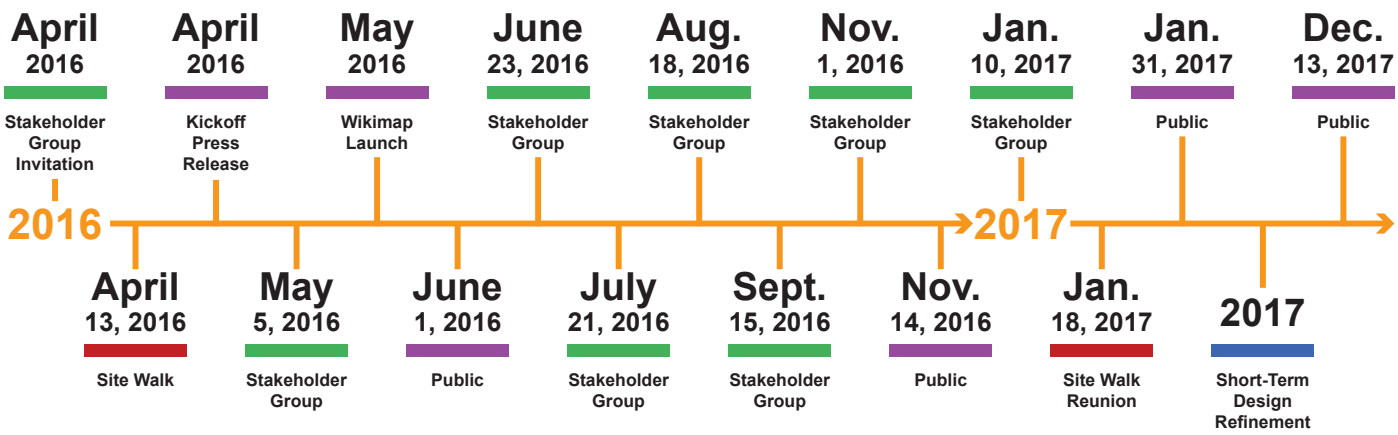
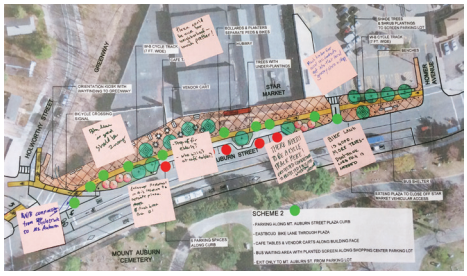
Design Development and Concepts

After establishing the shared goals in June 2016, work on the long-term design began in earnest, and a basic short-term design concept was created to refer to throughout the project. The short-term design maintained existing medians and catenary poles for the MBTA's trackless trolley buses and employed low-cost changes to gain some of the benefits of the long-term design. The short-term design focused on the Mount Auburn Street and Fresh Pond Parkway intersection, the bicycle connection to the Charles River, and the transit priority lanes and signals.

Five more stakeholder meetings and two additional public meetings were held during the long-term concept design process to ensure the direction of the design was in concordance with community needs with the public feedback. In several instances, balance (established as a shared value) was needed to resolve needs that were in conflict with each other. It was clear from the outset of the project that some neighborhood residents desired bus lanes in both directions for the entire length of the corridor, others wanted protected bike lanes on every part of the project, and still others objected to any lanes being taken away from traffic regardless of what traffic analysis predicted. Through careful study, data analysis, and observation, a plan was created that attempted to balance as many needs as possible, focusing on the idea of moving more people through the corridor at a faster rate in the morning peak hours. With this democratic approach, established in the shared goals (measure people, not cars), a concept for a higher performance Mount Auburn Street corridor was created. See **Figure 16**.

Figure 16. **Public Process for the Mount Auburn Street Corridor Study**





Design Alternatives and Discussions

The next few sections detail the major conversation points the stakeholder group and design team encountered on the way to the final concept design. These sections will allow newcomers to understand how the concepts were initially reached. Before delving into details of the final concept design, it is helpful to discuss what it is not. A number of different ideas were discussed, tested, and ultimately put aside before the stakeholder group and project team came to the concept described in this report. These ideas came from the community, traffic engineers, and historical evidence of how the intersections in question were configured historically. The alternatives discussed generally focused on four intersections where more than one general direction was proposed. These intersections were Mount Auburn Street and Fresh Pond Parkway, Brattle Street and Mount Auburn Street, and the two three-legged interchanges connecting Gerrys Landing Road, Memorial Drive, the Eliot Bridge, and Greenough Boulevard (which were discussed together as a pair). The design alternatives for these four intersections are discussed in the following sections.

MOUNT AUBURN STREET AT FRESH POND PARKWAY

The design team looked at seven different ideas before settling on the final concept: two Double-T ideas, two roundabout ideas, one continuous flow intersection idea, and two tunnel ideas. The results of these considerations are as follows.

