Newton Center Intersection Summary Report

traffic solutions SM

EXECUTIVE SUMMARY

The Town of Newton has retained Traffic Solutions, LLC to evaluate current conditions, both operationally and geometrically, at three locations in Newton Center:

- Centre Street at Beacon Street
- Langley Road/Sumner Street at Beacon Street
- Centre Street at Cypress Street

The focus of this study is to evaluate current transportation conditions for pedestrians, bicyclists, and vehicular traffic. This report summarizes the findings for these three intersections and recommends multi-modal improvements.

This summary report takes a comprehensive approach to each intersection through analysis of vehicles, bicycles, pedestrians, and the general streetscape. Through an on-site inventory, a data collection effort and related performance analysis, and an evaluation of crash data, Traffic Solutions was able to identify critical issues that affect network operations in Newton Center. This summary report presents the findings from the analyses and offers recommendations to improve the existing system in both the short and long-term.

Short-term improvements are those that can be made with relative ease, with a modest budget and staff. Examples of this type include pavement marking adjustments, timing adjustments, lane designations, parking revisions, and minor physical improvements. Conversely, long-term improvements require significant capital outlay, additional planning and design. This summary report contains one long-term conceptual plan for each of the three intersections.

We would like to extend our appreciation to Clint Schuckel and David Koses from the City of Newton for their assistance on this project.

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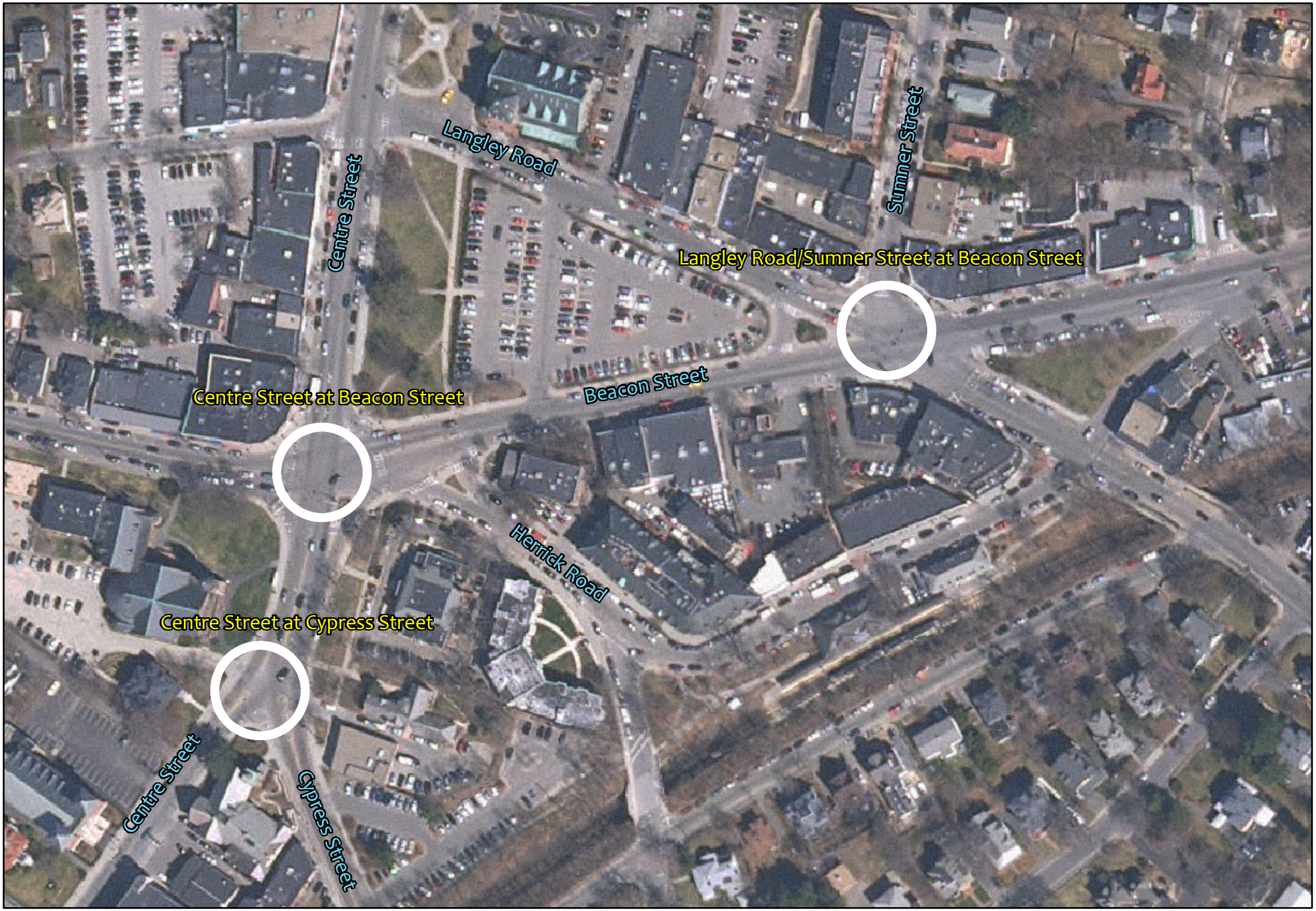

traffic solutions	TITLE: Study Locus Map	PROJECT: Newton Center Intersection Audit	1 inch equals 150 feet 0 75 150 Feet N	**FIGURE 1**

CENTRE STREET AT BEACON STREET

The Facts:

Centre Street at Beacon Street is a signalized four-legged intersection (Figure 1 and Figure 3). Centre Street flows North/South and Beacon Street traffic flows East/West.

At the southern side of the intersection, Centre Street northbound has a right-turn slip lane, a through lane, and a shared lane for the through movement and left turn while two receiving lanes are provided. Centre Street northbound and Beacon Street westbound have a lead-left signal, allowing northbound vehicles to have a "head-start" to make turns and travel through the intersection before opposing vehicles begin to travel.

At the north side of the intersection, Centre Street southbound vehicles have a shared left turn and through movement lane, a dedicated through lane, and a right turn lane while one receiving lane is provided. Beacon Street, at the western side of the intersection, has a short exclusive left turn lane and a shared through and right lane for eastbound traffic while there is one receiving lane. At the eastern side of the intersection, Beacon Street has recently been restriped to provide an exclusive left turn lane and a shared right turn and through movement lane. There is one wide receiving lane for eastbound traffic. On-street parking is provided on both the south and north sides of both Beacon Street approaches. Parking is also provided on the east and west side of Centre Street, north of the intersection. No parking is provided on the south side of the intersection.

Crosswalks and accompanying audible pedestrian signals are provided at all approaches.

Vehicle crashes reached 29 in 2005, the latest year of available data from Mass Highway (Figure 2). The crash rate at this intersection exceeds the Mass Highway District average (Table 1).

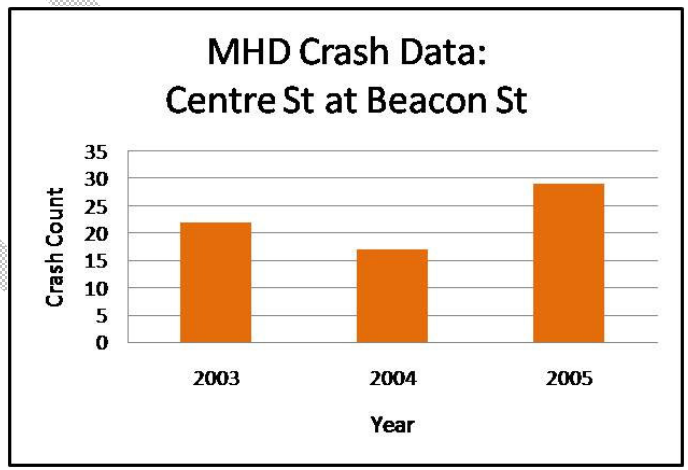

Figure 2. Centre Street at Beacon Street - MassHighway Department Crash Data for 2003-2005

Table 1. Centre Street at Beacon Street - Crash Rate Comparison

Intersection	Crash Rate	District 4 Crash Rate
Centre at Beacon	1.87	0.88

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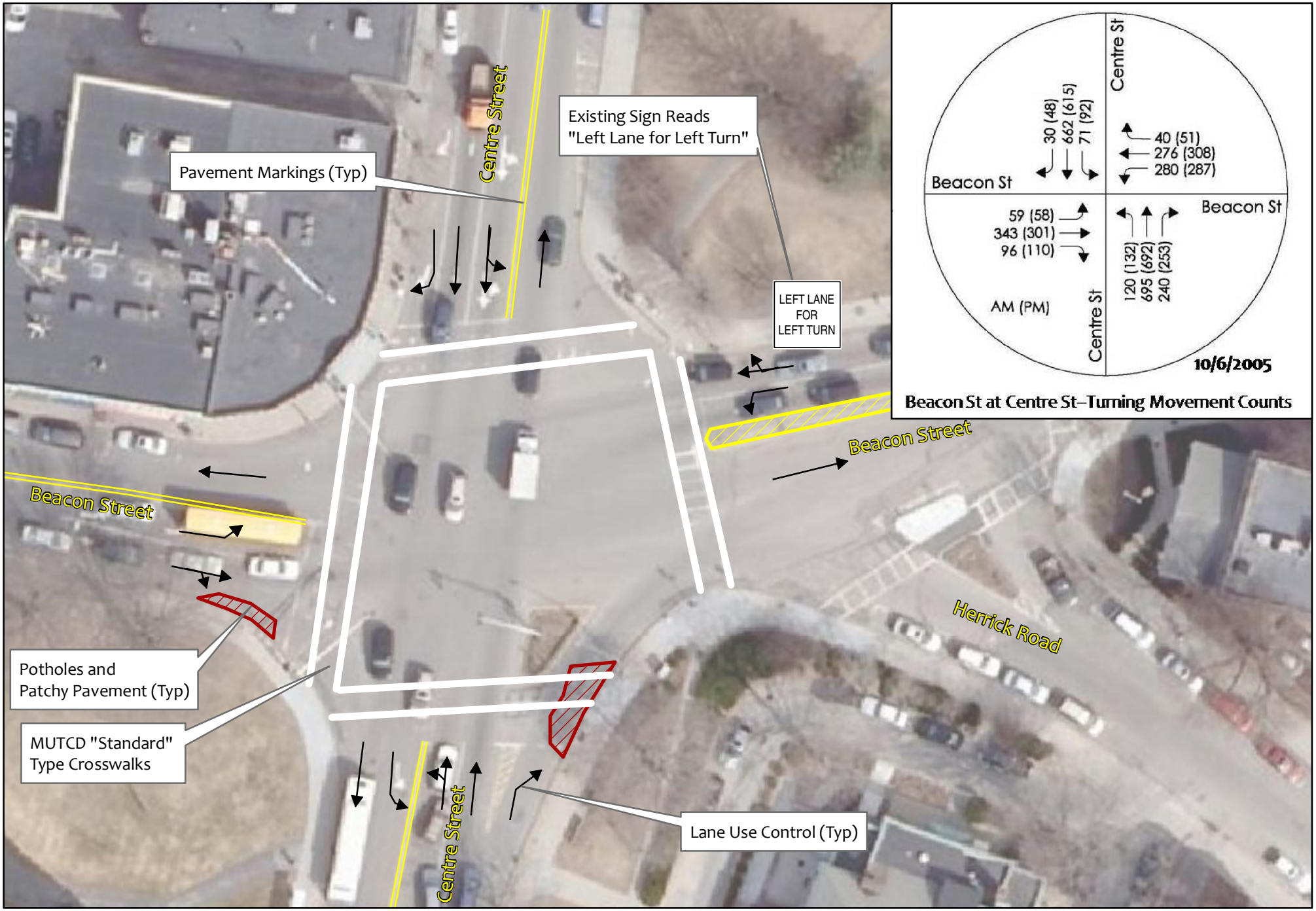

