Companies
1140 Reservoir Avenue
Cranston, Rhode Island 02920

Re: Proposed Commercial Redevelopment
Neon Marketplace and Car Wash
1149 Division Street (Route 401)
Warwick, Rhode Island 02886

Dear Mr. Giacobbi:

BETA Group, Inc., has completed an update to our October 2021 Traffic Impact Study to address changes to the site redevelopment proposal to include the addition of a car wash facility. The redevelopment project is located on the northerly side of Division Street just west of Route 4 in the City of Warwick. The previously approved convenience market/gas station, *Neon Marketplace,* at 1149 Division Street is proposed to be expanded to include the car wash on an abutting property to the east. The site for the car wash previously contained a single-family home that was razed to allow temporary use of the property by the RIDOT as a staging area for an ongoing bridge reconstruction project to the immediate east.

Based upon information provided by your office, and a review of the current site plan prepared by *Bohler Engineering*, it is our understanding that the additional use will include a new 4,739 square foot building to accommodate a single bay automated car wash and associated parking area for 14 vehicles, 10 of which contain vacuum stations. Primary access and egress to the car wash building will be at the signalized intersection of Division Street with the Route 4 Southbound Ramps through the *Neon Marketplace* property via an internal connection. A secondary right turn only entrance will also be provided on Division Street.

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 including the convenience store/gasoline station and car wash uses. 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.

Herman C. Peralta, PE
Project Manager

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 the expansion of the proposed *Neon Marketplace* commercial redevelopment project to include a car wash facility on an adjacent lot with a shared access on Division Street. The subject parcels located in the City of Warwick, are situated along the northerly side of Division Street between Route 2 and Route 4, opposite the interchange ramps. Refer to the Figure 1, Project Vicinity Map, on the following page for the project location within the community.

The redevelopment proposal, in addition to the *Neon Marketplace* that was previously approved at both the local and state level, will consist of construction of a 4,739 square foot building to accommodate a single bay car wash including a parking lot containing 14 spaces of which 10 are dedicated to vacuum stations. Main access and egress to the abutting site will be provided from the existing signalized driveway intersection with Division Street and the Route 4 southbound ramps via a driveway connection to the *Neon Marketplace* property. A secondary access will be provided along the property frontage on Division Street, which will be restricted to a right turn entrance-only driveway for westbound vehicles.

The study summarized herein focused on both traffic flow efficiency and safety along Division Street (Route 401) in the immediate vicinity of the subject property, and specifically at the site 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:

- Traffic data collection to define the existing traffic patterns and operational characteristics along the servicing roadways. The data collection included a manual turning movement count (TMC) at the Division Street (Route 401) signalized intersection with the Route 4 southbound ramps and review of record data from the Rhode Island Department of Transportation (RIDOT) and from previous traffic studies completed in the site vicinity.

- An inventory of the physical roadway characteristics of Division Street (Route 401) 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 local police department to define potential safety issues along the immediate servicing roadways adjacent to the site.

- An estimate of future traffic volumes for the proposed commercial redevelopment including the convenience store/gasoline station and car wash was calculated using data from the "Trip Generation" Manual, an informational report published by the Institute of Transportation Engineers (ITE).

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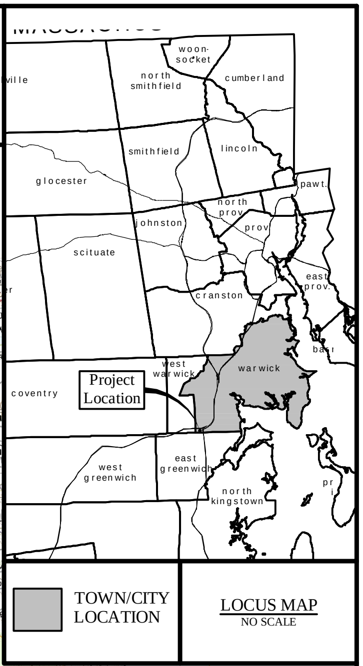
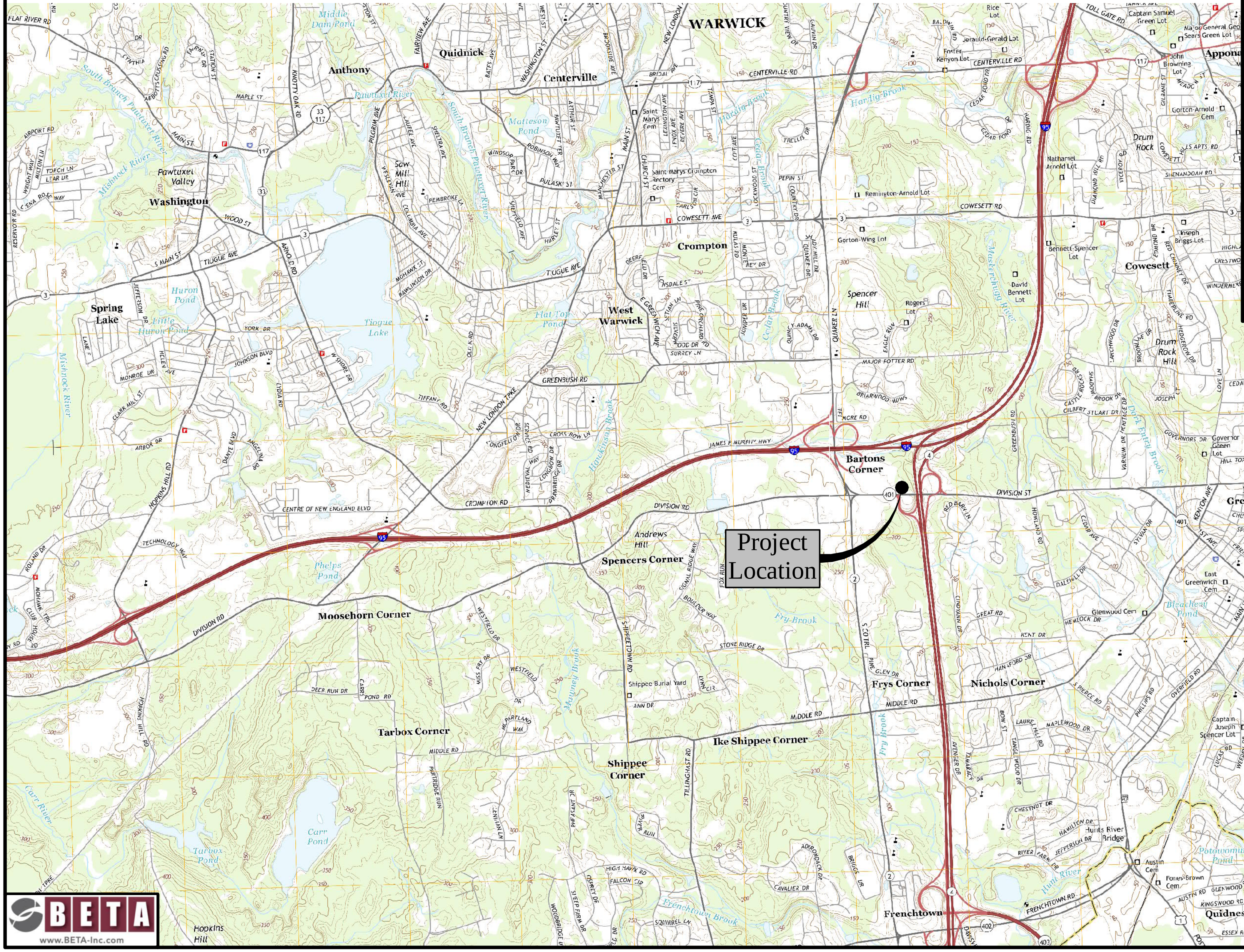
WARWICK, RHODE ISLAND

Figure 1 - Project Vicinity Map





- Evaluation and analysis of the traffic safety and operations for existing and future traffic conditions and development of recommendations if determined necessary, to maintain safe and adequate access to the redeveloped commercial property.

2.0 PROJECT AREA

As noted in the previous section, the property containing the expanded car wash use is situated on the northerly side of Division Street adjacent to the *Neon Marketplace* property to the east. The lot is defined by Assessor's Plat 215, Lot 007, which contains approximately 0.81 acres of partially developed land that will remain a separate property from the *Neon Marketplace* site. This property is currently under temporary use by the RIDOT as previously discussed. Figure 2 on the following page depicts the general project area, and the boundary lines of the subject property.

Land use in the immediate project area is predominantly commercial in nature along Division Street. Immediately abutting the property to the north is a Rhode Island Energy power transformer station, to the east is wooded and undeveloped Rhode Island Energy land between the subject site and the Route 4 corridor, and to the west is the former *1149 Restaurant* property that will be redeveloped for the *Neon Marketplace*. To the south, directly across Division Street, is the Route 4 southbound on/off-ramp interchange. Further north along Quaker Lane (Route 2) is a commercial corridor that includes large commercial plazas, gas stations, car dealerships, restaurants, and retail shops.

Division Street will serve as the primary access route to the redeveloped properties. Based upon the operating characteristics along the servicing roadway, and the estimated volume and type of traffic associated with the commercial redevelopment, a study impact area was defined for the project. The limits of our analysis focused Division Street between Route 2 and the Route 4 corridors, specifically focusing on the intersection of Division Street (Route 401) with the Route 4 southbound interchange and the site driveways.

3.0 EXISTING CONDITIONS

3.1 ROADWAYS

Division Street (Route 401)

Division Street (Route 401) is an east/west principal arterial extending from Quaker Lane/S. County Trail (Route 2) to the west to First Avenue to the east. Division Street creates a boundary line between the City of Warwick and Town of East Greenwich, which is centered along the roadway with the City of Warwick on the north and the Town of East Greenwich on the south. Division Street provides immediate local access to abutting properties but also links to higher order facilities including Route 4 to the east and I-95 to the north.

In the project area, Division Street varies in width and section due to the Route 4 interchange and the large commercial plazas to the west where separate left turn and right turn lanes are provided at the

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Figure 2 - Project Area Map

signalized junctions, but typically provides two 11-foot travel lanes in each direction separated by a raised cement concrete median island as seen in the photograph on the following page. The pavement surface can be classified as being in good condition with very minor pavement distress. Cement concrete curbing is provided on both sides of Division Street with no sidewalks. Cobra-head light fixtures on utility poles are located sporadically along the southerly side of the corridor for nighttime illumination. The speed limit is posted at 35 mph in the site vicinity.

It should be noted that the Division Street bridge over Route 4 replacement project is currently underway by the Rhode Island Department of Transportation and will continue through the 2022 calendar year.

3.2 INTERSECTIONS

Division Street (Route 401) at Route 4 Southbound Ramps/Site Driveway

Division Street (Route 401) intersects the Route 4 Southbound ramps and site driveway to form a signalized, four-way junction as depicted on the adjacent image. The Division Street eastbound approach provides a shared left turn/thru lane, a thru lane, and a channelized right turn lane. The Division Street westbound approach provides a separate left turn lane, a thru lane, and a shared thru/right turn lane. The Route 4 southbound exit ramp northbound approach provides a separate left turn lane, a shared left/thru/right lane, and a separate right turn lane. The site driveway southbound approach provides a single multiuse lane.

The traffic signal system appears to be in good working condition as some of the older equipment has been upgraded as part of regular maintenance projects. The layout of the equipment consists of mast arm mounted signal heads with in-road vehicle loop detectors. In addition, no pedestrian accommodations are provided at the intersection.

The intersection was determined to operate in a fully actuated-coordinated mode with four phases. The Division Street eastbound and westbound movements are serviced in two phases including an advanced protected westbound left turn, followed by through/right turn concurrent movements. The Route 4 southbound exit ramp northbound and site driveway southbound approaches are serviced under the two remaining (split) phases.

3.3 Traffic Flow Data

Existing travel demand characteristics for the servicing roadways were developed from a traffic counting program completed by BETA. The data collection included a Manual Turning Movement Count (TMC) at the signalized intersection of Division Street (Route 401) with the Route 4 Southbound Ramps/Commercial Driveway during the weekday morning and afternoon, and Saturday midday peak periods between 7:00 to 9:00 AM, 4:00 to 6:00 PM, and 11:30 AM to 1:30 PM, respectively, in June 2022. In addition, BETA reviewed the RIDOT seasonal adjustment factors and determined that urban principal arterial in the month of June typically experience higher than average daily traffic volumes during the weekday. To be conservative in the analysis, June 2022 traffic volumes were not reduced to reflect average traffic conditions.

Based upon review of the TMC data, Division Street (Route 401) was found to service approximately 2,200 vehicles during the weekday morning peak hour between 7:30 and 8:30 AM with approximately 1,320 vehicles eastbound and 880 vehicles westbound. During the weekday afternoon peak hour between 4:30 and 5:30 PM, Division Street serviced 2,880 vehicles with approximately 1,590 vehicles eastbound and 1,290 vehicles westbound. During a Saturday midday peak hour between 12:00 and 1:00 PM, Division Street serviced 2,525 vehicles with approximately 1,385 vehicles eastbound and 1,140 vehicles westbound. Figure 3 on the following page depict the daily peak hour turning movement volumes at the study intersection. Complete count information can be found in the Appendix.

4.0 Safety Analysis

To determine if there are any limiting factors affecting safety relating to access to the proposed commercial project, the physical characteristics of Division Street (Route 401) in the project area and specifically at the site driveway location 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 exit the main site access driveway when turning right from the site driveway as all other movements are controlled (protected) movements at the traffic signal.

The horizontal and vertical alignment of Division Street (Route 401) in the project area can be described as relatively straight with a minor crest vertical curve just east of the main site access driveway. Based upon the existing roadway geometry as described, the available sight distance at the main site access driveway intersection is greater than 500 feet to the east. These values are greater than AASHTO's recommended minimum stopping sight distance of 250 feet based on the posted speed limit of 35 mph.

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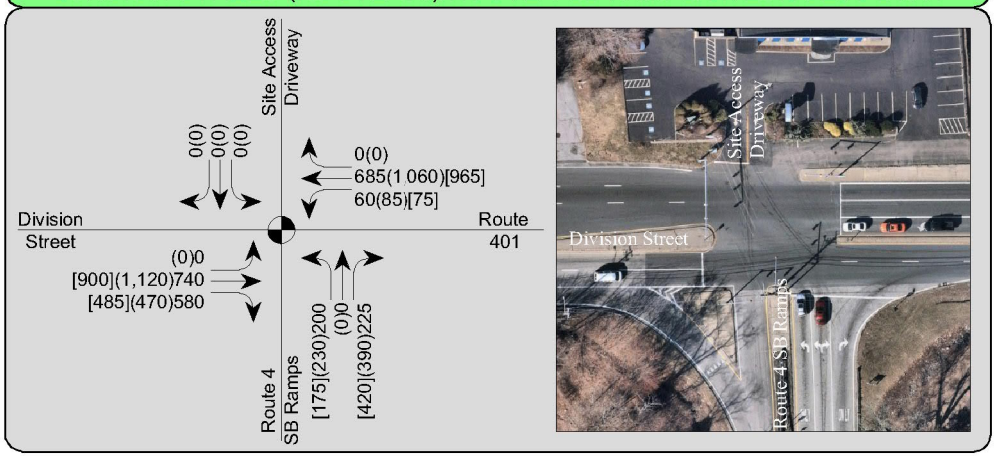
Figure 3 - Existing Traffic Volumes

1 DIVISION STREET (ROUTE 401)/ROUTE 4 SB RAMPS/SITE ACCESS DWY.



LEGEND:

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

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It should be noted that speeds are highly variable due to the controlled Division Street (Route 401) and Route 4 Southbound Ramps junction, where vehicles are turning off or onto Division Street at a low speed or slowing to the stop line at the traffic signal.

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 East Greenwich and Warwick Police Departments for the latest recorded full three-year period from January 2017 to December 2019 to determine if any location in the project area experienced a high frequency or pattern of crashes. The 2020 and 2021 data were not requested due to the atypical roadway conditions during both years.

Summarizing the data, a total of 41 crashes (avg. 14 per year) occurred over the three-year study period, with nine involving an injury, at the signalized intersection of Division Street (Route 401) with the Route 4 Southbound ramps/Site Driveway. The majority of the crashes 33 (80%) at the study intersection were rear-end crashes, which is typical of signalized junctions where the rear end crashes are more common due to the numerous starting and stopping movements required for the signal change intervals.

Further reviewing the data, the two angle collisions were attributed to vehicles running a red light. The sideswipe (same direction) collisions are attributed to vehicles changing lanes to avoid turning vehicles. The three collisions with an object were single vehicle crashes that occurred along the Division Street eastbound to Route 4 southbound channelized right turn lane where motorists were traveling at high speeds and misjudged the turn and hit the median.

Based upon the historical crash data obtained from the local police, and a review of existing roadway geometry, physical features, and operations, roadway or traffic related safety improvements could be investigated to improve safety at the study signalized junction. The RIDOT could review the clearance intervals to determine if they require adjustment while also investigating the benefits of the installation of traffic signal head backplates with retroreflective border to increase head visibility in an effort to reduce the number of rear-end collisions.