DOUBLE-T CONCEPTS

Two distinct concepts for squaring up the skewed intersection of Mount Auburn Street and Fresh Pond Parkway were explored in the study.

One Double-T concept maintained Mount Auburn Street as the primary street and created two T-intersections, one with Fresh Pond Parkway and one with Gerrys Landing Road. The volumes making these additional turns would require additional left-turn lanes from Fresh Pond Parkway southbound, and additional left-turn lanes from Gerrys Landing Road to handle that increased demand, both of which would create a longer crossing for pedestrians and bicyclists.

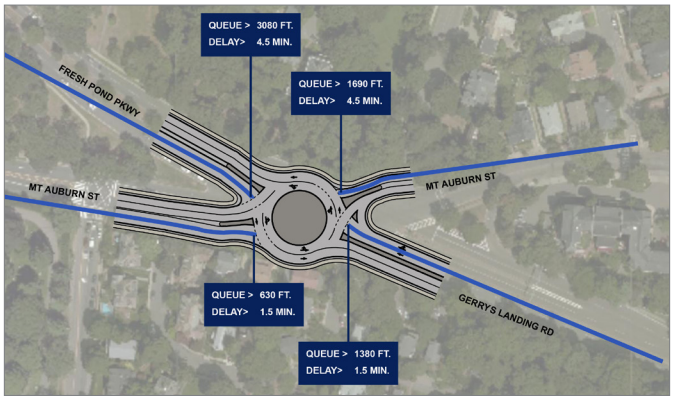
T Concept with Mount Auburn Street as the primary street.

A second Double-T concept maintained Fresh Pond Parkway as the primary street and created two-T intersections, one with the western approach of Mount Auburn Street and one with eastern approach. This concept creates a similar problem with the first one, as now Mount Auburn Street eastbound vehicles will have to turn right at one intersection, but then turn left at the next so they can continue on Mount Auburn Street eastbound – maneuvers which will impede bus operations and efficiency on the eastbound direction in the a.m. peak and the westbound direction in the p.m. peak, problems that exist today.

T Concept with Fresh Pond Parkway as the primary street.

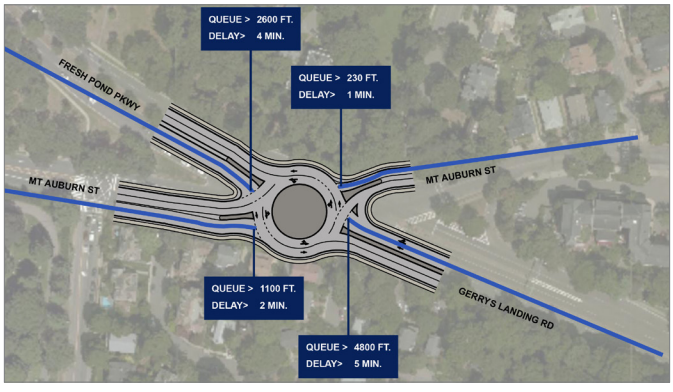
ROUNDABOUTS

Suggestions for a roundabout at this location came in two forms. One suggestion came from a community member who had enjoyed visiting La Rotonda in Lacarno, Switzerland, which is large enough to include a community event space in its center connected to the community through underground tunnels. This concept, however, was too grand for this location due to its size. Switzerland's La Rotonda is 465 feet in diameter, which, at this location in Cambridge, would require the removal of several privately-owned houses and encroach significantly on the Old Cambridge Historic District.



a.m. peak-hour traffic queues with a two-lane roundabout

A second suggestion arose from the fact that at one time in history the intersection was indeed a variant of a rotary (as distinct from a roundabout), albeit with trolley tracks running directly through its center. This was discovered on aerial photos of the area taken in 1952 and 1955 and is believed to be a short-lived design; by 1962, the intersection had been reconstructed in its current configuration. The rotary was not in place in earlier photos from 1938. The rotary of that time maintained three northbound lanes at its northbound approach, a practice that is not consistent with today's practice due to safety concerns.



p.m. peak-hour traffic queues with a two-lane roundabout

The volume that goes through the Fresh Pond Parkway/ Gerrys Landing Road/Mount Auburn Street intersection requires at least a two-lane roundabout. To construct a modern two-lane roundabout at this location it was found that a 168-foot diameter roundabout would be needed. This would also encroach on private land, threatening either houses on Coolidge Hill Road or encroaching significantly on privately owned land in the Old Cambridge Historic District and affecting Lowell Park, which is also of historical significance.

HSH's analysis of the roundabout concept using SIDRA 6.0 software found that Fresh Pond Parkway southbound traffic queues in the a.m. peak could reach up to 3,100 feet, and Fresh Pond Parkway northbound traffic queues in the p.m. peak could reach over 4,800 feet. The SIDRA analysis outputs are provided in **Appendix B**. In both instances, the traffic queues would extend into other intersections, creating a potential for gridlock.