traffic solutions	TITLE: Centre St at Beacon St - Existing Conditions	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	FIGURE 3

The Issues:

All approaches are subject to long delays and long queues during peak travel times. Average delays can be over two minutes long and with some queues extending beyond 450 ft (Table 2). The southbound approach on Centre Street is prone to this phenomenon as drivers traveling southbound through the intersection stay clear of the shared left and through movement lane to avoid being trapped behind vehicles making left turns. Queues at the westbound Beacon Street approach, particularly during the PM peak, extend from the Beacon Street at Centre Street intersection back to the Langley Road/Sumner Street at Beacon Street intersection. This condition interferes with traffic flow not only along Beacon Street but also along Langley Road. Similarly, the queues at the northbound Centre Street approach extend back to the Centre Street at Cypress Street intersection and farther along Cypress Street. The extended queues, high volumes of vehicular traffic, and long delays, may contribute to driver frustration and rules-of-the-road non-compliance.

Safety, particularly of drivers and pedestrians, is an additional concern at this intersection as the vehicular crash rate is more than double the state average. Besides the vehicular traffic delays, there is a steady flow of pedestrian traffic through the intersection. Many pedestrians press the button to cross the street but ultimately do not wait for the exclusive pedestrian phase; they cross with the adjacent traffic instead. This pedestrian behavior contributes to unnecessary vehicular delays and driver frustration.

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Recommendations:

Through field work, observations, and capacity analyses, a number of recommendations have been identified (Figure 18). The existing conditions as well as over eight other options were analyzed to determine the recommended signal timing modifications to improve efficiency.

Signals:

Observation: The existing signal timing and signal phasing are not optimal; providing for lead left turns for both the NB and WB left turn movements. More importantly, the inclusion of an exclusive pedestrian phase substantially increases delays resulting in extended queues. The extensive delays and long queues contribute to inefficient operations at nearby intersections (e.g., Beacon at Langley and Center at Cypress).

Action: 1) Optimize signal timing, without changing the existing phasing – This low cost action results in minor improvements to delay but does not address the queuing issue at all (Table 2 and Table 3, M1).

Note: Coordination is not recommended – Analyses have determined that coordination does not reduce delay or queuing.

2) Change pedestrian phasing from exclusive to concurrent phasing (i.e., pedestrians crossing the street parallel to moving traffic). This action results in the most significant reduction in delay and much shorter queues (Table 2 and Table 3, Option 1). Because of this significant improvement, this phasing is included in Options 1 though 8 (Table 2 and Table 3).

3) Adjust the signal phasing to reflect the following:

- Provide permissive left turns on the SB, EB, and NB approaches.
- Provide a protected/permissive phase for the WB left turn.
- The NB right turn should overlap with the WB lead left turn (protected phase) (Table 2 and Table 3, Option 5). This low-cost action results in further minor improvements, reducing both delay and queues.

If the above actions are taken, the average overall intersection delay will be reduced from nearly 2 minutes to approximately 20 seconds and the 95th percentile queues will be reduced from over 400 feet to less than 280 feet.

One additional improvement, additional parking restrictions, will also aid in improving operations along Beacon Street during the peak hours. The additional restrictions include extending the parking restriction hours along the north side of Beacon Street (between Centre Street and Langley Road) to further reduce queue lengths during the peak hours.

- Extend the parking restriction on the north side of Beacon Street to 3-7 PM (currently 4-6 PM).
- Add parking restriction on the north side of Beacon Street from 7-9 AM

Long-Term Action: Consider modifying the intersection to include a two-lane roundabout (Figure 19).

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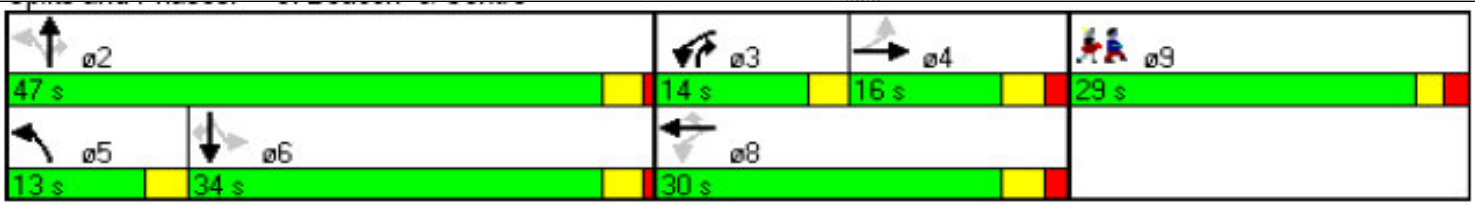
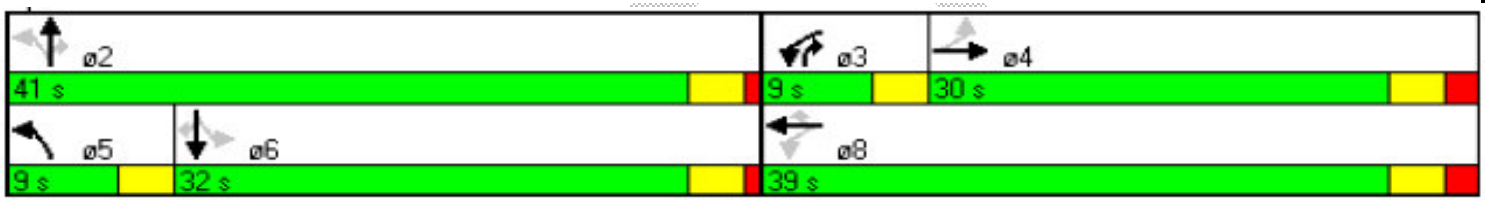
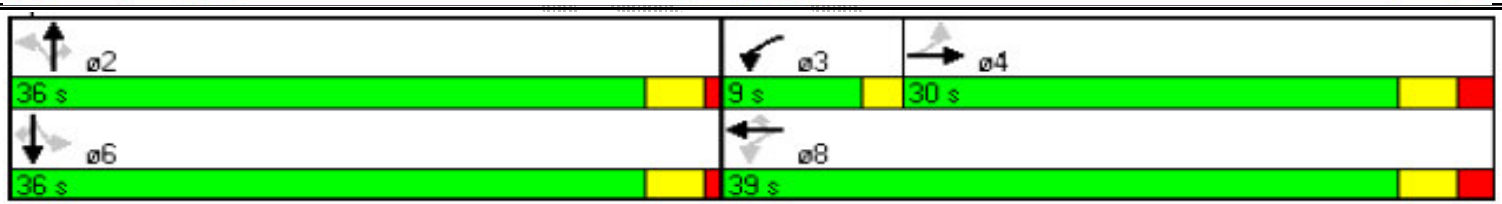
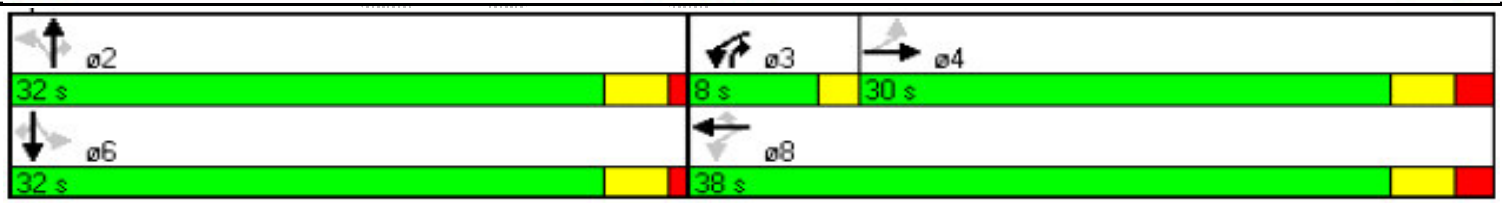
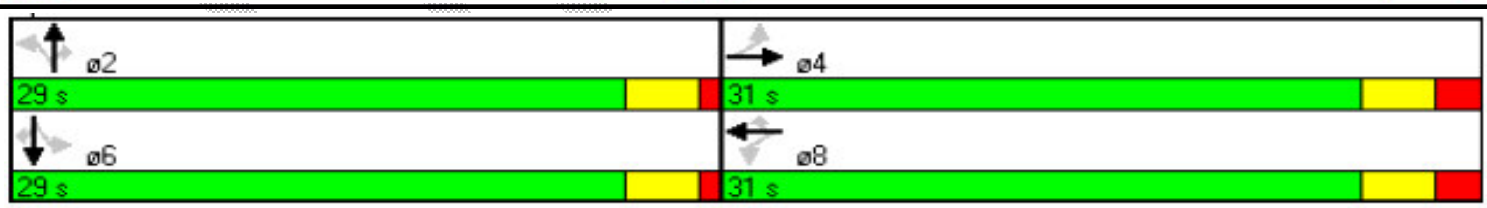
Table 2. Beacon Street at Centre Street – Peak Period Performance (Level of Service)

