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Date: September 16, 2025

Project #: R175768

From: Patrick Dunford, P.E.
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Re: **Transportation evaluation**
380 King Street
Franklin, Massachusetts

VHB has evaluated the potential transportation-related impacts associated with the development of 30 residential units (the "Project") proposed to be located within a currently vacant lot at 380 King Street in Franklin, Massachusetts (the "Site"). The proposal for the Site involves the construction of 30 new residential units within a single three-story building along with parking, internal roadways, and supporting infrastructure.

This memorandum includes estimates of Project trip generation and parking demands, and an evaluation of on-Site traffic circulation and potential off-Site impacts. As detailed herein, the Site layout can readily accommodate the expected traffic circulation and parking needs for the Project, while the Project itself will have a negligible impact on traffic operations in the vicinity of the Site.

Project Description and Site Location

The Project Site is located south of and adjacent to King Street in Franklin, Massachusetts. The overall property consists of four separate lots owned by the Project proponent. These include the existing 7-11 convenience store/gas station at the southeast corner of the King Street/Union Street intersection and the King Street Café property located east of and adjacent to that. The Project Site is located immediately east of and adjacent to that lot, with the existing King's Brick Oven Pizza & Pub located to the east of that. The Site is abutted to the south by the Spruce Pond Condominium development to the south. The four parcels comprising the overall property currently have internal connections which will be maintained as part of the Project, though with some modifications as discussed further below.

The proposal for the Site involves the construction of 30 new two-bedroom residential condominium units within a single three-story building. The Project's parking needs will be accommodated by 59 surface parking spaces with internal roadways and supporting infrastructure also being constructed.

Site Access

There currently is a single full-access driveway along the Site frontage which VHB observed to primarily be used by the adjacent King Street Café to the west. A driveway to the King's Brick Oven Pizza & Pub lot is located roughly 120 feet further to the east of the existing Site driveway. Another 165 feet to the west, there is an existing full-access driveway located along the King Street Café frontage. During field visits, VHB observed traffic from the adjacent 7-11 parcel also using this driveway. Finally, an enter-only curb cut on King Street serving the 7-11 parcel is located immediately east of and adjacent to the King Street/Union Street signalized intersection.

A full-access driveway is located along the 7-11 Union Street frontage roughly 110 feet to the south of that roadway's signalized intersection with King Street. Each of the four lots are interconnected by internal drive aisles located approximately 35 feet to the south of King Street. Similar cross connections exist to the south of the 7-11 and King

Street Café buildings. There also is an existing connecting driveway starting at the south side of the King Street Café heading one-way through the Site to the King's Brick Oven Pizza & Pub lot to the east.

As part of the Project the existing Site driveway along the Site's King Street frontage will be closed. Site residents and visitors still will be able to access and egress the Site using one of the nearby curb cuts and interconnecting drive aisles as noted above.

A graphic showing the Project Site in relation to the surrounding area is provided in Figure 1.

Existing Conditions

The existing condition analysis consists of an inventory of the traffic control, roadway, driveway, and intersection geometry in the study area, a review of traffic volumes

Study Area

Based on an understanding of the current traffic operations in the region, the study area for this evaluation focused on the Project Site and its access and egress. This determination was made considering that the Project trip generation is expected to be nominal as discussed later in this document.

Study Area Roadways

King Street

In the immediate vicinity of the Site, King Street is classified as an arterial roadway running in a general east west direction north-south direction between Washington Street roughly 1.2 miles to the southwest and East Central Street (Route 140) approximately one mile to the northeast. King Street is under local Town of Franklin jurisdiction adjacent to the Site and has a posted speed limit of 35 miles per hour (mph) in both directions. King Street provides single lanes in each direction next to the Site with exclusive turning lanes at key intersections. There is not any on-street parking provided. Sidewalks are provided on both sides of the road near the Site to the east of Union Street and on the southerly side to the west of Union Street. Land use along King Street is a mixture of commercial and residential in the immediate vicinity of the Site.

Union Street

Within the study area, Union Street is classified as an arterial/collector roadway to the north of King Street and a local roadway to the south of King Street. The road runs in a general north/south direction extending from Beaver Street 1.6 miles to the north and 0.3 miles to its terminus to the south of King Street. This roadway is under Town of Franklin jurisdiction and has a posted 30 mph speed limit in both directions near King Street. The roadway generally provides single lanes in each direction with exclusive turning lanes at key intersections. Land use along this roadway near the Site is primarily residential with various commercial establishments.



Source: Imagery @ 2025 Nearmap; accessed September 9, 2025.

Figure 1
Site Location Map

**380 King Street
Franklin, Massachusetts**

Study Area Intersections

King Street/Union Street

Union Street intersects King Street from the north and south to form a four-way signalized intersection. The eastbound King Street approach features a single through lane with exclusive left- and right-turn lanes. The westbound King Street approach has a shared through-/right-turn lane and an exclusive left-turn lane. The northbound Union Street approach features a single through-/right-turn lane and an exclusive left-turn lane while the southerly approach has a shared through-left-turn lane and an exclusive right-turn lane. Crosswalks are provided across each leg of the intersection with a corresponding exclusive pedestrian phase.

