Landmark Center Rotary
Path and Roadway Redesign

"We want a ground to which people may easily go when the day's work is done, and where they may stroll for an hour, seeing hearing and feeling nothing of the bustle and jar of the streets, where they shall, in effect, find the city put far away from them..."
(Frederick Law Olmsted, 1870)

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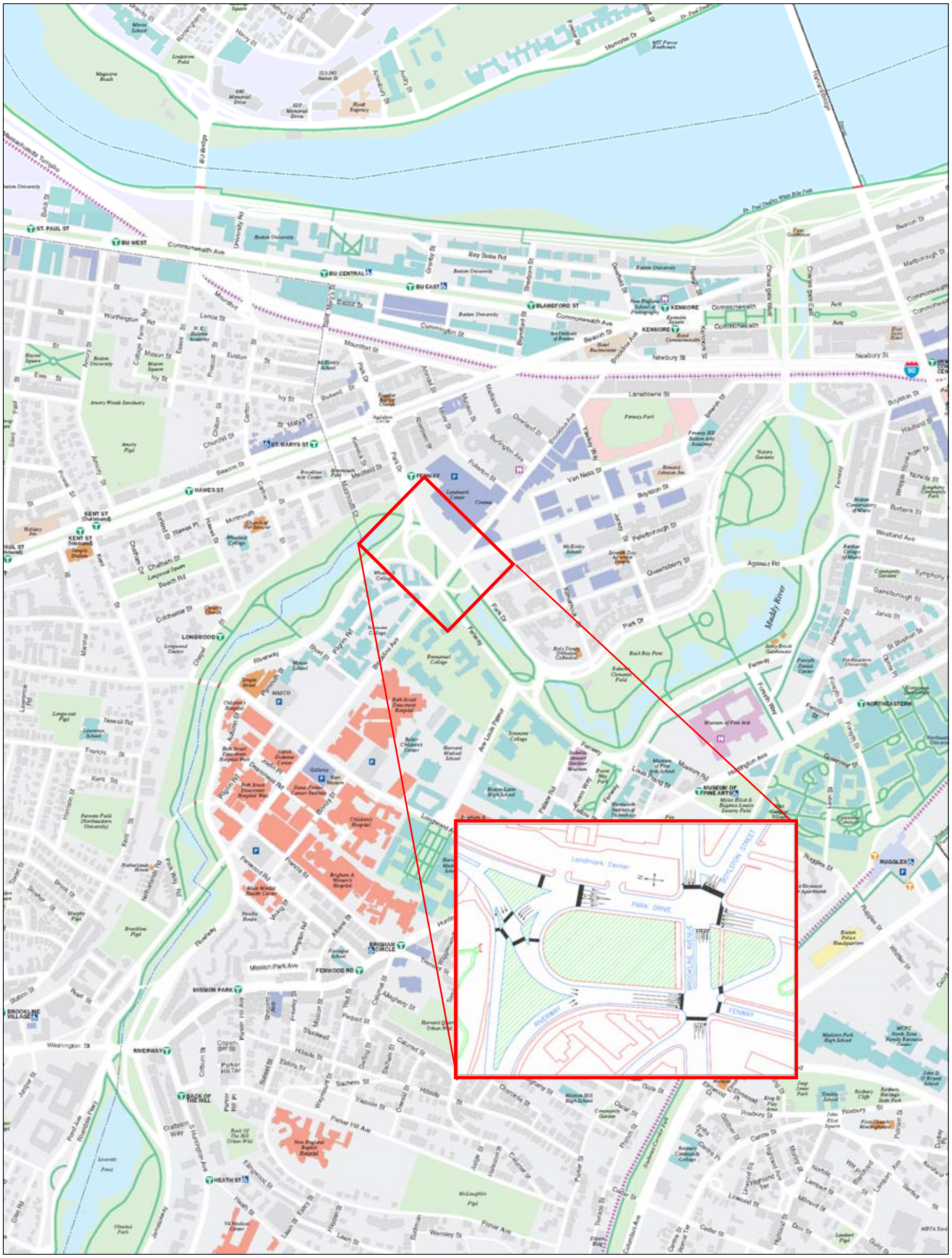


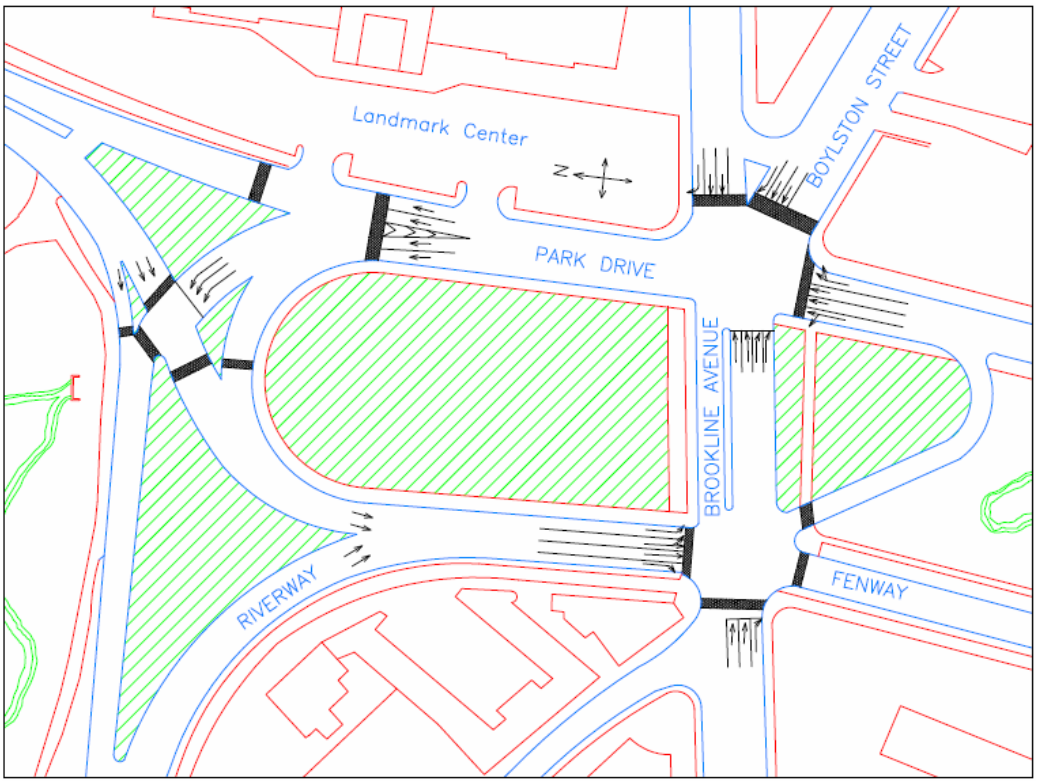
Introduction

Currently, the Landmark Center Rotary causes significant traffic problems while essentially creating a break in Olmsted's Emerald Necklace. With the recent allocation of 55 million dollars towards vehicular and pedestrian improvements in the Fenway area and the current project being undertaken by the Army Corp of Engineers to daylight the Muddy River, a unique opportunity to greatly improve both the traffic flow as well as the functionality of the park has presented itself.

Over the past few months, we have collected extensive data on the Landmark Center Rotary (also known as the Sears Rotary). Traffic counts at each intersection as well as Origin-Destination counts were done for both AM and PM peak periods. This data has allowed us to determine the feasibility of several alternatives (both new and old) to the current rotary. Our initial research showed that there were four main roadway and park designs worth further investigating.

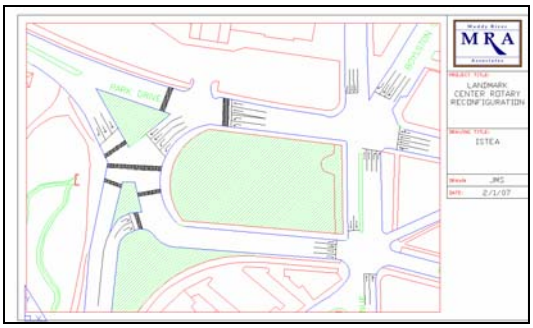
Each design was evaluated with several main objectives in mind:

- Increasing pedestrian and bicycle access to the park by reconnecting it to Frederick Olmstead's Emerald Necklace and improving paths
- Improving Traffic Flow



Current Layout

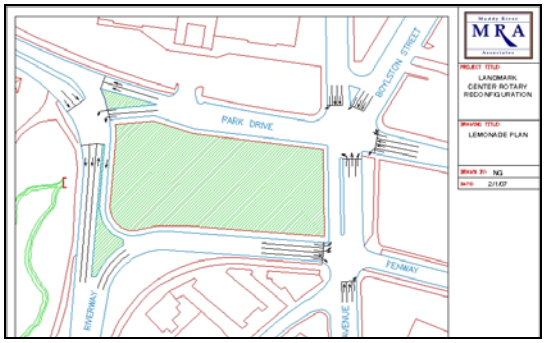
The four alternatives as well as the current roadway layout are shown below, and can also be found in more detail in the appendix of this report.



Alternative A - ISTEA

Alternative B - Vollmer's 2001 Alternative

Alternative C - The Sandal



Alternative D - Lemonade

Current Problems with the Rotary

The rotary has several main problematic areas shown below:

(* Note that for discussion purposes, the streets running East-West are Brookline Ave, Boylston St, and part of The Riverway while Park Drive and Fenway run North-South.)

1. Where The Riverway merges before the Brookline Ave intersection is particularly bad, especially during heavy traffic flow. The majority of cars coming from the northwest side of the rotary either want to continue down The Fenway or make a right onto Brookline West Bound, and the majority of cars coming from The

Riverway into the rotary want to make a left at the Brookline Ave. intersection. This results in a significant number of cars from each approach attempting to cross one or two lanes to continue through the intersection in the desired direction. With too short a distance between the intersection and the merge point, cars often become blocked by queues waiting to discharge, resulting in cars not being able to fill in a spot in their lane's queue. This weave problem greatly decreases the capacity of the intersection and is very hectic for drivers (see Image 1). This problem is further described in section titled, "The Riverway Merge and intersection."

Also, Pedestrians and bicyclists coming from Wheelock College currently have no marked crossing across The Riverway. They are forced to either cross at the Riverway/Brookline/Fenway intersection or run across The Riverway. This creates a huge safety issue. A pedestrian crossing across The Riverway would solve this problem.

2. Pedestrians and bicyclists coming from the paths upriver of the central park currently have to make a four stage crossing of The Riverway. This is incredibly tedious for a pedestrian trying to make a legal crossing, essentially creating a break in Olmsted's paths running through the parks to the North and South of the Landmark Center Park. Also, the current roadway layout covers a significant distance of the Muddy River, which will result in a very wide (and very expensive) bridge in the upcoming Muddy River Day-Lighting project. Subsequently, a wide bridge would mean a very long underpass which would be an undesirable characteristic for the pedestrian path (further discussed in the "Feasibility of pedestrian walkway under The Riverway Bridge" memo).

3. Queues in the section of Brookline Ave westbound between Park Drive and The Fenway often become backed up enough to interfere with the flow of traffic in the Park Drive/Boylston/Brookline intersection as well as the Riverway/Brookline/Fenway intersection. On the West bound side of this section Brookline, these backups are often a result of the all pedestrian phase being called by the push buttons at the crossings of Brookline and The Riverway.

4. There are no pedestrian "interior" crossings (meaning the crossings of Brookline from one park to the other) at the Riverway/Brookline/Fenway intersection, and this forces pedestrians to make multiple stage crossings when single stage crossings could work. Currently, an all pedestrian phase exists, yet there is no crosswalk across the western side of the intersection, so pedestrians and bicyclists wishing to continue down the Muddy River paths are expected to make three street crossings where only one is needed.

5. The same problem exists at the Brookline/Park Drive/Boylston intersection. Pedestrians and bicyclists wishing to continue down the Muddy River paths are currently expected to make a four stage crossing (across Park Drive, then Brookline, then Boylston, then Park Drive again) where a one stage crossing (across Brookline) would be ideal.

Origin-Destination Data

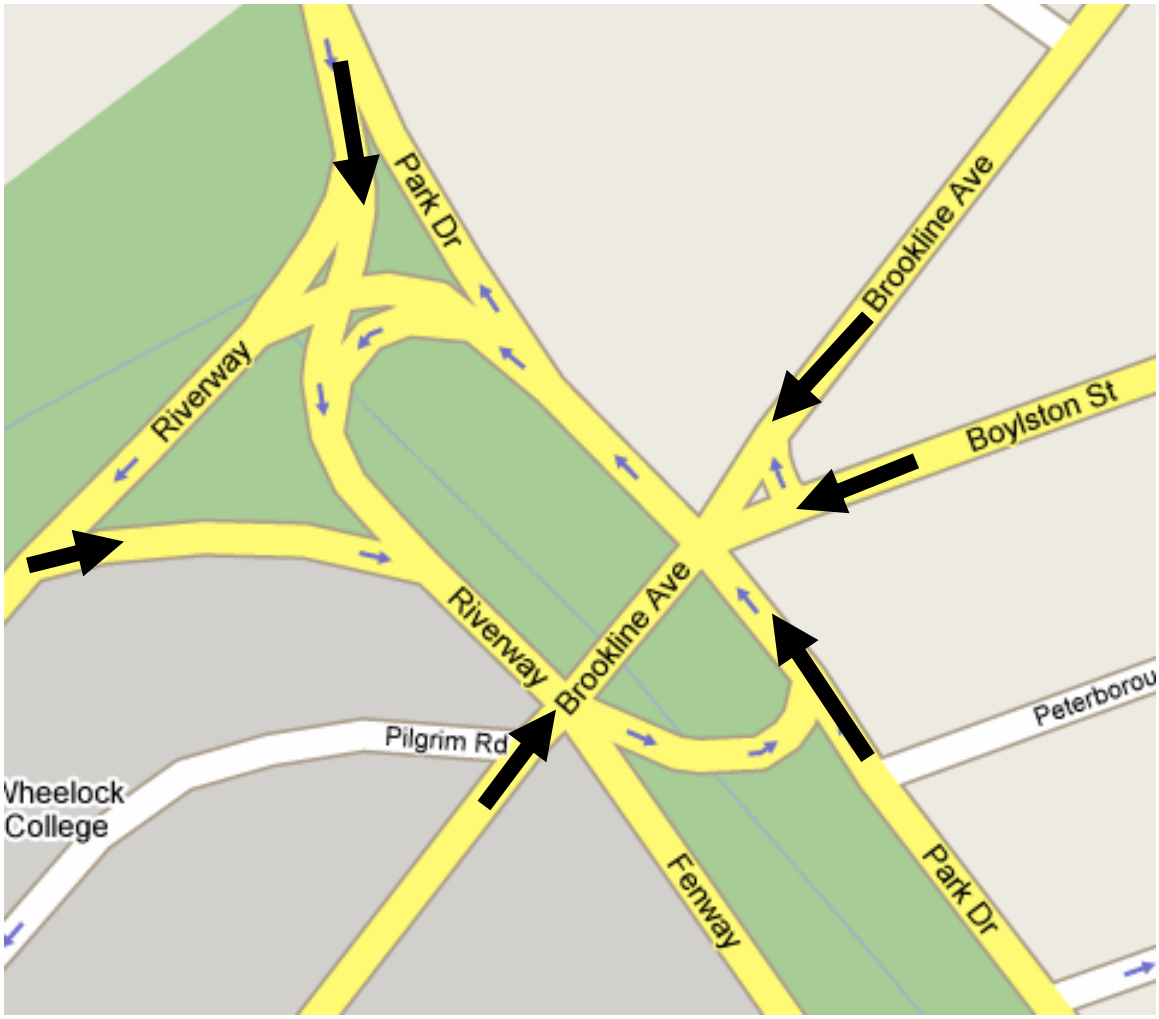


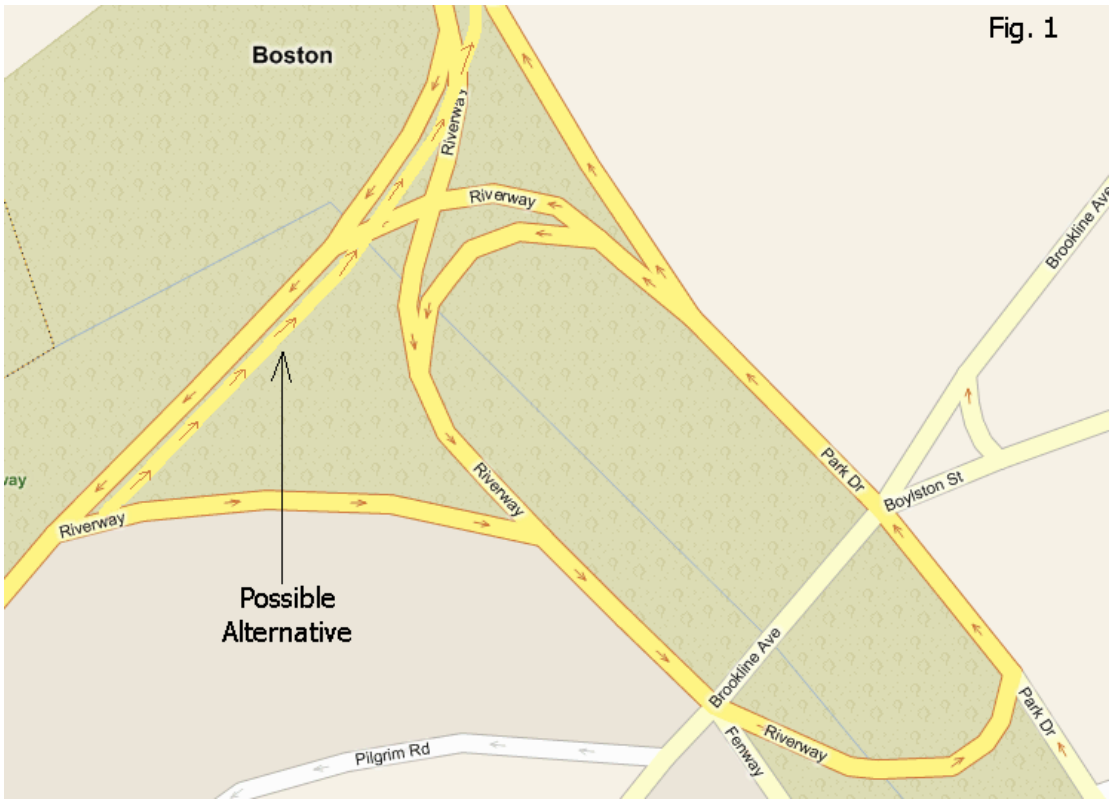
Image 2 - six main routes into the rotary

Six main routes into the rotary

- The Riverway
- Brookline Ave EB
- Brookline Ave WB
- Park Drive SB
- Park Drive NB
- Boylston

One of our main objectives in the redesign of the Sears Rotary is to improve traffic circulation while decreasing its effect on pedestrian and bicyclist activity in and around the park. In order to further understand the traffic demands on the rotary, it was necessary to do traffic counts for each intersection, as well as what we call 'Origin-Destination' counts. These counts were necessary since in the rotary, it is not always clear by doing standard traffic counts where each car entered and left the rotary. For example, in evaluating whether it is beneficial to connect The Riverway East Bound with Park Drive North Bound (depiction of example shown in figure 1) it is very important to understand the number of cars wishing to make this trip. Since these cars currently have

to go through multiple intersections to take this route it would be impossible to get a quantitative assessment of this demand using only the standard traffic counting methods.



Example Alternative

In order to get accurate results for the origin-destination counts, we needed a reliable way to track cars where they entered and left the intersection. A simple and effective way of doing this is to take a random sample of cars and watch their movement through the intersection. We decided to track all red cars entering the rotary from every possible origin and record where that car left the rotary. We were able to get origin-destination counts over a four day period starting on January 29th. Counts for the AM were conducted between 8:15 and 9:30 while counts for the PM were conducted between 4:00 and 5:30. During the counting periods, queues were observed to have grown and shrunk sporadically.

Approximately 200 cars during the AM peak and 200 cars during the PM peak were tracked for each origin and their destinations were recorded. This data was then converted into a percentage for each destination per origin. This percentage, combined with the raw traffic counts per intersection, was converted into vehicles per hour making the 31 different possible routes through the intersection. Results from the analysis can be found in Appendix C.

Origin-Destination Traffic Counts (vph) AM		Destination						
		Riverway	Brookline EB	Fenway	Park Drive NB	Boylston	Brookline WB	**Total**
Origin	Riverway	~	148	252	126	585	49	**1160**
	Brookline EB	8	222	90	75	429	~	**824**
	Park Drive NB	67	67	0	349	36	70	**590**
	Boylston	287	21	62	29	~	542	**940**
	Brookline WB	89	~	48	35	0	260	**432**
	Park Drive SB	231	38	342	~	73	119	**804**
	Total	**682**	**496**	**793**	**614**	**1124**	**1041**	**4750**

Table 1

Origin-Destination Traffic Counts (vph) PM		Destination						
		Riverway	Brookline EB	Fenway	Park Drive NB	Boylston	Brookline WB	**Total**
Origin	Riverway	~	86	154	86	400	49	**776**
	Brookline EB	23	279	98	51	553	~	**1004**
	Park Drive NB	176	71	0	297	62	115	**720**
	Boylston	418	0	71	55	~	367	**912**
	Brookline WB	182	~	112	93	0	317	**704**
	Park Drive SB	275	27	241	~	69	153	**764**
	Total	**1075**	**462**	**676**	**582**	**1084**	**1001**	**4880**

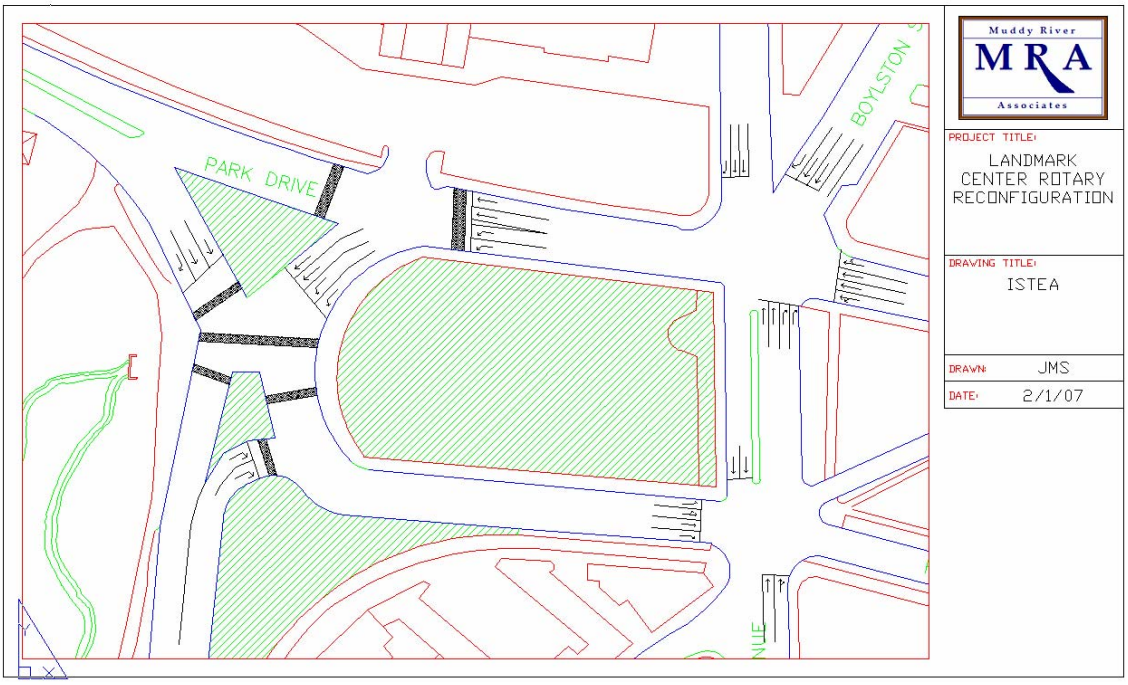
Table 2

Previous Designs

ISTEA

ISTEA is an alternative that was developed in 1997 by the Abbey Group. It was developed when the area was being converted from the Sears building into the Landmark Center. It hoped to obtain federal funding from the **I**ntermodal **S**urface **T**ransportation **E**quity **A**ct, hence the name. The main points of this alternative are that it would:

- Modernize the traffic signals
- Narrow the Park Drive/Riverway intersection
- Remove the merge from The Riverway Westbound into the rotary
- Eliminate the right-turn cutout from Boylston St. to Brookline Ave.
- Insert a bulb-out into the right lane of Boylston St.
- Rearrange crosswalks across Riverway and Park Drive



The ISTEA alternative adds green space while making pedestrian improvements such as crosswalks, neckdowns, and signal timing. ISTEA also improves the connection of the Muddy River paths for pedestrians crossing The Riverway. It does this by creating a three phase cycle with an all-pedestrian phase. In the ISTEA alternative, the medians are larger than the current medians, allowing bicycles to cross where there currently isn't room. Besides this, there is the additional green space, which adds to the aesthetics of the area. Another improvement for pedestrians is the bulb-out on Boylston St. to decrease the crossing distance and improve pedestrian visibility.

ISTEA improves traffic flow and eliminates the need for Riverway motorists to merge across multiple lanes of traffic when going to the Riverway/Brookline Ave. intersection. It does this by moving the Riverway lanes and having them as part of the signalized intersection with the pedestrian phase. It improves the flow by combining the

lanes coming from Park Drive onto The Riverway. This results in larger pedestrian sanctuaries and more green space as well. Solving the merging problem is a major improvement. Modernizing the traffic signals will produce the shortest cycle possible, resulting in shorter waiting times and therefore smaller queues for motorists.

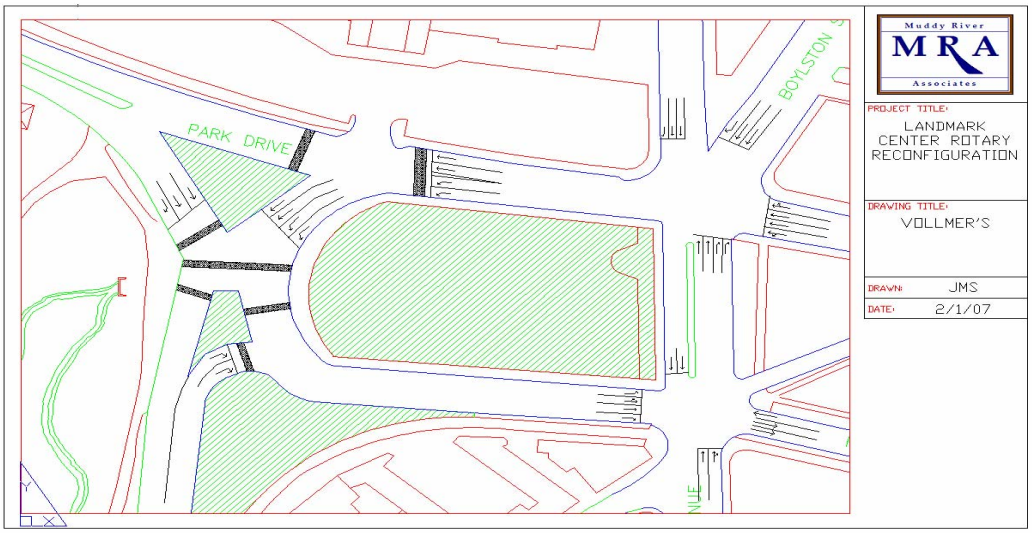
While this is a better model than the current situation, improvements could still be made. The current layout requires pedestrians to make a 4 stage crossing to continue up the muddy river path across The Riverway. The ISTEA alternative improves this with a single stage crossing, yet pedestrians would still have to cross six lanes of traffic (a distance of about eighty feet) in the middle of an intersection. This generally leads pedestrians to feel exposed and also results in a long ped phase. Fewer lanes would result in an easier crossing. There is also no "interior crossing" for people attempting to cross Brookline Ave. following the Muddy River path. This means it fails to restore the integrity of the Emerald Necklace, leaving Brookline Ave. as a barrier to bicyclists and pedestrians traveling along the Muddy River.

There are also some potential traffic problems caused by the ISTEA alternative. The elimination of the right-turn cut-out from Boylston to Brookline EB is unnecessary as it adds no green space and doesn't improve pedestrians' ability to cross Boylston St. and Brookline Ave. Another problem is that this alternative doesn't provide direct access from Riverway to Park Drive, which would decrease the traffic going into the Riverway/Brookline Ave. intersection and the Park Drive/Boylston/Brookline intersection. The ISTEA plan makes no improvements to the Riverway/Brookline Ave. intersection. This intersection is very busy, and it deserves some attention. The Park Drive/Brookline/Boylston intersection also remains unchanged for motorists. Overall, ISTEA is an alternative that has its good points but also could use some additional thought.

Vollmer's 2001 Alternative

Vollmer's alternative was developed in 2001 by Vollmer Associates. It was developed for the Urban Ring project to study the feasibility of bus access from the Urban Ring. It is very similar to the ISTEA alternative with a few exceptions:

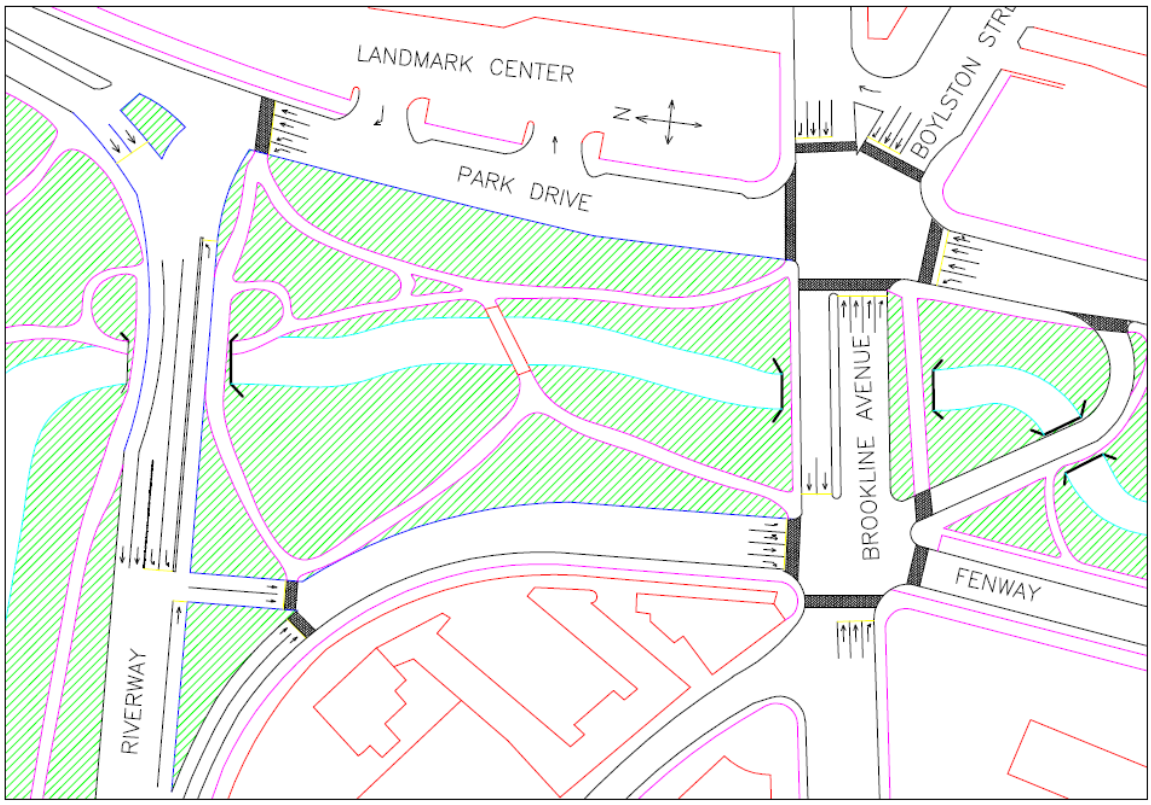
- No bulb-out on Boylston St.
- A counterflow bus lane along Fenway



The counterflow bus lane up The Fenway would be part of the Urban Ring, a proposed new mass transit rout, alleviating some of the traffic congestion. This would work well with Boston's plans to increase the number of users of mass transit. Since a lane would essentially be removed from the Fenway, there is concern that this would decrease the capacity of the road and the Brookline intersection. However, the intersection currently only has two lanes traveling onto the Fenway, and the road itself is heavily under utilized.