Table 2 - Intersection Performance - Beacon Street at Centre Street, Newton, MA												
			AM					PM				
			Direction				Overall	Direction				Overall
Option	Description		EB	WB	NB	SB	INT.°	EB	WB	NB	SB	INT.°
E	Existing Conditions	LOS (sec)	F (385.1)	F (98.6)	D (49.5)	D (37.8)	F (117.3)	F (336.7)	F (85.3)	E (56.2)	D (51.1)	F (108.7)
		Queue (ft)	416	359	442	368		387	351	456	396	
M1	Existing Conditions Optimized	LOS (sec)	F (115.7)	F (89.3)	E (56.0)	D (49.5)	E (72.2)	F (102.5)	F (82.3)	E (59.1)	E (58.8)	E (71.6)
		Queue (ft)	448	488	584	474		412	487	596	519	
M2	Existing Conditions Optimized and Coordinated	LOS (sec)	F (115.7)	E (73.7)	E (65.0)	D (55.0)	E (73.4)	F (112.5)	E (75.6)	E (59.0)	E (58.8)	E (71.8)
		Queue (ft)	448	463	602	517		422	475	596	519	
1	Existing Vehicular Phasing w/ Concurrent Pedestrian Phase*	LOS (sec)	C (26.4)	D (36.2)	B (17.7)	B (17.5)	C (23.2)	C (26.6)	C (31.6)	B (18.5)	B (18.8)	C (23.0)
		Queue (ft)	171	241	257	218		157	223	305	230	
2	Existing Vehicular Phasing w/ Concurrent Pedestrian Phase and Coordination*	LOS (sec)	C (32.1)	C (22.7)	C (23.9)	C (22.1)	C (24.6)	C (27.8)	C (27.9)	C (21.3)	C (21.2)	C (23.9)
		Queue (ft)	172	217	311	236		157	223	314	235	
3	Westbound Lead Left w/ Concurrent Pedestrian Phase*	LOS (sec)	C (24.5)	C (24.0)	B (19.3)	B (18.1)	C (20.9)	C (25.9)	C (29.0)	C (20.1)	B (19.4)	C (22.9)
		Queue (ft)	155	180	288	219		157	221	307	231	
4	Westbound Lead Left w/ Concurrent Pedestrian Phase and Coordination*	LOS (sec)	C (23.8)	C (23.8)	C (20.7)	B (19.0)	C (21.5)	C (25.6)	C (25.5)	C (22.8)	C (21.7)	C (23.6)
		Queue (ft)	143	174	283	213		145	194	310	231	
5	WB Permissive & Protected phase with a NB Right Turn Overlap and a Concurrent Pedestrian Phase*	LOS (sec)	C (22.7)	C (24.8)	B (18.2)	B (17.2)	C (20.2)	C (25.7)	C (28.4)	B (19.9)	B (19.6)	C (22.8)
		Queue (ft)	140	164	275	207		157	220	307	231	
6	WB Permissive & Protected phase with a NB Right Turn Overlap and a Concurrent Pedestrian Phase and Coordination*	LOS (sec)	C (23.7)	C (22.5)	C (21.3)	B (19.6)	C (21.5)	C (26.6)	C (21.4)	C (25.8)	C (24.4)	C (24.6)
		Queue (ft)	143	172	284	214		157	203	317	238	
7	7 - All Permissive Left Turns w/ Concurrent Pedestrian Phase*	LOS (sec)	B (11.3)	D (36.3)	C (24.7)	B (20.0)	C (23.6)	B (11.2)	D (40.0)	C (27.9)	C (23.3)	C (26.7)
		Queue (ft)	99	243	252	185		92	252	263	219	
8	All Permissive Left Turns w/ Concurrent Pedestrian Phase and Coordination*	LOS (sec)	B (11.3)	D (35.4)	C (25.5)	C (20.4)	C (23.8)	B (11.2)	D (39.5)	C (28.3)	C (23.5)	C (26.8)
		Queue (ft)	99	243	253	186		92	252	263	220	

Table 3. Intersection Sequence and Phasing – Beacon Street at Centre Street, Newton, MA

Table 3 - Intersection Sequence and Phasing - Beacon Street at Centre Street, Newton, MA

EXISTING, M1, M2	
Options 1 & 2*	
Options 3 & 4*	
Options 5 & 6*	
Options 7 & 8*	

Pavement:

Observation: Pavement is fairly well maintained and in good condition. However, some of the pavement at the intersection is deteriorating, and as a result, potholes have started to appear along Centre Street northbound and Beacon Street eastbound (Figure 4 and Figure 5).

Action: Repair deteriorated pavement surface.

Figure 4. Centre St at Beacon St looking East - Potholes at southeast corner

Figure 5. Centre St at Beacon St looking South - Potholes at southwest corner

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Observation: When the exclusive pedestrian signal is activated, a red signal is eventually illuminated on all approaches, stopping all traffic, allowing pedestrians to cross. Some pedestrians wait to cross but some don't, and as a result, drivers experience unnecessary delays.

Action: Change the current pedestrian signals to allow pedestrians to cross the street concurrently or "with the flow of traffic". The following sign should be added as part of this improvement: "Turning Traffic Must Yield to Pedestrians" (Figure 6).

Observation: The pedestrian heads with the illuminated hands but without countdown timers are less informative to pedestrians (Figure 7).

Action: Modify the pedestrian heads to include countdown timers with informative push button signs including a warning "Watch For Vehicles" (Figure 8 and Figure 9).

Observation: This intersection does not have vehicle preemption equipment. A vehicle preemption system detects an approaching emergency vehicle such as a police car or ambulance and provides a green signal to that approach. During heavily congested conditions, first responders may be unnecessarily delayed at this location.

Action: Add an emergency vehicle preemption system to better manage traffic flows during emergency situations.

Figure 6. "Turning Traffic Must Yield To Pedestrians" Sign (MUTCD* R10-15)

Figure 7. Pedestrian Signal - Flashing Hand

Figure 8. Pedestrian Signal - Countdown Timer

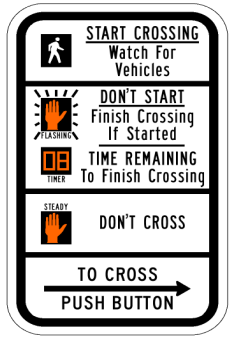

Figure 9. Pedestrian Crossing Sign (MUTCD* R10-3e)

*MUTCD = Manual on Uniform Traffic Control Devices

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Intersection Geometry:

Observation: Northbound drivers on Centre Street, during high traffic periods, are unable to access the right-turn slip lane, which contributes to congestion at the Centre Street at Cypress Street intersection (Figure 10 and Figure 12).

Action: See action under "Signals". Optimized signal operations should improve this situation.

Long-Term Action: The right-turn slip lane may be eliminated, which would tighten up the intersection. Continue to provide space for right turn movements with a shared right and through lane to create an opportunity for greater continuous green space.

Long-Term Action: Alternatively, widen the pavement near Cypress Street to allow right turning vehicles to access the right turn lane (Figure 39).

Figure 10. Centre Street looking South towards Cypress Street

Pavement Markings:

Observation: Pavement markings are fairly well maintained and in good condition.

Action: Continue to maintain the pavement markings.

Signs:

Observation: Overall the signs are in good condition. One exception is the yellow reflective object marker that warns approaching vehicles about the traffic island at the southeast corner of Beacon Street and Centre Street (Figure 11).

Action: Continue to maintain all regulatory, warning, and parking signs. Replace the faded sign with a new object marker.

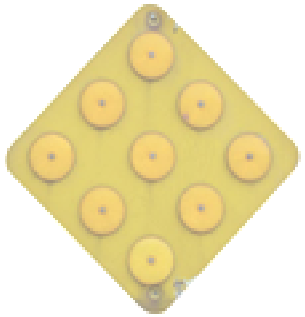

Figure 11. Object Marker (MUTCD OM1-1)

Figure 12. Centre Street looking North towards Beacon Street

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Observation: Lane markings were recently changed along Beacon Street Westbound from a shared left and through lane to an exclusive lane for left turns. However, the sign still reads "left lane for left turn" (Figure 14).

Action: Update the sign to Manual on Uniform Traffic Control Devices (MUTCD) standards to read "left lane must turn left" to reflect the lane change to left-turning vehicles only (Figure 13).

Bicycles:

Observation: Bicycle parking accommodations are not provided around this intersection.

Action: Place strategically-located and aesthetic bicycle rings and racks around Newton Center (Figure 15, Figure 16, and Figure 20).

Observation: Exclusive bicycle lanes are not provided on any of the approaches. Bicycles are required to share the road with vehicles.

Action: Add a "Share-the-Road" sign assembly around Newton Center (Figure 17).

Long-Term Action: Consider adding bike lanes.