Signal Phasing

The signal at this location operates as part of a coordinated system with the nearby signals at the I-495 interchange. This system is in operation on weekdays from 6 AM to 11 PM, on Saturdays from 9 AM to 9 PM, and on Sundays from 10 AM to 7 PM. The signal phasing includes an eastbound “lead” phase during which left turns run unopposed along with eastbound through movements. Southbound right turns from Union Street also are allowed during this phase. This is followed by a phase for both eastbound and westbound King Street traffic, with only westbound left turns being allowed permissively. This is followed by a King Street westbound-only phase. The next phase is a push-button actuated pedestrian phase. The subsequent Union Street phasing starts with a northbound lead phase followed by a phase for both northbound and southbound traffic, with left turns being allowed permissively.

Existing Conditions Traffic Volumes

The off-Site traffic counts for this current transportation analysis were obtained from a prior Transportation Impact Assessment (TIA)¹ prepared for a proposed warehouse development further to the west on King Street. That study’s traffic data collection was conducted in May 2021 and included turning movement counts at the King Street/Union Street intersection. These counts were subsequently used in a separate study² for a proposed daycare on Union Street to the south. Both studies include adjustments based on COVID-related factors and seasonal factors. Following that, the critical weekday morning and evening peak hours were identified as being from 8:00 AM to 9:00 AM and 4:30 PM to 5:30 PM, respectively.

Future Conditions Traffic Volumes

The existing conditions volumes from the more recent daycare TIA noted above were projected across a standard seven-year horizon to 2029. Anticipated traffic from other planned development projects (including the nearby warehouse proposal) was added onto these volumes as part of that study to create the future 2029 No-Build volumes used in the daycare study. Finally, the anticipated daycare trip generation was added to the 2029 No-Build volumes in that study to develop the 2029 Build volumes for that assessment.

1 Transportation Impact Assessment – Proposed Child Day Care Center, Stonefield Engineering & Design, LLC, Salem, Massachusetts, June 22, 2022.
2 Transportation Impact Assessment – Proposed Warehouse Building – 585 King Street, Vanasse & Associates Inc., Andover, Massachusetts, October 2021.

For consistency, the volumes discussed above were used as this current study's "2029 No-Build" condition without further adjustment. For comparison purposes, separate 2029 Build condition volumes were developed for this study by adding the anticipated Project trip generation as discussed in the following section.

Trip Generation

To estimate the number of vehicle trips to be generated by the proposed Project, standard national data provided in the *Trip Generation Manual*³, published by the Institute of Transportation Engineers (ITE), were utilized. The number of vehicle trips expected to be generated by the proposed Project were estimated based on ITE land use code (LUC) 220 – Multifamily Housing (Low-Rise) for the proposed 30-unit development. This database is comprised of traffic counts from sites having two- or three-floors of residences while not being located within ½ mile of public rail transit.

The resulting Project trips based on the TE trip generation estimates are shown in Table 1.

3 [Trip Generation Manual \(12th edition\)](#), Institute of Transportation Engineers (Washington DC), 2025.

Table 1 Project-Generated Trips

	Total Vehicle Trips
Weekday Daily	
Enter	145
<u>Exit</u>	<u>145</u>
Total	290
Weekday Morning Peak Hour	
Enter	6
<u>Exit</u>	<u>18</u>
Total	24
Weekday Evening Peak Hour	
Enter	14
<u>Exit</u>	<u>8</u>
Total	22
Saturday Daily	
Enter	69
<u>Exit</u>	<u>69</u>
Total	138
Saturday Midday Peak Hour	
Enter	6
<u>Exit</u>	<u>9</u>
Total	15

Source: Trip Generation Manual, 12th Edition, Institute of Transportation Engineers (ITE), Washington, D.C., 2025. based on ITE Land Use Code 220 "Multifamily Housing (Low-Rise)" for the proposed 30-unit development.

As shown in Table 1, the Project is expected to generate 24 and 22 vehicle trips during the respective weekday morning and evening peak hours. Saturday peak-hour trip generation is expected to be slightly lower, with only 15 trips generated during the midday peak hour. These projected volumes translate into no more than roughly one vehicle being generated every three minutes under peak conditions. Traffic volumes associated with the Site are expected to be lower throughout the remainder of the day.

Site Access Plan

As noted earlier, primary access to the Site will be provided via the existing driveways for 370 King Street (King's Brick Oven Pizza & Pub) and 390 King Street (King Street Café). Site access and egress also will be available from the existing Union Street driveway to the 400 King Street parcel occupied by 7-11. There are existing access easements connecting these parcels, all of which are under common ownership by the proponent. With these easements, there are existing connections between each parcel located just south of King Street. Existing cross-connections between 390 King Street and 400 King Street also exist to the rear of King Street Café and 7-11, respectively. An existing one-way eastbound driveway behind the King Street Café to the adjacent Project Site parcel also will be maintained.

