Tab 12

TRAFFIC STUDY

EAST POINTE
ROGER WILLIAMS AVENUE
EAST PROVIDENCE, RHODE ISLAND

Prepared for:
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PRELIMINARY

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INTRODUCTION

Northeast Engineers and Consultants (NE&C) have been asked to prepare a traffic study for the East Point residential development in East Providence, Rhode Island. The site has approximately 28.2 acres occupied by the vacant Ocean State Steel plant and is shown on Figure 1. The proposal consists of residential and water related uses. The residential portion will contain 495 units comprising 464 multifamily units and 31 single-family houses. The other uses include 50,000 square feet of office space, 33,000 square feet of retail uses, a 75-slip marina and several restaurants with a total of 140 seats.

METHODOLOGY

As part of this study a field reconnaissance was made of the site environs noting roadway characteristics and land use. The Rhode Island Department of Transportation (RIDOT) was contacted for available traffic volume data. In addition automatic traffic counts (ATC) were made on Roger Williams Avenue and Bourne Avenue. Manual turning movement counts were made at several nearby intersections during the morning and afternoon on a weekday and on a Saturday afternoon. Information on accidents was obtained for the study intersections from both the East Providence Police Department and RIDOT.

Site traffic volumes were estimated for the proposed uses. The site traffic volumes were distributed to the roadway network and capacity analyses were made of the study intersections for the before and after development conditions. The impact of the site traffic was determined and recommendations were made.

ROADWAYS

Interstate I-195 provides regional access to the area. It is an east/west limited access highway starting in Providence at I-95 and continuing into Massachusetts. There are a number of interchanges in the area. Interchange 4 provides access to Taunton Avenue (Route 44), Warren Avenue (Route 6) and Veterans Memorial Parkway. Interchange 5 provides access to Broadway to and from the west and interchange 6 provides access to Route 6 to and from the east. Interchanges 7 and 8 provide access to Route 6 and the East Shore Expressway. Interchange 5 is the only exit available westbound on I-195 in East Providence.

Route 44 is and east/west arterial entering Gloucester from Connecticut and running through Rhode Island leaving East Providence and continuing into Massachusetts. It is a four-lane road with a speed limit of 30 miles per hour (mph) in the vicinity of Pawtucket Avenue (Route 114). Route 6 is also an east/west arterial entering Foster from Connecticut and exiting into Massachusetts from East Providence. Both Route 44 and Route 6 are part of I-95 and I-195 in Providence before separating in East Providence. Route 6 then runs parallel to I-195.

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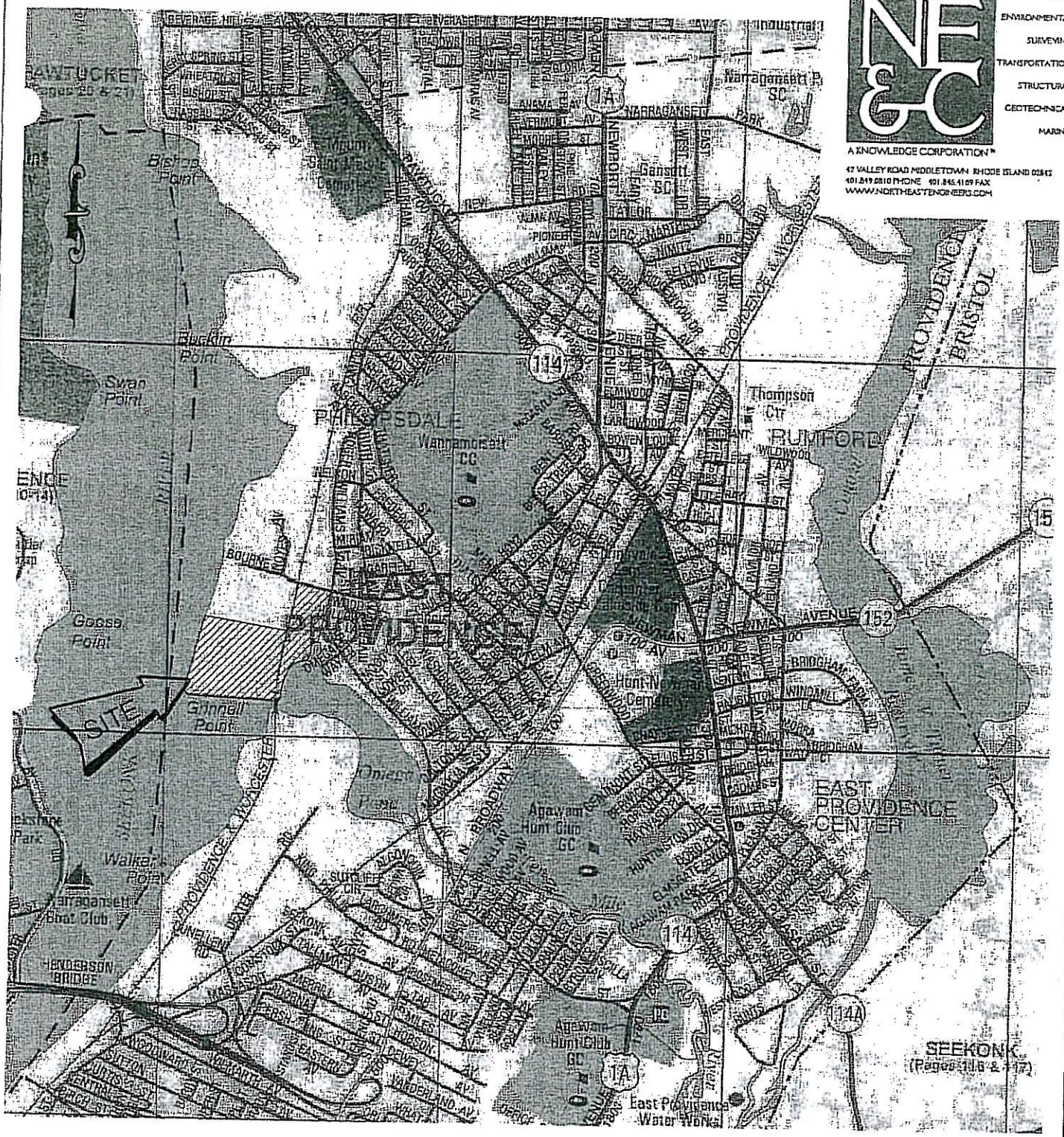

Scale: N.T.S.	Date: 16 MAR 04	Designed By:	Drawn By: DPP	Checked By:
Project Title: GEONOVA EAST PROVIDENCE, R.I.		Drawing Title: FIGURE 1 SITE LOCATION		
Issued for:		Drawing Number: F-1	Project Number: 03103.0	

Route 114 is a north/south road connecting Route 122 in Woonsocket with Route 138 in Newport. In East Providence it is called Pawtucket Avenue and is also numbered as Route 1A. It is a four-lane road with a speed limit of 35 mph. North of the Newport Avenue (Route 1A) intersection it is a two-lane road with a speed limit of 30 mph. In the vicinity of Roger Williams Avenue parking is allowed on the east side of the road and there are sidewalks on both sides of the road. Between I-195 and Roger Williams Avenue there are traffic signals at the intersections on Waterman Avenue, Route 44, Centre Street, Route 114A, Route 152, Wilson Avenue, Route 1A and Roger Williams Avenue.

Bourne Avenue and Roger Williams Avenue will provide the immediate access to the site. Bourne Avenue is a local east/west road running between Wilson Avenue and ending west of Roger Williams Avenue. West of Roger Williams Avenue it is approximately 30 feet wide with parking on the north side of the road. Bourne Avenue has Stop signs at its intersection with Roger Williams Avenue. There is an at-grade crossing of the Providence and Worcester Railroad on Bourne Avenue west of Roger Williams Avenue.

Roger Williams Avenue is a north/south road connecting Pawtucket Avenue (Route 114) and North Broadway. East of North Broadway it continues as Centre Street. The intersection of Roger Williams Avenue, Centre Street and North Broadway is signalized. In the site vicinity Roger Williams Avenue is around 30 feet wide with no parking and sidewalks on both sides of the road. Vehicles were observed parking halfway into the street south of Bourne Avenue in front of a church. The speed limit is posted at 25 mph. The RIDOT had a proposal in 1993 to reconstruct Roger Williams Avenue from Pawtucket Avenue to North Broadway. The project is divided into three segments. The segment from North Broadway to Bourne Avenue encompasses the site location. This project is currently on hold.

Centre Street begins at North Broadway opposite Roger Williams Avenue and ends at Pawtucket Avenue. It is a two-lane road with parking on the north side of the road. The speed limit is posted at 25 mph. Broadway is a north/south local road connecting Greenwood Avenue with Veterans Memorial Parkway south of I-195. In the site vicinity it is called North Broadway. South of Roger Williams Avenue it is initially a three-lane road before dropping a lane and having parking on both sides of the road. The speed limit is posted at 30 mph. It provides access to the Henderson Bridge into and out of Providence. It also provides a bypass of the one-way circulation system in downtown East Providence to reach interchange 5 of I-95.

Another RIDOT project in the area is Waterfront Drive. Waterfront Drive is a two lane limited access highway running from I-195 to Pawtucket Avenue along the Providence and Worcester railroad tracks which are designed to be relocated to the eastern side of the right of way. The design of the northern portion of the road has been completed. Other portions of Waterfront have not been designed and the project is on hold with no immediate plans for it to become active in the near future.

SITE ENVIRONS

Besides the vacant Ocean State Steel plant there are a number of land uses in the area. Phillipsdale Landing, a commercial/industrial development with a number of tenants, is located adjacent to the site at the end of Bourne Avenue west of Roger Williams Avenue. New England Construction is also located on Bourne Avenue. Bourne Avenue is residential east of Roger Williams Avenue. Land use on Roger Williams Avenue is mostly residential. Ross Common Condominiums are being built on the west side of Roger Williams Avenue north of Bourne Avenue. E&M Motors is located on the southeast corner of Roger Williams Avenue and Bourne Avenue. The Grace Chapel Assembly of God is located on Roger Williams Avenue south of Bourne Avenue. The Wannamoisett Country Club and the Agawam Hunt Club are located between Roger Williams Avenue and Pawtucket Avenue. Land use on North Broadway is commercial south of its intersection with Roger Williams Avenue while land use on Centre Street is residential.

Land use on Route 44 is commercial. The Wapanoag Mall and Shoppers Town Mall are located at the intersection of Route 44 and Pawtucket Avenue. Land use on Pawtucket Avenue is commercial in the southern section. It becomes residential north of Route 44 with sporadic commercial uses at major intersections. The East Providence High School is located on the east side of Pawtucket Avenue south of Route 44. Police were observed directing exiting traffic at the high school in the afternoon. A playground is located on Pawtucket Avenue opposite the Centre Street intersection.

EXISTING TRAFFIC VOLUMES

Automatic traffic counts (ATC) in the area were obtained from RIDOT. A summary of the counts is shown on Table 1. The counts by hour are located in Appendix A. The annual average daily traffic (AADT) on Pawtucket Avenue was 11,300 vehicles in 2000 at the city line. It increased to 18,000 vehicles in the area between Route 1A and Route 152. There were 12,200 vehicles per day in 2000 on Pawtucket Avenue between Route 114A and Centre Street. RIDOT also had two traffic counts made in 2000 on Roger Williams Avenue between Pawtucket Avenue and Bourne Avenue. The northern end of Roger Williams Avenue had 4,200 vehicles while the southern end had 9,300 vehicles.

In addition to the RIDOT counts NE&C made an ATC on Roger Williams Avenue south of Bourne Avenue and on Bourne Avenue west of Roger Williams Avenue from Thursday April 10, 2003 to Monday April 14, 2003. A summary of the count is included in Table 1 and the hourly volumes are in Appendix A. The all day traffic on Roger Williams Avenue on Friday April 11, 2003 was adjusted to an AADT of 6,300 vehicles. During the morning peak hour from 7:00 to 8:00 AM there were 206 vehicles northbound and 221 vehicles southbound for a total of 427 vehicles. During the afternoon peak hour from 5:00 to 6:00 PM there were 298 vehicles northbound and 254 vehicles southbound for a total of 552 vehicles.

The AADT on Bourne Avenue was calculated to be 1,300 vehicles. During the morning peak hour from 7:00 to 8:00 AM there were 27 vehicles eastbound and 61 vehicles westbound for a total of 88 vehicles. During the afternoon peak hour from 4:00 to 5:00 PM there were 79 vehicles eastbound and 24 vehicles westbound for a total of 103 vehicles. This corresponds to vehicles entering Bourne Avenue in the morning to go to work and leaving in the afternoon.

Table 1
TRAFFIC VOLUMES

Location	Date	AADT	AM Peak	PM Peak
Pawtucket Avenue (Route 114)				
At East Providence/Pawtucket city line	May 2002	11,300	1,024	1,354
Between Newman and Newport Ave	August 2000	18,000	1,251	1,816
Between Pleasant St and Centre St	August 2000	12,200	721	1,234
Roger Williams Avenue				
Between Pawtucket Ave and Bourne Ave	July 2000	4,200	289	427
Between Bourne Ave and N Broadway	July 2000	9,300	637	896
South of Bourne Ave	April 2003	6,300	427	552
Northbound		3,300	206	298
Southbound		3,000	221	254
Bourne Avenue				
West of Roger Williams Ave	April 2003	1,300	88	103
Eastbound		660	27	79
Westbound		640	61	24

AADT- Average Annual Daily Traffic

In addition to the traffic volumes, the speed of vehicles on Roger Williams Avenue was also measured and the results can be found in Appendix A. The 85th percentile speed was 33 mph northbound and 31 mph southbound. This means that eighty-five percent of the vehicles were traveling at or below that speed. The average speed was calculated as 32 mph northbound and 30 mph southbound. Since the posted speed limit is 25 mph vehicles are traveling at an acceptable speed.

NE&C made manual turning movement counts at several intersections in the area. The intersection of Roger Williams Avenue and Bourne Avenue was counted on Thursday April 10, 2003, Friday April 11, 2003 and Saturday April 12, 2003. The intersection of Roger Williams Avenue, Centre Street and North Broadway was counted on Tuesday April 22 and Saturday May 10, 2003. The intersection of Pawtucket Avenue and Roger Williams Avenue was counted on Wednesday April 23, 2003 and Saturday May 3, 2003.

The intersection of Pawtucket Avenue and Centre Street was counted on Thursday April 24, 2003 and Saturday April 26, 2003. The counts were made in the morning from 7:00 to 9:00 AM, in the afternoon from 4:00 to 6:00 PM and on Saturday from 12 noon to 2:00 PM. The counts by fifteen-minute intervals are included in Appendix A. Figures 2 to 4 show the existing traffic volumes for the morning, afternoon and Saturday peak hour. Traffic volumes on Pawtucket Avenue, Roger Williams Avenue, Centre Street and North Broadway are less on Saturday than during the morning and afternoon peak hour.

ACCIDENTS

The East Providence Police Department and RIDOT were contacted for accidents at the study intersections. Computer printouts of accidents and accident reports for the years 2000 through 2003 were reviewed. A summary of the accidents by location and year is included in Appendix A along with the accident rate calculations. Table 2 summarizes the accident data by intersection for the four-year period.

Table 2
ACCIDENT ANALYSIS

Location	Number of Accidents		Type of Accidents									Rate
	Property Damage	Injury	Turn	Rear End	Angle	Side-swipe	Fixed Object	Parked	Back-ing	Other	Total	
Pawtucket Ave & Roger Williams Ave	9	5	2	7	1	1	0	0	0	3	14	0.62
Pawtucket Ave & Centre St	13	3	1	8	0	4	0	1	1	1	16	0.75
Roger Williams Ave, Centre St & Broadway	31	3	11	13	2	3	1	0	0	4	34	1.07
Roger Williams Ave & Bourne Ave	9	4	0	1	3	1	4	2	1	1	13	1.17

There were a total of 14 accidents at the intersection of Pawtucket Avenue and Roger Williams Avenue. Seven of the accidents were rear end crashes. Three of the accidents were self-reporting and the type of accident is unknown. This intersection has a rate of 0.62 accidents per million entering vehicles. The intersection of Pawtucket Avenue and Centre Street had 16 accidents with eight rear end crashes and four sideswipe accidents. Most of the accidents occurred on Pawtucket Avenue. This intersection has a rate of 0.75 accidents per million entering vehicles.

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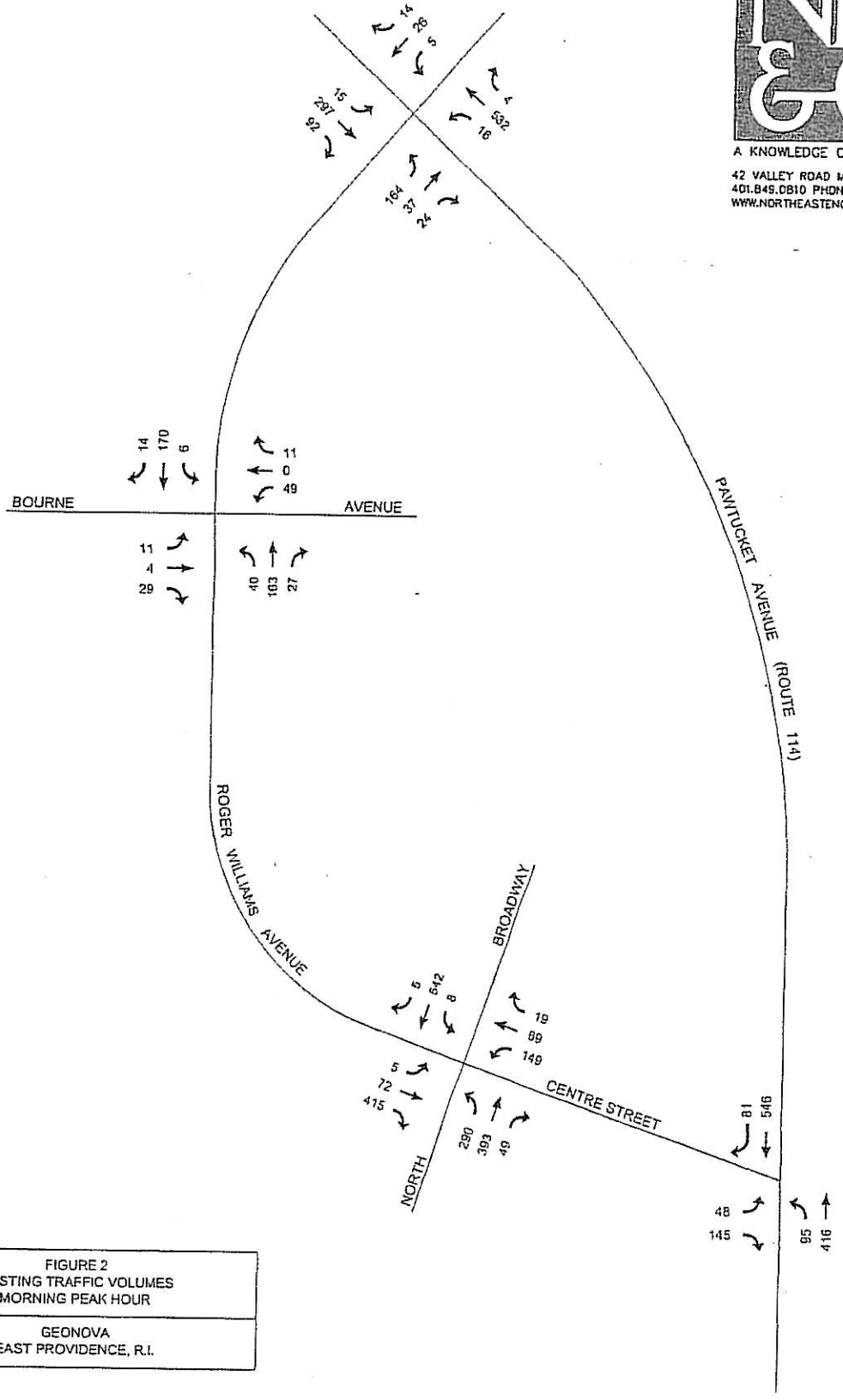

FIGURE 2
EXISTING TRAFFIC VOLUMES
MORNING PEAK HOUR

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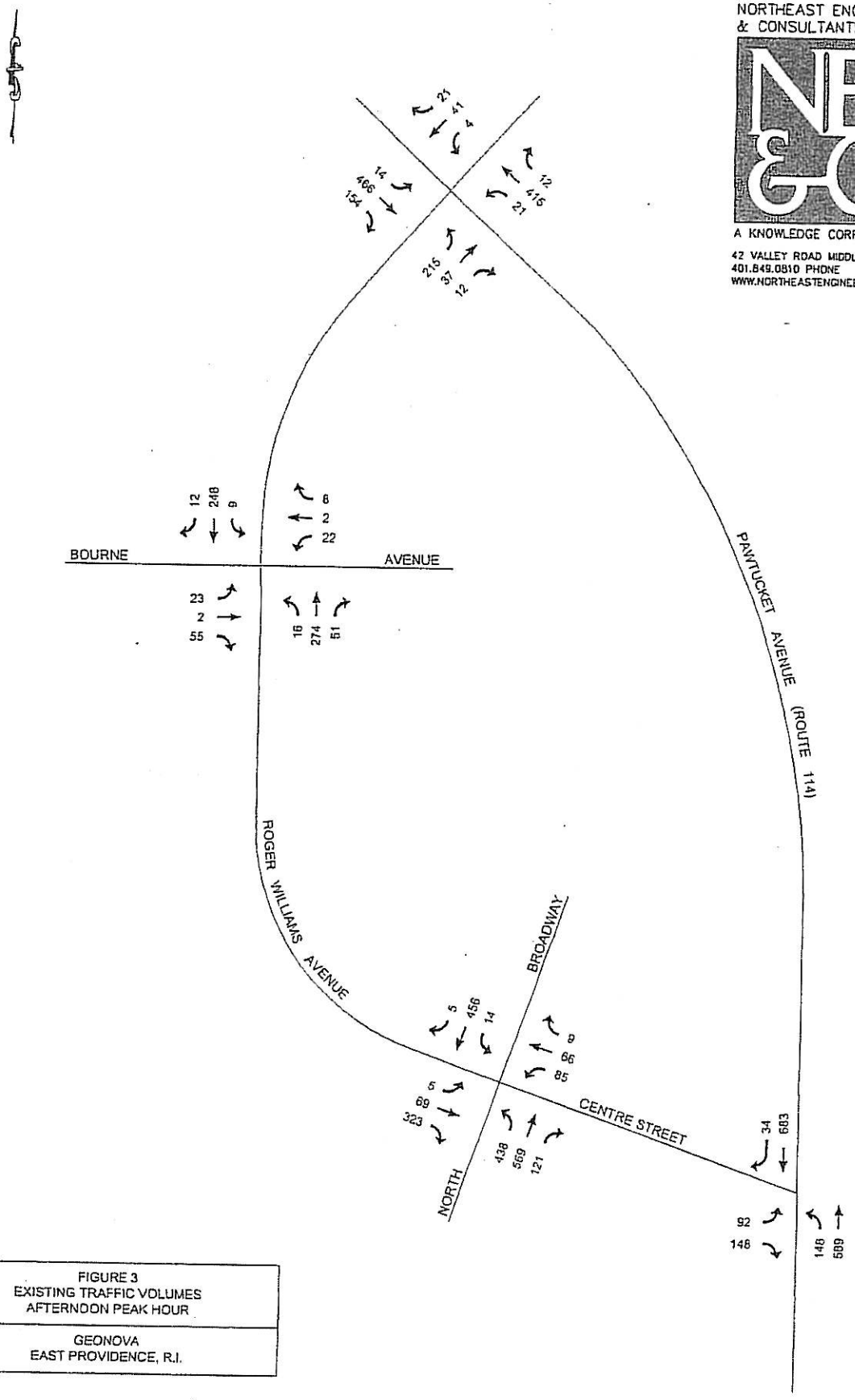

FIGURE 3
EXISTING TRAFFIC VOLUMES
AFTERNOON PEAK HOUR

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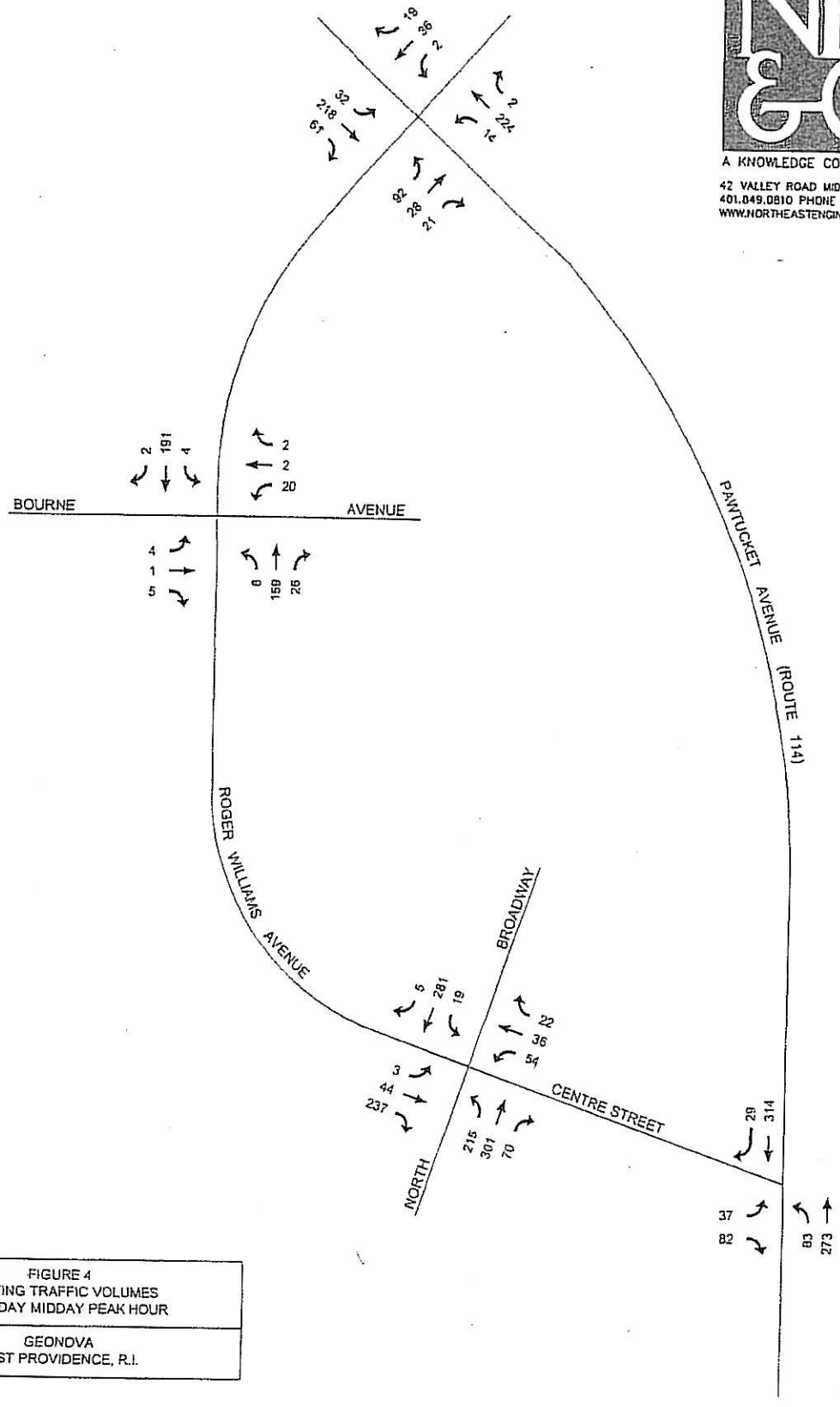

FIGURE 4
EXISTING TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR

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There were 34 accidents at the intersection of Roger Williams Avenue, Centre Street and North Broadway over the four-year time period. Most of the accidents involved turns or rear end crashes. There were also three accidents where the type of crash was unknown. The rate for this intersection is 1.07 accidents per million entering vehicles.