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 for the subject properties include; the *Neon Marketplace*, a 5,500 square foot convenience store and gasoline station with 16 fueling positions that was previously approved at both the local and state level, and the addition of a 4,739 building on the adjacent lot to the east to accommodate a single bay car wash with associated parking and vacuum stations. Figure 4 on the following page depicts the site layout and access plan, prepared by *Bohler Engineering.*

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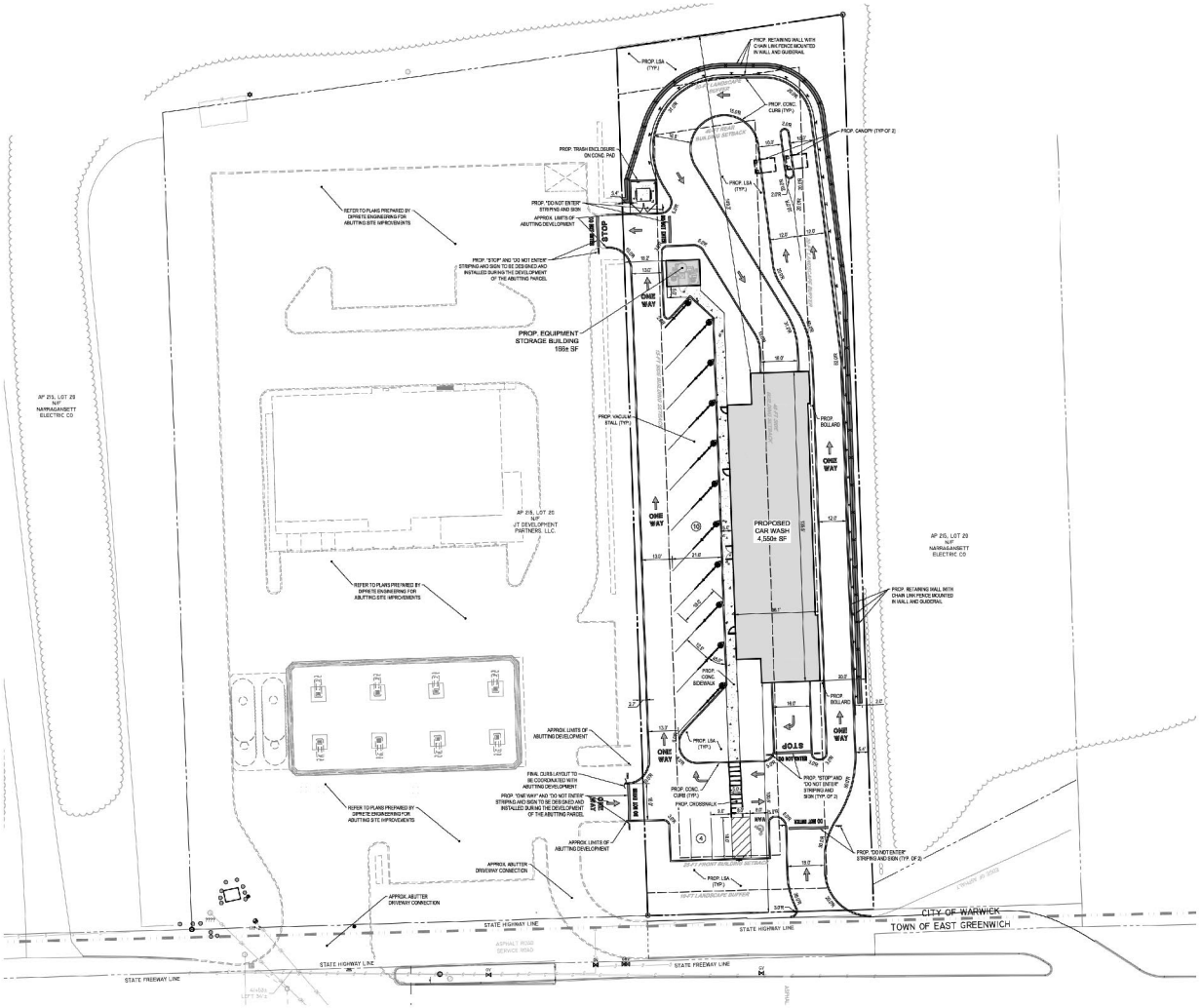
Figure 4 - Site Layout



Site Plan provided by Bohler Engineering

For this redevelopment proposal that shares a common driveway between uses, projected traffic volumes for the commercial project were based on use of the 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 developments.

For the proposed convenience market/gas station and automated car wash, Land Use Code 945 Convenience Market/Gas Station, which was updated to the latest edition (11th Edition) of the ITE Trip Generation Manual, and Land Use Code 948 Automated Car Wash were reviewed, respectively, for applicability in developing an estimate of site related vehicle trips. The appropriate worksheets from the manual are included in the Appendix along with the trip estimate calculations. Table 1 summarizes the estimate trip volumes calculated for this project for the weekday AM and PM, and Saturday MD Peak Periods which would represent the peak traffic conditions associated with the land use in combination with the adjacent street traffic, representing a worse case traffic condition at the site driveways.

TABLE 1 – Trip Generation Estimate

	Description		Enter	Exit	Total
Weekday AM Peak Hour					
ITE Land Use Code 945	Convenience Store/Gas Station		165	165	330
ITE Land Use Code 948	Automated Car Wash		-	-	-
		Total	165	165	330
Weekday PM Peak Hour					
ITE Land Use Code 945	Convenience Store/Gas Station		173	173	346
ITE Land Use Code 948	Automated Car Wash		34	34	68
		Total	207	207	414
Saturday MD Peak Hour					
ITE Land Use Code 945	Convenience Store/Gas Station		152	151	303
ITE Land Use Code 948	Automated Car Wash		72	72	144
		Total	224	223	447

It is important to note that the compatibility of uses, where a single site trip is generated for the two uses being proposed, is referred to as "internal-capture" where a driver would potentially visit the other proposed use within a development. Consequently, these internal trips capture would allow reduction of the total trips generated by a multiple use development. In addition to the internal capture potential, for this type of service-oriented use, it is estimated that between 40% and 60% of trips generated by the proposed convenience market/gas station 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 Conditions

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. For this project, a conservative annual growth rate of 1.0 percent was utilized for the future background traffic growth based on record traffic volumes in the project area where volumes have remained relatively level or declined over the last decade. This rate was applied to the existing volumes to establish a Future 2025 Build traffic condition on the servicing roadways. The Future 2025 Build condition included traffic generated by the new commercial development. Figure 5 on the following page depicts the estimated future traffic volumes at the study intersection.

It should be noted that a major RIDOT roadway project currently in the Environmental Permitting phase and scheduled for construction in the next five years, will have a major impact to future traffic volumes along the Division Street corridor. The long-delayed project will provide the missing links between the Route 4 and Route 95 freeways. Presently drivers are forced to use Route 2 and Division Street in this area to go from Route 95 north to Route 4 south, and from Route 4 north to Route 95 south. These missing movements generate unnecessary traffic along these local roads of Division Street and Route 2, which will be removed when the interchange project is complete, reducing traffic volumes and helping to reduce afternoon peak hour congestion along the corridors.

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 in the area coupled with the service-oriented nature of the proposed convenience store/gas station and car wash where the site trips are anticipated to be pass-by trips, though new to the servicing roadway as indicated previously to be conservative in our analysis. Site distribution figures are also provided in the Appendix for reference.

5.3 Operation 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, Saturday MD peak hours would represent this worst-case combination of site-generated traffic with the servicing roadway peak traffic period.

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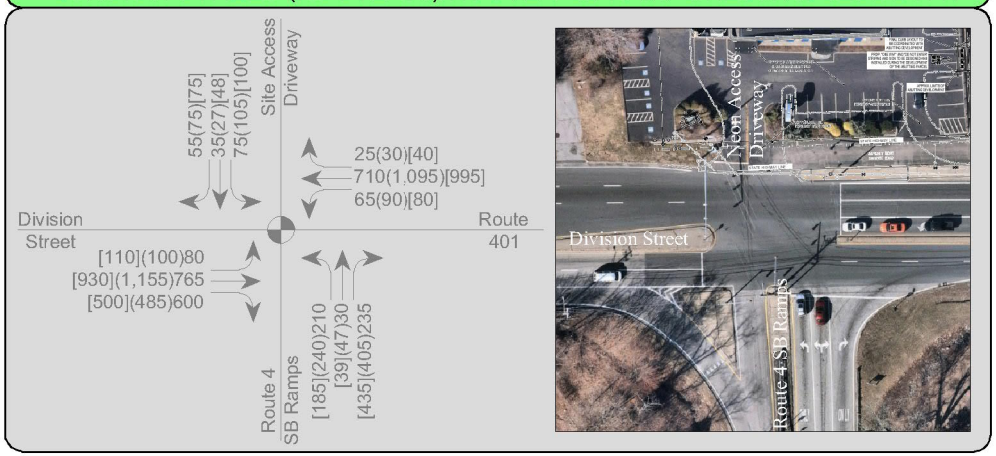
Figure 5 - Future Traffic Volumes

1 DIVISION STREET (ROUTE 401)/ROUTE 4 SB RAMPS/NEON ACCESS DWY.



LEGEND:

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

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The Highway Capacity Manual methodologies provide the most accurate means of evaluating traffic capacity and delays for roadways and intersections. The results of these procedures 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 2 below outlines the Level of Service delay criteria presented in the Highway Capacity Manual for signalized and unsignalized intersections.

TABLE 2 – 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 Division Street (Route 401) intersection with the Route 4 Southbound Ramps/Site Access Driveway was analyzed for the weekday morning and afternoon, and Saturday midday peak hours, which as indicated would represent the worst-case operational condition along the servicing roadways. The capacity analysis worksheets are included in the Appendix and Table 3 and 4 summarize the results of the Existing and Future Build conditions analyses at the study intersection.

As can be seen in Table 3 on the following page, the signalized junction of Division Street (Route 401) with the Route 4 Southbound Ramps/Site Access Driveway currently operates overall at an efficient Level of Service (LOS) B or better with the critical movements experiencing LOS D or better during the weekday AM and PM, and Saturday MD peak hours. It should be noted that these results are not reflective of historical operating conditions at this junction where greater delays, but overall acceptable operations were experienced at the intersection. The existing conditions analyzed as part of this study reflect the restaurant closure with no traffic volumes being generated by an existing developed property. This business, which had been operating for years, contributed traffic to the intersection resulting in additional delays than what is presently experienced and defined in the table.

Table 4 presents the estimated future conditions at the signalized junction of Division Street (Route 401) with the Route 4 Southbound Ramps/Site Access Driveway that incorporates minor physical modifications to include a separate eastbound left turn lane to minimize the impact to eastbound traffic flow. The analysis found that the estimated increase in traffic during the peak periods resulting from the proposed site redevelopment project including the *Neon Marketplace* and the addition of a car wash, combined with the base traffic growth along the servicing roadways will provide for acceptable peak hour traffic operations at the junction and along Division Street (Route 401) with the proposed site access design.

TABLE 3 – Level of Service Summary (Existing Conditions)

Location / Movement	2022 EXISTING CONDITIONS								
	AM Peak Hour			PM Peak Hour			Sat. MD Peak Hour		
	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)
Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway (S)									
Division St. EB Left/Thru	A	9.1	7	C	28.7	17	B	16.1	12
Division St. EB Right	A	0.7	0	A	0.4	0	A	0.5	0
Division St. WB Left	D	45.3	3	D	48.5	4	D	39.9	3
Division St. WB Thru/Right	A	3.5	4	A	9.9	11	A	7.5	8
Route 4 SB Ramp NB Left	D	43.5	6	C	28.2	4	C	23.1	3
Route 4 SB Ramp NB Left/Thru/Right	B	11.5	3	C	29.6	10	C	23.8	7
Route 4 SB Ramp NB Right	A	9.1	2	A	5.7	2	A	5.3	2
Site Access Dwy. SB	A	0.0	0	A	0.0	0	A	0.0	0
OVERALL	A	8.7	-	B	18.3	-	B	11.9	-

(S) – Signalized

TABLE 4 – Level of Service Summary (Future Conditions)

Location / Movement	2025 BUILD CONDITIONS*								
	AM Peak Hour			PM Peak Hour			Sat. MD Peak Hour		
	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)	LOS	Delay	95th % Queue Length (veh.)
Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway (S)									
Division St. EB Left	D	41.7	4	C	34.3	4	D	42.1	5
Division St. EB Thru	B	18.5	10	C	32.2	18	B	19.1	11
Division St. EB Right	A	4.0	3	B	14.8	9	A	3.6	3
Division St. WB Left	D	45.5	4	D	51.6	4	D	44.6	4
Division St. WB Thru	B	19.2	9	C	23.5	12	C	20.7	13
Route 4 SB Ramp NB Left	D	35.1	4	D	53.3	9	D	46.1	7
Route 4 SB Ramp NB Left/Thru/Right	E	57.6	12	C	31.1	7	C	22.0	6
Route 4 SB Ramp NB Right	A	4.3	1	A	8.9	3	A	9.8	2
Site Access Dwy. SB Left/Thru	D	48.9	5	D	54.4	6	D	47.3	6
Site Access Dwy. SB Right	A	1.6	0	A	5.7	1	A	2.4	1
OVERALL	C	20.8	-	C	27.9	-	C	20.3	-

The findings of the operational analysis determined that the estimated increase in traffic during the peak periods resulting from the proposed commercial redevelopment project, will have a minor effect on overall traffic operations along Division Street (Route 401), particularly during the weekday morning, afternoon, and Saturday midday peak hours when the site and adjacent roadway service their greatest daily volumes with the recommended driveway and phasing modifications depicted in the plan provided and defined in the report.

Therefore, based upon the data collected on the servicing roadways, the analysis completed as part of this study, along with the access design and recommendations proposed, the commercial redevelopment 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.

[i]

[i]Aerial Images provided in this document were obtained from Nearmap.

To increase capacity and reduce delays on the minor approach, the site access driveway will be designed with separate shared left/thru and right turn exiting lanes. This will allow right turning traffic to operate more efficiently with less delay, while also reducing the need for the driveway phase to be called to service the movement, and result in more green time for mainline traffic flow. In addition, left turn entering traffic, which will be provided from a new exclusive left turn lane as noted, will be serviced concurrently with the Division Street advanced westbound protected left turn phase, and will operate in an acceptable manner at LOS D or better during the weekday morning and afternoon, Saturday midday peak hours. This conceptual design is shown in the Appendix for reference.

The study intersection has been evaluated utilizing the existing cycle times and splits and based upon the analysis, will operate overall at an acceptable LOS C during the morning and afternoon, and Saturday midday peak hours. Further analysis with optimization found that all critical movements will operate at an acceptable LOS D or better during these peak periods. Based upon the initial approval by Rhode Island Department of Transportation (RIDOT) through the Physical Alteration Permit process, a post construction analysis is to be completed to determine the need of making any timing adjustments to accommodate actual traffic volumes, movement distributions and operating conditions at the junction. The signal phasing and timing optimization will be coordinated with the Department if future traffic conditions warrant a modification.

In addition to the main site driveway, the secondary access points for the *Neon Marketplace* and the car wash properties on Division Street (Route 401), will operate efficiently with minimal delays during the weekday morning and afternoon, and Saturday midday peak traffic conditions. This is expected due to the low site-related volumes for these movements, coupled with the restricted right turn enter-only movements, which will be unimpeded and do not require a delay analysis.

6.0 Conclusions and Recommendations

In summary, the study has shown that the proposed commercial project, *Neon Marketplace*, including the addition of an automated car wash on the adjacent lot as part of an expansion of the development, access, and site circulation plan has been designed to provide a level of traffic safety and efficiency on the servicing roadway system and within the site. The safety of the servicing roadway and specifically the study intersection was reviewed for geometry and sight distances. The review determined the intersection provides sufficient sight distances in accordance with AASHTO criteria for visibility and decision making of drivers attempting to enter/exit main street traffic from a side street or driveway location.

In reference to safety, as previously noted, a few minor measures were recommended to be considered at the signalized intersection of Division Street (Route 401) with the Route 4 Southbound ramps/Site Access driveway. The RIDOT could review the clearance intervals to determine if they require adjustment in an effort to reduce the number of rear-end collisions, while also investigating installation of traffic signal head backplates with retroreflective borders to potentially help reduce the overall number of crashes at this intersection. These will be placed on any new heads that are proposed as part of the intersection improvements.

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

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

A

Intersection Turning Movement Count

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

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P: 401.333.2382 | W: www.BETA-inc.com

Project: Proposed Car Wash
Town/City: Warwick, RI
Location: Division St. at Route 4 SB Ram
Weather: Sunny/70s

File Name : Division at Route 4 SB Ramps_Weekday
Site Code : 06222022
Start Date : 6/22/2022
Page No : 1

Groups Printed- Cars - Heavy Vehicles - Bikes

	Southbound					Division Street (Route 401) Westbound					Route 4 Southbound Ramps Northbound					Division Street (Route 401) Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	101	15	0	116	16	0	23	0	39	119	114	0	0	233	388
07:15 AM	0	0	0	0	0	0	133	24	0	157	44	0	47	0	91	175	121	0	0	296	544
07:30 AM	0	0	0	0	0	0	154	16	0	170	47	0	41	0	88	185	183	0	1	369	627
07:45 AM	0	0	0	0	0	0	187	11	0	198	56	0	59	0	115	149	186	0	0	335	648
Total	0	0	0	0	0	0	575	66	0	641	163	0	170	0	333	628	604	0	1	1233	2207
08:00 AM	0	0	0	0	0	0	162	20	0	182	50	0	50	0	100	116	198	0	2	316	598
08:15 AM	0	0	0	0	0	0	181	14	0	195	71	0	49	1	121	130	173	0	0	303	619
08:30 AM	0	0	0	0	0	0	165	22	0	187	47	0	62	0	109	131	182	0	0	313	609
08:45 AM	0	0	0	0	0	0	183	15	0	198	52	0	41	0	93	101	212	0	0	313	604
Total	0	0	0	0	0	0	691	71	0	762	220	0	202	1	423	478	765	0	2	1245	2430
*** BREAK ***																					
04:00 PM	0	0	0	0	0	0	295	26	0	321	85	0	60	1	146	118	255	0	0	373	840
04:15 PM	0	0	0	0	0	0	283	19	0	302	83	0	50	0	133	106	248	0	0	354	789
04:30 PM	0	0	0	0	0	0	260	24	0	284	69	0	42	0	111	123	271	0	0	394	789
04:45 PM	0	0	0	0	0	0	281	26	0	307	97	0	60	2	159	114	276	0	0	390	856
Total	0	0	0	0	0	0	1119	95	0	1214	334	0	212	3	549	461	1050	0	0	1511	3274
05:00 PM	0	0	0	0	0	0	253	19	0	272	87	0	40	1	128	113	327	0	0	440	840
05:15 PM	0	0	0	0	0	0	261	17	0	278	90	0	70	0	160	125	277	0	1	403	841
05:30 PM	0	0	0	0	0	0	266	24	0	290	116	0	60	0	176	117	239	0	1	357	823
05:45 PM	0	0	0	0	0	0	189	22	0	211	99	0	64	1	164	84	219	0	0	303	678
Total	0	0	0	0	0	0	969	82	0	1051	392	0	234	2	628	439	1062	0	2	1503	3182
Grand Total	0	0	0	0	0	0	3354	314	0	3668	1109	0	818	6	1933	2006	3481	0	5	5492	11093
Apprch %	0	0	0	0		0	91.4	8.6	0		57.4	0	42.3	0.3		36.5	63.4	0	0.1		
Total %	0	0	0	0	0	0	30.2	2.8	0	33.1	10	0	7.4	0.1	17.4	18.1	31.4	0	0	49.5	
Cars	0	0	0	0	0	0	3310	313	0	3623	1107	0	815	6	1928	1952	3463	0	5	5420	10971
% Cars	0	0	0	0	0	0	98.7	99.7	0	98.8	99.8	0	99.6	100	99.7	97.3	99.5	0	100	98.7	98.9
Heavy Vehicles	0	0	0	0	0	0	44	1	0	45	2	0	3	0	5	54	18	0	0	72	122
% Heavy Vehicles	0	0	0	0	0	0	1.3	0.3	0	1.2	0.2	0	0.4	0	0.3	2.7	0.5	0	0	1.3	1.1
Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Lincoln, Rhode Island 02865
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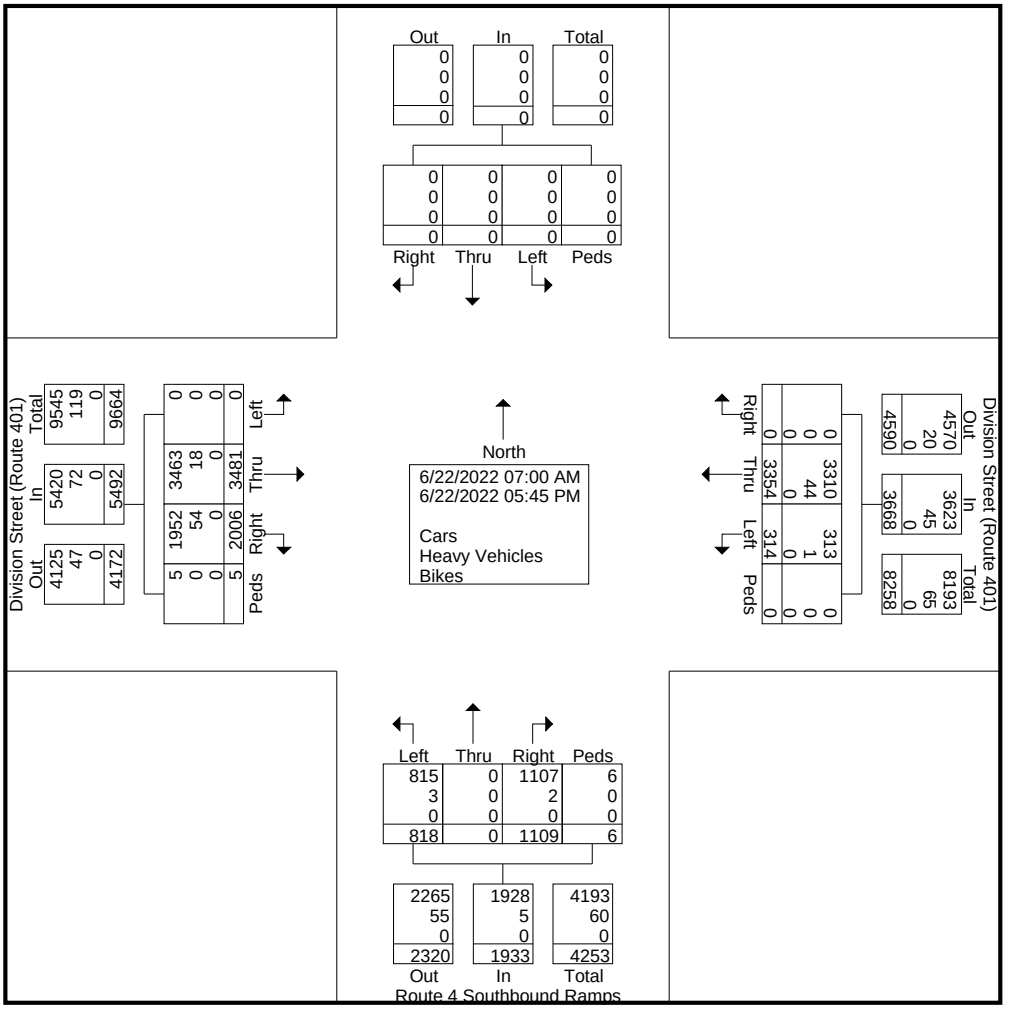
File Name : Division at Route 4 SB Ramps_Weekday
Site Code : 06222022
Start Date : 6/22/2022
Page No : 2