However, that connection will end at the Project Site and will no longer continue to the 370 King Street parcel occupied by King’s Brick Oven Pizza & Pub.

To help minimize conflicts along King Street, the existing driveway for 380 King Street will be closed. The striping for the existing exclusive left-turn lane on King Street will be removed as part of this Project using acceptable means and methods approved by the Franklin Department of Public Works.

Project Parking

The potential parking demand expected for the Project has been estimated based on the Parking Generation Manual⁴, published by ITE. Parking generation was estimated based using ITE’s Multifamily Housing (Low-Rise) database (ITE land use code 220). This category for residential developments having between two and three levels of residence and having at least one two-bedroom unit. ITE provides separate rates and equations based on the number of units or the number of total bedrooms in a development. Considering this information, the resulting parking demands for the Project were compared as shown in Table 2. Using both variables, the average demand and the 85th percentile parking demand (the demand that would only be exceeded 15 percent of the time) were calculated.

Table 2 Project Parking Generation Summary

	Weekday		Saturday		Proposed Supply ^b
	Average Demand ^a	85 th Percentile Demand ^a	Average Demand	85 th Percentile Demand	
Units (30)	38	48	40	44	59
Bedrooms (60)	40	52	48	53	59

a Parking Generation Manual (6th Edition); Institute of Transportation Engineers (Washington, D.C.) 2023. Land Use Code 220 Multifamily Housing 2+ BR (Low-Rise). Average and 85th percentile parking demands calculated for 30 residential units (60 bedrooms).

b Source: “380 King Street – Condominiums – Proposed Site Plan” prepared by Narragansett Engineering Inc. dated October 10, 2024 (revised through July 23, 2025).

ITE indicates the peak residential parking demand can be expected to occur around 5 AM when most residents would be home on both a typical weekday and Saturday. The resulting peak 85th percentile parking demand is expected to occur on a Saturday with a demand of 53 parked vehicles. This estimated demand is lower than the proposed 59-space parking supply, so the Project parking needs readily can be accommodated within the Site.

Sight Distance

VHB conducted a sight distance analysis, conforming to guidelines of the American Association of State Highway and Transportation Officials (AASHTO)⁵, at the existing King’s Brick Oven Pizza & Pub and King Street Café driveways on King Street. Sight distance measurements also were conducted at the existing Union Street driveway at the 7-11 lot as

4 Parking Generation Manual (5th Edition), Institute of Transportation Engineers, Washington D.C., 2019.

5 A Policy on the Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, 2011.

that curb cut also may be used by Site traffic. Sight distance is generally divided into two categories: Stopping Sight Distance (SSD) and Intersection Sight Distance (ISD).

Sight Distance Procedures

Stopping Sight Distance (SSD) is the distance required for a vehicle approaching an intersection from either direction to perceive, react and come to a complete stop before colliding with an object in the road, in this case the exiting vehicle from a driveway. In this respect, SSD can be considered as the minimum visibility criterion for the safe operation of an unsignalized intersection.

Intersection Sight Distance (ISD) is based on the time required for perception, reaction and completion of the desired critical exiting maneuver once the driver on a minor street or driveway approach decided to execute the maneuver. Calculation for the critical ISD includes the time to (1) turn left, and to clear the half of the intersection without conflicting with the vehicles approaching from the left; and (2) accelerate to the operating speed of the roadway without causing approaching vehicles to unduly reduce their speed. In this context, ISD can be considered as a desirable visibility criterion for the safe operation of an unsignalized intersection. Essentially, while SSD is the minimum distance needed to avoid collisions, ISD is the minimum distance needed so that mainline motorists will not have to substantially reduce their speed due to turning vehicles. To maintain the safe operation of an unsignalized intersection, ISD only needs to be equal to the stopping sight distance, though it is desirable to meet ISD requirements by themselves.

Sight Distance Analysis

Table 3 summarizes the sight distance analysis for the existing Site access driveways anticipated to be used by Project traffic based on the posted speed limits in this area.

Table 3 Sight Distance Analysis Summary

Location	Stopping Sight Distance (ft) ^a			Intersection Sight Distance (ft) ^a		
	Traveling	Required	Measured	Turning	Desired	Measured
Existing 370 King Street (King's Brick Oven & Pizza) Site driveway	Eastbound	250	500'+	Left	390	410'
	Westbound	250	500'+	Right	390	600+
Existing 390 King Street (King Street Café) Site driveway	Eastbound	250	475'	Left	390	315' ^b
	Westbound	250	500'+	Right	390	600'+
Existing Union Street (7-11) Site driveway	Northbound	200	450'+	Left	330	295' ^c
	Southbound	200	450'+	Right	330	275' ^d

- a Based on guidelines established in *A Policy on the Geometric Design of Highways and Streets, Seventh Edition*, American Association of State Highway and Transportation Officials (AASHTO), 2018 for posted 35-mph speed limit on King Street and 30 mph speed limit on Union Street.
- b 290-foot intersection sight distance measured from 14.5-foot setback increases to 315 feet when measured from 10-foot setback.
- c 220-foot intersection sight distance measured from 14.5-foot setback increases to 295 feet when measured from 10-foot setback.
- d Intersection sight distance looking to right blocked by tree when measured from 14.5-foot setback. 275-foot intersection sight distance available when measured from 10-foot setback.