MRA's Proposed Designs

The Sandal



To alleviate the merging problem on The Riverway, it is necessary to either allow for more room to merge (increasing the distance between the merge and the intersection), or to control the traffic entering the weave with a signal. Alternative C, The Sandal, utilizes a combination of these two solutions. First, the distance between the merge and the intersection has been increased significantly. Second, traffic entering the weave will be controlled by signals with short cycle lengths for a high level of service. More details on this point are explained on page 14 in "The Riverway Merge and Intersection Analysis."

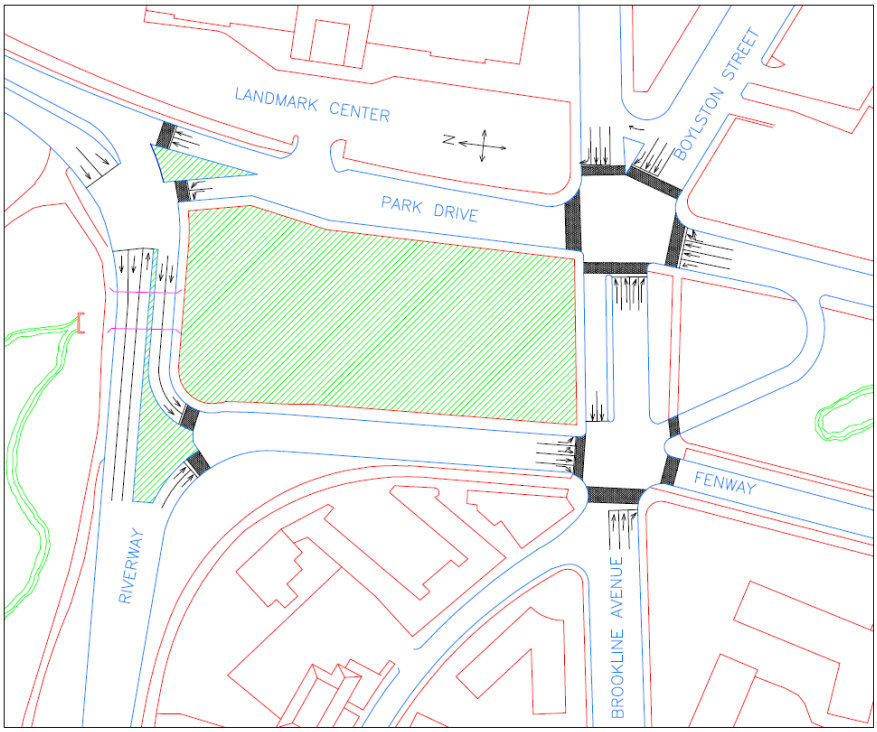
A signalized intersection would also allow for crosswalks to be installed where the two legs of The Riverway heading towards the Fenway merge, allowing pedestrians and bicyclists to easily cross. Currently, pedestrians trying to make this crossing are expected to walk down to Brookline Ave to cross. With these crosswalks installed, students and other residents near Wheelock University will have a safe and much more direct way to walk to the Landmark Center and the Fenway T stop. In order to avoid any negative affects these crosswalks would have on the traffic flow, the walk signals could run concurrently with the traffic light. Image 2 shows pedestrians attempting to make the crossing without any protection from oncoming traffic.

Image 2

Pedestrians and bicyclists trying to follow the paths along the Muddy River through the rotary would also greatly benefit from this alternative. The four stage crossing of The Riverway that currently exists would be changed to either an all ped phase, four lane crossing or even could travel under the Riverway Bridge on a pedestrian walkway as discussed in the "Pedestrian Underpass" section. The four lane crossing would drastically reduce the delay for pedestrians, and would most likely re-open the crossing as a realistic connection between the Muddy River Paths.

Making a direct connection between The Riverway and Park Drive North Bound would greatly reduce the distance and delay for vehicles wishing to continue up Park Drive from the River Way. It would also remove 125 veh/hr from the two Brookline Ave intersections, which are currently oversaturated during peak flows. This in itself is a major improvement for the rotary.

Lemonade



The Lemonade Plan is similar to The Sandal plan, with only one major difference: cars traveling from The Riverway to Park Drive NB would only have to go through one light instead of two. This would however make the crossing of the Riverway into a 5 lane crossing as opposed to the 4 lane crossing that would exist in the Sandal Plan, meaning that if pedestrians were to make the crossing under the Riverway, they would have to travel a greater distance under the bridge. This would also take away from the amount of park space that this project hopes to restore.

As in the Sandal Alternative, cars would be able to travel directly from The Riverway to Park Drive NB (decreasing some of the congestion at the Brookline Ave intersections), the Riverway merge could be solved by adding in a traffic signal, and pedestrian access to the park could also be improved with the addition of the proposed crosswalks.

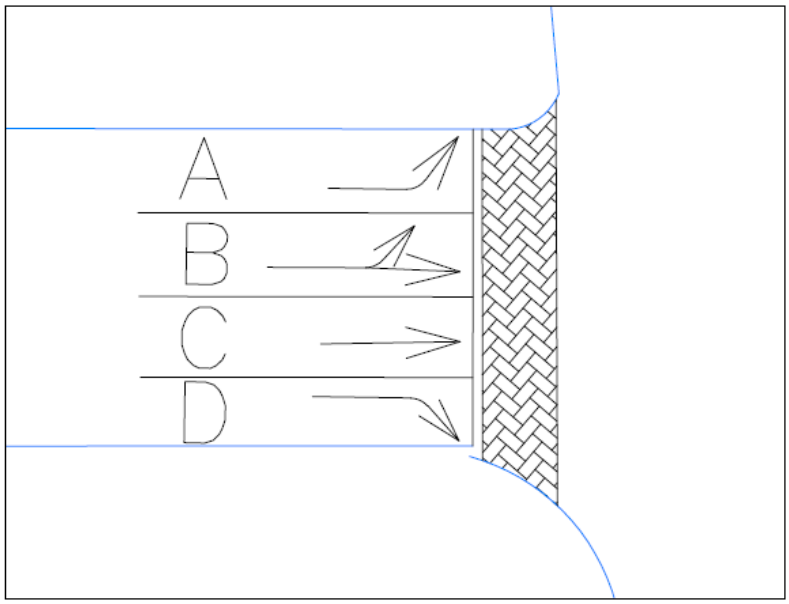
Alternative Selection

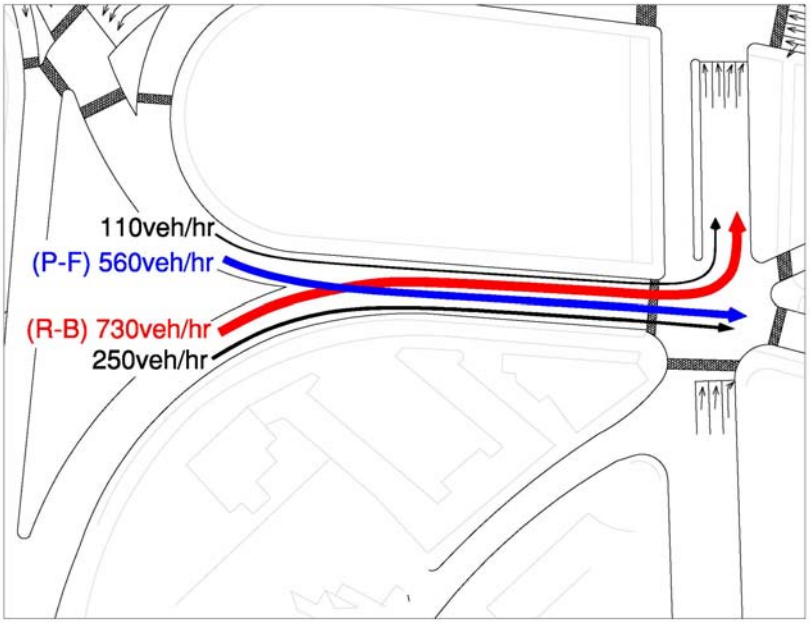
It is clear that both the Lemonade and the Sandal plans are best suited to solve the goals of this study. It is our opinion however that the Sandal Plan slightly outweighs the Lemonade Plan since it would create less of a foot print for the Riverway roads. This also means that a smaller and less expensive Riverway Bridge could be used, hence a shorter pedestrian underpass. For the rest of this report, we will analyze the specifics of the Sandal Plan and analyze the different components of the plan in terms of both vehicular improvements as well as pedestrian and bicyclist improvements.

The Riverway Merge and Intersection Analysis

Existing Conditions

The Riverway approach is one part of the Landmark Center Rotary that currently hurts the capacity of the roadway network. The main problem with the approach is the Riverway and Park Drive Weave. Shown below are the lanes that make up the Riverway approach. The lanes have been labeled A, B, C, & D and these labels will be referred to throughout the rest of this memo.





The graphic above is an illustration of how the weave affects the approach. The red arrow represents the heavy demand from Riverway to get towards the left side of the approach and turn on to Brookline Avenue (R-B stream). The green arrow represents the heavy demand from Park Drive to go straight through the intersection to Fenway (P-F stream). Since the queues often extend back to the merge point, the weaving movement is not just a difficult maneuver, but it is frequently blocked. Sometimes the P-F traffic stream blocks the merge point, starving Lane A. Other times, the R-B stream blocks the merge point, starving Lane C. In either case, the result is poor lane utilization, thus lowering the intersection's capacity. The weaving problem also creates a dangerous merging area for motorists to travel through and for pedestrians to cross.

Data Collection

The data collection process included finding the saturation flow rates in both the morning and afternoon peak times as well as finding the blocked state saturated flow rate in the morning peak to see how many cars could get through the intersection during each green period. The blocked state occurred more frequently in the morning, so the analysis is based on the data from the a.m. peak period.

In order to calculate unblocked state saturation flow rates, we observed 5 cycles of data for three of the four lanes. We did not include the far right lane because it is a right turn only lane that is permitted to go on red and is rarely saturated. For each lane and each cycle, we observed the time it took for four cars to cross the stop line, for ten cars to cross the stop line, and for *n* cars to cross the stop line for a given green period, where *n* is the number of stopped cars in the queue. Measurements with fewer than eight stopped cars were excluded. While we were collecting the data, we observed that valid queues only occurred when there was no blocked state.

For the blocked state data, we also observed 5 cycles of data for the same three lanes but instead, we counted all of the cars that passed through the stop line through the green period. During these cycles, there was always a queue with cars waiting to use the blocked lanes.

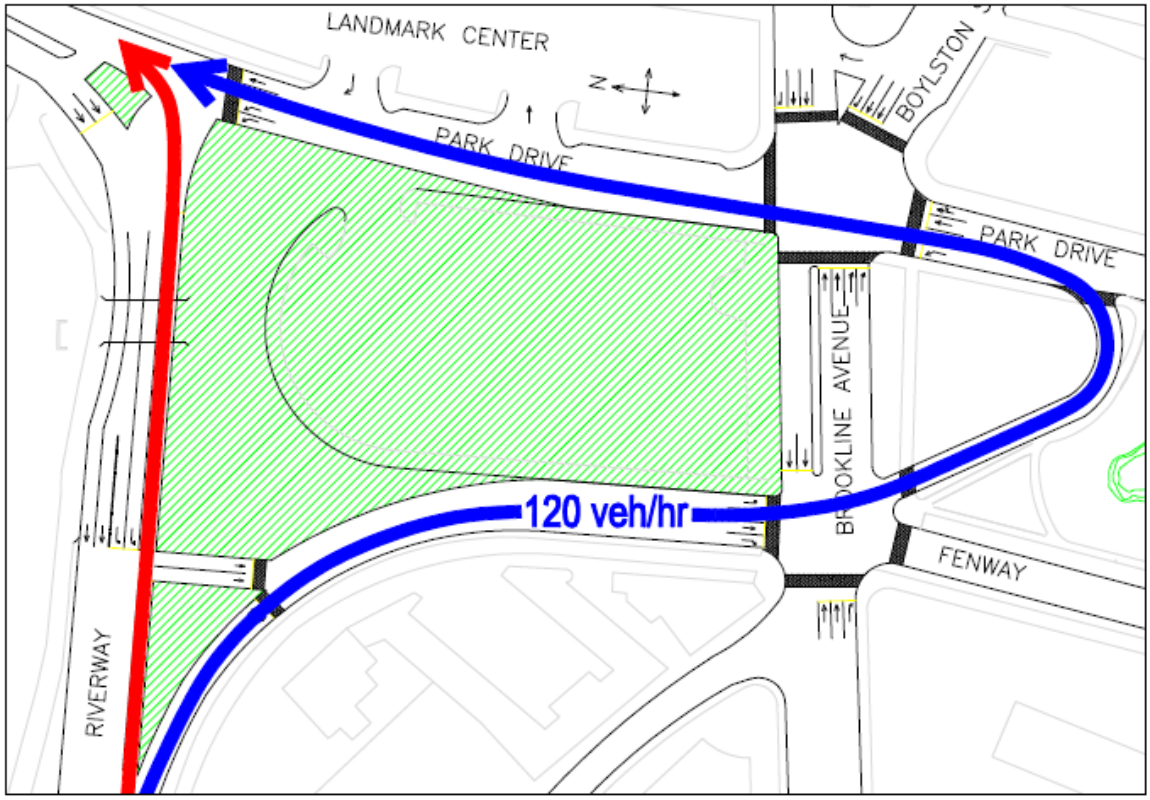
As shown in the table below, the blocked state causes Lanes A and C to be used at only 71% of their capacity. This lose of capacity only exacerbates the blocking problem because fewer cars get through the intersection per cycle. The vehicles that can not get through the intersection start the next queue which helps create the next blocked state. By calculating the lane utilization factor, we are able to estimate about how many more cars per hour could utilize each lane with improvements to the Riverway merge. Also, please see the tables attached for all of the recorded data and calculations for each lane.

Green Ratio: (g/C)= 0.4

Lane	Ideal "s" (veh/hr)	Blocked State (veh/hr)	Lane Utilization (veh/hr)	Unblocked Capacity (veh/hr)	Blocked Capacity (veh/hr)
A	1400	1000	0.71	560	400
B	1400	1400	1.00	560	560
C	1750	1250	0.71	700	500

Improvements

The proposed traffic circulation plan, "The Sandal", shown below, includes several improvements for the Riverway Approach that will help alleviate the weaving problem and thereby increase the capacity of the approach. Listed below are the proposed improvements and how they will affect the traffic flow.



Two-way traffic for Riverway

In The Sandal plan, Riverway is redesigned to carry two-way traffic. This means that vehicles that want to get from Riverway to Park Drive northbound will be able to continue on Riverway and turn left onto Park Drive (shown with the red arrow). If a vehicle wanted to follow this route in the current plan, they would have to weave into the Riverway Approach, get into Lane B, and take the jughandle to reach Park Drive headed

northbound (shown with the blue arrow). Through our Origin-Destination Data Collection we estimate that the new plan will remove 120 veh/hr from the Riverway Approach. These vehicles currently are trying to merging into Lane B, the most used lane of the approach. Removing them will help lessen the degree of saturation for the lane. Lane B causes the weaving problem when it has too many cars queued up for a cycle. The queue backs up to the merge point and blocks off the other lanes from being utilized. The data that we collected shows how the lanes are currently used. When there is a blocked state Lane B still carries just as many vehicles as when there is no blockage, but Lanes A and C lose capacity when there is a blockage.

Lengthening Approach

The short distance from the stop line to the merge point is one of the causes of the weaving problem. One of the goals of The Sandal Plan is to extend the distance provided for vehicles to queue up. The current situation only allows for 300' of queue space, which equates to 12 vehicles. After there are more than 12 in Lane B, then the weave becomes blocked and the capacity suffers. The Sandal plan lengthens the available queue length to 400' which will allow for 4 additional vehicles per lane to queue up during a given cycle without causing a blocked state.

Signalized Merge

The final improvement that is included in The Sandal plan is that the now free merge of Riverway and Park Drive will be controlled by a traffic signal. The signal will give each roadway their own time to proceed to the Riverway Approach and it will allow for safer crossing for pedestrians. The signal timing will be coordinated to the other intersections in the rotary so that there is minimal delay for both Park Drive and Riverway motorists trying to get to the Riverway Approach. The signals will also be coordinated so that neither weaving movement blocks the other. This can be accomplished mainly by using appropriate offsets. In addition, by using detectors that sense when a lane is blocked, the signals will prevent gridlock by not allowing a green signal to continue when the receiving lane is blocked.

Conclusion

All of these improvements help to solve the Riverway weaving problem that is one of the major issues that needs to be addressed for the Landmark Center Rotary. The weaving creates a situation that is both unsafe and ineffective. The Sandal Plan provides Riverway with two-way flows to reduce the number of vehicles that need to weave; the reassignment of lanes helps to more evenly distribute the vehicles per lane; vehicles are given more space to merge and queue up; and the signalized merge should eliminate the conflicts at the merge point.

Once the weaving problem is solved there won't be the blocked state which occurs during almost every cycle during the a.m. peak period. The elimination of the blocking will in turn increase the capacity per lane for the Approach. Lane A will be able to carry 160

more vehicles per hour and Lane C will be able to handle an extra 200 vehicles per hour. This increase in capacity will lead to less delay for motorist and will allow for traffic growth in the future due to new development in the Fenway area.

Below is a table showing a comparison of the volume to capacity ratios for the current situation and for The Sandal. The current plan doesn't offer enough capacity for the amount of cars that need to turn left or for the cars that go through. The ratios are over one for the current state meaning the approach is oversaturated. The oversaturation leads to the very long queue lengths and the long delay time. After the combined affect of the reduced demand and increased capacity, the volume to capacity ratios are down to acceptable values which will significantly improve the approach's conditions.

Analysis of Volume to Capacity Ratios

Left Turn

	Demand	Lanes	Capacity	Volume/Capacity
Current	970	A + 80% B	848	1.14
Sandal	844	A + 80% B	1008	0.84

Thru Lane

	Demand	Lanes	Capacity	Volume/Capacity
Current	703	20% B + C	612	1.15
Sandal	703	20% B + C	812	0.87

Removal of the All-Ped Phase

The intersection of Brookline Ave and Fenway has an all pedestrian phase that can be called by people crossing either Brookline Ave or the Fenway. This intersection is shown below in figure 1:

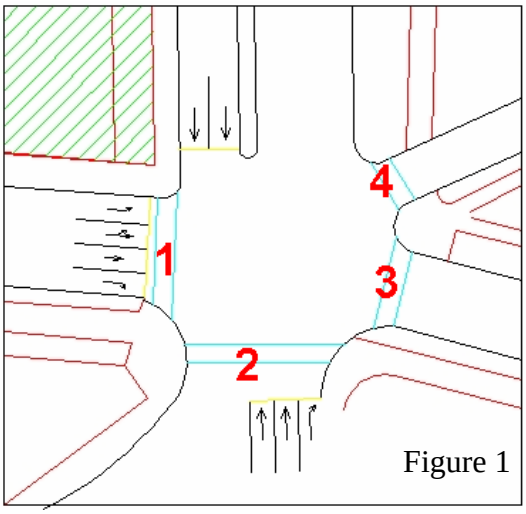


Figure 1

When the all-ped is activated cars get backed-up on Brookline Ave West Bound. During peak periods, this area can get backed up into the Boylston-Brookline-Park Drive Intersection. This causes gridlock, and wasted green time from Park Drive north bound due to intersection blocking. Our objective in studying this intersection was to find out if the all-ped phase is needed, and if it's elimination could help the intersection's capacity. In order to answer these questions, we studied pedestrians and whether or not they crossed with a concurrent phase, as well as the cycle timing of the lights.

Pedestrians crossing with concurrent phase:

It was observed that pedestrians crossed Brookline Ave during the Riverway green time and they crossed Fenway and the jughandle during the Brookline Ave green time regardless of whether or not the ped-phase was called. This leads us to believe that the all-ped is not needed, and this will be addressed in the solution. The phase sequence is shown in figure 2:

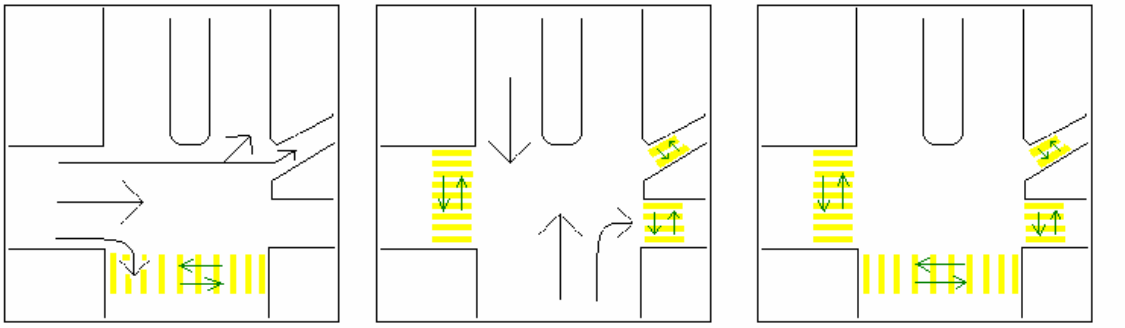


Figure 2: Phase Sequence

After studying the intersection, it was noted that the all-ped phase occurs after the Brookline Ave. traffic. Pedestrians who pushed the all-ped button during the Brookline Ave. traffic waited for the all-ped phase before they crossed the street. This data doesn't support the need for the all-ped phase because, as mentioned earlier, it was noted that pedestrians crossed after the Brookline Ave. traffic regardless of whether or not the all-ped phase occurred. For example, pedestrians who pushed the all-ped button during the

Riverway green time crossed Brookline Ave. before the all-ped phase was called. This can sometimes cause an all-ped phase to stop all traffic with no pedestrians waiting to cross.

Pedestrians who want to cross the Fenway and the Jughandle do so during the Brookline Ave. green time. It was noted that none of pedestrians waited for the all-ped phase because they were already crossing with the concurrent traffic phase. If a pedestrian arrived at the crossing during the River-Fenway traffic, they waited for the Brookline Ave. green light before crossing. If a pedestrian arrived at the crossing during the Brookline Ave. green time, they simply looked to see if any cars from Brookline Ave. were turning and proceeded to cross when it was safe.

Data & Analysis:

In order to determine the reason for the traffic back-up, data was collected at this intersection. We wanted to know the cycle time and how much green time was allocated to each street when the phase wasn't called as well as when it was called. This data is presented in figure 3:

Phase		No Ped. Phase	Ped Phase Called
	Cycle Time	90 secs.	84 secs.
1	**Riverway-Fenway Green time**	42 secs.	42 secs.
2	**Brookline Ave. Green time**	43 secs.	18 secs.
3	**Ped-phase**	0 secs.	19 secs.
	All Red time	5 secs.	5 secs.

Figure 3: Data Collection

From this data, it is quite obvious why the traffic on Brookline Ave. gets backed up. When the all-ped phase is called, the Brookline Ave effective green time gets cut from 43 seconds to 18 seconds. This data also shows that the Riverway isn't affected by the all-ped phase. The decrease in Brookline Ave. effective green time is shown in the following circle graphs, which present the distribution of time for the cycle both with and without the ped-phase:

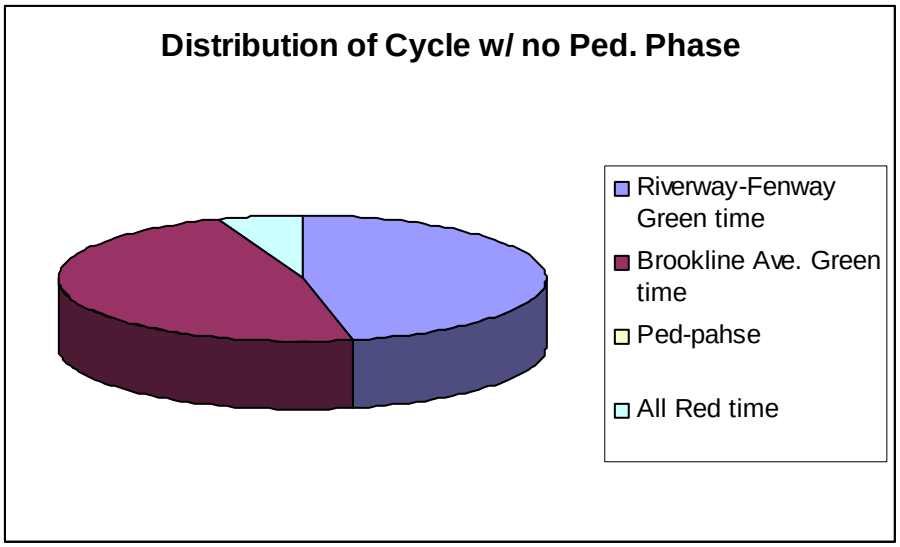


Figure 4: Cycle time distribution without all-ped phase

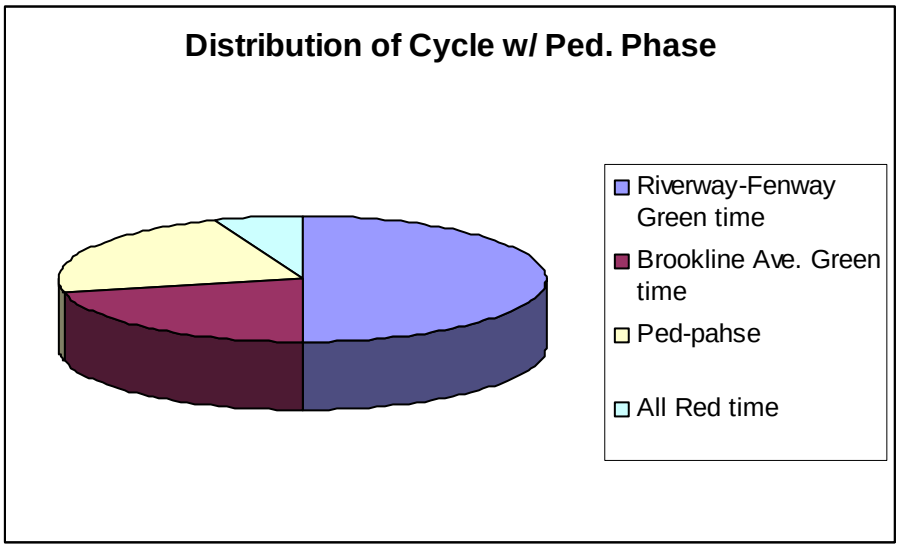


Figure 5: Cycle time distribution with the all-ped phase

Figures 3 and 4 shown a dramatic cut in the Brookline Ave. effective green time and that is the leading cause of the back-up of traffic along Brookline Ave. heading west bound.

During the data collection, it was also noted that on average, the all-ped phase is called once every 3 cycles. From this data Brookline Ave. stands to lose 325 seconds of green time every hour. This cuts down the capacity of Brookline Ave by 23%. Without any all-ped called, Brookline Ave would receive 1720 seconds of green time per hour. This is the main problem causing cars to back up into the Park Drive north bound intersection.

Solution:

In order to fix this problem, we propose to eliminate the all-ped phase. Pedestrians can cross Brookline Ave. during the Riverway-Fenway green time. The green time for Riverway-Fenway is 42 seconds, and that's more than enough time for pedestrians to cross the 4 lanes of traffic. Currently, as shown in figure 3, pedestrians are given 19 seconds to cross Brookline.

The safety of pedestrians is one of our main concerns, so we analyzed the traffic flow through Brookline Ave. during the Riverway-Fenway green time. The number of cars turning right from Riverway to Brookline Ave. west bound is only 170 veh/hr which turns out to be 4 vehicles per cycle. Pedestrians should not have a problem crossing the street because this is a small number of vehicles in each cycle and the cars will be going slow around the right hand turn. Given the fact that pedestrians already cross during the Brookline Ave. green time without the all-ped phase is evidence that this crossing is feasible and safe.

Traffic flow and the safety of pedestrians crossing Fenway during the Brookline Ave. green time was analyzed as well. Pedestrians can cross Fenway and the Jughandle during the Brookline Ave. green time. As was the case with crossing Brookline Ave., the vehicles turning right will be going slow enough to be able to react to pedestrians in a cross walk. Also there are only approximately 150 veh/hr turning from Brookline Ave east bound to the Jughandle and the Fenway, which is approximately 2 vehicles per cycle. The green time for Brookline Ave. would always be 43 seconds and that's plenty of time for pedestrians to cross, which is longer then the 19 seconds that's allotted for the all-ped phase. As mentioned earlier, pedestrians complete this crossing currently without waiting for the all-ped phase.