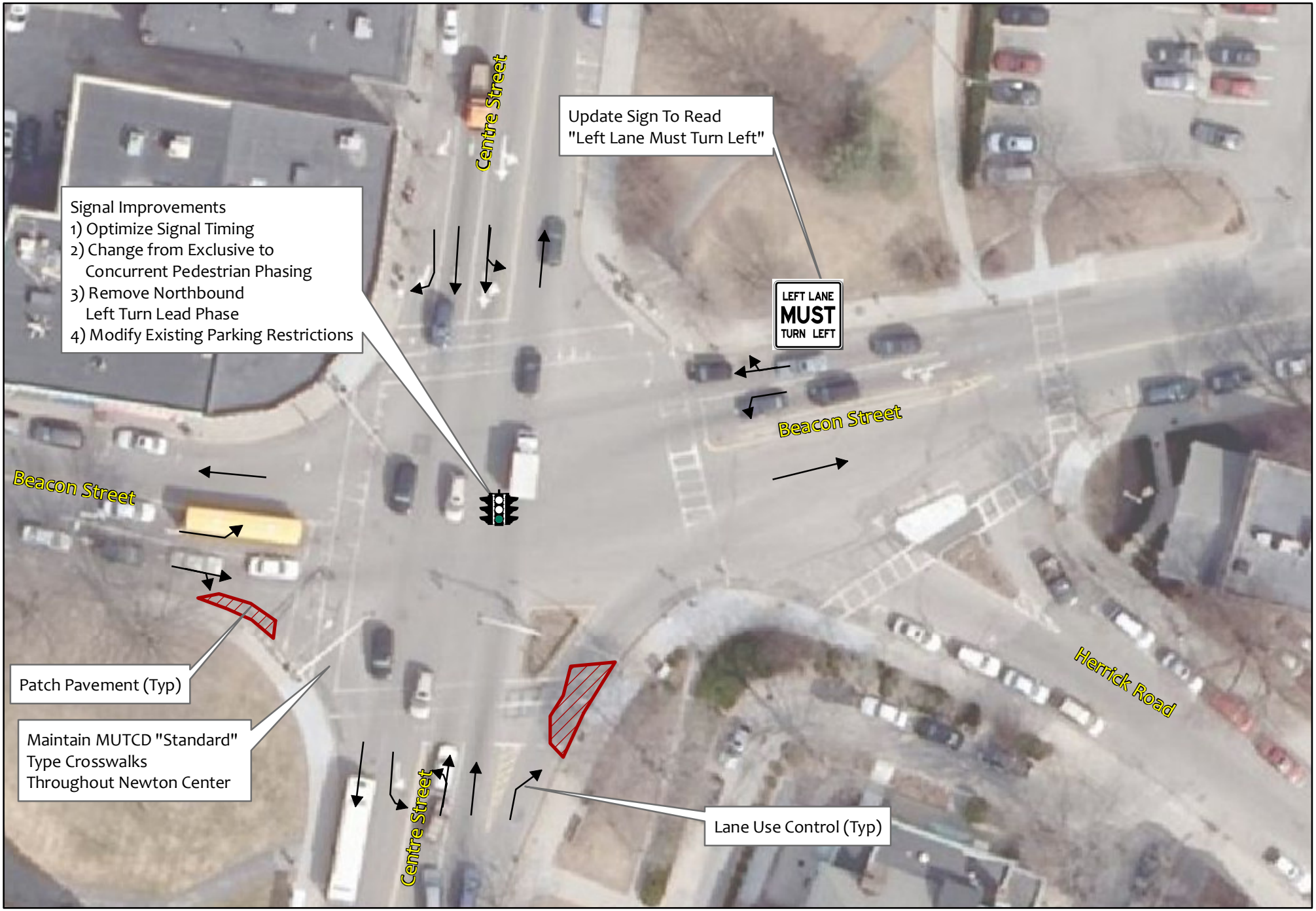
Figure 15. Example of Bicycle Parking - Rings

Figure 16. Example of Bicycle Parking - Racks

Figure 13. Recommended Sign (MUTCD R3-7L)

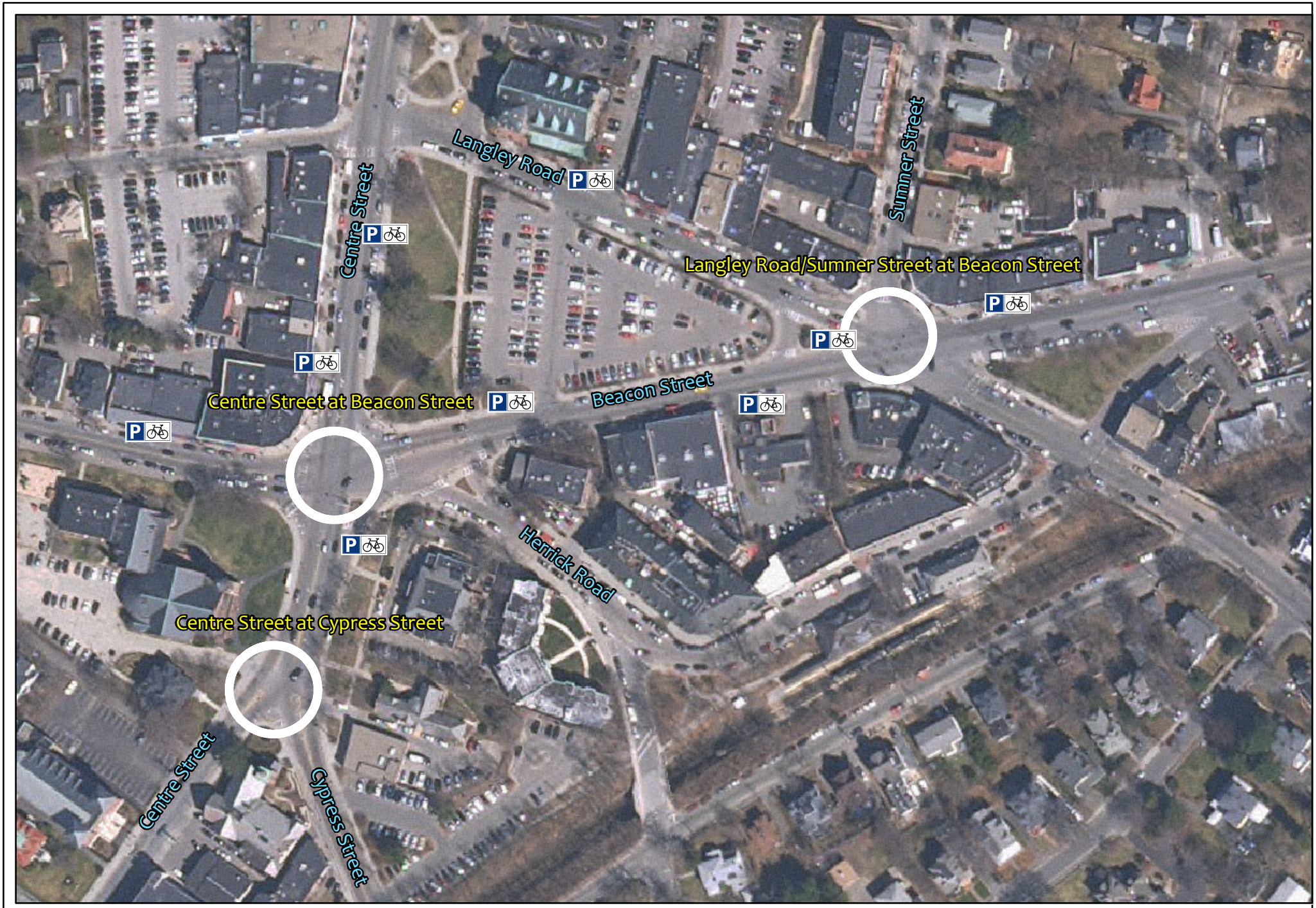
Figure 14. Beacon St looking West towards Centre St - Existing Sign

Figure 17. Share the Road with Bicyclists Assembly (MUTCD W11-1/W16-1)



traffic solutions	TITLE: Centre St at Beacon St - Short-Term Improvements	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	**FIGURE 18**

traffic solutions	TITLE: Centre St at Beacon St - Long-Term Improvements	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	**FIGURE 19**



traffic solutions	TITLE: Proposed Bicycle Parking	PROJECT: Newton Center Intersection Audit	1 inch equals 150 feet 0 80 160 Feet N	**FIGURE 20**

LANGLEY ROAD/SUMNER STREET AT BEACON STREET

The Facts:

Langley Road/Sumner Street at Beacon Street is a signalized five-legged intersection. The Sumner Street approach is one-way northbound and the Langley Road southeastbound approach is one-way southeastbound. Both Beacon Street approaches and the northwestbound Langley Road approach are two-way streets (Figure 1 and Figure 22).

Both the Sumner Street approach and the Langley Road southeastbound approach have one travel lane and on-street parking on both sides. A right turn slip lane along the Langley Road southeastbound approach permits southeastbound traffic to turn right onto Beacon Street westbound with minimal delay. On the eastern side of the intersection, Beacon Street has on-street parking on both the north and south side with a shared left turn and through movement lane as well as a shared right and through lane for westbound traffic and one receiving lane. On the western side of the intersection, Beacon Street has one all-purpose travel lane for eastbound traffic and two receiving lanes. The Langley Road northwestbound approach has on-street parking on both sides of the road and provides an exclusive left lane and a shared through movement and right turn lane for northwestbound traffic. In addition, it has one receiving lane for southeastbound traffic.

Crosswalks exist across all approaches. Also, two crosswalks at the right turn slip lane at Langley Road connect the municipal parking lot with the traffic island.

Crashes have steadily increased from 2003-2005 (Figure 21). The crash rate at this intersection greatly exceeds the Mass Highway district average (Table 4).