As shown in Table 3, the required SSD and ISD values are met at the existing King Street driveway for 370 King Street. Sight-line measurements were not conducted for the existing 380 King Street curb cut as that driveway will be closed as part of the Project.

The available SSD at the existing 390 King Street (King Street Café) driveway exceeds the required levels specified by AASHTO. However, the available ISD looking to the left does not meet the desirable ISD value specified by AASHTO. The constraining factor at this location is brush located along the northerly property line for 400 King Street. The AASHTO standards specify a precise 14.5-foot setback for the driver's eye from the edge of the King Street travelled way. However, transportation engineers frequently use a shorter setback (typically ten feet) to reflect "real world" conditions. In instances where there are visual obstructions, such as buildings or shrubbery, most motorists regularly use the shorter 10' setback without necessarily being aware of it falling below AASHTO standard lengths. Under that condition, the ISD looking to the left is 315 feet. This still falls below the desirable 390-foot level for 35-mph speeds. However, as the ISD is still above the required 250 foot stopping sight distance, approaching traffic will be able to reduce its speed to allow for exiting maneuvers from driveways without creating an unsafe condition.

The SSD measurements at the existing Union Street driveway exceed AASHTO requirements in both directions. When measured from the standard 14.5-foot setback noted above, visibility looking to the right is blocked for exiting traffic by a large tree just north of the driveway. However, when measured from a 10-foot setback, the ISD looking to the right extends beyond Union Street's intersection with King Street. While the ISD still falls below the desirable 330-foot distance, it still exceeds the required SSD, which results in an acceptable condition as noted earlier. ISD looking to the left also is limited by brush along the easterly side of the roadway. When measured from a 10-foot setback, there is 275 feet of ISD looking to the left. This falls beneath the AASHTO desirable level but still is well above the required SSD.

As part of the Project, existing overgrown brush along the Project Site's King Street and Union Street frontages will be cut back to help improve the sight lines beyond the levels noted above.

Traffic Operations Analysis

The Project is expected to generate only nominal traffic volumes, with Project trips having multiple means of accessing and egressing the Site. With traffic being dissipated in this manner the likelihood of impacts at any one point on the surrounding roadways is reduced. Regardless, intersection capacity analyses were conducted during the critical weekday morning and evening peak hours at the King Street/Union Street intersection for the 2029 No-Build and 2029 Build conditions discussed earlier. This type of analysis is undertaken to identify how well a given location functions under the traffic demands placed upon it, with operating conditions classified by calculated "levels-of-service".

Level of Service Criteria

The evaluation criteria used to analyze area intersections in this evaluation are based on the percentile delay method for signalized intersections and the Highway Capacity Manual (HCM), 6th Edition⁶ for unsignalized intersections. Level-of-service (LOS) is the term used to denote the different operating conditions that occur at a given intersection under various traffic volume loads. It is a qualitative measure considering several factors including roadway geometry, speed, travel delay, and freedom to maneuver. LOS designations range from A to F, with LOS A representing the best

⁶ Highway Capacity Manual, 6th Edition, Transportation Research Board, Washington, D.C., 2016.

conditions and LOS F representing the worst. These designations are based on delay and are reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection and the LOS designation is for overall conditions at the intersection. Table 4 shows the LOS criteria for signalized intersections.

Table 4 Intersection Level-of-Service Criteria

Level-of-Service	Delay – Signalized Intersection
A	0 to 10 seconds
B	10 to 20 seconds
C	20 to 35 seconds
D	35 to 55 seconds
E	55 to 80 seconds
F	Greater than 80 seconds

Source: 2010 Highway Capacity Manual Exhibit 19-1.

Signalized Intersection Capacity Analysis

Consistent with MassDOT guidelines, Synchro 11™ software was used to model operations at the King Street/Union Street intersection. Signalized intersection capacity analyses were conducted at this location for a future 2029 condition with and without the Project in place. This analysis was conducted using the volumes discussed earlier along with the same signal phasing, signal timings, and other inputs from the analysis presented in the prior nearby daycare report. Table 5 summarizes the intersection capacity analyses and the capacity analysis worksheets are included in the Appendix to this report.