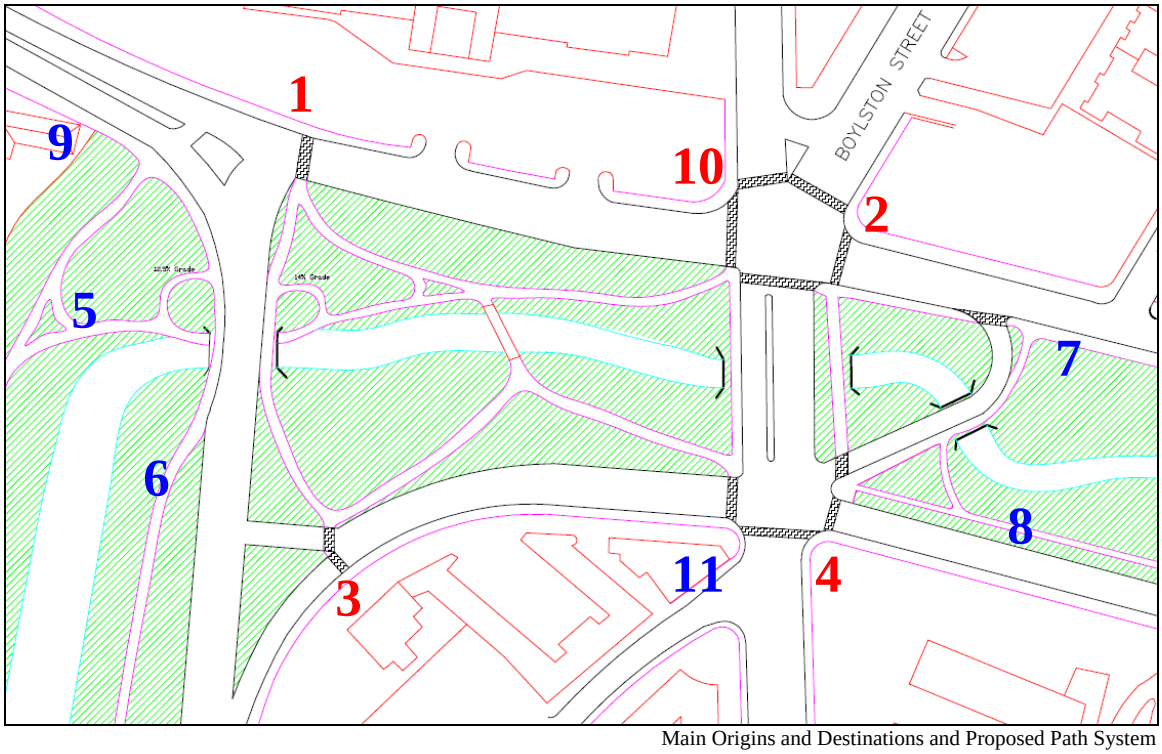
The all-ped phase backs up traffic from Brookline Ave west bound and from data collection and analysis; we found that the all-ped phase is not needed. Pedestrians can and already do cross Brookline Ave and the Fenway /Jughandle with the concurrent traffic phases, without waiting for the all-ped phase. Taking into account these facts, we propose to eliminate the all-ped phase at this intersection. The elimination of the all-ped phase won't have any effect on pedestrian crossings, and will alleviate some of the congestion on Brookline Ave west bound as well as allow Park Drive north bound cars to continue through their intersection without blockage or major congestion.

Pedestrian Path System

One of the main goals of this project was to determine feasible ways for pedestrians and bicyclists to get to the park and through the park. This requires a system of paths that suits the vast majority of users of the park. The park paths should be able to:

- Allow pedestrians easy access across the park. The main origins / destinations of pedestrians are:
    1) Fenway T Stop & Landmark Center
    2) Boylston Street & Fenway Park
    3) Wheelock College
    4) Longwood Medical Area
- Allow pedestrians and bicyclists to safely and conveniently continue along the Muddy River Paths both upstream of the rotary (5 & 6 in the figure below) and downstream of the rotary (7 & 8).

In order to accomplish these goals, the following path system was designed. All the new paths are designed to be 8-12 feet wide and asphalt paved in order to accommodate varying numbers of pedestrians and bicyclists.



Main Origins and Destinations and Proposed Path System

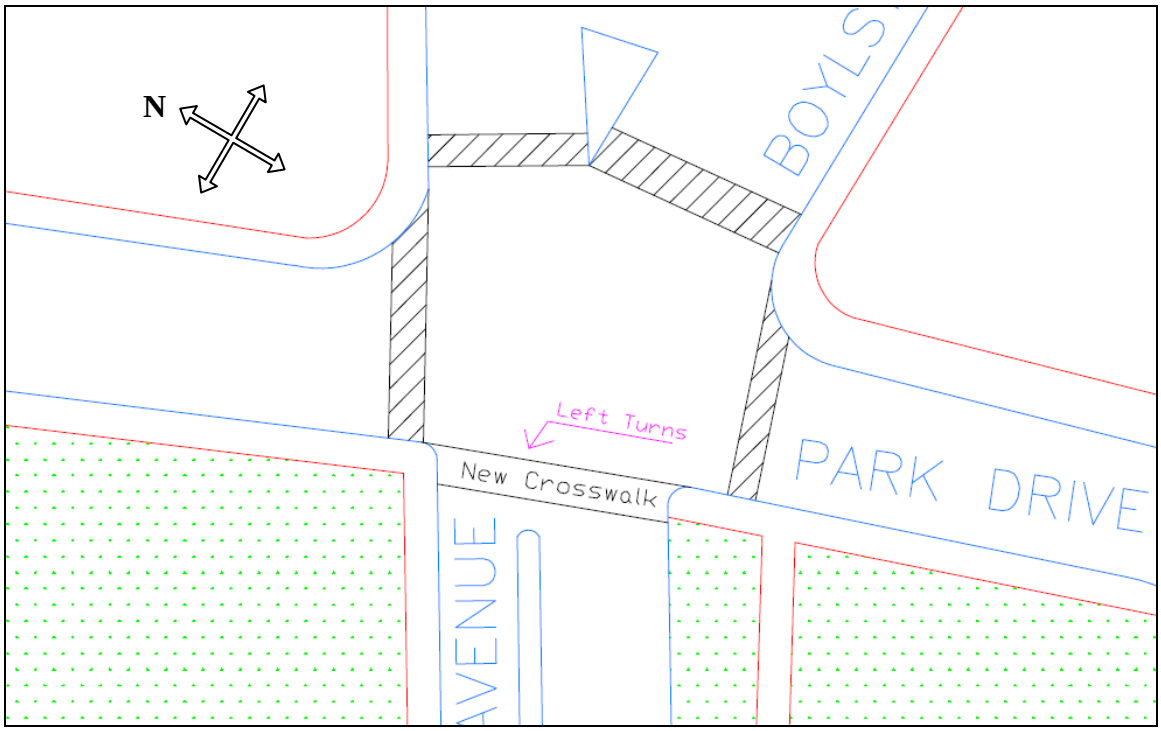
One of the main components of the path system is the pedestrian bridge located in the middle of the park. Currently, this is a heavily used path that makes the connection between the Longwood Medical Area and the Fenway T Stop. The bridge would not only

provide service to pedestrians and bicyclists crossing the park, but would greatly improve the aesthetics of the park.

The picture above was taken of a bridge almost identical to the one in the design for the Landmark Center Park. With the addition of the bridge, the people traveling between the Landmark Center / Fenway T Stop and the Longwood Medical Area would be able to walk through the park instead of on the sidewalk next to the street, restoring one of the true purposes of the Emerald Necklace.

Left Turn on Park Drive NB

In order to provide a better interior crossing, our design includes the installation of a crosswalk across Brookline Avenue at the Park Drive intersection, connecting the two parks. Since we have determined that having an all pedestrian phase at this intersection would have too significant an impact on the vehicular capacity, it is necessary to run the crosswalks concurrently with the traffic. This intersection was chosen because of the possibility of doing this. To better serve the pedestrians making this crossing, we looked into the possibility of either prohibiting cars from making the left turn at the intersection onto Brookline or providing an exclusive left turn lane.

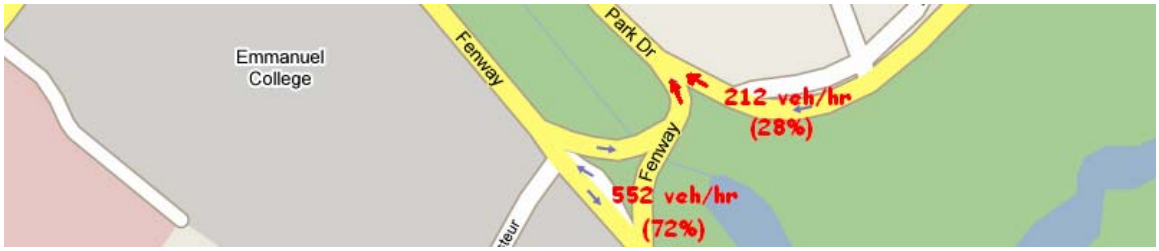


Park Drive / Brookline / Boylston Intersection

The main concern involving the elimination of the left turn was the decreased convenience for the vehicles wishing to go from Park Drive NB to Brookline Ave WB. While it is expected that most vehicles would be able to find an alternative approach to continue down Brookline WB, there would remain the secondary option of continuing around the rotary and making a right onto Brookline WB from the Riverway / Brookline intersection. To further understand the impact that this change would have, a traffic study was done on the cars entering the intersection from Park Drive.

There are three main groups of vehicles entering the Brookline Ave. intersection via Park Drive (D): through traffic coming from Boylston (A), local traffic arriving on Park Drive from side streets in the area (B), and through traffic coming from The Fenway (C). If the left turn were eliminated, it is assumed that local residents wishing to travel down Brookline Ave. WB would be able to use Boylston Street (E). Also, vehicles trying to get onto Brookline WB originating from Boylston (A) would simply be able to continue on Boylston instead of turning onto Park Drive.

The last group of cars is of the most concern. Vehicles coming from the Fenway (C) who are looking to travel into the Longwood medical area would be inconvenienced since they would now be required to travel around the Landmark Center Rotary, going through four lights instead of two. To get a better idea of the number of cars impacted by this, origin destination counts were done.



Origin of cars arriving at Brookline Ave Intersection via Park Drive

Our PM traffic count showed that 212 veh/hr (28%) were continuing up Park Drive while 552 veh/hr (72%) were arriving by from the Fenway. We then observed the number of cars arriving from the Fenway that were making this left turn. Out of the 135 cars observed, 12 made this left turn (9%) while 123 (91%) continued down either Boylston, Brookline, or Park Drive. This means that an average of 50 veh/hr would be significantly affected by the elimination of the left turn.

The other aspect that we looked into was whether or not pedestrians and bicyclists would be adversely affected by the cars making a left turn on Brookline WB (driving over the crosswalk during a walk-time). A reasonably sharp turn is required for vehicles going down Brookline, causing cars to drive fairly slow, which is a big advantage for peds. Also, pedestrians and bicyclists would be very visible to cars, further decreasing the danger of crossing with permitted left turns.

Another point to consider is that there will most likely not be a particularly high volume of pedestrians making this crossing. The bulk of the ped traffic will be people continuing up or down the Muddy River Paths. This, combined with the low volume of cars making the left, and the physical characteristics of the intersection would make eliminating the left turn at the intersection not necessary. With the small advantage for pedestrians being outweighed by the added inconvenience for vehicles, we recommend that the crosswalk run concurrently with Park Drive's green time without the elimination of the left turn. It is also recommended that this lane be made into an exclusive left turn lane, to prevent fender benders and rear-ends as cars slow in the intersection to allow for pedestrians to cross.

Riverway Bridge Feasibility

A major obstacle in improving bicycle and pedestrian paths along the Muddy River is the crossing of The Riverway. The current day-lighting project being taken on by the Army Corps of Engineers consists of constructing a CON/SPAN bridge to allow The Riverway to cross over the Muddy River. We are looking at the feasibility of constructing a pedestrian and bicycle path through the underpass of that bridge, with pedestrians and bicyclists passing under the Riverway on a riverside path. To construct an underpass with a pedestrian and bicycle path, an adjustment to the elevation of the existing roadway would be necessary.

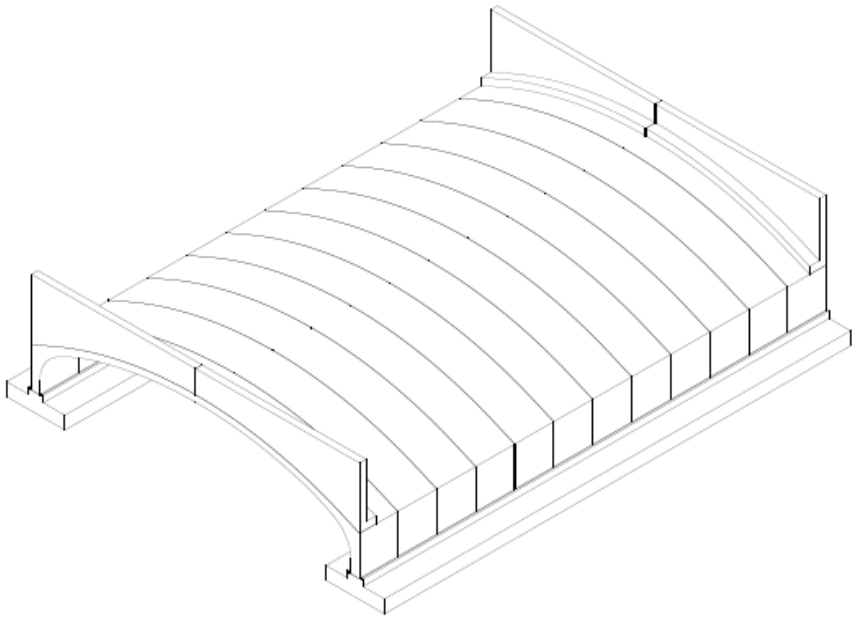


Figure 1 – CON/SPAN bridge structure

Current Bike and Pedestrian paths

The current bike and pedestrian paths along the Muddy River are not continuous throughout the Emerald Necklace. A break occurs at the Landmark Center Rotary where there are paths upstream and downstream of the rotary, yet no paths going through the rotary itself. Figure 2 shows the current layout of the rotary with no pedestrian paths going through.

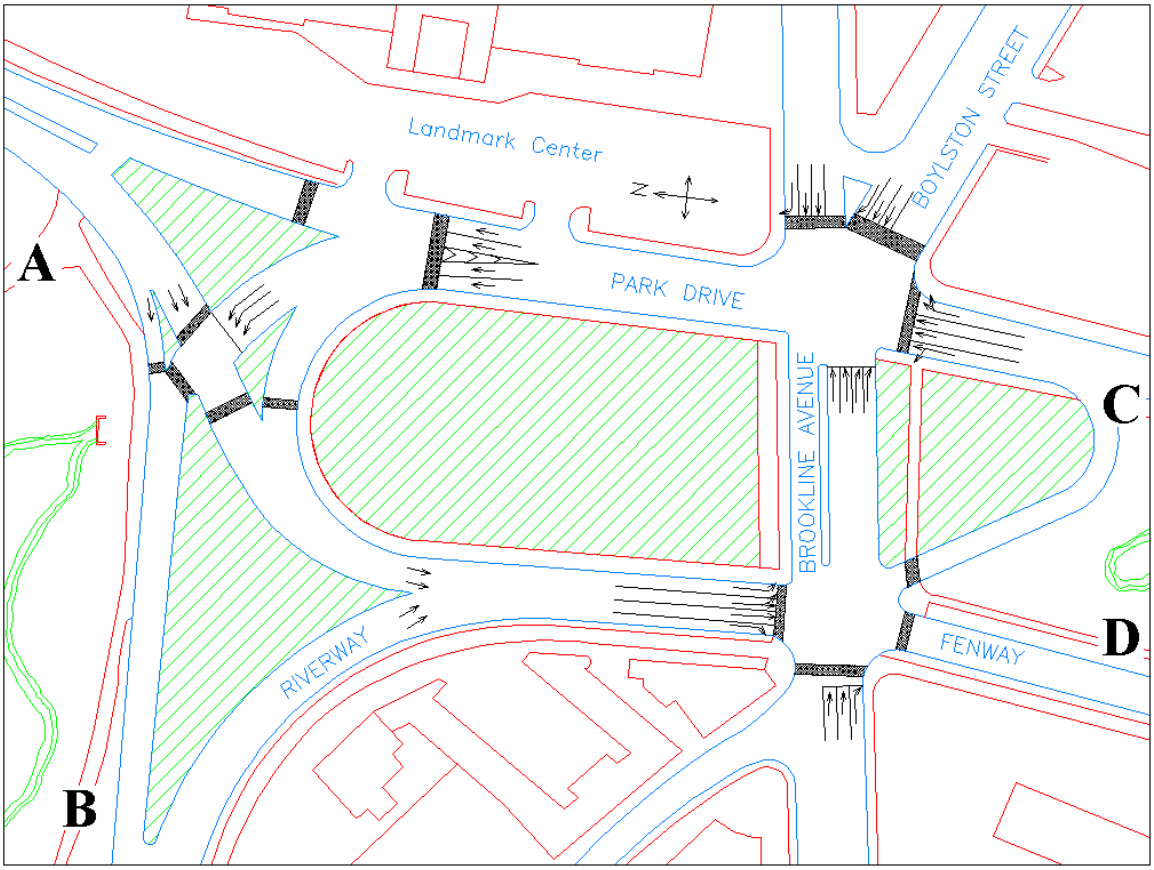


Figure 2 – Current paths along the Muddy River

The preferred bicycle path upstream of The Riverway (path A in Figure 2) is on the Brookline bank and is paved with asphalt instead of a clay and gravel mix which makes up the composition of the path on the Boston bank. The paths downstream of the rotary are similar on both sides of the river. In order to create a desirable, continuous path, there needs to be a connection from path A to the paths on either side of the Muddy River downstream of the rotary, paths C and D.

Figure 2 also shows that crossing The Riverway is currently a tough task. Pedestrians and bikers must go through a 4-stage crossing in order to safely cross the street. This takes a lot of time and effort, and should be done in a more efficient manner. When the day-lighting of the pond takes place, this crossing must be fixed so that bikers and pedestrians can conveniently cross The Riverway and follow a path along the Muddy River.

Our new layout, called ‘The Sandal’, includes a pedestrian underpass through The Riverway Bridge. This layout is shown with a pedestrian path that connects the upstream and downstream paths. In this design, the path follows the day-lighted river and enters the underpass on the east side and connects directly to the preferred path, path A, on the Brookline bank upstream of The Riverway. Both paths upstream are connected to the underpass via loops. This is shown more clearly in figures 3 & 3.1:

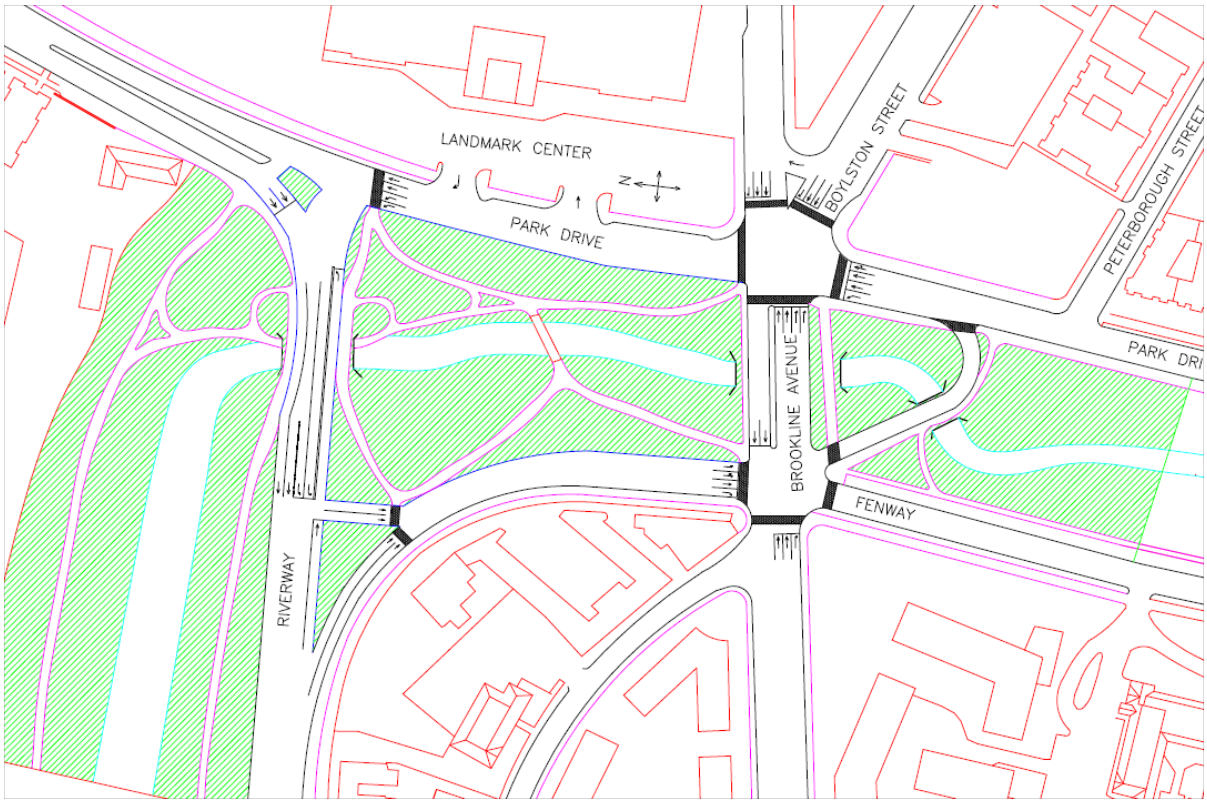


Figure 3- Pedestrian path through rotary

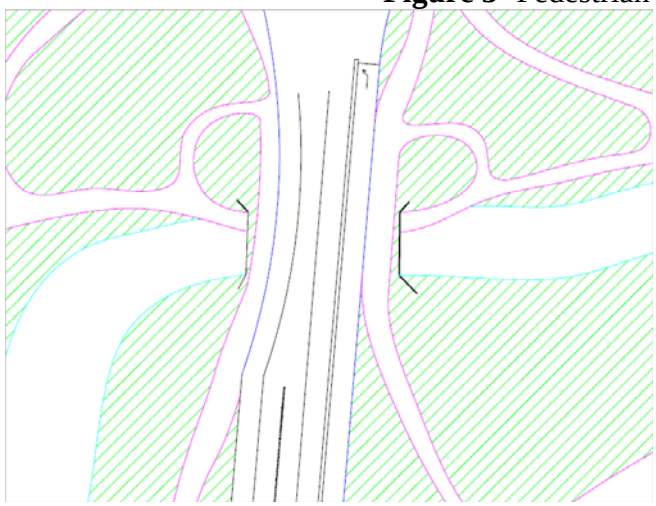


Figure 3.1 – Pedestrian path through underpass

The paths in figure 3.1 are connected to the underpass with two sets of loops: tight loops with 12.5% and 14% slopes, and longer loops whose slope stays below 5% to accommodate persons who can't negotiate the steeper ramps. The steeper paths are primarily for pedestrians and bicyclists and are not ADA accessible; however, people with disabilities would be able to use the slightly longer routes that have less of a slope. To get a better idea of the grade of these paths, figure 3.2 shows a graphical representation of the slope.

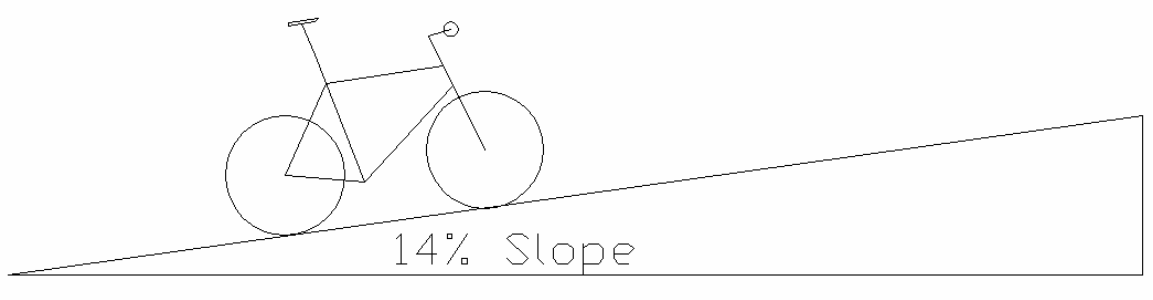


Figure 3.2

Underpass path dimensions

The bike and pedestrian path below The Riverway is going to be 12 feet wide with an overhead clearance of 8 feet, which is the bike path standard. The path will be 1 foot above the river elevation. This distance of 1 foot will allow the path to be used during most storms that will cause a slight rise in the waterline. After the current day lighting project, a rise of one foot would only occur in a 5 year storm or greater. In order to keep the elevation of the Riverway as low as possible, we decided to design for the 5 year flood. A 3 foot 6 inch railing will be placed at the edge of any walkway next to the water. All of these dimensions are shown in the figure below, figure 4;

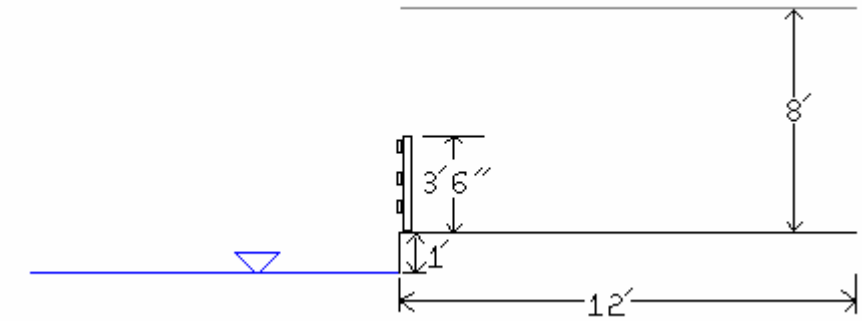


Figure 4 – Pedestrian path dimensions

Currently, a pedestrian path with an 8 foot over head clearance would not fit through the underpass of the Riverway bridge. The roadway elevation would have to be raised approximately 3 feet. The current underpass would also cover a distance of 185 feet if no roadway improvements were made to Riverway-Park Drive. In our Sandal layout, as shown in figure 3, the underpass length would be decreased to approximately 72 feet. Even if an underpass is not put in, the minimizing of this distance makes crossing The Riverway safer at grade.

Roadway elevations and profiles

The current roadway would have to be raised 3 feet at the peak of the bridge in order to accommodate the pedestrian path through the underpass. Figure 5 shows a profile with the current elevation of The Riverway and the proposed elevation with the bridge underpass. The proposed roadway elevation will meet the existing elevations at points 'A',125 feet to the west of the bridge peak and point 'C' 175 feet to the east of the

bridge peak. The bridge peak is located at point 'B', and is 3 feet higher than the current elevation.

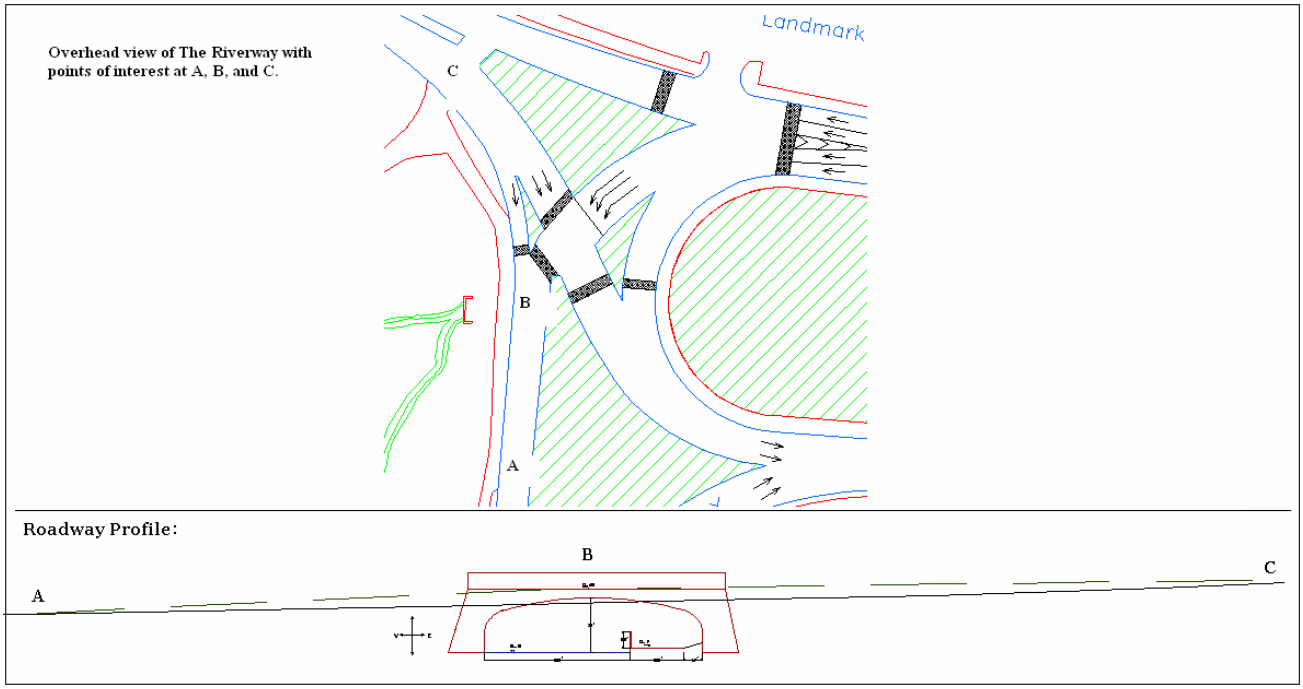


Figure 5 – Roadway profile

The raising of The Riverway will have a minimal impact on the grade. Figure 6 shows the existing grades compared to the proposed grades.

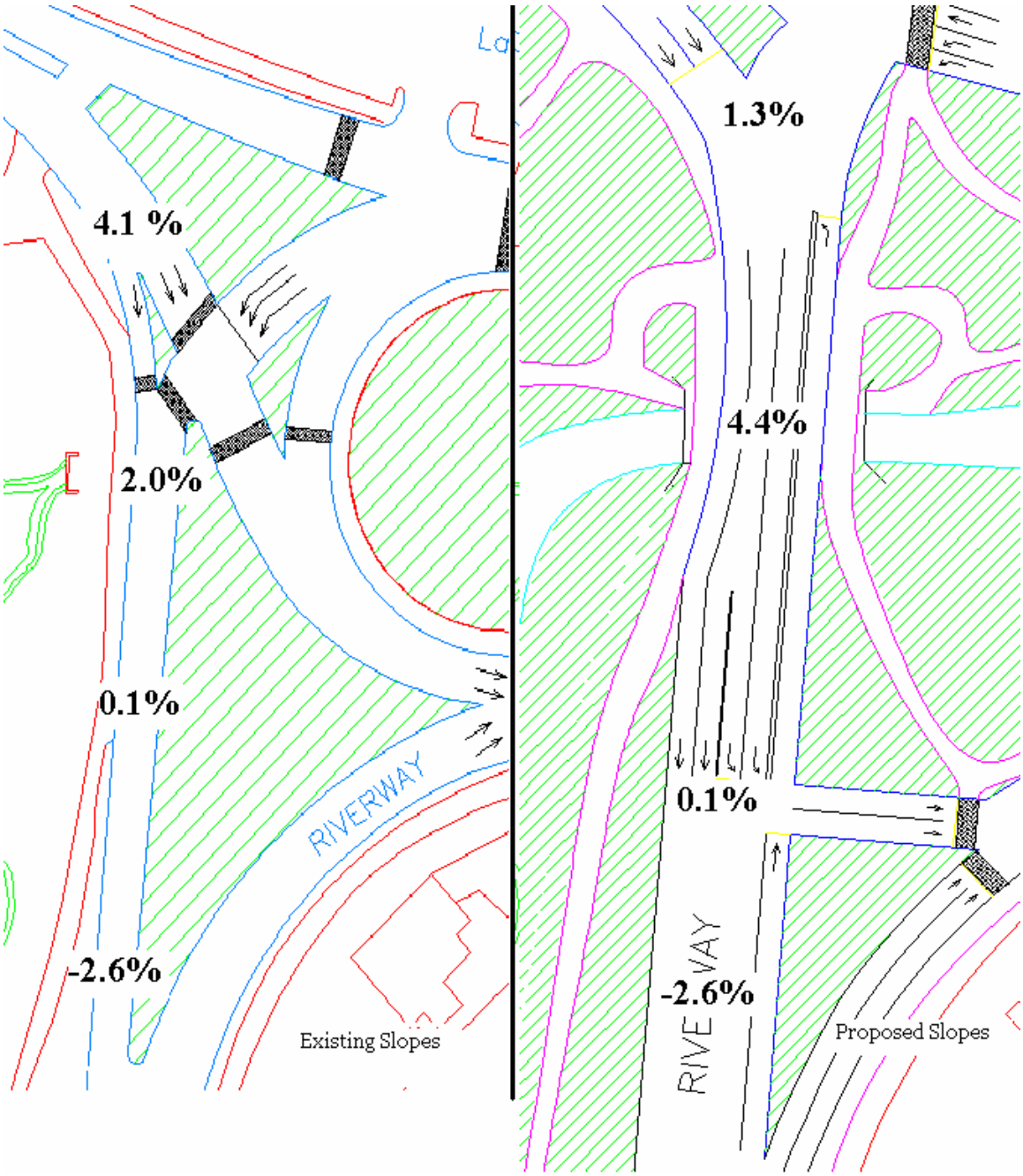


Figure 6 – Existing grades along The Riverway

When comparing these layouts, the biggest grade change is 2.8% to the east of the underpass. The change in grade on the west side of the underpass is 2.2%. As shown in figure 6, the change in elevation would simply push the slope of 4% further west and closer the Riverway-Park Drive merge.