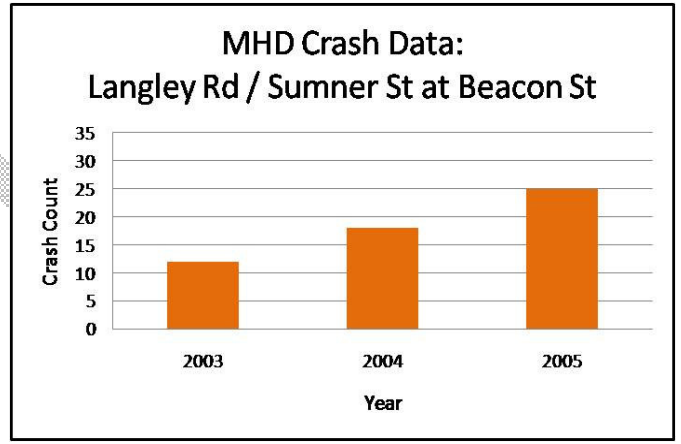


Figure 21. Langley Road/Sumner Street at Beacon Street - MassHighway Department Crash Data for 2003-2005

Table 4. Langley Road/Sumner Street at Beacon Street - Crash Rate Comparison

Intersection	Crash Rate	District 4 Crash Rate
Langley/Sumner at Beacon	2.29	0.88

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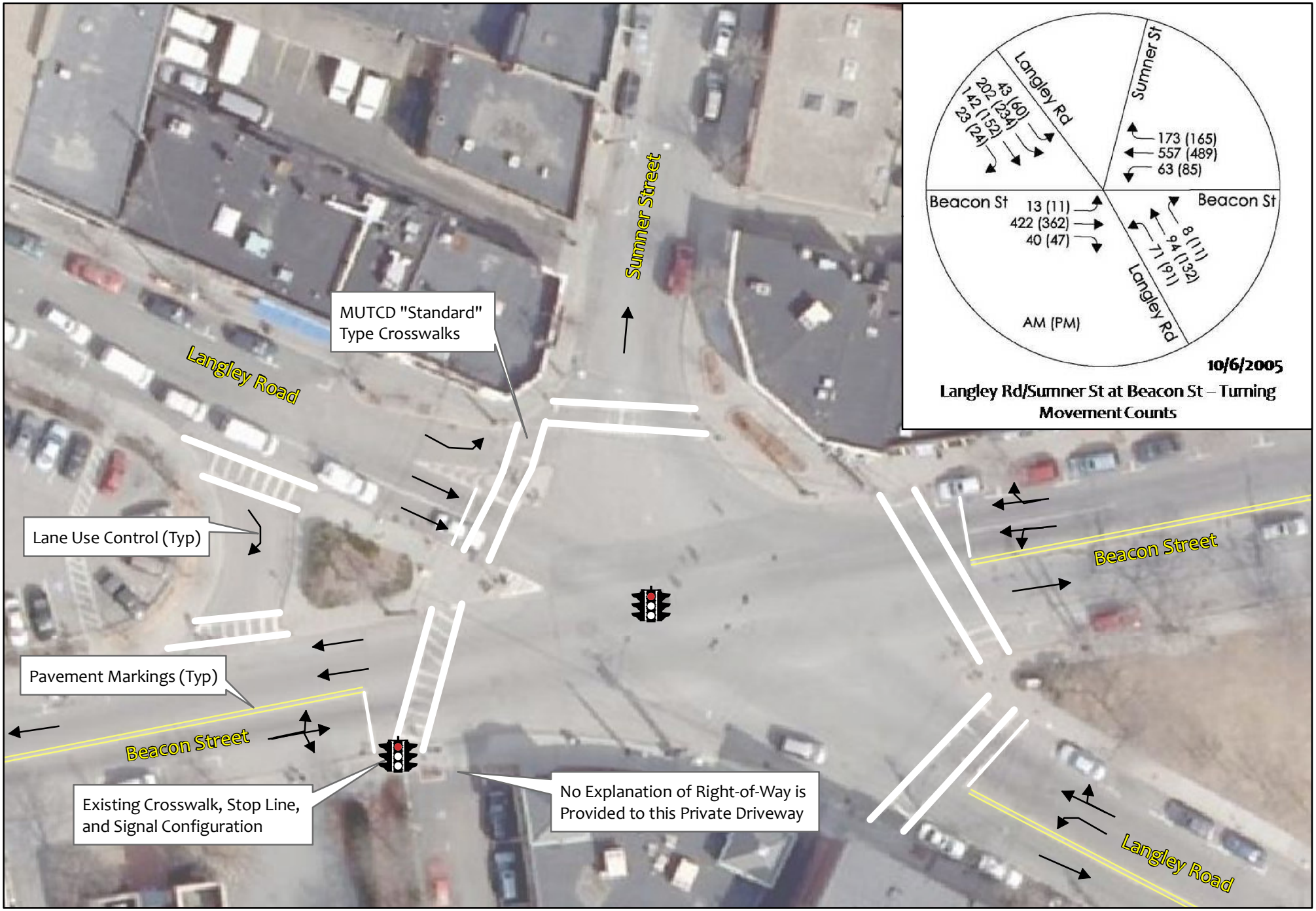

traffic solutions	TITLE: Langley Rd/Sumner St at Beacon St - Existing Conditions	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	**FIGURE 22**

The Issues:

The adjacent intersection, Beacon Street at Centre Street, impacts Langley Road/Sumner Street at Beacon Street during periods of high traffic volume and the PM peak hours. Westbound drivers queuing on Beacon Street are not able to make it through the signal during one cycle. This subsequent accumulation of vehicles results in a queue that extends backwards along Beacon Street, interfering with traffic flow at the Langley Road/Sumner Street at Beacon Street intersection. Otherwise, operations at this intersection perform at acceptable levels of service. Existing parking restrictions on the north side of Beacon Street during the PM peak but not the AM peak are confusing to drivers not familiar with the area.

Recommendations:

Through field work, observations, and capacity analyses, a number of recommendations have been identified (Figure 28). The existing conditions as well as over eight other options were analyzed to determine the recommended signal timing modifications to improve efficiency (Table 5 and Table 6).

Intersection Geometry:

Observation:	This intersection has a wide-expanse of pavement, and provides little guidance to drivers passing through the intersection.
Action:	Add lane-line extensions to provide additional guidance to drivers (Figure 28).
Long-Term Action:	Consider tightening up the intersection by modifying intersection design to include a two-lane roundabout (Figure 29).

Figure 23. Langley Rd/Sumner St at Beacon St Intersection looking East - Existing Driveway for Peet's Coffee

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Signals:

Observation: The existing signal timing and signal phasing are not optimal; providing for split phasing for the Langley Road approaches and a lead left turn for the westbound approach. More importantly, the inclusion of an exclusive pedestrian phase increases delays resulting in extended queues.

Action: 1) Optimize signal timing, without changing the existing phasing – This low cost action results in minor improvements to delay and queuing (Table 5 and Table 6, M1).

Note: Coordination is not recommended – Analyses have determined that coordination does not result in a noticeable reduction in delay or queuing.

2) Change pedestrian phasing from exclusive to concurrent phasing (i.e., pedestrians crossing the street parallel to moving traffic). This action results in the most significant reduction in delay and much shorter queues (Table 5 and Table 6, Option 1). Because of this significant improvement, this phasing is included in Options 1 though 8 (Table 5 and Table 6).

3) Adjust the signal phasing to reflect the following:

- Change phasing to provide only two phases, providing permissive left turns on all four approaches (Table 5 and Table 6, Option 5-7). This low-cost action results in further minor improvements, reducing both delay and queues.

If the above actions are taken (in conjunction with the recommended improvements to the Beacon Street at Centre Street traffic signal), the average overall intersection delay will be reduced from approximately 30 seconds to less than 12 seconds and the 95th percentile queues will be reduced from over 200 feet to less than 100 feet.

One additional improvement, additional parking restrictions, will also aid in improving operations along Beacon Street during the peak hours. The additional restrictions include extending the parking restriction hours along the north side of Beacon Street (between Centre Street and Langley Road) to further reduce queue lengths, reducing the chance of vehicles "backing up" into this intersection.

- Extend the parking restriction on the north side of Beacon Street to 3-7 PM (currently 4-6 PM).
- Add parking restriction on the north side of Beacon Street from 7-9 AM

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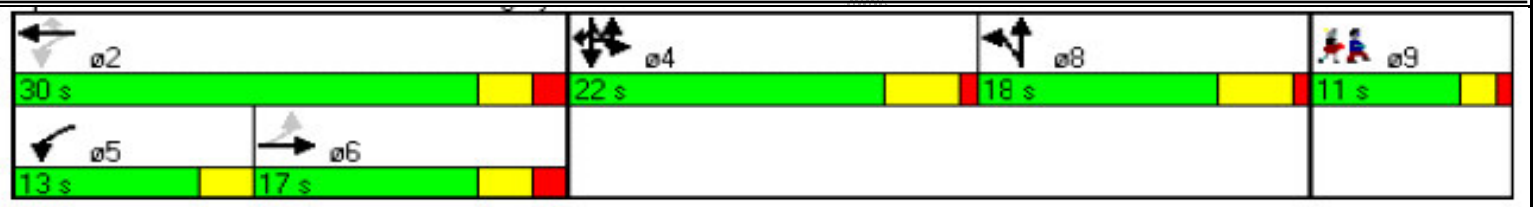
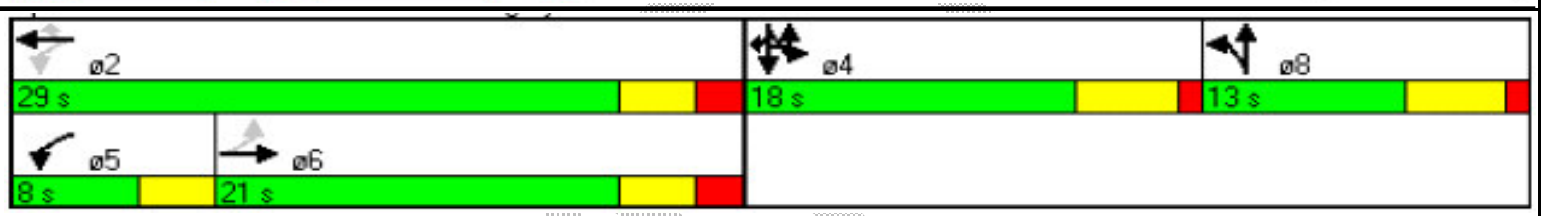
Table 5. Langley Rd/Sumner St at Beacon St – Peak Period Performance (Level of Service)

