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Lawrence, MA 01843

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MEMORANDUM

TO: Ms. Sarah Barnat
Barnat Beverly LLC
30 Rowes Wharf, Suite 600
Boston, MA 02110

DATE: October 28, 2016

FROM: Samuel W. Gregorio, P.E., PTOE, Project Engineer
Douglas S. Halpert, E.I.T., Project Engineer

PROJECT NO.: T0664

RE: #112 Rantoul Street Development – Beverly, Massachusetts
Supplemental Traffic Impact Assessment

INTRODUCTION

TEC, Inc. has been retained by Barnat Beverly LLC (the "Applicant") to prepare a Traffic Impact, Access, and Parking Study (TIAPS) associated with the development of the vacant pad site located at #112 Rantoul Street in Beverly, Massachusetts (the "Project"). The TIAPS was submitted to the City of Beverly Planning Department on September 23, 2016. The site directly abuts the Massachusetts Bay Transportation Authority (MBTA) Beverly Depot parking garage. The project consists of constructing a mixed-use development containing up to 70 residential apartment units (67 units currently planned), ±3,000 square feet (SF) of specialty retail space, and a ±1,500 SF restaurant use. The Applicant has assumed the restaurant space will be operated as a coffee shop to provide a conservative traffic analysis condition.

On Tuesday, October 4, 2016, the Applicant presented the TIAPS to the City of Beverly Parking and Traffic Commission. As part of this hearing, the Parking and Traffic Commission requested that the Applicant expand the traffic impact study area to include the intersection of River Street/ Pleasant Street. In addition, the Commission requested that a sensitivity analysis be conducted at the intersection of Rantoul Street (Route 1A) / Railroad Avenue that includes an exclusive pedestrian phase as part of the proposed signal operations. TEC has prepared this Supplemental Traffic Impact Assessment (TIA) to evaluate the impacts of the proposed site plan on the intersection of River Street / Pleasant Street and Rantoul Street / Railroad Avenue, and assess the potential for off-site mitigation measures.

EXISTING CONDITIONS

Intersection

River Street / Pleasant Street

Pleasant Street intersects River Street to form a three-legged, unsignalized intersection. Although oriented as a typical T-intersection, regulatory control of the intersection is non-standard, with the Pleasant Street westbound and the River Street northbound non-opposing

approaches operating under STOP control. The River Street southbound approach operates under a free-flowing condition. The River Street northbound and southbound approaches consist of a single general purpose lane with directional flow separated by a marked centerline. The Pleasant Street westbound approach consists of a single general purpose lane with directional flow separation unmarked. Due to the travel lane width along River Street southbound, it is common to observe vehicles traveling southbound to bypass southbound left-turning vehicles at the intersection. An element of the perceived traffic impact is directly related to its proximity to the MBTA Commuter Rail Station, which is situated on the northeast corner of the intersection.

Access management for abutting land uses is a challenge at the intersection. Currently, the private abutter on the southeast corner of the intersection, Autoparts International, provides an open curb-cut driveway along Pleasant Street between River Street and the MBTA rail bridge overhead, approximately 120-feet east of the intersection. The portion of the open curb-cut closest to River Street is a section of depressed asphalt sidewalk in which the curb reveal is non-existent, causing this portion of sidewalk to be utilized as parking for the Autoparts International. On the northeast corner of the intersection, a one-way drive aisle for the MBTA surface parking lot egresses onto Pleasant Street.

Sidewalks are provided on both sides of River Street, south of the intersection, and on the westerly side of the roadway north of the intersection. Sidewalks are provided along both sides of Pleasant Street, but a depressed section of the sidewalk along the southerly side warrants reconstruction. Crosswalks are provided across the Pleasant Street westbound and the River Street northbound approaches. The River Street northbound approach crosswalk is set 14 feet south of the intersection and creates driver confusion when approaching the STOP-line and frequently results in the tail end of the vehicle encroaching into the crosswalk. The STOP-line on this approach is located downstream from the crosswalk. Of the four existing curb ramps, only one has a tactile warning pad. The landing areas and ramp slopes of all curb ramps do not meet current Americans with Disabilities Act (ADA) / Architectural Access Board (AAB) guidelines. A curb ramp is not provided on the easterly side of the MBTA Egress Driveway located on the northerly side of the roadway.

Existing Sight Distance

TEC, Inc. visited the site on Tuesday, October 13, 2016 to measure the available sight distances along the Pleasant Street westbound STOP-controlled approach, looking north (free-flowing approach). The available sight distances were compared to minimum requirements established by the American Association of State Highway and Transportation Officials (AASHTO).

Sight distance represents the length of roadway that is visible to a driver traveling within the roadway. Two types of sight distance are typically evaluated for driveways and intersections: stopping sight distance (SSD) and intersection sight distance (ISD). SSD is the minimum distance required for a driver traveling along a roadway to perceive an object in the roadway and stop safely in advance of the object when traveling on a wet pavement surface. SSD is measured from an eye height of 3.5 feet to an object height of two (2) feet above the ground, which is equivalent to a driver viewing the taillight of a vehicle ahead. SSD is measured along the centerline of the travel lane approaching the driveway or intersection.

ISD represents the length of the roadway visible to a driver waiting to exit a driveway or minor street. Minimum ISD requirements are based on the distance required for a driver to exit a minor street onto a major street without requiring an approaching vehicle to reduce its speed from the design speed to less than 70 percent of the design speed. ISD is measured from an eye height of 3.5 feet to an object height of 3.5 feet and is measured from a distance of 15 feet off the edge of the travel-way of the major roadway to represent a driver waiting to exit a driveway or minor roadway.

SSD is typically considered the critical sight distance, as it represents the minimum distance required for safe stopping, while ISD represents an acceptable speed reduction for approaching vehicles. The ISD, however, must be at least equal to the minimum required SSD in order to prevent a driver from entering the roadway when an approaching vehicle is too close to stop safely. The guidance provided by AASHTO states:

> *"If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road."*

Table 1 provides a summary of the available sight distances at the study intersections.

Table 1 – Sight Distance Measurements

Approach / Direction	Posted Speed	Minimum Required	AASHTO Recommend	Measured	
				Stopping Sight Distance	Intersection Sight Distance
Pleasant Street at River Street:					
North of Pleasant Street	30 mph[(a)]	200 FT	335 FT	>500 FT	310 FT
South of Pleasant Street	30 mph[(a)]	200 FT	335 FT	>500 FT	195 FT

From the Pleasant Street westbound approach, the ISD looking north along River Street meets AASHTO minimum recommendations. Looking south, the building corner of the Autoparts International structure limits the ISD to 195 feet. Although this approach is under STOP-control under existing condition, improving the ISD on this approach will be necessary should the STOP-sign on the River Street northbound approach be removed and converted to a free-flow condition.

Collision Data Summary

Based on crash data provided by the Massachusetts Department of Transportation (MassDOT), the River Street / Pleasant Street intersection experienced one (1) reportable crash per year over the five-year study period. The crash rate for this intersection was lower than the statewide and District-wide averages. Of these crashes, 80 percent (4 of 5) were angled crashes which may be a result of the non-opposing STOP controlled approaches and the River Street southbound approach operating freely. Three (3) of the angled crashes involved a vehicle exiting Pleasant Street and a vehicle travelling southbound along River Street. This may be the result of vehicles traveling southbound on River Street by-passing left-turning traffic, a

condition that is not consistently noticeable to vehicles exiting Pleasant Street. A compilation of the detailed crash data and the MEV rate calculation worksheets is provided in Attachment A.

Forecasting Traffic Volumes

Manual Turning Movements Counts (TMCs) were conducted at the River Street / Pleasant Street intersection during the weekday morning (7:30 AM – 8:45 AM) and weekday evening (4:35 PM – 5:50 PM) peak periods on Thursday, October 13, 2016 and Monday, October 17, 2016. Area schools were in regular session during the traffic counts. A detailed summary of the TMCs, partitioned into 15-minute intervals, is provided within Attachment B. The resulting 2016 Existing weekday morning and weekday evening peak-hour traffic-volume networks are illustrated in Figure 1.

2023 No-Build Conditions

In accordance with MassDOT standards for completion of a TIA, seasonal adjustment, specific developments by others, and background growth rates were applied to the raw traffic volumes consistent with the TIAPS submitted to the City of Beverly on September 23, 2016. The 2023 No-Build weekday morning and weekday evening peak-hour traffic-volume networks were developed by applying the 1.0 percent per year compounded annual background traffic growth rate on the 2016 Existing peak-hour traffic volumes over the seven-year design horizon and adding traffic to be generated by the specific developments by others. The resulting 2023 No-Build weekday morning and weekday evening peak-hour traffic-volume networks are illustrated in Figure 1.

Site-Generated Traffic

Calculations for the projected site-generated traffic associated with the #112 Rantoul Street Development are presented in the TIAPS submitted to the City of Beverly on September 23, 2016. The site-generated trips calculated in the previously-submitted TIAPS have been distributed through the River Street / Pleasant Street intersection as part of the supplemental analysis. For the purposes of this analysis, it was assumed that no site-generated traffic would distribute to River Street south of Pleasant Street.

Build Traffic Volumes

The 2023 Build Condition traffic-volume networks consist of the 2023 No-Build traffic volumes with the addition of the site-generated traffic. The resulting 2023 Build weekday morning and weekday evening peak-hour traffic-volume networks are presented in Figure 1.