Table 5 Signalized Intersection Capacity Analysis

	2029 No-Build Conditions ¹					2029 Build Conditions				
	v/c	Del	LOS	50 Q	95 Q	v/c	Del	LOS	50 Q	95 Q
<i>Weekday Morning</i>										
King Street EB L	0.61	51	D	85	139	0.61	51	D	85	139
King Street EB T	0.47	14	B	205	253	0.47	14	B	209	256
King Street EB R	0.14	1	A	0	16	0.14	1	A	0	16
King Street WB L/T/R	0.57	27	C	172	232	0.58	28	C	174	233
Union Street NB L	0.57	35	C	100	177	0.58	35	D	103	184
Union Street NB T/RR	0.24	13	B	24	72	0.24	14	B	26	76
Union Street SB L/T	0.69	67	E	65	#161	0.69	67	E	66	#162
<u>Union Street SB R</u>	<u>0.38</u>	<u>6</u>	<u>A</u>	<u>2</u>	<u>48</u>	<u>0.51</u>	<u>8</u>	<u>A</u>	<u>0</u>	<u>36</u>
Overall		24	C				24	C		
<i>Weekday Evening</i>										
King Street EB L	0.76	52	D	163	237	0.76	52	D	163	237
King Street EB T	0.54	13	B	211	298	0.55	13	B	215	304
King Street EB R	0.10	0	A	0	3	0.10	0	A	0	3
King Street WB L/T/R	0.77	35	D	223	#346	0.78	35	D	223	#347
Union Street NB L	0.64	42	D	111	#192	0.65	43	D	114	#200
Union Street NB T/RR	0.22	14	B	20	65	0.23	14	B	21	66
Union Street SB L/T	0.86	97	F	~88	#200	0.89	104	F	~91	#205
<u>Union Street SB R</u>	<u>0.34</u>	<u>8</u>	<u>A</u>	<u>25</u>	<u>73</u>	<u>0.22</u>	<u>2</u>	<u>A</u>	<u>0</u>	<u>25</u>
Overall		30	C				30	C		

1 Source: analysis based on "2029 Build Condition" volumes presented in "Transportation Impact Assessment – Proposed Child Care Center" prepared by Stonefield (Salem, Massachusetts), dated June 22, 2022.
 a Volume to capacity ratio.
 b Average total delay, in seconds per vehicle.
 c Level-of-service.
 d 50th percentile queue, in feet.
 e 95th percentile queue, in feet.
 # 95th percentile volume exceeds capacity; queue may be longer.
 ~ volume exceeds capacity; queue is theoretically infinite
 L = Left-turn movement; T = through movement; R = Right-turn movement

As shown in Table 5, the King Street/Union Street intersection is projected to operate at LOS C during peak hour conditions under the 2029 No-Build condition without the Project. While the intersection operates at an overall LOS C, some movements function with longer delays. Specifically, the Union Street southbound left-turn/through-movement operates at LOS E and LOS F during the respective weekday morning and evening peak hours. This is a function of this intersection operating as part of a coordinated system with the existing signals to the southwest at the I-495 interchange. During the coordinated operation of the signal green time is prioritized for the King Street through movements with the southbound Union Street green time being limited compared to off-peak times. Regardless, even with the longer delays on this approach, the 95th percentile queue generally should be limited to 200 feet.

With the addition of Project traffic under the 2029 Build condition, the overall LOS at the intersection will remain at LOS C during both critical peak hours. Likewise, the LOS for the southbound Union Street movements discussed above. Increases in delay due to the Project are projected to be one and seven seconds during the respective weekday morning and evening peak hours. The 95th percentile queue lengths for these movements only are expected to

increase by one to five feet. Based on these results, the Project should not have a noticeable impact on traffic operations at this intersection.

Conclusion

VHB has concluded a transportation evaluation to assess the potential traffic impacts associated with the proposed 30-unit residential development with 59 supporting parking spaces. As part of this Project, the existing driveway for 380 King Street will be closed to help minimize conflicts on King Street. Project trips will be able to access and egress the Site by way of existing drive aisles connecting to 370 King Street, 390 King Street, and 400 King Street, all of which are under common ownership. The striping for the existing exclusive left-turn lane on King Street at the 380 King Street driveway will be removed as part of this Project using acceptable means and methods approved by the Franklin Department of Public Works.

The proposed Project is expected to generate 24 and 22 vehicle trips during the respective weekday morning and evening peak hours. Saturday peak-hour trip generation is expected to be slightly lower, with only 15 trips generated during the midday peak hour. These projected volumes translate into no more than roughly one vehicle being generated every three minutes under peak conditions. Having multiple means of entering and exiting the Site also will help dissipate traffic further so that no single location will be overburdened. As shown by this report's capacity analysis, this nominal level of traffic generation is not expected to create a perceptible impact on the study area roadways.

The potential parking demand expected for the Project has been estimated based on the Parking Generation Manual⁷, published by ITE. Parking generation was estimated based using ITE's Multifamily Housing (Low-Rise) database (ITE land use code 220). This category is for residential developments having between two and three levels of residence and having at least one two-bedroom unit. The Project parking demand was estimated using the ITE data, with a peak 85th percentile demand of 53 parked vehicles identified. This estimated demand is lower than the proposed 59-space parking supply, so the Project parking needs readily can be accommodated within the Site.