Table 5 - Intersection Performance - Beacon Street at Langley Road and Sumner Street, Newton, MA*												
			AM					PM				
			Direction				Overall	Direction				Overall
Option	Description		EB	WB	NB	SB	INT.°	EB	WB	NB	SB	INT.°
E	Existing Conditions	LOS (sec)	C (22.4)	C (25.2)	C (32.6)	C (34.2)	C (27.4)	C (23.2)	C (23.7)	C (33.2)	D (35.2)	C (27.9)
		Queue (ft)	160	224	74	173		140	199	97	217	
M1	Existing Conditions Optimized	LOS (sec)	C (20.5)	C (22.4)	D (36.4)	C (33.8)	C (26.0)	B (19.5)	C (24.6)	C (33.0)	D (41.6)	C (29.2)
		Queue (ft)	144	201	80	174		114	192	84	219	
M2	Existing Conditions Optimized and Coordinated	LOS (sec)	B (19.6)	C (23.9)	C (26.2)	E (55.1)	C (30.6)	B (19.3)	C (23.5)	C (33.4)	D (42.4)	C (29.0)
		Queue (ft)	144	198	80	174		114	192	84	219	
1	Existing Vehicular Phasing w/ Concurrent Pedestrian Phase*	LOS (sec)	B (13.5)	B (13.6)	C (23.2)	C (23.2)	B (16.8)	B (13.9)	B (15.5)	C (23.8)	C (25.3)	B (18.8)
		Queue (ft)	102	140	58	134		87	132	70	162	
2	Existing Vehicular Phasing w/ Concurrent Pedestrian Phase and Coordination*	LOS (sec)	B (13.0)	B (12.7)	C (26.1)	C (27.4)	B (17.6)	B (13.2)	B (13.8)	C (25.2)	C (26.9)	B (18.7)
		Queue (ft)	102	140	58	134		87	131	70	162	
3	Westbound Lead Left w/ Concurrent Pedestrian Phase*	LOS (sec)	A (6.8)	A (6.6)	B (10.3)	B (15.0)	A (9.0)	A (9.0)	A (9.8)	B (10.1)	B (16.6)	B (11.5)
		Queue (ft)	55	77	33	124		62	95	42	142	
4	Westbound Lead Left w/ Concurrent Pedestrian Phase and Coordination*	LOS (sec)	A (6.8)	A (6.8)	B (12.2)	C (21.3)	B (10.8)	A (8.3)	A (8.6)	B (11.7)	C (20.1)	B (12.0)
		Queue (ft)	55	77	33	124		62	94	42	142	
5	WB Permissive & Protected phase with a NB Right Turn Overlap and a Concurrent Pedestrian Phase*	LOS (sec)	A (8.0)	A (7.7)	A (9.0)	B (11.6)	A (8.8)	A (8.6)	A (9.9)	A (9.5)	B (16.2)	B (11.3)
		Queue (ft)	66	92	29	87		56	88	38	132	
6	WB Permissive & Protected phase with a NB Right Turn Overlap and a Concurrent Pedestrian Phase and Coordination*	LOS (sec)	A (7.6)	A (7.4)	B (10.3)	B (15.5)	A (9.7)	A (8.5)	A (8.7)	B (10.5)	B (19.0)	B (11.7)
		Queue (ft)	66	92	29	87		70	88	38	132	
7	7 - All Permissive Left Turns w/ Concurrent Pedestrian Phase*	LOS (sec)	A (8.0)	A (7.7)	A (9.0)	B (11.6)	A (8.8)	A (8.6)	A (9.9)	A (9.5)	B (16.2)	B (11.3)
		Queue (ft)	66	92	29	87		56	88	38	132	
8	All Permissive Left Turns w/ Concurrent Pedestrian Phase and Coordination*	LOS (sec)	A (7.6)	A (7.4)	B (10.3)	B (15.5)	A (9.7)	A (8.0)	A (8.7)	B (10.5)	B (19.0)	B (11.6)
		Queue (ft)	66	92	29	87		56	88	38	132	

Table 6. Intersection Sequence and Phasing – Beacon Street at Langley Road and Sumner Street, Newton, MA

Table 6 - Intersection Sequence and Phasing - Beacon Street at Langley Road and Sumner Street, Newton, MA

EXISTING, M1, M2	
Options 1 & 2	
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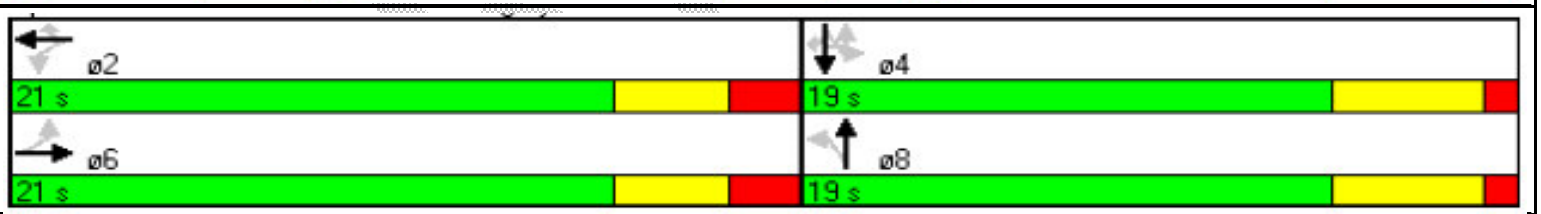
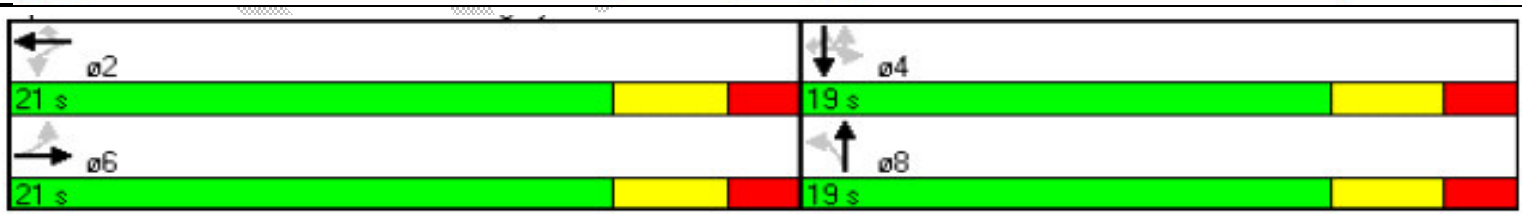
Options 5 & 6	
Options 7 & 8	

Observation: During high traffic volume periods, delays often occur at the Beacon Street at Centre Street intersection. This congestion causes queues to extend down Beacon Street westbound and "back up" through the Langley Road/Sumner Street at Beacon Street intersection. As a result, westbound drivers, experiencing driver frustration due to lack of traffic movement, pull forward into the intersection and block the cross traffic from Langley Road leading to additional delay.

Action: Improve signal timing and phasing at the Beacon Street at Centre Street intersection to reduce excessive queues. Restrict parking on the north side of Beacon Street between Centre Street and Langley Road for more than the current two hour restriction during the PM peak.

Observation: When the exclusive pedestrian signal is activated, a red signal is eventually illuminated on all approaches, stopping all traffic, allowing pedestrians to cross. Some pedestrians wait to cross but some don't, and as a result, time is unnecessarily taken away from traffic flow.

Action: Change the current pedestrian signals to allow pedestrians to cross the street concurrently or "with the flow of traffic". Although there are 5 legs to the intersection, concurrent pedestrian signal phasing is possible.

Action: The following signs should be added as part of this improvement: "Yield to Pedestrians on Turns" (Figure 6).

Observation: Peet's Coffee exit drive is currently uncontrolled. As a result, drivers exiting the parking lot behind Peet's Coffee currently bypass the traffic signal, creating a potential safety hazard as vehicles directly enter the intersection at their own risk (Figure 23).

Action: Move the stop line and crosswalk approximately ten feet East on the Beacon Street eastbound approach. This new location will encourage drivers to obey the traffic signal indication for the Beacon Street eastbound approach to the signal when exiting Peet's driveway (Figure 22).

Observation: This intersection does not have vehicle preemption equipment. A vehicle preemption system detects an approaching emergency vehicle such as a police car or ambulance and provides a green signal to that approach. During heavily congested conditions, first responders may be unnecessarily delayed at this location.

Action: Add an emergency vehicle preemption system to better manage traffic flows during emergency situations.

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Signs:

Observation: Due to extended queues primarily along Beacon Street westbound, peak hour traffic consistently "backs up" into the intersection, blocking opposing traffic and disrupting traffic flow.

Action: Add a "Do Not Block Intersection" sign at all intersection approaches to promote responsible driving through the intersection (Figure 25).

Observation: The parking lane along the north side of Beacon Street in front of the municipal parking lot is restricted during the PM peak (i.e. no vehicles can park there); however, drivers appear hesitant to use the extra travel lane (Figure 27). This hesitation may be due to the parking stall markings and the parking restriction sign which is positioned low and facing the driver who would be parking, not informing a driver traveling westbound on Beacon Street. In addition, although parking is allowed during the AM peak, utilization of the spaces is low throughout the morning (Figure 26). The underutilization of this lane causes traffic to "back up" along Beacon Street westbound, creating a queue that extends into the Langley Road/Sumner Street at Beacon Street intersection.

Action: Restrict the parking lane during the AM peak, at a minimum. Update the parking restriction signs to inform drivers about the available lane during the peak hours. Consider restricting this parking lane during the entire day to eliminate confusion regarding when it is available for use as a travel lane. If full day restriction is not feasible, consider extending the PM restriction to start at 3pm and end at 7pm. Consider adding a lane use sign similar in design to the I-93 lane use signs that allow driving in the breakdown lane during peak hours (Figure 24).

Figure 24. I-93 Lane Use Sign

Figure 25. Recommended Sign (MUTCD R10-7)