Not to Scale

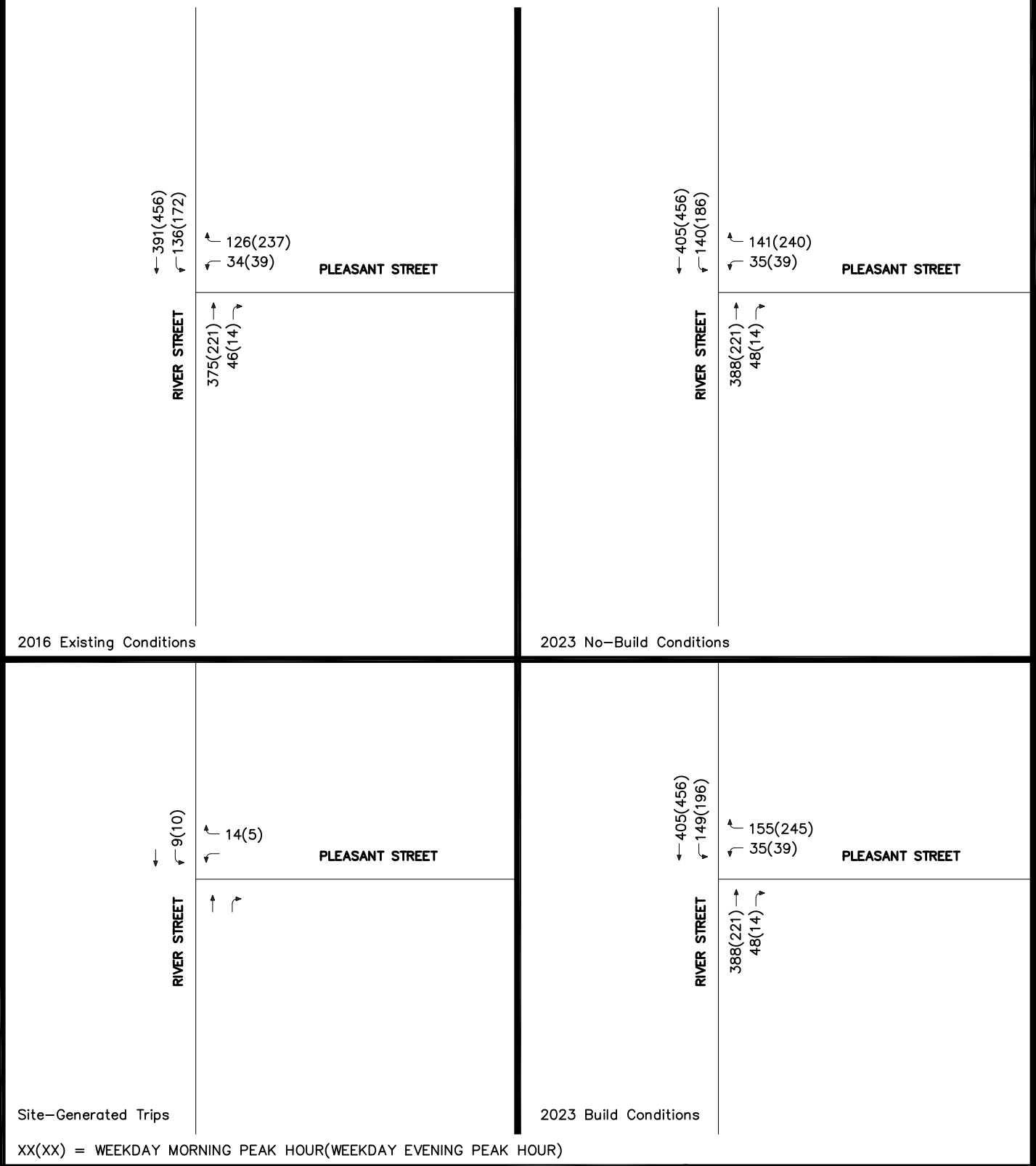


Figure 1

Weekday Morning, and Weekday Evening Peak Hour Traffic Volumes

TRAFFIC OPERATIONS ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build, and Build traffic-volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

The unsignalized intersection capacity and queue analysis for the intersection of River Street / Pleasant Street was conducted using Sidra Intersection v5.1™ software due to the restrictions posed on unsignalized intersection analysis using Synchro 9.0™ or Highway Capacity Software 2010 (HCS 2010). This includes unsignalized intersections with STOP control on two non-opposing approaches.

River Street / Pleasant Street Intersection Capacity and Queue Analysis Results

Under 2023 Build Conditions, all movements at the River Street / Pleasant Street intersection are anticipated to operate at acceptable levels of service (LOS B or better) under all analysis scenarios. In addition, the volume-to-capacity (v/c) ratio will be well below 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes. Under 2023 Build conditions, the 95th percentile queue along the Pleasant Street westbound approach is anticipated to extend approximately 200-feet (8 vehicles) during the weekday evening peak hour. Generally, this includes a combination of vehicles along Pleasant Street and those queued along the MBTA Egress Driveway. During direct observation, it is common for vehicles to present a short one- or two-vehicle queue within the drive aisle. As a result, the 2023 Build Condition 95th percentile queue is not anticipated to extend past the upstream intersection of Pleasant Street / Park Street. The detailed intersection capacity and queue analysis worksheets are provided in Attachment C. The results of the updated intersection capacity and queue analysis are summarized in Table 2.

Table 2 – River Street / Pleasant Street Capacity and Queue Analysis Summary

	2023 No-Build				2023 Build			
Intersection / Lane Group	**V/C[a]**	**Delay[b]**	**LOS[c]**	**Queue[d]**	**V/C**	**Delay**	**LOS**	**Queue**
River Street / Pleasant Street								
Weekday Morning Peak Period								
Pleasant Street WB Approach	0.19	9.8	A	62	0.22	9.8	A	83
River Street NB Approach	0.27	7.7	A	46	0.28	7.8	A	49
River Street SB Approach	0.32	0.0	A	<25	0.34	0.0	A	<25
Weekday Evening Peak Period								
Pleasant Street WB Approach	0.33	10.6	B	187	0.35	10.7	B	199
River Street NB Approach	0.15	7.3	A	<25	0.15	7.3	A	<25
River Street SB Approach	0.38	0.0	A	<25	0.40	0.0	A	<25

[a] Volume-to-capacity ratio, [b] Delay expressed in seconds per vehicle (average)
[c] Level-of-Service, [d] Only 95th Percentile Queue expressed for unsignalized

Rantoul Street / Railroad Avenue Sensitivity Capacity and Queue Analysis Results

At the request of the Parking and Traffic Commission, TEC completed a sensitivity analysis for the intersection of Rantoul Street / Railroad Avenue that included the incorporation of an exclusive pedestrian phase. As part of the Route 1A (Rantoul Street and Cabot Street) Reconstruction Project (MassDOT Project #600220), concurrent pedestrian phases were designed along the Rantoul Street corridor. Subsequent to approval of the design, the Town Engineer, Greg St. Louis, P.E., has indicated his desire to have these signalized intersections along Rantoul Street operate with exclusive pedestrian phases. Therefore, the sensitivity analysis compares the 2023 No-Build and 2023 Build conditions at the intersection with an exclusive pedestrian phase. Under 2023 No-Build and Build Conditions, all movements at the Rantoul Street / Railroad Avenue intersection are anticipated to operate at LOS E or better under all analysis scenarios. Although the intersection approach is anticipated to operate at LOS E, the traffic generated by the Project continues to have no perceivable effect on operations at the intersection as compared to the No-Build condition. Based on the high volume of pedestrians crossing at this location, an exclusive pedestrian phase would provide the greatest safety benefit.

Table 3 – Rantoul Street / Railroad Avenue Sensitivity Analysis Summary

	2023 No-Build				2023 Build			
Intersection / Lane Group	**V/C[a]**	**Delay[b]**	**LOS[c]**	**Queue[d]**	**V/C**	**Delay**	**LOS**	**Queue**
Rantoul Street / Railroad Avenue with Exclusive Pedestrian Phase								
Weekday Morning Peak Period								
Railroad Avenue EB Approach	0.72	57.5	E	120/189	0.73	55.6	E	137/211
Railroad Avenue WB Approach	0.08	42.5	D	<25/40	0.08	40.4	D	<25/39
Rantoul Street NB Approach	0.46	11.3	B	190/324	0.49	12.8	B	207/348
Rantoul Street SB Approach	0.41	10.6	B	160/276	0.43	12.1	B	175/297
Overall Intersection	**0.47**	**20.3**	**C**	**-**	**0.50**	**21.7**	**C**	**-**
Weekday Evening Peak Period								
Railroad Avenue EB Approach	0.76	57.2	E	157/230	0.77	57.0	E	163/238
Railroad Avenue WB Approach	0.05	40.2	D	<25/33	0.05	39.7	D	<25/33
Rantoul Street NB Approach	0.50	13.0	B	222/375	0.51	13.4	B	226/382
Rantoul Street SB Approach	0.54	13.7	B	243/413	0.55	14.3	B	252/428
Overall Intersection	**0.54**	**22.1**	**C**	**-**	**0.56**	**22.6**	**C**	**-**

[a] Volume-to-capacity ratio
[b] Delay expressed in seconds per vehicle (average)
[c] Level-of-Service
[d] 50th / 95th Percentile Queue (feet)

OPERATIONS AND SAFETY ENHANCEMENT OPPORTUNITIES

After evaluating the traffic operations and safety deficiencies at the intersection of River Street / Pleasant Street and along Pleasant Street between River Street and Court Street, TEC has assembled a list of traffic operations and safety enhancements that the City should consider for improvement:

Intersection Control Improvements

- Consider removing STOP-control along the River Street northbound approach to redefine River Street as the mainline roadway through the intersection. Currently, the sight distance along Pleasant Street looking south is approximately five feet short of minimum AASHTO recommendations for safe operations based on the posted speed of 30 miles per hour (MPH). Should STOP-control be removed along the River Street northbound approach, additional modifications, such as modifications to the River Street edge line, may be need to further extend the sight line; and
- Consider providing all-way STOP-control at the intersection to enhance the safety of vehicles. Providing an all-way STOP at the intersection will increase the safety at the intersection by eliminating free-flow operations; however the delays on the River Street approach would increase slightly. The results of the intersection capacity and queue analysis under all-way STOP conditions are summarized in Table 4.

