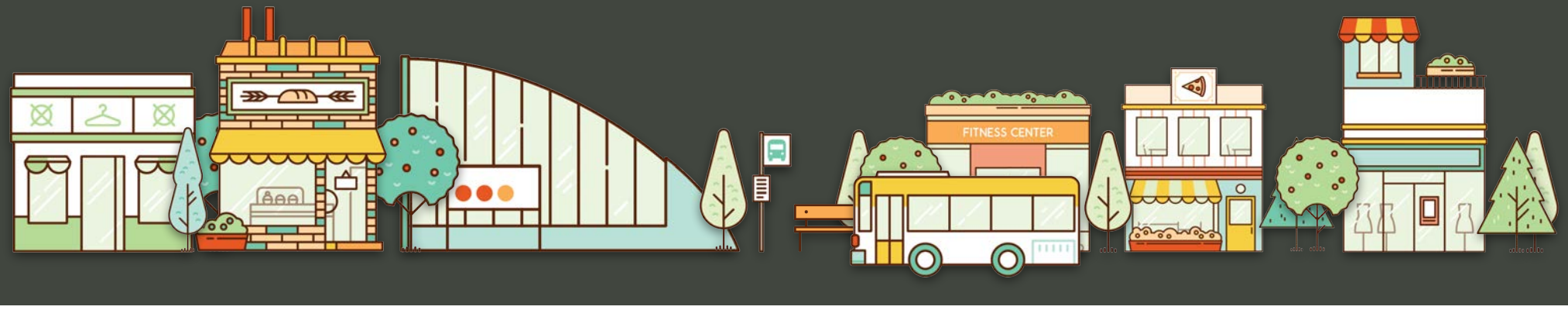
The Northland Newton Development

TRANSPORTATION IMPLEMENTATION PLAN

128

Final Report
produced by 128 Business Council
for Northland Investment Corporation
October 16, 2018 (update)



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EXECUTIVE SUMMARY

pre-existing conditions

128 Business Council performed an analysis of the preexisting transportation infrastructure available at and around the Northland Newton Development, which particularly highlighted the difficulty presented to commuters hoping to **(a) reach major transportation hubs or (b) make north-south trips** more generally from the Development area by means of the current alternative transportation options.

128 Business Council also performed an extensive survey of commuters into and out of the Newton-Needham area, collecting information about demographics, commuting origins and destinations, and transportation usage, modes, and attitudes. Relative to the Development, the most important aspect of this survey was the analysis of trip zip code data, which was used to create frequency maps of the origins, destinations, and most common trips taken by the 1320 survey participants.

This origin/destination analysis highlighted the fact that shuttle routes that focus on getting single-occupancy vehicles off the road for **internal trips (trips between and within Newton and Needham) would have the greatest impact on congestion reduction**. That said, for shuttle routes to have a genuine impact on congestion, they must be part of a broad plan to encourage a **car-free transportation lifestyle**. It is therefore important to plan for a wide range of trip types—not just those trips that are anticipated to be highest frequency.

the transportation hub

The four routes recommended here would all depart from and return to a central transportation hub, with interior and exterior real-time signage, curb cutouts for staging multiple shuttles, and a pleasant indoor waiting area. The hub will serve as a clearly visible sign of the Development's commitment to all modes of alternative transportation.

On the interior of the transit hub, 128bc recommends the use of TransitScreen digital information boards or similar technology, while on the exterior of the hub 128bc recommends the use of both weatherproof electronic displays and weatherproof static maps.

The transportation hub will serve both shuttle and MBTA riders, since it will be located adjacent to a preexisting MBTA stop. Digital and static signage will also point residents and customers toward the Development's bike & bikeshare, carshare, carpool/vanpool, and Transportation Network Company (TNC, e.g. Uber and Lyft) connections.

Managing TNC usage must be seen as a priority for the Northland Newton Development. This will be achieved through the establishment of TNC-specific pick-up/drop-off points, which need to be isolated from the shuttles' path of travel and from other high-traffic areas, while still offering sufficient convenience to actually be used.

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the rider experience

Running successful shuttle routing involves more than moving riders from Point A to Point B. 128 Business Council provides marketing, communication, and technology services—including 128bc's Rider App, which integrates AVL, GPS, trip planning, shuttle tracking, fare collection, ridership counting, and rider-facing communication. 128bc builds and maintains dedicated webpages for every route, where riders can see schedule and fare information, map out the shuttle's stops, purchase tickets, watch for route-specific shuttle notifications, etc. 128 Business Council will also provide additional services and programs meant to support alternative transportation users of all modes, including 128bc's **Emergency Ride Home program** which provides alternative commuters with a guaranteed ride home in the event of an emergency.

service phasing

The routes proposed here are meant to be phased into service in step with the phasing of the Development. This phasing will allow specific route stops, timings, and service hours to be adjusted to suit the needs of an evolving ridership. Given all of the advancements being made by the City and other regional actors, a successful route system must be responsive to changing conditions—responsive to new housing patterns, responsive to economic development, and especially responsive to the surrounding community's evolving commuting patterns.