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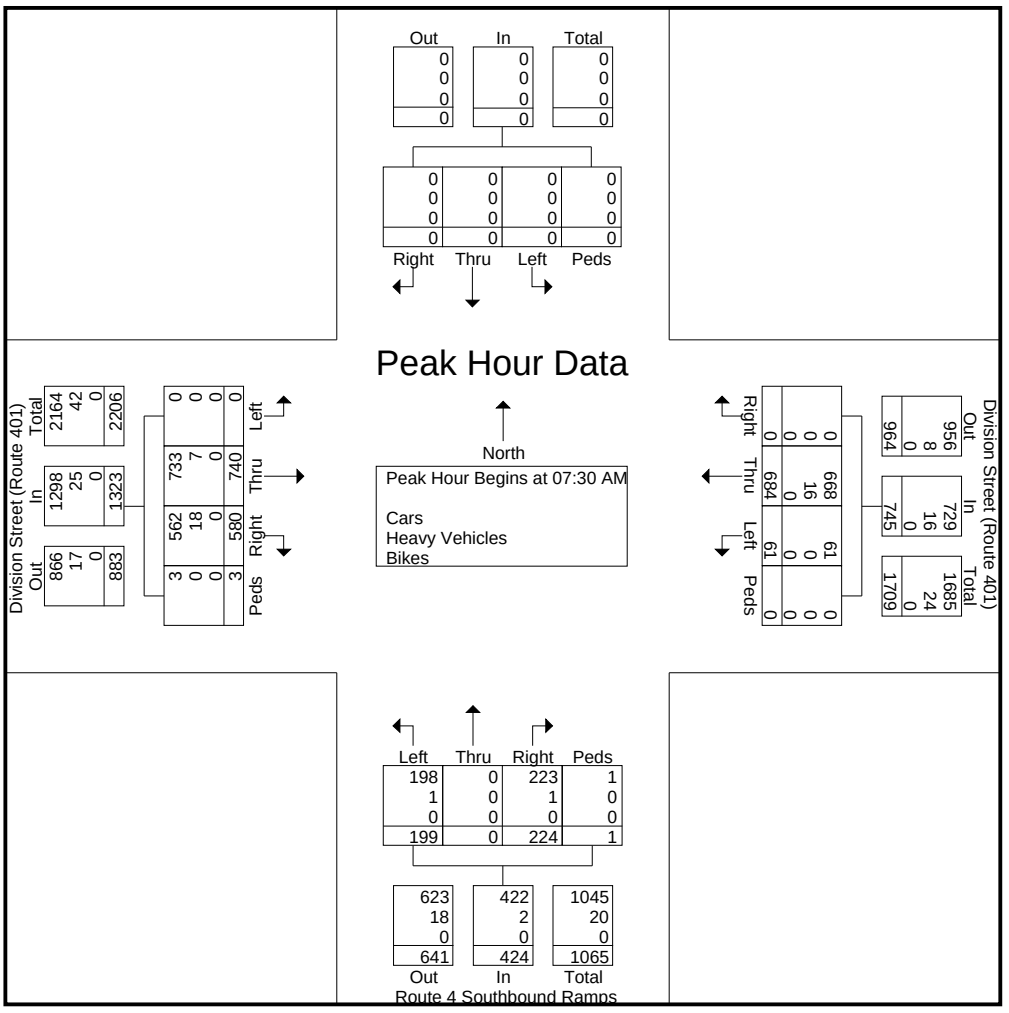
File Name : Division at Route 4 SB Ramps_Weekday
Site Code : 06222022
Start Date : 6/22/2022
Page No : 3

	Southbound					Division Street (Route 401) Westbound					Route 4 Southbound Ramps Northbound					Division Street (Route 401) Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 11:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	0	154	16	0	170	47	0	41	0	88	**185**	183	0	1	**369**	627
07:45 AM	0	0	0	0	0	0	**187**	11	0	**198**	56	0	**59**	0	115	149	186	0	0	335	**648**
08:00 AM	0	0	0	0	0	0	162	**20**	0	182	50	0	50	0	100	116	**198**	0	**2**	316	598
08:15 AM	0	0	0	0	0	0	181	14	0	195	**71**	0	49	**1**	**121**	130	173	0	0	303	619
Total Volume	0	0	0	0	0	0	684	61	0	745	224	0	199	1	424	580	740	0	3	1323	2492
% App. Total	0	0	0	0		0	91.8	8.2	0		52.8	0	46.9	0.2		43.8	55.9	0	0.2		
PHF	.000	.000	.000	.000	.000	.000	.914	.763	.000	.941	.789	.000	.843	.250	.876	.784	.934	.000	.375	.896	.961
Cars	0	0	0	0	0	0	668	61	0	729	223	0	198	1	422	562	733	0	3	1298	2449
% Cars	0	0	0	0	0	0	97.7	100	0	97.9	99.6	0	99.5	100	99.5	96.9	99.1	0	100	98.1	98.3
Heavy Vehicles	0	0	0	0	0	0	16	0	0	16	1	0	1	0	2	18	7	0	0	25	43
% Heavy Vehicles	0	0	0	0	0	0	2.3	0	0	2.1	0.4	0	0.5	0	0.5	3.1	0.9	0	0	1.9	1.7
Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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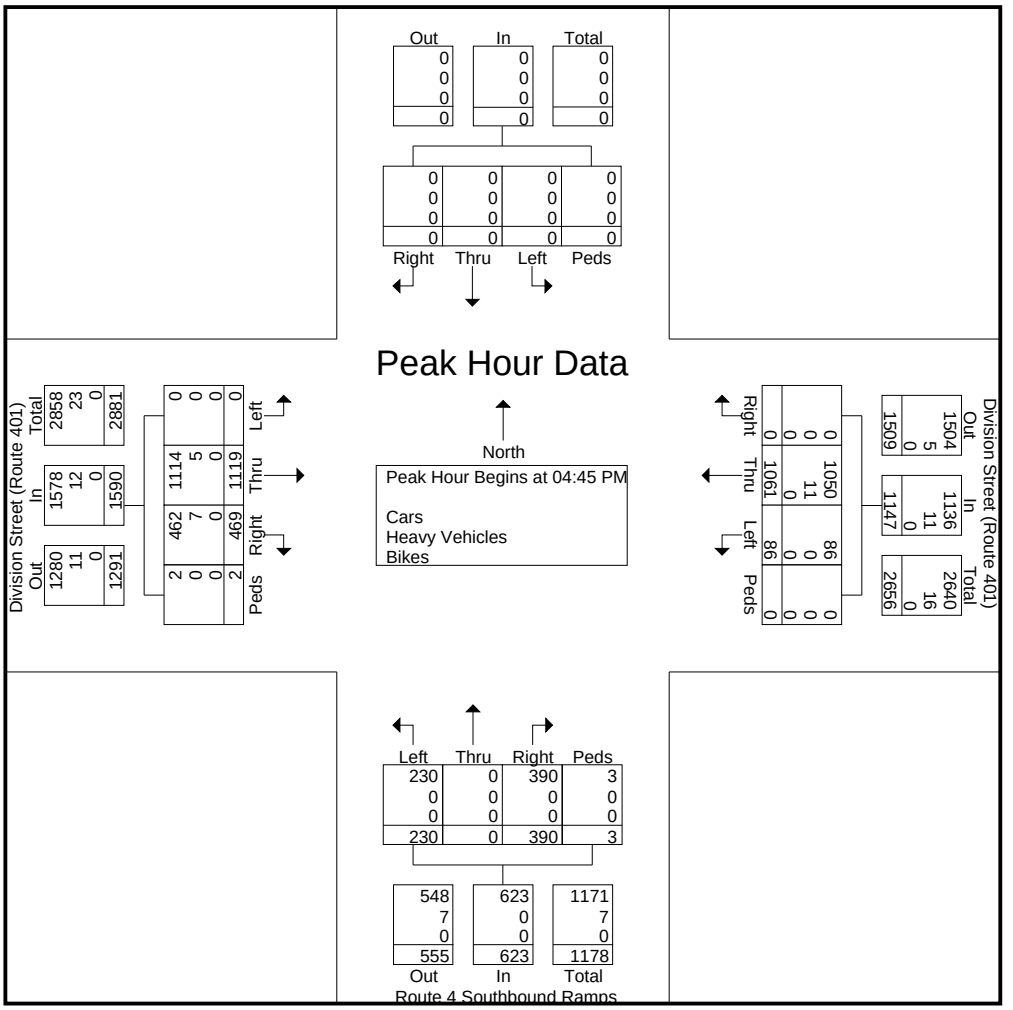
File Name : Division at Route 4 SB Ramps_Weekday
Site Code : 06222022
Start Date : 6/22/2022
Page No : 4

	Southbound					Division Street (Route 401) Westbound					Route 4 Southbound Ramps Northbound					Division Street (Route 401) Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 12:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	0	**281**	**26**	0	**307**	97	0	60	**2**	159	114	276	0	0	390	**856**
05:00 PM	0	0	0	0	0	0	253	19	0	272	87	0	40	1	128	113	**327**	0	0	**440**	840
05:15 PM	0	0	0	0	0	0	261	17	0	278	90	0	**70**	0	160	**125**	277	0	**1**	403	841
05:30 PM	0	0	0	0	0	0	266	24	0	290	**116**	0	60	0	**176**	117	239	0	1	357	823
Total Volume	0	0	0	0	0	0	1061	86	0	1147	390	0	230	3	623	469	1119	0	2	1590	3360
% App. Total	0	0	0	0		0	92.5	7.5	0		62.6	0	36.9	0.5		29.5	70.4	0	0.1		
PHF	.000	.000	.000	.000	.000	.000	.944	.827	.000	.934	.841	.000	.821	.375	.885	.938	.856	.000	.500	.903	.981
Cars	0	0	0	0	0	0	1050	86	0	1136	390	0	230	3	623	462	1114	0	2	1578	3337
% Cars	0	0	0	0	0	0	99.0	100	0	99.0	100	0	100	100	100	98.5	99.6	0	100	99.2	99.3
Heavy Vehicles	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	7	5	0	0	12	23
% Heavy Vehicles	0	0	0	0	0	0	1.0	0	0	1.0	0	0	0	0	0	1.5	0.4	0	0	0.8	0.7
Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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Lincoln, Rhode Island 02865
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Project: Proposed Car Wash
Town/City: Warwick, RI
Location: Division St. at Route 4 SB Ram
Weather: Sunny/80s

File Name : Division at Route 4 SB Ramps_Saturday
Site Code : 06222022
Start Date : 6/25/2022
Page No : 1

Groups Printed- Cars - Heavy Vehicles - Bikes

	Southbound					Division Street (Route 401) Westbound					Route 4 SB Ramps Northbound					Division Street (Route 401) Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
11:30 AM	0	0	0	0	0	0	214	26	0	240	71	0	36	0	107	121	221	0	0	342	689
11:45 AM	0	0	0	0	0	0	225	9	0	234	114	0	56	0	170	137	233	0	0	370	774
Total	0	0	0	0	0	0	439	35	0	474	185	0	92	0	277	258	454	0	0	712	1463
12:00 PM	0	0	0	0	0	0	228	21	0	249	102	0	41	0	143	110	229	0	0	339	731
12:15 PM	0	0	0	0	0	0	288	27	0	315	105	0	42	0	147	117	221	0	0	338	800
12:30 PM	0	0	0	0	0	0	225	18	0	243	98	0	36	0	134	119	219	0	0	338	715
12:45 PM	0	0	0	0	0	0	202	11	0	213	92	0	50	0	142	102	201	0	0	303	658
Total	0	0	0	0	0	0	943	77	0	1020	397	0	169	0	566	448	870	0	0	1318	2904
01:00 PM	0	0	0	0	0	0	217	27	0	244	87	0	46	0	133	74	205	0	0	279	656
01:15 PM	0	0	0	0	0	0	225	35	0	260	122	0	42	0	164	125	180	0	0	305	729
Grand Total	0	0	0	0	0	0	1824	174	0	1998	791	0	349	0	1140	905	1709	0	0	2614	5752
Apprch %	0	0	0	0		0	91.3	8.7	0		69.4	0	30.6	0		34.6	65.4	0	0		
Total %	0	0	0	0	0	0	31.7	3	0	34.7	13.8	0	6.1	0	19.8	15.7	29.7	0	0	45.4	
Cars	0	0	0	0	0	0	1817	174	0	1991	791	0	349	0	1140	900	1709	0	0	2609	5740
% Cars	0	0	0	0	0	0	99.6	100	0	99.6	100	0	100	0	100	99.4	100	0	0	99.8	99.8
Heavy Vehicles	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	5	0	0	0	5	12
% Heavy Vehicles	0	0	0	0	0	0	0.4	0	0	0.4	0	0	0	0	0	0.6	0	0	0	0.2	0.2
Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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File Name : Division at Route 4 SB Ramps_Saturday
Site Code : 06222022
Start Date : 6/25/2022
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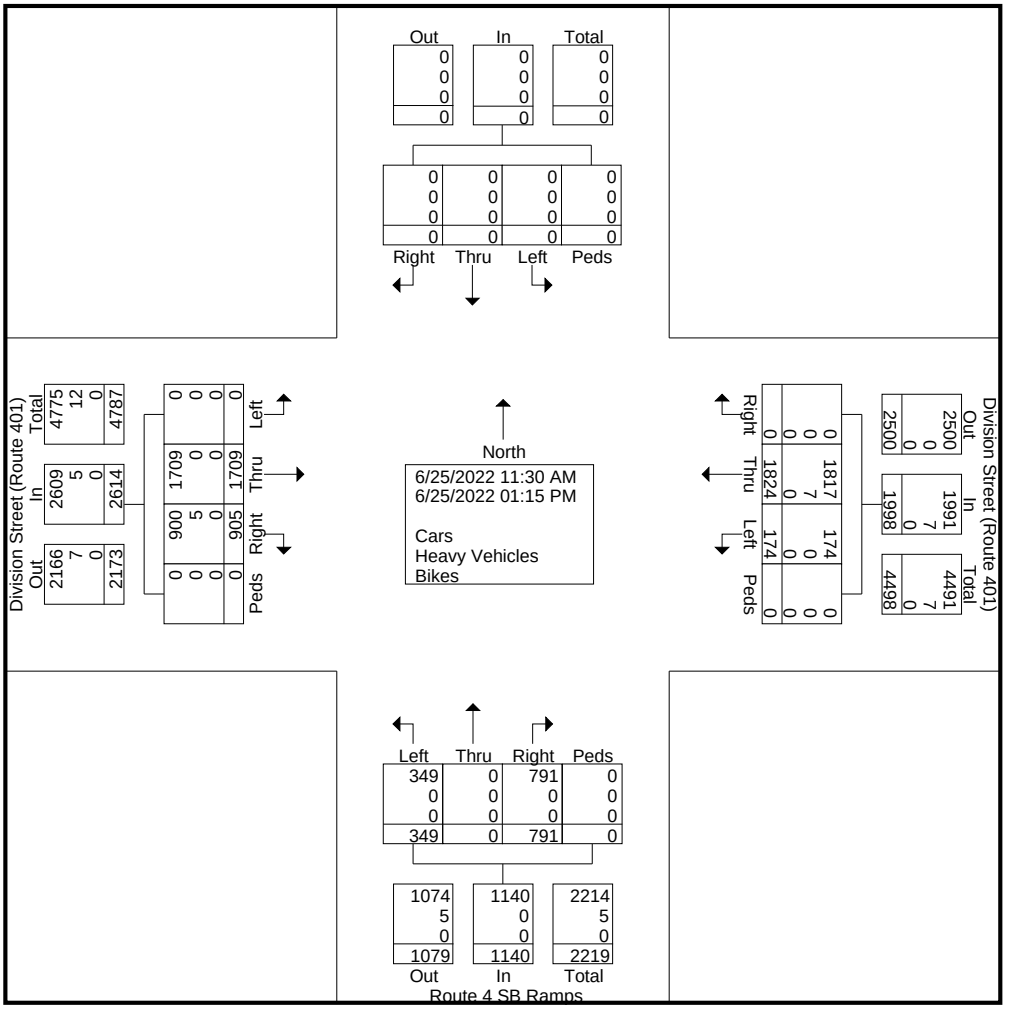