Cross Section

Our design for the Riverway bridge includes a CON/SPAN structure to span 48 feet with the pedestrian walkway entering through underpass on the left bank. A detailed cross-section of the underpass with the pedestrian path is shown in figure 7.

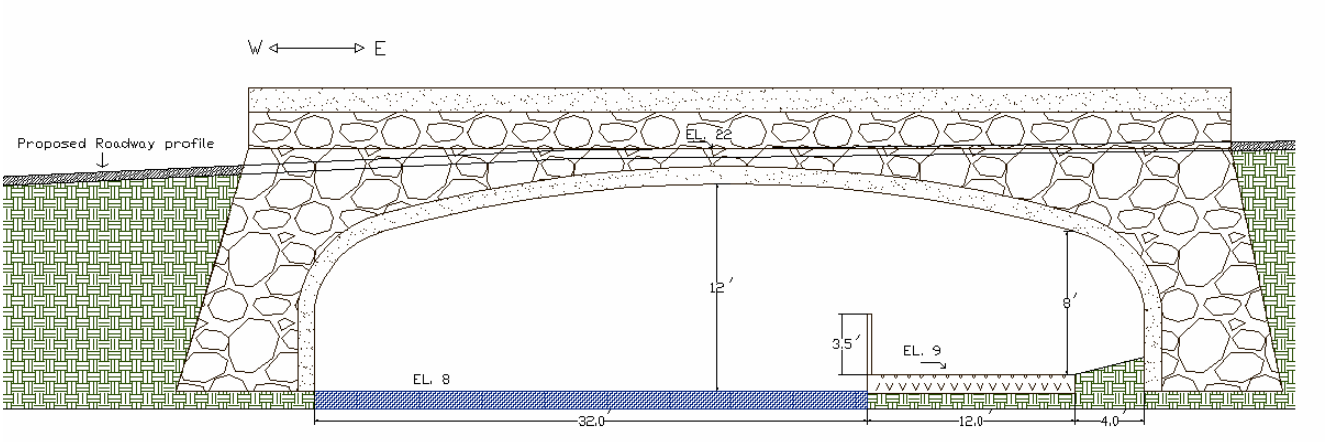


Figure 7 – Underpass cross-section

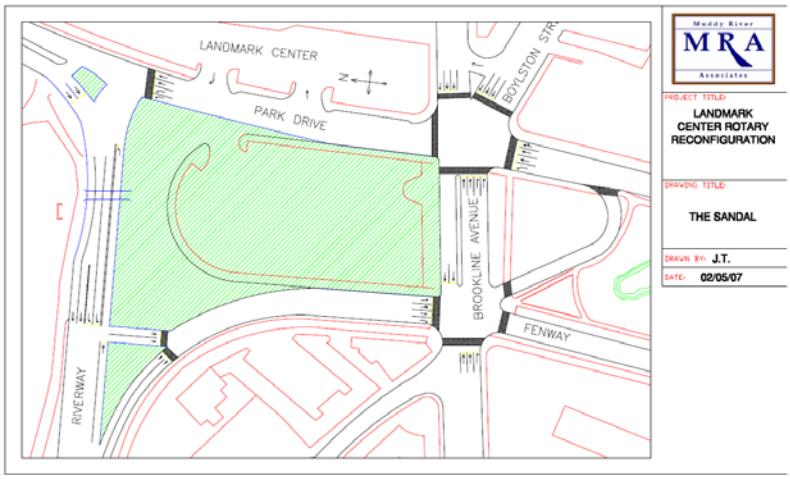
We were informed by a CON/SPAN consultant to use a bridge that spans 48 feet in order to get the proper clearance off the bike path. CON/SPAN also recommended going with a rise of 12'. In figure 7, it is shown that with a rise of 12 feet, and a bridge and deck thickness of 2 feet, the elevation of the road would be 14 feet above the river which has an elevation of 8 feet during normal conditions.

Conclusion

We feel that is feasible to put a pedestrian path through the underpass of The Riverway Bridge. The Riverway would only have to be raised approximately 3 feet to accommodate the path and the proposed new grade would also create a smoother roadway profile for traffic. Constructing a pedestrian path through the underpass would help to alleviate some of our main problems in the rotary, giving pedestrians and cyclists a high quality connection and allowing traffic to circulate without being stopped for a pedestrian phase.

Pedestrian Crossing Speed Design

Some of the pedestrians using the Landmark Center Rotary area walk slower than the standard design speed of 4 ft/s. Analysis was performed to find whether a speed of 3.5 ft/s could be accommodated. The method used for analysis was to first find the "flashing don't walk" time for each of these crossings. Once this was accomplished, 3 seconds of the "walk" time were added to the crossing, assuming that slower pedestrians would wait for the start of the walk time and start within the first 4 seconds. This time was multiplied by the desired walking speed for slower pedestrians to see if they would be able to cross the intersection in the given amount of time.



The Sandal Alternative

The first pedestrian crossing analyzed was the 2-stage crossing across Boylston St. and then Brookline Ave. The picture above shows the layout of the streets analyzed. Using the technique aforementioned, it was concluded that each stage had a sufficient amount of time for even these slower pedestrians to safely cross the street. The analysis was continued with Park Drive and the proposed interior crossing across Brookline Ave. In each case, the conclusion was that there would be sufficient time for people who walk slower than the design speed, given that they utilized the walk time as well as the flashing don't walk time. Crossing The Riverway will occur under the road, so there is no traffic to account for; therefore any pedestrian speed is acceptable.

Crossing Speed Analysis

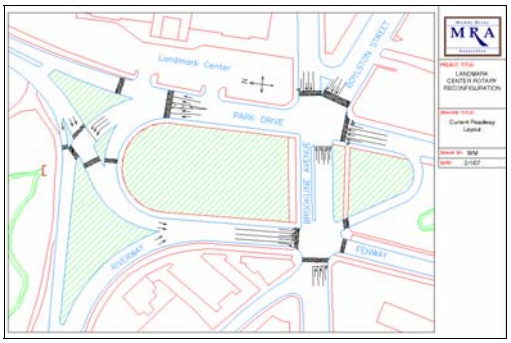
Street	4 ft/s	3.5 ft/s	Available Walk Time
Boylston St.	12.5 sec	14.5 sec	15.5 sec
Brookline EB	12.5 sec	14.5 sec	15.5 sec
Park Dr.	12 sec	14 sec	15 sec
Brookline Ave.	18 sec	20.5 sec	21 sec

Based on this analysis, the conclusion is that all of the crossings in the Landmark Center Rotary area are safe for both the average pedestrian and those traveling at a slower pace.

Summary

Generally speaking, pedestrian improvements come at the cost of vehicular circulation. The alternatives evaluated in this memo have the advantage that they make significant improvements to the traffic circulation while providing better access to and through the park for pedestrians and bicyclists. There has recently been 55 million dollars allocated by the state for improvements in the area. That, with the fact that the Army Corps of Engineers is currently working on plans to daylight the Muddy River provides the city with a unique opportunity. By integrating the goals of the two projects, huge improvements can be made with minimal cost to the public. For example, by redesigning the roads, the size of the The Riverway Bridge is greatly reduced. This would not only allow for a more desirable way for pedestrians to cross The Riverway (either above or below the road) but would also provide better circulation for vehicles and would cost much less since the bridge required would be significantly smaller. The alternatives discussed in this memo represent the most effective way to make significant improvements to the landmark center rotary.

Future Developments Analysis



Current Layout

Proposed Layout

The Muddy River Associates group has come up with a solution for the pedestrian and traffic problems in the area of the rotary. It solves the current problems, but future conditions must also be taken into account for the design to succeed. Using the report by CDM studying the rotary area, which estimates future traffic, it was possible to factor future development into the design.

Some of the impending developments that will affect traffic in the rotary are the Trinity apartments and parking, a new Red Sox parking garage, and the daylighting of the Muddy River. Each of these projects was taken into account when estimating future traffic volumes. The tables below show current traffic volumes for the streets in the area as well as the estimates for the future volumes due to development.

Current Origin-Destination Traffic Counts (vph)		**Destination**						
		Riverway	Brookline EB	Fenway	Park Drive NB	Boylston	Brookline WB	**Total**
Origin	Riverway	~	148	252	126	585	49	**1160**
	Brookline EB	8	222	90	75	429	~	**824**
	Park Drive NB	67	67	0	349	36	70	**590**
	Boylston	287	21	62	29	~	542	**940**
	Brookline WB	89	~	48	35	0	260	**432**
	Park Drive SB	231	38	342	~	73	119	**804**
	Total	**682**	**496**	**793**	**614**	**1124**	**1041**	**4750**

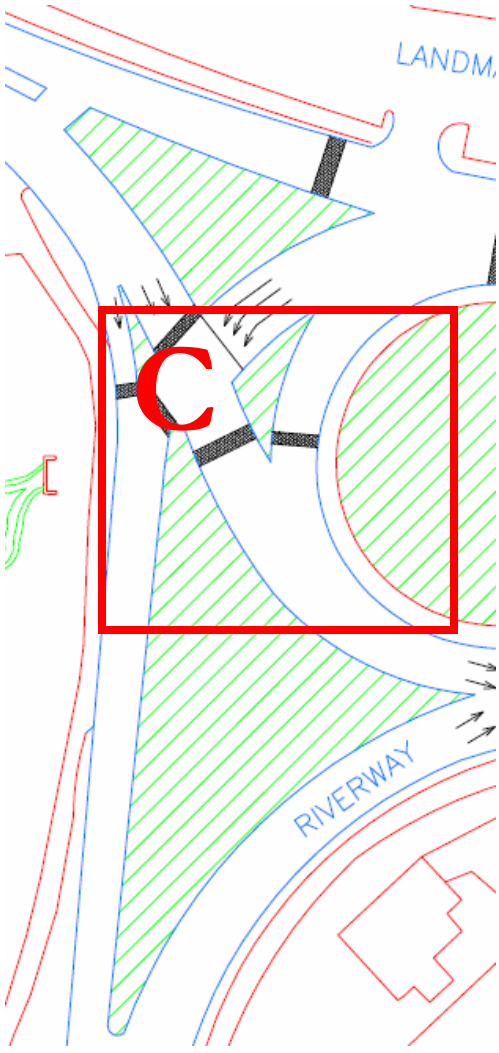
Future Origin-Destination Traffic Counts (vph)		Destination						
		Riverway	Brookline EB	Fenway	Park Drive NB	Boylston	Brookline WB	**Total**
Origin	Riverway	~	171	292	146	677	56	**1342**
	Brookline EB	9	230	93	78	444	~	**854**
	Park Drive NB	77	77	0	406	43	82	**685**
	Boylston	379	28	82	38	~	716	**1243**
	Brookline WB	92	~	50	36	0	270	**448**
	Park Drive SB	268	45	396	~	86	138	**933**
	Total	**825**	**551**	**913**	**704**	**1250**	**1262**	**5505**

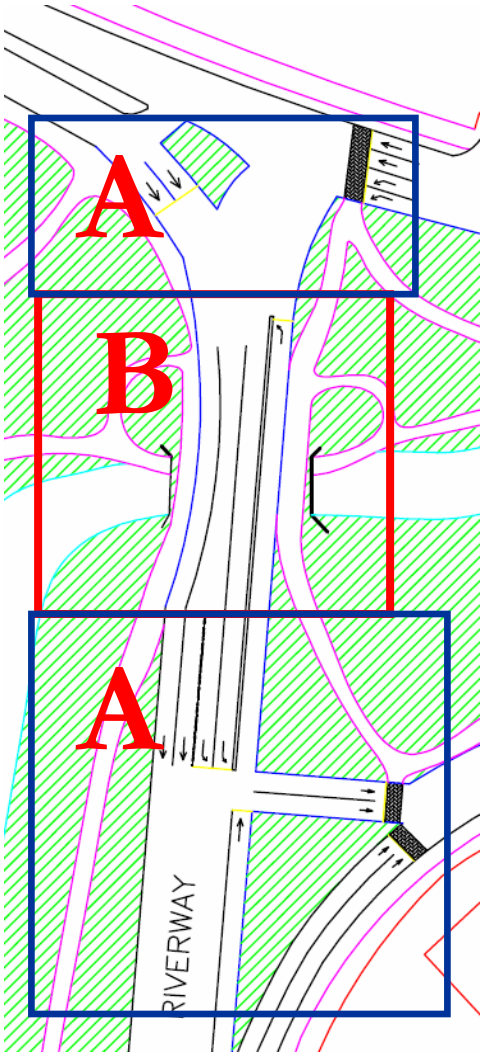
This data was used to decide whether the proposed design is adequate to handle the additional traffic.

A Synchro model was used to analyze the intersections with future traffic volumes. The volume/capacity ratio did not exceed 0.92 for any streets, meaning that no street exceeded its ability to hold traffic. The ideal maximum volume to capacity ratio is 0.93, so the proposed design is more than sufficient for the additional expected traffic.

Cost Estimate

After analyzing the current layout of the Landmark Center Rotary and distinguishing between the proposed roadways, paths, crosswalks, lane markings, signals and bridges from The Sandal plan, we were able to come up with estimates on the total cost it will take to install these new features. Because the Army Corps of Engineers have designed a layout for day lighting the Muddy River in certain areas of the park, we have taken into account that they will be responsible for all cut and fill and elevation changes to the Landmark Center park area. Since we have no access to the Army Corps's actual plans of day lighting the Muddy River, we have assumed that they are not changing any roads or paths. Another assumption we are making is that we are not changing the layout of the parks, such as elevations or grade changes. We have assumed the amount of roadway the Army Corps will be removing and replacing as about 23,215 square feet. From our design, in the same area as the Army Corps will be working on excavating and replacing the roadways, we will be using a smaller area of roadway to conduct this performance by using only 13,100 square feet. Please see the marked areas below from the existing layout and from The Sandal layout to distinguish the difference in areas of roadways.





In order to develop estimates for The Sandal's roadways, paths, crosswalks, lane markings, signals and bridges, we talked with Bob Grover, Director of Stoneham DPW/Town Engineer to help us determine the unit costs of the materials specific for each design. From talking with Mr. Grover, we were able to estimate that it costs $2.25 per square yard to excavate a current roadway. To prepare the sub-base by grading, it will cost about $2.50 per square yard. For the paving asphalt, the binder course which would be about 2" thick would cost $5 per square yard as well as the top course at 1" thick. From these unit costs, the amount of roadway we are proposing brings the total amount to about $38,000 while accounting for 20% of engineering and contingency work. Please see the following table for the complete cost breakdown of each specific area.

Section	A	B	C
Excavation	$7,250	$3,000	$5,750
Grading	$8,055	$3,500	$6,388
Paving	$32,222	$15,000	$25,555
Total (With 20% added for engineering and contingency)	$57,000	$26,000	$45,000

Difference:	**$38,000**

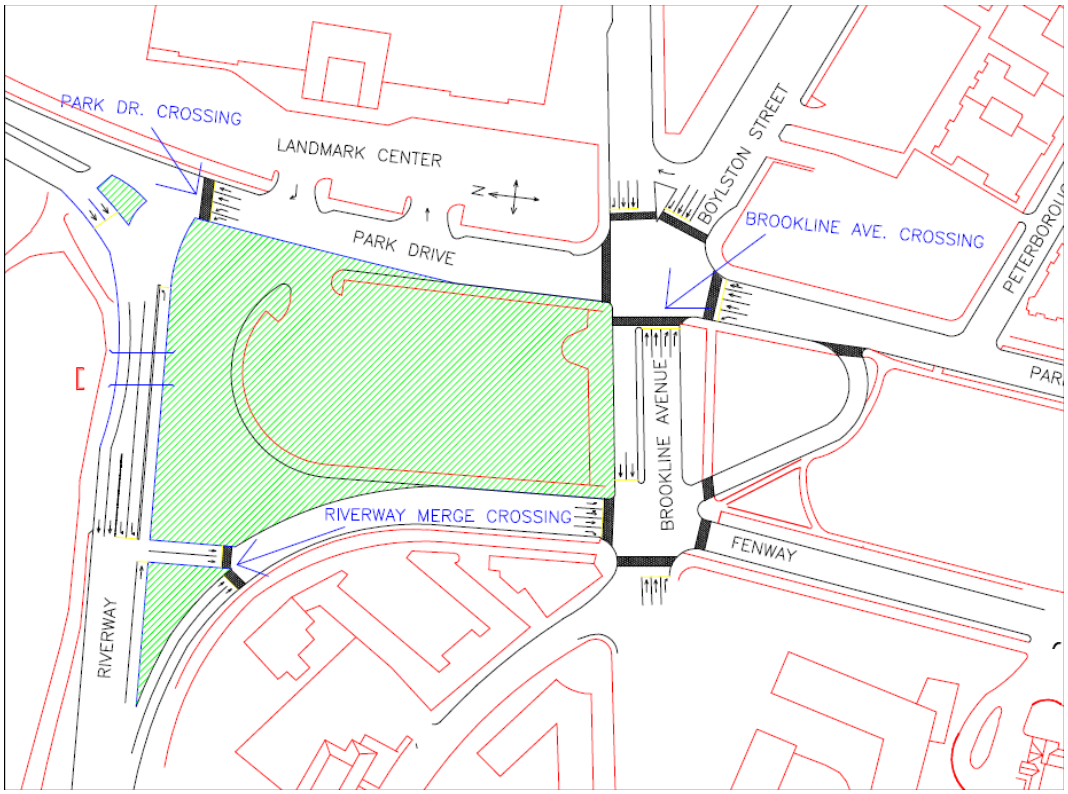
Taking into account our proposed pathway system, we had to find the total cost it would take to construct the paths. Also from talking with Mr. Grover, we found that for preparation and construction, it would cost about $12 per square yard for 3" thick paths. From our design, we have a total of 1,940 feet of proposed 12 foot wide shared paved paths which will equal about $31,040 to install.

Using the formula:

0.062172*Thickness (in.)*Area (square yards) = Asphalt Yield (Tons)

we were able to determine the amount of asphalt needed to design the roadways and paths. By using a 2.5" thickness, we determined that we would be using about 227 tons of asphalt for the roads and about 402 tons for the paths.

With The Sandal plan, we will be adding three new crosswalks. The new crosswalks are located at the Brookline Ave intersection, Park Drive crossing and the Riverway merge (please see next page for exact locations). Crosswalks cost about $20 per linear foot to install. For the Brookline Ave crossing, it will cost about $1,560 to put in. It will cost about $880 to install the Park Drive crossing and about $960 for the Riverway merge crossing.



Using striping with fast-drying paint for lane markings usually costs about $0.07 per linear foot in urban areas.

According to our proposed design of The Sandal, we are replacing traffic signals at 4 intersections. It costs about $130,000 to buy and install traffic signals at each intersection. Therefore, our cost for adding the 4 new signals would be $520,000.

At the Boylston Street and Park Drive intersection, a bulb-out has been added on the Boylston Street side of the road to allow a shorter distance for pedestrians and bicyclists to cross Boylston Street. This does not affect the traffic in any way because there is enough lane usage for motorists to travel to their destinations. The cost for adding this bulb-out is very minor. To remove curb, it costs about $7 per linear foot. We will be removing about 63 feet of curb making the total amount to be about $440 to add the bulb-out.

Finally, the two added bridges that are located crossing the soon to be day lighted Muddy River in the Landmark Center Park and across The Riverway add to the final cost of our design. After contacting a representative from CON/SPAN, the bridge that will cross the Muddy River in the middle of Landmark Center Park will cost approximately $41,000. We received an estimate for the Riverway Bridge that we propose to account for our pedestrian underpass. CON/SPAN estimated the bridge at approximately $228,000, which we conclude is approximately only $28,000 more expensive then what the Army Corps plans on using.

The total amount for all of the work that we propose in addition to what the Army Corps has planned is approximately $790,000. If we were to completely take control and take over the bridge cost and total rotary reconstruction, our estimate would be $1.1 million.

Conclusion

At the beginning of this project, it was our objective to address several areas of concern relating to the Landmark Center Rotary. There was a need to improve the pedestrian and bike access to the park in the middle of the rotary as well as improve the path system along the Muddy River. We also wanted to improve traffic flow throughout the rotary while reconnecting the park to the rest of the Emerald Necklace.

The proposed re-design of the rotary accomplishes all of these goals. The interior pedestrian crossing at the Brookline Ave-Boylston-Park Drive intersection facilitates pedestrians and bikers into the rotary. Before there was no interior crossing to get into the park from the downstream paths. Pedestrian and bike traffic also benefit from the pathway underpass at the Riverway bridge. This underpass allows bikers and pedestrians to safely cross the Riverway without having to worry about traffic or make their way through a 4 stage crossing.

The path system will greatly improve pedestrian access to and through the park. Pedestrians are now given direct paths from the Fenway T-stop to Wheelock College and the Longwood Medical Area. There are also paths along the Muddy River that allow pedestrians and bikers to enjoy nature and use the park as Frederick Olmsted intended. These paths also connect the park to the rest of Boston's Emerald Necklace.

Traffic in the rotary will see better flow and less congestion due to some of the proposed improvements. Connecting Riverway east bound to Park Drive north bound will keep some cars out of the Brookline Ave-Boylston intersection, as well as give those motorists an easier route to get from their origin to their destination. Another proposal that will help improve traffic flow is the elimination of the all-ped phase at the Brookline Ave-Fenway intersection. Since the pedestrians do not need this to safely cross either Brookline Ave or the Fenway, the extra green time will help alleviate the congestion on Brookline Ave. The proposed synchronization of the traffic lights in the rotary will also serve as a traffic improvement. The average level of service of the rotary is up from a C to a B.

We believe that the proposed design has met the challenges associated with the area and that all of the objectives have been satisfied. Both pedestrian/ bicycle and vehicular uses will be greatly improved. After the reconstruction detailed in this report, the park will hopefully once again be used as it was designed in the eyes of Fredrick Olmsted himself.

Appendix

Appendix A

Data and Calculations for Saturation Flow

Unblocked Data (first 3 pages)

- Data observed from start of green to end of immediate lane queue

Blocked Data (last page)

- Data observed during entire green period, during which there was a queue either in the lane or blocked behind the merge point

Lane A

Saturation Flow Rate

AM

Cycle	1	2	3	4	5	Average
DATA						
Start Time (s)	0.0	0.0	0.0	0.0	0.0	
4th Crossing	7.0	7.0	9.0	8.0	7.0	
10th Crossing	20.0		22.0		25.0	
nth Crossing	20.0	17.0	26.0	17.0	25.0	
n	10	7	11	8	10	
CALCS						
n-4	6	3	7	4	6	
time for n-4	13.0	10.0	17.0	9.0	18.0	
sat headway (s)	2.2	3.3	2.4	2.3	3.0	
sat rate (veh/s)	0.5	0.3	0.4	0.4	0.3	
sat rate (veh/hr)	1661.5	1080.0	1482.4	1600.0	1200.0	1400

PM

Cycle	1	2	3	4	5	
DATA						
Start Time (s)	0.0	0.0	0.0	0.0	0.0	
4th Crossing	6.0	6.0	7.0	10.0	8.0	
10th Crossing	21.0				23.0	
nth Crossing	21.0	17.0	14.0	22.0	23.0	
n	10	9	7	9	10	
CALCS						
n-4	6	5	3	5	6	
time for n-4	15.0	11.0	7.0	12.0	15.0	
sat headway (s)	2.5	2.2	2.3	2.4	2.5	
sat rate (veh/s)	0.4	0.5	0.4	0.4	0.4	
sat rate (veh/hr)	1440.0	1636.4	1542.9	1500.0	1440.0	1500

Lane B

Saturation Flow Rate

AM

Cycle	1	2	3	4	5	Average
DATA						
Start Time (s)	0.0	0.0	0.0	0.0	0.0	
4th Crossing	7.0	7.0	5.0	6.0	8.0	
10th Crossing	19.0	23.0	21.0	20.0	21.0	
nth Crossing	36.0	31.0	25.0	34.0	33.0	
n	14	13	11	16	15	
CALCS						
n-4	10	9	7	12	11	
time for n-4	29.0	24.0	20.0	28.0	25.0	
sat headway (s)	2.9	2.7	2.9	2.3	2.3	
sat rate (veh/s)	0.3	0.4	0.4	0.4	0.4	
sat rate (veh/hr)	1241.4	1350.0	1260.0	1542.9	1584.0	1400

PM

Cycle	1	2	3	4	5	
DATA						
Start Time (s)	0.0	0.0	0.0	0.0	0.0	
4th Crossing	6.0	7.0	8.0	7.0	8.0	
10th Crossing	18.0	19.0	21.0	18.0	19.0	
nth Crossing	23.0	19.0	27.0	22.0	24.0	
n	12	10	13	12	12	
CALCS						
n-4	8	6	9	8	8	
time for n-4	17.0	12.0	19.0	15.0	16.0	
sat headway (s)	2.1	2.0	2.1	1.9	2.0	
sat rate (veh/s)	0.5	0.5	0.5	0.5	0.5	
sat rate (veh/hr)	1694.1	1800.0	1705.3	1920.0	1800.0	1800

Lane C

Saturation Flow Rate — AM

Cycle	1	2	3	4	5	Average
DATA						
Start Time (s)	0.0	0.0	0.0	0.0	0.0	
4th Crossing	6.0	8.0	6.0	6.0	7.0	
10th Crossing	18.0	20.0	18.0	16.0	21.0	
nth Crossing	18.0	20.0	18.0	16.0	21.0	
n	10	10	10	9	10	
CALCS						
n-4	6	6	6	5	6	
time for n-4	12.0	12.0	12.0	10.0	14.0	
sat headway (s)	2.0	2.0	2.0	2.0	2.3	
sat rate (veh/s)	0.5	0.5	0.5	0.5	0.4	
sat rate (veh/hr)	1800.0	1800.0	1800.0	1800.0	1542.9	1750

PM

Cycle	1	2	3	4	5	
DATA						
Start Time (s)	0.0	0.0	0.0	0.0	0.0	
4th Crossing	6.0	7.0	7.0	7.0	6.0	
10th Crossing	19.0	20.0	23.0	18.0	19.0	
nth Crossing	24.0	23.0	23.0	23.0	25.0	
n	12	11	10	12	12	
CALCS						
n-4	8	7	6	8	8	
time for n-4	18.0	16.0	16.0	16.0	19.0	
sat headway (s)	2.3	2.3	2.7	2.0	2.4	
sat rate (veh/s)	0.4	0.4	0.4	0.5	0.4	
sat rate (veh/hr)	1600.0	1575.0	1350.0	1800.0	1515.8	1550

Lane Utilization-Blocked State

AM

Lane A g = 35s

DATA						Average
Cycle	1	2	3	4	5	
veh/g	9	10	11	9	10	
veh/sec	0.26	0.29	0.31	0.26	0.29	
sat flow rate (veh/hr)	925.71	1028.57	1131.43	925.71	1028.57	1000

AM

Lane B g = 35s

DATA						Average
Cycle	1	2	3	4	5	
veh/g	15	13	13	12	16	
veh/sec	0.43	0.37	0.37	0.34	0.46	
sat flow rate (veh/hr)	1542.86	1337.14	1337.14	1234.29	1645.71	1400

AM

Lane C g = 35s

DATA						Average
Cycle	1	2	3	4	5	
veh/g	12	11	13	13	12	
veh/sec	0.34	0.31	0.37	0.37	0.34	
sat flow rate (veh/hr)	1234.29	1131.43	1337.14	1337.14	1234.29	1250

Appendix B

Origin-Destination Data

Collected between Jan 31st and February 10th 2007

Origin-Destination Traffic Counts (vph) AM		Destination						
		Riverway	Brookline EB	Fenway	Park Drive NB	Boylston	Brookline WB	**Total**
Origin	Riverway	~	148	252	126	585	49	**1160**
	Brookline EB	8	222	90	75	429	~	**824**
	Park Drive NB	67	67	0	349	36	70	**590**
	Boylston	287	21	62	29	~	542	**940**
	Brookline WB	89	~	48	35	0	260	**432**
	Park Drive SB	231	38	342	~	73	119	**804**
	Total	**682**	**496**	**793**	**614**	**1124**	**1041**	4750

Origin-Destination Traffic Counts (vph) PM		Destination						
		Riverway	Brookline EB	Fenway	Park Drive NB	Boylston	Brookline WB	**Total**
Origin	Riverway	~	86	154	86	400	49	**776**
	Brookline EB	23	279	98	51	553	~	**1004**
	Park Drive NB	176	71	0	297	62	115	**720**
	Boylston	418	0	71	55	~	367	**912**
	Brookline WB	182	~	112	93	0	317	**704**
	Park Drive SB	275	27	241	~	69	153	**764**
	Total	**1075**	**462**	**676**	**582**	**1084**	**1001**	4880

Origin-Destination (AM)