Acceptable sight lines are available for traffic turning to and from the various Site access points. With this and the proposed removal of the existing 380 King Street driveway, safe and efficient access will be provided.

⁷ Parking Generation Manual (5th Edition), Institute of Transportation Engineers, Washington D.C., 2019.

APPENDIX

- Capacity Analysis

Capacity Analysis



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	131	509	130	75	485	27	197	49	76	33	69	174
Future Volume (vph)	131	509	130	75	485	27	197	49	76	33	69	174
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	14	11	11	12	12	12	12	12	11	11	11
Satd. Flow (prot)	1711	1968	1561	0	3473	0	1805	1703	0	0	1807	1516
Flt Permitted	0.950				0.798		0.433				0.841	
Satd. Flow (perm)	1705	1968	1522	0	2787	0	820	1703	0	0	1545	1496
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164		5			78				181
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		738			483			681			1283	
Travel Time (s)		16.8			11.0			15.5			29.2	
Confl. Peds. (#/hr)	3		5	5		3	4					
Confl. Bikes (#/hr)									2			1
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 (%)	2%	3%	0%	0%	3%	0%	0%	0%	0%	0%	0%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	139	541	138	0	625	0	210	133	0	0	108	185
Turn Type	Prot	NA	Perm	pm+pt	NA		pm+pt	NA		Perm	NA	pm+ov
Protected Phases	5	2		1	6		3	8			4	5
Permitted Phases			2	6			8			4		4
Detector Phase	5	2	2	1	6		3	8		4	4	5
Switch Phase												
Minimum Initial (s)	5.0	12.0	12.0	12.0	12.0		5.0	8.0		8.0	8.0	5.0
Minimum Split (s)	11.0	18.0	18.0	18.0	18.0		11.0	14.0		14.0	14.0	11.0
Total Split (s)	27.0	55.0	55.0	11.0	39.0		19.0	34.0		15.0	15.0	27.0
Total Split (%)	27.0%	55.0%	55.0%	11.0%	39.0%		19.0%	34.0%		15.0%	15.0%	27.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0		6.0		6.0	6.0			6.0	6.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead			Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes			Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Min		None	None		None	None	None
Act Effect Green (s)	13.4	58.6	58.6		39.2		29.4	29.4			10.2	23.6
Actuated g/C Ratio	0.13	0.59	0.59		0.39		0.29	0.29			0.10	0.24
v/c Ratio	0.61	0.47	0.14		0.57		0.57	0.24			0.69	0.38
Control Delay	51.4	13.7	1.2		27.3		34.7	13.2			67.0	6.4
Queue Delay	0.0	0.0	0.0		0.0		0.0	0.0			0.0	0.0
Total Delay	51.4	13.7	1.2		27.3		34.7	13.2			67.0	6.4
LOS	D	B	A		C		C	B			E	A
Approach Delay		18.0			27.3			26.4			28.7	
Approach LOS		B			C			C			C	
Queue Length 50th (ft)	85	205	0		172		100	24			65	2
Queue Length 95th (ft)	139	253	16		232		177	72			#161	48
Internal Link Dist (ft)		658			403			601			1203	
Turn Bay Length (ft)												
Base Capacity (vph)	359	1153	960		1096		377	567			159	595
Starvation Cap Reductn	0	0	0		0		0	0			0	0
Spillback Cap Reductn	0	0	0		0		0	0			0	0
Storage Cap Reductn	0	0	0		0		0	0			0	0
Reduced v/c Ratio	0.39	0.47	0.14		0.57		0.56	0.23			0.68	0.31

Intersection Summary

Area Type: Other
 Cycle Length: 100
 Actuated Cycle Length: 100
 Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.69
 Intersection Signal Delay: 23.7 Intersection LOS: C
 Intersection Capacity Utilization 80.8% ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 10: Union Street & King Street