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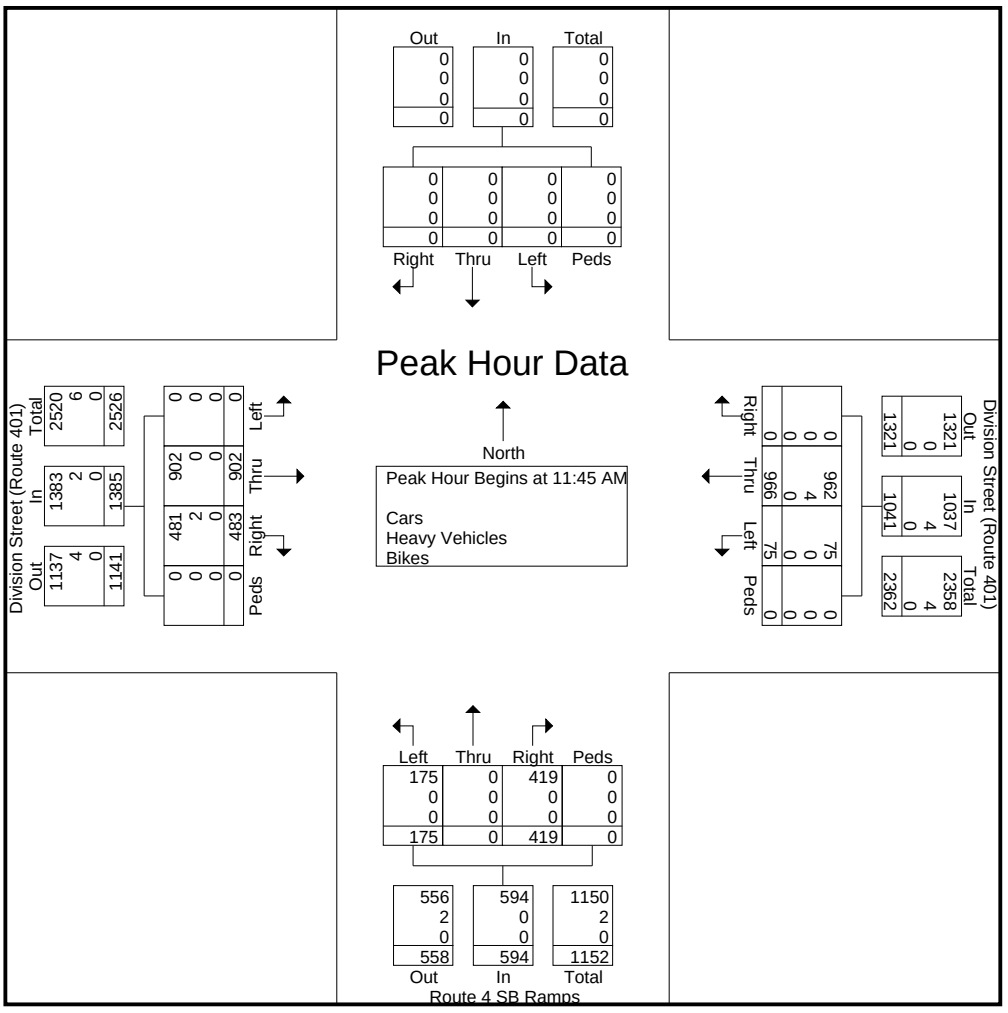
File Name : Division at Route 4 SB Ramps_Saturday
Site Code : 06222022
Start Date : 6/25/2022
Page No : 3

	Southbound					Division Street (Route 401) Westbound					Route 4 SB Ramps Northbound					Division Street (Route 401) Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:30 AM to 01:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:45 AM																					
11:45 AM	0	0	0	0	0	0	225	9	0	234	**114**	0	**56**	0	**170**	**137**	**233**	0	0	**370**	774
12:00 PM	0	0	0	0	0	0	228	21	0	249	102	0	41	0	143	110	229	0	0	339	731
12:15 PM	0	0	0	0	0	0	**288**	**27**	0	**315**	105	0	42	0	147	117	221	0	0	338	**800**
12:30 PM	0	0	0	0	0	0	225	18	0	243	98	0	36	0	134	119	219	0	0	338	715
Total Volume	0	0	0	0	0	0	966	75	0	1041	419	0	175	0	594	483	902	0	0	1385	3020
% App. Total	0	0	0	0		0	92.8	7.2	0		70.5	0	29.5	0		34.9	65.1	0	0		
PHF	.000	.000	.000	.000	.000	.000	.839	.694	.000	.826	.919	.000	.781	.000	.874	.881	.968	.000	.000	.936	.944
Cars	0	0	0	0	0	0	962	75	0	1037	419	0	175	0	594	481	902	0	0	1383	3014
% Cars	0	0	0	0	0	0	99.6	100	0	99.6	100	0	100	0	100	99.6	100	0	0	99.9	99.8
Heavy Vehicles	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	2	0	0	0	2	6
% Heavy Vehicles	0	0	0	0	0	0	0.4	0	0	0.4	0	0	0	0	0	0.4	0	0	0	0.1	0.2
Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



APPENDIX B – Traffic Crash Data

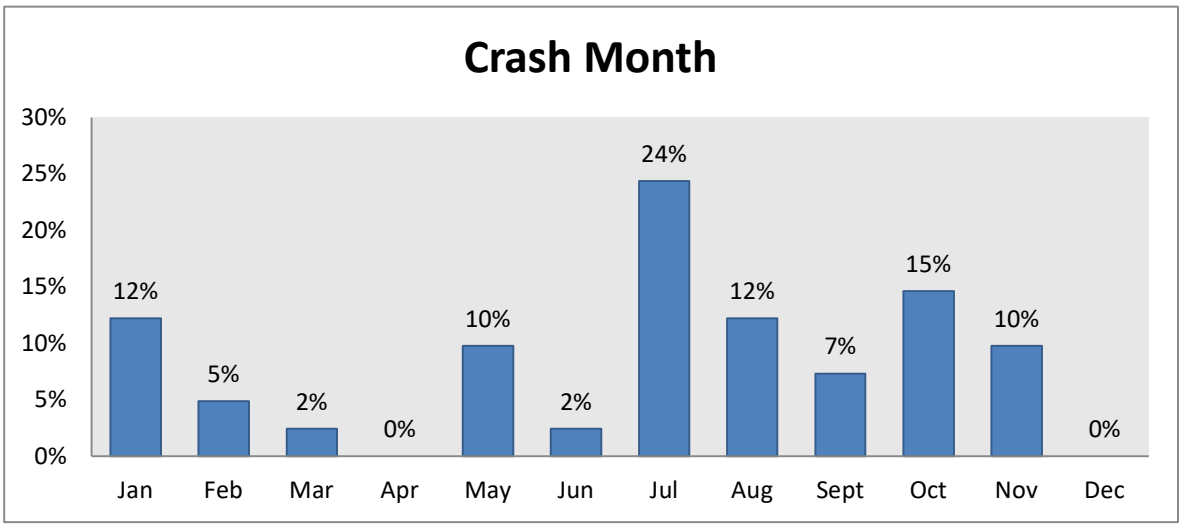
January 2017 through December 2019

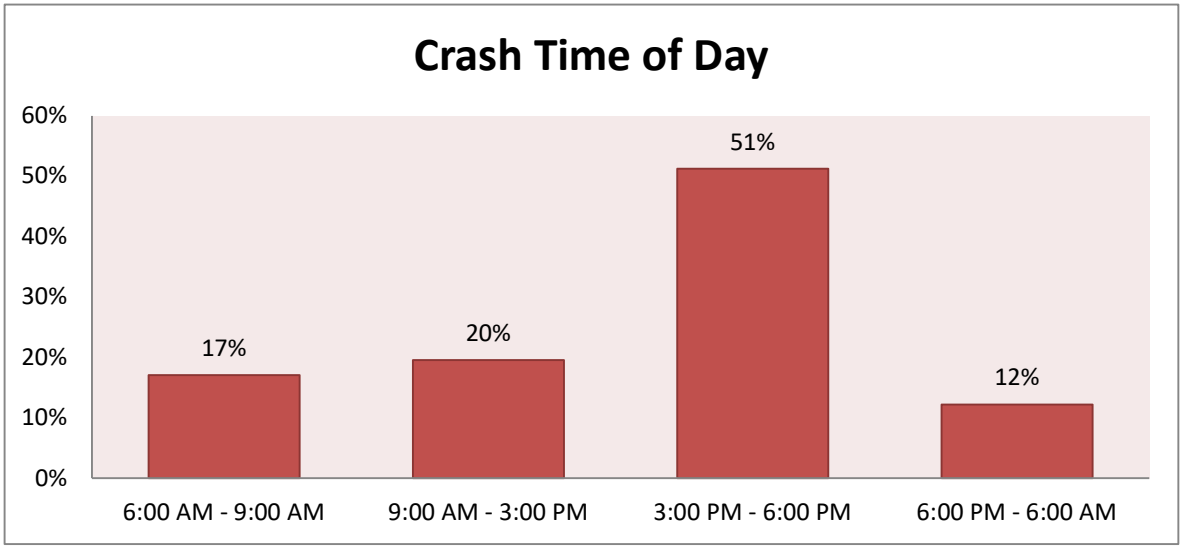
Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

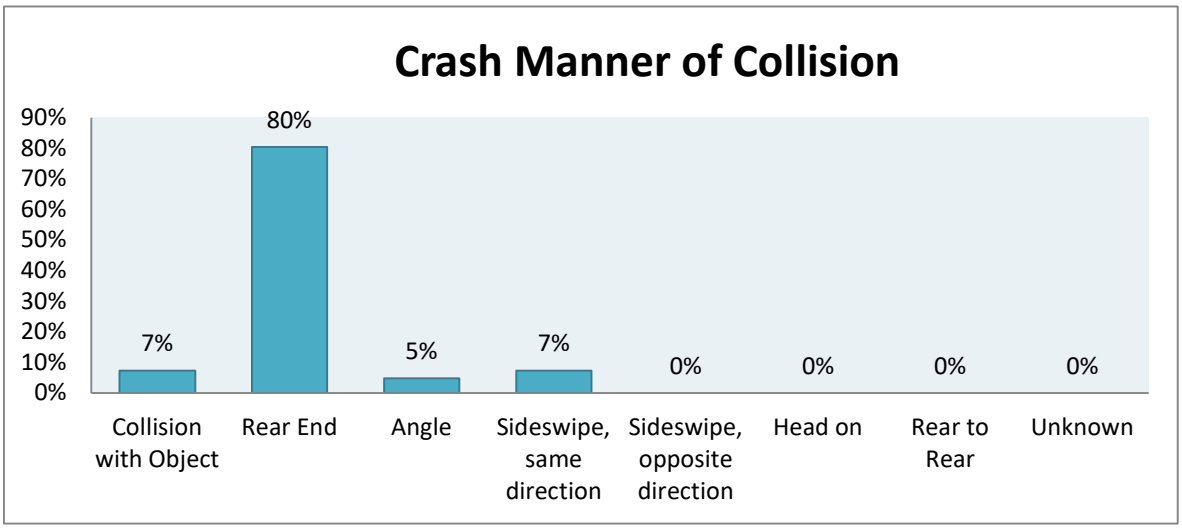
Division Street (Route 401) at Route 4 Southbound Ramps/Site Driveway

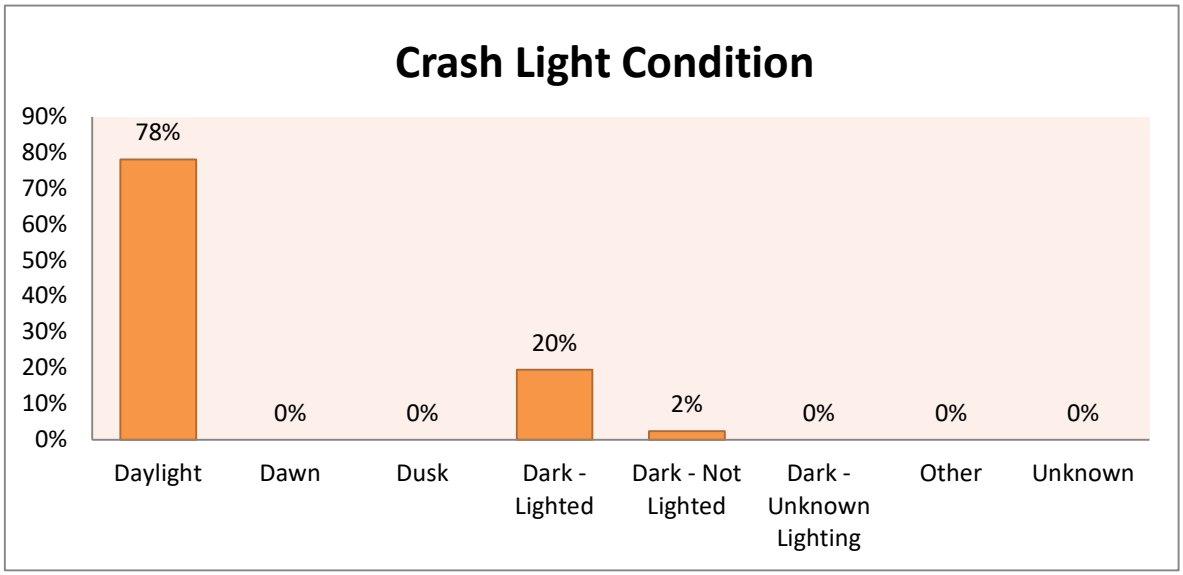
		2017	2018	2019	Total	Percent
Collision Type						
	Rear End	12	12	9	**33**	80%
	Angle	0	1	1	**2**	5%
	Head-On	0	0	0	**0**	0%
	Pedestrian	0	0	0	**0**	0%
	Sideswipe, Same Direction	0	1	2	**3**	7%
	Sideswipe, Opposite Direction	0	0	0	**0**	0%
	Collision with Object	1	2	0	**3**	7%
	Collision with Deer	0	0	0	**0**	0%
	Other	0	0	0	**0**	0%
	Unknown	0	0	0	**0**	0%
Crash Severity						
	Property	10	14	8	**32**	78%
	Injury	3	2	4	**9**	22%
Light Condition						
	Daylight	9	14	9	**32**	78%
	Dawn	0	0	0	**0**	0%
	Dusk	0	0	0	**0**	0%
	Dark - Lighted	4	2	2	**8**	20%
	Dark - Not Lighted	0	0	1	**1**	2%
	Dark - Unknown Lighting	0	0	0	**0**	0%
Road Condition						
	Dry	10	15	8	**33**	80%
	Wet	3	1	4	**8**	20%
	Snow	0	0	0	**0**	0%
	Slush	0	0	0	**0**	0%
	Ice/Frost	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	4	3	**7**	17%
	9:00 AM - 3:00 PM	4	3	1	**8**	20%
	3:00 PM - 6:00 PM	7	8	6	**21**	51%
	6:00 PM - 6:00 AM	2	1	2	**5**	12%
	Total Crashes:	**13**	**16**	**12**	**41**	

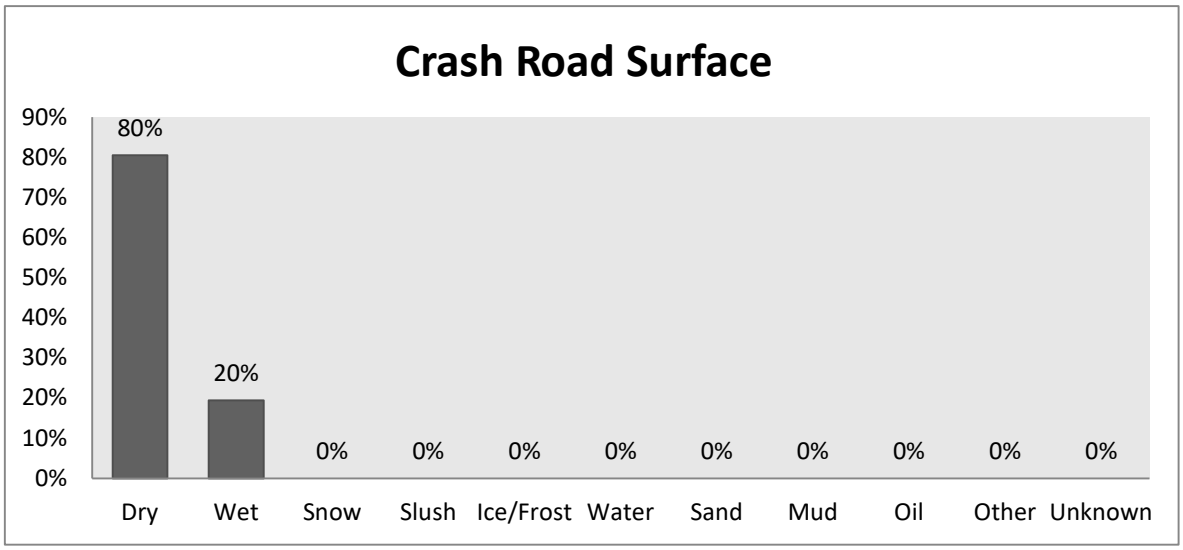
Crash Data Summary Charts








Crash Light Condition
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
78%
0%
0%
20%
2%
0%
0%
0%
Daylight
Dawn
Dusk
Dark - Lighted
Dark - Not Lighted
Dark - Unknown Lighting
Other
Unknown


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

APPENDIX C – Trip Generation

ITE Trip Generation Summary

Site Trip Distribution

ITE Land Use Code

- ITE Land Use Code 945 – Convenience Store/Gas Station
- ITE Land Use Code 948 – Automated Car Wash

C

ITE Trip Generation Summary

Trip Generation Summary

Summary;