There were 13 accidents in the vicinity of Roger Williams Avenue and Bourne Street. Most of the accidents occurred on Roger Williams Avenue in the vicinity of Bourne Street rather than at the intersection. There were four fixed object accidents, two accidents involving parked cars and one backing accident on Roger Williams Avenue. While these accidents didn't really occur at the intersection a rate of 1.17 accidents per million entering vehicles was calculated. According to RIDOT an intersection is considered a high hazard location if there are ten or more accidents in a year. Since none of the intersections reviewed had 40 or more accidents in the four-year period they are not considered a safety problem.

PROPOSED DEVELOPMENT

The site consists of approximately 28.2 acres occupied by the vacant Ocean State Steel plant. The proposal consists of residential, commercial and water related uses. The residential portion will contain 495 units comprising 31 single-family houses and 464 multifamily units. The other uses include 50,000 square feet of office space, 33,000 square feet of retail uses, a 75-slip marina and several restaurants totaling 140 seats. A total of 1,266 parking spaces will be provided for the project.

The Providence and Worcester Railroad bisects the property. The tracks are used by the railroad twice a day. There is an existing driveway to the site on Roger Williams Avenue approximately 450 south of Bourne Avenue. An at-grade crossing over the railroad provides access to the rest of the site. This driveway on Roger Williams Avenue will provide the main access for the new development also. The existing railroad crossing will be used to connect both sections of the property. One driveway accessing the front portion of the site will be provided on Bourne Avenue. In addition there is a 20-foot right of way through Pillipsdale Landing west of the railroad tracks that can be used for emergency access to Bourne Avenue.

The sight distance for the existing site driveway on Roger Williams Avenue was investigated in the field. The driveway is on the outside of a curve with the road curving to the east in both the north and south directions. In addition Roger Williams Avenue is on a slight downgrade to the north in the vicinity of the driveway and then has a slight upgrade past Bourne Avenue. To the north a sight distance is available past the intersection with Bourne Avenue, which is 450 feet away. To the south a sight distance of around 500 feet is available.

A Policy of Geometric Design of Streets and Highways[1] was reviewed to determine the desirable sight distances for vehicles exiting the site driveway. The 85th percentile speed of 33 mph northbound and 31 mph southbound was used to calculate the required sight distance. The desirable sight distance from the driveway would be 300 feet to the north (left) for right turns and 370 feet to the south (right) for left turns. The available sight distance is greater than required so the driveway will provide safe ingress and egress to the site. The sight distance calculations are located in Appendix A.

ANTICIPATED SITE TRAFFIC VOLUMES

The traffic volumes estimated to be generated by the proposed new development were determined using rates published in the Institute of Transportation Engineers (ITE) *Trip Generation* manual.[2] Land Use Code (LUC) 210 Single Family Houses was used for houses and LUC 230 Residential Condominium/Townhouse was used for the multifamily units. LUC 420 Marina was used for the marina slips. The restaurant traffic was determined using LUC 832 High Turnover Sit-Down Restaurant. LUC 820 Shopping Center was used for the retail use. LUC 710 General Office Building was used for the office use.

Table 3 shows the traffic volumes associated with each land use and the total expected volumes for the time periods evaluated. All day on a weekday the proposed uses are estimated to generate 5,890 vehicle trips with 415 vehicle trips entering and exiting during the morning peak hour and 545 vehicle trips during the afternoon peak hour. On a Saturday all day vehicle trips would be 5,830 with 580 vehicles entering and exiting during the midday peak hour. The trip generation calculations are located in Appendix B.

SITE TRAFFIC DISTRIBUTION

Visitors will be coming to the site for the marina, restaurant, office and retail facilities and residents of the site will be leaving for work, shopping, etc. The existing traffic flows in the area and the traffic counts made by NE&C were used to determine the distribution of the site traffic. In addition *Journey to Work*[3] data for residents of East Providence was evaluated. This information is also included in Appendix B.

Figure 5 illustrates the distribution of the site traffic. Based on the site and parking layout it is estimated that 15% of the traffic would use the driveways on Bourne Avenue and 85% of the traffic would use the main driveway on Roger Williams Avenue. It is estimated that 80% of the site traffic will arrive and depart on Roger Williams Avenue to and from the south and 20% will be to and from the north.

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[1] A Policy of Geometric Design of Streets and Highways, Fourth Edition, American Association of State Highway and Transportation Officials, 2001.
[2] Trip Generation, Seventh Edition, Institute of Transportation Engineers, 2003.
[3] 2000 Census Data for Transportation Planning, Technical Paper Number 153, Statewide Planning Program, Rhode Island Department of Transportation, 2003.

Table 3
Anticipated Site Traffic
East Pointe
East Providence, Rhode Island

	Single Family Houses (1)	Multifamily (2)	Marina (3)	Restaurant (4)	Retail (5)	Office(6)	Total
Number of Units / Square Footage	31	464	75	140	33,000	50,000	
Weekday All Day							
In	150	1,360	110	340	710	275	2,945
Out	150	1,360	110	340	710	275	2,945
Total	300	2,720	220	680	1,420	550	5,890
Morning Peak Hour							
In	5	35	2	33	20	70	165
Out	20	170	3	32	15	10	250
Total	25	205	5	65	35	80	415
Afternoon Peak Hour							
In	20	160	10	35	60	15	300
Out	10	80	5	25	65	60	245
Total	30	240	15	60	125	75	545
Saturday All Day							
In	160	1,315	120	435	825	60	2,915
Out	160	1,315	120	435	825	60	2,915
Total	320	2,630	240	870	1,650	120	5,830
Saturday Peak Hour							
In	15	120	10	70	85	10	310
Out	15	100	10	55	80	10	270
Total	30	220	20	125	165	20	580

Note: Trips calculated based on trip rates published in Institute of Transportation Engineers Trip Generation:
(1) Land Use 210- 31 single family houses
(2) Land Use 230- 444 residential townhouse/condominium
(3) Land Use 420- 75 slip marina
(4) Land Use 932- 140 seat high turnover sit-down restaurant
(5) Land Use 820 - 33,000 square foot shopping center
(6) Land Use 710- 50,000 square foot office building

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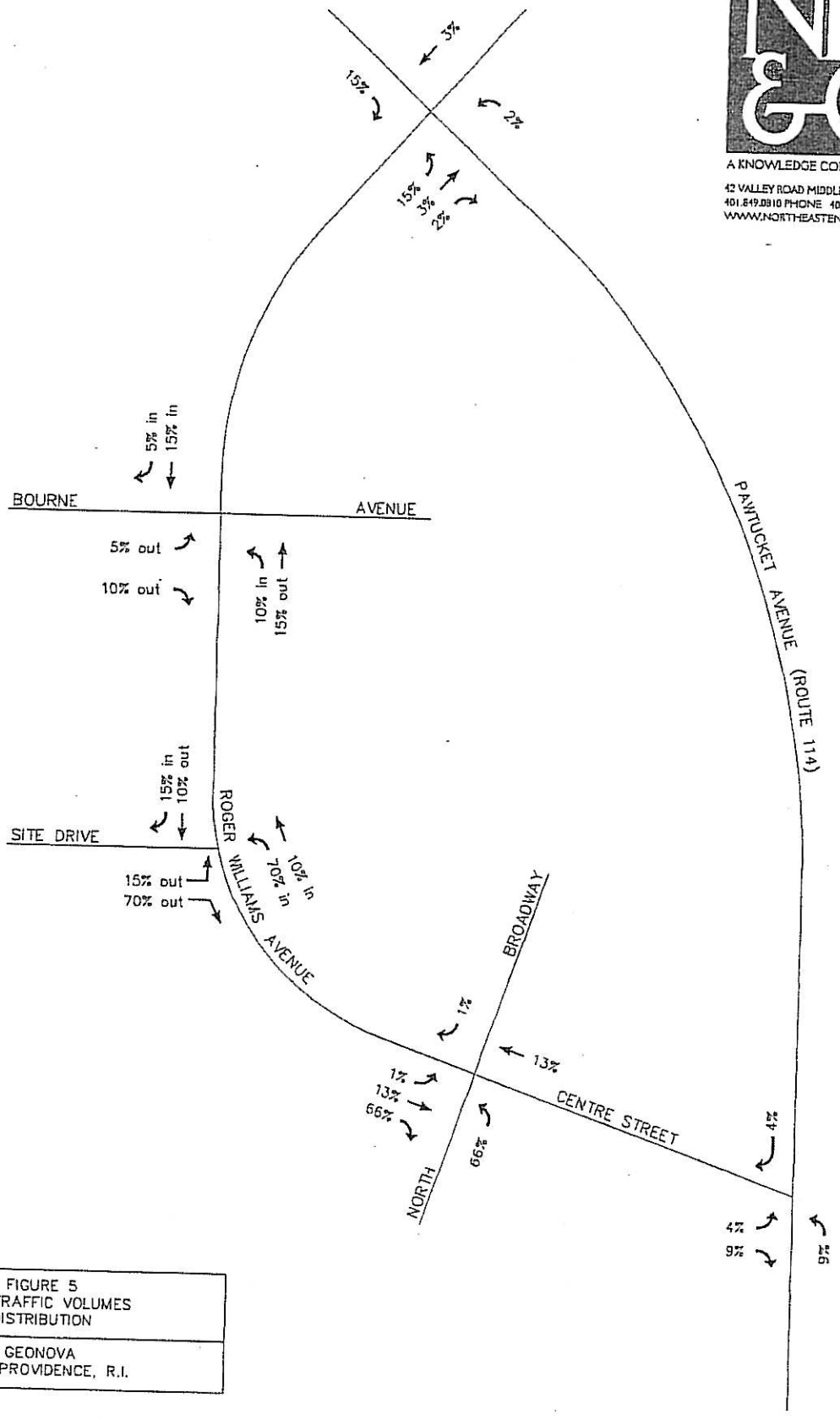

FIGURE 5
SITE TRAFFIC VOLUMES
DISTRIBUTION

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Of the 20% at the intersection with Pawtucket Avenue it was assumed that 15% would turn on Pawtucket Avenue to the north, 3% would continue on Roger Williams Avenue and 2% would turn on Pawtucket Avenue to the south. Of the 80% of the site traffic at the intersection of Roger Williams Avenue, North Broadway and Centre Street it was assumed that 66% would turn on North Broadway to the south, 1% would turn on North Broadway to the north and 13% would continue straight onto Centre Street. At Centre Street and Pawtucket Avenue it was assumed that 9% would turn to the south and 4% would turn to the north.

FUTURE TRAFFIC CONDITIONS

The existing manual turning movement traffic volumes for the peak hours increased by five percent to adjust for the difference in traffic between April and July and then were increased by another seven percent (1% per year for seven years) to account for traffic growth to 2010. The adjustment factors are included in Appendix A. In addition traffic from the expansion of New England Construction and the Ross Common Condominiums were included. Figures 6 to 8 show these background traffic volumes for the study intersections for the weekday morning and afternoon and Saturday peak hours. The site traffic volumes were distributed to the roadway using the proposed distribution as shown on Figures 9 to 11. The site traffic volumes were then added to the background traffic volumes to form the combined future traffic volumes. Figures 12 to 14 show the future combined traffic volumes for the weekday morning and afternoon peak hour and the Saturday midday peak hour.

CAPACITY ANALYSES

Capacity analyses were performed for the morning, afternoon and Saturday peak hours for the signalized intersections of Roger Williams Avenue and Pawtucket Avenue, Roger Williams Avenue, Centre Street and North Broadway and Centre Street and Pawtucket Avenue for the existing, background and combined traffic volumes. These analyses were done to determine the quality of traffic operations of the intersection. The quality of operations is measured and expressed as a Level of Service (LOS). LOS is defined as a measure of delay and inconvenience that motorists experience. The levels are expressed with letter designations of A through F. LOS A represents little or no vehicle delay while LOS F reflects an intersection or movement that is over capacity and where long delays can be expected. A description of Level of Service for signalized intersections and the analysis sheets are included in Appendix C. Queuing analyses for the combined traffic volumes is also included in the Appendix. Table 4 shows the results of the capacity analyses for the existing, background and combined conditions for the three intersections.

All three intersections operate at an acceptable LOS with the existing and background traffic volumes. With the addition of the site traffic the intersection of Pawtucket Avenue and Centre Street and the intersection of Roger Williams Avenue and Pawtucket Avenue continue to operate at a good LOS for all time periods.

The intersection of Roger Williams Avenue, North Broadway and Centre Street operates at LOS D for the morning peak hour, LOS F for the afternoon peak hour and LOS B for the Saturday peak hour. The signal cycle was increased to 90 seconds for the morning peak hour and 100 seconds for the afternoon peak hour for the combined traffic volumes. This intersection has the largest percentage of site traffic going through it and therefore is impacted more than the other two intersections. To improve the LOS some improvements are proposed at this intersection. Improvements are constrained by crossings over the Ten Mile River to the north and west of the intersection. On Centre Street it is recommended that the intersection be restriped to provide a left turn lane and a through/right lane. In addition the phasing should be changed to provide a westbound advance for that approach. With these changes the LOS improves from D to C in the morning peak hour and from F to D in the afternoon peak hour. Queuing analyses for this intersection for the morning and afternoon peak hour with the combined traffic volumes and intersection improvements is also included in the Appendix.

Table 4
SIGNALIZED CAPACITY ANALYSES

Intersection	AM Peak Hour	PM Peak Hour	Saturday Peak Hour
Pawtucket Ave and Centre St			
Existing Traffic Volumes	B (2.8)	B (13.6)	B (12.0)
Background Traffic Volumes	B (13.3)	B (14.7)	B (12.3)
Future Traffic Volumes	B (14.0)	B (16.1)	B (13.1)
Pawtucket Ave and Roger Williams Ave			
Existing Traffic Volumes	B (11.4)	B (12.8)	A (9.7)
Background Traffic Volumes	B (12.8)	B (15.2)	A (10.0)
Future Traffic Volumes	B (14.6)	B (19.8)	B (10.9)
North Broadway, Roger Williams Ave and Centre St			
Existing Traffic Volumes	B (15.4)	B (15.5)	A (9.7)
Background Traffic Volumes	B (19.8)	C (20.7)	A (10.0)
Future Traffic Volumes no Improvements	D (40.2)	F (98.4)	B (12.0)
Future Traffic Volumes with Improvements	C (26.3)	D (35.9)	B (14.4)

An analysis was also made of the unsignalized intersection of Bourne Avenue and Roger Williams Avenue since secondary access to the site will be located on Bourne Avenue. A description of Level of Service for unsignalized intersections and the analysis sheets are also included in Appendix C. Capacity analyses for unsignalized intersections evaluate the ability of vehicles on the minor road to exit onto the major road and for left turning vehicles on the major road to enter the minor road. The chief impact on LOS is left turns exiting the minor road, which must contend with traffic in both directions on the major road. Table 5 summarizes the results of the analyses.

Table 5
UNSIGNALIZED CAPACITY ANALYSES

Intersection	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	EB	WB	EB	WB	EB	WB
Roger Williams Ave and Bourne Ave						
Existing Traffic Volumes	B (10.7)	B (13.2)	B (12.5)	C (15.5)	B (10.7)	B (11.7)
Background Traffic Volumes	B (11.7)	C (15.1)	B (14.3)	C (18.5)	B (10.8)	B (12.1)
Future Traffic Volumes	B (13.4)	C (18.2)	C (19.4)	C (24.5)	B (12.1)	B (14.8)
	LEFT	RIGHT	LEFT	RIGHT	LEFT	RIGHT
Roger Williams Avenue and Site Drive						
Future Traffic Volumes no Improvements	C (19.9)	B (12.1)	E (47.3)	B (13.8)	D (26.4)	B (11.3)
Future Traffic Volumes with Improvements	C (19.9)	B (12.1)	E (47.3)	B (13.8)	C (26.4)	B (11.3)

Finally an analysis of the unsignalized intersection of the site driveway and Roger Williams Avenue was made. Left turns exiting the site driveway operate at LOS C for the morning, LOS E for the afternoon peak hour and LOS D for the Saturday peak hour as shown on Table 5. Right turns exiting the site driveway operate at LOS B for all time periods. Left turning vehicles entering the site driveway operate at LOS A. Left turns exiting in the afternoon peak hour operate poorly due to conflicts with the large number of left turning vehicles entering the site and the larger volumes of traffic on Roger Williams Avenue. There are only 35 exiting vehicles turning left but there are 210 vehicles turning left into the site.

An analysis was also made with a northbound left turn lane on Roger Williams Avenue and this made no change to the LOS. With the large number of vehicles turning left into the site Roger Williams Avenue should be widened at the site driveway if possible to provide either a left turn lane or bypass area to allow through traffic to proceed around vehicles waiting to turn left into the site.

SIGNAL WARRANT ANALYSES

Due to the poor LOS of vehicles exiting the site during the afternoon peak hour a signal warrant analysis was made to see if a signal is needed at the intersection of the site driveway and Roger Williams Avenue.

Warrant 1-Eight-Hour Vehicular Volume, Warrant 2 Four-Hour Vehicular Volume and Warrant 3-Peak Hour were reviewed and the results are included in Appendix C. Future traffic volumes on Roger Williams Avenue and left turning traffic exiting the site were used for the warrant analysis. Neither the traffic on Roger Williams Avenue nor turning left from the site meets the three warrants. Therefore a traffic signal is not recommended at this location.

RECOMMENDATIONS AND CONCLUSIONS

The addition of the site traffic causes a reduction in LOS at the intersection of Roger Williams Avenue, North Broadway and Centre Street. To improve the LOS the Centre Street approach should be widened to provide a left turn lane and a through/right lane. In addition the signal phasing should be changed to provide an advance for that approach and the cycle should be increased to 90 seconds for the morning peak hour and 100 seconds for the afternoon peak hour. With these improvements the intersection will operate at LOS D or better. Additional improvements to the intersection are inhibited by crossings over the Three Mile River in the immediate vicinity. The intersections of Pawtucket Avenue with Roger Williams Avenue and with Centre Street operate at a good LOS with the future traffic volumes. The unsignalized intersection of Roger Williams Avenue and Bourne Avenue also operates at an acceptable LOS.

It should be noted that the property was formerly a working steel plant. At its peak it also generated sizeable amounts of traffic. At one time the front parcel was a large parking lot and the back parcel contained numerous buildings. Therefore the traffic generated by this previous use in its prime might have had similar traffic volumes on a weekday when compared to the new proposal.

A traffic signal warrant analysis was made to determine if a signal should be installed at the intersection of Roger Williams Avenue and the site drive. Using the future traffic volumes on both roads it was determined that a signal is not warranted at the intersection. However due to the large number of vehicles turning left into the site a widening of Roger Williams Avenue is recommended to accommodate either a left turn lane or a bypass lane.

The site traffic has an impact on some intersections in the vicinity. To improve the traffic operation some improvements including road widening and signal upgrading are proposed. With these improvements the roadway network in the area can accommodate the site traffic.

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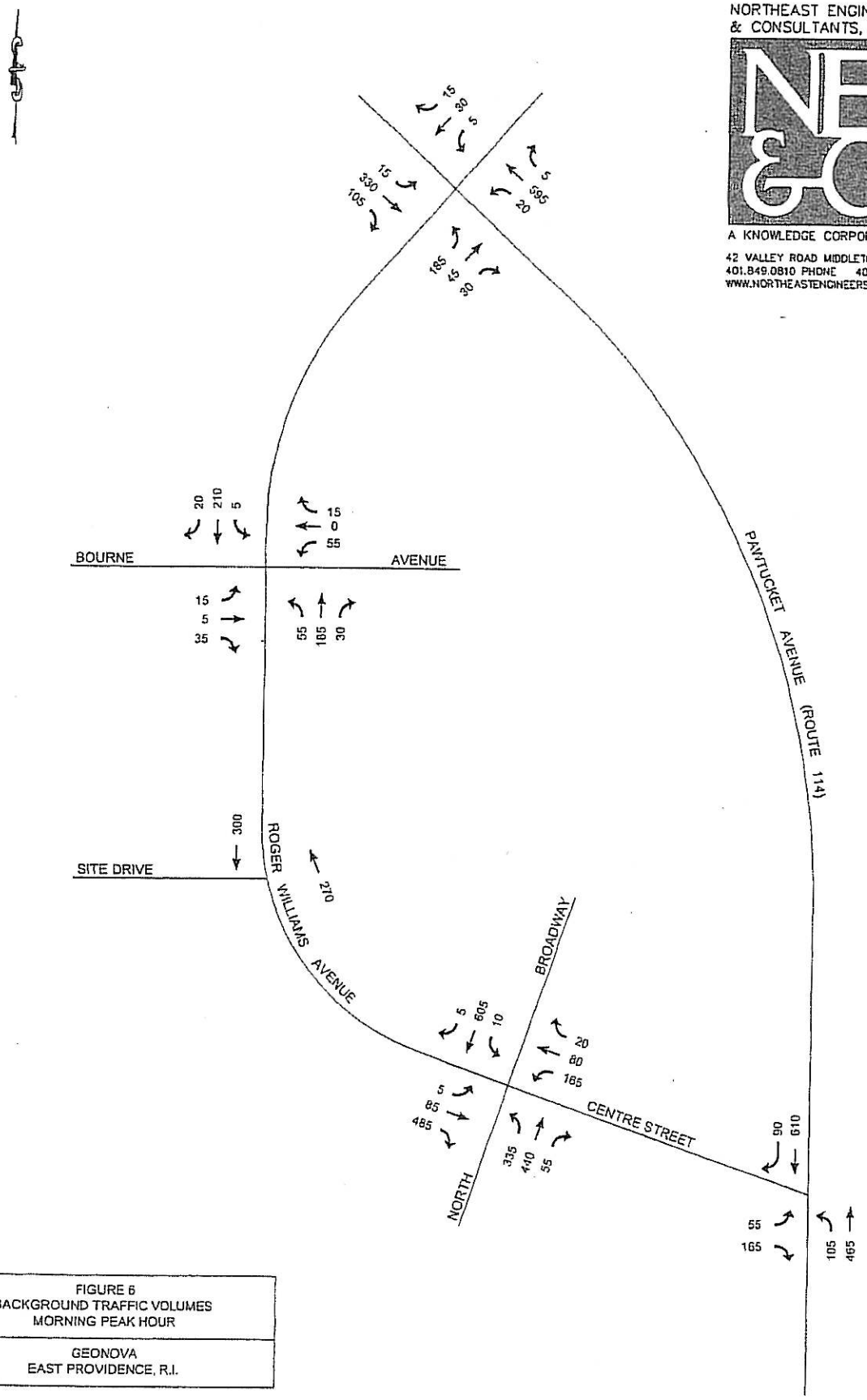

FIGURE 6
BACKGROUND TRAFFIC VOLUMES
MORNING PEAK HOUR

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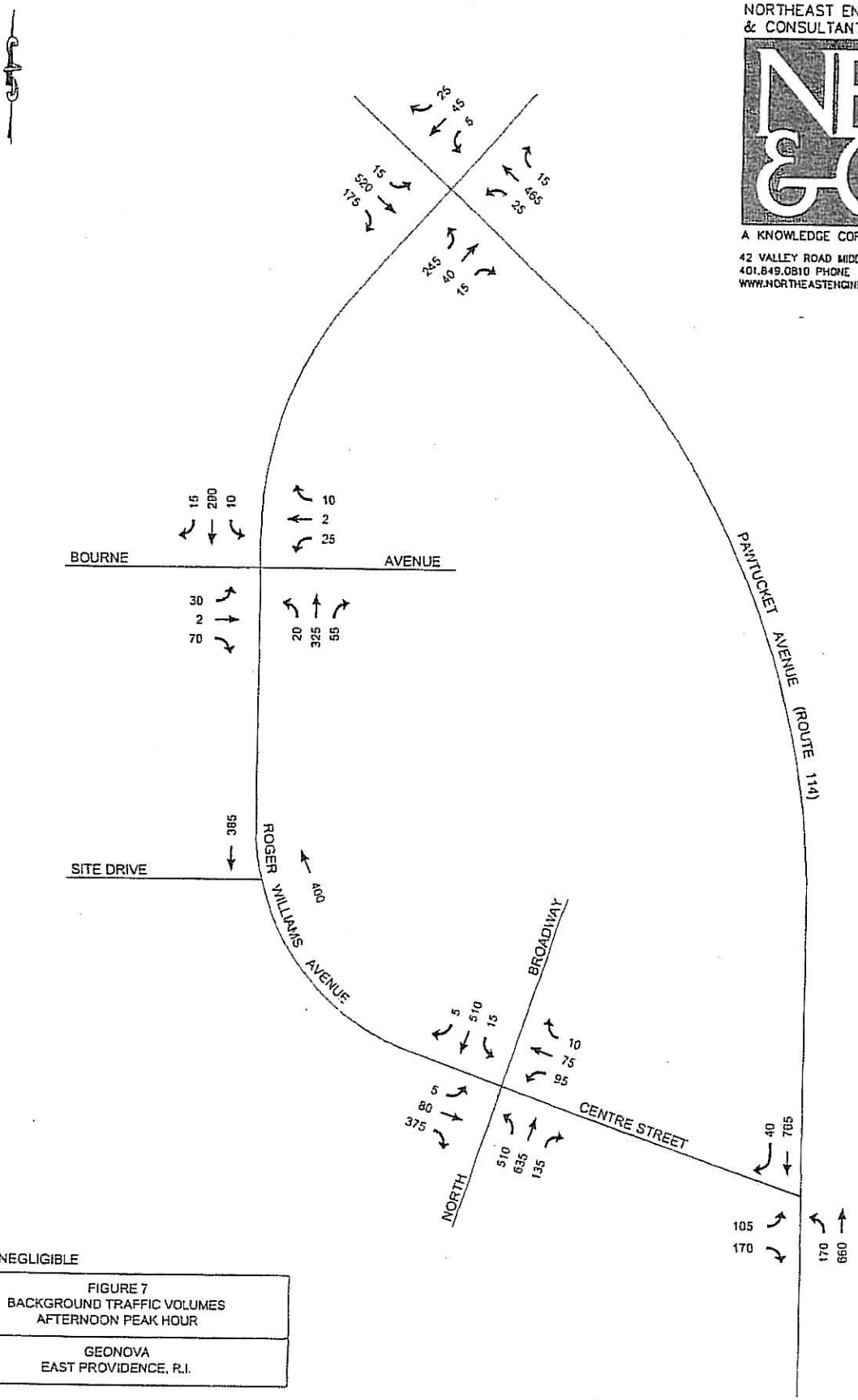