Table 4 – River Street / Pleasant Street All-Way STOP Analysis Summary

	2023 No-Build				2023 Build			
Intersection / Lane Group	**V/C[a]**	**Delay[b]**	**LOS[c]**	**Queue[d]**	**V/C**	**Delay**	**LOS**	**Queue**
River Street / Pleasant Street – ALL-WAY STOP								
Weekday Morning Peak Period								
Pleasant Street WB Approach	0.33	12.0	B	35	0.35	12.5	B	40
River Street NB Approach	0.71	20.2	D	145	0.72	21.1	C	153
River Street SB Approach	0.87	33.2	C	260	0.90	37.1	E	283
Weekday Evening Peak Period								
Pleasant Street WB Approach	0.46	13.8	B	63	0.48	14.1	B	65
River Street NB Approach	0.39	12.4	B	45	0.39	12.5	B	45
River Street SB Approach	0.94	48.8	E	355	0.98	53.4	F	378

[a] Volume-to-capacity ratio
[b] Delay expressed in seconds per vehicle (average)
[c] Level-of-Service
[d] Only 95th Percentile Queue expressed for unsignalized intersections

Geometric Improvements

- Consider construction of an exclusive left-turn lane along the River Street southbound approach to separate left-turning and through traffic. This will provide improved definition for vehicles exiting Pleasant Street at the River Street cross-section and eliminate by-passing southbound traffic. Based on guidance

provided in the *MassDOT Project Design and Development Guide* (PDDG), a left-turn lane is warranted along this approach;

- The City should consider a review of curb cuts, aprons, and sidewalk extensions to clearly define the limits of driveways in the vicinity of the intersection. If possible, the reconstruction should allow for the reestablishment of an accessible curb ramp on the southeast corner of the intersection, with 6-inch granite curb providing vertical separation between vehicular and pedestrian traffic; and
- Reconstruct the curb-cut for the MBTA Egress Driveway to clearly define the limits of driveway. The reconstruction should allow for the reestablishment of an accessible curb ramp on the southeast corner of the intersection, with 6-inch granite curb providing vertical separation between vehicular and pedestrian traffic. In addition, the reconstruction will provide a clear limit of the final parking stall.

Pedestrian Improvements[1]

- Reconstruct the sidewalks along Pleasant Street between River Street and Court Street to improve ADA-compliance for cross-slopes and provide improved definition of the pedestrian facility;
- Reconstruct accessible curb ramps at the intersection of Pleasant Street / Park Street / Court Street; and
- At the intersection of River Street / Pleasant Street, construct a new accessible curb ramp on the east side of the MBTA Egress Driveway to provide continuity of the pedestrian facility between the intersection and points east along Pleasant Street. Reconstruct accessible curbs across River Street south of the Pleasant Street intersection. The ramp on the southeast corner should be shifted closer to the intersection and the STOP-line moved behind the painted crosswalk. Upon a shift in the STOP-line location, sight lines from the River Street northbound approach should be maintained to view a pedestrian in the sidewalk attempting to cross Pleasant Street.

Signing and Striping Improvements

- Restripe pavement markings through the intersection. Specifically, stripe a new centerline along Pleasant Street to better define bi-directional travel;
- Replace damaged or faded "No Parking" signage along the River Street approaches in the immediate vicinity of the intersection to reinforce the regulatory condition and place them on new sign posts instead of utility poles; and

1 The improvements listed above do not include construction of new sidewalk along the easterly side of River Street between Pleasant Street and the northerly MBTA Access Driveway. This area is currently utilized for pedestrian activity and is visibly seen as a "goat path" through the grass. The sidewalk north of the MBTA Access Driveway is anticipated to be constructed as part of a future River Street / Bridge Street intersection project. Upon initial investigation, construction of this sidewalk link is estimated at $45,000 with contingency.

- Provide under-deck lighting below the MBTA Commuter Rail bridge to improve pedestrian visibility and personal safety along the roadway.

APPLICANT'S IMPROVEMENT COMMITMENT

The Applicant has committed to provide improvements along Pleasant Street to enhance the pedestrian connectivity in the vicinity of the site. The following is a list of pedestrian safety enhancements that the Applicant has proposed to provide a funding contribution for:

- Reconstruct the sidewalk along the north side of Pleasant Street between River Street and Court Street to improve ADA-compliance for cross-slopes and provide improved definition of the pedestrian facility;
- Construct new accessible curb ramps along the north side of Pleasant Street at the intersections with River Street, the MBTA Egress Driveway, and Park Street; and
- Install new STOP and DO NOT ENTER signage at the MBTA Egress Driveway to provide improved definition of the one-way flow condition.

Improvements listed above are graphically shown in Figure 2. TEC estimates that the recommendations listed above will result in a construction cost of approximately $38,000.

TRANSPORTATION DEMAND MANAGEMENT

Vehicle /Parking Amenities

The Applicant will be coordinating with the North Shore Transportation Management Association (TMA) to assist with the development of on-site Transportation Demand Management (TDM) opportunities such as ridesharing and carpooling. Additional TDM measures will be discussed with the North Shore TMA should membership be secured.

Pedestrian Amenities

The Applicant is committed to creating a more pedestrian-friendly on-site area with streetscape improvements along Rantoul Street. In addition, the Applicant is committed to maintaining sidewalk access on the ground level (under-podium) along the MBTA Beverly Depot Parking Garage and to/from the parking garage stairwell. This will allow for pedestrians to pass through the parking garage to continue their access to the pedestrian fly-over walkway to the MBTA Commuter Rail Station. Trees and landscaping treatments will create aesthetically-pleasing and pedestrian-friendly areas.

Bicycle Amenities

The Proponent has committed to additional bicycle-related TDM measures, such as bicycle racks outside the residential building.

Scale: 1" = 60'

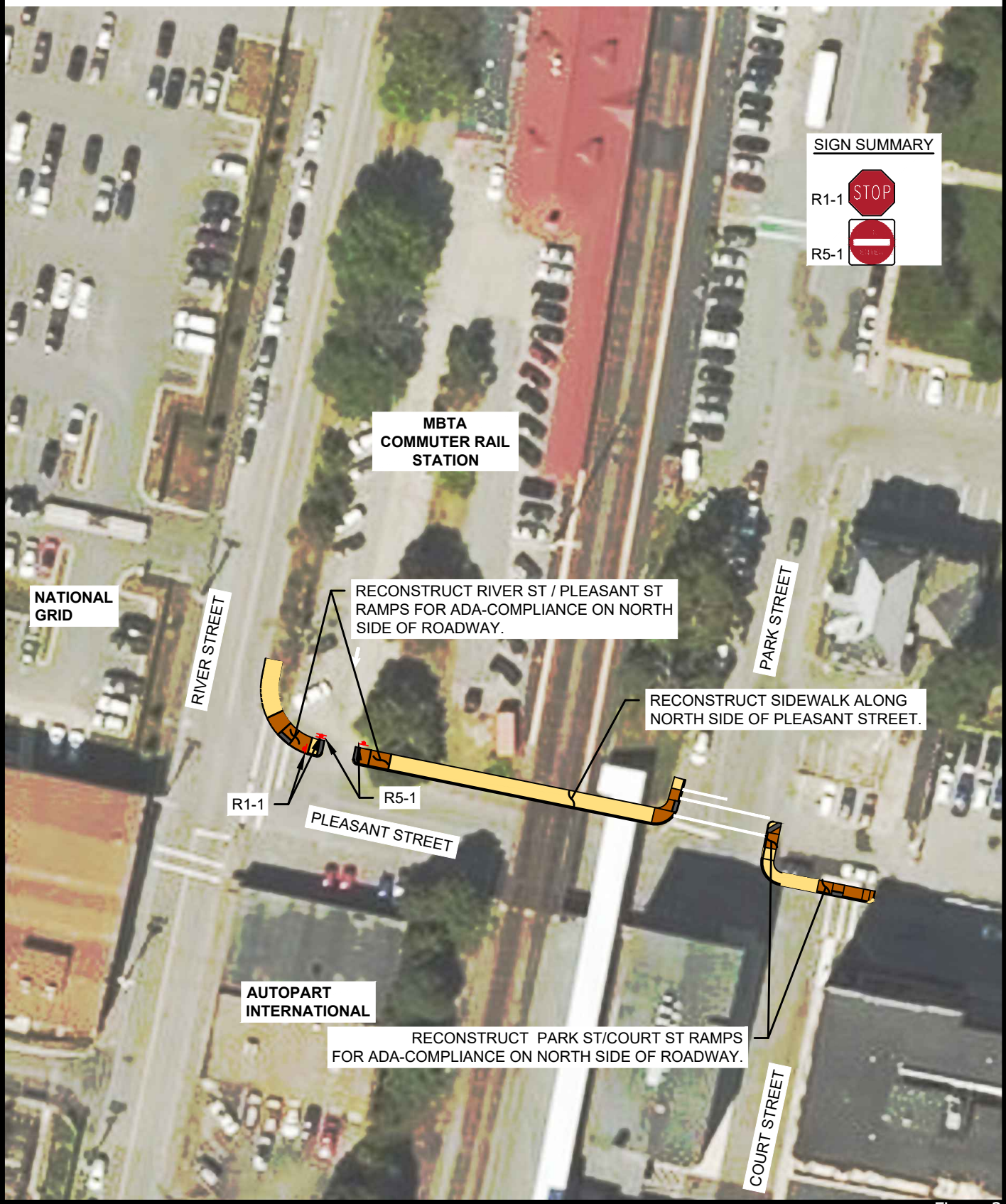


Figure 2

Pleasant Street Corridor
Conceptual Improvements

TEC, Inc.