	Description		Enter	Exit	Total
Weekday AM Peak Hour					
ITE Land Use Code 945	Convenience Store/Gas Station		165	165	330
ITE Land Use Code 948	Automated Car Wash		-	-	-
		TOTAL	165	165	330
Weekday PM Peak Hour					
ITE Land Use Code 945	Convenience Store/Gas Station		173	173	346
ITE Land Use Code 948	Automated Car Wash		34	34	68
		TOTAL	207	207	414
Satruday MD Peak Hour					
ITE Land Use Code 945	Convenience Store/Gas Station		152	151	303
ITE Land Use Code 948	Automated Car Wash		72	72	144
		TOTAL	224	223	447

Calculations;

ITE Land Use Code 945 Convenience Store/Gas Station

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

X = 2200 AM
X = 2880 PM
X = 2525 MD

AM Peak Directional Distribution: 50% Entering 50% Exiting

T = 0.15 x (X)
T = 0.15 x 2200
T = 330

Enter: 165
Exit: 165
Total: 330

PM Peak Directional Distribution: 50% Entering 50% Exiting

T = 0.12 x (X)
T = 0.12 x 2880
T = 346

Enter: 173
Exit: 173
Total: 346

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

T = 0.12 x (X)
T = 0.12 x 2525
T = 303

Enter: 152
Exit: 151
Total: 303

ITE Land Use Code 948 Automated Car Wash (4,739 GFA)

Independent Variable (X) = Thousand Gross Floor Area (GFA) X = 4.74

AM Peak n/a

PM Peak Directional Distribution: 50% Entering 50% Exiting

T = 14.20 x (X)
T = 14.20 x 4.74
T = 68

Enter: 34
Exit: 34
Total: 68

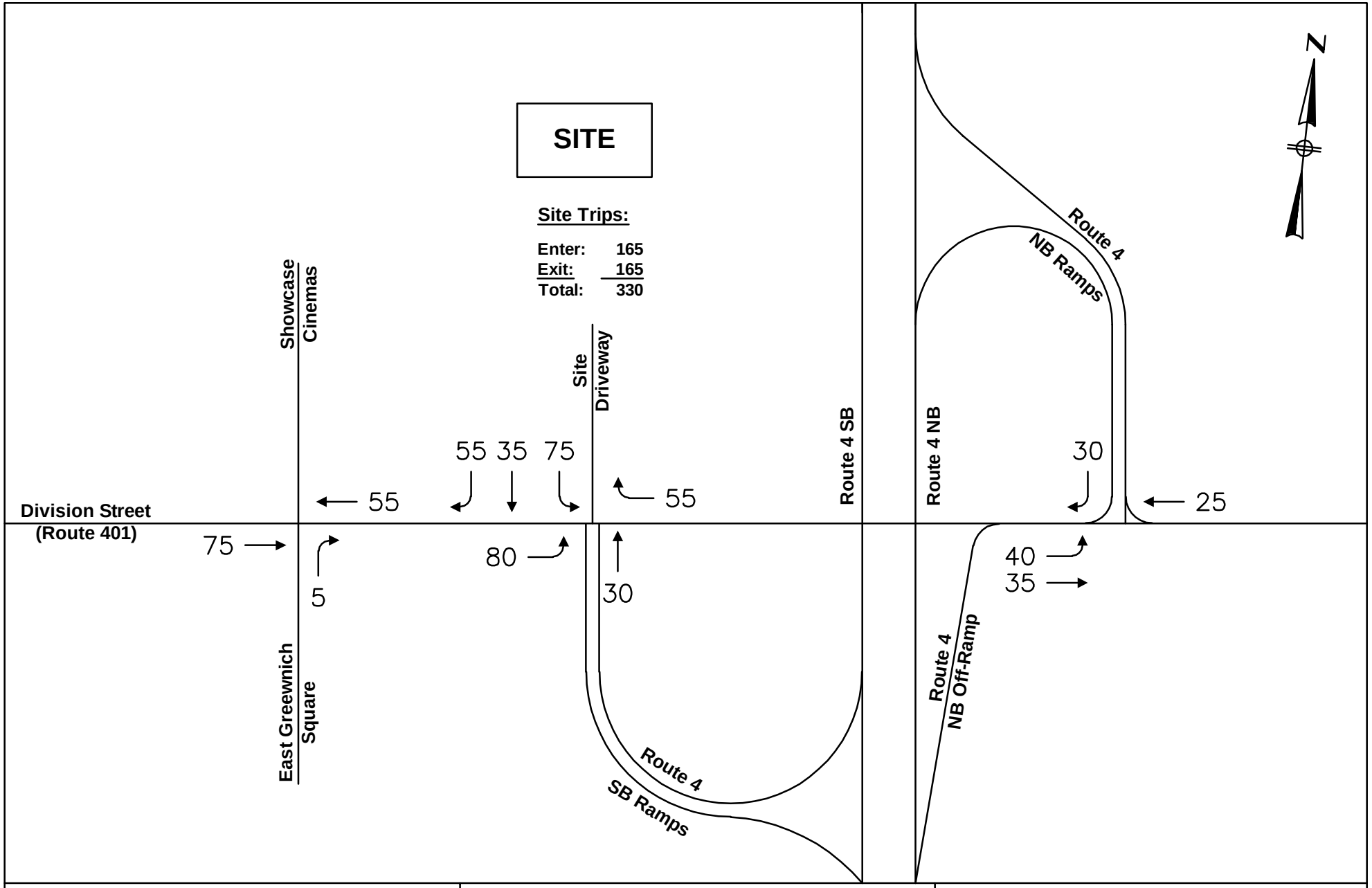
Sat. MD Peak Directional Distribution: 50% Entering 50% Exiting

T = 30.40 x (X)
T = 30.40 x 4.74
T = 144

Enter: 72
Exit: 72
Total: 144

C

Site Trip Distribution



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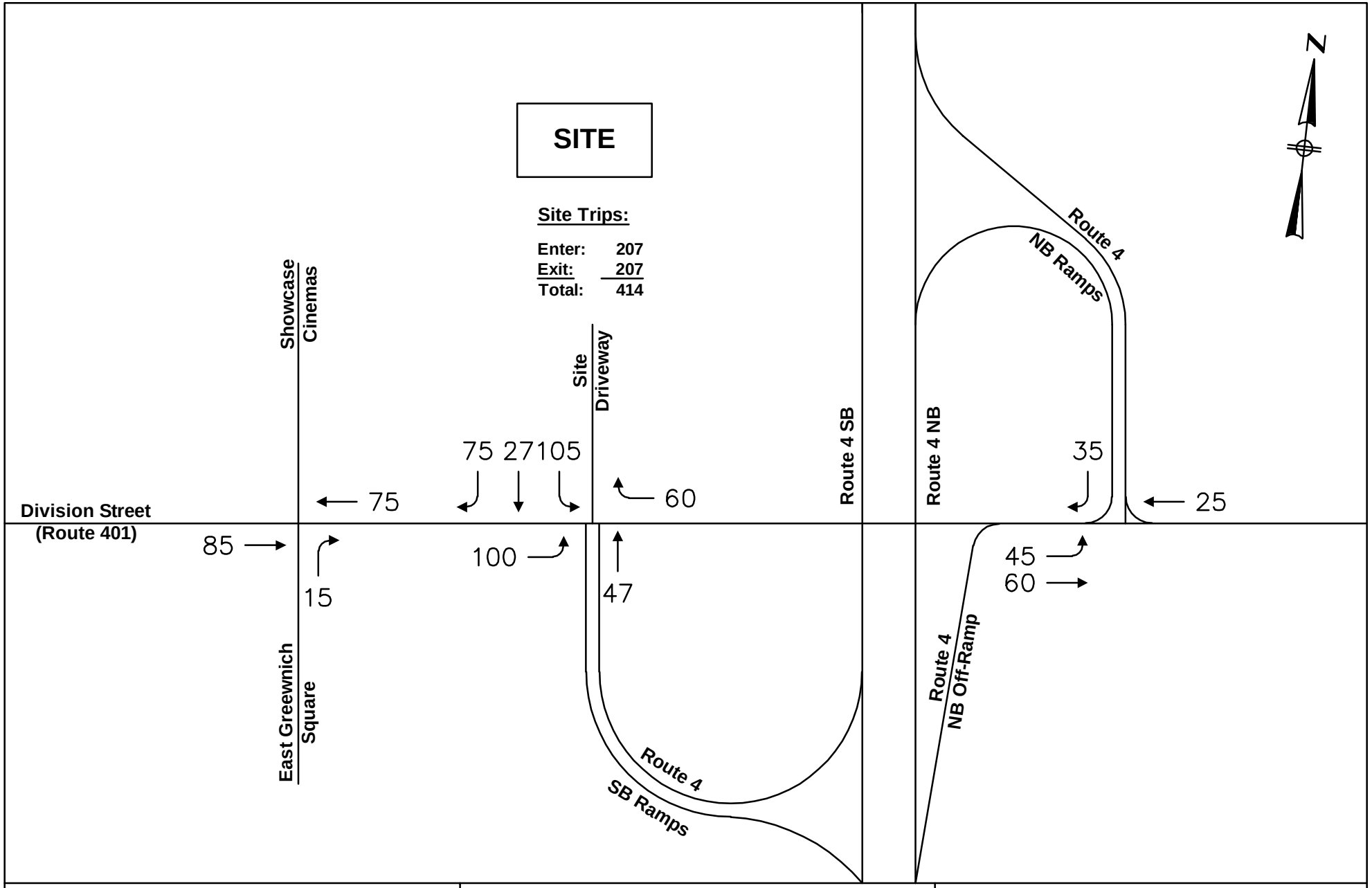
SITE TRIP DISTRIBUTION
WEEKDAY AM PEAK HOUR

NEON MARKETPLACE EXPANSION
WARWICK, RHODE ISLAND

2025 Build Condition



BETA
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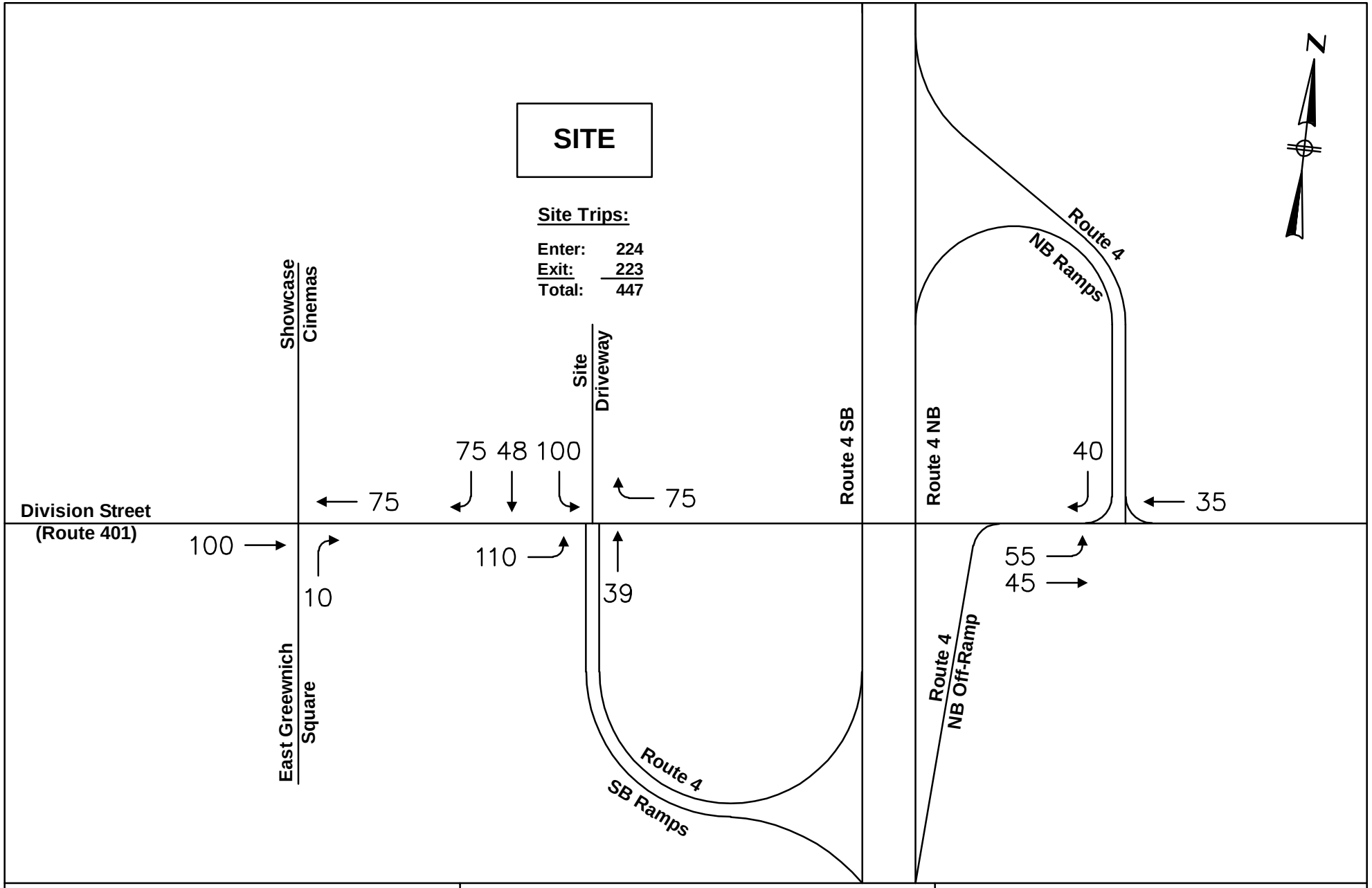
SITE TRIP DISTRIBUTION
WEEKDAY PM PEAK HOUR

NEON MARKETPLACE EXPANSION
WARWICK, RHODE ISLAND

2025 Build Condition



SITE TRIP DISTRIBUTION
SATURDAY MD PEAK HOUR

NEON MARKETPLACE EXPANSION
WARWICK, RHODE ISLAND

2024 Build Condition

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C

ITE Land Use Code

ITE Land Use Code 945 – Convenience Store/Gas Station

ITE Land Use Code 948 – Automated Car Wash

ITE Land Use Code 945 – Convenience Store/Gas Station

Land Use: 945
Convenience Store/Gas Station

Description

A convenience store/gas station is a facility with a co-located convenience store and gas station. The convenience store sells grocery and other everyday items that a person may need or want as a matter of convenience. The gas station sells automotive fuels such as gasoline and diesel.

A convenience store/gas station is typically located along a major thoroughfare to optimize motorist convenience. Extended hours of operation (with many open 24 hours, 7 days a week) are common at these facilities.

The convenience store product mix typically includes pre-packaged grocery items, beverages, dairy products, snack foods, confectionary, tobacco products, over-the-counter drugs, and toiletries. A convenience store may sell alcohol, often limited to beer and wine. Coffee and pre-made sandwiches are also commonly sold at a convenience store. Made-to-order food orders are sometimes offered. Some stores offer limited seating.

The sites in this land use include both self-pump and attendant-pumped fueling positions and both pre-pay and post-pay operations.

Convenience store (Land Use 851), gasoline/service station (Land Use 944), and truck stop (Land Use 950) are related uses.

Land Use Subcategory

Multiple subcategories were added to this land use to allow for multi-variable evaluation of sites with single-variable data plots. All study sites are assigned to one of three subcategories, based on the number of vehicle fueling positions (VFP) at the site: between 2 and 8 VFP, between 9 and 15 VFP, and between 16 and 24 VFP. For each VFP range subcategory, data plots are presented with GFA as the independent variable for all time periods and trip types for which data are available. The use of both GFA and VFP (as the independent variable and land use subcategory, respectively) provides a significant improvement in the reliability of a trip generation estimate when compared to the single-variable data plots in prior editions of *Trip Generation Manual*.

Further, the study sites were also assigned to one of three other subcategories, based on the gross floor area (GFA) of the convenience store at the site: between 2,000 and 4,000 square feet, between 4,000 and 5,500 square feet, and between 5,500 and 10,000 square feet. For each GFA subcategory range, data plots are presented with VFP as the independent variable for all time periods and trip types for which data are available. The use of both VFP and GFA (as the independent variable and land use subcategory, respectively) provides a significant improvement in the reliability of a trip generation estimate when compared to the single-variable data plots in prior editions of *Trip Generation Manual*.

When analyzing the convenience store/gas station land use with each combination of GFA and VFP values as described above, the two sets of data plots will produce two estimates of site-generated trips. Both values can be considered when determining a site trip generation estimate.

Data plots are also provided for three additional independent variables: AM peak hour traffic on adjacent street, PM peak hour traffic on adjacent street, and employees. These independent variables are intended to be analyzed as single independent variables and do not have sub-categories associated with them. Within the data plots and within the ITETripGen web app, these plots are found under the land use subcategory "none."

Additional Data

ITE recognizes there are existing convenience store/gas station sites throughout North America that are larger than the sites presented in the data plots. However, the ITE database does not include any site with more than 24 VFP or any site with gross floor area greater than 10,000 square feet. Submission of trip generation data for larger sites is encouraged.

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (https://www.ite.org/technical-resources/topics/trip-and-parking-generation/).

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), Arkansas, California, Connecticut, Delaware, Florida, Indiana, Iowa, Kentucky, Maryland, Massachusetts, Minnesota, Nevada, New Hampshire, New Jersey, Pennsylvania, Rhode Island, South Dakota, Texas, Utah, Vermont, Washington, and Wisconsin.