NEG = NEGLIGIBLE

FIGURE 7
BACKGROUND TRAFFIC VOLUMES
AFTERNOON PEAK HOUR

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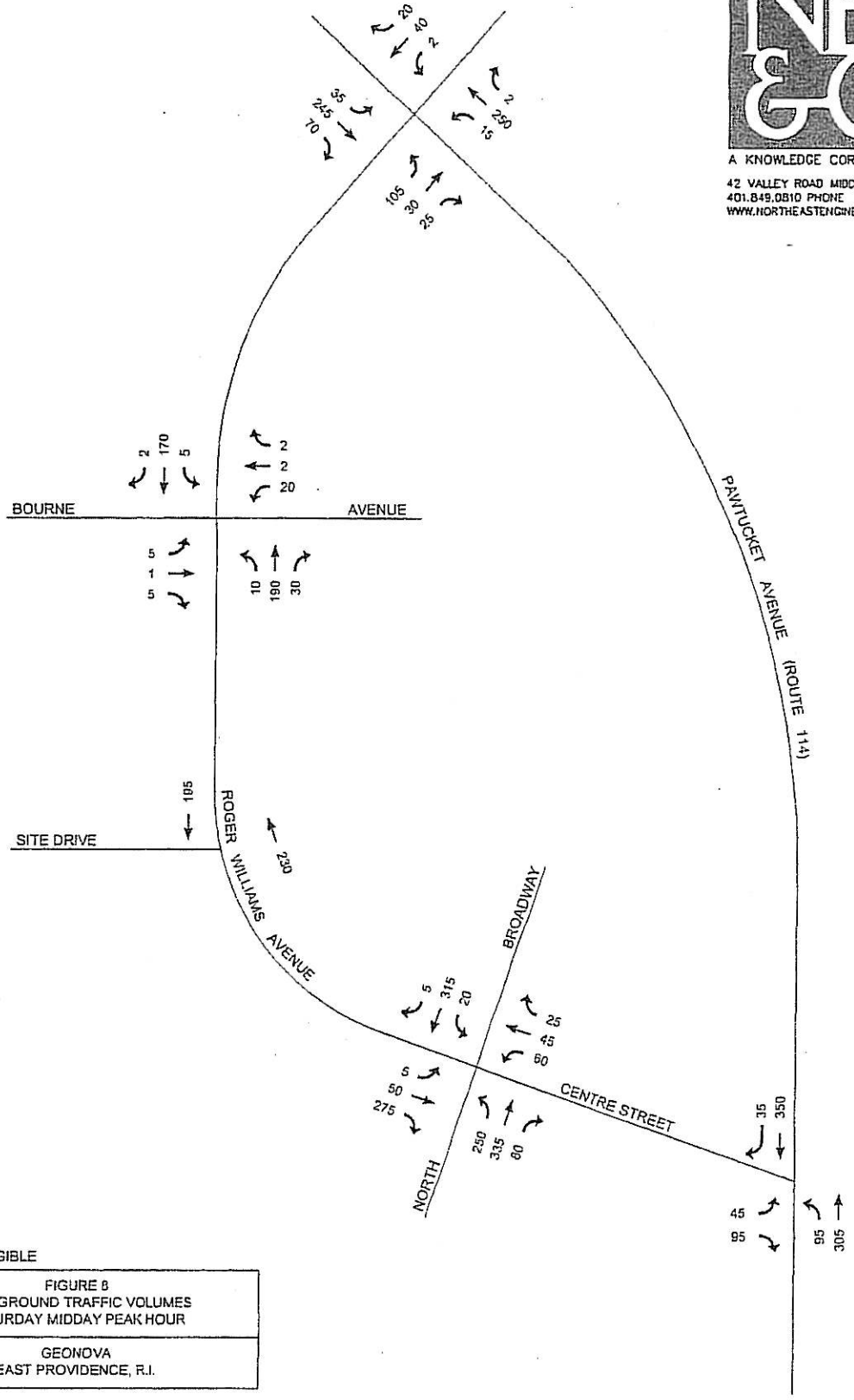

NEG = NEGLIGIBLE

FIGURE 8
BACKGROUND TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR

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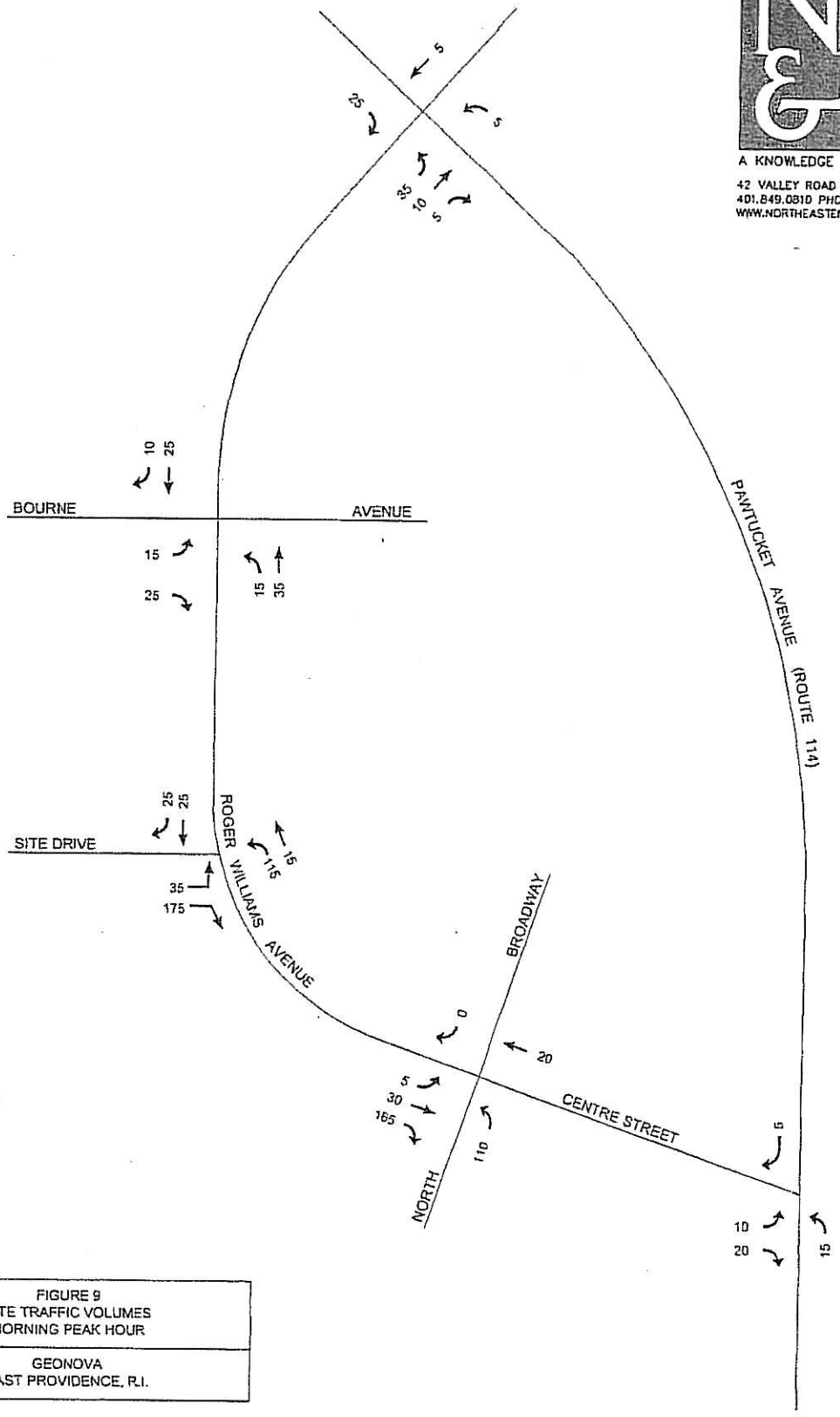

FIGURE 9
SITE TRAFFIC VOLUMES
MORNING PEAK HOUR

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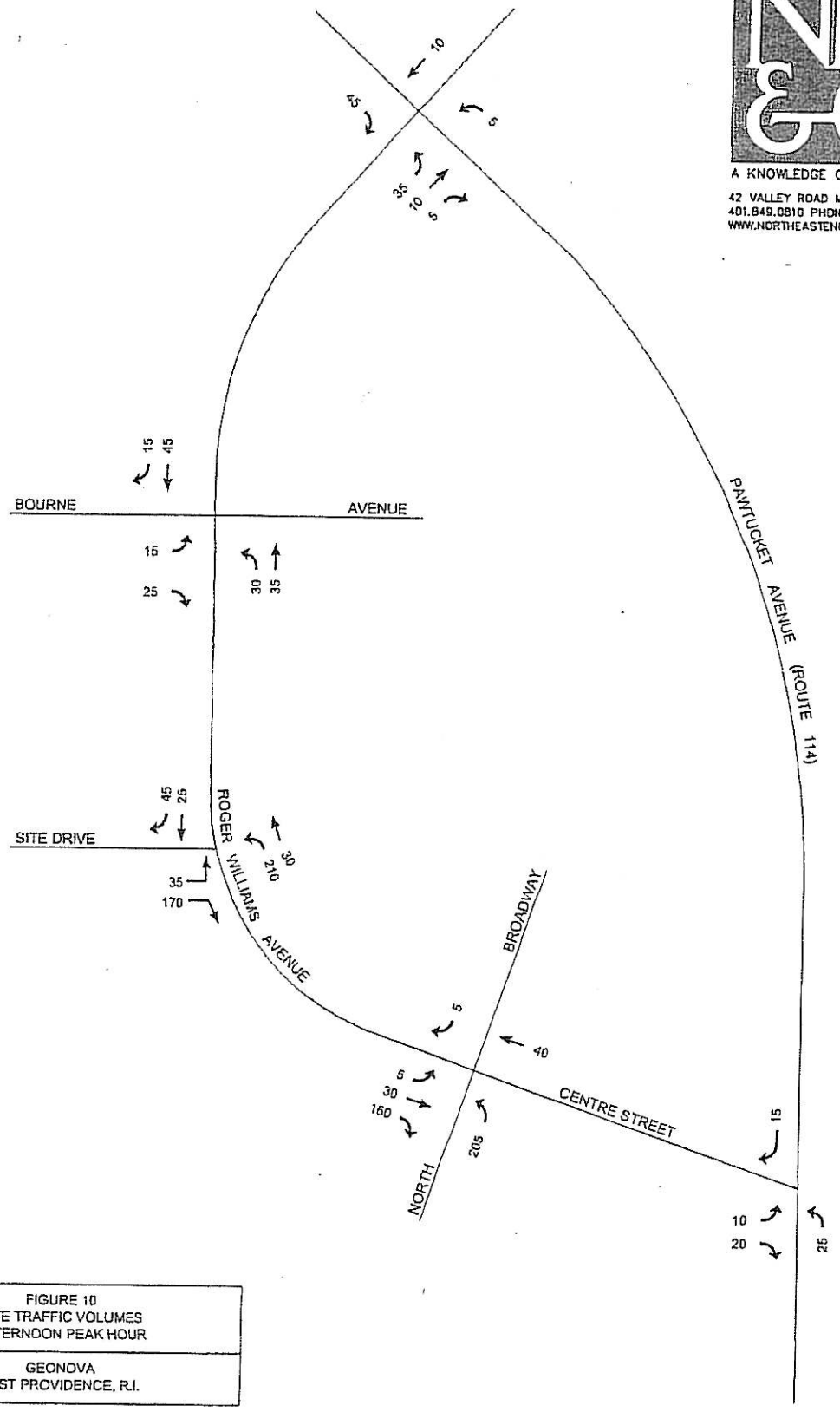

FIGURE 10
SITE TRAFFIC VOLUMES
AFTERNOON PEAK HOUR

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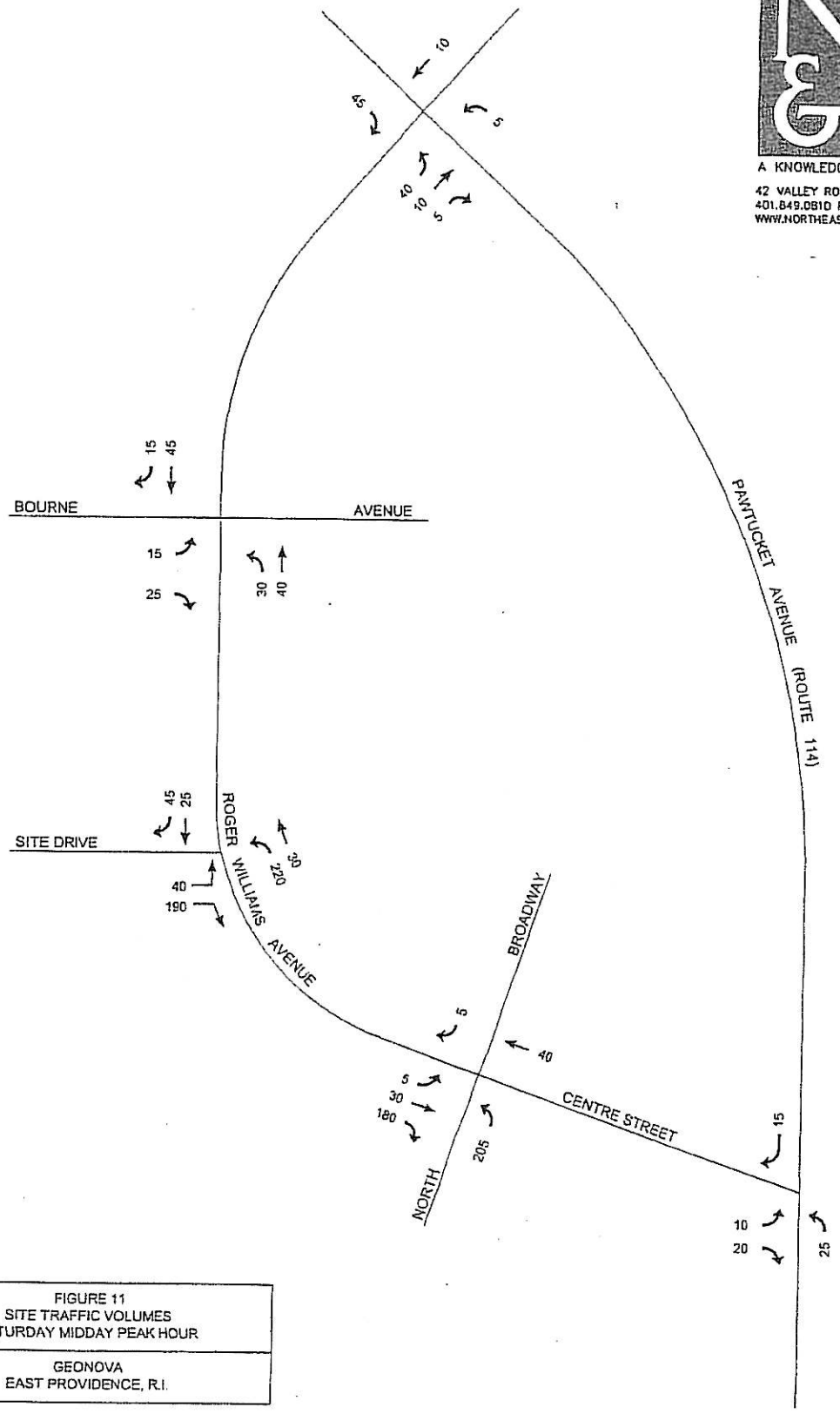

FIGURE 11
SITE TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR

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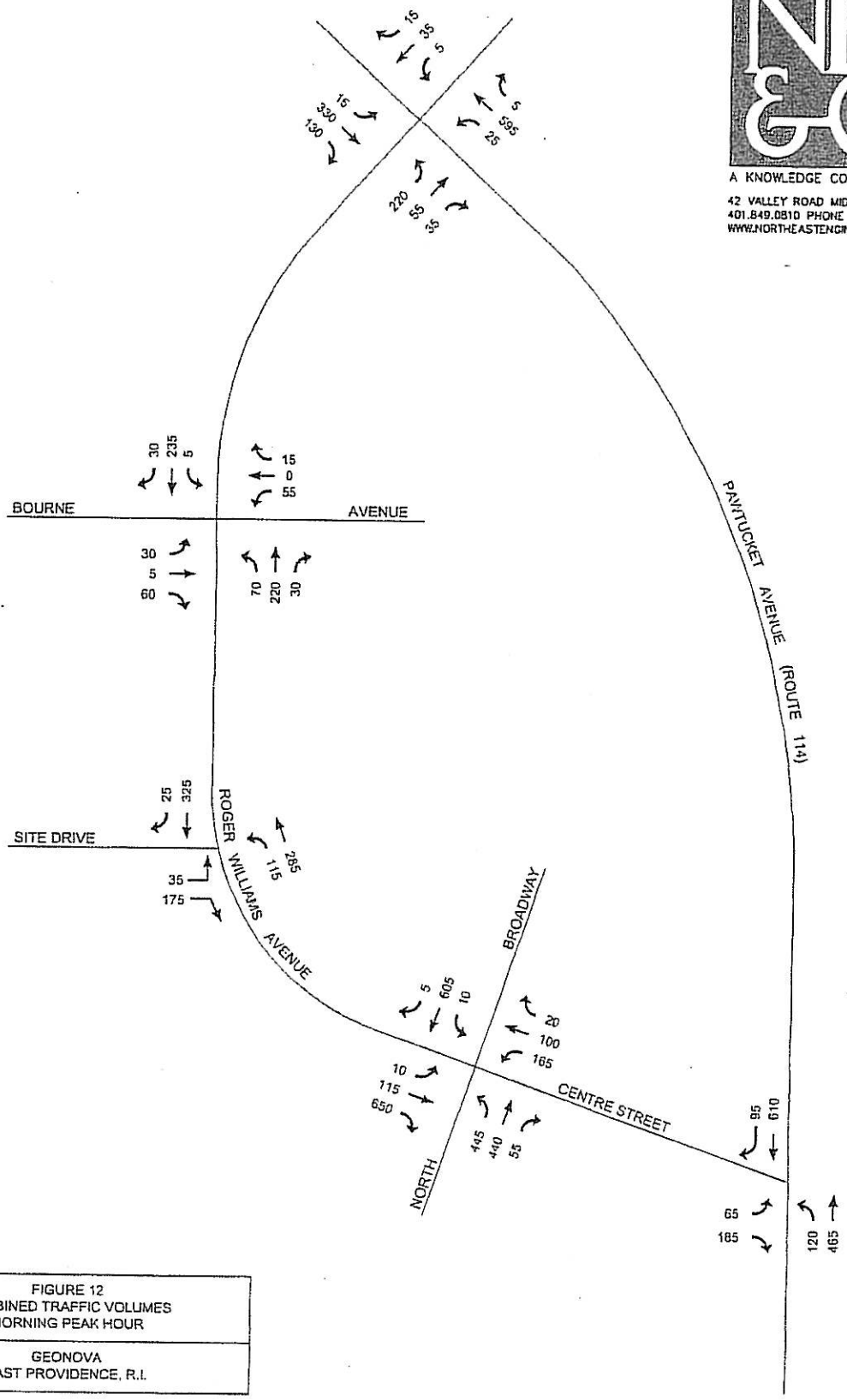

FIGURE 12
COMBINED TRAFFIC VOLUMES
MORNING PEAK HOUR

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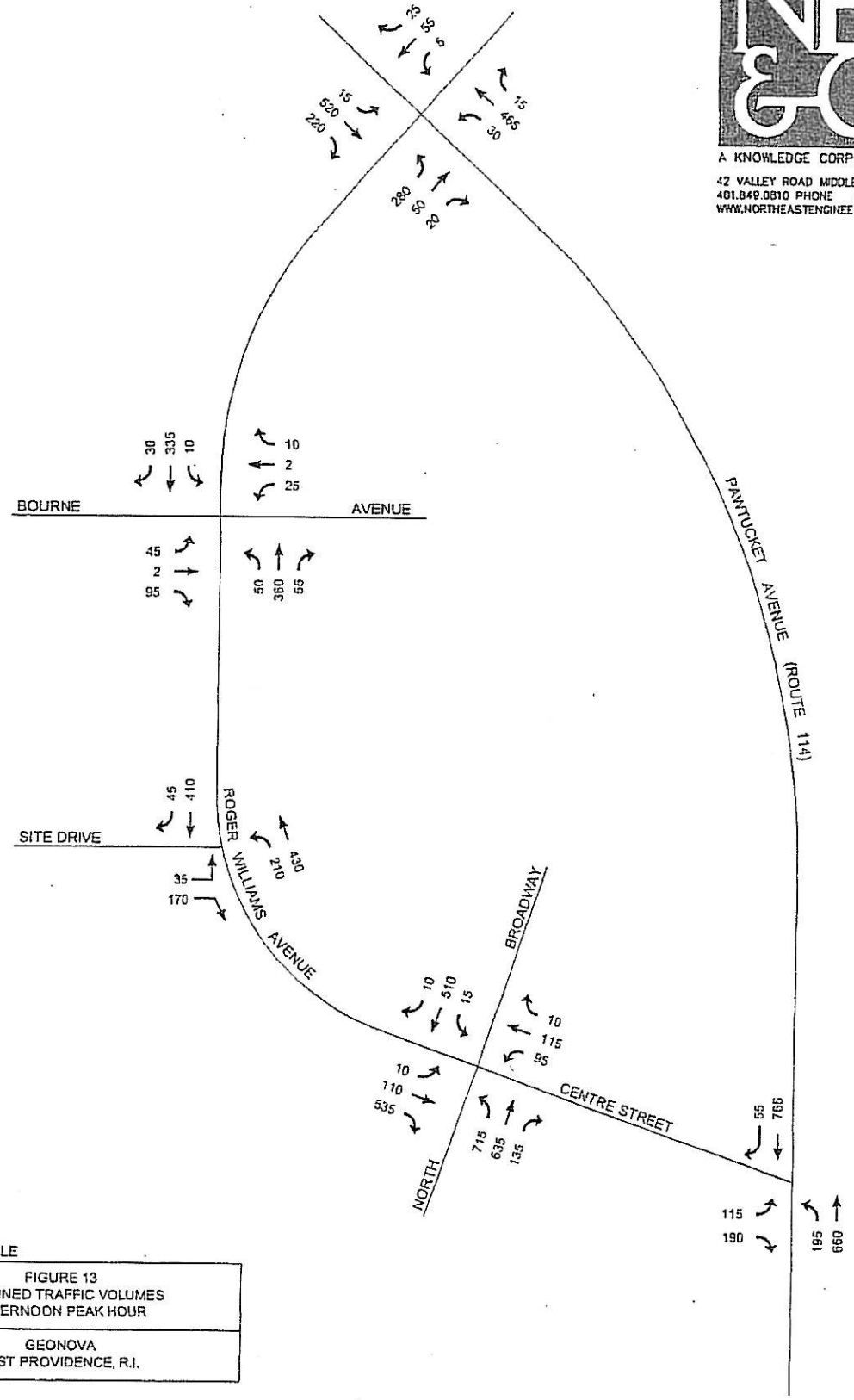

NEG = NEGLIGIBLE

FIGURE 13
COMBINED TRAFFIC VOLUMES
AFTERNOON PEAK HOUR

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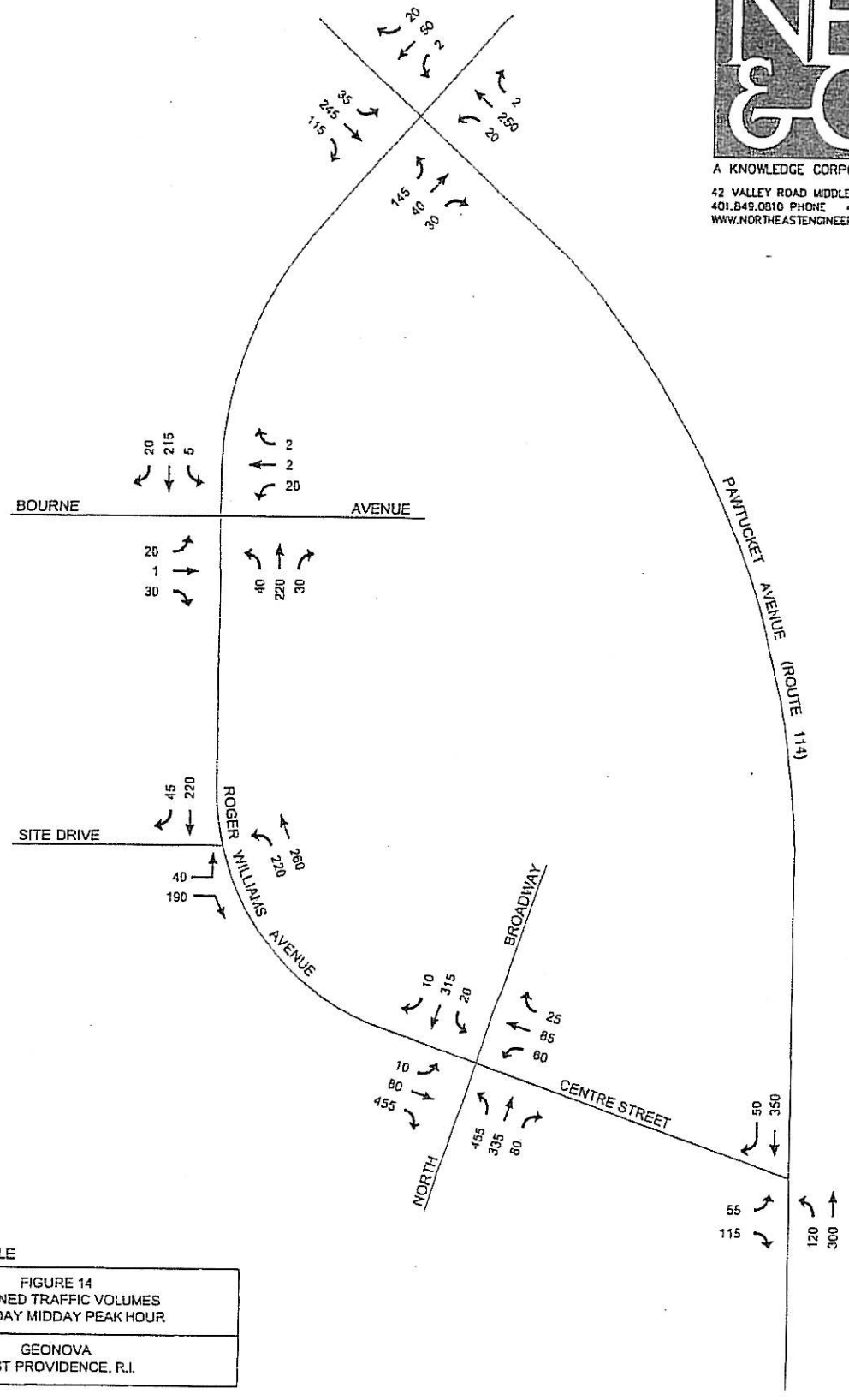

NEG = NEGLIGIBLE

FIGURE 14
COMBINED TRAFFIC VOLUMES
SATURDAY MIDDAY PEAK HOUR

GEONOVA
EAST PROVIDENCE, R.I.