Transit Amenities

The Applicant has committed to market the development as a TOD. To increase transit use by residents, the Proponent will post public transportation schedules with transit maps for all nearby routes in the building and provided this information to residents. In addition, the Applicant is looking to subsidize transit passes for the MBTA Commuter Rail to enhance the opportunity for residents to travel to/from the public transportation.

CONCLUSIONS

TEC has examined the potential traffic operations and safety impacts on the River Street / Pleasant Street intersection associated with the proposed redevelopment of the property located at the MBTA Beverly Depot site. The following is a summary of the results and conclusions of this effort:

- The transit-oriented development (TOD) project consists of constructing a mixed-use development containing up to 70 residential apartment units (67 units are currently planned), ±3,000 SF of specialty retail space, and a ±1,500 SF restaurant use;
- The River Street / Pleasant Street intersection experienced one (1) crash per year over the five-year study period. The crash rate for this intersection was well below the statewide and district-wide averages;
- All movements at the River Street / Pleasant Street intersection are anticipated to operate at acceptable levels of service (LOS B or better) under all analysis conditions. In addition, the volume-to-capacity (v/c) ratio will be well below 1.00, indicating there will be adequate capacity to accommodate the anticipated traffic volumes. The queue along Pleasant Street under Build conditions is not anticipated to extend downstream past Park Street; and
- Under 2023 No-Build and Build Conditions, all movements at the Rantoul Street / Railroad Avenue intersection are anticipated to operate at LOS E or better under all analysis scenarios. Although the intersection approach is anticipated to operate at LOS E, the traffic generated by the Project continues to have no significant effect on operations at the intersection as compared to the No-Build condition. Based on the high volume of pedestrians crossing at this location, an exclusive pedestrian phase would provide the greatest safety benefit.

In conclusion, the traffic generated by the proposed #112 Rantoul Street Project can be safely and efficiently accommodated at the intersection of River Street / Pleasant Street. Although no project-specific mitigation is warranted based on the operations noted in the original TIAPS and this supplemental TIA, the Applicant had funded this additional assessment initiative worth approximately $1,800 and has committed to contribute $38,000 towards the construction of safety improvements along Pleasant Street.

Attachment A

Updated Crash Data

Crash Number	Crash Date	Crash Time	Crash Severity	Number of Non-Fatal Injuries	Number of Fatal Injuries	Number of Vehicles	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Driver Contributing Codes	Non Motorist Type	Road Surface	Ambient Light	Weather Condition	Roadway	Distance And Direction From Intersection	Near Intersection Roadway
2645002	9/27/2010	12:58 PM	Property damage only (none injured)	0	0	2	Angle	V1: Turning left / V2:Travelling straight ahead	V1:W / V2:N	V1:() V2:(Collision with motor vehicle in traffic)	D1:()D2:(Disregarded traffic signs, signals, road markings)		Wet	Daylight	Rain/Rain	PLEASANT STREET / RIVER STREET		
2653411	10/22/2010	4:42 PM	Property damage only (none injured)	0	0	2	Angle	V1: Turning left / V2:Travelling straight ahead	V1:W / V2:S	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	D1:(Failed to yield right of way) D2:(No improper driving)		Dry	Daylight	Cloudy/Cloudy	RIVER ST / PLEASANT ST		
2736085	6/27/2011	4:29 PM	Property damage only (none injured)	0	0	2	Rear-end	V1: Slowing or stopped in traffic / V2:Slowing or stopped in traffic	V1:N / V2:N	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	D1:(No improper driving) D2:(Inattention)		Dry	Daylight	Clear/Clear	RIVER ST / PLEASANT ST		
3737083	2/19/2014	12:45 PM	Non-fatal injury	2	0	2	Angle	V1: Turning left / V2:Slowing or stopped in traffic	V1:E / V2:W	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	D1:(Over-correcting,over-steering) D2:()		Dry	Daylight	Cloudy/Cloudy	RIVER ST / PLEASANT ST		
3740161	2/24/2014	11:30 AM	Property damage only (none injured)	0	0	2	Angle	V1: Travelling straight ahead / V2:Entering traffic lane	V1:S / V2:E	V1:(Collision with motor vehicle in traffic) V2:(Collision with motor vehicle in traffic)	D1:(No improper driving) D2:(Visibility obstructed),(Failed to yield right of way)		Dry	Daylight	Clear/Clear	RIVER STREET	100 feet N of	PLEASANT STREET