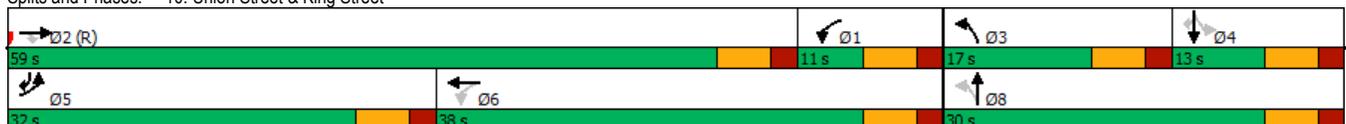


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	248	621	93	62	625	42	187	38	66	61	45	204
Future Volume (vph)	248	621	93	62	625	42	187	38	66	61	45	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	14	11	11	12	12	12	12	12	11	11	11
Satd. Flow (prot)	1745	2027	1561	0	3533	0	1787	1693	0	0	1785	1531
Flt Permitted	0.950				0.820		0.413				0.760	
Satd. Flow (perm)	1745	2027	1527	0	2908	0	777	1693	0	0	1396	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164		7			72				164
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		738			483			681			1283	
Travel Time (s)		16.8			11.0			15.5			29.2	
Confl. Peds. (#/hr)			2	2					1			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	270	675	101	0	792	0	203	113	0	0	115	222
Turn Type	Prot	NA	Perm	pm+pt	NA		pm+pt	NA		Perm	NA	pm+ov
Protected Phases	5	2		1	6		3	8			4	5
Permitted Phases			2	6			8			4		4
Detector Phase	5	2	2	1	6		3	8		4	4	5
Switch Phase												
Minimum Initial (s)	5.0	12.0	12.0	5.0	12.0		5.0	12.0		12.0	12.0	5.0
Minimum Split (s)	11.0	18.0	18.0	11.0	18.0		11.0	18.0		18.0	18.0	11.0
Total Split (s)	32.0	59.0	59.0	11.0	38.0		17.0	30.0		13.0	13.0	32.0
Total Split (%)	32.0%	59.0%	59.0%	11.0%	38.0%		17.0%	30.0%		13.0%	13.0%	32.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0		6.0		6.0	6.0			6.0	6.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead			Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes			Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	None		None	Max		None	None	None
Act Effect Green (s)	20.3	61.3	61.3		35.0		26.7	26.7			9.6	35.9
Actuated g/C Ratio	0.20	0.61	0.61		0.35		0.27	0.27			0.10	0.36
v/c Ratio	0.76	0.54	0.10		0.77		0.64	0.22			0.86	0.34
Control Delay	51.5	12.8	0.4		35.3		42.0	14.3			97.4	8.2
Queue Delay	0.0	0.0	0.0		0.0		0.0	0.0			0.0	0.0
Total Delay	51.5	12.8	0.4		35.3		42.0	14.3			97.4	8.2
LOS	D	B	A		D		D	B			F	A
Approach Delay		21.6			35.3			32.1			38.6	
Approach LOS		C			D			C			D	
Queue Length 50th (ft)	163	211	0		223		111	20			~88	25
Queue Length 95th (ft)	237	298	3		#346		#192	65			#200	73
Internal Link Dist (ft)		658			403			601			1203	
Turn Bay Length (ft)												
Base Capacity (vph)	453	1243	999		1023		322	504			133	732
Starvation Cap Reductn	0	0	0		0		0	0			0	0
Spillback Cap Reductn	0	0	0		0		0	0			0	0
Storage Cap Reductn	0	0	0		0		0	0			0	0
Reduced v/c Ratio	0.60	0.54	0.10		0.77		0.63	0.22			0.86	0.30

Intersection Summary

Area Type: Other
 Cycle Length: 100
 Actuated Cycle Length: 100
 Offset: 0 (0%), Referenced to phase 2:EBT, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 29.6
 Intersection LOS: C
 Intersection Capacity Utilization 85.1%
 ICU Level of Service E
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 10: Union Street & King Street





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘		↖↗		↖	↗			↖↗	↘
Traffic Volume (vph)	131	512	130	75	487	28	205	51	76	34	69	174
Future Volume (vph)	131	512	130	75	487	28	205	51	76	34	69	174
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	14	11	11	12	12	12	12	12	11	11	11
Satd. Flow (prot)	1711	1968	1561	0	3473	0	1805	1706	0	0	1807	1516
Flt Permitted	0.950				0.798		0.434				0.838	
Satd. Flow (perm)	1706	1968	1522	0	2787	0	822	1706	0	0	1539	1516
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164		5			75				229
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		738			483			681			1283	
Travel Time (s)		16.8			11.0			15.5			29.2	
Confl. Peds. (#/hr)	3		5	5		3	4					
Confl. Bikes (#/hr)									2			1
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 (%)	2%	3%	0%	0%	3%	0%	0%	0%	0%	0%	0%	3%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	139	545	138	0	628	0	218	135	0	0	109	185
Turn Type	Prot	NA	custom	pm+pt	NA		pm+pt	NA		custom	NA	custom
Protected Phases	5			1	6		3	8				4
Permitted Phases		2	2	6			8			4	4	
Detector Phase	5	2	2	1	6		3	8		4	4	4
Switch Phase												
Minimum Initial (s)	5.0	12.0	12.0	12.0	12.0		5.0	8.0		8.0	8.0	8.0
Minimum Split (s)	11.0	18.0	18.0	18.0	18.0		11.0	14.0		14.0	14.0	14.0
Total Split (s)	27.0	55.0	55.0	11.0	39.0		19.0	34.0		15.0	15.0	15.0
Total Split (%)	27.0%	55.0%	55.0%	11.0%	39.0%		19.0%	34.0%		15.0%	15.0%	15.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0		6.0		6.0	6.0			6.0	6.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead			Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes			Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Min		None	None		None	None	None
Act Effct Green (s)	13.4	58.4	58.4		39.0		29.6	29.6			10.3	10.3
Actuated g/C Ratio	0.13	0.58	0.58		0.39		0.30	0.30			0.10	0.10
v/c Ratio	0.61	0.47	0.14		0.58		0.58	0.24			0.69	0.51
Control Delay	51.4	13.9	1.2		27.5		35.2	13.8			67.2	8.0
Queue Delay	0.0	0.0	0.0		0.0		0.0	0.0			0.0	0.0
Total Delay	51.4	13.9	1.2		27.5		35.2	13.8			67.2	8.0
LOS	D	B	A		C		D	B			E	A
Approach Delay		18.1			27.5			27.0			30.0	
Approach LOS		B			C			C			C	
Queue Length 50th (ft)	85	209	0		174		103	26			66	0
Queue Length 95th (ft)	139	256	16		233		184	76			#162	36
Internal Link Dist (ft)		658			403			601			1203	
Turn Bay Length (ft)												
Base Capacity (vph)	359	1149	957		1091		379	567			159	362
Starvation Cap Reductn	0	0	0		0		0	0			0	0
Spillback Cap Reductn	0	0	0		0		0	0			0	0
Storage Cap Reductn	0	0	0		0		0	0			0	0
Reduced v/c Ratio	0.39	0.47	0.14		0.58		0.58	0.24			0.69	0.51