APPENDIX A

TRAFFIC VOLUMES AND ACCIDENTS

Hourly Automatic Traffic Count
Pawtucket Ave (Route 114) at East Providence/Pawtucket Town Line
August 2000

Time	Tuesday	Wednesday	Thursday
mid-1:00 AM		89	78
1:00-2:00 AM		51	50
2:00-3:00 AM		31	38
3:00-4:00 AM		28	32
4:00-5:00 AM		57	48
5:00-6:00 AM		207	213
6:00-7:00 AM		702	714
7:00-8:00 AM		1,024	970
8:00-9:00 AM		1,024	1,020
9:00-10:00 AM		643	633
10:00-11:00 AM		733	575
11:00-noon		684	740
noon-1:00 PM	779	709	817
1:00-2:00 PM	751	723	758
2:00-3:00 PM	915	875	826
3:00-4:00 PM	1,172	1,171	1,133
4:00-5:00 PM	1,370	1,344	1,349
5:00-6:00 PM	1,338	1,338	1,354
6:00-7:00 PM	747	837	771
7:00-8:00 PM	581	555	542
8:00-9:00 PM	442	451	113
9:00-10:00 PM	317	377	11
10:00-11:00 PM	233	253	3
11:00-mid	167	156	3
Total	8,812	14,062	12,791

AADT-11,300
Source: Rhode Island Department of Transportation

Hourly Automatic Traffic Count
Pawtucket Ave (Route 114) between Newport Ave & Newman St
August 2000

Time	Monday	Tuesday	Wednesday	Thursday
mid-1:00 AM		131	135	122
1:00-2:00 AM		72	85	85
2:00-3:00 AM		56	49	39
3:00-4:00 AM		53	36	48
4:00-5:00 AM		93	99	87
5:00-6:00 AM		274	278	286
6:00-7:00 AM		813	780	788
7:00-8:00 AM		1,251	1,216	1,272
8:00-9:00 AM		1,194	1,189	
9:00-10:00 AM		1,044	964	
10:00-11:00 AM		1,144	1,058	
11:00-noon		1,168	1,098	
noon-1:00 PM	1,315	1,266	1,281	
1:00-2:00 PM	1,266	1,169	1,185	
2:00-3:00 PM	1,359	1,167	1,302	
3:00-4:00 PM	1,456	1,511	1,456	
4:00-5:00 PM	1,659	1,724	1,696	
5:00-6:00 PM	1,802	1,767	1,816	
6:00-7:00 PM	1,256	1,299	1,219	
7:00-8:00 PM	989	969	900	
8:00-9:00 PM	767	757	662	
9:00-10:00 PM	661	611	494	
10:00-11:00 PM	390	470	346	
11:00-mid	312	273	305	
Total	13,232	20,276	19,649	2,727

AADT-18,000
Source: Rhode Island Department of Transportation

Hourly Automatic Traffic Count
Pawtucket Ave (Route 114) between Pleasant St & Centre St
August 2000

Time	Monday	Tuesday	Wednesday	Thursday
mid-1:00 AM		90	89	85
1:00-2:00 AM		51	67	55
2:00-3:00 AM		26	28	24
3:00-4:00 AM		30	21	27
4:00-5:00 AM		44	54	39
5:00-6:00 AM		146	145	143
6:00-7:00 AM		440	426	442
7:00-8:00 AM		717	721	730
8:00-9:00 AM		811	800	
9:00-10:00 AM		706	663	
10:00-11:00 AM		671	708	
11:00-noon		792	748	
noon-1:00 PM	923	866	891	
1:00-2:00 PM	847	840	864	
2:00-3:00 PM	909	811	934	
3:00-4:00 PM	1,011	1,047	932	
4:00-5:00 PM	1,174	1,159	1,144	
5:00-6:00 PM	1,277	1,226	1,234	
6:00-7:00 PM	905	916	960	
7:00-8:00 PM	731	715	716	
8:00-9:00 PM	588	585	463	
9:00-10:00 PM	449	409	348	
10:00-11:00 PM	249	317	259	
11:00-mid	182	180	179	
Total	9,245	13,595	13,394	1,545

AADT-12,200
Source: Rhode Island Department of Transportation

Hourly Automatic Traffic Count
Roger Williams Ave between Pawtucket Ave and Bourne Ave
July 2000

Time	Monday	Tuesday	Wednesday	Thursday
mid-1:00 AM		24	30	34
1:00-2:00 AM		17	17	24
2:00-3:00 AM		12	11	17
3:00-4:00 AM		8	10	11
4:00-5:00 AM		19	29	25
5:00-6:00 AM		75	84	77
6:00-7:00 AM		253	234	245
7:00-8:00 AM		278	289	281
8:00-9:00 AM		266	232	245
9:00-10:00 AM		197	178	
10:00-11:00 AM	191	203	213	
11:00-noon	190	230	195	
noon-1:00 PM	281	265	275	
1:00-2:00 PM	238	247	265	
2:00-3:00 PM	237	250	263	
3:00-4:00 PM	367	371	364	
4:00-5:00 PM	406	407	427	
5:00-6:00 PM	386	427	420	
6:00-7:00 PM	285	281	290	
7:00-8:00 PM	212	233	243	
8:00-9:00 PM	164	176	201	
9:00-10:00 PM	141	164	153	
10:00-11:00 PM	86	100	109	
11:00-mid	66	74	66	
Total	3,250	4,577	4,598	959

AADT-4,200
Source: Rhode Island Department of Transportation

Hourly Automatic Traffic Count
Roger Williams Ave between Bourne Ave and North Broadway
July 2000

Time	Monday	Tuesday	Wednesday	Thursday	Friday
mid-1:00 AM		71	74	73	73
1:00-2:00 AM		36	28	40	49
2:00-3:00 AM		25		25	31
3:00-4:00 AM		25		25	32
4:00-5:00 AM		43		44	41
5:00-6:00 AM		171		181	183
6:00-7:00 AM		515		516	485
7:00-8:00 AM		637		595	641
8:00-9:00 AM		583		567	498
9:00-10:00 AM		447		449	452
10:00-11:00 AM	448	457	385	466	530
11:00-noon	517	559	513	516	
noon-1:00 PM	522	569	555	544	
1:00-2:00 PM	524	518	565	515	
2:00-3:00 PM	631	586	661	618	
3:00-4:00 PM	776	818	752	756	
4:00-5:00 PM	876	896	944	904	
5:00-6:00 PM	799	850	877	872	
6:00-7:00 PM	573	567	620	626	
7:00-8:00 PM	499	509	525	502	
8:00-9:00 PM	377	376	423	482	
9:00-10:00 PM	296	348	348	339	
10:00-11:00 PM	183	225	230	249	
11:00-mid	147	155	150	147	
Total	7,168	9,986	7,650	10,051	3,015

AADT-9,300
Source: Rhode Island Department of Transportation

Hourly Automatic Traffic Counts
Bourne Avenue east of Roger Williams Avenue
East Providence, Rhode Island
April 2003

Time	Thursday April 10, 2003			Friday April 11, 2003			Saturday April 12,2003			Sunday April 13, 2003			Monday April 14, 2003		
	Eastbound	Westbound	Total	Eastbound	Westbound	Total	Eastbound	Westbound	Total	Eastbound	Westbound	Total	Eastbound	Westbound	Total
mid-1:00 AM				2	1	3	3	1	4	1	1	2	0	0	0
1:00-2:00 AM				0	0	0	5	0	5	2	9	11	0	0	0
2:00-3:00 AM				4	2	6	4	1	5	7	6	13	1	1	2
3:00-4:00 AM				1	3	4	1	1	2	3	2	5	1	2	3
4:00-5:00 AM				8	29	37	1	7	8	9	1	10	5	30	35
5:00-6:00 AM				3	19	22	3	11	14	0	3	3	8	28	36
6:00-7:00 AM				19	70	89	3	10	13	1	2	3	18	74	92
7:00-8:00 AM				27	61	88	5	9	14	4	6	10	20	54	74
8:00-9:00 AM				42	47	89	6	10	16	3	4	7	49	57	106
9:00-10:00 AM				41	36	77	12	13	25	3	8	11	41	42	83
10:00-11:00 AM				46	50	96	14	11	25	10	11	21			
11:00-noon				76	52	128	16	15	31	7	5	12			
noon-1:00 PM				53	68	121	18	12	30	8	8	16			
1:00-2:00 PM				48	39	87	11	10	21	6	5	11			
2:00-3:00 PM				69	51	120	13	15	28	12	11	23			
3:00-4:00 PM	51	26	77	81	32	113	24	15	39	5	6	11			
4:00-5:00 PM	79	24	103	58	30	88	9	8	17	7	13	20			
5:00-6:00 PM	46	28	74	45	24	69	12	13	25	8	5	13			
6:00-7:00 PM	28	22	50	21	11	32	4	3	7	11	7	18			
7:00-8:00 PM	26	19	45	14	16	30	9	3	12	7	4	11			
8:00-9:00 PM	6	6	12	16	20	36	3	2	5	5	5	10			
9:00-10:00 PM	14	11	25	21	12	33	1	1	2	4	2	6			
10:00-11:00 PM	6	5	11	3	1	4	1	2	3	2	2	4			
11:00-mid	2	3	5	5	3	8	2	2	4	2	0	2			
Total	258	144	402	703	677	1,380	180	175	355	127	126	253	143	288	431

AADT- 1,300
Source: Northeast Enigneers and Consultants

Hourly Automatic Traffic Counts
Roger Williams Avenue south of Bourne Avenue
East Providence, Rhode Island
April 2003

Time	Thursday April 10, 2003			Friday April 11, 2003			Saturday April 12,2003			Sunday April 13, 2003			Monday April 14, 2003		
	Northbound	Southbound	Total	Northbound	Southbound	Total	Northbound	Southbound	Total	Northbound	Southbound	Total	Northbound	Southbound	Total
mid-1:00 AM				21	11	32	48	27	75	50	29	79	19	12	31
1:00-2:00 AM				20	7	27	38	18	56	43	18	61	16	13	29
2:00-3:00 AM				10	5	15	28	17	45	31	18	49	12	6	18
3:00-4:00 AM				12	8	20	14	4	18	19	11	30	7	13	20
4:00-5:00 AM				35	13	48	24	11	35	10	13	23	27	10	37
5:00-6:00 AM				61	35	96	30	23	53	14	14	28	75	43	118
6:00-7:00 AM				223	123	346	55	60	115	20	35	55	237	134	371
7:00-8:00 AM				206	221	427	67	55	122	44	53	97	169	193	362
8:00-9:00 AM				184	240	424	108	103	211	86	76	162	168	202	370
9:00-10:00 AM				136	158	294	130	105	235	105	124	229			
10:00-11:00 AM				158	136	294	137	134	271	121	134	255			
11:00-noon				188	196	384	171	161	332	201	132	333			
noon-1:00 PM				198	176	374	189	169	358	219	142	361			
1:00-2:00 PM				198	193	391	198	164	362	185	141	326			
2:00-3:00 PM				272	222	494	208	171	379	196	144	340			
3:00-4:00 PM				253	353	606	208	163	371	196	150	346			
4:00-5:00 PM	315	287	602	258	260	518	175	175	350	168	151	319			
5:00-6:00 PM	310	276	586	298	254	552	167	159	326	170	137	307			
6:00-7:00 PM	233	191	424	220	190	410	160	160	320	156	122	278			
7:00-8:00 PM	167	141	308	200	139	339	162	131	293	151	108	259			
8:00-9:00 PM	130	96	226	143	101	244	159	131	290	113	97	210			
9:00-10:00 PM	133	75	208	112	97	209	131	78	209	81	102	183			
10:00-11:00 PM	86	61	147	104	79	183	88	72	160	62	60	122			
11:00-mid	52	32	84	84	53	137	82	63	145	59	29	88			
Total	1,426	1,159	2,585	3,594	3,270	6,864	2,777	2,354	5,131	2,500	2,040	4,540	730	626	1,356

AADT- 6,300
Source: Northeast Enigneers and Consultants

Speed Data
Roger Williams Avenue south of Bourne Avenue
East Providence, Rhode Island
April 2003

Speed (mph)	Thursday April 10, 2003		Friday April 11, 2003		Saturday April 12, 2003		Sunday April 13, 2003		Monday April 14, 2003	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
0-15	17	4	32	20		10		2		3
16-20	25	10	44	48		25		21		7
21-25	24	75	109	339		172		248		82
26-30	347	471	1012	1471		999		952		305
31-35	734	482	1813	1133		925		698		267
36-40	201	79	443	157		176		95		39
41-45	21	14	37	15		16		13		8
46-50	3	1	4	5		7		1		1
Over 50	11	2	22	19		6		3		2
Total	1383	1138	3516	3207		2336		2033		714
Average	32	30	32	30		30		29		30
85th %	33	32	33	31		32		31		31

Note: No data for speeds northbound is available after Friday April 11, 2003

Manual Turning Movement Count
East Pointe
Roger Willliams Avenue and Bourne Avenue
East Providence, Rhode Island

Friday April 11, 2003

	Roger Williams Avenue						Bourne Avenue						
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
7:00-7:15 AM	6	24	2	0	24	3	4	0	8	4	0	0	75
7:15-7:30 AM	12	41	5	3	43	6	2	0	5	12	1	1	131
7:30-7:45 AM	8	40	1	1	41	4	1	0	6	9	0	5	116
7:45-8:00 AM	13	52	3	2	43	6	1	1	4	10	0	4	139
8:00-8:15 AM	8	41	9	1	40	3	4	1	10	16	0	0	133
8:15-8:30 AM	11	30	14	2	46	1	5	2	9	14	0	2	136
8:30-8:45 AM	4	39	3	1	36	9	2	0	5	10	0	2	111
8:45-9:00 AM	11	29	5	2	30	3	1	0	8	14	1	1	105
TOTAL	73	296	42	12	303	35	20	4	55	89	2	15	946
PEAK HOUR 7:30-8:30 AM	40	163	27	6	170	14	11	4	29	49	0	11	524
PHF	0.77	0.78	0.48	0.75	0.92	0.58	0.55	0.50	0.73	0.77	0.00	0.55	0.94

Thursday April 10, 2003

	Roger Williams Avenue						Bourne Avenue						
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
4:00-4:15 PM	3	35	11	0	32	1	3	0	6	4	1	0	96
4:15-4:30 PM	4	69	12	1	56	3	4	1	7	7	0	2	166
4:30-4:45 PM	7	68	12	3	66	2	7	2	19	10	0	2	198
4:45-5:00 PM	4	68	12	3	54	2	9	0	14	6	1	1	174
5:00-5:15 PM	2	70	10	2	67	3	5	0	17	3	1	2	182
5:15-5:30 PM	3	68	17	1	61	5	2	0	5	3	0	3	168
5:30-5:45 PM	2	59	13	1	59	2	4	3	10	15	0	2	170
5:45-6:00 PM	1	61	7	0	53	4	5	0	5	10	2	1	149
TOTAL	26	498	94	11	448	22	39	6	83	58	5	13	1303
PEAK HOUR 4:30-5:30 PM	16	274	51	9	248	12	23	2	55	22	2	8	722
PHF	0.57	0.98	1.06	0.75	0.94	0.60	0.64	0.25	0.72	0.55	0.50	1.00	0.91

Saturday April 12, 2003

	Roger Williams Avenue						Bourne Avenue						
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
12:00-12:15 PM	0	22	2	2	25	0	3	0	4	1	0	0	59
12:15-12:30 PM	1	43	4	1	33	4	0	0	4	9	0	1	100
12:30-12:45 PM	2	40	10	1	18	2	2	0	1	7	0	0	83
12:45-1:00 PM	1	45	7	1	42	1	0	0	2	6	2	1	108
1:00-1:15 PM	3	29	5	1	31	0	3	1	1	2	0	0	76
1:15-1:30 PM	2	38	6	1	37	1	0	0	1	8	0	0	94
1:30-1:45 PM	2	47	8	1	31	0	1	0	1	4	0	1	96
1:45-2:00 PM	3	45	5	0	33	1	1	0	3	8	0	0	99
TOTAL	14	309	47	8	250	9	10	1	17	45	2	3	715
PEAK HOUR 12:45-1:45 PM	8	159	26	4	141	2	4	1	5	20	2	2	374
PHF	0.67	0.88	0.81	1.00	0.84	0.50	0.33	0.25	0.63	0.63	0.25	0.50	0.87

Manual Turning Movement Count
East Pointe
Pawtucket Avenue (Route 114) and Centre Street
East Providence, Rhode Island

Thursday April 24, 2003

	Pawtucket Avenue (Route 114)				Centre Street		
	Northbound		Southbound		Eastbound		
TIME	Left	Through	Through	Right	Left	Right	TOTAL
7:00-7:15 AM	13	50	82	7	4	41	197
7:15-7:30 AM	20	73	130	18	2	49	292
7:30-7:45 AM	24	126	129	33	12	50	374
7:45-8:00 AM	24	104	145	15	15	35	338
8:00-8:15 AM	21	92	139	13	15	37	317
8:15-8:30 AM	26	94	133	20	6	23	302
8:30-8:45 AM	29	96	89	18	6	21	259
8:45-9:00 AM	11	74	74	12	6	31	208
TOTAL	168	709	921	136	66	287	2287
PEAK HOUR 7:30-8:30 AM	95	416	546	81	48	145	1331
PHF	0.99	0.83	0.94	0.61	0.80	0.73	0.89

Thursday April 24, 2003

	Pawtucket Avenue (Route 114)				Centre Street		
	Northbound		Southbound		Eastbound		
TIME	Left	Through	Through	Right	Left	Right	TOTAL
4:00-4:15 PM	33	117	144	11	13	31	349
4:15-4:30 PM	29	121	132	7	16	36	341
4:30-4:45 PM	35	142	121	4	15	27	344
4:45-5:00 PM	39	129	151	10	22	35	386
5:00-5:15 PM	33	156	172	5	14	34	414
5:15-5:30 PM	41	150	186	11	31	43	462
5:30-5:45 PM	35	154	174	8	25	36	432
5:45-6:00 PM	32	121	153	8	21	32	367
TOTAL	277	1090	1233	64	157	274	3095
PEAK HOUR 4:45-5:45 PM	148	589	683	34	92	148	1694
PHF	0.90	0.94	0.92	0.77	0.74	0.86	0.92

Saturday April 26, 2003

	Pawtucket Avenue (Route 114)				Centre Street		
	Northbound		Southbound		Eastbound		
TIME	Left	Through	Through	Right	Left	Right	TOTAL
12:00-12:15 PM	27	82	84	7	10	30	240
12:15-12:30 PM	24	62	90	8	8	14	206
12:30-12:45 PM	10	68	67	5	7	19	176
12:45-1:00 PM	22	61	73	9	12	19	196
1:00-1:15 PM	18	68	74	4	9	17	190
1:15-1:30 PM	19	66	65	6	8	22	186
1:30-1:45 PM	20	70	71	5	7	10	183
1:45-2:00 PM	13	62	81	5	13	16	190
TOTAL	153	539	605	49	74	147	1567
PEAK HOUR 12:00-1:00 PM	83	273	314	29	37	82	818
PHF	0.77	0.83	0.87	0.91	0.77	0.68	0.85

Manual Turning Movement Count
East Pointe
Pawtucket Avenue (Route 114) and Roger Willliams Avenue
East Providence, Rhode Island

Wednesday April 23, 2003

	Pawtucket Avenue (Route 114)						Roger Williams Avenue						
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
7:00-7:15 AM	0	54	1	2	28	17	21	4	2	1	5	1	136
7:15-7:30 AM	2	82	1	0	59	12	26	5	1	2	9	3	202
7:30-7:45 AM	3	132	0	3	78	21	33	8	6	1	9	1	295
7:45-8:00 AM	1	149	0	5	77	24	52	16	5	1	5	6	341
8:00-8:15 AM	5	128	3	3	75	17	41	9	9	0	5	4	299
8:15-8:30 AM	7	123	1	4	67	30	38	4	4	3	7	3	291
8:30-8:45 AM	0	94	0	5	61	11	36	11	6	1	4	2	231
8:45-9:00 AM	1	63	2	5	60	19	23	3	5	1	4	3	189
TOTAL	19	825	8	27	505	151	270	60	38	10	48	23	1984
PEAK HOUR 7:30-8:30 AM	16	532	4	15	297	92	164	37	24	5	26	14	1226
PHF	0.57	0.89	0.33	0.75	0.95	0.96	0.79	0.58	0.67	0.42	0.72	0.58	0.90

Wednesday April 23, 2003

	Pawtucket Avenue (Route 114)						Roger Williams Avenue						
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
4:00-4:15 PM	3	87	0	4	90	31	33	5	2	0	3	2	260
4:15-4:30 PM	9	88	0	4	104	32	40	14	3	1	8	3	306
4:30-4:45 PM	3	102	2	2	125	53	59	8	2	1	11	6	374
4:45-5:00 PM	7	97	4	5	134	28	50	11	3	0	9	6	354
5:00-5:15 PM	5	121	3	3	115	34	46	13	5	1	13	5	364
5:15-5:30 PM	6	95	3	4	92	39	60	5	2	2	8	4	320
5:30-5:45 PM	12	85	1	1	81	28	46	12	3	0	10	3	282
5:45-6:00 PM	14	67	4	6	72	21	32	6	3	0	8	5	238
TOTAL	59	742	17	29	813	266	366	74	23	5	70	34	2498
PEAK HOUR 4:30-5:30 PM	21	415	12	14	466	154	215	37	12	4	41	21	1412
PHF	0.75	0.86	0.75	0.70	0.87	0.73	0.90	0.71	0.60	1.00	0.79	0.88	0.94

Saturday May 3, 2003

	Pawtucket Avenue (Route 114)						Roger Williams Avenue						
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
12:00-12:15 PM	4	46	1	1	48	14	35	8	3	1	5	3	169
12:15-12:30 PM	4	47	0	6	59	17	26	7	4	1	7	5	183
12:30-12:45 PM	3	59	0	8	50	13	25	10	5	0	10	2	185
12:45-1:00 PM	4	61	1	10	58	18	27	7	5	0	11	6	208
1:00-1:15 PM	3	57	1	8	51	13	14	4	7	1	8	6	173
1:15-1:30 PM	1	48	0	3	54	12	26	3	3	0	4	5	159
1:30-1:45 PM	2	44	1	2	49	15	25	4	2	1	8	3	156
1:45-2:00 PM	2	45	0	1	57	16	27	13	3	0	5	4	173
TOTAL	23	407	4	0	426	118	205	56	32	4	58	34	1406
PEAK HOUR 12:15-1:15 PM	14	224	2	32	218	61	92	28	21	2	36	19	749
PHF	0.88	0.92	0.50	0.80	0.92	0.85	0.85	0.70	0.75	0.50	0.82	0.79	0.90

Manual Turning Movement Count
East Pointe
Roger Willliams Avenue, North Broadway and Centre Street
East Providence, Rhode Island

Tuesday April 22, 2003

	North Broadway						Roger Williams Avenue			Centre Street			
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
7:00-7:15 AM	34	48	12	2	84	0	0	14	56	16	7	2	275
7:15-7:30 AM	45	95	7	2	117	2	1	17	81	30	10	2	409
7:30-7:45 AM	76	92	9	3	126	0	1	24	110	40	10	5	496
7:45-8:00 AM	70	106	10	3	134	3	2	13	99	48	19	5	512
8:00-8:15 AM	68	98	14	1	123	1	0	15	100	26	17	4	467
8:15-8:30 AM	76	97	16	1	159	1	2	20	106	35	23	5	541
8:30-8:45 AM	52	84	13	2	114	1	0	14	95	37	10	1	423
8:45-9:00 AM	82	92	13	5	77	1	0	13	73	31	10	3	400
TOTAL	503	712	94	19	934	9	6	130	720	263	106	27	3523
PEAK HOUR 7:30-8:30 AM	290	393	49	8	542	5	5	72	415	149	69	19	2016
PHF	0.95	0.93	0.77	0.67	0.85	0.42	0.63	0.75	0.94	0.93	0.75	0.95	0.93

Tuesday April 22, 2003

	North Broadway						Roger Williams Avenue			Centre Street			
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
4:00-4:15 PM	66	101	13	5	85	0	1	17	87	24	26	2	427
4:15-4:30 PM	94	119	24	1	124	0	0	17	77	17	22	4	499
4:30-4:45 PM	74	119	27	3	80	1	2	18	100	17	18	7	466
4:45-5:00 PM	94	129	33	5	95	1	2	18	86	24	11	4	502
5:00-5:15 PM	99	125	30	3	140	1	2	20	76	17	18	2	533
5:15-5:30 PM	137	155	38	5	121	2	1	18	89	29	23	2	620
5:30-5:45 PM	108	160	20	1	100	1	0	13	72	15	14	1	505
5:45-6:00 PM	106	101	25	3	105	0	1	14	82	21	21	2	481
TOTAL	778	1009	210	26	850	6	9	135	669	164	153	24	4033
PEAK HOUR 4:45-5:45 PM	438	569	121	14	456	5	5	69	323	85	66	9	2160
PHF	0.80	0.89	0.80	0.70	0.81	0.63	0.63	0.86	0.91	0.89	0.72	0.56	0.87

Saturday May 10, 2003

	North Broadway						Roger Williams Avenue			Centre Street			
	Northbound			Southbound			Eastbound			Westbound			
TIME	Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	TOTAL
12:00-12:15 PM	50	52	10	3	53	0	1	7	51	8	10	1	246
12:15-12:30 PM	40	68	25	2	54	3	1	13	54	9	15	5	289
12:30-12:45 PM	49	83	14	4	72	1	1	7	58	15	7	7	318
12:45-1:00 PM	53	69	21	2	71	0	1	17	66	17	14	5	336
1:00-1:15 PM	56	69	15	7	93	3	1	8	47	11	8	3	321
1:15-1:30 PM	57	80	20	6	45	1	0	12	66	11	7	7	312
1:30-1:45 PM	44	50	10	2	51	1	1	7	45	17	10	2	240
1:45-2:00 PM	66	80	10	2	61	1	1	13	47	13	4	2	300
TOTAL	415	551	125	28	500	10	7	84	434	101	75	32	2362
PEAK HOUR 12:30-1:30 PM	215	301	70	19	281	5	3	44	237	54	36	22	1287
PHF	0.94	0.91	0.83	0.68	0.76	0.42	0.75	0.65	0.90	0.79	0.64	0.79	0.96

Accident Analysis

East Providence

Location	Number of Accidents		Type of Accidents									
	Property Damage	Injury	Turn	Rear End	Unknown	Angle	Sideswipe	Fixed Object	Parked	Head on	Backing	Total
Pawtucket Ave (Route 114)												
At Roger Williams Ave												
2000	3	1	1	2			1					4
2001	4	1		1	3	1						5
2002	0	0										0
2003	2	3	1	4								
Total	9	5	2	7	3	1	1	0	0		0	14
At Centre St												
2000	2	2		3			1					4
2001	5	1		2			2		1		1	6
2002	4	0		2	1		1					4
2003	2	0	1	1								2
Total	13	3	1	8	1		4		1		1	16
Roger Williams Ave & Bourne Avenue												
2000	2	3						2	2		1	5
2001	4	1				2		2		1		5
2002	1						1					1
2003	2			1		1						2
Total	9	4	0	1	0	3	1	4	2	1	1	13
At Centre St & North Broadway												
2000	7	2	3	4		1		1				9
2001	8	1	3	2	2	1	1					9
2002	9	0	2	5	1					1		9
2003	7	0	3	2			2					7
Total	31	3	11	13	3	2	3	1	0	1	0	34

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
42 VALLEY ROAD
MIDDLETOWN, RHODE ISLAND 02842
(401) 849-0810

JOB 03103.0 East Pointe
SHEET NO. 1 OF 2
CALCULATED BY JZR DATE 9/28/04
CHECKED BY DATE
SCALE

Accident Rate

Pawtucket Ave & Roger Williams Ave

AADT Pawtucket Ave 11,300
Roger Williams Ave 4,200
15,500

Total Number of Accidents 14 over 4 years
14/4 = 3.5 accidents per year

Rate = Accidents x Basis / Exposure

Rate = 3.5 x 1 million / 15,500 x 365 = 0.62 MEV
million entering vehicles

Pawtucket Ave & Centre St

AADT Pawtucket Ave 12,200
Centre St
PM Peak - 472
Assume 2 to 5,000/h = 2,500
14,700

Total Number of Accidents 16 over 4 years
4 accidents per year

Rate = 4 x 1 million / 14,700 x 365 = .75 MEV

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
42 VALLEY ROAD
MIDDLETOWN, RHODE ISLAND 02842
(401) 849-0810

JOB 03103.0 East Pointe
SHEET NO. 2 OF 2
CALCULATED BY JZR DATE 9/28/04
CHECKED BY _____ DATE _____
SCALE _____

Accident Rate

Roger Williams Ave, Centre St & Broadway

AADT - Roger Williams Ave - 9,300/2 = 4,650
Broadway NB PM Peak 1772 20,000/2 10,000
Broadway SB PM Peak 1058 19,600/2 5,300
Centre St PM Peak 364 3,700/2 1,850
21,800

Accidents 34 over 4 years = 8.5/year

Rate = $\frac{8.5 \times 1 \text{ million}}{21,800 \times 365} = 1.07$ MEV

Roger Williams Ave & Bourne Ave

AADT Roger Williams - 6,300
Bourne 1,300
7,600

Total Number of Accidents 13 over 4 years 3.25/year

Rate = $\frac{3.25 \times 1 \text{ million}}{7,600 \times 365} = 1.17$ MEV

Metric				US Customary			
Design speed (km/h)	Stopping sight distance (m)	Intersection sight distance for passenger cars		Design speed (mph)	Stopping sight distance (ft)	Intersection sight distance for passenger cars	
		Calculated (m)	Design (m)			Calculated (ft)	Design (ft)
20	20	41.7	45	15	80	165.4	170
30	35	62.6	65	20	115	220.5	225
40	50	83.4	85	25	155	275.6	280
50	65	104.3	105	30	200	330.8	335
60	85	125.1	130	35	250	385.9	390
70	105	146.0	150	40	305	441.0	445
80	130	166.8	170	45	360	496.1	500
90	160	187.7	190	50	425	551.3	555
100	185	208.5	210	55	495	606.4	610
110	220	229.4	230	60	570	661.5	665
120	250	250.2	255	65	645	716.6	720
130	285	271.1	275	70	730	771.8	775
				75	820	826.9	830
				80	910	882.0	885

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap must be adjusted and required sight distance recalculated.