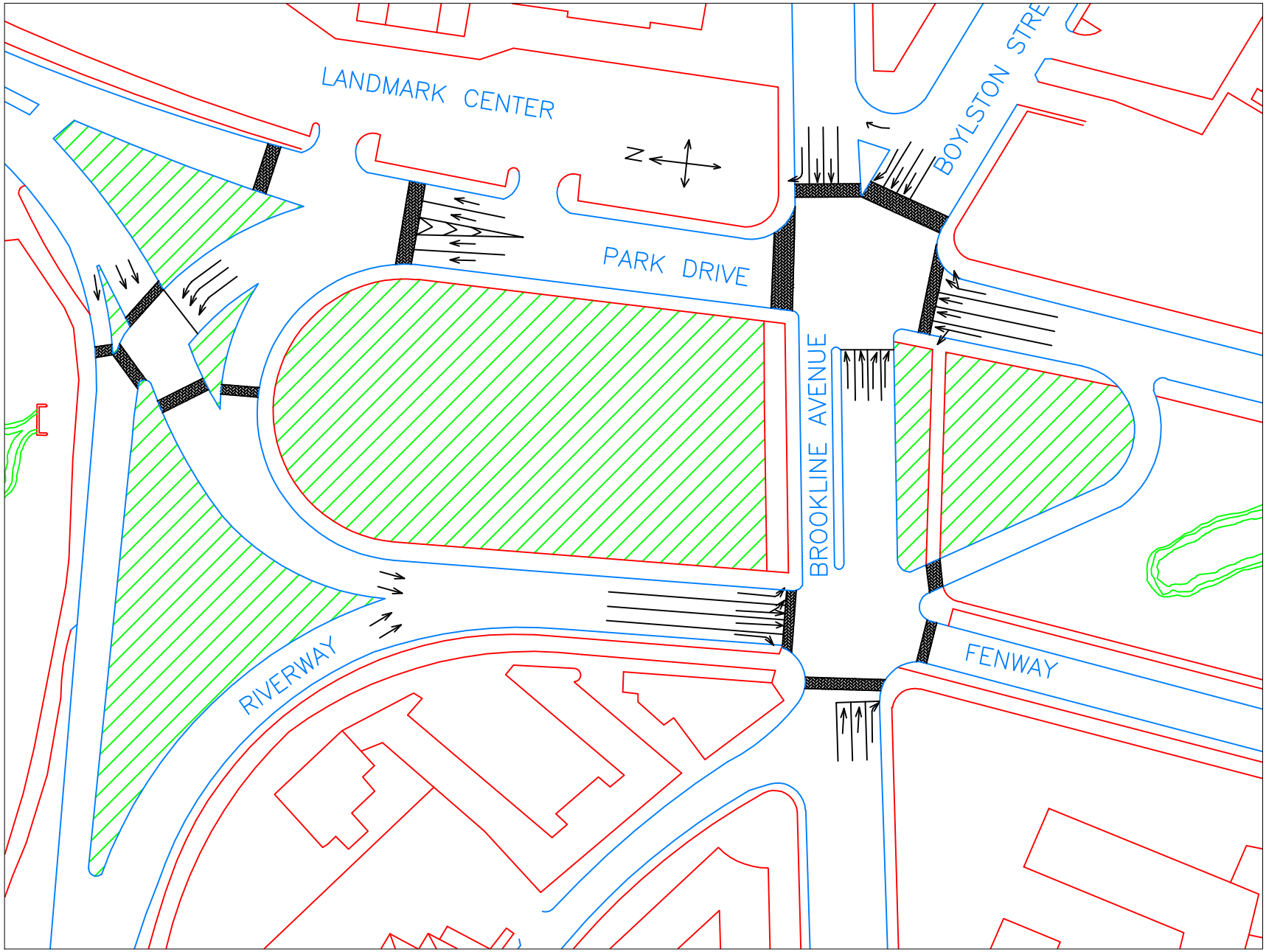
Origin	Raw Count	Percentage	Counted (veh/hr)	Projected Total (veh/hr)
Riverway	*212*	*<- Total*		
Brookline Ave. WB	9	4.2%	1160	49
Brookline Ave. EB	27	12.7%	1160	148
Fenway	46	21.7%	1160	252
Boylston	107	50.5%	1160	585
Park Drive	23	10.8%	1160	126
Park Drive NB	*245*	*<- Total*		
Brookline Ave. WB	29	11.8%	590	70
Brookline Ave. EB	28	11.4%	590	67
The Fenway	0	0.0%	590	0
Boylston	15	6.1%	590	36
Park Drive	145	59.2%	590	349
The Riverway	28	11.4%	590	67
Park Drive SB	*209*	*<- Total*		
Brookline Ave. WB	31	14.8%	804	119
Brookline Ave. EB	10	4.8%	804	38
The Fenway	89	42.6%	804	342
Boylston	19	9.1%	804	73
The Riverway	60	28.7%	804	231
Brookline Ave. EB	*219*	*<- Total*		
Brookline Ave. EB	59	26.9%	824	222
The Fenway	24	11.0%	824	90
Boylston	114	52.1%	824	429
Park Drive	20	9.1%	824	75
The Riverway	2	0.9%	824	8
Brookline Ave. WB	*209*	*<- Total*		
Brookline Ave. WB	126	60.3%	432	260
The Fenway	23	11.0%	432	48
Boylston	0	0.0%	432	0
Park Drive	17	8.1%	432	35
The Riverway	43	20.6%	432	89
Boylston	*229*	*<- Total*		
Brookline Ave. WB	132	57.6%	940	542
Brookline Ave. EB	5	2.2%	940	21
The Fenway	15	6.6%	940	62
Park Drive	7	3.1%	940	29
The Riverway	70	30.6%	940	287

Origin-Destination (PM)

Origin	Raw Count	Percentage	Counted (veh/hr)	Projected Total (veh/hr)
Riverway	*126*	*<- Total*		
Brookline Ave. WB	8	6.3%	776	49
Brookline Ave. EB	14	11.1%	776	86
Fenway	25	19.8%	776	154
Boylston	65	51.6%	776	400
Park Drive	14	11.1%	776	86
Park Drive NB	*245*	*<- Total*		
Brookline Ave. WB	39	15.9%	720	115
Brookline Ave. EB	24	9.8%	720	71
The Fenway	0	0.0%	720	0
Boylston	21	8.6%	720	62
Park Drive	101	41.2%	720	297
The Riverway	60	24.5%	720	176
Park Drive SB	*200*	*<- Total*		
Brookline Ave. WB	40	20.0%	764	153
Brookline Ave. EB	7	3.5%	764	27
The Fenway	63	31.5%	764	241
Boylston	18	9.0%	764	69
The Riverway	72	36.0%	764	275
Brookline Ave. EB	*216*	*<- Total*		
Brookline Ave. EB	60	27.8%	1004	279
The Fenway	21	9.7%	1004	98
Boylston	119	55.1%	1004	553
Park Drive	11	5.1%	1004	51
The Riverway	5	2.3%	1004	23
Brookline Ave. WB	*213*	*<- Total*		
Brookline Ave. WB	96	45.1%	704	317
The Fenway	34	16.0%	704	112
Boylston	0	0.0%	704	0
Park Drive	28	13.1%	704	93
The Riverway	55	25.8%	704	182
Boylston	*231*	*<- Total*		
Brookline Ave. WB	93	40.3%	912	367
Brookline Ave. EB	0	0.0%	912	0
The Fenway	18	7.8%	912	71
Park Drive	14	6.1%	912	55
The Riverway	106	45.9%	912	418

Appendix C

Current Roadway Layout



Muddy River MRA Associates

PROJECT TITLE:

LANDMARK CENTER ROTARY RECONFIGURATION

DRAWING TITLE:

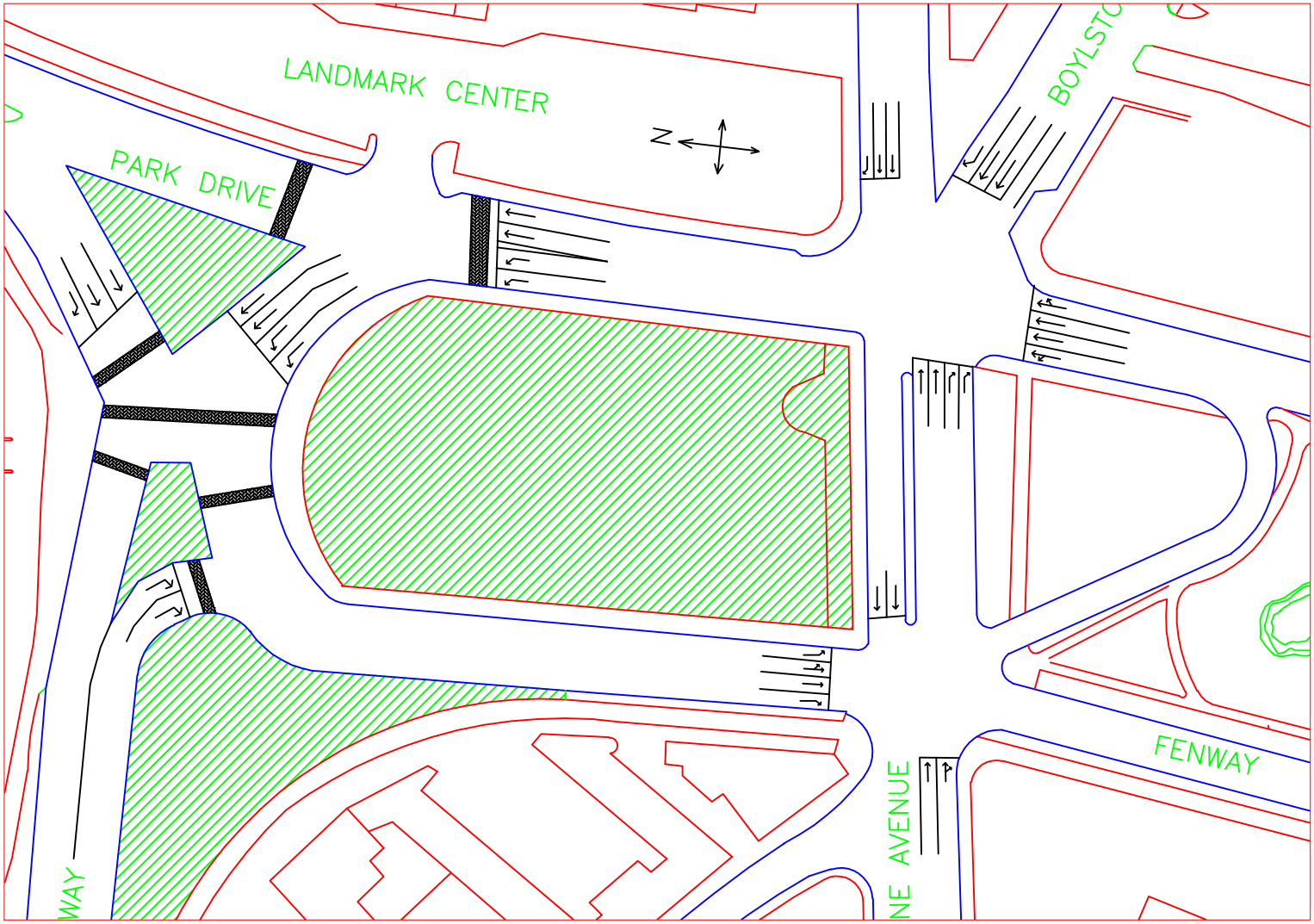
Current Roadway Layout

DRAWN BY: **WM**

DATE: **04/02/07**

Appendix D

ISTEA Design



Muddy River
MRA
Associates

PROJECT TITLE:

LANDMARK CENTER ROTARY RECONFIGURATION

DRAWING TITLE:

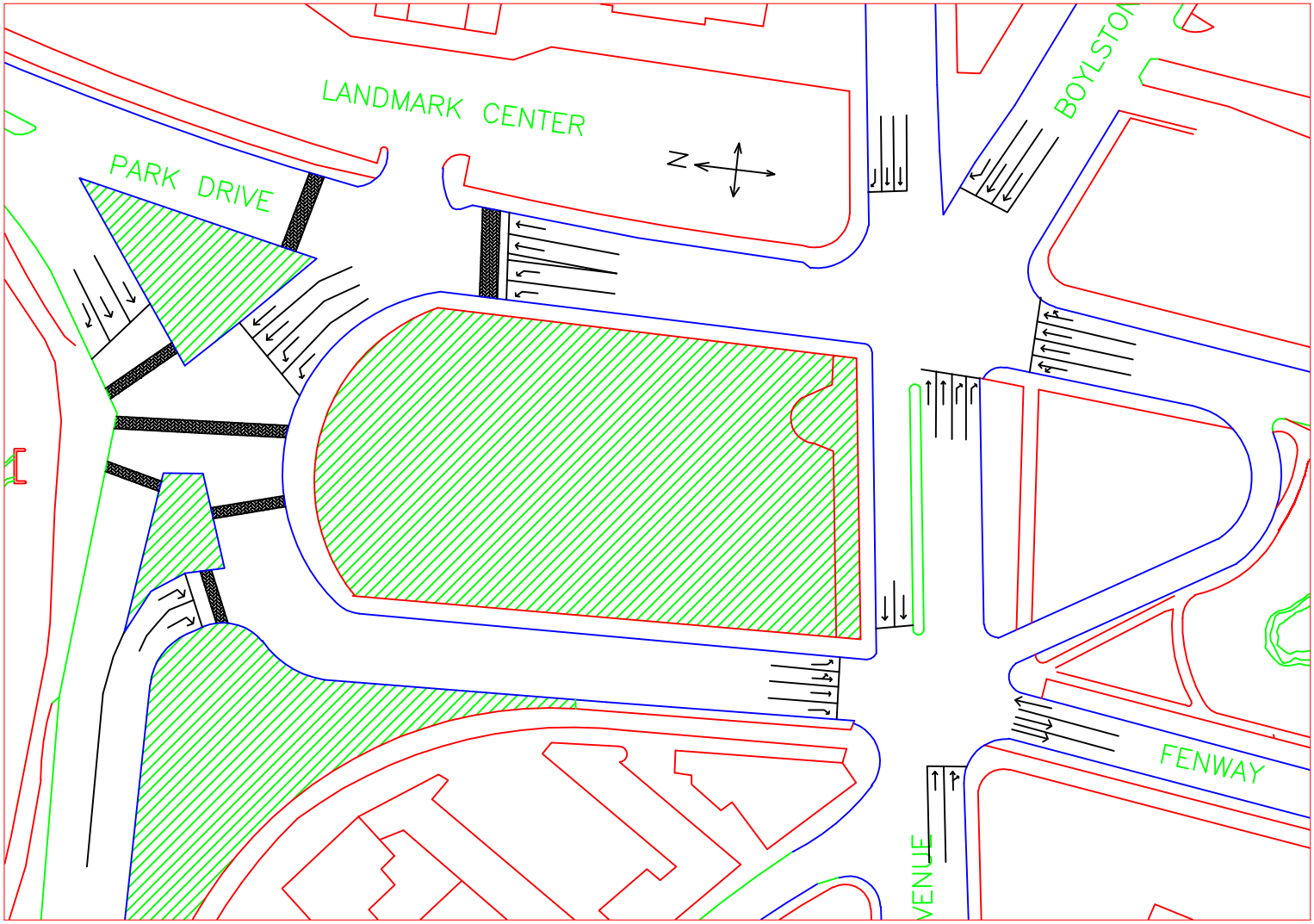
ISTEA

DRAWN: JMS

DATE: 04/01/07

Appendix E

Vollmer's 2001 Design



Muddy River
MRA
Associates

PROJECT TITLE:
LANDMARK CENTER ROTARY RECONFIGURATION

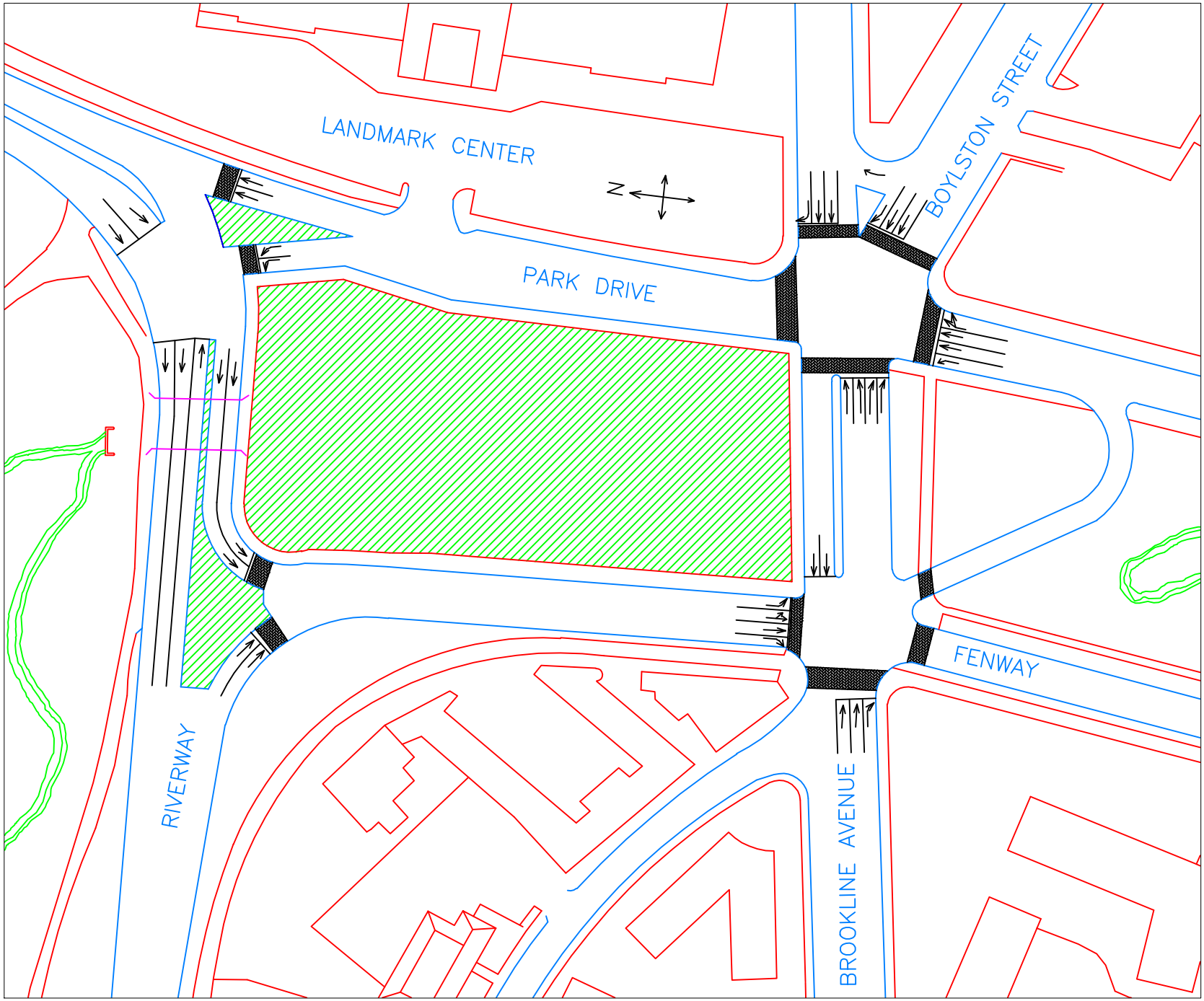
DRAWING TITLE:
VOLLMER'S

DRAWN: JMS

DATE: 04/01/07

Appendix F

MRA’s Lemonade Design



Muddy River
MRA
Associates

PROJECT TITLE:

LANDMARK CENTER ROTARY RECONFIGURATION

DRAWING TITLE:

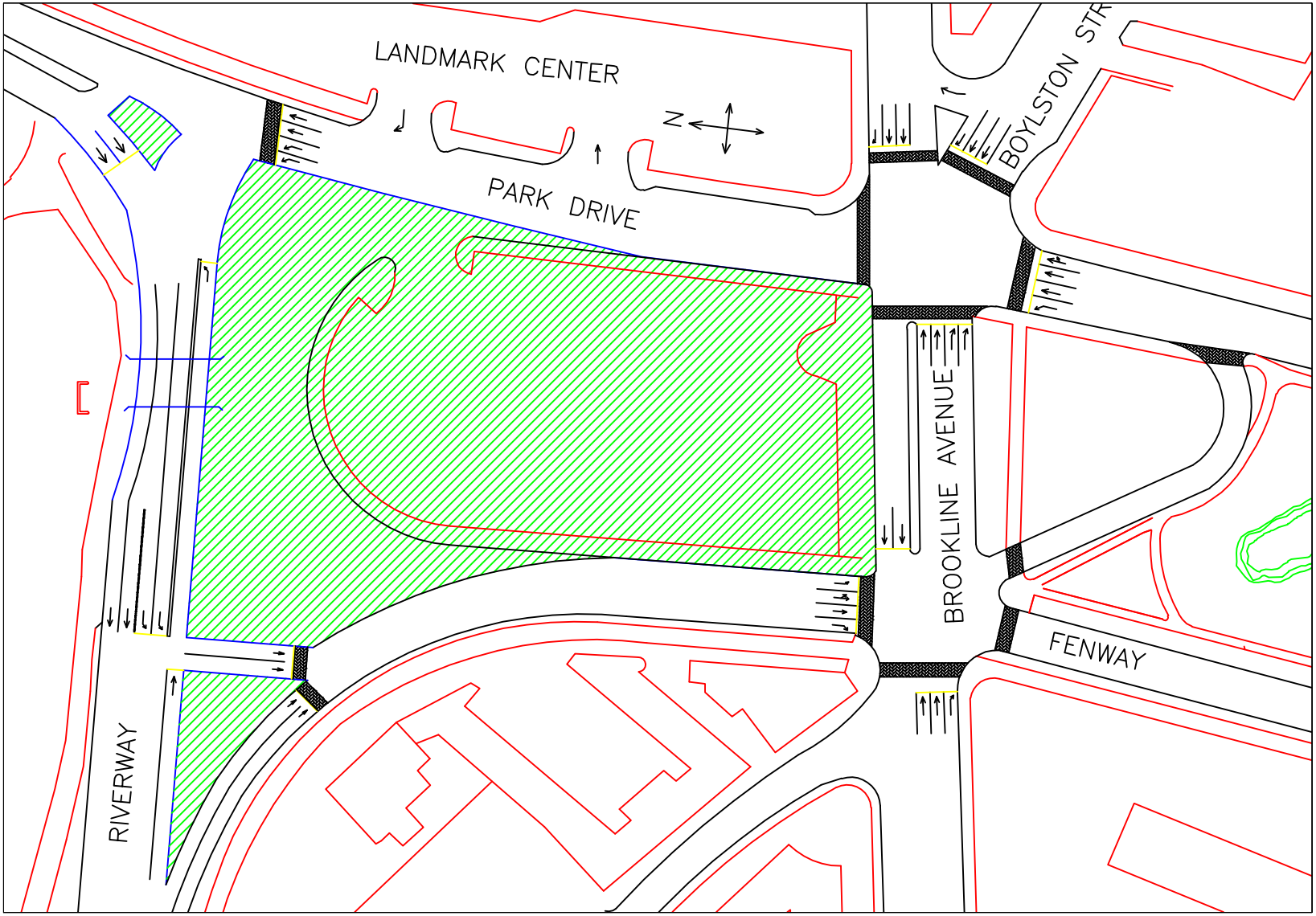
LEMONADE PLAN

DRAWN BY: **NG**

DATE: **04/06/07**

Appendix G

MRA’s Sandal Design



Muddy River MRA Associates

PROJECT TITLE:

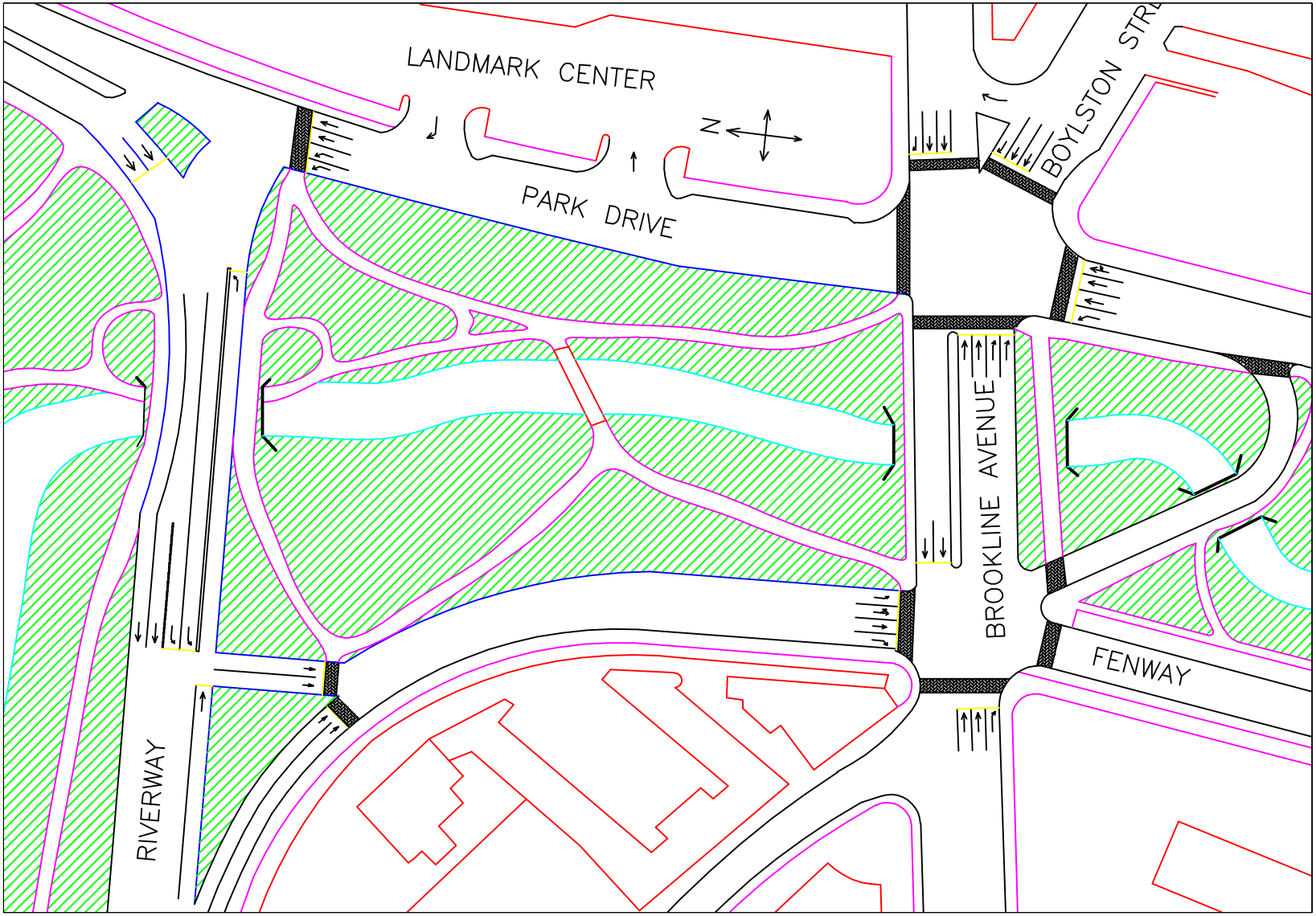
LANDMARK CENTER ROTARY RECONFIGURATION

DRAWING TITLE:

THE SANDAL

DRAWN BY: J.T.

DATE: 04/05/07



Muddy River MRA Associates

PROJECT TITLE:

LANDMARK CENTER ROTARY RECONFIGURATION

DRAWING TITLE:

THE SANDAL

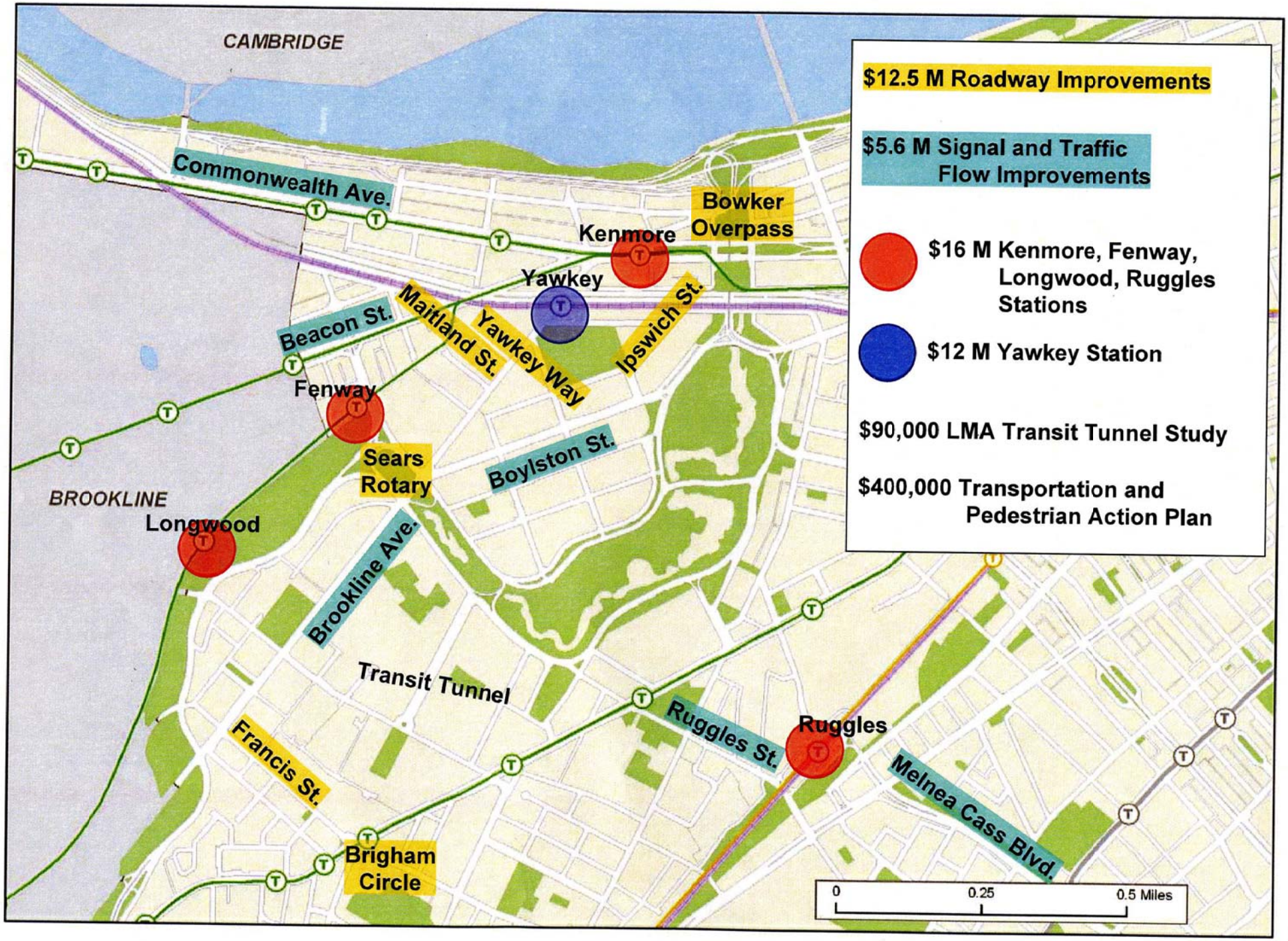
DRAWN BY: J.T.