Finally, as pedestrian and bicycle accommodations need to be improved at this intersection, shared-use paths would need to be considered adjacent to a roundabout to accommodate both of these modes – something that would require additional land to install. A two-lane roundabout can also introduce pedestrian and bicycle safety issues when they attempt to cross the approaching and departing lanes, usually requiring signalization and impacting the efficiency of the roundabout.

UNDERPASSES AND TUNNELS

At more than one meeting, the idea of an underpass/tunnel was brought up to help increase the free flow of traffic at this intersection. The team looked at the idea of tunneling Fresh Pond Parkway under Mount Auburn Street, and also the idea of tunneling Mount Auburn Street under Fresh Pond Parkway. In both cases, the width and length of the necessary infrastructure was prohibitive.

In the case of Fresh Pond Parkway under Mount Auburn Street, the width required to provide the appropriate number of lanes, medians, sidewalks, and other elements was 120 feet. The length required to provide minimum vehicle clearances to get under a Mount Auburn Street bridge was

850 feet and extended further to the north than to the south due to existing grades. This would require taking a significant amount of land from historic Lowell Park and would also impact the Old Cambridge Historic District. In addition to potential local opposition from the Friends of Lowell Park, the land takings would require lengthy municipal, state, and federal processes that would not be guaranteed to be successful given that the current intersection at Fresh Pond Parkway and Mount Auburn Street can be redesigned to process the traffic volumes of today more efficiently without encroaching on park land.

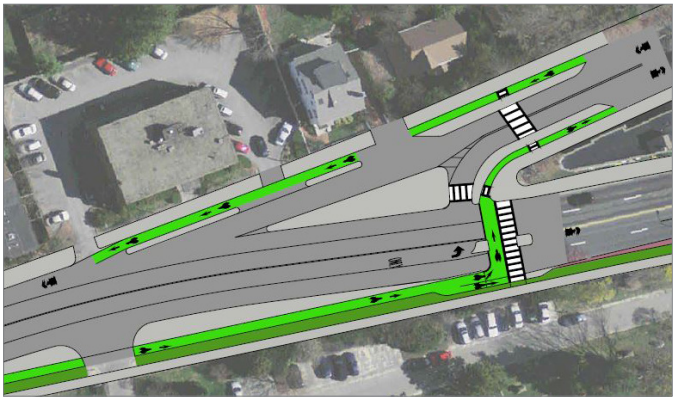
The image above shows the approximate width and length that would be required for a tunnel under Mount Auburn Street."

The possibility of running Mount Auburn Street under Fresh Pond Parkway was also discussed and determined infeasible, as the impacts would be even greater than vice versa. It would have a direct impact to houses, and possibly the cemetery abutting Mount Auburn Street. Maintaining the catenary for the buses under Fresh Pond Parkway would require additional clearance, necessitating a longer underpass and creating even greater impacts to the surrounding area.

MOUNT AUBURN STREET AND BRATTLE STREET

MAINTAIN THE MERGE ALTERNATIVE

Based on recommendations from the August 2016 RSA, the project team first proposed creating a T-intersection of both the eastbound and westbound lanes of Brattle Street, in place of the westbound traffic merge with Mount Auburn Street that is in place today. The design includes a traffic signal to improve the pedestrian crossing of both streets, and to allow Brattle Street westbound a clear opportunity to enter Mount Auburn Street westbound lanes. When this design was proposed, some community members were skeptical of its operation. Based on that feedback, the team tested both the T-intersection option and another option that preserved the merge.



Community members had the opportunity to vote on Option B, which maintained the merge, at a public meeting on November 14, 2016. The maintain the merge option was ruled out for safety reasons based on the findings of the RSA at the intersection.

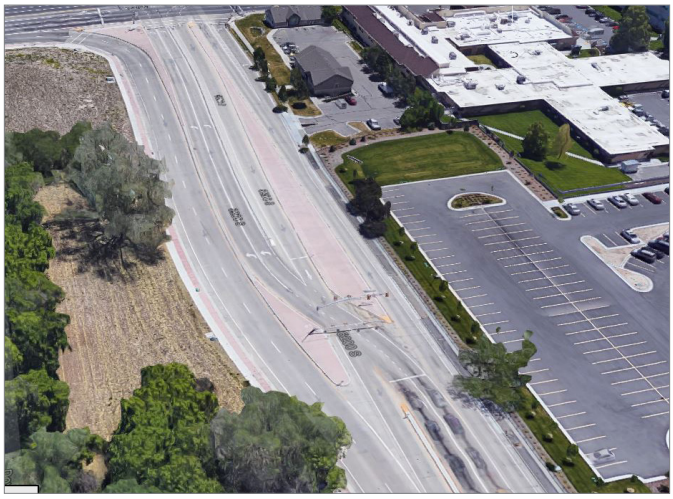
Both concepts were able to handle traffic volumes in VISSIM simulations. VISSIM is a type of multi-modal traffic flow simulation software created in Germany to model traffic in cities. In addition to the geometry of intersections and roadways, traffic signal cycles and timings are a factor in traffic performance and are adjustable. Because both options operating efficiently, the option to maintain the traffic merge was eliminated based on the many collisions attributed to the traffic merge in the RSA.