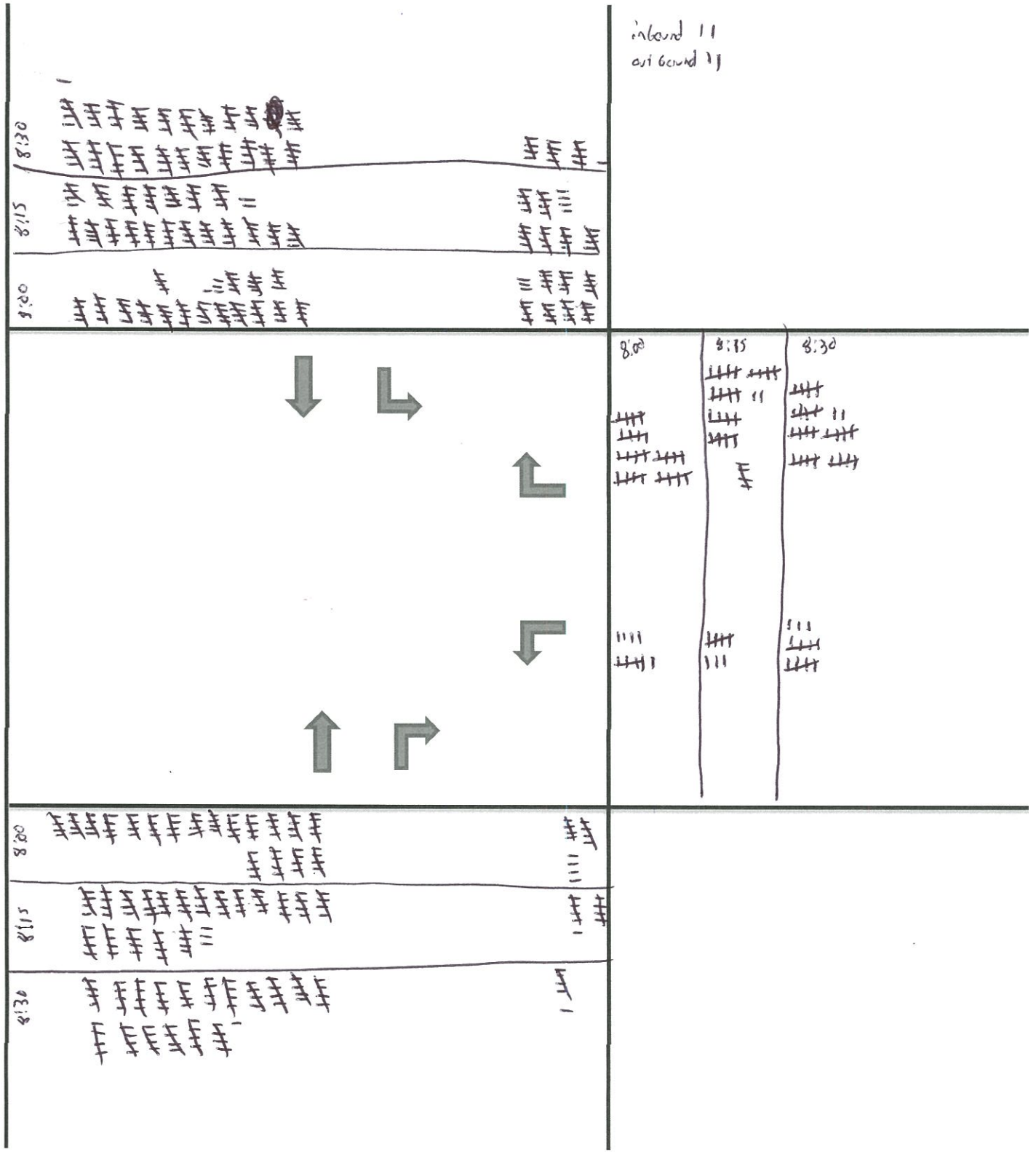
Attachment B

Turning Movement Counts

10/13/16 T0664 MBTA Development Beverly, MA

N

Today
Counted by: DSH
Th 10/13/16
7:20-8:45

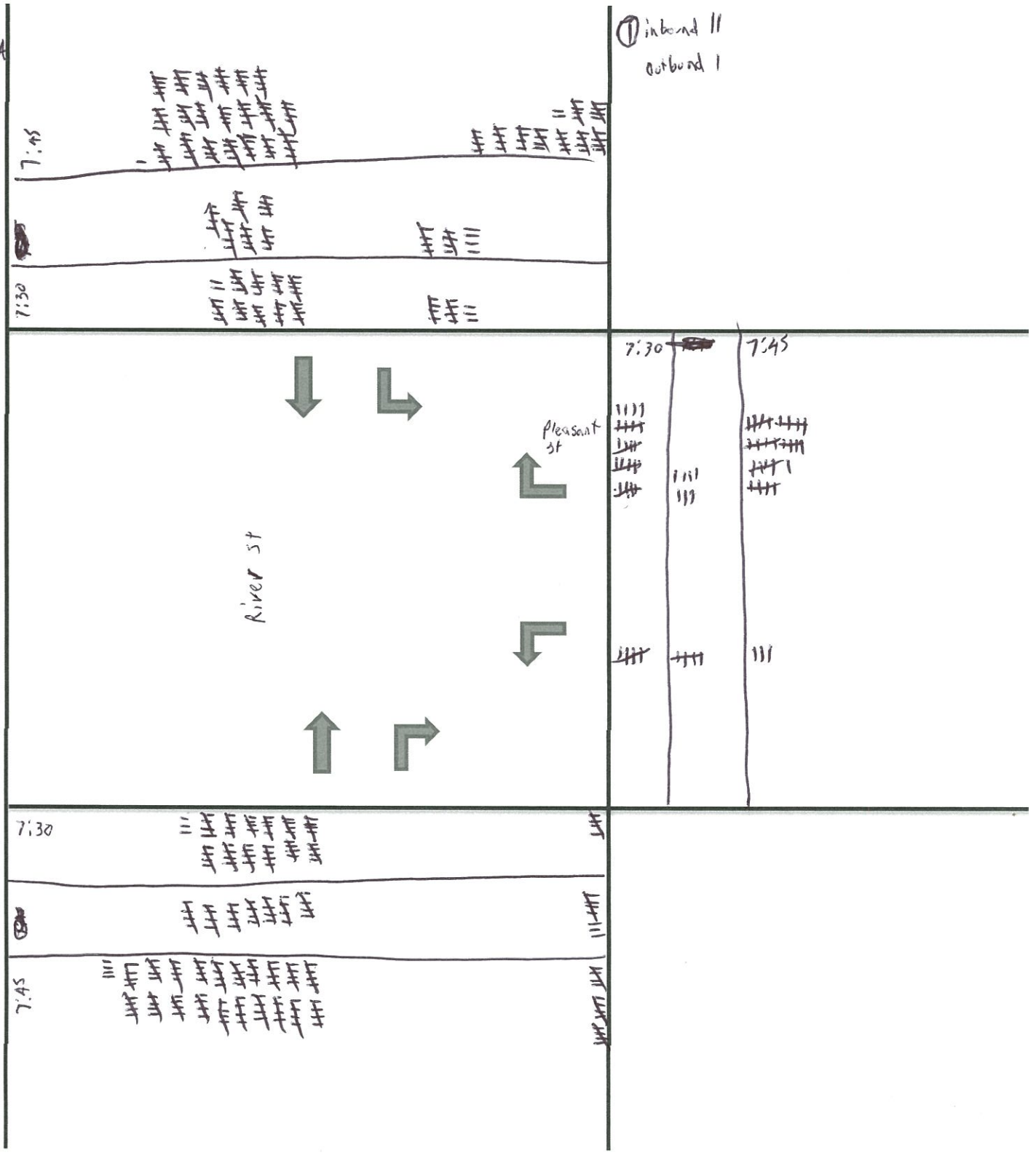


10/13/16 T0664 MBTA Development Beverly, MA

N

sunny / Dry

T0664
Counted by: DSN
Th 10/13/16
7:30-8:45



CALCULATIONS

65 GLENN STREET, LAWRENCE, MA 01843
TEL 978.794.1792 | FAX 978.794.1793 | TECMASS.COM

TRAIN
NB 4:53p SB 5:14
NB 5:00p NBS: 15
NB 5:30
NB 5:36

JOB: 112 RANTOUL ST REDEVELOPMENT
JOB NUMBER: TO664
LOCATION: BEVERLY, MA
DATE: MONDAY OCTOBER 17, 2016
TITLE: PLEASANT ST @ RIVER ST PM COUNT
SHEET: 1 OF
CALCULATED BY: SWG
CHECKED BY:

	WBL	WBR	NBT	NBR	SBL	SBT	River PD1	Pleasant PD2
4:35-4:50	5	51	53 T	4	42 B	127 TT		
4:50-5:05	6	66	57 C	4	41 B	94 C TT	PP	PPPP
5:05-5:20	14	66 CT	49 TT	3	40	119 CC	PP	PPP PP
5:20-5:35	11	47	64 T	5	41	112 CT	PPP	PPPP PP
5:35-5:50	8 TT	56 CC	50	2	49	128 CTT	PP	

Attachment C

Intersection Capacity and Queue Analyses

River Street @ Pleasant Street

MOVEMENT SUMMARY

Site: Beverly, MA

River Street / Pleasant Street

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: River Street											
8	T	426	2.0	0.265	7.7	LOS A	1.8	46.2	0.34	0.66	24.0
18	R	52	0.0	0.265	7.7	LOS A	1.8	46.2	0.34	0.85	23.9
Approach		478	1.8	0.265	7.7	LOS A	1.8	46.2	0.34	0.68	24.0
East: Pleasant Street											
1	L	39	0.0	0.194	9.8	LOS A	2.5	62.1	0.79	1.00	18.8
16	R	143	0.0	0.194	9.8	LOS A	2.5	62.1	0.79	0.21	18.8
Approach		182	0.0	0.194	9.8	LOS A	2.5	62.1	0.79	0.38	18.8
North: River Street											
7	L	155	0.0	0.324	0.0	LOS A	0.0	0.0	0.00	0.89	29.1
4	T	444	2.0	0.324	0.0	LOS A	0.0	0.0	0.00	0.00	35.0
Approach		599	1.5	0.324	0.0	NA	0.0	0.0	0.00	0.23	33.3
All Vehicles		1259	1.4	0.324	4.3	NA	2.5	62.1	0.24	0.42	26.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

HCM Delay Model used. Geometric Delay not included.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Beverly, MA

River Street / Pleasant Street

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: River Street											
8	T	441	2.0	0.275	7.8	LOS A	1.9	49.0	0.36	0.64	24.0
18	R	55	0.0	0.275	7.8	LOS A	1.9	49.0	0.36	0.85	23.9
Approach		495	1.8	0.275	7.8	LOS A	1.9	49.0	0.36	0.66	24.0
East: Pleasant Street											
1	L	40	0.0	0.223	9.8	LOS A	3.3	82.9	0.85	1.02	18.8
16	R	176	0.0	0.223	9.8	LOS A	3.3	82.9	0.85	0.15	18.8
Approach		216	0.0	0.223	9.8	LOS A	3.3	82.9	0.85	0.31	18.8
North: River Street											
7	L	169	0.0	0.341	0.0	LOS A	0.0	0.0	0.00	0.88	29.1
4	T	460	2.0	0.341	0.0	LOS A	0.0	0.0	0.00	0.00	35.0
Approach		630	1.5	0.341	0.0	NA	0.0	0.0	0.00	0.24	33.2
All Vehicles		1341	1.3	0.341	4.4	NA	3.3	82.9	0.27	0.41	26.4

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

HCM Delay Model used. Geometric Delay not included.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Beverly, MA

River Street / Pleasant Street

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: River Street											
8	T	426	2.0	0.265	7.7	LOS A	1.8	46.2	0.34	0.66	24.0
18	R	52	0.0	0.265	7.7	LOS A	1.8	46.2	0.34	0.85	23.9
Approach		478	1.8	0.265	7.7	LOS A	1.8	46.2	0.34	0.68	24.0
East: Pleasant Street											
1	L	39	0.0	0.194	9.8	LOS A	2.5	62.1	0.79	1.00	18.8
16	R	143	0.0	0.194	9.8	LOS A	2.5	62.1	0.79	0.21	18.8
Approach		182	0.0	0.194	9.8	LOS A	2.5	62.1	0.79	0.38	18.8
North: River Street											
7	L	155	0.0	0.324	0.0	LOS A	0.0	0.0	0.00	0.89	29.1
4	T	444	2.0	0.324	0.0	LOS A	0.0	0.0	0.00	0.00	35.0
Approach		599	1.5	0.324	0.0	NA	0.0	0.0	0.00	0.23	33.3
All Vehicles		1259	1.4	0.324	4.3	NA	2.5	62.1	0.24	0.42	26.5

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

HCM Delay Model used. Geometric Delay not included.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Beverly, MA

River Street / Pleasant Street

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: River Street											
8	T	260	1.0	0.150	7.3	LOS A	0.9	23.6	0.34	0.66	24.2
18	R	16	0.0	0.150	7.3	LOS A	0.9	23.6	0.34	0.85	24.1
Approach		276	0.9	0.150	7.3	LOS A	0.9	23.6	0.34	0.68	24.2
East: Pleasant Street											
1	L	45	5.0	0.332	10.6	LOS B	7.4	186.9	1.00	1.15	18.7
16	R	276	0.0	0.332	10.6	LOS B	7.4	186.9	1.00	0.00	18.7
Approach		321	0.7	0.332	10.6	LOS B	7.4	186.9	1.00	0.16	18.7
North: River Street											
7	L	195	1.0	0.384	0.0	LOS A	0.0	0.0	0.00	0.88	29.1
4	T	518	1.0	0.384	0.0	LOS A	0.0	0.0	0.00	0.00	35.0
Approach		714	1.0	0.384	0.0	NA	0.0	0.0	0.00	0.24	33.2
All Vehicles		1311	0.9	0.384	4.1	NA	7.4	186.9	0.32	0.31	26.3

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

HCM Delay Model used. Geometric Delay not included.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Beverly, MA

River Street / Pleasant Street

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: River Street											
8	T	441	2.0	0.275	7.8	LOS A	1.9	49.0	0.36	0.64	24.0
18	R	55	0.0	0.275	7.8	LOS A	1.9	49.0	0.36	0.85	23.9
Approach		495	1.8	0.275	7.8	LOS A	1.9	49.0	0.36	0.66	24.0
East: Pleasant Street											
1	L	40	0.0	0.223	9.8	LOS A	3.3	82.9	0.85	1.02	18.8
16	R	176	0.0	0.223	9.8	LOS A	3.3	82.9	0.85	0.15	18.8
Approach		216	0.0	0.223	9.8	LOS A	3.3	82.9	0.85	0.31	18.8
North: River Street											
7	L	169	0.0	0.341	0.0	LOS A	0.0	0.0	0.00	0.88	29.1
4	T	460	2.0	0.341	0.0	LOS A	0.0	0.0	0.00	0.00	35.0
Approach		630	1.5	0.341	0.0	NA	0.0	0.0	0.00	0.24	33.2
All Vehicles		1341	1.3	0.341	4.4	NA	3.3	82.9	0.27	0.41	26.4