Source Numbers

221, 245, 274, 288, 300, 340, 350, 351, 352, 355, 359, 385, 440, 617, 718, 810, 813, 844, 850, 853, 864, 865, 867, 869, 882, 883, 888, 904, 926, 927, 936, 938, 954, 960, 962, 977, 1004, 1024, 1025, 1027, 1052

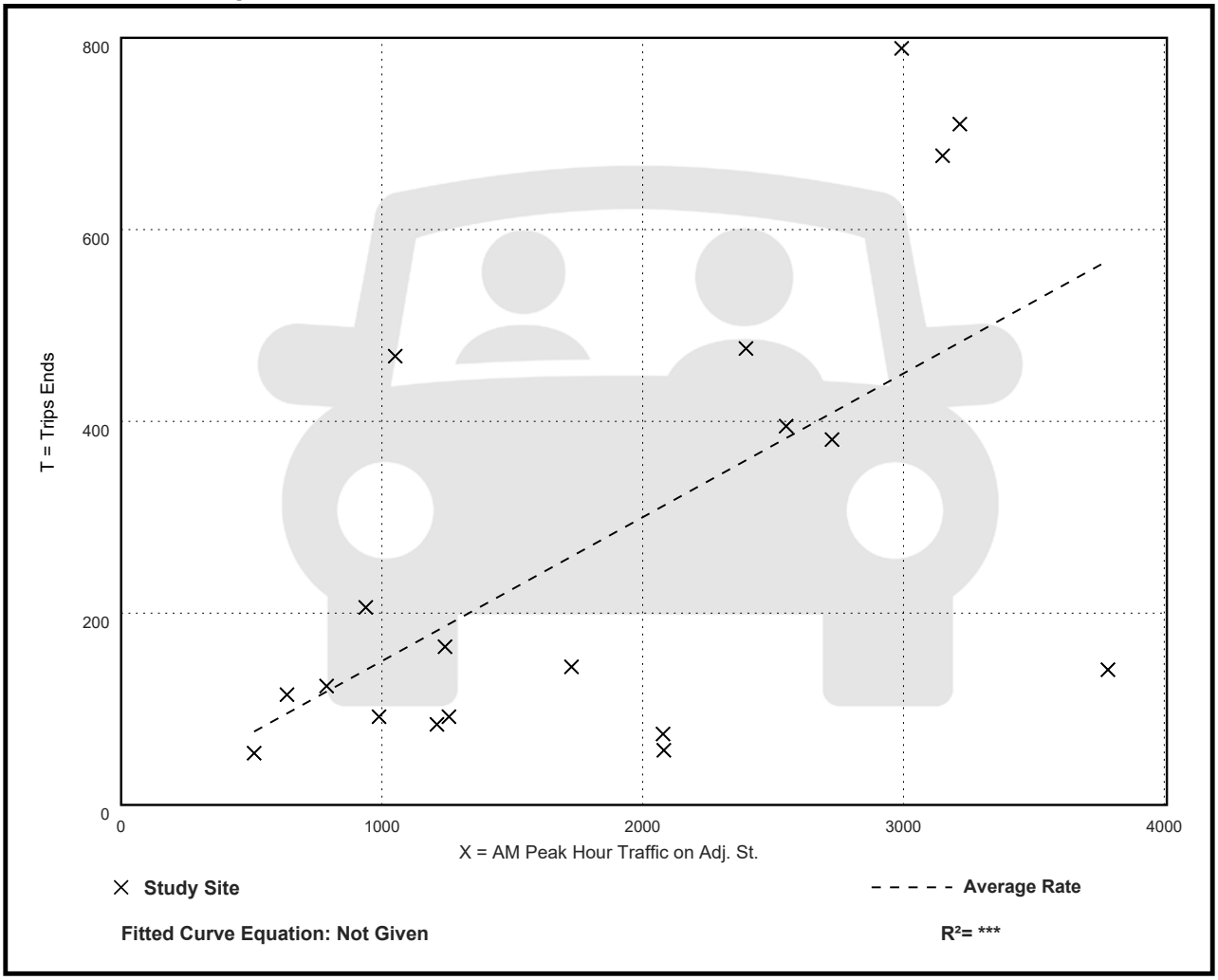
Convenience Store/Gas Station - None (945)

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: 19
Avg. AM Peak Hour Traffic on Adj. St.: 1859
Directional Distribution: 50% entering, 50% exiting

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

Average Rate	Range of Rates	Standard Deviation
0.15	0.03 - 0.45	0.10

Data Plot and Equation



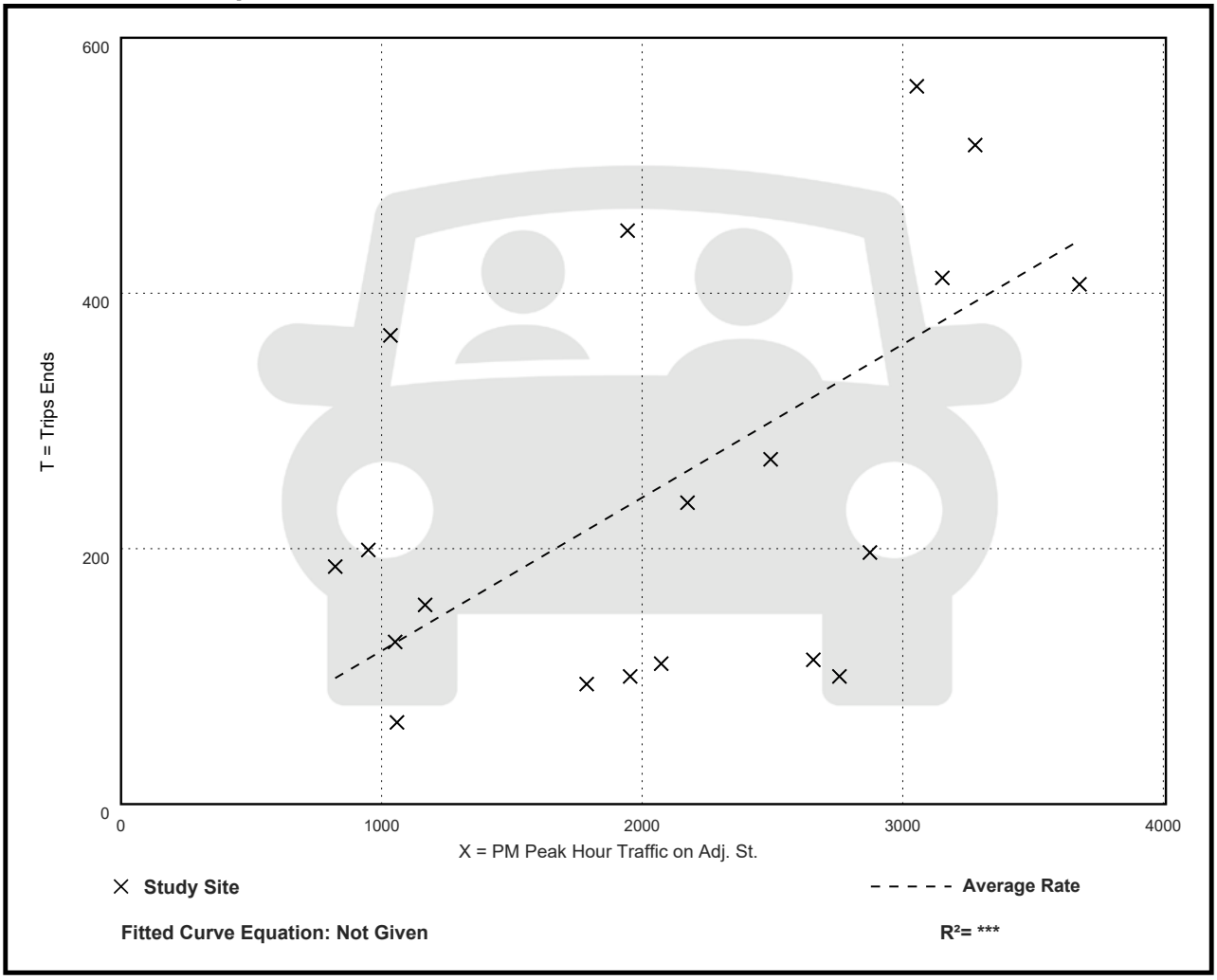
Convenience Store/Gas Station - None (945)

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: 19
Avg. PM Peak Hour Traffic on Adj. St.: 2103
Directional Distribution: 50% entering, 50% exiting

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

Average Rate	Range of Rates	Standard Deviation
0.12	0.04 - 0.35	0.07

Data Plot and Equation



Fitted Curve Equation: Not Given

R^2= ***

ITE Land Use Code 948 – Automated Car Wash

Land Use: 948
Automated Car Wash

Description

An automated car wash is a facility that allows for the mechanical cleaning of the exterior of vehicles. Manual cleaning service may also be available at the facility. Self-service car wash (Land Use 947) and car wash and detail center (Land Use 949) are related uses.

Additional Data

The sites were surveyed in the 1990s and the 2000s in New Jersey, New York, and Washington.

Source Numbers

552, 555, 585, 599, 954

Automated Car Wash
(948)

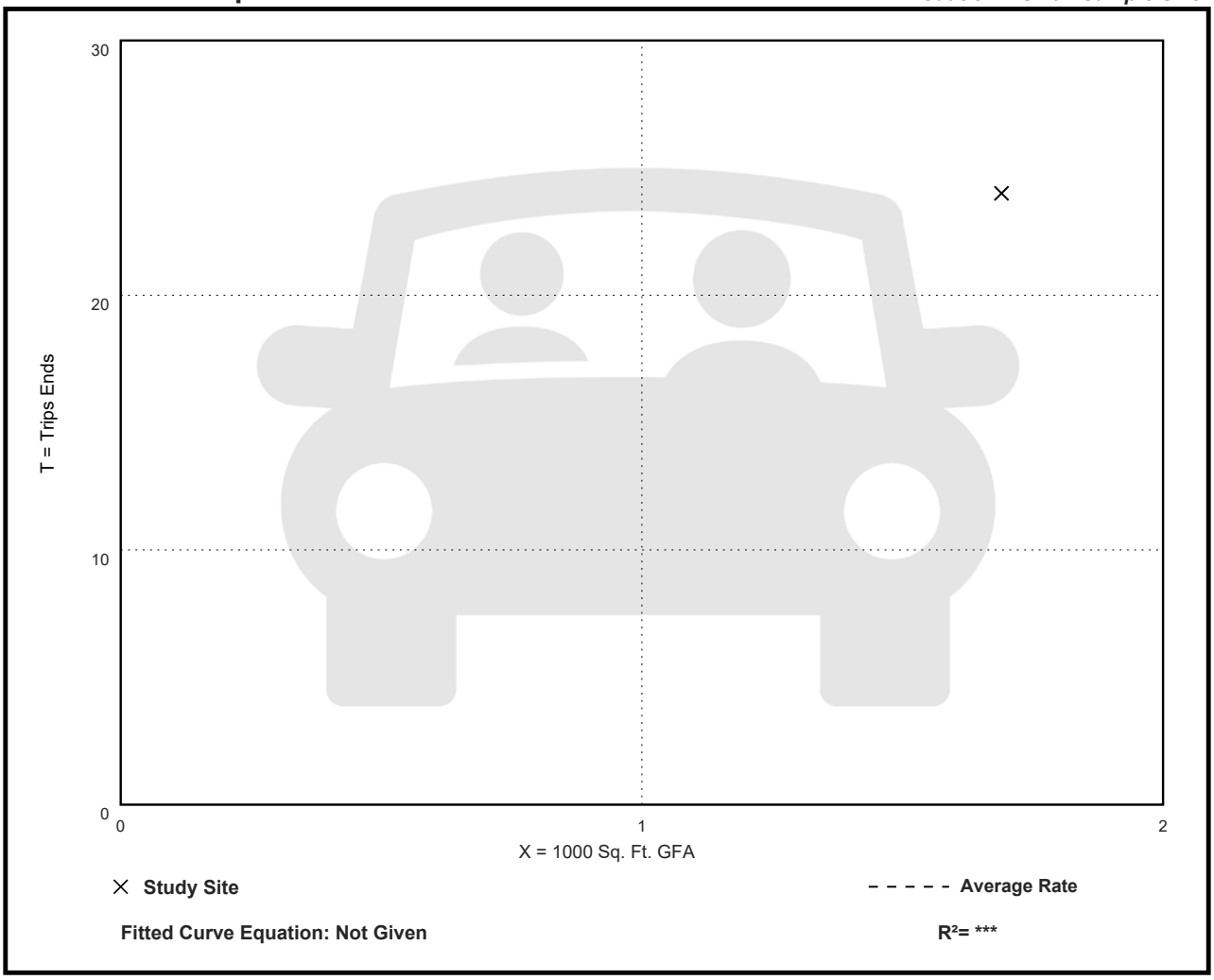
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 1
Avg. 1000 Sq. Ft. GFA: 2
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
14.20	14.20 - 14.20	***

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= ***

Automated Car Wash
(948)

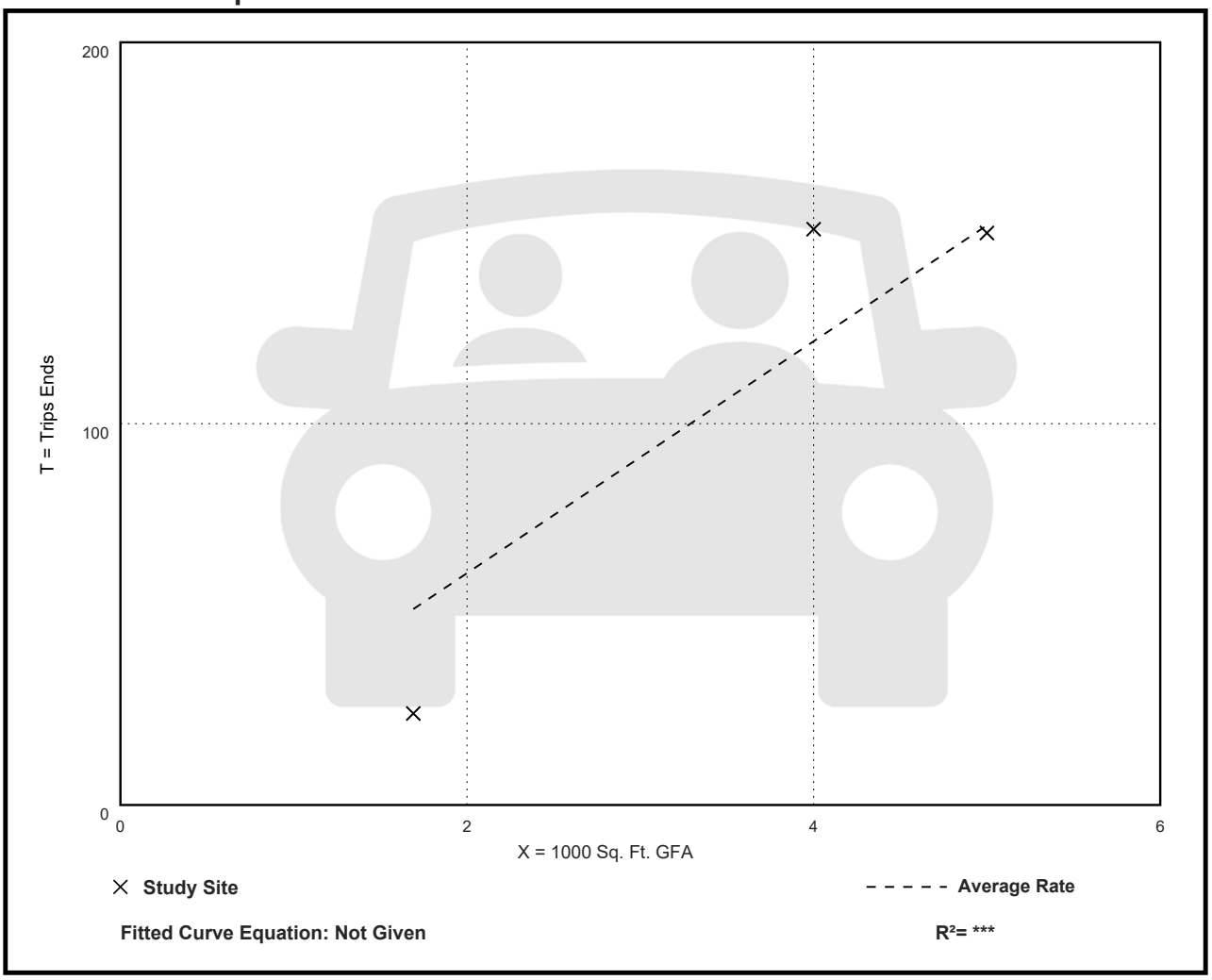
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Saturday, Peak Hour of Generator

Setting/Location: General Urban/Suburban
Number of Studies: 3
Avg. 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
30.40	14.20 - 37.75	9.63

Data Plot and Equation



APPENDIX D – Operational Analysis

Existing Conditions

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

Future Build Conditions

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

D

Existing Weekday AM / PM / Saturday MD Peak Hour

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

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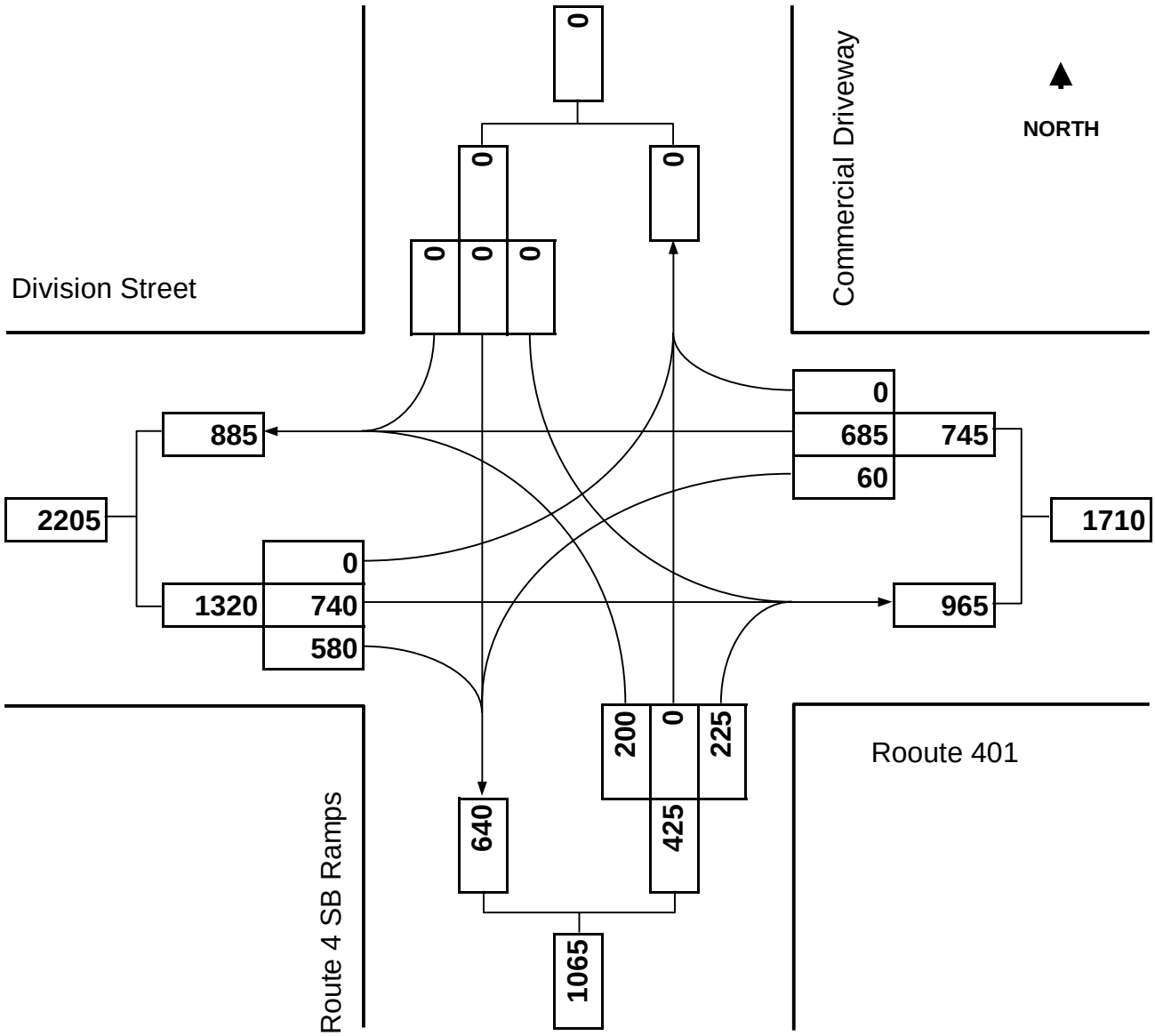
Turning Movement Diagram