DATE: 04/05/07

Appendix H

Economic Stimulus Bill Summary

Economic Stimulus Bill



Economic Stimulus Bill

SECTION 2A, APPROPRIATIONS

$12.5 M ROADWAY DESIGN & IMPROVEMENTS

Sears Rotary, Ipswich, Maitland, Yawkey Way, Francis Streets, Brigham Circle, Bowker Overpass

$5.6 M TRAFFIC MANAGEMENT

Signals, traffic management center

$5 M MBTA STATION IMPROVEMENTS

Kenmore, Fenway & Longwood Stations

$12 M YAWKEY STATION

$0.5 M NORTH ALLSTON MULTIMODAL STATION

Commuter rail & bus station & garage

$0.4 M TRANSPORTATION & PEDESTRIAN ACTION PLAN

$36 M TOTAL

SECTION 2B, BOND AUTHORIZATION

$11 M MBTA STATION IMPROVEMENTS

Kenmore, Fenway & Longwood Stations

$0.9 M URBAN RING TUNNEL STUDY

$8 M PARK STREET STATION

$19 M TOTAL

BTD, BRA with EOT, MBTA and DCR

January, 2007

Transportation & Pedestrian Action Plan

PRIORITIES

- **Transportation improvements that benefit the residents, businesses and institutions of the Fenway, Longwood, Mission Hill, and Kenmore neighborhoods.**
- **Prioritize and advance projects in the Economic Stimulus Bill.**
- **Build on existing studies and project designs.**
- **Model the combined traffic impacts of all current and future developments.**
- **Immediate operations improvements to address critical traffic congestion.**
- **Open public process supported by city-state agency coordination.**

Economic Stimulus Bill – RFP Framework

$400,000
Transportation & Ped. Action Plan

1. Recommend short-term improvements
2. Inventory status of all ongoing projects
3. Develop concept designs for prioritized projects and propose $12.5 million Action Plan

$5.6 million
Traffic Management Improvements

1. Conduct stem to stern review & document deficiencies
2. Propose $5.6 mil. Traffic Operations Action Plan
3. Procurement of signal/communications equipment & staff

Approx $500,000 of $12.5 million
Road & Sidewalk Improvements

1. Prepare 25% design w/ cost estimates
2. Develop implementation plan w/ project phasing
3. Prepare RFP for $12 million in capital improvements

$400,000 TRANSPORTATION & PED. ACTION PLAN RFP OVERVIEW

1. Expand/Update Synchro Traffic Model.
2. Recommend short-term traffic flow & pedestrian safety improvements.

---

3. Inventory status of all ongoing roadway, bicycle/pedestrian and transit projects.
4. Develop concept designs for prioritized projects & test feasibility using Synchro model.
5. Propose $12.5 million Roadway Improvement Action Plan.

---

6. Recommend on and off-street parking strategies for residents, commuters & visitors.

---

7. Project & establish long-term traffic model.
8. Test projected development, parking & roadway improvement scenarios.

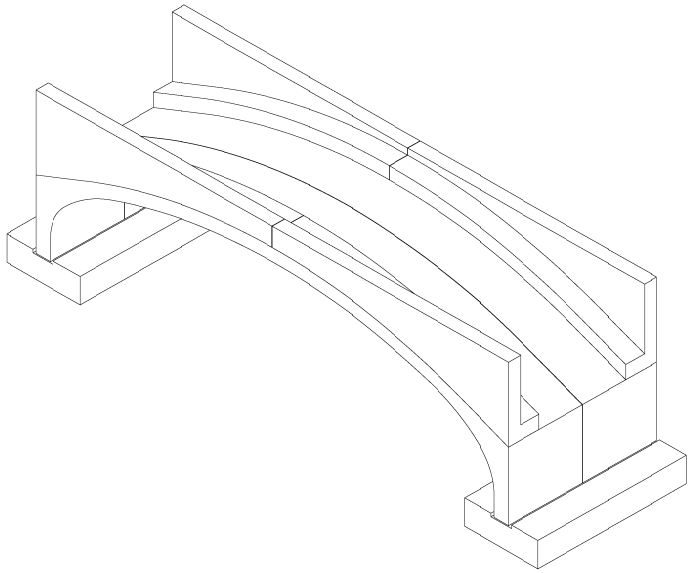
Appendix I

Mid Park Bridge Specifications

Landmark Center Rotary

Boston **MA**

Upstream



ISOMETRIC VIEW *Downstream*

Preliminary Drawings prepared for:
Thomas Hennessey

CONSPAN® BRIDGE SYSTEMS
3100 Research Blvd. P.O. Box 20266 Dayton, Ohio 45420-0266
Phone: (800) 526-3999 Fax: 937-254-8365
www.con-span.com

MA

Landmark Center Rotary

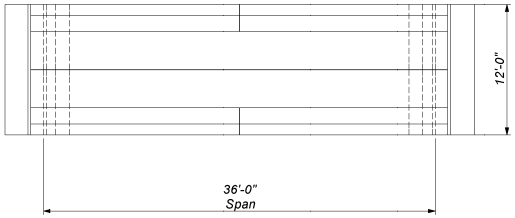
Boston

Date: *04/03/07*

DYOB No. *115965*

Sheet No. ***1***

Upstream



Downstream

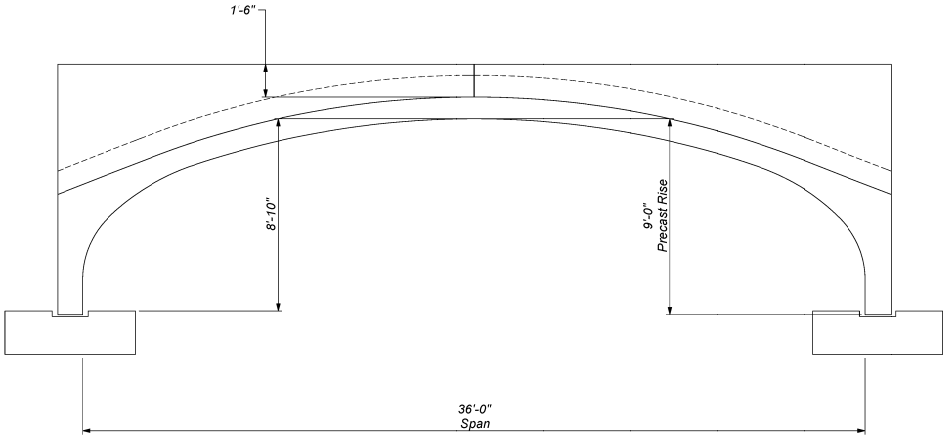
BRIDGE PLAN

Preliminary Drawings prepared for:
Thomas Hennessey

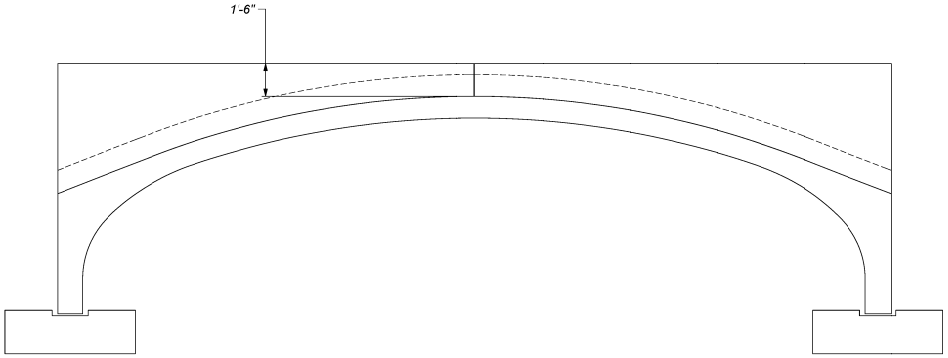
CONSPAN® BRIDGE SYSTEMS
3100 Research Blvd. P.O. Box 20266 Dayton, Ohio 45420-0266
Phone: (800) 526-3999 Fax: 937-254-8365
www.con-span.com

MA
Boston
Landmark Center Rotary

Date: *04/03/07*
DYOB No. *115965*
Sheet No. **2**



DOWNSTREAM END ELEVATION



UPSTREAM END ELEVATION

Preliminary Drawings prepared for:
Thomas
Hennessey

CONSPAN® BRIDGE SYSTEMS
3100 Research Blvd. P.O. Box 20366 Dayton, Ohio 45420-0366
Phone: (800) 526-3999 Fax: 937-254-8383
www.con-span.com

MA

Boston

Landmark Center Rotary

Date:
04/03/07

DYOB No.
115965

Sheet No.
3

Appendix J

Bridge Costs Estimate

41 Fenton Street
Palmer, Ma 01069
Office (413) 283-7610
Fax: (413) 289-1548
www.contechbridge.com

To: Muddy River Associates
74 Hillside Street
Roxbury, MA 02120

Date: April 4, 2007

Attn: Jeff Haelle

Re: Landmark Center
Boston, MA

Thank you for contacting CONTECH Bridge Solutions for your project. Based on the information that you provided in your email dated April 3, 2007 I offer an engineering estimate for your consideration.

The following is an engineering estimate for the CON/SPAN Arch Bridge System precast concrete bridge system for the on Landmark Center Boston, MA Bridge replacement:

12'linear feet of CON/SPAN Arch Bridge 36' – 0" Span x 9' – 0" rise. This includes 2 each 1' – 5" detached headwalls on the end arch units. No wingwalls. The arch units are designed for 1 foot of earth cover and HS-25 live load. The maximum unit weight is 22 tons end section. Also included are the joint materials, embedded hardware, connection plates, and delivery to the jobsite, installation drawings, shop drawings, and a CONTECH project consultant on the days of installation. Sales taxes not included.

Engineering Estimate = $ 38,600.00

Other cost items to be considered include unclassified excavation, foundations, crane rental, backfilling, contractor's equipment, contractor's overhead and profit, permits, utilities, etc. I have attached a couple interpretations of the information that you provided to me in your email. **Once more detailed site information is available; I would be able to assist you with the most cost effective layout for the bridge system.**

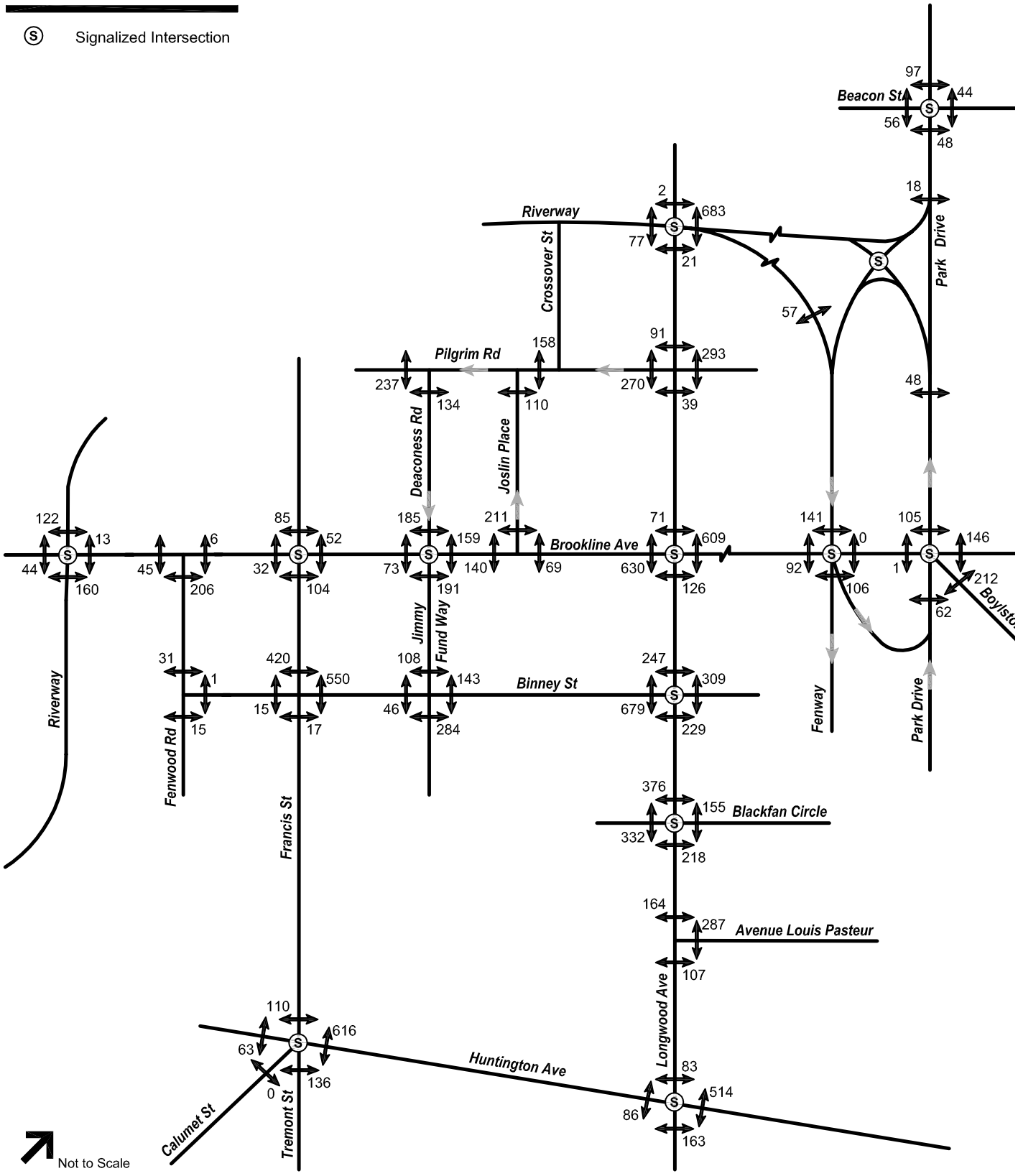
CONTECH Bridge Solutions Inc. appreciates this opportunity to provide the estimate for your review and consideration. If you have any questions please call.

Respectfully,

Tom Hennessey
Region Manager

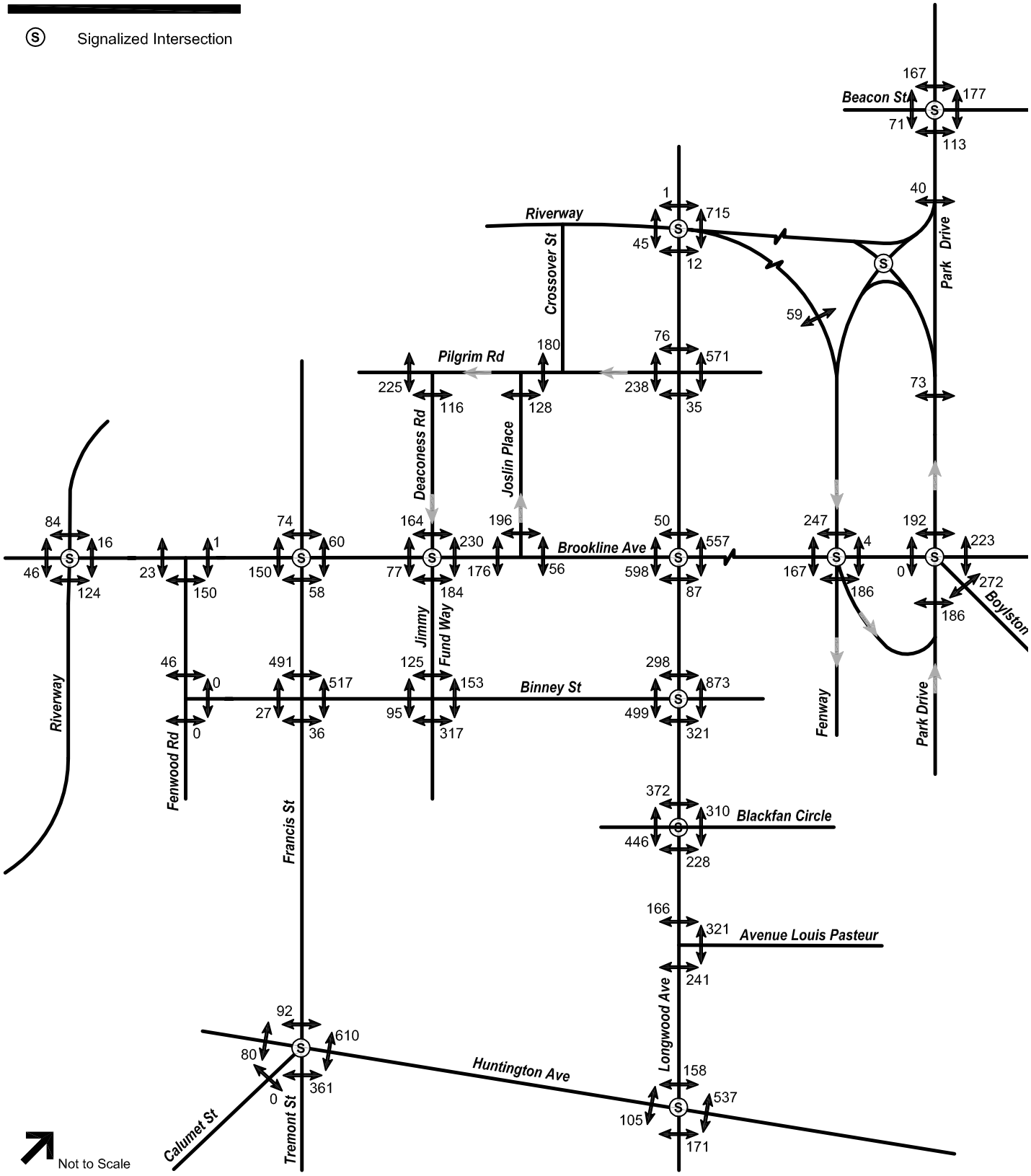
Appendix K

Pedestrian Counts



DANA-FARBER CANCER INSTITUTE
CENTER FOR CANCER CARE
DPIR/DEIR

2006 Existing Condition
Morning Peak Hour
Pedestrian Volumes
FIGURE 5-15



DANA-FARBER CANCER INSTITUTE
CENTER FOR CANCER CARE
DPIR/DEIR

2006 Existing Condition
Evening Peak Hour
Pedestrian Volumes
FIGURE 5-16

Appendix L

Synchro Analysis Results:

Current Layout: AM Traffic
Current Layout: PM Traffic
Sandal Design: AM Traffic
Sandal Design: PM Traffic
Current Layout: Future Traffic
Sandal Design: Future Traffic

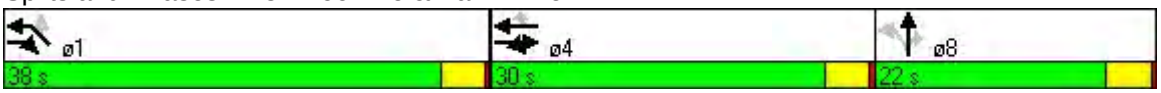
Current Layout
AM Traffic

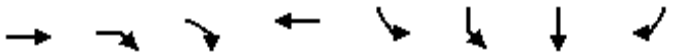
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	NBR2	NWL	NWR	NWR2
Lane Configurations											
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9		9	15		9	9	15	9	9
Lane Util. Factor	0.95	0.88	0.95	1.00	0.91	0.91	1.00	0.91	0.97	1.00	0.95
Frt		0.850		0.850			0.850			0.850	
Flt Protected						0.995			0.950		
Satd. Flow (prot)	3061	2410	3061	1369	0	4376	1369	0	2969	1369	0
Flt Permitted						0.995			0.950		
Satd. Flow (perm)	3061	2410	3061	1369	0	4376	1369	0	2969	1369	0
Right Turn on Red				No				No			No
Satd. Flow (RTOR)											
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30			30			30		
Link Distance (ft)	252		342			148			380		
Travel Time (s)	5.7		7.8			3.4			8.6		
Volume (vph)	408	1087	260	172	70	626	67	36	542	378	21
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
Adj. Flow (vph)	443	1182	283	187	76	680	73	39	589	411	23
Lane Group Flow (vph)	443	1182	283	187	0	756	112	0	589	434	0
Turn Type		custom		Perm	Perm		Perm			Perm	
Protected Phases	4	4 1	4			8			1		
Permitted Phases		4 1		4	8	8	8			1	
Minimum Split (s)	20.0		20.0	20.0	20.0	20.0	20.0		20.0	20.0	
Total Split (s)	30.0	68.0	30.0	30.0	22.0	22.0	22.0	0.0	38.0	38.0	0.0
Total Split (%)	33%	76%	33%	33%	24%	24%	24%	0%	42%	42%	0%
Maximum Green (s)	26.0		26.0	26.0	18.0	18.0	18.0		34.0	34.0	
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0		0	0	0	0	0		0	0	
Act Effct Green (s)	26.0	64.0	26.0	26.0		18.0	18.0		34.0	34.0	
Actuated g/C Ratio	0.29	0.71	0.29	0.29		0.20	0.20		0.38	0.38	
v/c Ratio	0.50	0.69	0.32	0.47		0.86	0.41		0.52	0.84	
Uniform Delay, d1	26.6	7.4	25.1	26.3		34.8	31.4		21.7	25.5	
Delay	29.3	10.9	25.4	27.1		39.6	32.2		22.1	33.4	
LOS	C	B	C	C		D	C		C	C	
Approach Delay	15.9		26.1			38.7			26.9		
Approach LOS	B		C			D			C		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 75 (83%), Referenced to phase 1:NWL, Start of Green	
Natural Cycle: 70	

Control Type: Pretimed
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 24.9 Intersection LOS: C
Intersection Capacity Utilization 70.1% ICU Level of Service C

Splits and Phases: 3: Brookline & Park Drive



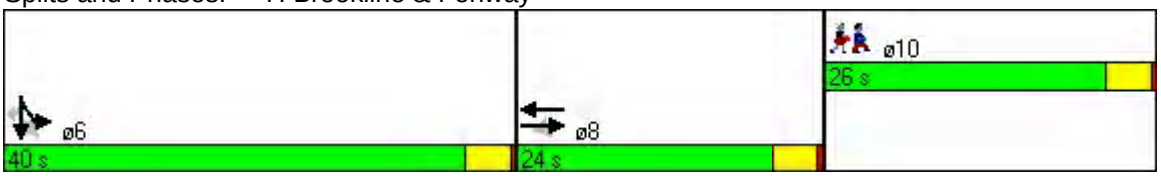


Lane Group	EBT	EBR	EBR2	WBT	SBL2	SBL	SBT	SBR	ø10
Lane Configurations									
Ideal Flow (vphpl)	1700	1700	1700	1700	1000	1700	1250	1700	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Leading Detector (ft)	50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0	
Turning Speed (mph)		9	9		15	15		9	
Lane Util. Factor	0.95	1.00	0.95	0.95	0.91	0.91	0.91	1.00	
Frt		0.850						0.850	
Flt Protected					0.950		0.980		
Satd. Flow (prot)	3061	1369	0	3061	819	0	2113	1369	
Flt Permitted					0.950		0.980		
Satd. Flow (perm)	3061	1369	0	3061	819	0	2113	1369	
Right Turn on Red			No					No	
Satd. Flow (RTOR)									
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
Link Speed (mph)	30			30			30		
Link Distance (ft)	263			252			337		
Travel Time (s)	6.0			5.7			7.7		
Volume (vph)	651	83	90	872	844	126	703	170	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	708	90	98	948	917	137	764	185	
Lane Group Flow (vph)	708	188	0	948	504	0	1314	185	
Turn Type		Perm			custom	Perm		Perm	
Protected Phases	8			8	6		6		10
Permitted Phases		8			6	6		6	
Detector Phases	8	8		8	6	6	6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	24.0	24.0	0.0	24.0	40.0	40.0	40.0	40.0	26.0
Total Split (%)	27%	27%	0%	27%	44%	44%	44%	44%	29%
Maximum Green (s)	20.0	20.0		20.0	36.0	36.0	36.0	36.0	22.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag									
Lead-Lag Optimize?									
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max		Max	Coord	Coord	Coord	Coord	Ped
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0
Act Effct Green (s)	20.0	20.0		20.0	42.0		42.0	42.0	
Actuated g/C Ratio	0.22	0.22		0.22	0.47		0.47	0.47	
v/c Ratio	1.04	0.62		1.39	1.32		1.33	0.29	
Uniform Delay, d1	35.0	31.5		35.0	24.0		24.0	14.8	
Delay	73.9	32.5		176.1	148.4		148.3	12.3	
LOS	E	C		F	F		F	B	
Approach Delay	65.2			176.1			135.7		
Approach LOS	E			F			F		

Intersection Summary

Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 5 (6%), Referenced to phase 6:SBTL, Start of Green			
Natural Cycle: 150			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.39			
Intersection Signal Delay: 129.3		Intersection LOS: F	
Intersection Capacity Utilization 88.4%		ICU Level of Service D	

Splits and Phases: 7: Brookline & Fenway

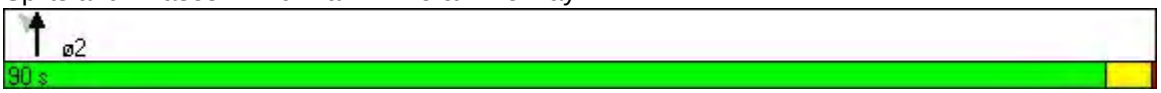


Lane Group	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15			9	15	9
Lane Util. Factor	0.97	0.95	1.00	1.00	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	2969	3061	0	0	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	2969	3061	0	0	0	0
Right Turn on Red	No			No		No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)		30	30		30	
Link Distance (ft)		346	219		176	
Travel Time (s)		7.9	5.0		4.0	
Volume (vph)	561	614	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	610	667	0	0	0	0
Lane Group Flow (vph)	610	667	0	0	0	0
Turn Type	Perm					
Protected Phases		2				
Permitted Phases	2					
Minimum Split (s)	20.0	20.0				
Total Split (s)	90.0	90.0	0.0	0.0	0.0	0.0
Total Split (%)	100%	100%	0%	0%	0%	0%
Maximum Green (s)	86.0	86.0				
Yellow Time (s)	3.5	3.5				
All-Red Time (s)	0.5	0.5				
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	5.0	5.0				
Flash Dont Walk (s)	11.0	11.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	90.0	90.0				
Actuated g/C Ratio	1.00	1.00				
v/c Ratio	0.21	0.22				
Uniform Delay, d1	0.0	0.0				
Delay	0.0	0.0				
LOS	A	A				
Approach Delay		0.0				
Approach LOS		A				

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:NBTL, Start of Green	
Natural Cycle: 40	

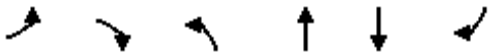
Control Type: Pretimed
Maximum v/c Ratio: 0.22
Intersection Signal Delay: 0.0 Intersection LOS: A
Intersection Capacity Utilization 24.0% ICU Level of Service A

Splits and Phases: 10: Park Drive & Riverway



Lane Group	NBL	NBR	SEL	SER	SWL	SWR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15	9	15	9
Lane Util. Factor	1.00	1.00	1.00	0.76	0.94	1.00
Frt				0.850		
Flt Protected					0.950	
Satd. Flow (prot)	0	0	0	3122	4316	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	0	0	3122	4316	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30		30	
Link Distance (ft)	337		139		216	
Travel Time (s)	7.7		3.2		4.9	
Volume (vph)	0	0	0	1160	683	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1261	742	0
Lane Group Flow (vph)	0	0	0	1261	742	0
Sign Control	Stop		Yield		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 55.3%		ICU Level of Service A	



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	1.00	0.86	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1531	0	0	5542	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1531	0	0	5542	0	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	139			190	148	
Travel Time (s)	3.2			4.3	3.4	
Volume (vph)	209	0	0	590	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	227	0	0	641	0	0
Lane Group Flow (vph)	227	0	0	641	0	0
Sign Control	Yield			Free	Stop	

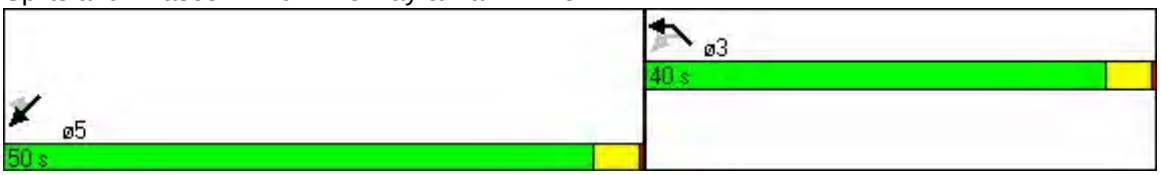
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 31.1%		ICU Level of Service A	

Lane Group	EBL	EBR	NWL2	NWL	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15	15	9	15		9	15		9
Lane Util. Factor	1.00	1.00	0.97	0.94	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt											0.850
Flt Protected			0.950	0.950							
Satd. Flow (prot)	0	0	2969	4316	0	0	0	0	0	3061	1369
Flt Permitted			0.950	0.950							
Satd. Flow (perm)	0	0	2969	4316	0	0	0	0	0	3061	1369
Right Turn on Red			No		No			No			No
Satd. Flow (RTOR)											
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	265			176			216			160	
Travel Time (s)	6.0			4.0			4.9			3.6	
Volume (vph)	0	0	110	451	0	0	0	0	0	573	231
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
Adj. Flow (vph)	0	0	120	490	0	0	0	0	0	623	251
Lane Group Flow (vph)	0	0	120	490	0	0	0	0	0	623	251
Turn Type			Perm								Perm
Protected Phases				3						5	
Permitted Phases			3	3						5	5
Minimum Split (s)			20.0	20.0						20.0	20.0
Total Split (s)	0.0	0.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0
Total Split (%)	0%	0%	44%	44%	0%	0%	0%	0%	0%	56%	56%
Maximum Green (s)			36.0	36.0						46.0	46.0
Yellow Time (s)			3.5	3.5						3.5	3.5
All-Red Time (s)			0.5	0.5						0.5	0.5
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)			5.0	5.0						5.0	5.0
Flash Dont Walk (s)			11.0	11.0						11.0	11.0
Pedestrian Calls (#/hr)			0	0						0	0
Act Effct Green (s)			36.0	36.0						46.0	46.0
Actuated g/C Ratio			0.40	0.40						0.51	0.51
v/c Ratio			0.10	0.28						0.40	0.36
Uniform Delay, d1			16.9	18.3						13.5	13.2
Delay			14.0	14.6						13.7	13.6
LOS			B	B						B	B
Approach Delay				14.5						13.7	
Approach LOS				B						B	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 84 (93%), Referenced to phase 5:SWT, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.40
Intersection Signal Delay: 14.0 Intersection LOS: B
Intersection Capacity Utilization 36.3% ICU Level of Service A

Splits and Phases: 16: Riverway & Park Drive



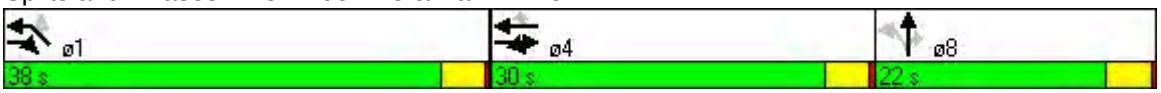
Current Layout
PM Traffic

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	NBR2	NWL	NWR
Lane Configurations										
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9		9	15		9	9	15	9
Lane Util. Factor	0.95	0.88	0.95	1.00	0.91	0.91	1.00	0.91	0.97	1.00
Frt		0.850		0.850			0.850			0.850
Flt Protected						0.990			0.950	
Satd. Flow (prot)	3061	2410	3061	1369	0	4354	1369	0	2969	1369
Flt Permitted						0.990			0.950	
Satd. Flow (perm)	3061	2410	3061	1369	0	4354	1369	0	2969	1369
Right Turn on Red				No				No		
Satd. Flow (RTOR)										
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30			30			30	
Link Distance (ft)	252		342			148			380	
Travel Time (s)	5.7		7.8			3.4			8.6	
Volume (vph)	392	1022	317	387	115	473	71	62	367	544
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	426	1111	345	421	125	514	77	67	399	591
Lane Group Flow (vph)	426	1111	345	421	0	639	144	0	399	591
Turn Type		custom		Perm	Perm		Perm			Perm
Protected Phases	4	4 1	4			8			1	
Permitted Phases		4 1		4	8	8	8			1
Minimum Split (s)	20.0		20.0	20.0	20.0	20.0	20.0		20.0	20.0
Total Split (s)	30.0	68.0	30.0	30.0	22.0	22.0	22.0	0.0	38.0	38.0
Total Split (%)	33%	76%	33%	33%	24%	24%	24%	0%	42%	42%
Maximum Green (s)	26.0		26.0	26.0	18.0	18.0	18.0		34.0	34.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5
Lead/Lag										
Lead-Lag Optimize?										
Walk Time (s)	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0	0		0	0
Act Effct Green (s)	26.0	64.0	26.0	26.0		18.0	18.0		34.0	34.0
Actuated g/C Ratio	0.29	0.71	0.29	0.29		0.20	0.20		0.38	0.38
v/c Ratio	0.48	0.65	0.39	1.07		0.73	0.53		0.36	1.14
Uniform Delay, d1	26.4	7.0	25.6	32.0		33.7	32.2		20.1	28.0
Delay	31.3	11.1	26.0	85.9		34.1	33.1		20.4	99.5
LOS	C	B	C	F		C	C		C	F
Approach Delay	16.7		58.9			33.9			67.6	
Approach LOS	B		E			C			E	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 89 (99%), Referenced to phase 1:NWL, Start of Green	
Natural Cycle: 100	