Exhibit 9-55. Design Intersection Sight Distance—Case B1—Left Turn From Stop

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right turns (Case B2) will provide sufficient sight distance for a passenger car to cross the near roadway to reach the median. Possible exceptions are addressed in the discussion of Case B3.

If the design vehicle can be stored in the median with adequate clearance to the through lanes, a departure sight triangle to the right for left turns should be provided for that design vehicle turning left from the median roadway. Where the median is not wide enough to store the design vehicle, a departure sight triangle should be provided for that design vehicle to turn left from the minor-road approach.

The median width should be considered in determining the number of lanes to be crossed. The median width should be converted to equivalent lanes. For example, a 7.2-m [24-ft] median should be considered as two additional lanes to be crossed in applying the multilane highway adjustment for time gaps in Exhibit 9-54. Furthermore, a departure sight triangle for left turns from the median roadway should be provided for the largest design vehicle that can be stored on

Design vehicle	Time gap (s) at design speed of major road (t_g)
Passenger car	6.5
Single-unit truck	8.5
Combination truck	10.5

Note: Time gaps are for a stopped vehicle to turn right onto or cross a two-lane highway with no median and grades 3 percent or less. The table values require adjustment as follows:

For multilane highways:
For crossing a major road with more than two lanes, add 0.5 seconds for passenger cars and 0.7 seconds for trucks for each additional lane to be crossed and for narrow medians that cannot store the design vehicle.

For minor road approach grades:
If the approach grade is an upgrade that exceeds 3 percent, add 0.1 seconds for each percent grade.

Exhibit 9-57. Time Gap for Case B2—Right Turn from Stop and Case B3—Crossing Maneuver

Metric				US Customary			
Design speed (km/h)	Stopping sight distance (m)	Intersection sight distance for passenger cars		Design speed (mph)	Stopping sight distance (ft)	Intersection sight distance for passenger cars	
		Calculated (m)	Design (m)			Calculated (ft)	Design (ft)
20	20	36.1	40	15	80	143.3	145
30	35	54.2	55	20	115	191.1	195
40	50	72.3	75	25	155	238.9	240
50	65	90.4	95	30	200	286.7	290
60	85	108.4	110	35	250	334.4	335
70	105	126.5	130	40	305	382.2	385
80	130	144.6	145	45	360	430.0	430
90	160	162.6	165	50	425	477.8	480
100	185	180.7	185	55	495	525.5	530
110	220	198.8	200	60	570	573.3	575
120	250	216.8	220	65	645	621.1	625
130	285	234.9	235	70	730	668.9	670
				75	820	716.6	720
				80	910	764.4	765

Note: Intersection sight distance shown is for a stopped passenger car to turn right onto or cross a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap must be adjusted and required sight distance recalculated.

Exhibit 9-58. Design Intersection Sight Distance—Case B2—Right Turn from Stop and Case B3—Crossing Maneuver

Table 16.8
Forecast Year 2020 Vehicle Miles Traveled by Municipality

Municipality (City/Town)	Vehicle Miles Traveled		% Growth per Year
	1990	2020	
Barrington	181,843	236,473	0.88%
Bristol	187,801	244,208	0.88%
Burrillville	253,781	333,795	0.92%
Central Falls	95,732	116,000	0.64%
Charlestown	152,220	222,630	1.28%
Coventry	344,690	484,358	1.14%
Cranston	1,459,060	2,008,320	1.07%
Cumberland	521,711	854,686	1.66%
East Greenwich	454,246	634,616	1.12%
East Providence	906,041	1,195,640	0.93%
Exeter	292,762	419,835	1.21%
Foster	120,477	170,241	1.16%
Glocester	196,922	260,820	0.94%
Hopkinton	263,344	374,671	1.18%
Jamestown	82,420	117,146	1.18%
Johnston	786,291	1,168,820	1.33%
Lincoln	620,708	967,829	1.49%
Little Compton	39,897	58,111	1.26%
Middletown	259,456	398,511	1.44%
Narragansett	172,926	268,247	1.47%
New Shoreham	5,483	9,456	1.83%
Newport	206,625	318,870	1.46%
North Kingstown	685,839	1,071,540	1.50%
North Providence	340,380	454,231	0.97%
North Smithfield	445,187	596,651	0.98%
Pawtucket	1,064,020	1,298,320	0.67%
Portsmouth	389,658	566,083	1.25%
Providence	2,993,210	3,701,660	0.71%
Richmond	204,836	319,103	1.49%
Scituate	236,507	339,389	1.21%
Smithfield	381,489	602,416	1.53%
South Kingstown	464,389	675,003	1.25%
Tiverton	277,258	381,838	1.07%
Warren	187,797	244,928	0.89%
Warwick	2,030,960	2,730,910	0.99%
West Greenwich	311,319	472,897	1.40%
West Warwick	331,166	469,023	1.17%
Westerly	342,018	503,570	1.30%
Woonsocket	355,812	489,640	1.07%
Statewide	18,646,281	25,780,485	1.09%

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
42 VALLEY ROAD
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(401) 849-0810

JOB 03103.0 East Pointe
SHEET NO. _____ OF _____
CALCULATED BY JZR DATE 5/13/03
CHECKED BY _____ DATE _____
SCALE _____

Adjustment Factors

Daily Monthly Diversion April 1.072 > 1.041 July is 4% higher than April
July 1.113

East Providence Growth Factor

.93% /yr x 7 years = 6.51%
use 1% per year for 7%

Increase existing Factors by 12% to 2010

Traffic Counts

Percent of Monthly Average Daily Traffic (%MADT) By Day of Week and Month

	Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*	*Year*	*Group*
Jan	74.7	99.0	106.9	99.1	106.9	113.7	95.5	3	URBAN
Feb	78.5	90.0	99.0	110.1	113.5	108.9	100.1		
Mar	77.4	101.7	105.7	106.5	97.2	114.2	102.1		
Apr	78.9	101.7	101.8	104.7	106.1	111.7	92.5		
May	82.0	91.3	102.1	103.9	104.5	112.3	99.7		
Jun	77.2	102.7	106.1	101.9	105.3	112.7	99.3		
Jul	83.2	101.6	104.2	104.7	105.7	100.0	96.6		
Aug	81.8	98.9	103.8	105.2	99.4	109.9	96.1		
Sep	78.3	95.6	102.6	105.9	105.9	112.8	99.2		
Oct	72.7	97.0	104.6	103.9	104.7	114.2	97.4		
Nov	76.4	103.7	102.8	105.5	105.0	114.3	98.6		
Dec	65.8	108.8	115.6	103.8	98.2	114.3	85.6		

MADT Percent of AADT

Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
90.6	87.9	94.5	102.8	106.3	106.0	106.1	106.0	105.8	106.7	95.9	87.0

Daily, Monthly Divisor

Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
.944	.945	.975	1.072	1.100	1.107	1.105	1.089	1.109	1.114	1.001	.921

APPENDIX B

TRIP GENERATION AND DISTRIBUTION

Land Use code 210- Single Family Houses

All Day Weekday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	9.57	4.31	21.85	50%	31	148	67	339	150
OUT	9.57	4.31	21.85	50%	31	148	67	339	150
									300

AM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.75	0.33	2.27	25%	31	6	3	18	5
OUT	0.75	0.33	2.27	75%	31	17	8	53	20
									25

PM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	1.01	0.42	2.98	63%	31	20	8	58	20
OUT	1.01	0.42	2.98	37%	31	12	5	34	10
									30

All Day Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	10.1	5.32	15.25	50%	31	157	82	236	160
OUT	10.1	5.32	15.25	50%	31	157	82	236	160
									320

Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.94	0.5	1.75	54%	31	16	8	29	15
OUT	0.94	0.5	1.75	46%	31	13	7	25	15
									30

Land Use code 230- Residential Condominium/Townhouse

All Day Weekday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	5.86	1.83	11.79	50%	464	1360	425	2735	1360
OUT	5.86	1.83	11.79	50%	464	1360	425	2735	1360
									2720

AM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.44	0.15	1.61	17%	464	35	12	127	35
OUT	0.44	0.15	1.61	83%	464	169	58	620	170
									205

PM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.52	0.18	1.24	67%	464	162	56	385	160
OUT	0.52	0.18	1.24	33%	464	80	28	190	80
									240

All Day Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	5.67	1.17	11.4	50%	464	1315	271	2645	1315
OUT	5.67	1.17	11.4	50%	464	1315	271	2645	1315
									2630

Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.47	0.14	0.93	54%	464	118	35	233	120
OUT	0.47	0.14	0.93	46%	464	100	30	198	100
									220

Land Use code 420- Marina

All Day Weekday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	2.96	1.91	10.04	50%	75	111	72	377	110
OUT	2.96	1.91	10.04	50%	75	111	72	377	110
									220

AM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.08	0.07	0.09	33%	75	2	2	2	2
OUT	0.08	0.07	0.09	67%	75	4	4	5	3
									5

PM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.19	0.17	0.21	60%	75	9	8	9	10
OUT	0.19	0.17	0.21	40%	75	6	5	6	5
									15

All Day Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	3.22	2.47	12.78	50%	75	121	93	479	120
OUT	3.22	2.47	12.78	50%	75	121	93	479	120
									240

Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Units	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.27	0.21	0.48	44%	75	9	7	16	10
OUT	0.27	0.21	0.48	56%	75	11	9	20	10
									20

Land Use Code 932- High Turnover Sit Down Restaurant

All Day Weekday

	Mean Generator	Min Generator	Max Generator	%	Number of Seats	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	4.83	4.37	5.49	50%	140	338	306	384	340
OUT	4.83	4.37	5.49	50%	140	338	306	384	340
									680

AM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Seats	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.47	0.30	0.76	52%	140	34	22	55	33
OUT	0.47	0.30	0.76	48%	140	32	20	51	32
									65

PM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Number of Seats	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.42	0.14	1.73	58%	140	34	11	140	35
OUT	0.42	0.14	1.73	42%	140	25	8	102	25
									60

All Day Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Seats	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	6.21	5.6	7.09	50%	140	435	392	496	435
OUT	6.21	5.6	7.09	50%	140	435	392	496	435
									870

Saturday

	Mean Generator	Min Generator	Max Generator	%	Number of Seats	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.88	0.45	1.88	58%	140	71	37	153	70
OUT	0.88	0.45	1.88	42%	140	52	26	111	55
									125

B4

Land Use Code 820-Shopping Center

All Day Weekday

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	42.94	12.50	270.89	50%	33	709	206	4470	710
OUT	42.94	12.50	270.89	50%	33	709	206	4470	710
									1420

AM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	1.03	0.10	9.05	61%	33	21	2	182	20
OUT	1.03	0.10	9.05	39%	33	13	1	116	15
									35

PM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	3.75	0.68	29.27	48%	33	59	11	464	60
OUT	3.75	0.68	29.27	52%	33	64	12	502	65
									125

All Day Saturday

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	49.97	16.7	227.5	50%	33	825	276	3754	825
OUT	49.97	16.7	227.5	50%	33	825	276	3754	825
									1650

Saturday

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	4.97	1.46	19.32	52%	33	85	25	332	85
OUT	4.97	1.46	19.32	48%	33	79	23	306	80
									165

Land Use Code 710-General Office

All Day Weekday

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	11.01	3.58	28.8	50%	50	275	90	720	275
OUT	11.01	3.58	28.8	50%	50	275	90	720	275
									550

AM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	1.55	0.60	5.98	88%	50	68	26	263	70
OUT	1.55	0.60	5.98	12%	50	9	4	36	10
									80

PM Peak Hour

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	1.49	0.49	6.39	17%	50	13	4	54	15
OUT	1.49	0.49	6.39	83%	50	62	20	265	60
									75

All Day Saturday

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	2.37	0.59	14.67	50%	50	59	15	367	60
OUT	2.37	0.59	14.67	50%	50	59	15	367	60
									120

Saturday

	Mean Generator	Min Generator	Max Generator	%	Square Feet 1,000	Mean Anticipated Site Traffic	Min Anticipated Site Traffic	Max Anticipated Site Traffic	Used Value
IN	0.41	0.16	1.57	54%	50	11	4	42	10
OUT	0.41	0.16	1.57	46%	50	9	4	36	10
									20

North on Roger Williams

COMMUTING PATTERNS
RHODE ISLAND WORKERS BY PLACE OF RESIDENCE AND PLACE OF WORK
2000

Commuting from: Place of Residence	WORKERS Number	Percent	Commuting to: Place of Work
East Providence	6,257	27.89%	East Providence
	5,163	23.01%	Providence
	1,510	6.73%	Pawtucket 6.73
	1,205	5.37%	Warwick
	982	4.38%	Cranston
	408	1.82%	Lincoln ½ .72
	348	1.55%	Barrington
	274	1.22%	Woonsocket
	266	1.19%	Warren
	264	1.18%	Smithfield
	248	1.11%	Johnston
	235	1.05%	Cumberland ½ .525
	200	0.89%	Bristol
	169	0.75%	North Providence
	144	0.64%	Newport
	139	0.62%	North Kingstown
	128	0.57%	Central Falls .57
	98	0.44%	North Smithfield
	90	0.40%	East Greenwich
	77	0.34%	West Warwick
	59	0.26%	Portsmouth
	50	0.22%	South Kingstown
	49	0.22%	Coventry
	48	0.21%	West Greenwich
	43	0.19%	Burrillville
	37	0.16%	Richmond
	35	0.16%	Tiverton
	29	0.13%	Middletown
	28	0.12%	Charlestown
	26	0.12%	Westerly
	21	0.09%	Scituate
	19	0.08%	Foster
	14	0.06%	Little Compton
	12	0.05%	Glocester
	10	0.04%	Exeter
	7	0.03%	Hopkinton
	0	0.00%	Jamestown
	0	0.00%	Narragansett
	0	0.00%	New Shoreham
	18,692	**83.32%**	**Total Rhode Island**
	63	0.28%	New London County, CT
	27	0.12%	New Haven County, CT
	13	0.06%	Windham County, CT
	12	0.05%	Tolland County, CT
	7	0.03%	Middlesex County, CT
	122	**0.54%**	**Total Connecticut**
	2,424	10.81%	Bristol County, MA ½ 5.4
	531	2.37%	Norfolk County, MA
	254	1.13%	Suffolk County, MA
	150	0.67%	Middlesex County, MA
	85	0.38%	Plymouth County, MA
	60	0.27%	Worcester County, MA
	19	0.08%	Nantucket County, MA
	8	0.04%	Hampden County, MA
	8	0.04%	Essex County, MA
	6	0.03%	Barnstable County, MA
	5	0.02%	Franklin County, MA
	3,550	**15.82%**	**Total Massachusetts**
	70	0.31%	All Other States
	0	0.00%	Abroad
	70	**0.31%**	**Total Other States & Abroad**
	22,434	**100.00%**	**TOTAL WORKERS**

18,305 So
use 20%

Source: U.S. Census Bureau

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JOB 03103.0 East Pointe
SHEET NO. 1 OF 4
CALCULATED BY JZR DATE 5/8/03
CHECKED BY _____ DATE _____
SCALE Distribution

Bourne & Page Williams

AM Peak 7-9 AM

OUT

11 18%
49 82%
15 14%
89 86%

IN

18% → 6
82% 27
22% → 12
78% 42

PM Peak 4-6 PM

8 38%
22 73%
13 18%
58 82%

15% → 9
85% 51
11 → 10%
90%
99

Use 20% North
80% South

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
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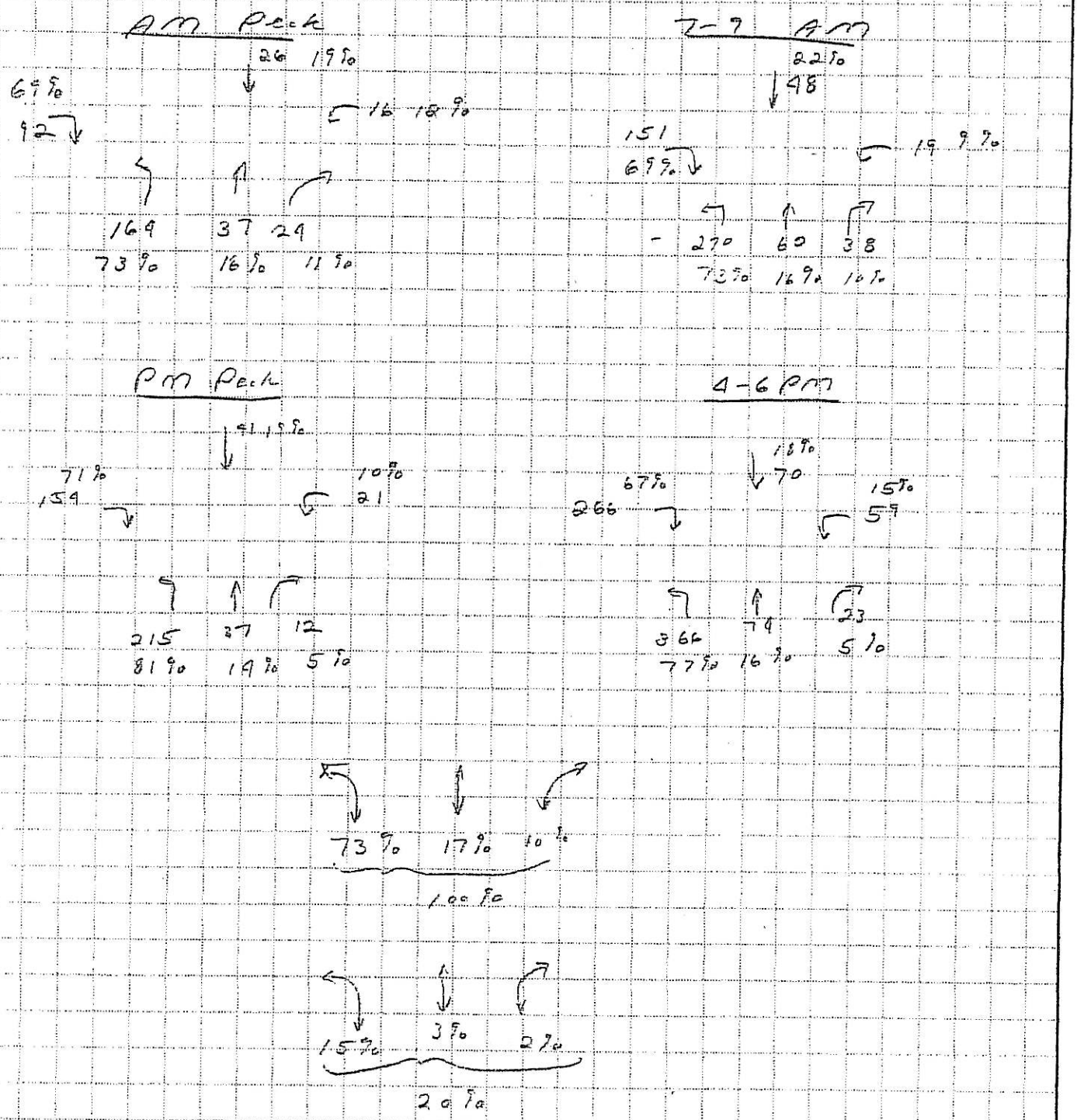
(401) 849-0810

JOB 03103.0 East Pointe
SHEET NO. 2 OF 4
CALCULATED BY JZR DATE 5/8/03
CHECKED BY _____ DATE _____
SCALE Distribution

Roger Williams & Pawtuchet Ave



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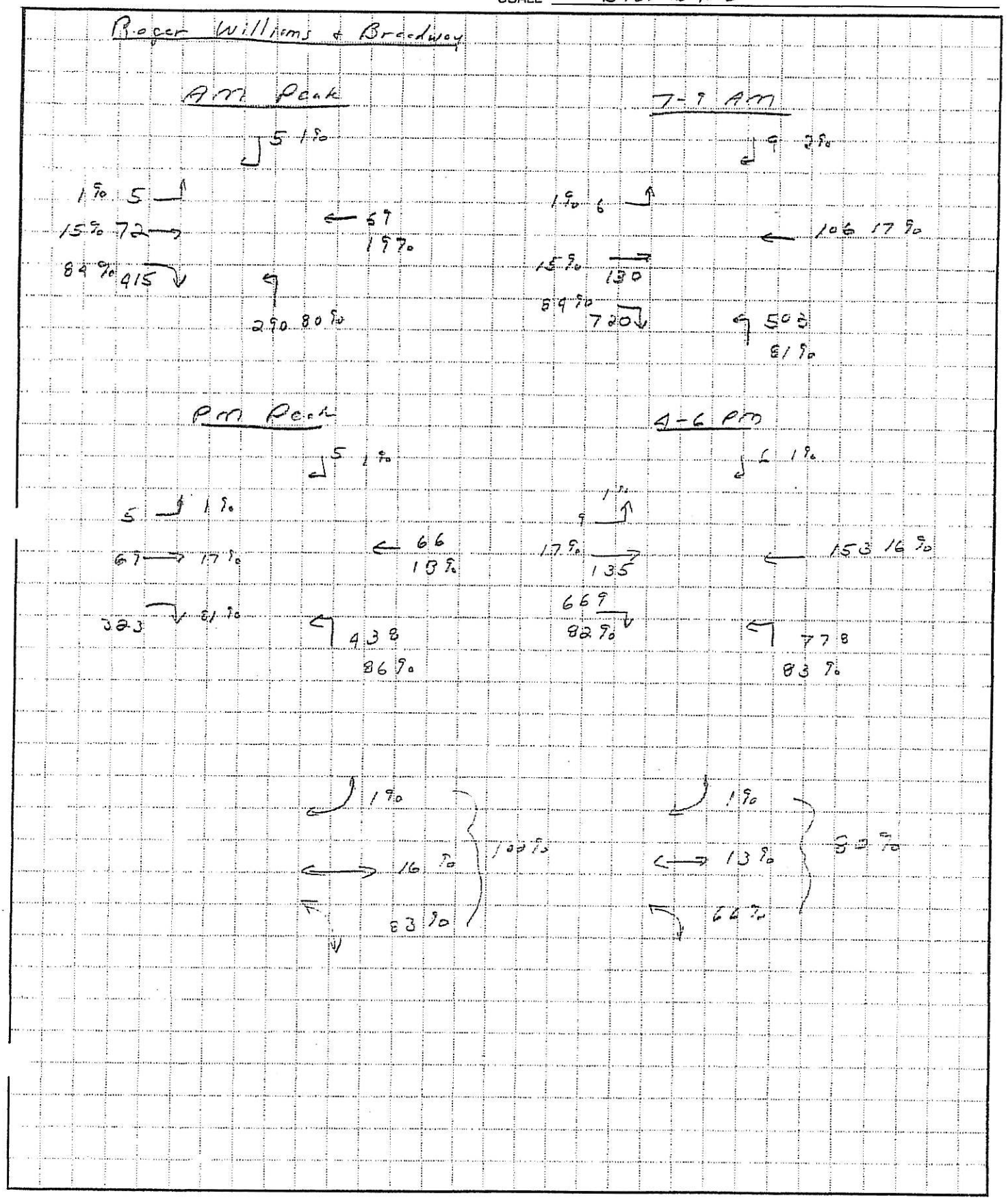
(401) 849-0810