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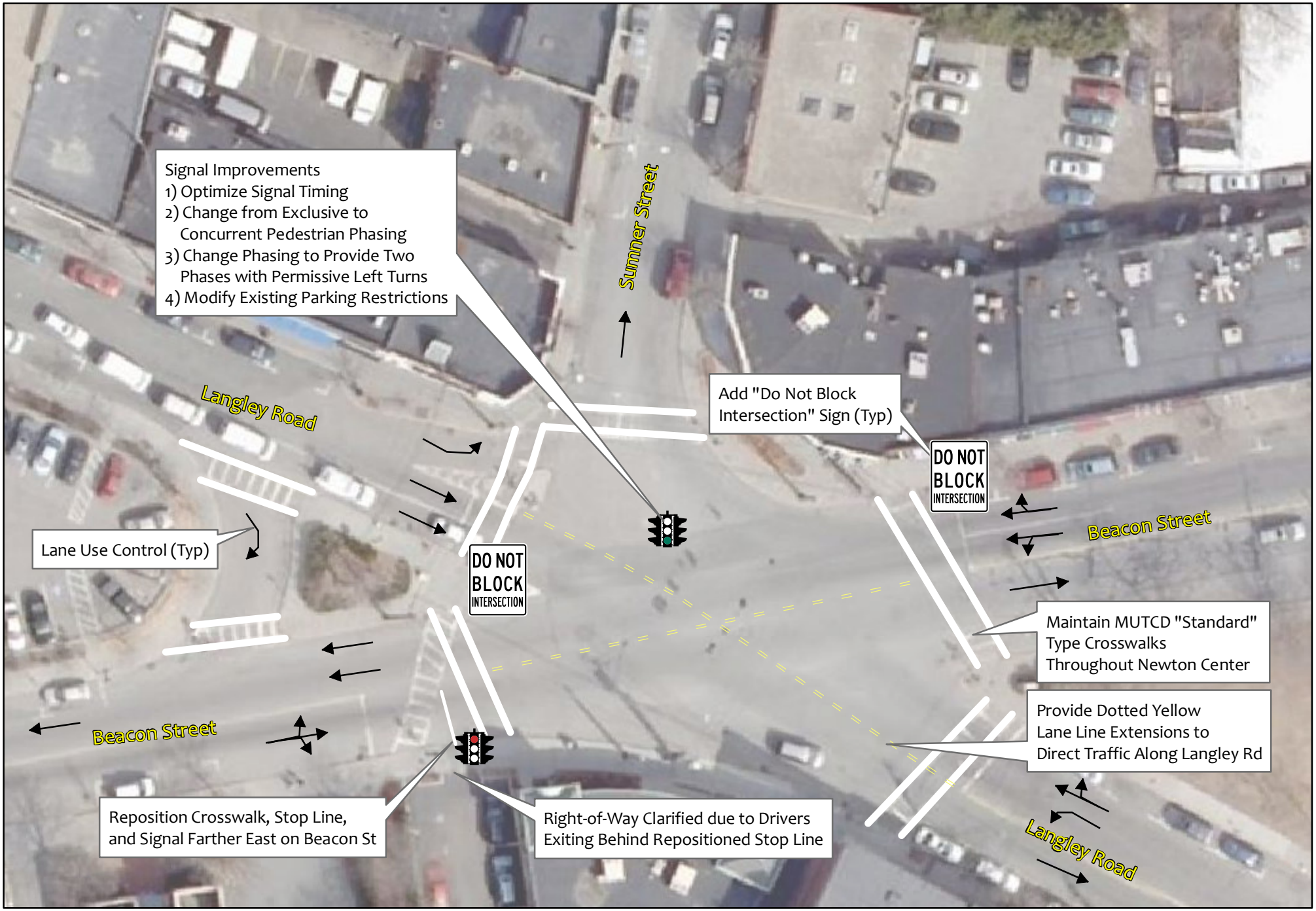
Bicycles:

Observation: Bicycle parking accommodations are not provided around this intersection.
Action: Place strategically-located and aesthetic bicycle racks around Newton Center (Figure 15, Figure 16, and Figure 20).

Observation: Exclusive bicycle lanes are not provided on any of the approaches. Bicycles are required to share the road with vehicles.
Action: Add a "Share-the-Road" sign assembly around Newton Center (Figure 17).
Long-Term Action: Consider adding bike lanes.

Figure 26. Beacon Street looking West - Parking Lane during AM Peak

Figure 27. Beacon Street looking West - Parking Lane during PM Peak



traffic solutions	TITLE: Langley Rd/Sumner St at Beacon St- Short-Term Improvements	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	FIGURE 28

traffic solutions	TITLE: Langley Rd/Sumner St at Beacon St - Long-Term Improvements	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	**FIGURE 29**

CENTRE STREET AT CYPRESS STREET

The Facts:

Centre Street at Cypress Street is an unsignalized three-legged intersection that is a gateway for drivers entering the Newton Center area. The Centre Street northbound approach is yield-controlled and all other movements are uncontrolled (Figure 1 and Figure 31).

Cypress Street, a two-lane roadway comprises the southeastern leg, and Centre Street, comprises both the southwestern leg and northern leg. Cypress Street has a shared lane for the through movement and left turn movement. Centre Street, on the northern side of the intersection, has a dedicated left-turn lane and a through lane for southbound traffic while two receiving lanes are provided for northbound traffic. Center Street, on the southern side of the intersection, is a two-lane roadway.

Crosswalks are provided across two approaches – Cypress Street and the southwestern leg on Centre Street. On the Cypress Street crosswalk, a portable "Yield to Pedestrians in Crosswalk" sign provides warning to drivers.

The number of crashes each year is low (Figure 30). The crash rate at this intersection is approximately equal to the Mass Highway district average (Table 9).

The Issues:

Northbound drivers traveling through the Cypress Street at Centre Street intersection, frequently encounter queues extending through this intersection. Just north of this intersection (approximately 200 feet) is the intersection of Beacon Street at Centre Street, a high-volume signalized intersection, which frequently experiences queues of 200 feet or more. This queue extends through the intersection of Cypress Street and Centre Street and prevents traffic from entering the intersection. A "domino" effect then occurs – traffic extends southward down both Centre Street and Cypress Street. As a result, the extended queues increase driver frustration, which may encourage drivers to seek other cut-through routes, ultimately placing a burden on streets and neighborhoods that weren't designed to handle the additional traffic. The right of way may also contribute to driver confusion since none of the three approaches to the intersection are required to stop.

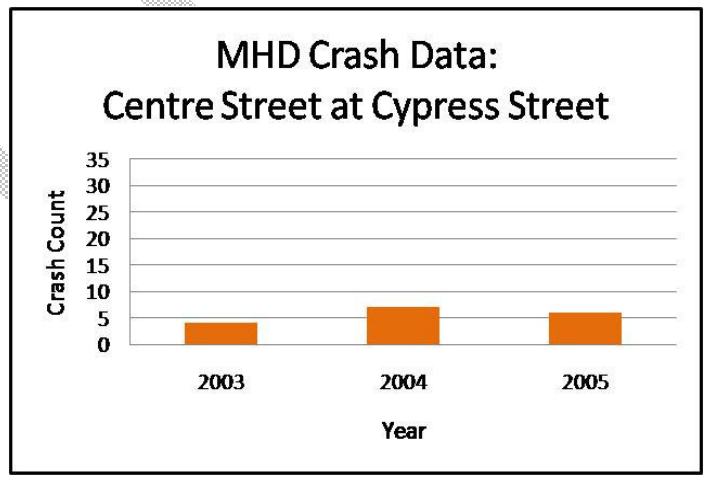


Figure 30. Centre Street at Cypress Street - MassHighway Department Crash Data for 2003-2005

Table 9. Centre Street at Cypress Street - Crash Rate Comparison

Intersection	Crash Rate	District 4 Crash Rate
Cypress at Centre	0.61	0.63

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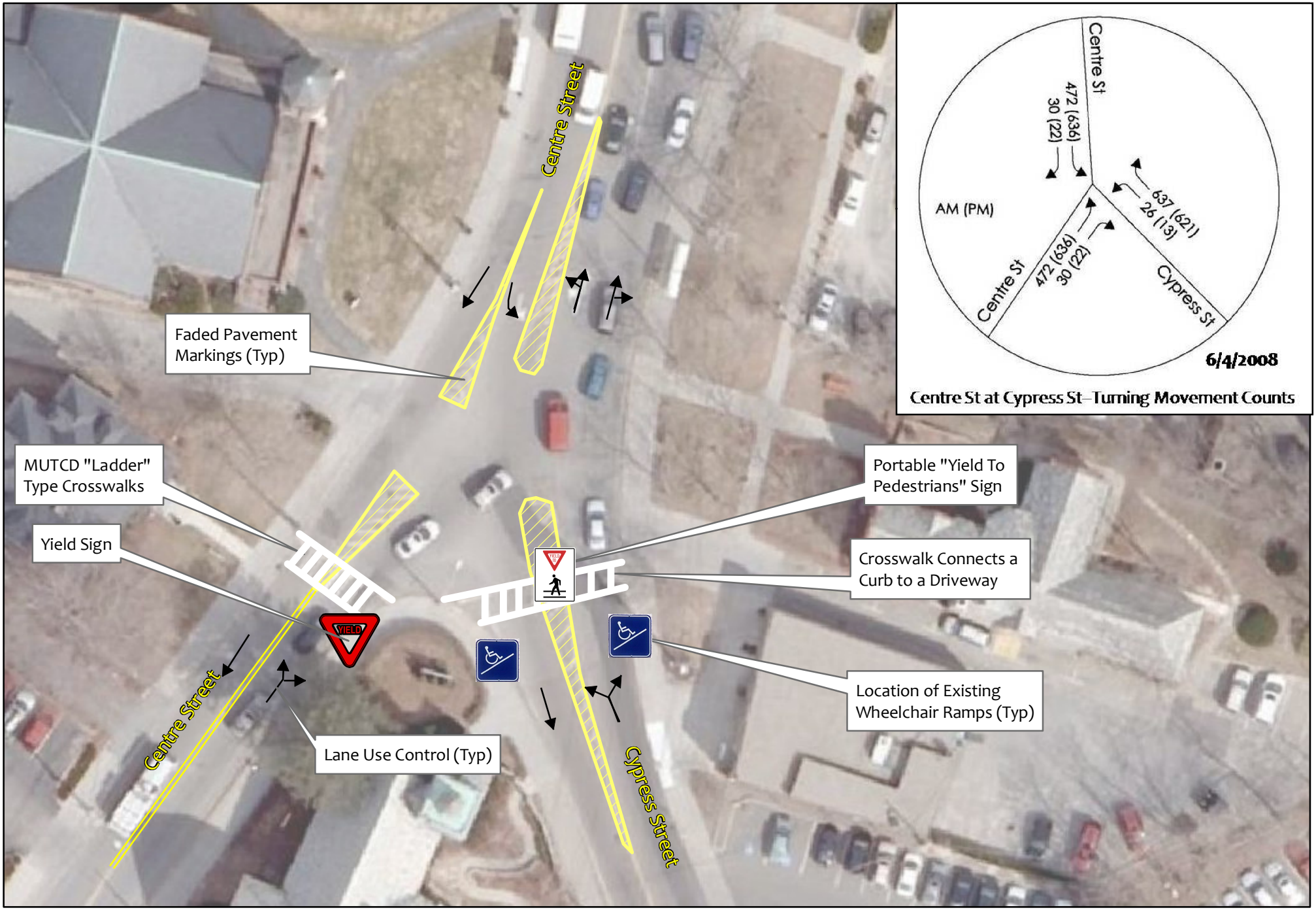

traffic solutions	TITLE: Centre St at Cypress St - Existing Conditions	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	FIGURE 31

Recommendations:
Through field work and capacity analyses, a number of observations and recommendations have been identified (Figure 38):

Intersection Geometry:

Observation: Traffic volume at this intersection is approximately equal on all three approaches. Therefore, the right of way is not clearly defined.