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

HCM Delay Model used. Geometric Delay not included.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: Beverly, MA

River Street / Pleasant Street

Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: River Street											
8	T	260	1.0	0.150	7.3	LOS A	1.0	24.1	0.36	0.64	24.2
18	R	16	0.0	0.150	7.3	LOS A	1.0	24.1	0.36	0.85	24.1
Approach		276	0.9	0.150	7.3	LOS A	1.0	24.1	0.36	0.65	24.2
East: Pleasant Street											
1	L	45	5.0	0.346	10.7	LOS B	7.9	199.4	1.00	1.16	18.6
16	R	285	0.0	0.346	10.7	LOS B	7.9	199.4	1.00	0.00	18.7
Approach		330	0.7	0.346	10.7	LOS B	7.9	199.4	1.00	0.16	18.6
North: River Street											
7	L	223	1.0	0.400	0.0	LOS A	0.0	0.0	0.00	0.87	29.1
4	T	518	1.0	0.400	0.0	LOS A	0.0	0.0	0.00	0.00	35.0
Approach		741	1.0	0.400	0.0	NA	0.0	0.0	0.00	0.26	33.0
All Vehicles		1348	0.9	0.400	4.1	NA	7.9	199.4	0.32	0.32	26.3

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

HCM Delay Model used. Geometric Delay not included.

SIDRA INTERSECTION

River Street @ Pleasant Street (ALL WAY STOP)

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	35	141	388	48	140	405
Future Volume (vph)	35	141	388	48	140	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	16	16	16
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.892		0.985			
Flt Protected	0.990					0.987
Satd. Flow (prot)	1902	0	2084	0	0	2094
Flt Permitted	0.990					0.987
Satd. Flow (perm)	1902	0	2084	0	0	2094
Link Speed (mph)	30		30			30
Link Distance (ft)	500		500			500
Travel Time (s)	11.4		11.4			11.4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%
Shared Lane Traffic (%)						
Sign Control	Stop		Stop			Stop

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Intersection Delay, s/veh	25.1
Intersection LOS	D

Movement	WBU	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Lane Configurations									
Traffic Vol, veh/h	0	35	141	0	388	48	0	140	405
Future Vol, veh/h	0	35	141	0	388	48	0	140	405
Peak Hour Factor	0.92	0.91	0.91	0.92	0.91	0.91	0.92	0.91	0.91
Heavy Vehicles, %	2	0	0	2	2	0	2	0	2
Mvmt Flow	0	38	155	0	426	53	0	154	445
Number of Lanes	0	1	0	0	1	0	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	12	20.2	33.2
HCM LOS	B	C	D

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	20%	26%
Vol Thru, %	89%	0%	74%
Vol Right, %	11%	80%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	436	176	545
LT Vol	0	35	140
Through Vol	388	0	405
RT Vol	48	141	0
Lane Flow Rate	479	193	599
Geometry Grp	1	1	1
Degree of Util (X)	0.706	0.325	0.871
Departure Headway (Hd)	5.308	6.045	5.237
Convergence, Y/N	Yes	Yes	Yes
Cap	680	592	689
Service Time	3.354	4.108	3.279
HCM Lane V/C Ratio	0.704	0.326	0.869
HCM Control Delay	20.2	12	33.2
HCM Lane LOS	C	B	D
HCM 95th-tile Q	5.8	1.4	10.4

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	39	240	221	14	186	456
Future Volume (vph)	39	240	221	14	186	456
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	16	16	16
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.884		0.992			
Flt Protected	0.993					0.986
Satd. Flow (prot)	1877	0	2116	0	0	2102
Flt Permitted	0.993					0.986
Satd. Flow (perm)	1877	0	2116	0	0	2102
Link Speed (mph)	30		30			30
Link Distance (ft)	500		500			500
Travel Time (s)	11.4		11.4			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	5%	0%	1%	0%	1%	1%
Shared Lane Traffic (%)						
Sign Control	Stop		Stop			Stop

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Intersection Delay, s/veh	33
Intersection LOS	D

Movement	WBU	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Lane Configurations									
Traffic Vol, veh/h	0	39	240	0	221	14	0	186	456
Future Vol, veh/h	0	39	240	0	221	14	0	186	456
Peak Hour Factor	0.92	0.97	0.97	0.92	0.97	0.97	0.92	0.97	0.97
Heavy Vehicles, %	2	5	0	2	1	0	2	1	1
Mvmt Flow	0	40	247	0	228	14	0	192	470
Number of Lanes	0	1	0	0	1	0	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	13.8	12.4	48.8
HCM LOS	B	B	E

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	14%	29%
Vol Thru, %	94%	0%	71%
Vol Right, %	6%	86%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	235	279	642
LT Vol	0	39	186
Through Vol	221	0	456
RT Vol	14	240	0
Lane Flow Rate	242	288	662
Geometry Grp	1	1	1
Degree of Util (X)	0.385	0.464	0.964
Departure Headway (Hd)	5.725	5.805	5.242
Convergence, Y/N	Yes	Yes	Yes
Cap	625	618	688
Service Time	3.789	3.869	3.288
HCM Lane V/C Ratio	0.387	0.466	0.962
HCM Control Delay	12.4	13.8	48.8
HCM Lane LOS	B	B	E
HCM 95th-tile Q	1.8	2.5	14.2

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	35	155	388	48	149	405
Future Volume (vph)	35	155	388	48	149	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	16	16	16
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.890		0.985			
Flt Protected	0.991					0.987
Satd. Flow (prot)	1899	0	2084	0	0	2095
Flt Permitted	0.991					0.987
Satd. Flow (perm)	1899	0	2084	0	0	2095
Link Speed (mph)	30		30			30
Link Distance (ft)	500		500			500
Travel Time (s)	11.4		11.4			11.4
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	2%	0%	0%	2%
Shared Lane Traffic (%)						
Sign Control	Stop		Stop			Stop

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Intersection Delay, s/veh	27.2
Intersection LOS	D

Movement	WBU	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Lane Configurations									
Traffic Vol, veh/h	0	35	155	0	388	48	0	149	405
Future Vol, veh/h	0	35	155	0	388	48	0	149	405
Peak Hour Factor	0.92	0.91	0.91	0.92	0.91	0.91	0.92	0.91	0.91
Heavy Vehicles, %	2	0	0	2	2	0	2	0	2
Mvmt Flow	0	38	170	0	426	53	0	164	445
Number of Lanes	0	1	0	0	1	0	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	12.5	21.1	37.1
HCM LOS	B	C	E

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	18%	27%
Vol Thru, %	89%	0%	73%
Vol Right, %	11%	82%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	436	190	554
LT Vol	0	35	149
Through Vol	388	0	405
RT Vol	48	155	0
Lane Flow Rate	479	209	609
Geometry Grp	1	1	1
Degree of Util (X)	0.718	0.353	0.897
Departure Headway (Hd)	5.392	6.081	5.307
Convergence, Y/N	Yes	Yes	Yes
Cap	666	589	682
Service Time	3.445	4.15	3.357
HCM Lane V/C Ratio	0.719	0.355	0.893
HCM Control Delay	21.1	12.5	37.1
HCM Lane LOS	C	B	E
HCM 95th-tile Q	6.1	1.6	11.3

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	39	245	221	14	196	456
Future Volume (vph)	39	245	221	14	196	456
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	16	16	16
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.883		0.992			
Flt Protected	0.993					0.985
Satd. Flow (prot)	1875	0	2116	0	0	2100
Flt Permitted	0.993					0.985
Satd. Flow (perm)	1875	0	2116	0	0	2100
Link Speed (mph)	30		30			30
Link Distance (ft)	500		500			500
Travel Time (s)	11.4		11.4			11.4
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	5%	0%	1%	0%	1%	1%
Shared Lane Traffic (%)						
Sign Control	Stop		Stop			Stop

Intersection Summary

Area Type: Other
Control Type: Unsignalized

Intersection	
Intersection Delay, s/veh	35.7
Intersection LOS	E

Movement	WBU	WBL	WBR	NBU	NBT	NBR	SBU	SBL	SBT
Lane Configurations									
Traffic Vol, veh/h	0	39	245	0	221	14	0	196	456
Future Vol, veh/h	0	39	245	0	221	14	0	196	456
Peak Hour Factor	0.92	0.97	0.97	0.92	0.97	0.97	0.92	0.97	0.97
Heavy Vehicles, %	2	5	0	2	1	0	2	1	1
Mvmt Flow	0	40	253	0	228	14	0	202	470
Number of Lanes	0	1	0	0	1	0	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	14.1	12.5	53.4
HCM LOS	B	B	F

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	14%	30%
Vol Thru, %	94%	0%	70%
Vol Right, %	6%	86%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	235	284	652
LT Vol	0	39	196
Through Vol	221	0	456
RT Vol	14	245	0
Lane Flow Rate	242	293	672
Geometry Grp	1	1	1
Degree of Util (X)	0.388	0.475	0.984
Departure Headway (Hd)	5.771	5.838	5.27
Convergence, Y/N	Yes	Yes	Yes
Cap	620	615	686
Service Time	3.836	3.905	3.317
HCM Lane V/C Ratio	0.39	0.476	0.98
HCM Control Delay	12.5	14.1	53.4
HCM Lane LOS	B	B	F
HCM 95th-tile Q	1.8	2.6	15.1