THREE-LEGGED INTERCHANGES CONNECTING GERRYS LANDING ROAD, MEMORIAL DRIVE, THE ELIOT BRIDGE, AND GREENOUGH BOULEVARD

CONTINUOUS-FLOW INTERSECTION (DISPLACED LEFTS)

The idea of a continuous flow intersection was suggested by a stakeholder representing MassDOT. A continuous flow intersection, also called a crossover displaced left, is an intersection where vehicles turn across the opposing direction of traffic before they enter the intersection. No

separate left turn signal phase in the intersection is necessary. Instead, vehicles traveling in both directions can proceed straight on green at the same time, allowing free-flowing left turns.



A continuous flow intersection in Taylorsville, Utah. Source: GoogleEarth

Based on the spacing of the two intersections on Gerrys Landing Road, not enough length was available to provide the necessary queue storage for the double left-turns to store the heavy left-turning Gerrys Landing Road northbound volumes in the p.m. peak between the new intersection and Memorial Drive. This would create a spillback into the Memorial Drive intersection.

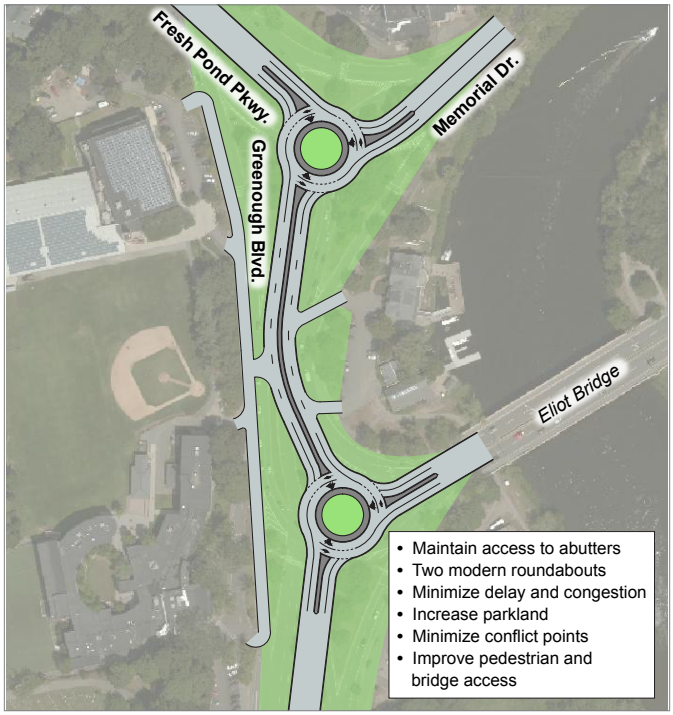
Furthermore, Gerrys Landing Road would have a six-lane cross-section at the left-turn cross-over point; two lanes southbound, two lanes northbound, and the two northbound left-turn lanes. Pedestrians crossing Gerrys Landing Road at Mount Auburn Street would still have to make a three-stage crossing, as medians would need to be constructed to separate all the conflicting moves on Gerrys Landing Road. This width and the overall vehicle-centric design does not meet the shared goals of the neighborhood and is contrary to the parkway context community members have voiced support for.

DOUBLE ROUNDABOUTS

Roundabouts were also studied for these two large interchanges by the Charles River. Space is plentiful; however, the dominant flow of traffic is moving between the Eliot Bridge and Fresh Pond Parkway, and this traffic pattern overwhelms the design's ability to merge existing traffic.

Using SIDRA 6.0 software, the team determined that during the a.m. peak hour, the two roundabouts created long traffic queues on all approaches. Greenough Boulevard experienced queues that exceeded 2,000 feet. The p.m. peak produced similar queues with one exception: the queue extending back onto Gerrys Landing Road northbound from Memorial Drive reached beyond 1,900 feet and spilled onto the Eliot Bridge.

Two-lane roundabouts are often difficult to make safe for pedestrians and cyclists. Though, in this case, the space is not constrained, offering opportunities to create safe crossings well outside of the roundabouts. Nevertheless, the significant traffic delays ruled this option out.



A concept for double roundabouts near the Charles River was tested, but did not manage traffic well.

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