Intersection Summary

Area Type: Other
 Cycle Length: 100
 Actuated Cycle Length: 100
 Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
 Natural Cycle: 70
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.69
 Intersection Signal Delay: 24.1
 Intersection LOS: C
 Intersection Capacity Utilization 81.5%
 ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 10: Union Street & King Street



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	248	628	93	62	626	42	190	39	66	63	45	204
Future Volume (vph)	248	628	93	62	626	42	190	39	66	63	45	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	14	11	11	12	12	12	12	12	11	11	11
Satd. Flow (prot)	1745	2027	1561	0	3533	0	1787	1696	0	0	1785	1531
Flt Permitted	0.950				0.818		0.403				0.757	
Satd. Flow (perm)	1745	2027	1527	0	2901	0	758	1696	0	0	1390	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			164		7			72				222
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		738			483			681			1283	
Travel Time (s)		16.8			11.0			15.5			29.2	
Confl. Peds. (#/hr)			2	2					1			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	270	683	101	0	793	0	207	114	0	0	117	222
Turn Type	Prot	NA	Perm	pm+pt	NA		pm+pt	NA		Perm	NA	custom
Protected Phases	5	2		1	6		3	8			4	5
Permitted Phases			2	6			8			4		6
Detector Phase	5	2	2	1	6		3	8		4	4	5
Switch Phase												
Minimum Initial (s)	5.0	12.0	12.0	5.0	12.0		5.0	12.0		12.0	12.0	5.0
Minimum Split (s)	11.0	18.0	18.0	11.0	18.0		11.0	18.0		18.0	18.0	11.0
Total Split (s)	32.0	59.0	59.0	11.0	38.0		17.0	30.0		13.0	13.0	32.0
Total Split (%)	32.0%	59.0%	59.0%	11.0%	38.0%		17.0%	30.0%		13.0%	13.0%	32.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0		6.0		6.0	6.0			6.0	6.0
Lead/Lag	Lead	Lead	Lead	Lag	Lag		Lead			Lag	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes			Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	None		None	Max		None	None	None
Act Effct Green (s)	20.3	61.4	61.4		35.1		26.6	26.6			9.4	61.4
Actuated g/C Ratio	0.20	0.61	0.61		0.35		0.27	0.27			0.09	0.61
v/c Ratio	0.76	0.55	0.10		0.78		0.65	0.23			0.89	0.22
Control Delay	51.5	12.9	0.4		35.4		42.9	14.4			103.9	1.5
Queue Delay	0.0	0.0	0.0		0.0		0.0	0.0			0.0	0.0
Total Delay	51.5	12.9	0.4		35.4		42.9	14.4			103.9	1.5
LOS	D	B	A		D		D	B			F	A
Approach Delay		21.6			35.4			32.8			36.9	
Approach LOS		C			D			C			D	
Queue Length 50th (ft)	163	215	0		223		114	21			~91	0
Queue Length 95th (ft)	237	304	3		#347		#200	66			#205	25
Internal Link Dist (ft)		658			403			601			1203	
Turn Bay Length (ft)												
Base Capacity (vph)	453	1243	1000		1022		319	504			131	1014
Starvation Cap Reductn	0	0	0		0		0	0			0	0
Spillback Cap Reductn	0	0	0		0		0	0			0	0
Storage Cap Reductn	0	0	0		0		0	0			0	0
Reduced v/c Ratio	0.60	0.55	0.10		0.78		0.65	0.23			0.89	0.22

Intersection Summary

Area Type: Other
 Cycle Length: 100
 Actuated Cycle Length: 100
 Offset: 0 (0%), Referenced to phase 2:EBT, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.89
 Intersection Signal Delay: 29.5
 Intersection LOS: C
 Intersection Capacity Utilization 85.7%
 ICU Level of Service E
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 10: Union Street & King Street