Rantoul Street @ Railroad Avenue (Exclusive Ped)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	52	74	21	0	37	0	443	14	19	383	0
Future Volume (vph)	54	52	74	21	0	37	0	443	14	19	383	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	10	10	10	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.96			1.00				
Frt		0.944			0.914			0.996				
Flt Protected		0.985			0.982						0.998	
Satd. Flow (prot)	0	1663	0	0	1319	0	0	1592	0	0	1614	0
Flt Permitted		0.893			0.785						0.969	
Satd. Flow (perm)	0	1507	0	0	1054	0	0	1592	0	0	1567	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		26			56			2				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		200			400			250			500	
Travel Time (s)		4.5			9.1			5.7			11.4	
Confl. Peds. (#/hr)			4			17			14			6
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	4%	10%	7%	0%	0%	6%	0%	3%	14%	6%	2%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Detector Phase	4	4		8	8			2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0			7.0		7.0	7.0	
Minimum Split (s)	18.0	18.0		18.0	18.0			18.0		18.0	18.0	
Total Split (s)	25.0	25.0		25.0	25.0			75.0		75.0	75.0	
Total Split (%)	21.4%	21.4%		21.4%	21.4%			64.1%		64.1%	64.1%	
Maximum Green (s)	20.0	20.0		20.0	20.0			70.0		70.0	70.0	
Yellow Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0			1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Recall Mode	None	None		None	None			C-Min		C-Min	C-Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												

Intersection Summary

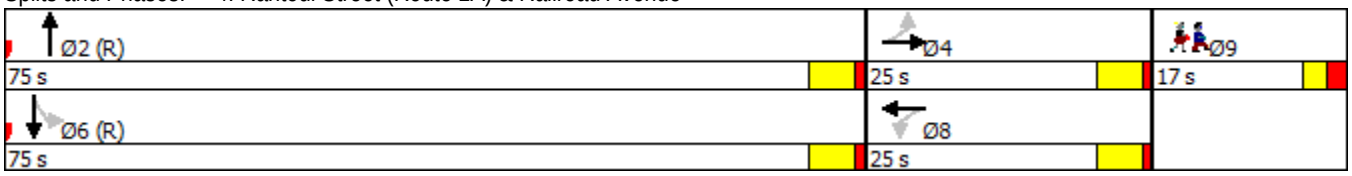
Area Type: Other
Cycle Length: 117
Actuated Cycle Length: 117
Offset: 75 (64%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	17.0
Total Split (s)	17.0
Total Split (%)	15%
Maximum Green (s)	13.0
Yellow Time (s)	2.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	6.0
Pedestrian Calls (#/hr)	30

Intersection Summary

Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 4: Rantoul Street (Route 1A) & Railroad Avenue



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	191	61	486	427
v/c Ratio	0.75	0.29	0.45	0.41
Control Delay	57.6	15.4	13.5	12.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	57.6	15.4	13.5	12.7
Queue Length 50th (ft)	120	3	190	160
Queue Length 95th (ft)	189	40	324	276
Internal Link Dist (ft)	120	320	170	420
Turn Bay Length (ft)				
Base Capacity (vph)	296	237	1088	1070
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.65	0.26	0.45	0.40

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	52	74	21	0	37	0	443	14	19	383	0
Future Volume (vph)	54	52	74	21	0	37	0	443	14	19	383	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	10	10	10	11	11	11	11	11	11
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		0.99			0.95			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.94			0.91			1.00			1.00	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1663			1315			1591			1614	
Flt Permitted		0.89			0.79			1.00			0.97	
Satd. Flow (perm)		1506			1051			1591			1568	
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
Adj. Flow (vph)	57	55	79	22	0	39	0	471	15	20	407	0
RTOR Reduction (vph)	0	22	0	0	47	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	169	0	0	14	0	0	485	0	0	427	0
Confl. Peds. (#/hr)			4			17			14			6
Heavy Vehicles (%)	4%	10%	7%	0%	0%	6%	0%	3%	14%	6%	2%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Actuated Green, G (s)		18.2			18.2			77.0			77.0	
Effective Green, g (s)		18.2			18.2			77.0			77.0	
Actuated g/C Ratio		0.16			0.16			0.66			0.66	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		234			163			1047			1031	
v/s Ratio Prot								c0.30				
v/s Ratio Perm		c0.11			0.01						0.27	
v/c Ratio		0.72			0.08			0.46			0.41	
Uniform Delay, d1		47.0			42.3			9.8			9.4	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		10.5			0.2			1.5			1.2	
Delay (s)		57.5			42.5			11.3			10.6	
Level of Service		E			D			B			B	
Approach Delay (s)		57.5			42.5			11.3			10.6	
Approach LOS		E			D			B			B	

Intersection Summary

HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	117.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	48	95	86	12	0	40	0	484	18	25	503	0
Future Volume (vph)	48	95	86	12	0	40	0	484	18	25	503	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	10	10	10	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.96			1.00				
Frt		0.949			0.897			0.995				
Flt Protected		0.990			0.988						0.998	
Satd. Flow (prot)	0	1779	0	0	1331	0	0	1626	0	0	1650	0
Flt Permitted		0.918			0.861						0.964	
Satd. Flow (perm)	0	1650	0	0	1160	0	0	1626	0	0	1593	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		24			56			3				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		303			423			250			465	
Travel Time (s)		6.9			9.6			5.7			10.6	
Confl. Peds. (#/hr)			3			12			25			16
Confl. Bikes (#/hr)			2			1			2			1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	2%	0%	0%	3%	0%	1%	0%	0%	0%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Detector Phase	4	4		8	8			2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0			7.0		7.0	7.0	
Minimum Split (s)	18.0	18.0		18.0	18.0			18.0		18.0	18.0	
Total Split (s)	30.0	30.0		30.0	30.0			70.0		70.0	70.0	
Total Split (%)	25.6%	25.6%		25.6%	25.6%			59.8%		59.8%	59.8%	
Maximum Green (s)	25.0	25.0		25.0	25.0			65.0		65.0	65.0	
Yellow Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0			1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Recall Mode	None	None		None	None			C-Min		C-Min	C-Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												

Intersection Summary

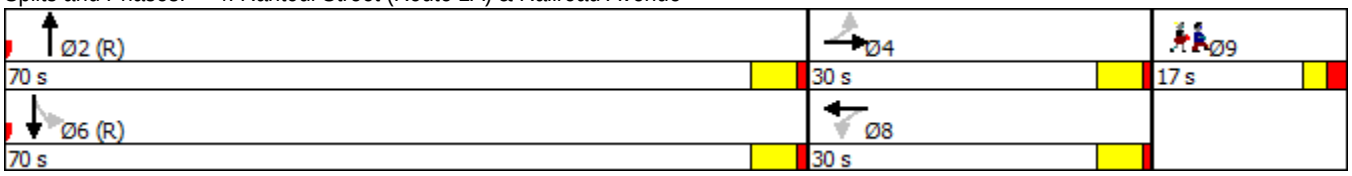
Area Type: Other
Cycle Length: 117
Actuated Cycle Length: 117

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	17.0
Total Split (s)	17.0
Total Split (%)	15%
Maximum Green (s)	13.0
Yellow Time (s)	2.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	6.0
Pedestrian Calls (#/hr)	25

Intersection Summary

Offset: 62 (53%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 4: Rantoul Street (Route 1A) & Railroad Avenue



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	239	55	523	550
v/c Ratio	0.78	0.22	0.49	0.53
Control Delay	57.6	11.6	15.3	16.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	57.6	11.6	15.3	16.3
Queue Length 50th (ft)	157	0	222	243
Queue Length 95th (ft)	230	33	375	413
Internal Link Dist (ft)	223	343	170	385
Turn Bay Length (ft)				
Base Capacity (vph)	379	297	1069	1046
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.63	0.19	0.49	0.53

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	48	95	86	12	0	40	0	484	18	25	503	0
Future Volume (vph)	48	95	86	12	0	40	0	484	18	25	503	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	10	10	10	11	11	11	11	11	11
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		0.99			0.96			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.95			0.90			1.00			1.00	
Flt Protected		0.99			0.99			1.00			1.00	
Satd. Flow (prot)		1777			1324			1627			1649	
Flt Permitted		0.92			0.86			1.00			0.96	
Satd. Flow (perm)		1649			1154			1627			1593	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	50	99	90	12	0	42	0	504	19	26	524	0
RTOR Reduction (vph)	0	20	0	0	45	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	219	0	0	10	0	0	522	0	0	550	0
Confl. Peds. (#/hr)			3			12			25			16
Confl. Bikes (#/hr)			2			1			2			1
Heavy Vehicles (%)	2%	0%	2%	0%	0%	3%	0%	1%	0%	0%	0%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Actuated Green, G (s)		20.5			20.5			74.7			74.7	
Effective Green, g (s)		20.5			20.5			74.7			74.7	
Actuated g/C Ratio		0.18			0.18			0.64			0.64	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		288			202			1038			1017	
v/s Ratio Prot								0.32				
v/s Ratio Perm		c0.13			0.01						c0.35	
v/c Ratio		0.76			0.05			0.50			0.54	
Uniform Delay, d1		45.9			40.1			11.3			11.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		11.2			0.1			1.7			2.1	
Delay (s)		57.2			40.2			13.0			13.7	
Level of Service		E			D			B			B	
Approach Delay (s)		57.2			40.2			13.0			13.7	
Approach LOS		E			D			B			B	