Control Type: Pretimed
Maximum v/c Ratio: 1.14
Intersection Signal Delay: 40.3 Intersection LOS: D
Intersection Capacity Utilization 94.0% ICU Level of Service E

Splits and Phases: 3: Brookline & Park Drive

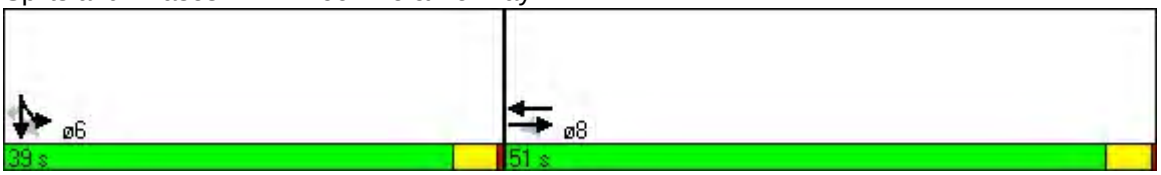


Lane Group	EBT	EBR	EBR2	WBT	SBL2	SBL	SBT	SBR
Lane Configurations								
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	9		15	15		9
Lane Util. Factor	0.95	1.00	0.95	0.95	0.91	0.91	0.91	1.00
Frt		0.850						0.850
Flt Protected					0.950		0.986	
Satd. Flow (prot)	3061	1369	0	3061	1393	0	2891	1369
Flt Permitted					0.950		0.986	
Satd. Flow (perm)	3061	1369	0	3061	1393	0	2891	1369
Right Turn on Red			No					No
Satd. Flow (RTOR)								
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30			30	
Link Distance (ft)	263			252			337	
Travel Time (s)	6.0			5.7			7.7	
Volume (vph)	832	74	98	799	582	62	604	49
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	904	80	107	868	633	67	657	53
Lane Group Flow (vph)	904	187	0	868	439	0	918	53
Turn Type		Perm			custom	Perm		Perm
Protected Phases	8			8	6		6	
Permitted Phases		8			6	6		6
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	20.0	20.0
Total Split (s)	51.0	51.0	0.0	51.0	39.0	39.0	39.0	39.0
Total Split (%)	57%	57%	0%	57%	43%	43%	43%	43%
Maximum Green (s)	47.0	47.0		47.0	35.0	35.0	35.0	35.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5
Lead/Lag								
Lead-Lag Optimize?								
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0
Act Effct Green (s)	47.0	47.0		47.0	35.0		35.0	35.0
Actuated g/C Ratio	0.52	0.52		0.52	0.39		0.39	0.39
v/c Ratio	0.57	0.26		0.54	0.81		0.82	0.10
Uniform Delay, d1	14.6	11.9		14.3	24.5		24.6	17.5
Delay	14.9	12.2		14.7	29.5		25.5	16.3
LOS	B	B		B	C		C	B
Approach Delay	14.4			14.7			26.4	
Approach LOS	B			B			C	

Intersection Summary
Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 15 (17%), Referenced to phase 6:SBTL, Start of Green
Natural Cycle: 40

Control Type: Pretimed
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 19.5 Intersection LOS: B
Intersection Capacity Utilization 63.3% ICU Level of Service B

Splits and Phases: 7: Brookline & Fenway

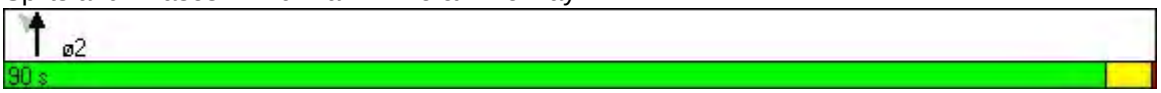


Lane Group	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15			9	15	9
Lane Util. Factor	0.97	0.95	1.00	1.00	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	2969	3061	0	0	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	2969	3061	0	0	0	0
Right Turn on Red	No			No		No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)		30	30		30	
Link Distance (ft)		346	219		176	
Travel Time (s)		7.9	5.0		4.0	
Volume (vph)	983	582	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1068	633	0	0	0	0
Lane Group Flow (vph)	1068	633	0	0	0	0
Turn Type	Perm					
Protected Phases		2				
Permitted Phases	2					
Minimum Split (s)	20.0	20.0				
Total Split (s)	90.0	90.0	0.0	0.0	0.0	0.0
Total Split (%)	100%	100%	0%	0%	0%	0%
Maximum Green (s)	86.0	86.0				
Yellow Time (s)	3.5	3.5				
All-Red Time (s)	0.5	0.5				
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	5.0	5.0				
Flash Dont Walk (s)	11.0	11.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	90.0	90.0				
Actuated g/C Ratio	1.00	1.00				
v/c Ratio	0.36	0.21				
Uniform Delay, d1	0.0	0.0				
Delay	0.0	0.0				
LOS	A	A				
Approach Delay		0.0				
Approach LOS		A				

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 80 (89%), Referenced to phase 2:NBTL, Start of Green	
Natural Cycle: 40	

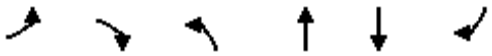
Control Type: Pretimed
Maximum v/c Ratio: 0.36
Intersection Signal Delay: 0.0 Intersection LOS: A
Intersection Capacity Utilization 37.4% ICU Level of Service A

Splits and Phases: 10: Park Drive & Riverway



Lane Group	NBL	NBR	SEL	SER	SWL	SWR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15	9	15	9
Lane Util. Factor	1.00	1.00	1.00	0.76	0.94	1.00
Frt				0.850		
Flt Protected					0.950	
Satd. Flow (prot)	0	0	0	3122	4316	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	0	0	3122	4316	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30		30	
Link Distance (ft)	337		139		216	
Travel Time (s)	7.7		3.2		4.9	
Volume (vph)	0	0	0	776	672	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	843	730	0
Lane Group Flow (vph)	0	0	0	843	730	0
Sign Control	Stop		Yield		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 44.2%		ICU Level of Service A	



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	1.00	0.86	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1531	0	0	5542	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1531	0	0	5542	0	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	139			190	148	
Travel Time (s)	3.2			4.3	3.4	
Volume (vph)	160	0	0	297	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	0	0	323	0	0
Lane Group Flow (vph)	174	0	0	323	0	0
Sign Control	Yield			Free	Stop	

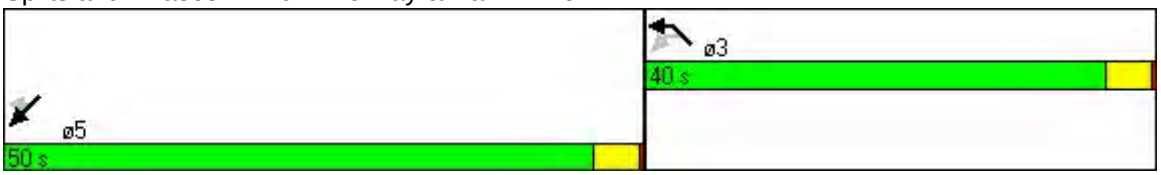
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 22.7%		ICU Level of Service A	

Lane Group	EBL	EBR	NWL2	NWL	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15	15	9	15		9	15		9
Lane Util. Factor	1.00	1.00	0.97	0.94	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt											0.850
Flt Protected			0.950	0.950							
Satd. Flow (prot)	0	0	2969	4316	0	0	0	0	0	3061	1369
Flt Permitted			0.950	0.950							
Satd. Flow (perm)	0	0	2969	4316	0	0	0	0	0	3061	1369
Right Turn on Red			No		No			No			No
Satd. Flow (RTOR)											
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	265			176			216			160	
Travel Time (s)	6.0			4.0			4.9			3.6	
Volume (vph)	0	0	183	799	0	0	0	0	0	489	275
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
Adj. Flow (vph)	0	0	199	868	0	0	0	0	0	532	299
Lane Group Flow (vph)	0	0	199	868	0	0	0	0	0	532	299
Turn Type			Perm								Perm
Protected Phases				3						5	
Permitted Phases			3	3						5	5
Minimum Split (s)			20.0	20.0						20.0	20.0
Total Split (s)	0.0	0.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0
Total Split (%)	0%	0%	44%	44%	0%	0%	0%	0%	0%	56%	56%
Maximum Green (s)			36.0	36.0						46.0	46.0
Yellow Time (s)			3.5	3.5						3.5	3.5
All-Red Time (s)			0.5	0.5						0.5	0.5
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)			5.0	5.0						5.0	5.0
Flash Dont Walk (s)			11.0	11.0						11.0	11.0
Pedestrian Calls (#/hr)			0	0						0	0
Act Effct Green (s)			36.0	36.0						46.0	46.0
Actuated g/C Ratio			0.40	0.40						0.51	0.51
v/c Ratio			0.17	0.50						0.34	0.43
Uniform Delay, d1			17.3	20.2						13.0	13.7
Delay			21.5	24.7						13.2	14.3
LOS			C	C						B	B
Approach Delay				24.1						13.6	
Approach LOS				C						B	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 85 (94%), Referenced to phase 5:SWT, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.50
Intersection Signal Delay: 19.5 Intersection LOS: B
Intersection Capacity Utilization 45.8% ICU Level of Service A

Splits and Phases: 16: Riverway & Park Drive



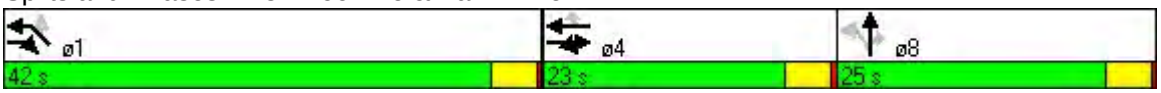
Sandal Design
AM Traffic

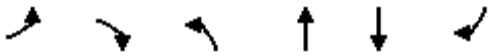
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	NBR2	NWL	NWR	NWR2
Lane Configurations											
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9		9	15		9	9	15	9	9
Lane Util. Factor	0.95	0.88	0.95	1.00	1.00	0.95	1.00	0.95	0.97	1.00	0.95
Frt		0.850		0.850			0.850			0.850	
Flt Protected					0.950				0.950		
Satd. Flow (prot)	3061	2410	3061	1369	1531	3061	1369	0	2969	1369	0
Flt Permitted					0.950				0.950		
Satd. Flow (perm)	3061	2410	3061	1369	1531	3061	1369	0	2969	1369	0
Right Turn on Red				No				No			No
Satd. Flow (RTOR)											
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30			30			30		
Link Distance (ft)	252		373			148			411		
Travel Time (s)	5.7		8.5			3.4			9.3		
Volume (vph)	408	1087	260	172	70	291	67	36	542	378	21
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
Adj. Flow (vph)	443	1182	283	187	76	316	73	39	589	411	23
Lane Group Flow (vph)	443	1182	283	187	76	316	112	0	589	434	0
Turn Type		custom		Perm	Perm		Perm			Perm	
Protected Phases	4	4 1	4			8			1		
Permitted Phases		4 1		4	8	8	8			1	
Minimum Split (s)	20.0		20.0	20.0	25.0	25.0	25.0		20.0	20.0	
Total Split (s)	23.0	65.0	23.0	23.0	25.0	25.0	25.0	0.0	42.0	42.0	0.0
Total Split (%)	26%	72%	26%	26%	28%	28%	28%	0%	47%	47%	0%
Maximum Green (s)	19.0		19.0	19.0	21.0	21.0	21.0		38.0	38.0	
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0		0	0	0	0	0		0	0	
Act Effct Green (s)	19.0	61.0	19.0	19.0	21.0	21.0	21.0		38.0	38.0	
Actuated g/C Ratio	0.21	0.68	0.21	0.21	0.23	0.23	0.23		0.42	0.42	
v/c Ratio	0.69	0.72	0.44	0.65	0.21	0.44	0.35		0.47	0.75	
Uniform Delay, d1	32.7	9.2	30.8	32.4	27.8	29.5	28.8		18.7	22.0	
Delay	33.2	9.6	31.2	34.6	28.4	29.9	29.6		19.0	24.5	
LOS	C	A	C	C	C	C	C		B	C	
Approach Delay	16.1		32.6			29.6			21.4		
Approach LOS	B		C			C			C		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 1:NWL, Start of Green, Master Intersection	
Natural Cycle: 75	

Control Type: Pretimed
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 21.6 Intersection LOS: C
Intersection Capacity Utilization 63.5% ICU Level of Service B

Splits and Phases: 3: Brookline & Park Drive



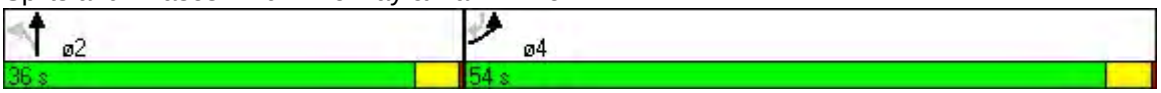


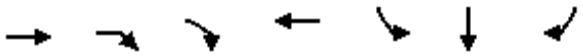
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	0.97	0.95	0.95	0.88
Frt						0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1531	0	2969	3061	0	2410
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1531	0	2969	3061	0	2410
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	148			409	159	
Travel Time (s)	3.4			9.3	3.6	
Volume (vph)	126	0	561	488	0	804
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	137	0	610	530	0	874
Lane Group Flow (vph)	137	0	610	530	0	874
Turn Type			Perm			custom
Protected Phases	4			2		
Permitted Phases			2			4
Minimum Split (s)	20.0		20.0	20.0		20.0
Total Split (s)	54.0	0.0	36.0	36.0	0.0	54.0
Total Split (%)	60%	0%	40%	40%	0%	60%
Maximum Green (s)	50.0		32.0	32.0		50.0
Yellow Time (s)	3.5		3.5	3.5		3.5
All-Red Time (s)	0.5		0.5	0.5		0.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	5.0		5.0	5.0		5.0
Flash Dont Walk (s)	11.0		11.0	11.0		11.0
Pedestrian Calls (#/hr)	0		0	0		0
Act Effct Green (s)	50.0		32.0	32.0		50.0
Actuated g/C Ratio	0.56		0.36	0.36		0.56
v/c Ratio	0.16		0.58	0.49		0.65
Uniform Delay, d1	9.8		23.5	22.6		13.9
Delay	0.1		21.9	21.0		14.4
LOS	A		C	C		B
Approach Delay	0.1			21.5		
Approach LOS	A			C		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 85 (94%), Referenced to phase 2:NBTL and 6:, Start of Green	
Natural Cycle: 45	

Control Type: Pretimed
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 17.2 Intersection LOS: B
Intersection Capacity Utilization 60.3% ICU Level of Service B

Splits and Phases: 6: Riverway & Park Drive





Lane Group	EBT	EBR	EBR2	WBT	SBL2	SBT	SBR
Lane Configurations							
Ideal Flow (vphpl)	1700	1700	1700	1700	1400	1750	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	9		15		9
Lane Util. Factor	0.95	1.00	0.95	0.95	0.91	0.91	1.00
Frt		0.850					0.850
Flt Protected					0.950	0.982	
Satd. Flow (prot)	3061	1369	0	3061	1147	2964	1369
Flt Permitted					0.950	0.982	
Satd. Flow (perm)	3061	1369	0	3061	1147	2964	1369
Right Turn on Red			No				No
Satd. Flow (RTOR)							
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30		30	
Link Distance (ft)	263			252		310	
Travel Time (s)	6.0			5.7		7.0	
Volume (vph)	651	83	90	872	844	703	119
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	708	90	98	948	917	764	129
Lane Group Flow (vph)	708	188	0	948	463	1218	129
Turn Type		Perm			custom		Perm
Protected Phases	4			4	8	8	
Permitted Phases		4			8		8
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	20.0
Total Split (s)	31.0	31.0	0.0	31.0	39.0	39.0	39.0
Total Split (%)	44%	44%	0%	44%	56%	56%	56%
Maximum Green (s)	27.0	27.0		27.0	35.0	35.0	35.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5
Lead/Lag							
Lead-Lag Optimize?							
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0	0
Act Effct Green (s)	27.0	27.0		27.0	35.0	35.0	35.0
Actuated g/C Ratio	0.39	0.39		0.39	0.50	0.50	0.50
v/c Ratio	0.60	0.36		0.80	0.81	0.82	0.19
Uniform Delay, d1	17.2	15.3		19.1	14.7	14.8	9.7
Delay	17.5	15.9		20.8	20.7	16.5	10.0
LOS	B	B		C	C	B	A
Approach Delay	17.2			20.8		17.1	
Approach LOS	B			C		B	

Intersection Summary	
Area Type:	Other
Cycle Length: 70	
Actuated Cycle Length: 70	
Offset: 29 (41%), Referenced to phase 4:EBWB, Start of Green	
Natural Cycle: 55	

Control Type: Pretimed
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 18.1 Intersection LOS: B
Intersection Capacity Utilization 70.5% ICU Level of Service C

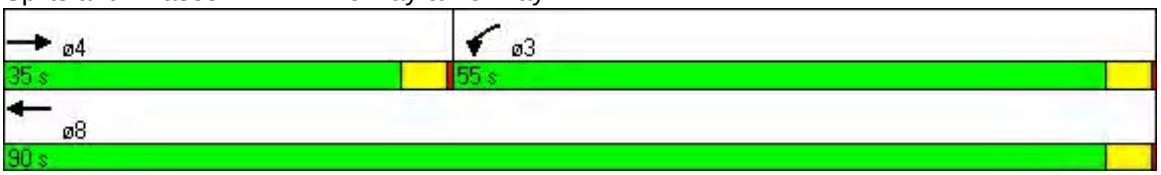
Splits and Phases: 7: Brookline & Fenway

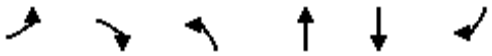
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Lane Util. Factor	1.00	1.00	0.97	0.95	1.00	1.00
Frt						
Flt Protected			0.950			
Satd. Flow (prot)	1611	0	2969	3061	0	0
Flt Permitted			0.950			
Satd. Flow (perm)	1611	0	2969	3061	0	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	223			111	100	
Travel Time (s)	5.1			2.5	2.3	
Volume (vph)	126	0	753	682	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	137	0	818	741	0	0
Lane Group Flow (vph)	137	0	818	741	0	0
Turn Type			Prot			
Protected Phases	4		3	8		
Permitted Phases						
Minimum Split (s)	20.0		8.0	20.0		
Total Split (s)	35.0	0.0	55.0	90.0	0.0	0.0
Total Split (%)	39%	0%	61%	100%	0%	0%
Maximum Green (s)	31.0		51.0	86.0		
Yellow Time (s)	3.5		3.5	3.5		
All-Red Time (s)	0.5		0.5	0.5		
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Walk Time (s)	5.0			5.0		
Flash Dont Walk (s)	11.0			11.0		
Pedestrian Calls (#/hr)	0			0		
Act Effct Green (s)	31.0		51.0	90.0		
Actuated g/C Ratio	0.34		0.57	1.00		
v/c Ratio	0.25		0.49	0.24		
Uniform Delay, d1	21.1		11.7	0.0		
Delay	21.6		11.2	0.0		
LOS	C		B	A		
Approach Delay	21.6			5.9		
Approach LOS	C			A		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 28 (31%), Referenced to phase 8:WBT, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.49
Intersection Signal Delay: 7.2 Intersection LOS: A
Intersection Capacity Utilization 40.8% ICU Level of Service A

Splits and Phases: 11: Riverway & Fenway



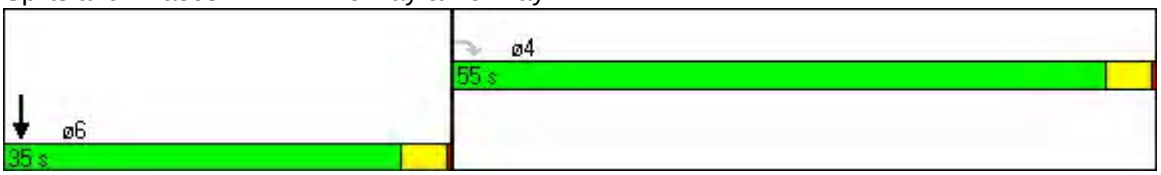


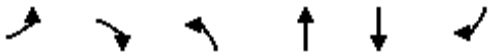
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	0.88	1.00	1.00	0.95	1.00
Frt		0.850				
Flt Protected						
Satd. Flow (prot)	0	2410	0	0	3061	0
Flt Permitted						
Satd. Flow (perm)	0	2410	0	0	3061	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	168			310	100	
Travel Time (s)	3.8			7.0	2.3	
Volume (vph)	0	1034	0	0	753	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1124	0	0	818	0
Lane Group Flow (vph)	0	1124	0	0	818	0
Turn Type		custom				
Protected Phases					6	
Permitted Phases		4				
Minimum Split (s)		20.0			20.0	
Total Split (s)	0.0	55.0	0.0	0.0	35.0	0.0
Total Split (%)	0%	61%	0%	0%	39%	0%
Maximum Green (s)		51.0			31.0	
Yellow Time (s)		3.5			3.5	
All-Red Time (s)		0.5			0.5	
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)		5.0			5.0	
Flash Dont Walk (s)		11.0			11.0	
Pedestrian Calls (#/hr)		0			0	
Act Effct Green (s)		51.0			31.0	
Actuated g/C Ratio		0.57			0.34	
v/c Ratio		0.82			0.78	
Uniform Delay, d1		15.8			26.4	
Delay		17.2			13.8	
LOS		B			B	
Approach Delay					13.8	
Approach LOS					B	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 85 (94%), Referenced to phase 6:SBT, Start of Green	
Natural Cycle: 55	

Control Type: Pretimed
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 15.8 Intersection LOS: B
Intersection Capacity Utilization 75.9% ICU Level of Service C

Splits and Phases: 12: Riverway & Fenway





Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	1.00	0.86	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1531	0	0	5542	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1531	0	0	5542	0	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	139			190	148	
Travel Time (s)	3.2			4.3	3.4	
Volume (vph)	83	0	0	381	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	90	0	0	414	0	0
Lane Group Flow (vph)	90	0	0	414	0	0
Sign Control	Yield			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 19.0%		ICU Level of Service A	

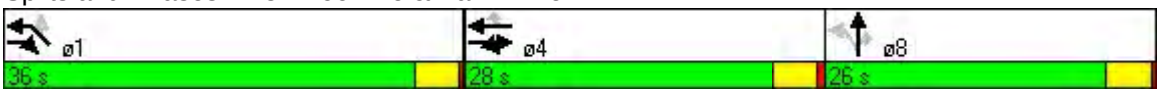
Sandal Design
PM Traffic

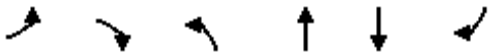
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	NBR2	NWL	NWR
Lane Configurations										
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9		9	15		9	9	15	9
Lane Util. Factor	0.95	0.88	0.95	1.00	1.00	0.95	1.00	0.95	0.97	1.00
Frt		0.850		0.850			0.850			0.850
Flt Protected					0.950				0.950	
Satd. Flow (prot)	3061	2410	3061	1369	1531	3061	1369	0	2969	1369
Flt Permitted					0.950				0.950	
Satd. Flow (perm)	3061	2410	3061	1369	1531	3061	1369	0	2969	1369
Right Turn on Red				Yes				No		
Satd. Flow (RTOR)				162						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30			30			30	
Link Distance (ft)	252		373			148			411	
Travel Time (s)	5.7		8.5			3.4			9.3	
Volume (vph)	391	1022	317	387	115	522	71	62	367	380
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	425	1111	345	421	125	567	77	67	399	413
Lane Group Flow (vph)	425	1111	345	421	125	567	144	0	399	413
Turn Type		custom		Perm	Perm		Perm			Perm
Protected Phases	4	4 1	4			8			1	
Permitted Phases		4 1		4	8	8	8			1
Minimum Split (s)	20.0		20.0	20.0	26.0	26.0	26.0		20.0	20.0
Total Split (s)	28.0	64.0	28.0	28.0	26.0	26.0	26.0	0.0	36.0	36.0
Total Split (%)	31%	71%	31%	31%	29%	29%	29%	0%	40%	40%
Maximum Green (s)	24.0		24.0	24.0	22.0	22.0	22.0		32.0	32.0
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5
Lead/Lag										
Lead-Lag Optimize?										
Walk Time (s)	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0		0	0	0	0	0		0	0
Act Effct Green (s)	24.0	60.0	24.0	24.0	22.0	22.0	22.0		32.0	32.0
Actuated g/C Ratio	0.27	0.67	0.27	0.27	0.24	0.24	0.24		0.36	0.36
v/c Ratio	0.52	0.69	0.42	0.87	0.33	0.76	0.43		0.38	0.85
Uniform Delay, d1	28.1	9.3	27.2	18.9	28.0	31.5	28.7		21.6	26.7
Delay	22.1	6.2	27.6	30.0	28.6	32.5	29.5		21.9	35.9
LOS	C	A	C	C	C	C	C		C	D
Approach Delay	10.6		28.9			31.4			29.0	
Approach LOS	B		C			C			C	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 1:NWL, Start of Green, Master Intersection	
Natural Cycle: 90	

Control Type: Pretimed
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 22.4 Intersection LOS: C
Intersection Capacity Utilization 85.2% ICU Level of Service D

Splits and Phases: 3: Brookline & Park Drive



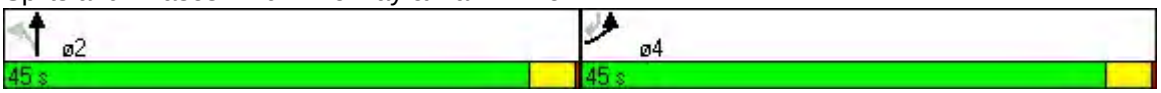


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	0.97	0.95	0.95	0.88
Frt						0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1531	0	2969	3061	0	2410
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1531	0	2969	3061	0	2410
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	155			409	159	
Travel Time (s)	3.5			9.3	3.6	
Volume (vph)	86	0	966	496	0	764
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	0	1050	539	0	830
Lane Group Flow (vph)	93	0	1050	539	0	830
Turn Type			Perm			custom
Protected Phases	4			2		
Permitted Phases			2			4
Minimum Split (s)	20.0		20.0	20.0		20.0
Total Split (s)	45.0	0.0	45.0	45.0	0.0	45.0
Total Split (%)	50%	0%	50%	50%	0%	50%
Maximum Green (s)	41.0		41.0	41.0		41.0
Yellow Time (s)	3.5		3.5	3.5		3.5
All-Red Time (s)	0.5		0.5	0.5		0.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	5.0		5.0	5.0		5.0
Flash Dont Walk (s)	11.0		11.0	11.0		11.0
Pedestrian Calls (#/hr)	0		0	0		0
Act Effct Green (s)	41.0		41.0	41.0		41.0
Actuated g/C Ratio	0.46		0.46	0.46		0.46
v/c Ratio	0.13		0.78	0.39		0.76
Uniform Delay, d1	14.2		20.6	16.2		20.3
Delay	0.1		18.2	13.5		20.9
LOS	A		B	B		C
Approach Delay	0.1			16.6		
Approach LOS	A			B		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 83 (92%), Referenced to phase 2:NBTL, Start of Green	
Natural Cycle: 50	

Control Type: Pretimed
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 17.4 Intersection LOS: B
Intersection Capacity Utilization 72.6% ICU Level of Service C

Splits and Phases: 6: Riverway & Park Drive



Lane Group	EBT	EBR	EBR2	WBT	SBL2	SBL	SBT	SBR
Lane Configurations								
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	9		15	15		9
Lane Util. Factor	0.95	1.00	0.95	0.95	0.91	0.91	0.91	1.00
Frt		0.850						0.850
Flt Protected					0.950		0.985	
Satd. Flow (prot)	3061	1369	0	3061	1393	0	2888	1369
Flt Permitted					0.950		0.985	
Satd. Flow (perm)	3061	1369	0	3061	1393	0	2888	1369
Right Turn on Red			Yes					Yes
Satd. Flow (RTOR)		91						65
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30			30	
Link Distance (ft)	263			252			310	
Travel Time (s)	6.0			5.7			7.0	
Volume (vph)	832	74	98	799	582	86	578	202
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	904	80	107	868	633	93	628	220
Lane Group Flow (vph)	904	187	0	868	438	0	916	220
Turn Type		Perm			custom	Perm		Perm
Protected Phases	4			4	8		8	
Permitted Phases		4			8	8		8
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	20.0	20.0
Total Split (s)	41.0	41.0	0.0	41.0	49.0	49.0	49.0	49.0
Total Split (%)	46%	46%	0%	46%	54%	54%	54%	54%
Maximum Green (s)	37.0	37.0		37.0	45.0	45.0	45.0	45.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5
Lead/Lag								
Lead-Lag Optimize?								
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0
Act Effct Green (s)	37.0	37.0		37.0	45.0		45.0	45.0
Actuated g/C Ratio	0.41	0.41		0.41	0.50		0.50	0.50
v/c Ratio	0.72	0.30		0.69	0.63		0.63	0.31
Uniform Delay, d1	22.1	8.7		21.8	16.4		16.5	9.0
Delay	22.6	9.4		15.6	15.4		15.2	8.3
LOS	C	A		B	B		B	A
Approach Delay	20.3			15.6			14.3	
Approach LOS	C			B			B	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 22 (24%), Referenced to phase 4:EBWB, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 16.5 Intersection LOS: B
Intersection Capacity Utilization 63.3% ICU Level of Service B

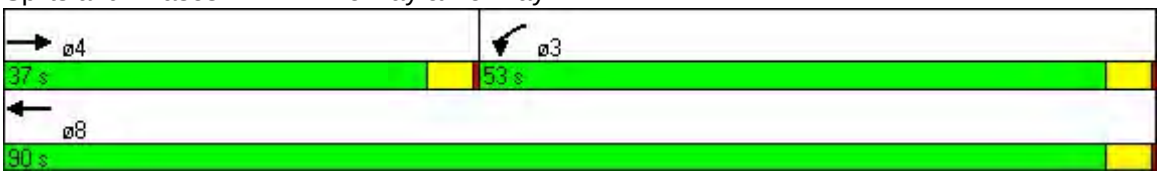
Splits and Phases: 7: Brookline & Fenway