Long-Term Action: Clarify the rights of way by creating a traditional "T" intersection with Centre Street as the major street and Cypress Street as the minor street through curb extensions. This measure will guide drivers entering the intersection and also increase safety for pedestrians crossing the street. Also, widen the Cypress Street approach to provide two approach lanes so that drivers making right turns are not impacted by longer delays associated with left turning vehicles (Figure 39).

Pavement Markings:

Observation: The crosswalks at Cypress Street and Centre Street have the ladder design (Figure 32 and Figure 34) whereas the other two intersections have the MUTCD standard design (Figure 33 and Figure 34).

Action: Change the crosswalks at Cypress Street and Centre Street to reflect the standard design. This will create a consistent pattern throughout the area and it will be more cost efficient.

Observation: Crosswalk markings on Cypress Street currently connect a driveway on the east side of Cypress Street to a curb on the west side (Figure 32). The existing crosswalk does not utilize existing accessible ramps.

Action: Align the pedestrian crosswalk with the existing pedestrian ramps for the short-term.

Long Term Action: Consider moving the drainage catch basin south to manage stormwater runoff before it reaches the crosswalk since Cypress Street slopes downhill towards its intersection with Centre Street.

Figure 32. Ladder crosswalk at Cypress Street

Figure 33. Standard crosswalk at Beacon Street

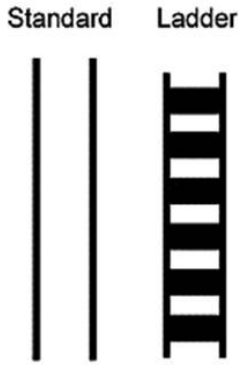

Figure 34. MUTCD Types of Crosswalks

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Observations: Pavement markings are not provided for southbound left-turning drivers on Centre Street to yield at the intersection (Figure 36).
Action: Add advanced yield markings (Figure 35).

Observation: The lane and median markings are faded at the intersection (Figure 36).
Action: Restripe the pavement markings to provide additional guidance to drivers.

Observation: The queues are extensive on Cypress Street due to the approach having only one lane of storage.
Long-Term Action: Provide two lanes of storage; one left turn lane and one right turn lane (Figure 39).

Signs:

Observation: None of the approaches are controlled by a stop sign. The volumes at this intersection warrant stop sign consideration. Yield control is only acceptable for low volume, low accident conditions.
Action: Change the Cypress Street approach to have stop sign control (Figure 38).
Long-Term Action: Consider modifying the Cypress Street approach to include two lanes (Figure 39).

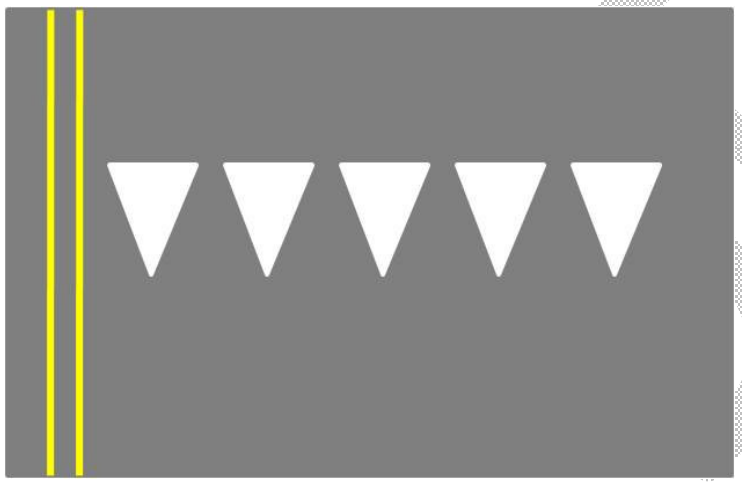

Figure 35. Advanced Yield Markings

Figure 36. Centre St at Cypress St looking Southwest - Fading Pavement Markings

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Observation: Other than the portable pedestrian sign, there are no additional signs that inform drivers in advance about the presence of pedestrian crosswalks.

Action: Add a Pedestrian Warning Sign with Supplemental Placard at Centre Street northbound to improve pedestrian safety at this intersection (Figure 37 and Figure 38).

Figure 37. Pedestrian Warning Sign with Supplemental Placard (MUTCD W11-2 / W16-7p)

Observation: Northbound traffic on Centre Street is controlled at the intersection by a Yield sign. However, the intersection does not fall within the MUTCD guidelines for a Yield Sign;

"For urban streets:

1) The major street has been designated as a through street with control along a substantial length that grants or implies right-of-way by using traffic."
Both Cypress and Centre Street have approximately equal traffic volumes.

2) "The average daily traffic should be less than 1,500 vehicles per day on the major street and less than 600 vehicles per day on the minor street."
The average daily traffic along Cypress Street is 11,921 vehicles and along Centre Street is 13,404 vehicles. Therefore, both the major and minor street exceed the criteria for a Yield Sign.

3) "The intersection should most likely be a residential street intersection with a speed limit of 25 mph or lower."
Neither Cypress nor Centre are residential streets with a speed limit of 25mph or lower.

4) "No more than two crashes involving vehicles on the minor street have occurred over the past three years."
There have been more than two crashes over the period 2003-2005 at this intersection (Figure 30).

Action: Eliminate the Yield sign at Centre Street northbound and add a Stop sign at Cypress Street northbound (Figure 38).

Bicycles:

Observation: Bicycle parking accommodations are not provided around this intersection.

Action: Place strategically-located and aesthetic bicycle racks around Newton Center (Figure 15, Figure 16, and Figure 20).

Observation: Exclusive bicycle lanes are not provided on any of the approaches. Bicycles are required to share the road with vehicles.

Action: Add a "Share-the-Road" sign assembly around Newton Center (Figure 17).

Long-Term Action: Consider adding bike lanes.

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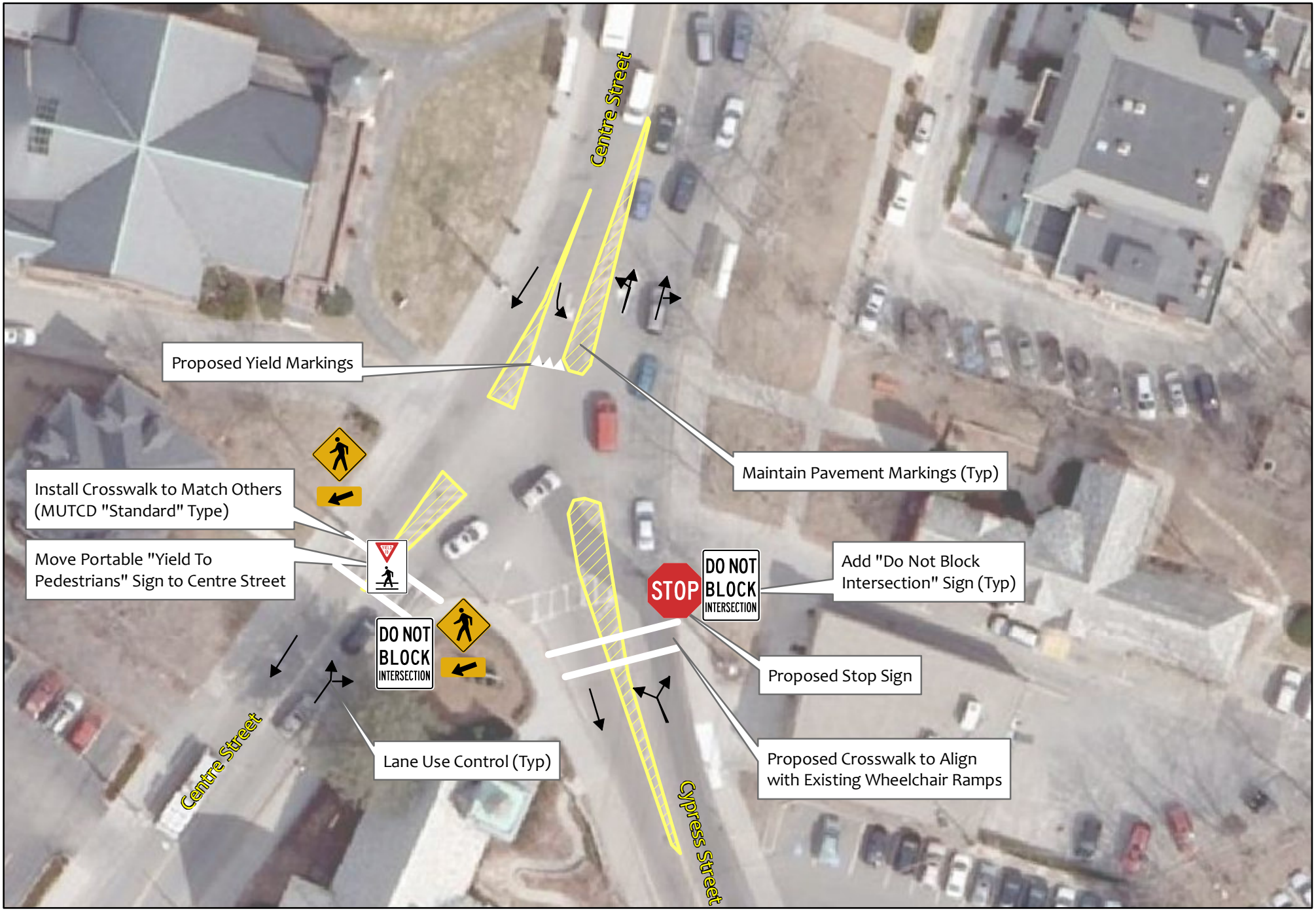

traffic solutions	TITLE: Centre St at Cypress St- Short-Term Improvements	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	**FIGURE 38**

traffic solutions	TITLE: Centre St at Cypress St Long-Term Improvements	PROJECT: Newton Center Intersection Audit	1 inch equals 40 feet 0 20 40 Feet N	**FIGURE 39**