JOB 02103.0 East Point
SHEET NO. 3 OF 4
CALCULATED BY JZR DATE 5/18/03
CHECKED BY _____ DATE _____
SCALE Distribution



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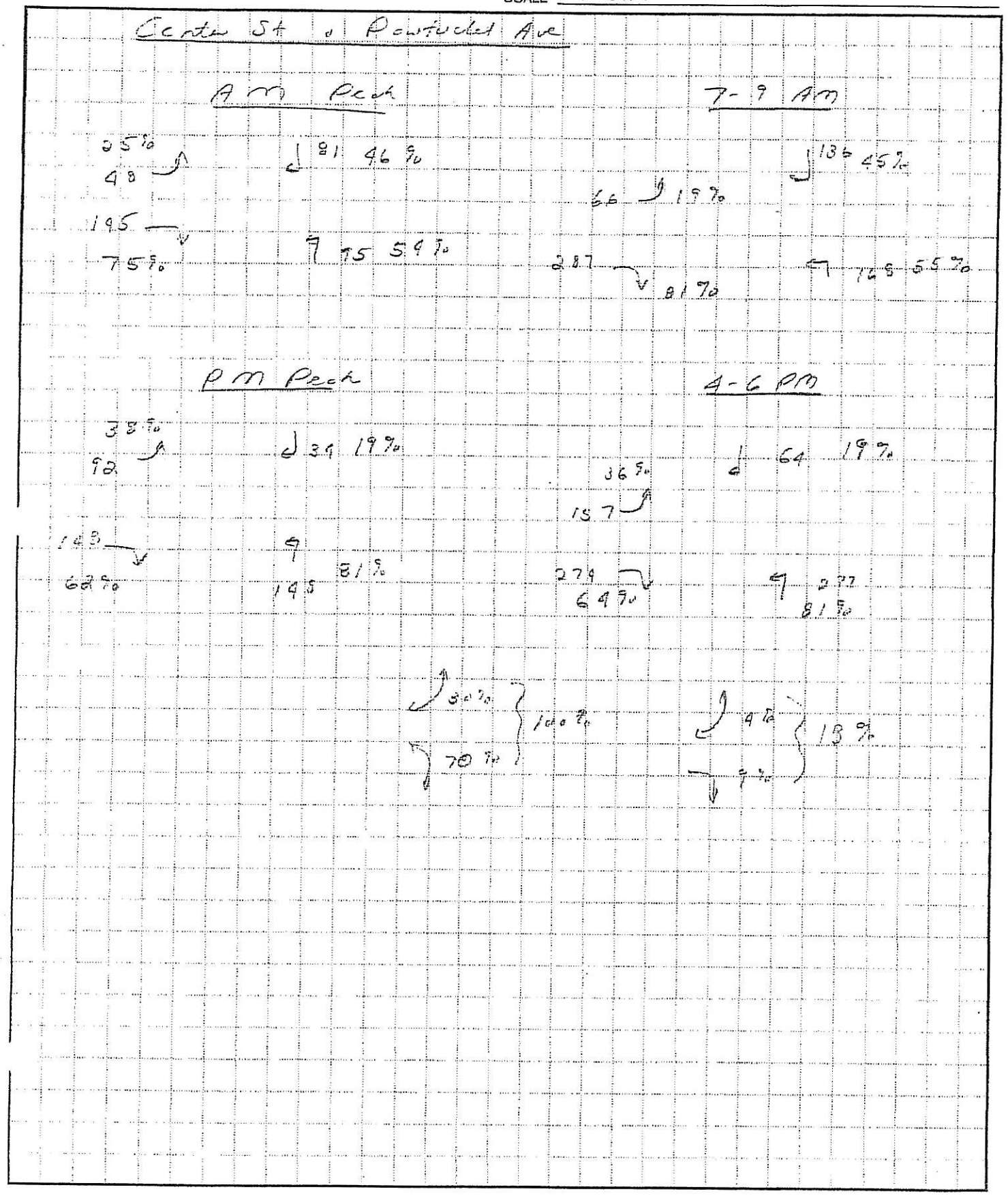
JOB 03103.0 East Pointe
SHEET NO. 4 OF 9
CALCULATED BY JZR DATE 5/8/03
CHECKED BY _____ DATE _____
SCALE Distribution



APPENDIX C

CAPACITY ANALYSES

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption and lost travel time. The delay experienced by a motorist is made up of a number of factors including amount and distribution of traffic movements, traffic composition, geometric characteristics and details of intersection signalization. LOS is evaluated for signalized intersections on the basis of control delay per vehicle. Control delay is the portion of the total delay that is attributed to the traffic signal operation. Control delay includes initial deceleration delay, queue move-up time, stopped delay and final acceleration delay. The average control delay per vehicle is estimated for each lane group and aggregated for each approach and the intersection as a whole. The LOS is directly related to the control delay as shown on the table below.

LEVEL OF SERVICE CRITERIA	
LEVEL OF SERVICE	CONTROL DELAY PER VEHICLE (SEC)
A	$\leq$ 10.0
B	> 10.0 to 20.0
C	> 20.0 to 35.0
D	> 35.0 to 55.0
E	> 55.0 to 80.0
F	> 80.00

Source: Highway Capacity Manual, Transportation Research Board, 2000.

Pawtucket Avenue and Centre Street

HCS2000™ DETAILED REPORT

General Information

Analyst	JZR
Agency or Co.	NE&C
Date Performed	3/25/04
Time Period	AM Peak Hour

Site Information

Intersection	Pawtucket Ave & Centre St
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	48		145				95	416			546	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.89		0.89				0.89	0.89			0.89	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =

Duration of Analysis, T = 1.00 | Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		217					107	467			613	
Lane group capacity, c		418					301	2161			1344	
v/c ratio, X		0.52					0.36	0.22			0.46	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		19.4					22.1	5.1			13.8	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.12					0.11	0.11			0.11	
Incremental delay, d_2		1.2					0.7	0.1			0.2	
Initial queue delay, d_3												
Control delay		20.6					22.9	5.1			14.1	
Lane group LOS		C					C	A			B	
Approach delay	20.6						8.4			14.1		
Approach LOS	C						A			B		
Intersection delay	12.8			X_c = 0.46			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information

Analyst	JZR
Agency or Co.	NE&C
Date Performed	3/30/04
Time Period	PM Peak Hour

Site Information

Intersection	Pawtucket Ave & Centre St
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	92		148				148	589			683	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.92		0.92				0.92	0.92			0.92	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =

Duration of Analysis, T = 1.00

Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		261					161	640			742	
Lane group capacity, c		423					301	2161			1344	
v/c ratio, X		0.62					0.53	0.30			0.55	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		20.0					22.9	5.4			14.5	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.20					0.14	0.11			0.15	
Incremental delay, d_2		2.7					1.9	0.1			0.5	
Initial queue delay, d_3												
Control delay		22.7					24.8	5.5			15.0	
Lane group LOS		C					C	A			B	
Approach delay	22.7						9.3			15.0		
Approach LOS	C						A			B		
Intersection delay	13.6			X_c = 0.57			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information

Analyst	JZR
Agency or Co.	NE&C
Date Performed	3/30/04
Time Period	Saturday Peak Hour

Site Information

Intersection	Pawtucket Ave & Centre St
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	37		82				83	273			314	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.85		0.85				0.85	0.85			0.85	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		140					98	321			369	
Lane group capacity, c		420					301	2161			1344	
v/c ratio, X		0.33					0.33	0.15			0.27	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		18.4					22.0	4.9			12.8	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.11					0.11	0.11			0.11	
Incremental delay, d_2		0.5					0.6	0.0			0.1	
Initial queue delay, d_3												
Control delay		18.9					22.7	4.9			12.9	
Lane group LOS		B					C	A			B	
Approach delay	18.9						9.0			12.9		
Approach LOS	B						A			B		
Intersection delay	12.0			X_c = 0.30			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Centre St
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	55		165				105	465			610	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.89		0.89				0.89	0.89			0.89	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		247					118	522			685	
Lane group capacity, c		418					301	2166			1346	
v/c ratio, X		0.59					0.39	0.24			0.51	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		19.8					22.3	5.2			14.2	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.18					0.11	0.11			0.12	
Incremental delay, d_2		2.2					0.8	0.1			0.3	
Initial queue delay, d_3												
Control delay		22.0					23.1	5.2			14.5	
Lane group LOS		C					C	A			B	
Approach delay	22.0						8.5			14.5		
Approach LOS	C						A			B		
Intersection delay	13.3			X_c = 0.51			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Centre St
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	PM Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_t	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	105		170				170	660			765	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.92		0.92				0.92	0.92			0.92	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		299					185	717			832	
Lane group capacity, c		423					301	2166			1346	
v/c ratio, X		0.71					0.61	0.33			0.62	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		20.5					23.2	5.5			15.0	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.27					0.20	0.11			0.20	
Incremental delay, d_2		5.5					3.8	0.1			0.9	
Initial queue delay, d_3												
Control delay		26.0					27.0	5.6			15.8	
Lane group LOS		C					C	A			B	
Approach delay	26.0						10.0			15.8		
Approach LOS	C						B			B		
Intersection delay	14.7			X_c = 0.65			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Centre St
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	Saturday Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	45		95				95	305			350	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.85		0.85				0.85	0.85			0.85	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		165					112	359			412	
Lane group capacity, c		421					301	2166			1345	
v/c ratio, X		0.39					0.37	0.17			0.31	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		18.7					22.2	4.9			12.9	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.11					0.11	0.11			0.11	
Incremental delay, d_2		0.6					0.8	0.0			0.1	
Initial queue delay, d_3												
Control delay		19.3					23.0	4.9			13.1	
Lane group LOS		B					C	A			B	
Approach delay	19.3						9.2			13.1		
Approach LOS	B						A			B		
Intersection delay	12.3			X_c = 0.35			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Centre St
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05/04	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	65		185				120	465			610	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.89		0.89				0.89	0.89			0.89	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		281					135	522			685	
Lane group capacity, c		418					301	2166			1346	
v/c ratio, X		0.67					0.45	0.24			0.51	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		20.3					22.5	5.2			14.2	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.24					0.11	0.11			0.12	
Incremental delay, d_2		4.3					1.1	0.1			0.3	
Initial queue delay, d_3												
Control delay		24.6					23.6	5.2			14.5	
Lane group LOS		C					C	A			B	
Approach delay	24.6						9.0			14.5		
Approach LOS	C						A			B		
Intersection delay	14.0			X_c = 0.55			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Centre St
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	PM Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	110		190				195	660			765	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.92		0.92				0.92	0.92			0.92	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		327					212	717			832	
Lane group capacity, c		422					301	2166			1346	
v/c ratio, X		0.77					0.70	0.33			0.62	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		20.9					23.6	5.5			15.0	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay callbration, k		0.32					0.27	0.11			0.20	
Incremental delay, d_2		9.3					7.6	0.1			0.9	
Initial queue delay, d_3												
Control delay		30.2					31.2	5.6			15.8	
Lane group LOS		C					C	A			B	
Approach delay	30.2						11.5			15.8		
Approach LOS	C						B			B		
Intersection delay	16.1			X_c = 0.68			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Centre St
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	Saturday Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	0	0	0	0	0	1	2	0	0	2	0
Lane group		LR					L	T			T	
Volume, V (vph)	55		115				120	300			350	
% Heavy vehicles, %HV	1		1				0	3			3	
Peak-hour factor, PHF	0.85		0.85				0.85	0.85			0.85	
Pretimed (P) or actuated (A)	A		A				A	A			A	
Start-up lost time, l_1		2.0					2.0	2.0			2.0	
Extension of effective green, e		2.0					2.0	2.0			2.0	
Arrival type, AT		3					3	3			3	
Unit extension, UE		3.0					3.0	3.0			3.0	
Filtering/metering, I		1.000					1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0					0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0						0		
Lane width		12.0					12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N		N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0					0	0			0	
Min. time for pedestrians, G_p	3.2			3.2						3.2		

Phasing	EB Only	02	03	04	NB Only	Thru Only	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 23.0	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y = 4	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		200					141	353			412	
Lane group capacity, c		421					301	2166			1346	
v/c ratio, X		0.48					0.47	0.16			0.31	
Total green ratio, g/C		0.25					0.17	0.62			0.38	
Uniform delay, d_1		19.1					22.6	4.9			12.9	
Progression factor, PF		1.000					1.000	1.000			1.000	
Delay calibration, k		0.11					0.11	0.11			0.11	
Incremental delay, d_2		0.9					1.2	0.0			0.1	
Initial queue delay, d_3												
Control delay		20.0					23.8	4.9			13.1	
Lane group LOS		B					C	A			B	
Approach delay	20.0						10.3			13.1		
Approach LOS	B						B			B		
Intersection delay	13.1			X_c = 0.39			Intersection LOS			B		

Pawtucket Avenue and Roger Williams Avenue

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Roger Williams
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	3/30/04	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2003
		Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	164	37	24	5	26	14	16	532	4	15	297	92
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		250			51			613			449	
Lane group capacity, c		445			556			999			966	
v/c ratio, X		0.56			0.09			0.61			0.46	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		17.0			14.4			9.2			8.2	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.16			0.11			0.20			0.11	
Incremental delay, d_2		1.6			0.1			1.1			0.4	
Initial queue delay, d_3												
Control delay		18.7			14.5			10.3			8.5	
Lane group LOS		B			B			B			A	
Approach delay	18.7			14.5			10.3			8.5		
Approach LOS	B			B			B			A		
Intersection delay	11.4			X_c = 0.59			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information

Analyst	JZR
Agency or Co.	NE&C
Date Performed	3/30/04
Time Period	PM Peak Hour

Site Information

Intersection	Pawtucket Ave & Roger Williams
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N,	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	215	37	12	4	41	21	21	415	12	14	466	154
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		281			70			476			675	
Lane group capacity, c		428			566			976			978	
v/c ratio, X		0.66			0.12			0.49			0.69	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		17.7			14.6			8.3			9.8	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.23			0.11			0.11			0.26	
Incremental delay, d_2		3.7			0.1			0.4			2.1	
Initial queue delay, d_3												
Control delay		21.4			14.7			8.7			11.9	
Lane group LOS		C			B			A			B	
Approach delay	21.4			14.7			8.7			11.9		
Approach LOS	C			B			A			B		
Intersection delay	12.8			X_c = 0.68			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information

Analyst	JZR
Agency or Co.	NE&C
Date Performed	3/30/04
Time Period	Saturday Peak Hour

Site Information

Intersection	Pawtucket Ave & Roger Williams
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	92	28	21	2	36	19	14	224	2	32	218	61
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		156			63			267			346	
Lane group capacity, c		462			571			991			950	
v/c ratio, X		0.34			0.11			0.27			0.36	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		15.7			14.5			7.1			7.6	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.11			0.11			0.11			0.11	
Incremental delay, d_2		0.4			0.1			0.1			0.2	
Initial queue delay, d_3												
Control delay		16.1			14.6			7.3			7.8	
Lane group LOS		B			B			A			A	
Approach delay	16.1			14.6			7.3			7.8		
Approach LOS	B			B			A			A		
Intersection delay	9.7			X_c = 0.35			Intersection LOS			A		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Roger Williams
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	185	45	30	5	30	15	20	595	5	15	330	105
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		289			56			689			501	
Lane group capacity, c		445			557			995			965	
v/c ratio, X		0.65			0.10			0.69			0.52	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		17.6			14.5			9.8			8.5	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.23			0.11			0.26			0.12	
Incremental delay, d_2		3.4			0.1			2.1			0.5	
Initial queue delay, d_3												
Control delay		21.0			14.5			11.9			9.0	
Lane group LOS		C			B			B			A	
Approach delay	21.0			14.5			11.9			9.0		
Approach LOS	C			B			B			A		
Intersection delay	12.8			X_c = 0.68			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Roger Williams
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	PM Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	245	40	15	5	45	25	25	465	15	15	520	175
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		320			80			538			755	
Lane group capacity, c		425			562			965			976	
v/c ratio, X		0.75			0.14			0.56			0.77	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		18.4			14.7			8.8			10.6	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.31			0.11			0.15			0.32	
Incremental delay, d_2		7.8			0.1			0.7			4.0	
Initial queue delay, d_3												
Control delay		26.2			14.8			9.5			14.6	
Lane group LOS		C			B			A			B	
Approach delay	26.2			14.8			9.5			14.6		
Approach LOS	C			B			A			B		
Intersection delay	15.2			X_c = 0.77			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Roger Williams
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	Saturday Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	105	30	25	2	40	20	15	250	2	35	245	70
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		178			68			297			389	
Lane group capacity, c		455			572			990			948	
v/c ratio, X		0.39			0.12			0.30			0.41	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		16.0			14.6			7.3			7.8	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.11			0.11			0.11			0.11	
Incremental delay, d_2		0.6			0.1			0.2			0.3	
Initial queue delay, d_3												
Control delay		16.5			14.6			7.4			8.1	
Lane group LOS		B			B			A			A	
Approach delay	16.5			14.6			7.4			8.1		
Approach LOS	B			B			A			A		
Intersection delay	10.0			X_c = 0.40			Intersection LOS			A		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Roger Williams
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	220	55	35	5	35	15	25	595	5	15	330	130
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		344			62			695			528	
Lane group capacity, c		443			559			987			962	
v/c ratio, X		0.78			0.11			0.70			0.55	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		18.6			14.5			9.9			8.7	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.33			0.11			0.27			0.15	
Incremental delay, d_2		9.0			0.1			2.3			0.7	
Initial queue delay, d_3												
Control delay		27.6			14.6			12.2			9.4	
Lane group LOS		C			B			B			A	
Approach delay	27.6			14.6			12.2			9.4		
Approach LOS	C			B			B			A		
Intersection delay	14.6			X_c = 0.73			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Roger Williams
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	PM Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N,	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	280	50	20	5	55	25	30	465	15	15	520	220
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		372			91			543			803	
Lane group capacity, c		426			565			951			972	
v/c ratio, X		0.87			0.16			0.57			0.83	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		19.4			14.8			8.9			11.1	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.40			0.11			0.17			0.36	
Incremental delay, d_2		21.4			0.1			0.8			6.3	
Initial queue delay, d_3												
Control delay		40.7			14.9			9.7			17.4	
Lane group LOS		D			B			A			B	
Approach delay	40.7			14.9			9.7			17.4		
Approach LOS	D			B			A			B		
Intersection delay	19.8			X_c = 0.84			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	Pawtucket Ave & Roger Williams
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	6/7/05	Jurisdiction	East Providence, RI
Time Period	Saturday Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	0	0	1	0	0	1	0	0	1	0
Lane group		LTR			LTR			LTR			LTR	
Volume, V (vph)	145	40	30	2	50	20	20	250	2	35	245	115
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3	0	0	3	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A	A	A	A	A
Start-up lost time, l_1		2.0			2.0			2.0			2.0	
Extension of effective green, e		2.0			2.0			2.0			2.0	
Arrival type, AT		3			3			3			3	
Unit extension, UE		3.0			3.0			3.0			3.0	
Filtering/metering, I		1.000			1.000			1.000			1.000	
Initial unmet demand, Q_b		0.0			0.0			0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0		0	0		0
Lane width		12.0			12.0			12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0			0			0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NS Perm	06	07	08
Timing	G = 19.0	G =	G =	G =	G = 33.0	G =	G =	G =
	Y = 4	Y =	Y =	Y =	Y = 4	Y =	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		238			80			302			439	
Lane group capacity, c		441			576			977			942	
v/c ratio, X		0.54			0.14			0.31			0.47	
Total green ratio, g/C		0.32			0.32			0.55			0.55	
Uniform delay, d_1		16.9			14.7			7.3			8.2	
Progression factor, PF		1.000			1.000			1.000			1.000	
Delay calibration, k		0.14			0.11			0.11			0.11	
Incremental delay, d_2		1.3			0.1			0.2			0.4	
Initial queue delay, d_3												
Control delay		18.2			14.8			7.5			8.5	
Lane group LOS		B			B			A			A	
Approach delay	18.2			14.8			7.5			8.5		
Approach LOS	B			B			A			A		
Intersection delay	10.9			X_c = 0.49			Intersection LOS			B		

North Broadway and Roger Williams Avenue/Centre Street

HCS2000™ DETAILED REPORT

General Information

alyst	JZR
ncy or Co.	NE&C
Date Performed	5/13/03
Time Period	AM Peak Hour

Site Information

Intersection	North Broadway & Roger William
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	5	72	415	149	69	19	290	393		8	542	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93		0.93	0.93	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
es stopping, N_B		0	0		0		0	0			0	
...l. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 18.0	G =	G =	G =	G = 6.0	G = 26.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		82	446		254		312	423			592	
Lane group capacity, c		550	740		410		420	1077			795	
v/c ratio, X		0.15	0.60		0.62		0.74	0.39			0.74	
Total green ratio, g/C		0.30	0.46		0.30		0.08	0.58			0.43	
Uniform delay, d_1		15.4	12.2		18.1		12.5	6.8			14.2	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.19		0.20		0.30	0.11			0.30	
Incremental delay, d_2		0.1	1.4		2.9		7.3	0.2			3.9	
Initial queue delay, d_3												
Control delay		15.5	13.6		20.9		19.8	7.0			18.2	
Lane group LOS		B	B		C		B	A			B	
Approach delay	13.9			20.9			12.4			18.2		
Approach LOS	B			C			B			B		
Intersection delay	15.4						Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information

Analyst	JZR
Agency or Co.	NE&C
Date Performed	5/20/03
Time Period	PM Peak Hour

Site Information

Intersection	North Broadway & Roger William
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	5	69	323	85	66	9	438	569	-	14	456	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87		0.87	0.87	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
ses stopping, N_B		0	0		0		0	0			0	
...n. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 14.0	G =	G =	G =	G = 10.0	G = 26.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =

Duration of Analysis, T = 1.00 | Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		85	371		184		503	654			540	
Lane group capacity, c		427	740		336		569	1200			784	
v/c ratio, X		0.20	0.50		0.55		0.88	0.55			0.69	
Total green ratio, g/C		0.23	0.46		0.23		0.15	0.65			0.43	
Uniform delay, d_1		18.5	11.4		20.2		8.2	5.7			13.7	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.11		0.15		0.41	0.15			0.26	
Incremental delay, d_2		0.2	0.5		1.9		18.2	0.5			2.6	
Initial queue delay, d_3												
Control delay		18.7	12.0		22.1		26.4	6.2			16.3	
Lane group LOS		B	B		C		C	A			B	
Approach delay	13.2			22.1			15.0			16.3		
Approach LOS	B			C			B			B		
Intersection delay	15.5						Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information

Analyst	JZR
Agency or Co.	NE&C
Date Performed	5/20/03
Time Period	Saturday Peak Hour

Site Information

Intersection	North Broadway & Roger William
Area Type	All other areas
Jurisdiction	East Providence, RI
Analysis Year	2003
Project ID	Existing Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	3	44	237	54	36	22	215	301	-	19	281	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0		0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 14.0	G =	G =	G =	G = 10.0	G = 26.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =

Duration of Analysis, T = 1.00 — Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		49	247		117		224	314			313	
Lane group capacity, c		430	740		366		712	1200			780	
v/c ratio, X		0.11	0.33		0.32		0.31	0.26			0.40	
Total green ratio, g/C		0.23	0.46		0.23		0.15	0.65			0.43	
Uniform delay, d_1		18.1	10.4		19.1		5.1	4.4			11.7	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.11		0.11		0.11	0.11			0.11	
Incremental delay, d_2		0.1	0.3		0.5		0.3	0.1			0.3	
Initial queue delay, d_3												
Control delay		18.2	10.7		19.6		5.4	4.5			12.0	
Lane group LOS		B	B		B		A	A			B	
Approach delay	11.9			19.6			4.9			12.0		
Approach LOS	B			B			A			B		
Intersection delay	9.7						Intersection LOS			A		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	5	85	485	165	80	20	335	440		10	605	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93		0.93	0.93	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0		0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 17.0	G =	G =	G =	G = 7.0	G = 26.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		96	522		285		360	473			662	
Lane group capacity, c		520	740		363		421	1107			794	
v/c ratio, X		0.18	0.71		0.79		0.86	0.43			0.83	
Total green ratio, g/C		0.28	0.46		0.28		0.60	0.60			0.43	
Uniform delay, d_1		16.3	13.0		19.8		9.5	6.5			15.1	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.27		0.33		0.39	0.11			0.37	
Incremental delay, d_2		0.2	3.1		11.7		18.3	0.3			8.2	
Initial queue delay, d_3												
Control delay		16.4	16.1		31.5		27.8	6.7			23.3	
Lane group LOS		B	B		C		C	A			C	
Approach delay	16.2			31.5			15.8			23.3		
Approach LOS	B			C			B			C		
Intersection delay	19.8			X_c = 0.97			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	PM Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	5	80	375	95	75	10	510	635		15	510	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		0.90	0.90	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0		0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 12.0	G =	G =	G =	G = 12.0	G = 26.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		95	417		200		567	706			584	
Lane group capacity, c		366	740		243		607	1261			783	
v/c ratio, X		0.26	0.56		0.82		0.93	0.56			0.75	
Total green ratio, g/C		0.20	0.46		0.20		0.68	0.68			0.43	
Uniform delay, d_1		20.3	11.9		23.0		8.7	4.9			14.2	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.16		0.36		0.45	0.16			0.30	
Incremental delay, d_2		0.4	1.0		23.2		30.1	0.6			4.0	
Initial queue delay, d_3												
Control delay		20.6	12.9		46.2		38.8	5.4			18.3	
Lane group LOS		C	B		D		D	A			B	
Approach delay	14.3			46.2			20.3			18.3		
Approach LOS	B			D			C			B		
Intersection delay	20.7			X_c = 1.10			Intersection LOS			C		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	Saturday Peak Hour	Analysis Year	2010
		Project ID	Background Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_1	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	5	50	275	60	45	25	250	335		20	315	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0		0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 14.0	G =	G =	G =	G = 10.0	G = 26.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =

Duration of Analysis, T = 1.00	Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		57	286		136		260	349			349	
Lane group capacity, c		427	740		364		686	1199			780	
v/c ratio, X		0.13	0.39		0.37		0.38	0.29			0.45	
Total green ratio, g/C		0.23	0.46		0.23		0.65	0.65			0.43	
Uniform delay, d_1		18.2	10.7		19.3		5.4	4.5			12.0	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.11		0.11		0.11	0.11			0.11	
Incremental delay, d_2		0.1	0.3		0.6		0.4	0.1			0.4	
Initial queue delay, d_3												
Control delay		18.3	11.0		20.0		5.8	4.7			12.4	
Lane group LOS		B	B		B		A	A			B	
Approach delay	12.2			20.0			5.1			12.4		
Approach LOS	B			B			A			B		
Intersection delay	10.0			X_c = 0.57			Intersection LOS			A		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2008
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N,	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	10	115	650	165	100	20	445	440		10	605	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93		0.93	0.93	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0		0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 28.0	G =	G =	G =	G = 17.0	G = 35.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		135	699		307		478	473			662	
Lane group capacity, c		563	870		357		490	1127			712	
v/c ratio, X		0.24	0.80		0.86		0.98	0.42			0.93	
Total green ratio, g/C		0.31	0.54		0.31		0.61	0.61			0.39	
Uniform delay, d_1		23.1	16.9		29.2		19.1	9.2			26.3	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.35		0.39		0.48	0.11			0.45	
Incremental delay, d_2		0.2	5.8		22.2		59.7	0.3			24.9	
Initial queue delay, d_3												
Control delay		23.3	22.6		51.4		78.8	9.4			51.2	
Lane group LOS		C	C		D		E	A			D	
Approach delay	22.8			51.4			44.3			51.2		
Approach LOS	C			D			D			D		
Intersection delay	40.2			X_c = 1.00			Intersection LOS			D		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	PM Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	10	110	535	95	115	10	715	635		15	510	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		0.90	0.90	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0		0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 20.0	G =	G =	G =	G = 32.0	G = 28.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y = 3	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		133	594		245		794	706			584	
Lane group capacity, c		404	996		233		742	1291			560	
v/c ratio, X		0.33	0.60		1.05		1.07	0.55			1.04	
Total green ratio, g/C		0.22	0.62		0.22		0.70	0.70			0.31	
Uniform delay, d_1		29.4	10.5		35.0		22.9	6.6			31.0	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.19		0.50		0.50	0.15			0.50	
Incremental delay, d_2		0.5	1.0		175.9		156.1	0.5			125.3	
Initial queue delay, d_3												
Control delay		29.9	11.4		210.9		178.9	7.1			156.3	
Lane group LOS		C	B		F		F	A			F	
Approach delay	14.8			210.9			98.0			156.3		
Approach LOS	B			F			F			F		
Intersection delay	98.4			X_c = 1.24			Intersection LOS			F		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	Saturday Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	1	0	1	0	0	2	0	0	1	0
Lane group		LT	R		LTR		DefL	T			LT	
Volume, V (vph)	10	80	455	60	85	25	455	335		20	315	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0		2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0		2.0		2.0	2.0			2.0	
Arrival type, AT		3	3		3		3	3			3	
Unit extension, UE		3.0	3.0		3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000		1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0		0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0		12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0		0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 15.0	G =	G =	G =	G = 10.0	G = 25.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y =	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		93	474		178		474	349			349	
Lane group capacity, c		452	767		403		663	1168			750	
v/c ratio, X		0.21	0.62		0.44		0.71	0.30			0.47	
Total green ratio, g/C		0.25	0.47		0.25		0.63	0.63			0.42	
Uniform delay, d_1		17.8	11.7		19.0		7.0	5.0			12.7	
Progression factor, PF		1.000	1.000		1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.20		0.11		0.28	0.11			0.11	
Incremental delay, d_2		0.2	1.5		0.8		3.8	0.1			0.5	
Initial queue delay, d_3												
Control delay		18.0	13.2		19.7		10.7	5.1			13.1	
Lane group LOS		B	B		B		B	A			B	
Approach delay	14.0			19.7			8.3			13.1		
Approach LOS	B			B			A			B		
Intersection delay	12.0			X_c = 0.62			Intersection LOS			B		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	9/30/04	Jurisdiction	East Providence, RI
Time Period	AM Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes With Improvements

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	1	1	1	0	0	2	0	0	1	0
Lane group		LT	R	L	TR		DefL	T			LT	
Volume, V (vph)	10	115	650	165	100	20	445	440		10	605	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93		0.93	0.93	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival type, AT		3	3	3	3		3	3			3	
Unit extension, UE		3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0	0	0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	EW Perm	02	03	04	NB Only	NS Perm	07	08
Timing	G = 24.0	G =	G =	G =	G = 18.0	G = 38.0	G =	G =
	Y = 3.5	Y =	Y =	Y =	Y = 3	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00						Cycle Length, C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		135	699	177	130		478	473			662	
Lane group capacity, c		488	816	307	494		561	1209			773	
v/c ratio, X		0.28	0.86	0.58	0.26		0.85	0.39			0.86	
Total green ratio, g/C		0.27	0.51	0.27	0.27		0.66	0.66			0.42	
Uniform delay, d_1		26.1	19.4	28.6	26.0		14.6	7.2			23.5	
Progression factor, PF		1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.39	0.17	0.11		0.38	0.11			0.39	
Incremental delay, d_2		0.3	9.9	2.7	0.3		13.5	0.2			10.4	
Initial queue delay, d_3												
Control delay		26.4	29.3	31.3	26.3		28.1	7.4			33.9	
Lane group LOS		C	C	C	C		C	A			C	
Approach delay	28.8			29.2			17.8			33.9		
Approach LOS	C			C			B			C		
Intersection delay	26.3			X_c = 0.86			Intersection LOS			C		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/04	Jurisdiction	East Providence, RI
Time Period	PM Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes With Improvements

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_i	0	1	1	1	1	0	0	2	0	0	1	0
Lane group		LT	R	L	TR		DefL	T			LT	
Volume, V (vph)	10	110	535	95	115	10	715	635		15	510	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90		0.90	0.90	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_i		2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival type, AT		3	3	3	3		3	3			3	
Unit extension, UE		3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0	0	0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	WB Only	EW Perm	03	04	NB Only	NS Perm	07	08
Timing	G = 4.0	G = 10.0	G =	G =	G = 37.0	G = 36.0	G =	G =
	Y = 3	Y = 3.5	Y =	Y =	Y = 3	Y = 3.5	Y =	Y =
Duration of Analysis, T = 1.00					Cycle Length, C = 100.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		133	594	106	139		794	706			584	
Lane group capacity, c		181	816	145	319		825	1402			648	
v/c ratio, X		0.73	0.73	0.73	0.44		0.96	0.50			0.90	
Total green ratio, g/C		0.10	0.50	0.17	0.17		0.76	0.76			0.36	
Uniform delay, d_1		43.7	19.4	39.8	37.2		21.1	4.7			30.3	
Progression factor, PF		1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay calibration, k		0.29	0.29	0.29	0.11		0.47	0.11			0.42	
Incremental delay, d_2		15.6	3.4	18.8	1.0		34.8	0.3			19.3	
Initial queue delay, d_3												
Control delay		59.4	22.7	58.7	38.2		55.9	5.0			49.7	
Lane group LOS		E	C	E	D		E	A			D	
Approach delay	29.4			47.0			31.9			49.7		
Approach LOS	C			D			C			D		
Intersection delay	35.9			X_c = 0.95			Intersection LOS			D		

HCS2000™ DETAILED REPORT

General Information		Site Information	
Analyst	JZR	Intersection	North Broadway & Roger William
Agency or Co.	NE&C	Area Type	All other areas
Date Performed	5/31/05	Jurisdiction	East Providence, RI
Time Period	Saturday Peak Hour	Analysis Year	2010
		Project ID	Combined Traffic Volumes With Improvements

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N_l	0	1	1	1	1	0	0	2	0	0	1	0
Lane group		LT	R	L	TR		DefL	T			LT	
Volume, V (vph)	10	80	455	60	85	25	455	335		20	315	
% Heavy vehicles, %HV	0	2	0	2	0	0	0	3		0	3	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		0.96	0.96	
Pretimed (P) or actuated (A)	A	A	A	A	A	A	A	A		A	A	
Start-up lost time, l_1		2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Extension of effective green, e		2.0	2.0	2.0	2.0		2.0	2.0			2.0	
Arrival type, AT		3	3	3	3		3	3			3	
Unit extension, UE		3.0	3.0	3.0	3.0		3.0	3.0			3.0	
Filtering/metering, I		1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Initial unmet demand, Q_b		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Ped / Bike / RTOR volumes	0		0	0		0	0			0		
Lane width		12.0	12.0	12.0	12.0		12.0	12.0			12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking maneuvers, N_m												
Buses stopping, N_B		0	0	0	0		0	0			0	
Min. time for pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	WB Only	EW Perm	03	04	NB Only	NS Perm	07	08
Timing	G = 3.0	G = 10.0	G =	G =	G = 10.0	G = 24.0	G =	G =
	Y = 3	Y = 3.5	Y =	Y =	Y =	Y = 3.5	Y =	Y =

Duration of Analysis, T = 1.00 | Cycle Length, C = 60.0

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted flow rate, v		93	474	63	115		474	349			349	
Lane group capacity, c		301	633	294	490		641	1138			719	
v/c ratio, X		0.31	0.75	0.21	0.23		0.74	0.31			0.49	
Total green ratio, g/C		0.17	0.39	0.27	0.27		0.62	0.62			0.40	
Uniform delay, d_1		22.0	15.7	16.8	17.2		7.6	5.4			13.4	
Progression factor, PF		1.000	1.000	1.000	1.000		1.000	1.000			1.000	
Delay calibration, k		0.11	0.30	0.11	0.11		0.30	0.11			0.11	
Incremental delay, d_2		0.6	5.1	0.4	0.2		4.7	0.2			0.5	
Initial queue delay, d_3												
Control delay		22.6	20.8	17.2	17.5		12.2	5.6			13.9	
Lane group LOS		C	C	B	B		B	A			B	
Approach delay	21.1			17.4			9.4			13.9		
Approach LOS	C			B			A			B		
Intersection delay	14.4			X_c = 0.66			Intersection LOS			B		

LEVEL OF SERVICE FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS) for unsignalized intersections is based on the assumption that minor street movements do not affect major street traffic. In order for the minor street traffic or traffic turning left into the minor street to proceed vehicles must wait for a gap in the major street traffic. The distribution of available gaps in the major street traffic stream depends on the total volume of traffic, its directional distribution, the number of lanes on the major street and the degree and type of platooning in the traffic stream. The gap sizes required by the minor street drivers depend on the type of maneuver (left, through, right), the number of lanes on the major street, the speed of major street traffic, sight distance, the length of time the major street vehicles has been waiting and driver characteristics (eyesight, reaction time, age). LOS is determined based on the control delay and is defined for each minor movement but not for the intersection as a whole. The LOS criteria are based on average control delay per vehicle as shown in the table below. Control delay is the total elapsed time for a vehicle joining the queue until its departure from the stop position at the head of the queue. The control delay also includes the time required to decelerate to a stop and to accelerate to the free flow speed.

LEVEL OF SERVICE CRITERIA	
LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SEC)
A	≤ 10.0
B	> 10.0 to 15.0
C	> 15.0 to 25.0
D	> 25.0 to 35.0
E	> 35.0 to 50.0
F	> 50.00

Source: Highway Capacity Manual, Transportation Research Board, 2000.

Roger Williams Avenue and Bourne Avenue

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/21/04	Analysis Year	2004
Analysis Time Period	AM Peak		

Project Description: Existing Traffic Volumes

East/West Street: Bourne Avenue | North/South Street: Roger Williams Ave

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	40	163	27	6	170	14
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	42	173	28	6	180	14
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	49	0	11	11	4	29
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	52	0	11	11	4	30
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	42	6		63			45	
C (m) (vph)	1379	1383		500			675	
v/c	0.03	0.00		0.13			0.07	
95% queue length	0.09	0.01		0.43			0.21	
Control Delay	7.7	7.6		13.2			10.7	
LOS	A	A		B			B	
Approach Delay	--	--	13.2			10.7		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/21/04	Analysis Year	2004
Analysis Time Period	PM Peak		

Project Description	Existing Traffic Volumes
East/West Street:	Bourne Ave
North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South
Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	16	274	51	9	248	12
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	17	301	56	9	272	13
Percent Heavy Vehicles	2	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	22	2	8	23	2	55
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	24	2	8	25	2	60
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	17	9		34			87	
C (m) (vph)	1277	1213		377			566	
v/c	0.01	0.01		0.09			0.15	
95% queue length	0.04	0.02		0.30			0.54	
Control Delay	7.9	8.0		15.5			12.5	
LOS	A	A		C			B	
Approach Delay	–	–	15.5			12.5		
Approach LOS	–	–	C			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/21/04	Analysis Year	2004
Analysis Time Period	SAT Peak		

Project Description	Existing Traffic Volumes
East/West Street:	Bourne Ave
North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South
Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	159	26	4	191	2
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	8	174	28	4	209	2
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	20	2	2	4	1	5
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	21	2	2	4	1	5
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	8	4		25			10	
C (m) (vph)	1360	1382		550			646	
v/c	0.01	0.00		0.05			0.02	
95% queue length	0.02	0.01		0.14			0.05	
Control Delay	7.7	7.6		11.9			10.7	
LOS	A	A		B			B	
Approach Delay	--	--	11.9			10.7		
Approach LOS	--	--	B			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	AM Peak		
Project Description	Background Traffic Volumes		
East/West Street:	Bourne Avenue	North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	55	185	30	5	210	20
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	58	196	31	5	223	21
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	55	0	15	15	5	35
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	58	0	15	15	5	37
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	58	5		73			57	
C (m) (vph)	1322	1353		429			595	
v/c	0.04	0.00		0.17			0.10	
95% queue length	0.14	0.01		0.61			0.32	
Control Delay	7.8	7.7		15.1			11.7	
LOS	A	A		C			B	
Approach Delay	--	--	15.1			11.7		
Approach LOS	--	--	C			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	PM Peak		

Project Description: Background Traffic Volumes

East/West Street: Bourne Ave | North/South Street: Roger Williams Ave

Intersection Orientation: North-South | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	20	335	55	10	290	15
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	21	368	60	10	318	16
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	25	2	10	30	2	70
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	27	2	10	32	2	76
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	21	10		39			110	
C (m) (vph)	1225	1142		306			495	
v/c	0.02	0.01		0.13			0.22	
95% queue length	0.05	0.03		0.43			0.84	
Control Delay	8.0	8.2		18.5			14.3	
LOS	A	A		C			B	
Approach Delay	--	--	18.5			14.3		
Approach LOS	--	--	C			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*JZR*	Intersection	*Roger Williams Ave & Bourne Av*
Agency/Co.	*NE&C*	Jurisdiction	*East Providence*
Date Performed	*6/7/05*	Analysis Year	*2010*
Analysis Time Period	*SAT Peak*		

Project Description *Background Traffic Volumes*

East/West Street: *Bourne Ave* | North/South Street: *Roger Williams Ave*

Intersection Orientation: *North-South* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	*10*	*190*	*30*	*5*	*170*	*2*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR	*10*	*208*	*32*	*5*	*186*	*2*
Percent Heavy Vehicles	2	–	–	*0*	–	–
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LTR*			*LTR*		
Upstream Signal		*0*			*0*	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	*20*	*2*	*2*	*5*	*1*	*5*
Peak-Hour Factor, PHF	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*	*0.91*
Hourly Flow Rate, HFR	*21*	*2*	*2*	*5*	*1*	*5*
Percent Heavy Vehicles	*0*	*0*	*0*	*2*	*0*	*2*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration		*LTR*			*LTR*	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LTR*	*LTR*		*LTR*			*LTR*	
v (vph)	*10*	*5*		*25*			*11*	
C (m) (vph)	*1386*	*1339*		*534*			*627*	
v/c	*0.01*	*0.00*		*0.05*			*0.02*	
95% queue length	*0.02*	*0.01*		*0.15*			*0.05*	
Control Delay	*7.6*	*7.7*		*12.1*			*10.8*	
LOS	*A*	*A*		*B*			*B*	
Approach Delay	–	–	*12.1*			*10.8*		
Approach LOS	–	–	*B*			*B*		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	AM Peak		
Project Description	Combined Traffic Volumes		
East/West Street:	Bourne Avenue	North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	70	220	30	5	235	30
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	74	234	31	5	250	31
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	55	0	15	30	5	60
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	58	0	15	31	5	63
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	74	5		73			99	
C (m) (vph)	1282	1311		346			527	
v/c	0.06	0.00		0.21			0.19	
95% queue length	0.18	0.01		0.78			0.69	
Control Delay	8.0	7.8		18.2			13.4	
LOS	A	A		C			B	
Approach Delay	--	--	18.2			13.4		
Approach LOS	--	--	C			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	PM Peak		
Project Description	Combined Traffic Volumes		
East/West Street:	Bourne Ave	North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	50	360	55	10	335	30
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	54	395	60	10	368	32
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	25	2	10	45	2	95
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	27	2	10	49	2	104
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	54	10		39			155	
C (m) (vph)	1159	1116		223			404	
v/c	0.05	0.01		0.17			0.38	
95% queue length	0.15	0.03		0.62			1.77	
Control Delay	8.3	8.3		24.5			19.4	
LOS	A	A		C			C	
Approach Delay	--	--	24.5			19.4		
Approach LOS	--	--	C			C		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Bourne Av
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	SAT Peak		
Project Description	Combined Traffic Volumes		
East/West Street:	Bourne Ave	North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	40	220	30	5	215	20
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	43	241	32	5	236	21
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	20	2	2	20	1	30
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	21	2	2	21	1	32
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LTR	LTR		LTR			LTR	
v (vph)	43	5		25			54	
C (m) (vph)	1308	1302		394			563	
v/c	0.03	0.00		0.06			0.10	
95% queue length	0.10	0.01		0.20			0.32	
Control Delay	7.8	7.8		14.8			12.1	
LOS	A	A		B			B	
Approach Delay	--	--	14.8			12.1		
Approach LOS	--	--	B			B		

Roger Williams Avenue and Site Driveway

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Site Dr
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	AM Peak		
Project Description	Future Traffic Volumes		
East/West Street:	Site Drive	North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	115	285	0	0	325	25
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	122	303	0	0	345	26
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	35	0	175
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	0	0	0	37	0	186
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					L		R
v (vph)	122					37		186
C (m) (vph)	1199					278		691
v/c	0.10					0.13		0.27
95% queue length	0.34					0.45		1.09
Control Delay	8.3					19.9		12.1
LOS	A					C		B
Approach Delay	–	–				13.4		
Approach LOS	–	–				B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Site Dr
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	PM Peak		
Project Description	Future Traffic Volumes		
East/West Street:	Site Drive	North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	210	430	0	0	410	45
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	230	472	0	0	450	49
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	35	0	170
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	0	0	0	38	0	186
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					L		R
v (vph)	230					38		186
C (m) (vph)	1075					122		595
v/c	0.21					0.31		0.31
95% queue length	0.81					1.22		1.33
Control Delay	9.3					47.3		13.8
LOS	A					E		B
Approach Delay	–	–				19.5		
Approach LOS	–	–				C		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Site Dr
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	SAT Peak		

Project Description	Future Traffic Volumes
East/West Street: Site Drive	North/South Street: Roger Williams Ave
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	220	260	0	0	220	45
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	241	285	0	0	241	49
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	40	0	190
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	0	0	0	43	0	208
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					L		R
v (vph)	241					43		208
C (m) (vph)	1283					211		778
v/c	0.19					0.20		0.27
95% queue length	0.69					0.74		1.08
Control Delay	8.5					26.4		11.3
LOS	A					D		B
Approach Delay	–	–				13.9		
Approach LOS	–	–				B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Site Dr
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	AM Peak		
Project Description	Future Traffic Volumes Left Turn Lane Entering		
East/West Street:	Site Drive	North/South Street:	Roger Williams Ave
Intersection Orientation:	North-South	Study Period (hrs):	0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	115	285	0	0	325	25
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	122	303	0	0	345	26
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	0
Configuration	L	T				TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	35	0	175
Peak-Hour Factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Hourly Flow Rate, HFR	0	0	0	37	0	186
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	122					37		186
C (m) (vph)	1199					278		691
v/c	0.10					0.13		0.27
95% queue length	0.34					0.45		1.09
Control Delay	8.3					19.9		12.1
LOS	A					C		B
Approach Delay	–	–				13.4		
Approach LOS	–	–				B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Site Dr
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	PM Peak		

Project Description	Future Traffic Volumes Left Turn Entering
East/West Street: Site Drive	North/South Street: Roger Williams Ave
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	210	430	0	0	410	45
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	230	472	0	0	450	49
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	0
Configuration	L	T				TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	35	0	170
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	0	0	0	38	0	186
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	230					38		186
C (m) (vph)	1075					122		595
v/c	0.21					0.31		0.31
95% queue length	0.81					1.22		1.33
Control Delay	9.3					47.3		13.8
LOS	A					E		B
Approach Delay	--	--				19.5		
Approach LOS	--	--				C		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	JZR	Intersection	Roger Williams Ave & Site Dr
Agency/Co.	NE&C	Jurisdiction	East Providence
Date Performed	6/7/05	Analysis Year	2010
Analysis Time Period	SAT Peak		

Project Description	Future Traffic Volumes Left Turn Lane Entering
East/West Street: Site Drive	North/South Street: Roger Williams Ave
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	220	260	0	0	220	45
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	241	285	0	0	241	49
Percent Heavy Vehicles	0	–	–	0	–	–
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	0	0	1	0
Configuration	L	T				TR
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	0	0	40	0	190
Peak-Hour Factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Hourly Flow Rate, HFR	0	0	0	43	0	208
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L					L		R
v (vph)	241					43		208
C (m) (vph)	1283					211		778
v/c	0.19					0.20		0.27
95% queue length	0.69					0.74		1.08
Control Delay	8.5					26.4		11.3
LOS	A					D		B
Approach Delay	–	–				13.9		
Approach LOS	–	–				B		

Version 4.1d

APPENDIX D

QUEUING AND SIGNAL WARRANT ANALYSES

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
AM Combined with improvements NB Left	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	561.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	59.00
C =cycle length	C	90.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	561.00
V =flow rate in Tf(usually in vph)	V	478.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.13
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	561.00
X =V/Qtf, degree of saturation	X	0.85
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.15
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600 where s=sat flow vps, g=eff green	Xo	0.71
	X-Xo	0.14
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	1.35
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.13
r =C-G =effective red time, qr in veh	C	90.00
C = cycle time in seconds	G	59.00
	r	31.00
	N	5.47
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	5.47
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.13
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	5.85

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	5.47
y = flow ratio q avg vps/sat flow	y	0.30
q = arrival vps, VPH/3600	q	0.13
r =C-G =effective red time, qr in veh	r	31.00
	V	478.00
No = avg overflow queue (total veh all lanes)	No	1.35
	Nm	7.76
		VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	11.69
		VEHICLES

REQUIRED STORAGE is jNc/n		
		292.36
		FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
AM Combined with improvements NB Through	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	1209.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	59.00
C =cycle length	C	90.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	1209.00
V =flow rate in Tf(usually in vph)	V	473.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.13
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	1209.00
X =V/Qtf, degree of saturation	X	0.39
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.61
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.71
where s=sat flow vps, g=eff green	X-Xo	-0.32
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	-0.80
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.13
r =C-G =effective red time, qr in veh	C	90.00
C = cycle time in seconds	G	59.00
	r	31.00
	N	3.28
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	3.28
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.13
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	3.50

MAXIMUM BACK OF QUEUE Nm = N/(1-y)		
reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	3.28
y = flow ratio q avg vps/sat flow	y	0.29
q = arrival vps, VPH/3600	q	0.13
r =C-G =effective red time, qr in veh	r	31.00
	V	473.00
No = avg overflow queue (total veh all lanes)	No	-0.80
	Nm	4.63
		VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	7.00
		VEHICLES

REQUIRED STORAGE is jNc/n		
		174.97
		FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
AM Combined with improvements SB Left/Through	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	773.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	38.00
C =cycle length	C	90.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	773.00
V =flow rate in Tf(usually in vph)	V	662.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.18
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	773.00
X =V/Qtf, degree of saturation	X	0.86
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.14
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.70
where s=sat flow vps, g=eff green	X-Xo	0.16
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	1.60
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.18
r =C-G =effective red time, qr in veh	C	90.00
C = cycle time in seconds	G	38.00
	r	52.00
	N	11.17
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	11.17
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.18
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	12.26

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	11.17
y = flow ratio q avg vps/sat flow	y	0.41
q = arrival vps, VPH/3600	q	0.18
r =C-G =effective red time, qr in veh	r	52.00
	V	662.00
No = avg overflow queue (total veh all lanes)	No	1.60
	Nm	18.88
		VEHICLES

CRITICAL QUEUE LENGTH		
Nc = 2 Nb	Nc	24.53
		VEHICLES

REQUIRED STORAGE is jNc/n		613.18
		FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
AM Combined with improvements EB Left/Through	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	488.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	24.00
C =cycle length	C	90.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	488.00
V =flow rate in Tf(usually in vph)	V	135.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.04
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	488.00
X =V/Qtf, degree of saturation	X	0.28
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.72
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.69
where s=sat flow vps, g=eff green	X-Xo	-0.41
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	-0.86
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.04
r =C-G =effective red time, qr in veh	C	90.00
C = cycle time in seconds	G	24.00
	r	66.00
	N	1.62
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	1.62
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.04
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	1.65

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	1.62
y = flow ratio q avg vps/sat flow	y	0.08
q = arrival vps, VPH/3600	q	0.04
r =C-G =effective red time, qr in veh	r	66.00
	V	135.00
No = avg overflow queue (total veh all lanes)	No	-0.86
	Nm	1.76
		VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	3.30
		VEHICLES

REQUIRED STORAGE is jNc/n		
		82.40
		FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
AM Combined with improvements EB Right	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	816.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	46.00
C =cycle length	C	90.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	816.00
V =flow rate in Tf(usually in vph)	V	699.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.19
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	816.00
X =V/Qtf, degree of saturation	X	0.86
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.14
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600 where s=sat flow vps, g=eff green	Xo	0.70
	X-Xo	0.15
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	1.55
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from: N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.19
r =C-G =effective red time, qr in veh	C	90.00
C = cycle time in seconds	G	46.00
	r	44.00
	N	10.09
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	10.09
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.19
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	11.15

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	10.09
y = flow ratio q avg vps/sat flow	y	0.43
q = arrival vps, VPH/3600	q	0.19
r =C-G =effective red time, qr in veh	r	44.00
	V	699.00
No = avg overflow queue (total veh all lanes)	No	1.55
	Nm	17.75 VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	22.30 VEHICLES

REQUIRED STORAGE is jNc/n		
		557.39 FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
AM Combined with improvements WB Left	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	307.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	24.00
C =cycle length	C	90.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	307.00
V =flow rate in Tf(usually in vph)	V	177.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.05
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	307.00
X =V/Qtf, degree of saturation	X	0.58
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.42
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.69
where s=sat flow vps, g=eff green	X-Xo	-0.11
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	-0.40
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.05
r =C-G =effective red time, qr in veh	C	90.00
C = cycle time in seconds	G	24.00
	r	66.00
	N	2.85 VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	2.85
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.05
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	2.92

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	2.85
y = flow ratio q avg vps/sat flow	y	0.11
q = arrival vps, VPH/3600	q	0.05
r =C-G =effective red time, qr in veh	r	66.00
	V	177.00
No = avg overflow queue (total veh all lanes)	No	-0.40
	Nm	3.20 VEHICLES

CRITICAL QUEUE LENGTH		
Nc = 2 Nb	Nc	5.84 VEHICLES

REQUIRED STORAGE is jNc/n		145.88 FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
AM Combined with improvements WB Through/Right	JOB #	3103

Overflow Queue:

Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	494.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	24.00
C =cycle length	C	90.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	494.00
V =flow rate in Tf(usually in vph)	V	130.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.04
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	494.00
X =V/Qtf, degree of saturation	X	0.26
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.74
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600 where s=sat flow vps, g=eff green	Xo	0.69
	X-Xo	-0.42
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	-0.87
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from: N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.04
r =C-G =effective red time, qr in veh	C	90.00
C = cycle time in seconds	G	24.00
	r	66.00
	N	1.51 VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	1.51
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.04
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	1.54

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	1.51
y = flow ratio q avg vps/sat flow	y	0.08
q = arrival vps, VPH/3600	q	0.04
r =C-G =effective red time, qr in veh	r	66.00
	V	130.00
No = avg overflow queue (total veh all lanes)	No	-0.87
	Nm	1.65 VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	3.08 VEHICLES

REQUIRED STORAGE is jNc/n		
		77.07 FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
PM Combined with improvements NB Left	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	825.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	75.00
C =cycle length	C	100.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	825.00
V =flow rate in Tf(usually in vph)	V	794.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.22
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	825.00
X =V/Qtf, degree of saturation	X	0.96
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.04
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600 where s=sat flow vps, g=eff green	Xo	0.73
	X-Xo	0.24
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	6.61
		VEHICLES
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from: N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.22
r =C-G =effective red time, qr in veh	C	100.00
C = cycle time in seconds	G	75.00
	r	25.00
	N	12.12
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	12.12
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.22
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	13.58

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	12.12
y = flow ratio q avg vps/sat flow	y	0.49
q = arrival vps, VPH/3600	q	0.22
r =C-G =effective red time, qr in veh	r	25.00
	V	794.00
No = avg overflow queue (total veh all lanes)	No	6.61
	Nm	23.78
		VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	27.16
		VEHICLES

REQUIRED STORAGE is jNc/n		
		679.12
		FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
PM Combined with improvements NB Through	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	1402.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	75.00
C =cycle length	C	100.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	1402.00
V =flow rate in Tf(usually in vph)	V	706.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.20
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	1402.00
X =V/Qtf, degree of saturation	X	0.50
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.50
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.73
where s=sat flow vps, g=eff green	X-Xo	-0.22
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	-0.67
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.20
r =C-G =effective red time, qr in veh	C	100.00
C = cycle time in seconds	G	75.00
	r	25.00
	N	4.23
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	4.23
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.20
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	4.68

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	4.23
y = flow ratio q avg vps/sat flow	y	0.44
q = arrival vps, VPH/3600	q	0.20
r =C-G =effective red time, qr in veh	r	25.00
	V	706.00
No = avg overflow queue (total veh all lanes)	No	-0.67
	Nm	7.49
		VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	9.35
		VEHICLES

REQUIRED STORAGE is jNc/n		
		233.76
		FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
PM Combined with improvements SB Left/Through	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	648.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	35.00
C =cycle length	C	100.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	648.00
V =flow rate in Tf(usually in vph)	V	584.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.16
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	648.00
X =V/Qtf, degree of saturation	X	0.90
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.10
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600 where s=sat flow vps, g=eff green	Xo	0.70
	X-Xo	0.20
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	2.86
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from: N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.16
r =C-G =effective red time, qr in veh	C	100.00
C = cycle time in seconds	G	35.00
	r	65.00
	N	13.40 VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	13.40
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.16
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	14.55

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	13.40
y = flow ratio q avg vps/sat flow	y	0.36
q = arrival vps, VPH/3600	q	0.16
r =C-G =effective red time, qr in veh	r	65.00
	V	584.00
No = avg overflow queue (total veh all lanes)	No	2.86
	Nm	20.96 VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	29.10 VEHICLES

REQUIRED STORAGE is jNc/n		
		727.60 FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
PM Combined with improvements EB Left/Through	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	181.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	11.00
C =cycle length	C	100.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	181.00
V =flow rate in Tf(usually in vph)	V	133.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.04
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	181.00
X =V/Qtf, degree of saturation	X	0.73
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.27
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.68
where s=sat flow vps, g=eff green	X-Xo	0.06
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	0.32
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.04
r =C-G =effective red time, qr in veh	C	100.00
C = cycle time in seconds	G	11.00
	r	89.00
	N	3.60
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	3.60
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.04
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	3.67

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	3.60
y = flow ratio q avg vps/sat flow	y	0.08
q = arrival vps, VPH/3600	q	0.04
r =C-G =effective red time, qr in veh	r	89.00
	V	133.00
No = avg overflow queue (total veh all lanes)	No	0.32
	Nm	3.93
		VEHICLES

CRITICAL QUEUE LENGTH		
Nc = 2 Nb	Nc	7.34
		VEHICLES

REQUIRED STORAGE is jNc/n		
		183.49
		FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
PM Combined with improvements EB Right	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	816.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	51.00
C =cycle length	C	100.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	816.00
V =flow rate in Tf(usually in vph)	V	594.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.17
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	816.00
X =V/Qtf, degree of saturation	X	0.73
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.27
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.71
where s=sat flow vps, g=eff green	X-Xo	0.02
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	0.11
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from:		
N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.17
r =C-G =effective red time, qr in veh	C	100.00
C = cycle time in seconds	G	51.00
	r	49.00
	N	8.19
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	8.19
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.17
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	8.91

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	8.19
y = flow ratio q avg vps/sat flow	y	0.37
q = arrival vps, VPH/3600	q	0.17
r =C-G =effective red time, qr in veh	r	49.00
	V	594.00
No = avg overflow queue (total veh all lanes)	No	0.11
	Nm	12.94 VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	17.82 VEHICLES

REQUIRED STORAGE is jNc/n		
		445.47 FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
PM Combined with improvements WB Left	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	145.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	18.00
C =cycle length	C	100.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	145.00
V =flow rate in Tf(usually in vph)	V	106.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.03
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	145.00
X =V/Qtf, degree of saturation	X	0.73
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.27
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.68
where s=sat flow vps, g=eff green	X-Xo	0.05
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	0.26
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from: N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.03
r =C-G =effective red time, qr in veh	C	100.00
C = cycle time in seconds	G	18.00
	r	82.00
	N	2.68 VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	2.68
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.03
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	2.71

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	2.68
y = flow ratio q avg vps/sat flow	y	0.07
q = arrival vps, VPH/3600	q	0.03
r =C-G =effective red time, qr in veh	r	82.00
	V	106.00
No = avg overflow queue (total veh all lanes)	No	0.26
	Nm	2.86 VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	5.43 VEHICLES

REQUIRED STORAGE is jNc/n		
		135.75 FEET

NORTHEAST ENGINEERS & CONSULTANTS, Inc.
QUEUE AND STORAGE LENGTH ANALYSIS

North Broadway, Roger Williams Ave/Centre St	DATE	10/5/2004
PM Combined with improvements WB Through/Right	JOB #	3103

Overflow Queue:
Each formula below can be considered to have a uniform and overflow component. Average overflow queue is the average number of vehicles left in the queue at the beginning of the green period. Even if the arrrival rate flow rate is, on average, less than the capacity, (ie the degree of saturation X<1) there are some oversaturated cycles because of the random fluctuations in arrival flow rates. The following approximate expressrion has been derived for predicting average overflow queues in both undersaturated (X<1) and oversaturated (X>1) conditions at isolated fixed time signals:

OVERFLOW QUEUE: No		
No =if known	Cap	319.00
n =number of lanes	n	1.00
S = cruising speed, MPH	S	35.00
g =effective green	g	18.00
C =cycle length	C	100.00
s = saturation flow	s	0.45
Q =capacity in vph	Q	319.00
V =flow rate in Tf(usually in vph)	V	139.00
Tf =flow period of demand V (a.aa hrs.)	Tf	1.00
q = flow rate in vps; V/Tf or V/3600	q	0.04
QTf =throughput, ie the max number of veh dishcharged in period Tf	Qtf	319.00
X =V/Qtf, degree of saturation	X	0.44
z =X-1 (note this has a negative value for X<1; also zQ=q-Q	z	-0.56
Xo =deg of sat below which avg overflow queue is approx zero and given by Xo =0.67+ s*g/600	Xo	0.68
where s=sat flow vps, g=eff green	X-Xo	-0.25
j = average queue space per vehicle (ft)	j	25.00
No = avg overflow queue (total veh all lanes)	No	-0.66
(Q*Tf/4)*(z+(z^2+12*(X-Xo)/Q*Tf)^.5) for X>Xo, otherwise No=0		VEHICLES

QUEUE LENGTH		
The avg number of vehicles in the queue at the start of the green period can be calculated from: N=qr+No		
where		
q=arrival demand rate in vps or veh/cycle	q	0.04
r =C-G =effective red time, qr in veh	C	100.00
C = cycle time in seconds	G	18.00
	r	82.00
	N	2.50
		VEHICLES

BACK OF THE QUEUE Nb = N/(1-(j/v)qL)		
WHERE		
Nb = back of the queue in vehicles		
N = the stop line queue in vehicles	N	2.50
qL = lane flow, in vehicles per sec (total movement flow divided by the number of lanes as a first approximation)		0.04
j = avg queue space per vehicle in feet	j	25.00
v = normal cruising speed in feet per second (hence j/v = time to travel one vehicle space at cruising speed	v	51.33
	Nb	2.55

MAXIMUM BACK OF QUEUE Nm = N/(1-y) reached after the start of green		
WHERE		
Nm = maximum back of queue		
N = qr +No	N	2.50
y = flow ratio q avg vps/sat flow	y	0.09
q = arrival vps, VPH/3600	q	0.04
r =C-G =effective red time, qr in veh	r	82.00
	V	139.00
No = avg overflow queue (total veh all lanes)	No	-0.66
	Nm	2.74
		VEHICLES

CRITICAL QUEUE LENGTH Nc = 2 Nb		
	Nc	5.10
		VEHICLES

REQUIRED STORAGE is jNc/n		
		127.53
		FEET

Table B1: Signal Warrant Study

	Existing Traffic	Total Traffic			Warrants For Left Turn Exiting Traffic		
	Roger Williams		Site		Warrant 1	Warrant 2	Warrant 3
Time	Total Traffic	Existing+Entering	Entering	Left Turn Exiting	Meets Warrant	Meets Warrant	Meets Warrant
mid-1:00	34	34	0	0			
1:00-2:00	28	28	0	0			
2:00-3:00	16	16	0	0			
3:00-4:00	21	21	0	0			
4:00-5:00	50	50	0	0			
5:00-6:00	101	106	5	6			
6:00-7:00	364	409	45	30			
7:00-8:00	449	564	115	41			
8:00-9:00	446	576	130	50			
9:00-10:00	309	404	95	37			
10:00-11:00	309	429	120	39			
11:00-noon	404	549	145	46			
noon-1:00	393	618	225	34			
1:00-2:00	411	636	225	34			
2:00-3:00	519	774	255	35			
3:00-4:00	637	917	280	43			
4:00-5:00	544	839	295	45			
5:00-6:00	580	880	300	48			
6:00-7:00	431	671	240	37			
7:00-8:00	356	546	190	33			
8:00-9:00	256	396	140	17			
9:00-10:00	220	300	80	12			
10:00-11:00	192	227	35	2			
11:00-mid	144	169	25	0			
Total	7214	10,159	2,945	589	No	No	No
			Warrant Requirement		75	110	250
					Over 750 in Major Street	Over 900 in Major Street	Over 900 in Major Street

Note:
Warrant 1: The Warrant required traffic volume must be surpassed during 8 hours
Warrant 2: The Warrant required traffic volume must be surpassed during 4 hours
Warrant 3: The Warrant required traffic volume must be surpassed during 1 hour

This analysis assume that all the exiting vehicles use the main site driveway (conservative approach).

Tab 13

COMMITMENT FOR TITLE INSURANCE
CHICAGO TITLE INSURANCE COMPANY

SCHEDULE A

Commitment Number: **5029446**

1. Effective Date: **November 10, 2014 at 8:00 a.m.**

2. Proposed policy or policies to be issued:

   (a) ALTA Owner's Policy (06-17-06) or Owner's Residential Advantage Policy (1-15-98)

   PROPOSED AMOUNT: **$TBD**

   PROPOSED INSURED: TBD

   (b) ALTA Loan Policy (06-17-06) or Advantage Residential Loan Policy (2-98)

   PROPOSED AMOUNT: **$TBD**

   PROPOSED INSURED: **TBD, its successors and or assigns as their interests may appear.**

3. Title to the **Fee Simple** estate or interest in the land described or referred to in this commitment is at the effective date hereof vested in:

   City of East Providence (as to Fee Simple)

   GeoNova Development Company LLC, a Delaware limited liability company (as to Ground Lease)

4. The land referred to in this Commitment is situated in the **City** of **East Providence,** the County of **Providence, State of Rhode Island** and is identified in accordance with Exhibit A attached hereto known and numbered as:

   * **300 Bourne Avenue, East Providence, RI – Map 203 Block 1 Parcel 4**

Countersigned by:

Ann-Marie Widmann

COMMITMENT FOR TITLE INSURANCE
CHICAGO TITLE INSURANCE COMPANY

EXHIBIT A

Commitment Number: 5029446

Those four (4) certain lots or parcels of land, with all the buildings and improvements thereon, situated in the City of East Providence, County of Providence and State of Rhode Island, bounded and described as follows:

PARCEL ONE

That tract or parcel of land, with all buildings and improvements thereon, situated southerly from the most westerly portion of Bourne Avenue (formerly Wilson Street) in the City of East Providence, State of Rhode Island bounding:

EASTERLY on the railroad location of the Providence and Worcester Company;

GENERALLY SOUTHERLY AND WESTERLY on the Seekonk River; and

GENERALLY NORTHERLY on land now or lately of the Okonite Company.

EXCLUDING, HOWEVER, the portion of said parcel conveyed by that certain deed from the Washburn Wire Company to The Okonite Company dated November 30, 1960 and recorded December 5, 1960 at 9:20 a.m. in Book 206 at Page 336.

TOGETHER WITH the right to pass and repass across and over the land adjoining said parcel on the north to and from Bourne Avenue as set forth in that certain deed from American Electrical Works to Francis M. Smith dated April 17, 1899 and recorded January 27, 1900 at 4:25 p.m. in Book 44 at Page 129, as modified by Agreement by and between Washburn Wire Company and American Electrical Works dated June 10, 1930 and recorded June 11, 1930 at 1:15 p.m. in Book 108 at Page 450, and as reserved in that certain deed from the Washburn Wire Company to The Okonite Company dated November 30, 1960 and recorded December 5, 1960 at 9:20 a.m. in Book 206 at Page 336.

TOGETHER WITH the appurtenant rights the right to lay, maintain and utilize sewer lines and pump through forced main on adjacent property as provided in the Memorandum of Agreement recorded in Book 147 at Page 70.

PARCEL TWO

That tract or parcel of land, with all buildings and improvements thereon, bounding

EASTERLY AND NORTHEASTERLY on Roger Williams Avenue;

SOUTHEASTERLY AND EASTERLY on land now or lately of Grace Church Memorial to Grace Phillips;

SOUTHEASTERLY on land now or lately of John J. Rose, et al (known as Phillipsdale Pond);

WESTERLY on the railroad location of Providence and Worcester Railroad Company, and

NORTHERLY on Bourne Avenue.

PARCEL THREE

The dam across Omega Pond or Ten Mile River at or near its mouth, and the gate and flume and other appurtenances connected or used or useful therewith and the right to maintain said dam and to drive and maintain priming in and along the embankments to the upland.

PARCEL FOUR

That strip of land of irregular shape and varying width along the southwesterly shore of Omega Pond and extending from the railroad location the Providence and Worcester Company southeasterly and southerly to land now or lately of The Providence Journal Company bounding generally northeasterly and easterly on said Pond, southeasterly on said land now or lately of The Providence Journal Company, westerly and southwesterly on land now or lately of Bird & Son, Inc. and westerly on said railroad location.

EXCLUDING FROM SAID PARCELS, HOWEVER, that certain lot or parcel of land described in that deed from Ocean State Steel, Inc. to Development One Corporation dated June 9, 1995 and recorded June 27, 1995 at 3:01 p.m. in Book 1157 at Page 212.

TOGETHER WITH all rights appurtenant thereto, including (1) all right, title and interest in and to that portion of the railroad location of the Providence and Worcester Company insofar as the same adjoins and is coextensive with the parcels herein described, and (2) all rights, privileges, and easements as set forth or referred to in deeds of record.

COMMITMENT FOR TITLE INSURANCE

CHICAGO TITLE INSURANCE COMPANY
SCHEDULE B – SECTION 1
Requirements

Commitment Number: 5029446

The following are the requirements to be complied with:

1. Payment to or for the account of the grantors or mortgagors of the full consideration for the estate or interest to be insured.

2. Pay the premiums, fees and charges due to the Company for the policy.

3. Satisfactory evidence should be had that improvements and/or repairs or alterations thereto are completed; that contractor, subcontractors, labor and materialmen are all paid.

4. Proper instrument(s) creating the estate or interest to be insured must be executed and duly filed for record to-wit:
   (a) Deed from TBD to TBD.
   (b) Mortgage Deed from TBD to TBD .

5. The nature of the transaction to be insured herein must be disclosed to the Company prior to closing. Title may be subject to additional exceptions as may be appropriate after disclosure of the type of transaction.

6. Compliance with Foreign Investment in Real Property Tax Act of 1980, Section 1445 and 897 of the IRS Code and related Treasury regulations.

7. Compliance with Rhode Island law and the Rhode Island Fire Code concerning Smoke and Carbon Monoxide Detectors.

The following matters or documents must be resolved and/or produced to the satisfaction of the Company:

8. Compliance with Rhode Island General Laws § 44-30-71.3 - Non Resident Withholding, and Regulations promulgated pursuant thereto. This applies only to the sale of property located in Rhode Island. If applicable, requires that a percentage of sellers' net proceeds be withheld and remitted to the Rhode Island Division of Taxation. A recitation of Rhode Island residency contained in a recorded deed discharges the § 44-30-71.3 lien. A recital as to the manner of compliance must be contained in any deed of conveyance.

9. Compliance with the Rhode Island Life Safety Code of the Rhode Island Fire Code, Section 8, Chapters 24 (one-and-two family dwellings), 25 (three family apartment buildings), 30 (new apartment buildings) or 31 (existing apartment buildings). These chapters apply to the sale of residential property located in Rhode Island and, if applicable, require that seller deliver to buyer a smoke and carbon monoxide detector inspection certificate dated not more than 60 days prior to the date of sale

10. Pay all unpaid real estate taxes, sewer installation charges, sewer use charges, water use charges, water installation charges, fire service (water), fire district taxes and all other applicable municipal charges and assessments. Municipal Lien Certificate to be ordered and recorded.

11. Water meter reading to be supplied to Company no later than 5 days prior to closing.

12. In order to Delete the Standard Exceptions from the Loan policy, the Company will require the following:

    a) Executed Mechanic's Lien and Parties in Possession Affidavit and Indemnity;

    b) A Survey, certified to Chicago Title Insurance Company and the Insured Lender, prepared in compliance with the Minimum Standard Detail Requirements for ALTA/ACSM Land Title Surveys as adopted by American Congress on Surveying & Mapping, together with an executed Surveyor's report. This Survey must be dated within 6 months prior to the date of the proposed closing.

13. Except in an exempt transaction, the Company must be furnished with seller's social security number or tax Identification number and all other information necessary to complete IRS Form 10998.

14. If A Usury Endorsement will be issued to the Proposed Insured Lender upon receipt by the Company of

(a) evidence that the loan is not secured by a mortgage against the principal residence of any member of the borrower;
(b) the borrower has obtained a "pro forma methods analysis" satisfactory to the Company from a Rhode Island-licensed CPA indicating that the loan is capable of being repaid, and
(c) additional special risk premium of $TBD per thousand dollars of policy liability.

15. As GeoNova Development Company, LLC is a Limited Liability Company, the Company requires the following information and/or documents prior to closing:

a) A Certificate of Existence from the Rhode Island Secretary of State;

b) A Certificate of Good Standing from the Rhode Island Division of Taxation if the entity operates as a corporation;

c) Vote and/or consent of the members of GeoNova Development Company, LLC authorizing the transaction to be insured.

d) Copy of the Operating Agreement forming the subject Limited Liability Company certified as true and correct by the members.

16. Obtain and record discharges, terminations and/or releases for the following instruments:

a. **Leasehold Mortgage and Security Agreement by GeoNova Development Company, LLC to the City of East Providence, dated September 26, 2003 and recorded with the City of East Providence Land Evidence Records on September 29, 2003 in Book 2114 at Page 53 to secure the amount of $3,000,000.00.**

b.

If the mortgage set forth above is purported to be a "Open End" mortgage. It is a requirement that the Mortgagor of said mortgage provide written authorization to close said credit line account to the Lender when the mortgage is being paid off through the Company or other Settlement/Escrow Agent or provide a satisfactory subordination of this mortgage to the proposed mortgage to be recorded at closing.

NOTE: All matters recited above as requiring recorded discharges, terminations and/or releases which are not as of the date of policy so discharged, terminated and/or released will appear as title exceptions in Schedule B-I of the Title Policy Issued hereunder.

NOTE: The Company may make other requirements or exceptions upon its review of the proposed documents creating the estate or interest to be insured or otherwise ascertaining details of the transaction.

COMMITMENT FOR TITLE INSURANCE

CHICAGO TITLE INSURANCE COMPANY
SCHEDULE B – SECTION 2
Exceptions

Commitment Number: 5029446

The policy or policies to be issued will contain exceptions to the following unless the same are disposed of to the satisfaction of the Company:

1. Defects, liens, encumbrances, adverse claims or other matters, if any, first appearing in the public records or attaching subsequent to the effective date hereof but prior to the date the proposed insured acquires for value of record an estate or interest or mortgage thereon covered by this Commitment.

2. Rights or claims of parties other than the Proposed Insured or Proposed Mortgagor in actual possession of any or all of the property. **To be deleted from the Residential Loan Title Insurance Policy upon execution of a satisfactory Owners/Sellers Affidavit.**

3. Any encroachment, encumbrance, violation or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land. **To be deleted from the Residential Loan Title Insurance Policy upon execution of a satisfactory Owners/Sellers Affidavit and payment of the survey deletion fee.**

4. Unfiled mechanics' or materialmen's liens. **To be deleted from the Residential Loan Title Insurance Policy upon execution of a satisfactory Owners/Sellers Affidavit.**

5. Riparian rights of others in and to the waters of any stream and/or rivers lying along and/or crossing the land, and any right, title and interest of others in an to any portion of the land consisting of filled tidal lands.

6. Covenants, Conditions, Restrictions, Reservations, Easements, Liens for Assessments, Options, Powers of Attorney and Limitations on title as set forth in the Declaration of Condominium, and By-Laws as recorded, as the same may be amended, and as contained in the Rhode Island Condominium Act, R.I. Gen. Laws §34-36.1-1 et seq. and the Rhode Island Condominium Ownership Act, R.I. Gen. Laws §34-36-1 et seq., as applicable. **Applicable only if the proposed insured premises is a condominium unit.**

7. Any provision in any recorded covenants, conditions and restrictions which indicate any preference, limitation or discrimination based on race, color, religion, sex, handicap, familial status or national origin are hereby deleted. **Applicable only if the proposed insured premises are subject to any recorded covenants, conditions and/or restrictions.**

8. Taxes and municipal charges and any water and/or sewer charges and/or assessments.

9. Any unrecorded leases and agreements.

10. Restrictions of record as set forth in Book 20 at Page 188.

11. Restrictions of record as set forth in Book 20 at Page 190.

12. Easement of record as set forth in Book 44 at Page 129; as modified in Book 108 at Page 450 (affects Parcel One)

13. Memorandum of Agreement made by and between Washburn Wire Company and Kennecott Wire and Cable Company dated December 8, 1950 and recorded with the City of East Providence Land Evidence Records on December 14, 1950 in Book 147 at Page 70. (affects Parcel One)

14. Agreement of record by and between the State of Rhode Island and Sayles Finishing Plants, Inc. dated December 26, 1949 and recorded with the City of East Providence Land Evidence Records on September 10, 1958 in Book 173 at Page 378. (affects Parcel Two)

15. Restrictions of record as set forth in Book 176 at Page 83.

COMMITMENT FOR TITLE INSURANCE

16. Restrictions of record as set forth in Book 199 at Page 279. (affects Parcel Two)

17. Affidavit recorded February 23, 1960 in Book 199 at Page 360.

18. Easement of record as set forth in Book 206 at Page 336.

19. Easement of record as set forth in Book 256 at Page 389. (affects Parcel Two)

20. Easement of record as set forth in Book 268 at Page 245. (affects Parcel Two)

21. Easement of record as set forth in Book 285 at Page 18. (affects Parcel Two)

22. Easement of record as set forth in Book 285 at Page 22. (affects Parcel Two)

23. Department of Environmental Management Notice of Violation dated July 11, 1979 and recorded with the City of East Providence Land Evidence Records on July 13, 1979 in Book 395 at Page 138.

24. Agreement of record by and between Rhode Island Forging Steel, Inc. and The Okonite Company, Inc. dated February 22, 1983 and recorded with the City of East Providence Land Evidence Records on March 29, 1983 in Book 488 at Page 175. Affects Parcels One-Four)

25. Coastal Resources Management Council letter recorded with the City of East Providence Land Evidence Records on October 1, 1990 in Book 866 at Page 63.

26. Any and all other rights and encumbrances as contained in Deed recorded in Book 1429 at Page 160.

27. Memorandum of Ground Lease made by and between the City of East Providence, as lessor, and GeoNova Development Company, LLC, as lessee, dated September 26, 2003 and recorded with the City of East Providence Land Evidence Records on September 29, 2003 in Book 2114 at Page 47.

28. Declaration of Covenants, Conditions and Restrictions dated September 26, 2003 and recorded with the City of East Providence Land Evidence Records on September 29, 2003 in Book 2114 at Page 38.

29. Coastal Resources Management Council Assent recorded November 12, 2003 in Book 2145 at Page 209.

30. Coastal Resources Management Council Assent recorded May 10, 2004 in Book 2249 at Page 130.

31. Rhode Island Department of Environmental Management Temporary Remedial Action Permit recorded May 10, 2004 in Book 2249 at Page 135.

32. Environmental Land Usage Restriction dated May 11, 2006 and recorded May 12, 2006 in Book 2662 at Page 107.

33. Notice of Acknowledgement and Agreement dated May 18, 2006 and recorded July 7, 2006 in Book 2691 at Page 185.

34. Rhode Island Department of Environmental Management Insignificant Alteration Permit dated August 22, 2007 and recorded August 29, 2007 in Book 2877 at Page 195.

35. Coastal Resources Management Council Assent recorded June 10 2008 in Book 2976 at Page 218.

36. Easement Agreement dated April 27, 2011 and recorded May 17, 2011 in Book 3257 at Page 49; as affected by a First Amendment to Easement Agreement recorded August 2, 2011 in Book 3275 at Page 200; as further affected by a Second Amendment to Easement Agreement recorded April 16, 2013 in Book 3454 at Page 202.

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NOTE: If policy is to be issued in support of a mortgage loan, attention is directed to the fact that the Company can assume no liability under its policy, the closing instructions, or Insured Closing Service for compliance with the requirements of any consumer credit protection or truth in lending law in connection with said mortgage loan.