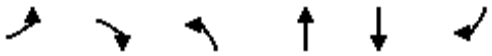
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Lane Util. Factor	1.00	1.00	0.97	0.95	1.00	1.00
Frt						
Flt Protected			0.950			
Satd. Flow (prot)	1611	0	2969	3061	0	0
Flt Permitted			0.950			
Satd. Flow (perm)	1611	0	2969	3061	0	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	223			104	100	
Travel Time (s)	5.1			2.4	2.3	
Volume (vph)	86	0	672	1075	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	0	730	1168	0	0
Lane Group Flow (vph)	93	0	730	1168	0	0
Turn Type			Prot			
Protected Phases	4		3	8		
Permitted Phases						
Minimum Split (s)	20.0		8.0	20.0		
Total Split (s)	37.0	0.0	53.0	90.0	0.0	0.0
Total Split (%)	41%	0%	59%	100%	0%	0%
Maximum Green (s)	33.0		49.0	86.0		
Yellow Time (s)	3.5		3.5	3.5		
All-Red Time (s)	0.5		0.5	0.5		
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Walk Time (s)	5.0			5.0		
Flash Dont Walk (s)	11.0			11.0		
Pedestrian Calls (#/hr)	0			0		
Act Effct Green (s)	33.0		49.0	90.0		
Actuated g/C Ratio	0.37		0.54	1.00		
v/c Ratio	0.16		0.45	0.38		
Uniform Delay, d1	19.1		12.4	0.0		
Delay	19.5		10.4	0.0		
LOS	B		B	A		
Approach Delay	19.5			4.0		
Approach LOS	B			A		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 33 (37%), Referenced to phase 8:WBT, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.45
Intersection Signal Delay: 4.7 Intersection LOS: A
Intersection Capacity Utilization 39.4% ICU Level of Service A

Splits and Phases: 11: Riverway & Fenway



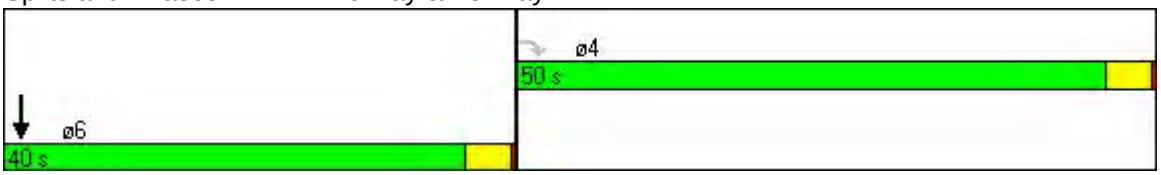


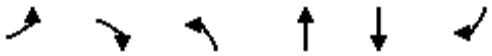
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	0.88	1.00	1.00	0.95	1.00
Frt		0.850				
Flt Protected						
Satd. Flow (prot)	0	2410	0	0	3061	0
Flt Permitted						
Satd. Flow (perm)	0	2410	0	0	3061	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	168			310	100	
Travel Time (s)	3.8			7.0	2.3	
Volume (vph)	0	690	0	0	672	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	750	0	0	730	0
Lane Group Flow (vph)	0	750	0	0	730	0
Turn Type		custom				
Protected Phases					6	
Permitted Phases		4				
Minimum Split (s)		20.0			20.0	
Total Split (s)	0.0	50.0	0.0	0.0	40.0	0.0
Total Split (%)	0%	56%	0%	0%	44%	0%
Maximum Green (s)		46.0			36.0	
Yellow Time (s)		3.5			3.5	
All-Red Time (s)		0.5			0.5	
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)		5.0			5.0	
Flash Dont Walk (s)		11.0			11.0	
Pedestrian Calls (#/hr)		0			0	
Act Effct Green (s)		46.0			36.0	
Actuated g/C Ratio		0.51			0.40	
v/c Ratio		0.61			0.60	
Uniform Delay, d1		15.6			21.3	
Delay		16.0			7.4	
LOS		B			A	
Approach Delay					7.4	
Approach LOS					A	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 84 (93%), Referenced to phase 6:SBT, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.61
Intersection Signal Delay: 11.7 Intersection LOS: B
Intersection Capacity Utilization 58.6% ICU Level of Service A

Splits and Phases: 12: Riverway & Fenway





Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	1.00	0.86	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1531	0	0	5542	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1531	0	0	5542	0	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	139			190	148	
Travel Time (s)	3.2			4.3	3.4	
Volume (vph)	160	0	0	560	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	174	0	0	609	0	0
Lane Group Flow (vph)	174	0	0	609	0	0
Sign Control	Yield			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.3%		ICU Level of Service A	

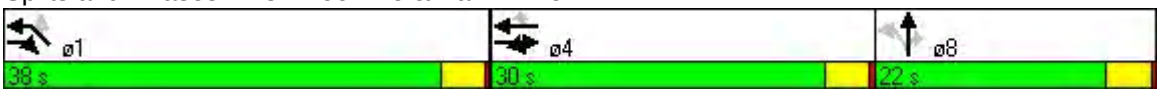
Current Layout
Future Traffic

Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	NBR2	NWL	NWR	NWR2
Lane Configurations											
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9		9	15		9	9	15	9	9
Lane Util. Factor	0.95	0.88	0.95	1.00	0.91	0.91	1.00	0.91	0.97	1.00	0.95
Frt		0.850		0.850			0.850			0.850	
Flt Protected						0.995			0.950		
Satd. Flow (prot)	3061	2410	3061	1369	0	4376	1369	0	2969	1369	0
Flt Permitted						0.995			0.950		
Satd. Flow (perm)	3061	2410	3061	1369	0	4376	1369	0	2969	1369	0
Right Turn on Red				No				No			No
Satd. Flow (RTOR)											
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30			30			30		
Link Distance (ft)	252		342			148			380		
Travel Time (s)	5.7		7.8			3.4			8.6		
Volume (vph)	446	1207	270	178	82	716	77	43	716	499	28
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
Adj. Flow (vph)	485	1312	293	193	89	778	84	47	778	542	30
Lane Group Flow (vph)	485	1312	293	193	0	867	131	0	778	572	0
Turn Type		custom		Perm	Perm		Perm			Perm	
Protected Phases	4	4 1	4			8			1		
Permitted Phases		4 1		4	8	8	8			1	
Minimum Split (s)	20.0		20.0	20.0	20.0	20.0	20.0		20.0	20.0	
Total Split (s)	30.0	68.0	30.0	30.0	22.0	22.0	22.0	0.0	38.0	38.0	0.0
Total Split (%)	33%	76%	33%	33%	24%	24%	24%	0%	42%	42%	0%
Maximum Green (s)	26.0		26.0	26.0	18.0	18.0	18.0		34.0	34.0	
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0		0	0	0	0	0		0	0	
Act Effct Green (s)	26.0	64.0	26.0	26.0		18.0	18.0		34.0	34.0	
Actuated g/C Ratio	0.29	0.71	0.29	0.29		0.20	0.20		0.38	0.38	
v/c Ratio	0.55	0.77	0.33	0.49		0.99	0.48		0.69	1.11	
Uniform Delay, d1	27.0	8.2	25.1	26.5		35.9	31.8		23.6	28.0	
Delay	27.4	8.8	25.5	27.3		59.2	32.7		24.1	89.0	
LOS	C	A	C	C		E	C		C	F	
Approach Delay	13.8		26.2			55.7			51.6		
Approach LOS	B		C			E			D		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 75 (83%), Referenced to phase 1:NWL, Start of Green	
Natural Cycle: 75	

Control Type: Pretimed
Maximum v/c Ratio: 1.11
Intersection Signal Delay: 35.2 Intersection LOS: D
Intersection Capacity Utilization 83.4% ICU Level of Service D

Splits and Phases: 3: Brookline & Park Drive

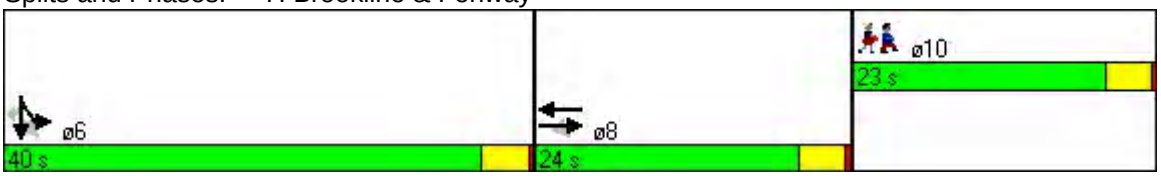


Lane Group	EBT	EBR	EBR2	WBT	SBL2	SBL	SBT	SBR	ø10
Lane Configurations									
Ideal Flow (vphpl)	1700	1700	1700	1700	1000	1700	1250	1700	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Leading Detector (ft)	50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0	0	0	0	
Turning Speed (mph)		9	9		15	15		9	
Lane Util. Factor	0.95	1.00	0.95	0.95	0.91	0.91	0.91	1.00	
Frt		0.850						0.850	
Flt Protected					0.950		0.980		
Satd. Flow (prot)	3061	1369	0	3061	819	0	2113	1369	
Flt Permitted					0.950		0.980		
Satd. Flow (perm)	3061	1369	0	3061	819	0	2113	1369	
Right Turn on Red			No					No	
Satd. Flow (RTOR)									
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	
Link Speed (mph)	30			30			30		
Link Distance (ft)	263			252			337		
Travel Time (s)	6.0			5.7			7.7		
Volume (vph)	674	87	93	1068	979	146	820	194	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	733	95	101	1161	1064	159	891	211	
Lane Group Flow (vph)	733	196	0	1161	585	0	1529	211	
Turn Type		Perm			custom	Perm		Perm	
Protected Phases	8			8	6		6		10
Permitted Phases		8			6	6		6	
Detector Phases	8	8		8	6	6	6	6	
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	24.0	24.0	0.0	24.0	40.0	40.0	40.0	40.0	23.0
Total Split (%)	28%	28%	0%	28%	46%	46%	46%	46%	26%
Maximum Green (s)	20.0	20.0		20.0	36.0	36.0	36.0	36.0	19.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5
Lead/Lag									
Lead-Lag Optimize?									
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	Max	Max		Max	Coord	Coord	Coord	Coord	Ped
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0	0	0	0
Act Effct Green (s)	20.0	20.0		20.0	39.0		39.0	39.0	
Actuated g/C Ratio	0.23	0.23		0.23	0.45		0.45	0.45	
v/c Ratio	1.04	0.62		1.65	1.59		1.61	0.34	
Uniform Delay, d1	33.5	30.1		33.5	24.0		24.0	15.6	
Delay	72.9	31.0		232.1	218.6		222.0	16.2	
LOS	E	C		F	F		F	B	
Approach Delay	64.0			232.1			202.5		
Approach LOS	E			F			F		

Intersection Summary

Area Type:	Other		
Cycle Length: 87			
Actuated Cycle Length: 87			
Offset: 5 (6%), Referenced to phase 6:SBTL, Start of Green			
Natural Cycle: 150			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.65			
Intersection Signal Delay: 181.2		Intersection LOS: F	
Intersection Capacity Utilization 103.5%		ICU Level of Service F	

Splits and Phases: 7: Brookline & Fenway

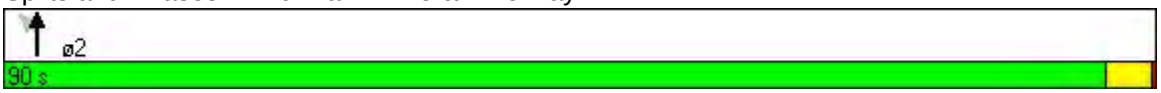


Lane Group	NBL	NBT	SBT	SBR	SEL	SER
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15			9	15	9
Lane Util. Factor	0.97	0.95	1.00	1.00	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	2969	3061	0	0	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	2969	3061	0	0	0	0
Right Turn on Red	No			No		No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)		30	30		30	
Link Distance (ft)		346	219		176	
Travel Time (s)		7.9	5.0		4.0	
Volume (vph)	689	704	0	0	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	749	765	0	0	0	0
Lane Group Flow (vph)	749	765	0	0	0	0
Turn Type	Perm					
Protected Phases		2				
Permitted Phases	2					
Minimum Split (s)	20.0	20.0				
Total Split (s)	90.0	90.0	0.0	0.0	0.0	0.0
Total Split (%)	100%	100%	0%	0%	0%	0%
Maximum Green (s)	86.0	86.0				
Yellow Time (s)	3.5	3.5				
All-Red Time (s)	0.5	0.5				
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	5.0	5.0				
Flash Dont Walk (s)	11.0	11.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	90.0	90.0				
Actuated g/C Ratio	1.00	1.00				
v/c Ratio	0.25	0.25				
Uniform Delay, d1	0.0	0.0				
Delay	0.0	0.0				
LOS	A	A				
Approach Delay		0.0				
Approach LOS		A				

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 2:NBTL, Start of Green	
Natural Cycle: 40	

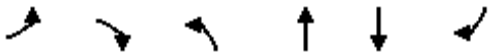
Control Type: Pretimed
Maximum v/c Ratio: 0.25
Intersection Signal Delay: 0.0 Intersection LOS: A
Intersection Capacity Utilization 27.2% ICU Level of Service A

Splits and Phases: 10: Park Drive & Riverway



Lane Group	NBL	NBR	SEL	SER	SWL	SWR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15	9	15	9
Lane Util. Factor	1.00	1.00	1.00	0.76	0.94	1.00
Frt				0.850		
Flt Protected					0.950	
Satd. Flow (prot)	0	0	0	3122	4316	0
Flt Permitted					0.950	
Satd. Flow (perm)	0	0	0	3122	4316	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30		30	
Link Distance (ft)	337		139		216	
Travel Time (s)	7.7		3.2		4.9	
Volume (vph)	0	0	0	1342	797	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	0	0	1459	866	0
Lane Group Flow (vph)	0	0	0	1459	866	0
Sign Control	Stop		Yield		Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 63.1%		ICU Level of Service B	



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	1.00	0.86	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1531	0	0	5542	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1531	0	0	5542	0	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	139			190	148	
Travel Time (s)	3.2			4.3	3.4	
Volume (vph)	233	0	0	685	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	0	0	745	0	0
Lane Group Flow (vph)	253	0	0	745	0	0
Sign Control	Yield			Free	Stop	

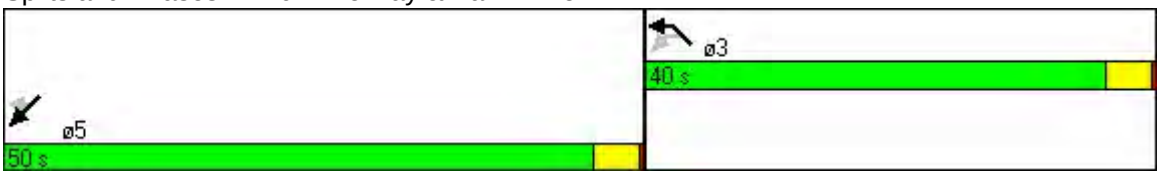
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 34.4%		ICU Level of Service A	

Lane Group	EBL	EBR	NWL2	NWL	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15	15	9	15		9	15		9
Lane Util. Factor	1.00	1.00	0.97	0.94	1.00	1.00	1.00	1.00	1.00	0.95	1.00
Frt											0.850
Flt Protected			0.950	0.950							
Satd. Flow (prot)	0	0	2969	4316	0	0	0	0	0	3061	1369
Flt Permitted			0.950	0.950							
Satd. Flow (perm)	0	0	2969	4316	0	0	0	0	0	3061	1369
Right Turn on Red			No		No			No			No
Satd. Flow (RTOR)											
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30			30			30	
Link Distance (ft)	265			176			216			160	
Travel Time (s)	6.0			4.0			4.9			3.6	
Volume (vph)	0	0	132	557	0	0	0	0	0	665	268
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
Adj. Flow (vph)	0	0	143	605	0	0	0	0	0	723	291
Lane Group Flow (vph)	0	0	143	605	0	0	0	0	0	723	291
Turn Type			Perm								Perm
Protected Phases				3						5	
Permitted Phases			3	3						5	5
Minimum Split (s)			20.0	20.0						20.0	20.0
Total Split (s)	0.0	0.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	50.0	50.0
Total Split (%)	0%	0%	44%	44%	0%	0%	0%	0%	0%	56%	56%
Maximum Green (s)			36.0	36.0						46.0	46.0
Yellow Time (s)			3.5	3.5						3.5	3.5
All-Red Time (s)			0.5	0.5						0.5	0.5
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)			5.0	5.0						5.0	5.0
Flash Dont Walk (s)			11.0	11.0						11.0	11.0
Pedestrian Calls (#/hr)			0	0						0	0
Act Effct Green (s)			36.0	36.0						46.0	46.0
Actuated g/C Ratio			0.40	0.40						0.51	0.51
v/c Ratio			0.12	0.35						0.46	0.42
Uniform Delay, d1			17.0	18.8						14.1	13.6
Delay			15.5	16.5						14.3	14.1
LOS			B	B						B	B
Approach Delay				16.3						14.3	
Approach LOS				B						B	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 84 (93%), Referenced to phase 5:SWT, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.46
Intersection Signal Delay: 15.1 Intersection LOS: B
Intersection Capacity Utilization 41.9% ICU Level of Service A

Splits and Phases: 16: Riverway & Park Drive



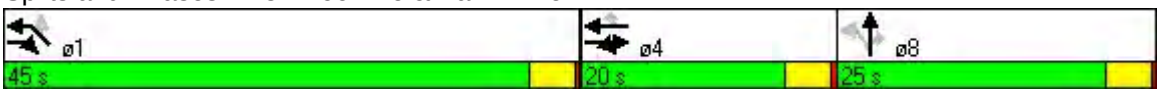
Sandal Design
Future Traffic

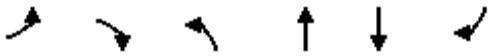
Lane Group	EBT	EBR	WBT	WBR	NBL	NBT	NBR	NBR2	NWL	NWR	NWR2
Lane Configurations											
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9		9	15		9	9	15	9	9
Lane Util. Factor	0.95	0.88	0.95	1.00	1.00	0.95	1.00	0.95	0.97	1.00	0.95
Frt		0.850		0.850			0.850			0.850	
Flt Protected					0.950				0.950		
Satd. Flow (prot)	3061	2410	3061	1369	1531	3061	1369	0	2969	1369	0
Flt Permitted					0.950				0.950		
Satd. Flow (perm)	3061	2410	3061	1369	1531	3061	1369	0	2969	1369	0
Right Turn on Red				No				No			No
Satd. Flow (RTOR)											
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30		30			30			30		
Link Distance (ft)	252		373			148			411		
Travel Time (s)	5.7		8.5			3.4			9.3		
Volume (vph)	446	1207	270	178	82	570	77	43	716	499	28
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
Adj. Flow (vph)	485	1312	293	193	89	620	84	47	778	542	30
Lane Group Flow (vph)	485	1312	293	193	89	620	131	0	778	572	0
Turn Type		custom		Perm	Perm		Perm			Perm	
Protected Phases	4	4 1	4			8			1		
Permitted Phases		4 1		4	8	8	8			1	
Minimum Split (s)	20.0		20.0	20.0	25.0	25.0	25.0		20.0	20.0	
Total Split (s)	20.0	65.0	20.0	20.0	25.0	25.0	25.0	0.0	45.0	45.0	0.0
Total Split (%)	22%	72%	22%	22%	28%	28%	28%	0%	50%	50%	0%
Maximum Green (s)	16.0		16.0	16.0	21.0	21.0	21.0		41.0	41.0	
Yellow Time (s)	3.5		3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5		0.5	0.5	0.5	0.5	0.5		0.5	0.5	
Lead/Lag											
Lead-Lag Optimize?											
Walk Time (s)	5.0		5.0	5.0	5.0	5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0		11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0		0	0	0	0	0		0	0	
Act Effct Green (s)	16.0	61.0	16.0	16.0	21.0	21.0	21.0		41.0	41.0	
Actuated g/C Ratio	0.18	0.68	0.18	0.18	0.23	0.23	0.23		0.46	0.46	
v/c Ratio	0.89	0.80	0.54	0.79	0.25	0.87	0.41		0.58	0.92	
Uniform Delay, d1	36.1	10.2	33.6	35.4	28.1	33.2	29.3		18.0	22.9	
Delay	38.1	9.1	34.0	48.3	28.7	39.8	30.0		18.4	37.0	
LOS	D	A	C	D	C	D	C		B	D	
Approach Delay	16.9		39.7			37.1			26.3		
Approach LOS	B		D			D			C		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 0 (0%), Referenced to phase 1:NWL, Start of Green, Master Intersection	
Natural Cycle: 90	

Control Type: Pretimed
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 26.0 Intersection LOS: C
Intersection Capacity Utilization 83.8% ICU Level of Service D

Splits and Phases: 3: Brookline & Park Drive



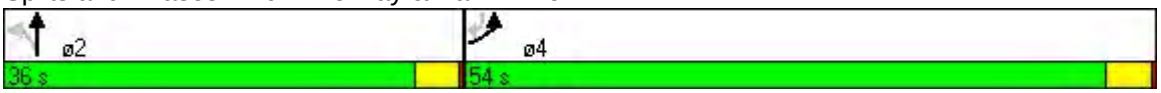


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	0.97	0.95	0.95	0.88
Frt						0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1531	0	2969	3061	0	2410
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1531	0	2969	3061	0	2410
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	148			409	159	
Travel Time (s)	3.4			9.3	3.6	
Volume (vph)	146	0	689	558	0	933
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	0	749	607	0	1014
Lane Group Flow (vph)	159	0	749	607	0	1014
Turn Type			Perm			custom
Protected Phases	4			2		
Permitted Phases			2			4
Minimum Split (s)	20.0		20.0	20.0		20.0
Total Split (s)	54.0	0.0	36.0	36.0	0.0	54.0
Total Split (%)	60%	0%	40%	40%	0%	60%
Maximum Green (s)	50.0		32.0	32.0		50.0
Yellow Time (s)	3.5		3.5	3.5		3.5
All-Red Time (s)	0.5		0.5	0.5		0.5
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)	5.0		5.0	5.0		5.0
Flash Dont Walk (s)	11.0		11.0	11.0		11.0
Pedestrian Calls (#/hr)	0		0	0		0
Act Effct Green (s)	50.0		32.0	32.0		50.0
Actuated g/C Ratio	0.56		0.36	0.36		0.56
v/c Ratio	0.19		0.71	0.56		0.76
Uniform Delay, d1	9.9		25.0	23.3		15.3
Delay	0.2		21.6	19.6		15.9
LOS	A		C	B		B
Approach Delay	0.2			20.7		
Approach LOS	A			C		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 77 (86%), Referenced to phase 2:NBTL, Start of Green	
Natural Cycle: 50	

Control Type: Pretimed
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 17.5 Intersection LOS: B
Intersection Capacity Utilization 70.2% ICU Level of Service C

Splits and Phases: 6: Riverway & Park Drive



Lane Group	EBT	EBR	EBR2	WBT	SBL2	SBT	SBR
Lane Configurations							
Ideal Flow (vphpl)	1700	1700	1700	1700	1400	1750	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	9		15		9
Lane Util. Factor	0.95	1.00	0.95	0.95	0.91	0.91	1.00
Frt		0.850					0.850
Flt Protected					0.950	0.982	
Satd. Flow (prot)	3061	1369	0	3061	1147	2964	1369
Flt Permitted					0.950	0.982	
Satd. Flow (perm)	3061	1369	0	3061	1147	2964	1369
Right Turn on Red			No				No
Satd. Flow (RTOR)							
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30		30	
Link Distance (ft)	263			252		310	
Travel Time (s)	6.0			5.7		7.0	
Volume (vph)	674	87	93	1068	979	820	194
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	733	95	101	1161	1064	891	211
Lane Group Flow (vph)	733	196	0	1161	539	1416	211
Turn Type		Perm			custom		Perm
Protected Phases	4			4	8	8	
Permitted Phases		4			8		8
Minimum Split (s)	20.0	20.0		20.0	20.0	20.0	20.0
Total Split (s)	41.0	41.0	0.0	41.0	49.0	49.0	49.0
Total Split (%)	46%	46%	0%	46%	54%	54%	54%
Maximum Green (s)	37.0	37.0		37.0	45.0	45.0	45.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5		0.5	0.5	0.5	0.5
Lead/Lag							
Lead-Lag Optimize?							
Walk Time (s)	5.0	5.0		5.0	5.0	5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0	0	0
Act Effct Green (s)	37.0	37.0		37.0	45.0	45.0	45.0
Actuated g/C Ratio	0.41	0.41		0.41	0.50	0.50	0.50
v/c Ratio	0.58	0.35		0.92	0.94	0.96	0.31
Uniform Delay, d1	20.5	18.2		25.1	21.2	21.5	13.3
Delay	20.9	18.8		25.4	25.3	24.5	11.9
LOS	C	B		C	C	C	B
Approach Delay	20.4			25.4		23.5	
Approach LOS	C			C		C	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 26 (29%), Referenced to phase 4:EBWB, Start of Green	
Natural Cycle: 60	

Control Type: Pretimed
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 23.4 Intersection LOS: C
Intersection Capacity Utilization 82.8% ICU Level of Service D

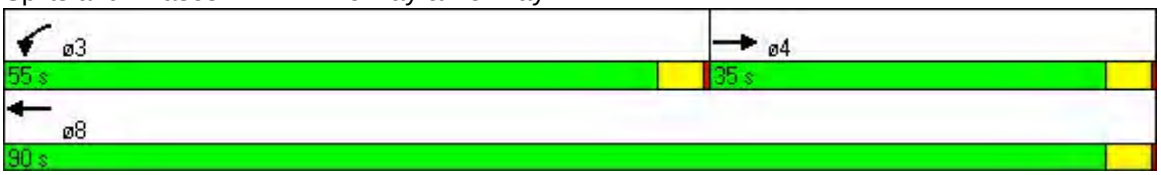
Splits and Phases: 7: Brookline & Fenway

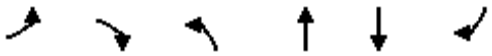
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Lane Util. Factor	1.00	1.00	0.97	0.95	1.00	1.00
Frt						
Flt Protected			0.950			
Satd. Flow (prot)	1611	0	2969	3061	0	0
Flt Permitted			0.950			
Satd. Flow (perm)	1611	0	2969	3061	0	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	223			111	100	
Travel Time (s)	5.1			2.5	2.3	
Volume (vph)	146	0	797	825	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	159	0	866	897	0	0
Lane Group Flow (vph)	159	0	866	897	0	0
Turn Type			Prot			
Protected Phases	4		3	8		
Permitted Phases						
Minimum Split (s)	20.0		8.0	20.0		
Total Split (s)	35.0	0.0	55.0	90.0	0.0	0.0
Total Split (%)	39%	0%	61%	100%	0%	0%
Maximum Green (s)	31.0		51.0	86.0		
Yellow Time (s)	3.5		3.5	3.5		
All-Red Time (s)	0.5		0.5	0.5		
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Walk Time (s)	5.0			5.0		
Flash Dont Walk (s)	11.0			11.0		
Pedestrian Calls (#/hr)	0			0		
Act Effct Green (s)	31.0		51.0	90.0		
Actuated g/C Ratio	0.34		0.57	1.00		
v/c Ratio	0.29		0.51	0.29		
Uniform Delay, d1	21.4		11.9	0.0		
Delay	22.0		11.7	0.0		
LOS	C		B	A		
Approach Delay	22.0			5.7		
Approach LOS	C			A		

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 61 (68%), Referenced to phase 8:WBT, Start of Green	
Natural Cycle: 40	

Control Type: Pretimed
Maximum v/c Ratio: 0.51
Intersection Signal Delay: 7.1 Intersection LOS: A
Intersection Capacity Utilization 43.6% ICU Level of Service A

Splits and Phases: 11: Riverway & Fenway



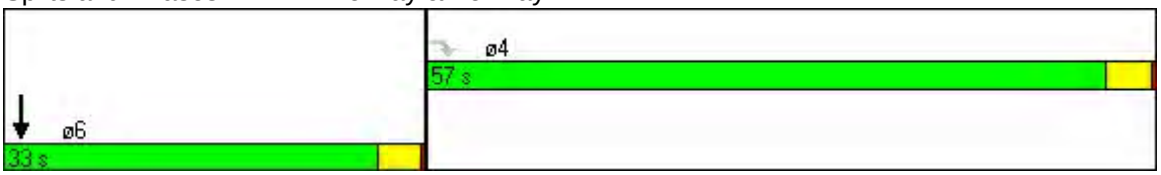


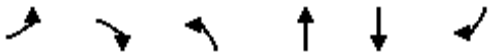
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	0.88	1.00	1.00	0.95	1.00
Frt		0.850				
Flt Protected						
Satd. Flow (prot)	0	2410	0	0	3061	0
Flt Permitted						
Satd. Flow (perm)	0	2410	0	0	3061	0
Right Turn on Red		No				No
Satd. Flow (RTOR)						
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	432			310	100	
Travel Time (s)	9.8			7.0	2.3	
Volume (vph)	0	1196	0	0	797	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1300	0	0	866	0
Lane Group Flow (vph)	0	1300	0	0	866	0
Turn Type		custom				
Protected Phases					6	
Permitted Phases		4				
Minimum Split (s)		20.0			20.0	
Total Split (s)	0.0	57.0	0.0	0.0	33.0	0.0
Total Split (%)	0%	63%	0%	0%	37%	0%
Maximum Green (s)		53.0			29.0	
Yellow Time (s)		3.5			3.5	
All-Red Time (s)		0.5			0.5	
Lead/Lag						
Lead-Lag Optimize?						
Walk Time (s)		5.0			5.0	
Flash Dont Walk (s)		11.0			11.0	
Pedestrian Calls (#/hr)		0			0	
Act Effct Green (s)		53.0			29.0	
Actuated g/C Ratio		0.59			0.32	
v/c Ratio		0.92			0.88	
Uniform Delay, d1		16.5			28.8	
Delay		22.5			19.6	
LOS		C			B	
Approach Delay					19.6	
Approach LOS					B	

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Offset: 80 (89%), Referenced to phase 6:SBT, Start of Green	
Natural Cycle: 70	

Control Type: Pretimed
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 21.4 Intersection LOS: C
Intersection Capacity Utilization 84.3% ICU Level of Service D

Splits and Phases: 12: Riverway & Fenway





Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700
Turning Speed (mph)	15	9	15			9
Lane Util. Factor	1.00	1.00	1.00	0.86	1.00	1.00
Frt						
Flt Protected	0.950					
Satd. Flow (prot)	1531	0	0	5542	0	0
Flt Permitted	0.950					
Satd. Flow (perm)	1531	0	0	5542	0	0
Headway Factor	1.04	1.04	1.04	1.04	1.04	1.04
Link Speed (mph)	30			30	30	
Link Distance (ft)	139			190	148	
Travel Time (s)	3.2			4.3	3.4	
Volume (vph)	87	0	0	685	0	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	95	0	0	745	0	0
Lane Group Flow (vph)	95	0	0	745	0	0
Sign Control	Yield			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 24.6%		ICU Level of Service A	