Intersection Summary

HCM 2000 Control Delay	22.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	117.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	52	94	21	0	37	0	449	14	19	389	0
Future Volume (vph)	61	52	94	21	0	37	0	449	14	19	389	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	10	10	10	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.96			1.00				
Frt		0.939			0.914			0.996				
Flt Protected		0.985			0.982						0.998	
Satd. Flow (prot)	0	1653	0	0	1319	0	0	1592	0	0	1614	0
Flt Permitted		0.893			0.792						0.969	
Satd. Flow (perm)	0	1499	0	0	1064	0	0	1592	0	0	1568	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		31			56			2				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		200			400			250			500	
Travel Time (s)		4.5			9.1			5.7			11.4	
Confl. Peds. (#/hr)			4			17			14			6
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	4%	10%	7%	0%	0%	6%	0%	3%	14%	6%	2%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Detector Phase	4	4		8	8			2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0			7.0		7.0	7.0	
Minimum Split (s)	18.0	18.0		18.0	18.0			18.0		18.0	18.0	
Total Split (s)	25.0	25.0		25.0	25.0			75.0		75.0	75.0	
Total Split (%)	21.4%	21.4%		21.4%	21.4%			64.1%		64.1%	64.1%	
Maximum Green (s)	20.0	20.0		20.0	20.0			70.0		70.0	70.0	
Yellow Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0			1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Recall Mode	None	None		None	None			C-Min		C-Min	C-Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												

Intersection Summary

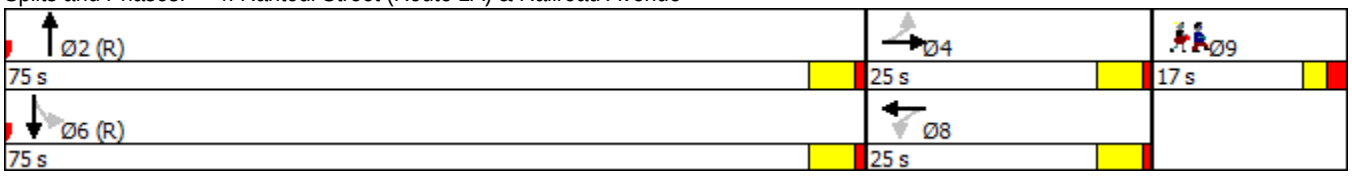
Area Type: Other
Cycle Length: 117
Actuated Cycle Length: 117
Offset: 75 (64%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	17.0
Total Split (s)	17.0
Total Split (%)	15%
Maximum Green (s)	13.0
Yellow Time (s)	2.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	6.0
Pedestrian Calls (#/hr)	30

Intersection Summary

Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 4: Rantoul Street (Route 1A) & Railroad Avenue



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	220	61	493	434
v/c Ratio	0.76	0.26	0.48	0.43
Control Delay	55.1	14.1	15.1	14.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	55.1	14.1	15.1	14.3
Queue Length 50th (ft)	137	3	207	175
Queue Length 95th (ft)	211	39	348	297
Internal Link Dist (ft)	120	320	170	420
Turn Bay Length (ft)				
Base Capacity (vph)	314	250	1071	1054
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.70	0.24	0.46	0.41

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	52	94	21	0	37	0	449	14	19	389	0
Future Volume (vph)	61	52	94	21	0	37	0	449	14	19	389	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	10	10	10	11	11	11	11	11	11
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		0.99			0.96			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.94			0.91			1.00			1.00	
Flt Protected		0.99			0.98			1.00			1.00	
Satd. Flow (prot)		1654			1320			1592			1614	
Flt Permitted		0.89			0.79			1.00			0.97	
Satd. Flow (perm)		1499			1064			1592			1568	
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
Adj. Flow (vph)	65	55	100	22	0	39	0	478	15	20	414	0
RTOR Reduction (vph)	0	26	0	0	46	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	194	0	0	15	0	0	492	0	0	434	0
Confl. Peds. (#/hr)			4			17			14			6
Heavy Vehicles (%)	4%	10%	7%	0%	0%	6%	0%	3%	14%	6%	2%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Actuated Green, G (s)		20.7			20.7			74.5			74.5	
Effective Green, g (s)		20.7			20.7			74.5			74.5	
Actuated g/C Ratio		0.18			0.18			0.64			0.64	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		265			188			1013			998	
v/s Ratio Prot								c0.31				
v/s Ratio Perm		c0.13			0.01						0.28	
v/c Ratio		0.73			0.08			0.49			0.43	
Uniform Delay, d1		45.5			40.2			11.2			10.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		10.1			0.2			1.7			1.4	
Delay (s)		55.6			40.4			12.8			12.1	
Level of Service		E			D			B			B	
Approach Delay (s)		55.6			40.4			12.8			12.1	
Approach LOS		E			D			B			B	

Intersection Summary

HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	117.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	95	93	12	0	40	0	486	18	25	511	0
Future Volume (vph)	50	95	93	12	0	40	0	486	18	25	511	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	16	16	16	10	10	10	11	11	11	11	11	11
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.96			1.00				
Frt		0.947			0.897			0.995				
Flt Protected		0.990			0.988						0.998	
Satd. Flow (prot)	0	1774	0	0	1331	0	0	1626	0	0	1650	0
Flt Permitted		0.918			0.862						0.964	
Satd. Flow (perm)	0	1645	0	0	1161	0	0	1626	0	0	1593	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25			56			3				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		303			423			250			465	
Travel Time (s)		6.9			9.6			5.7			10.6	
Confl. Peds. (#/hr)			3			12			25			16
Confl. Bikes (#/hr)			2			1			2			1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	2%	0%	0%	3%	0%	1%	0%	0%	0%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Shared Lane Traffic (%)												
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Detector Phase	4	4		8	8			2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0			7.0		7.0	7.0	
Minimum Split (s)	18.0	18.0		18.0	18.0			18.0		18.0	18.0	
Total Split (s)	30.0	30.0		30.0	30.0			70.0		70.0	70.0	
Total Split (%)	25.6%	25.6%		25.6%	25.6%			59.8%		59.8%	59.8%	
Maximum Green (s)	25.0	25.0		25.0	25.0			65.0		65.0	65.0	
Yellow Time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0			1.0		1.0	1.0	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.0			5.0			5.0			5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	
Recall Mode	None	None		None	None			C-Min		C-Min	C-Min	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												

Intersection Summary

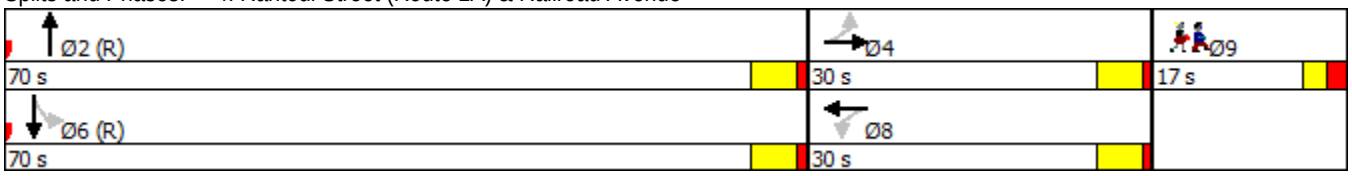
Area Type: Other
Cycle Length: 117
Actuated Cycle Length: 117

Lane Group	Ø9
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Heavy Vehicles (%)	
Parking (#/hr)	
Shared Lane Traffic (%)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	7.0
Minimum Split (s)	17.0
Total Split (s)	17.0
Total Split (%)	15%
Maximum Green (s)	13.0
Yellow Time (s)	2.0
All-Red Time (s)	2.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	7.0
Flash Dont Walk (s)	6.0
Pedestrian Calls (#/hr)	25

Intersection Summary

Offset: 62 (53%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 4: Rantoul Street (Route 1A) & Railroad Avenue



Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	248	55	525	558
v/c Ratio	0.78	0.22	0.50	0.54
Control Delay	57.5	11.4	15.8	16.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	57.5	11.4	15.8	16.9
Queue Length 50th (ft)	163	0	226	252
Queue Length 95th (ft)	238	33	382	428
Internal Link Dist (ft)	223	343	170	385
Turn Bay Length (ft)				
Base Capacity (vph)	381	299	1062	1040
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.65	0.18	0.49	0.54

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	50	95	93	12	0	40	0	486	18	25	511	0
Future Volume (vph)	50	95	93	12	0	40	0	486	18	25	511	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	16	16	16	10	10	10	11	11	11	11	11	11
Total Lost time (s)		5.0			5.0			5.0			5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		0.99			0.96			1.00			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.95			0.90			1.00			1.00	
Flt Protected		0.99			0.99			1.00			1.00	
Satd. Flow (prot)		1772			1325			1627			1649	
Flt Permitted		0.92			0.86			1.00			0.96	
Satd. Flow (perm)		1644			1156			1627			1593	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	52	99	97	12	0	42	0	506	19	26	532	0
RTOR Reduction (vph)	0	20	0	0	45	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	228	0	0	10	0	0	524	0	0	558	0
Confl. Peds. (#/hr)			3			12			25			16
Confl. Bikes (#/hr)			2			1			2			1
Heavy Vehicles (%)	2%	0%	2%	0%	0%	3%	0%	1%	0%	0%	0%	0%
Parking (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type	Perm	NA		Perm	NA			NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8						6		
Actuated Green, G (s)		21.1			21.1			74.1			74.1	
Effective Green, g (s)		21.1			21.1			74.1			74.1	
Actuated g/C Ratio		0.18			0.18			0.63			0.63	
Clearance Time (s)		5.0			5.0			5.0			5.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		296			208			1030			1008	
v/s Ratio Prot								0.32				
v/s Ratio Perm		c0.14			0.01						c0.35	
v/c Ratio		0.77			0.05			0.51			0.55	
Uniform Delay, d1		45.6			39.6			11.6			12.1	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		11.4			0.1			1.8			2.2	
Delay (s)		57.0			39.7			13.4			14.3	
Level of Service		E			D			B			B	
Approach Delay (s)		57.0			39.7			13.4			14.3	
Approach LOS		E			D			B			B	

Intersection Summary

HCM 2000 Control Delay	22.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	117.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group