Major Street:	Division Street (Rt. 401)	**Minor Street**:	Route 4 SB Ramps/Com. Dwy.
City/Town:	Warwick, RI	**Day of Week**:	Weekday
Reference No.:	7365	**Peak Period**:	7:30 AM - 8:30 AM
Existing:	AM Peak Hour	**Future**:	n/a



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	740	580	60	685	0	200	0	225	0	0	0
Future Volume (vph)	0	740	580	60	685	0	200	0	225	0	0	0
Satd. Flow (prot)	0	3574	1568	1805	3539	1900	1734	1521	1551	0	1900	0
Flt Permitted				0.950			0.950	0.982				
Satd. Flow (perm)	0	3574	1568	1805	3539	1900	1734	1521	1551	0	1900	0
Satd. Flow (RTOR)			604					133	140			
Lane Group Flow (vph)	0	771	604	63	714	0	154	148	140	0	0	0
Turn Type		NA	Free	Prot	NA	Perm	Split	NA	Perm			
Protected Phases		6		5	2		4	4		3	3	
Permitted Phases	6		Free			2			4			
Total Split (s)	36.0	36.0		20.0	56.0	56.0	20.0	20.0	20.0	14.0	14.0	
Total Lost Time (s)		3.5		5.5	3.5	4.5	3.0	3.0	3.0		3.0	
Act Effct Green (s)		58.4	90.0	7.9	69.7		13.8	13.8	13.8			
Actuated g/C Ratio		0.65	1.00	0.09	0.77		0.15	0.15	0.15			
v/c Ratio		0.33	0.39	0.40	0.26		0.58	0.43	0.39			
Control Delay		9.1	0.7	45.3	3.5		43.5	11.5	9.1			
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0			
Total Delay		9.1	0.7	45.3	3.5		43.5	11.5	9.1			
LOS		A	A	D	A		D	B	A			
Approach Delay		5.4			6.9			21.9				
Approach LOS		A			A			C				
Queue Length 50th (ft)		99	0	35	46		85	7	0			
Queue Length 95th (ft)		173	0	72	87		138	61	47			
Internal Link Dist (ft)		400			1142			508			178	
Turn Bay Length (ft)				100			300		250			
Base Capacity (vph)		2317	1568	290	2740		337	403	414			
Starvation Cap Reductn		0	0	0	0		0	0	0			
Spillback Cap Reductn		0	0	0	0		0	0	0			
Storage Cap Reductn		0	0	0	0		0	0	0			
Reduced v/c Ratio		0.33	0.39	0.22	0.26		0.46	0.37	0.34			

Intersection Summary	
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 60 (67%), Referenced to phase 2:WBT and 6:EBTL, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.58	
Intersection Signal Delay: 8.7	Intersection LOS: A
Intersection Capacity Utilization 57.2%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 12:

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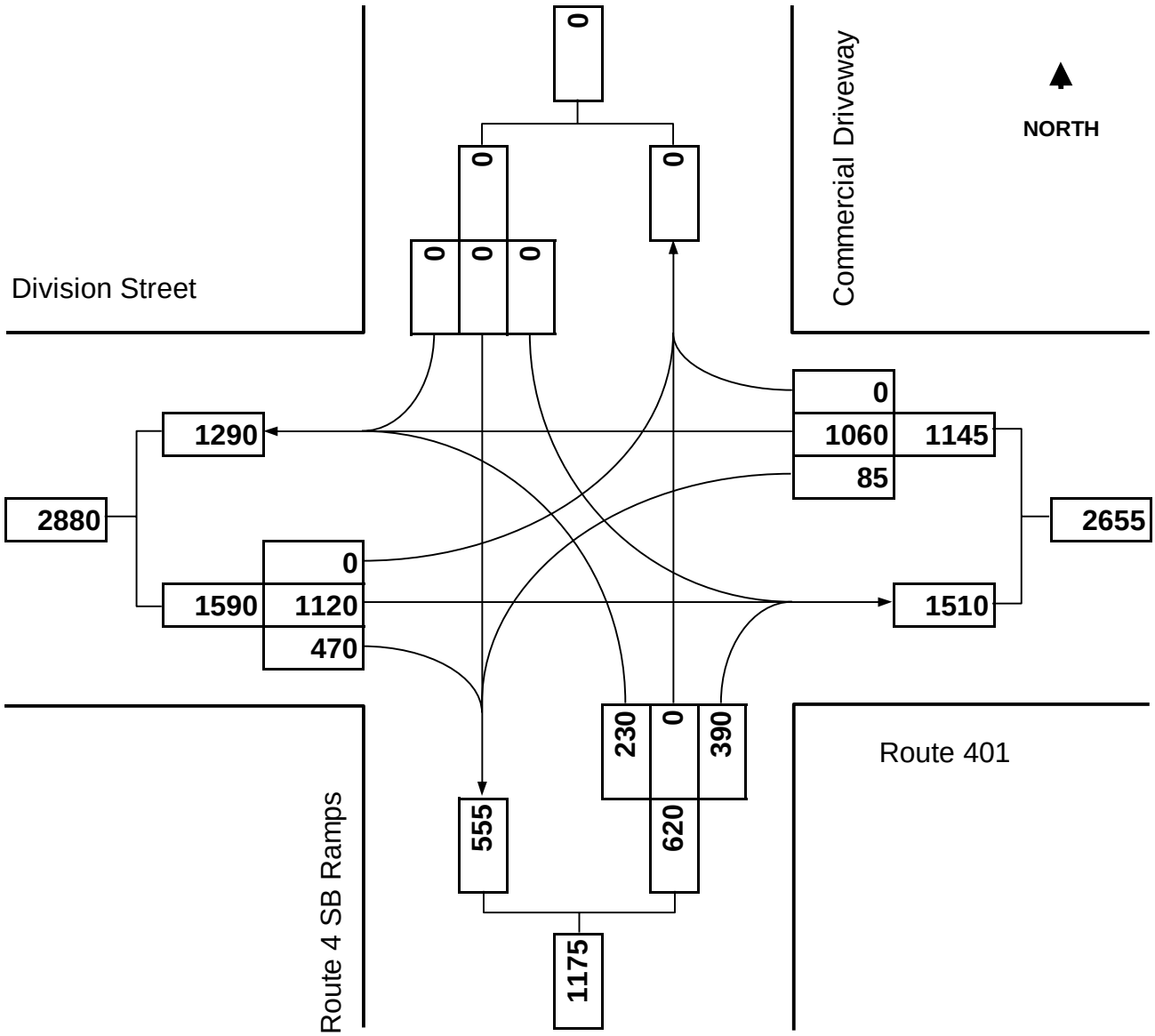
Turning Movement Diagram

Major Street:	Division Street (Rt. 401)	**Minor Street**:	Route 4 SB Ramps/Com. Dwy.
City/Town:	Warwick, RI	**Day of Week**:	Weekday
Reference No.:	7365	**Peak Period**:	4:30 PM - 5:30 PM
Existing:	PM Peak Hour	**Future**:	n/a



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1120	470	85	1060	0	230	0	390	0	0	0
Future Volume (vph)	0	1120	470	85	1060	0	230	0	390	0	0	0
Satd. Flow (prot)	0	3574	1583	1805	3574	1900	1751	1531	1567	0	1900	0
Flt Permitted				0.950			0.950	0.984				
Satd. Flow (perm)	0	3574	1583	1805	3574	1900	1751	1531	1567	0	1900	0
Satd. Flow (RTOR)			332					126	159			
Lane Group Flow (vph)	0	1143	480	87	1082	0	117	357	159	0	0	0
Turn Type		NA	Free	Prot	NA	Perm	Split	NA	Perm			
Protected Phases		6		5	2		4	4		3	3	
Permitted Phases	6		Free			2			4			
Total Split (s)	46.0	46.0		15.0	61.0	61.0	20.0	20.0	20.0	14.0	14.0	
Total Lost Time (s)		3.5		5.5	3.5	4.5	3.0	3.0	3.0		3.0	
Act Effct Green (s)		52.4	95.0	8.6	64.3		24.2	24.2	24.2			
Actuated g/C Ratio		0.55	1.00	0.09	0.68		0.25	0.25	0.25			
v/c Ratio		0.58	0.30	0.53	0.45		0.26	0.74	0.31			
Control Delay		28.2	0.4	48.5	9.9		28.2	29.6	5.7			
Queue Delay		0.5	0.0	0.0	0.0		0.0	0.0	0.0			
Total Delay		28.7	0.4	48.5	9.9		28.2	29.6	5.7			
LOS		C	A	D	A		C	C	A			
Approach Delay		20.4			12.8			23.3				
Approach LOS		C			B			C				
Queue Length 50th (ft)		352	0	54	198		57	140	0			
Queue Length 95th (ft)		425	0	m98	261		95	231	44			
Internal Link Dist (ft)		400			1142			508			178	
Turn Bay Length (ft)				100			300		250			
Base Capacity (vph)		1969	1583	185	2417		449	486	520			
Starvation Cap Reductn		397	0	0	0		0	0	0			
Spillback Cap Reductn		0	0	0	0		0	0	0			
Storage Cap Reductn		0	0	0	0		0	0	0			
Reduced v/c Ratio		0.73	0.30	0.47	0.45		0.26	0.73	0.31			

Intersection Summary

Cycle Length: 95
Actuated Cycle Length: 95
Offset: 60 (63%), Referenced to phase 2:WBT and 6:EBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 18.3 Intersection LOS: B
Intersection Capacity Utilization 80.6% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12:

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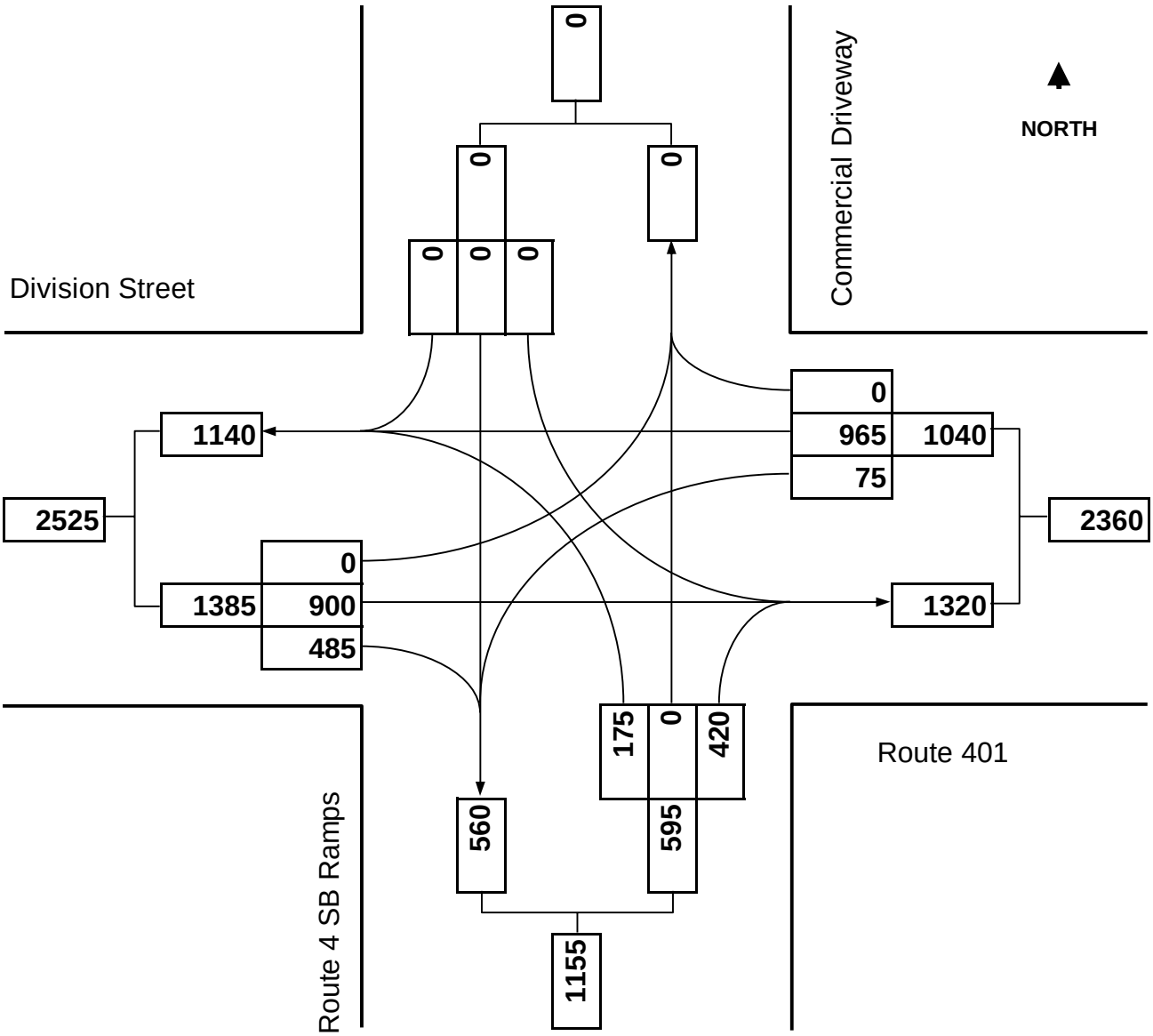
Turning Movement Diagram

Major Street:	Division Street (Rt. 401)	**Minor Street**:	Route 4 SB Ramps/Com. Dwy.
City/Town:	Warwick, RI	**Day of Week**:	Saturday
Reference No.:	7365	**Peak Period**:	12:00 PM - 1:00 PM
Existing:	MD Peak Hour	**Future**:	n/a



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	900	485	75	965	0	175	0	420	0	0	0
Future Volume (vph)	0	900	485	75	965	0	175	0	420	0	0	0
Satd. Flow (prot)	0	3610	1599	1805	3574	1710	1751	1517	1567	0	1900	0
Flt Permitted				0.950			0.950	0.987				
Satd. Flow (perm)	0	3610	1599	1805	3574	1710	1751	1517	1567	0	1900	0
Satd. Flow (RTOR)			507					160	179			
Lane Group Flow (vph)	0	957	516	80	1027	0	93	361	179	0	0	0
Turn Type		NA	Free	Prot	NA	Perm	Split	NA	Perm			
Protected Phases		6		5	2		4	4		3	3	
Permitted Phases	6		Free			2			4			
Total Split (s)	30.0	30.0		18.0	48.0	48.0	18.0	18.0	18.0	14.0	14.0	
Total Lost Time (s)		3.5		5.5	3.5	4.5	3.0	3.0	3.0		3.0	
Act Effct Green (s)		42.4	80.0	8.3	54.1		19.4	19.4	19.4			
Actuated g/C Ratio		0.53	1.00	0.10	0.68		0.24	0.24	0.24			
v/c Ratio		0.50	0.32	0.43	0.42		0.22	0.74	0.35			
Control Delay		16.1	0.5	39.9	7.5		23.1	23.8	5.3			
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0	0.0			
Total Delay		16.1	0.5	39.9	7.5		23.1	23.8	5.3			
LOS		B	A	D	A		C	C	A			
Approach Delay		10.6			9.9			18.5				
Approach LOS		B			A			B				
Queue Length 50th (ft)		161	0	38	106		38	100	0			
Queue Length 95th (ft)		286	0	77	197		65	178	41			
Internal Link Dist (ft)		400			1142			508			178	
Turn Bay Length (ft)				100			300		250			
Base Capacity (vph)		1914	1599	282	2417		443	503	530			
Starvation Cap Reductn		0	0	0	0		0	0	0			
Spillback Cap Reductn		0	0	0	0		0	0	0			
Storage Cap Reductn		0	0	0	0		0	0	0			
Reduced v/c Ratio		0.50	0.32	0.28	0.42		0.21	0.72	0.34			

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 80	
Offset: 60 (75%), Referenced to phase 2:WBT and 6:EBTL, Start of Green	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.74	
Intersection Signal Delay: 11.9	Intersection LOS: B
Intersection Capacity Utilization 70.7%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 12:

D

Future 2025 Weekday AM / PM / Saturday MD Peak Hour

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

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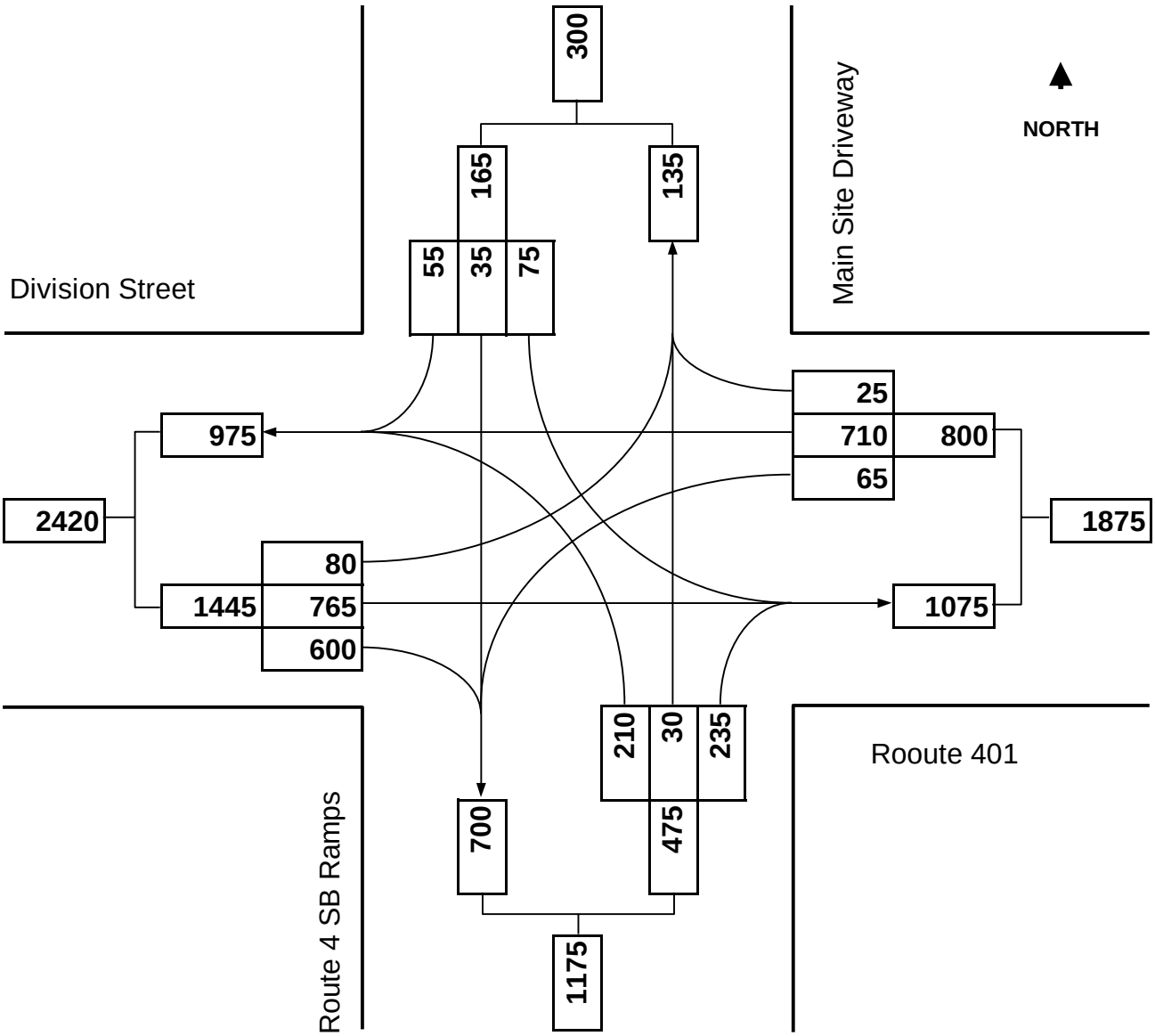
Turning Movement Diagram

Major Street:	Division Street (Rt. 401)	**Minor Street**:	Route 4 SB Ramps/Com. Dwy.
City/Town:	Warwick, RI	**Day of Week**:	Weekday
Reference No.:	7365	**Peak Period**:	AM Peak Hour
Existing:	n/a	**Future**:	2025 Build



Neon Marketplace Expansion
Division St. (Route 401) at Route 4 SB Ramps/Site Dwy. Warwick, RI

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	80	765	600	65	710	25	210	30	235	75	35	55
Future Volume (vph)	80	765	600	65	710	25	210	30	235	75	35	55
Satd. Flow (prot)	1805	3574	1568	1805	3524	0	1734	1552	1551	0	1837	1615
Flt Permitted	0.950			0.950			0.950	0.981			0.967	
Satd. Flow (perm)	1805	3574	1568	1805	3524	0	1734	1552	1551	0	1837	1615
Satd. Flow (RTOR)			625		4			51	133			133
Lane Group Flow (vph)	83	797	625	68	766	0	109	288	98	0	114	57
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Total Split (s)	20.0	36.0	36.0	20.0	36.0		20.0	20.0	20.0	14.0	14.0	14.0
Total Lost Time (s)	4.5	3.5	3.5	5.5	3.5		3.0	3.0	3.0		3.0	4.0
Act Effct Green (s)	10.5	44.4	44.4	8.2	43.3		16.6	16.6	16.6		9.9	8.9
Actuated g/C Ratio	0.12	0.49	0.49	0.09	0.48		0.18	0.18	0.18		0.11	0.10
v/c Ratio	0.40	0.45	0.57	0.41	0.45		0.34	0.88	0.25		0.56	0.20
Control Delay	41.7	18.5	4.0	45.5	19.2		35.1	57.6	4.3		48.9	1.6
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Delay	41.7	18.5	4.0	45.5	19.2		35.1	57.6	4.3		48.9	1.6
LOS	D	B	A	D	B		D	E	A		D	A
Approach Delay		13.8			21.4			42.1			33.2	
Approach LOS		B			C			D			C	
Queue Length 50th (ft)	44	169	0	37	165		55	146	0		62	0
Queue Length 95th (ft)	85	239	65	76	236		106	#304	23		116	0
Internal Link Dist (ft)		400			1142			508			178	
Turn Bay Length (ft)	50			100			300		250			
Base Capacity (vph)	310	1762	1090	290	1696		332	339	404		224	297
Starvation Cap Reductn	0	0	14	0	0		0	0	0		0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0		0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0		0	0
Reduced v/c Ratio	0.27	0.45	0.58	0.23	0.45		0.33	0.85	0.24		0.51	0.19

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 60 (67%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 21.6 Intersection LOS: C
Intersection Capacity Utilization 58.6% 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: 12: Division St.

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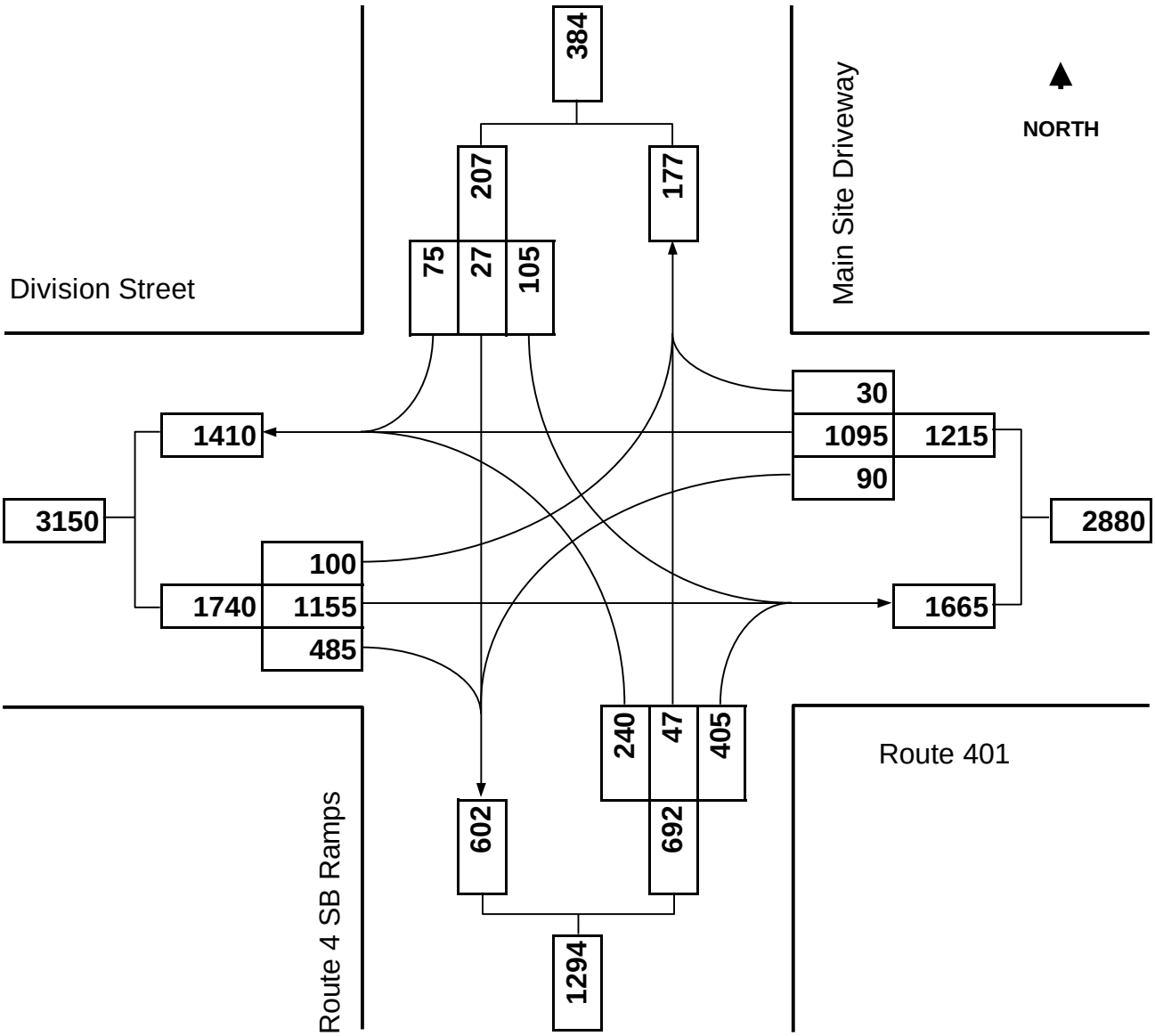
Turning Movement Diagram

Major Street:	Division Street (Rt. 401)	**Minor Street**:	Route 4 SB Ramps/Com. Dwy.
City/Town:	Warwick, RI	**Day of Week**:	Weekday
Reference No.:	7365	**Peak Period**:	PM Peak Hour
Existing:	n/a	**Future**:	2025 Build



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	1155	485	90	1095	30	240	47	405	105	27	75
Future Volume (vph)	100	1155	485	90	1095	30	240	47	405	105	27	75
Satd. Flow (prot)	1805	3574	1583	1805	3561	0	1751	1540	1567	0	1828	1615
Flt Permitted	0.950			0.950			0.950	0.995			0.962	
Satd. Flow (perm)	1805	3574	1583	1805	3561	0	1751	1540	1567	0	1828	1615
Satd. Flow (RTOR)			495		4			111	240			115
Lane Group Flow (vph)	102	1179	495	92	1148	0	220	246	240	0	135	77
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Total Split (s)	14.0	44.0	44.0	15.0	45.0		21.0	21.0	21.0	15.0	15.0	15.0
Total Lost Time (s)	3.5	3.5	3.5	5.5	3.5		3.0	3.0	3.0		3.0	4.0
Act Effct Green (s)	9.9	46.8	46.8	8.5	47.3		16.0	16.0	16.0		11.0	10.0
Actuated g/C Ratio	0.10	0.49	0.49	0.09	0.50		0.17	0.17	0.17		0.12	0.11
v/c Ratio	0.54	0.67	0.48	0.57	0.65		0.75	0.70	0.52		0.64	0.28
Control Delay	34.3	31.6	14.7	51.6	23.5		53.3	31.1	8.9		54.4	5.7
Queue Delay	0.0	0.6	0.1	0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Delay	34.3	32.2	14.8	51.6	23.5		53.3	31.1	8.9		54.4	5.7
LOS	C	C	B	D	C		D	C	A		D	A
Approach Delay		27.5			25.6			30.5			36.7	
Approach LOS		C			C			C			D	
Queue Length 50th (ft)	59	370	153	58	349		128	81	0		78	0
Queue Length 95th (ft)	m88	438	220	m97	394		#210	173	63		139	19
Internal Link Dist (ft)		400			1142			508			178	
Turn Bay Length (ft)	50			100			300		250			
Base Capacity (vph)	201	1760	1030	180	1776		331	381	491		230	288
Starvation Cap Reductn	0	234	79	0	0		0	0	0		0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0		0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0		0	0
Reduced v/c Ratio	0.51	0.77	0.52	0.51	0.65		0.66	0.65	0.49		0.59	0.27

Intersection Summary

Cycle Length: 95
Actuated Cycle Length: 95
Offset: 60 (63%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 27.9 Intersection LOS: C
Intersection Capacity Utilization 70.7% 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: 12: Division St.

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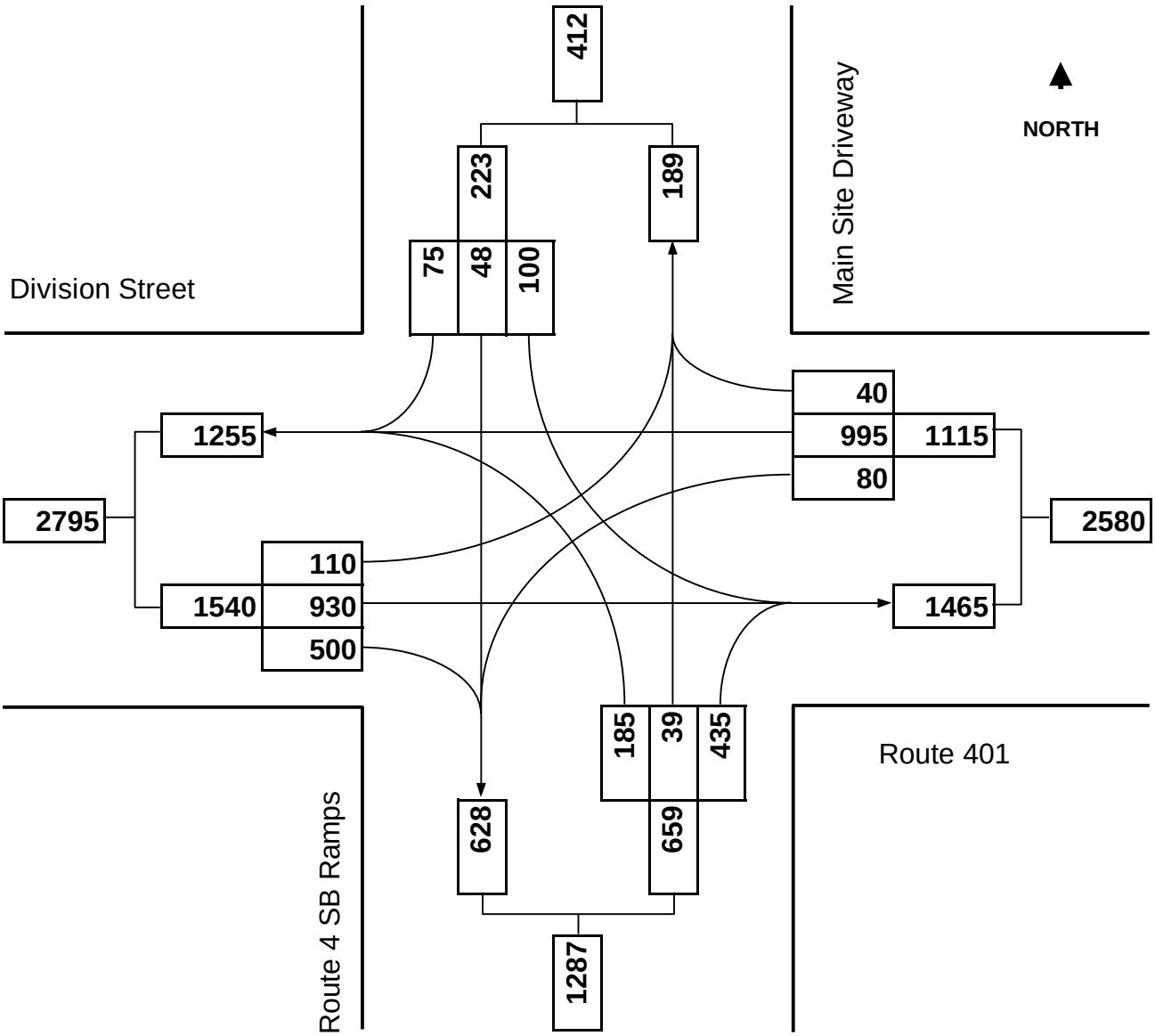
Turning Movement Diagram

Major Street:	Division Street (Rt. 401)	**Minor Street**:	Route 4 SB Ramps/Com. Dwy.
City/Town:	Warwick, RI	**Day of Week**:	Satuday
Reference No.:	7365	**Peak Period**:	MD Peak Hour
Existing:	n/a	**Future**:	2025 Build



Neon Marketplace Expansion
Division St. (Route 401) at Route 4 SB Ramps/Site Dwy. Warwick, RI

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	110	930	500	80	995	40	185	39	435	100	48	65
Future Volume (vph)	110	930	500	80	995	40	185	39	435	100	48	65
Satd. Flow (prot)	1805	3610	1599	1805	3554	0	1751	1524	1567	0	1837	1615
Flt Permitted	0.950			0.950			0.950	0.996			0.967	
Satd. Flow (perm)	1805	3610	1599	1805	3554	0	1751	1524	1567	0	1837	1615
Satd. Flow (RTOR)			532		5			185	259			150
Lane Group Flow (vph)	117	989	532	85	1102	0	177	265	259	0	157	69
Turn Type	Prot	NA	Perm	Prot	NA		Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2						8			4
Total Split (s)	18.0	30.0	30.0	18.0	30.0		18.0	18.0	18.0	14.0	14.0	14.0
Total Lost Time (s)	3.5	3.5	3.5	5.5	3.5		3.0	3.0	3.0		3.0	4.0
Act Effct Green (s)	11.3	35.4	35.4	8.5	34.7		12.8	12.8	12.8		10.4	9.4
Actuated g/C Ratio	0.14	0.44	0.44	0.11	0.43		0.16	0.16	0.16		0.13	0.12
v/c Ratio	0.46	0.62	0.53	0.45	0.71		0.63	0.66	0.55		0.66	0.21
Control Delay	36.9	21.6	4.1	40.1	24.8		41.6	19.0	9.0		47.3	1.5
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0
Total Delay	36.9	21.6	4.1	40.1	24.8		41.6	19.0	9.0		47.3	1.5
LOS	D	C	A	D	C		D	B	A		D	A
Approach Delay		17.0			25.9			21.0			33.3	
Approach LOS		B			C			C			C	
Queue Length 50th (ft)	54	210	0	41	251		84	38	0		75	0
Queue Length 95th (ft)	99	309	65	80	#407		148	120	61		#148	0
Internal Link Dist (ft)		400			1142			508			178	
Turn Bay Length (ft)	50			100			300		250			
Base Capacity (vph)	327	1599	1004	282	1546		328	436	504		252	333
Starvation Cap Reductn	0	0	0	0	0		0	0	0		0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0		0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0		0	0
Reduced v/c Ratio	0.36	0.62	0.53	0.30	0.71		0.54	0.61	0.51		0.62	0.21

Intersection Summary

Cycle Length: 80
Actuated Cycle Length: 80
Offset: 60 (75%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.71
Intersection Signal Delay: 21.6 Intersection LOS: C
Intersection Capacity Utilization 66.9% 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.

Splits and Phases: 12: Division St.

APPENDIX E – Off-Site Improvement Concept Plan

Division Street (Route 401) at Route 4 Southbound Ramps/Site Access Driveway

NUMBER	DATE	MADE BY	CHECKED BY	REVISIONS

DRAWN BY:

DESIGNED BY:

CHECKED BY:

REGISTERED PROFESSIONAL

For Review Only

PREPARED BY

BETA
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SUBCONSULTANT

SCALE

NONE

TITLE

Neon Marketplace Expansion Off-Site Improvement Concept Plan

Warwick, RI

BETA JOB NO. 10513

ISSUE DATE 7/19/2022 11:13 AM

SHEET NO.