proposed route 1: newton circulator

- Provides service to:
  - **Newton Highlands:** Newton Highlands represents the closest, most convenient location by which to connect the Development to the Green Line (D-Riverside Branch), and also offers primary access to the Route 59 bus.
  - **Newton Centre:** This location offers primary access to both the Green Line (D-Riverside Branch) and the Route 52 bus, as well as a preexisting ZipCar hub. Both the Route 59 bus and the Route 52 bus connect to Watertown, but the latter operates on a more limited schedule. **Why two Green Line connections on one route?** This route is meant to serve trips *internal* to Newton, not just trips leaving Newton via the Green Line.
  - **Newtonville:** Newtonville provides the closest access to the Worcester/Framingham Line. The shuttle stop would serve riders traveling to/from the Framingham/Worcester area, as well as riders heading in and out of Boston. The Newtonville stop could also be used by local commuters who are not actually taking the commuter rail, but for whom Newtonville is a convenient hub, thereby reducing congestion generated by local trips. Building this kind of ridership in particular would require effective community education.
  - Potential range of service hours: 5:15am - 1:00am weekdays. 6:15am - 1:00am weekends.

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- Potential frequency: 30 or 45 minutes during rush-hour service. 45 minutes during the rest of the weekday and all weekend.
- Potential weekly rides*: 18,410
- **Scaled schedule options:** The best option for scaling the schedule would be to limit service hours by trimming early-morning and late-night service.
- **Alternate Off-Peak Routing:** This route could be adjusted during off-peak hours (midday, late evening, weekends) in order to drive more shopping and dining business to the Development, and in order to better connect the Development's residents to high-interest locations. However, 128bc advises waiting to plan out such alternate routing until further along in the process when alternative stops could be identified based upon more up-to-date information regarding commercial trends, building occupancies, and other shuttle routes currently in development.
- **Phased Expansion:** The Newton Circulator would be the most efficient option for scaling services up in order to increase overall system capacity. Not only does it have the highest stops-to-travel-time ratio, but it is the most multi-functional of the routes—thanks to accommodating local, Green Line, and commuter rail connections. For example, the second vehicle (used during peak commuting hours only in the initial schedule) could also be kept on throughout the day in order to accommodate more local stops while maintaining 45-minute frequencies.

proposed route 2: needham commuter

- Provides service to:
  - **Needham Heights:** Connects to the Commuter Rail-Needham Line and Route 59 Bus. Commuter rail service runs Monday-Saturday, and terminates inbound at South Station. Needham Heights is the western end of the line, so the shuttle would exclusively offer service in and out of Boston. In the morning, the Needham Heights shuttle stop would allow the shuttle to drop off commuters heading into Boston and pick up commuters coming into Newton. In the evening, the shuttle would drop off riders heading into Boston (for late-shift work or recreational purposes) and then pick up commuters returning to Newton. The shuttle could also pick up local-trip commuters, who would be using Needham Heights as a convenient hub.
- Potential range of service hours: 5:45am - 10:30 and 4:30 - 8:30, Monday-Friday.
- Potential frequency: 35-45 minutes, variable to better accommodate commuter rail schedule.
- Potential weekly rides*: 3,680.

* Potential weekly rides are an estimate of the maximum number of single-occupancy trips that can be prevented by a shuttle route, and are related to shuttle capacity. Please note that potential weekly rides are not a projection of actual ridership. In fact, in an ideal scenario, ridership would always stay slightly below this number, so that riders would never have to wait for the next shuttle because of insufficient seats.

EXECUTIVE SUMMARY

- **Phased Expansion:** Since the Newton Circulator (Route 1) focuses on northbound stops, the Needham Commuter route could be expanded—both in terms of service hours and number of stops—to create connectivity with additional locations south of the Development. This would effectively turn this route into a second local circulator. However, structuring a local circulator around the Needham Line would only make sense if and when commuter rail ridership has been established.
- **Should this route be included at all?** Developers, tenants, and residents in the Development area frequently request a connection with Needham Heights. Ultimately, the utility of this stop will depend upon its role within the shuttle system as a whole. Service could be launched on a trial basis, and if ridership does not build, the route could be adjusted, or the shuttle could be taken off that route entirely and devoted to expanding a higher-demand route.

proposed route 3: cambridge express

- **128bc judges this to be the highest priority among the express shuttle services analyzed.** Without a dedicated shuttle, getting to Central Square or Kendall from the Development would require riders to take the circulator shuttle to Newton Highlands, then transfer from the Green Line to either the Red Line or a bus. Even before accounting for delays, the trip would take a minimum of 65 minutes and two transfers, which makes it an unlikely sell for commuters.
- Provides service to:
  - **Central Square:** Connects to the Red Line, as well as the Route 1, Route 47, Route 64, Route 70/70A, Route 83, Route 91, and CT1 buses.
  - **Kendall Square:** Connects to the Red Line, as well as the Route 64, Route 68, Route 85, and CT2 buses.
- Potential range of service hours: 5:45am - 12:45am, Monday-Sunday.
- Potential frequency: 60 minutes.
- Potential weekly rides: 8,288.
- **Scaled schedule options:** In addition to potentially trimming early-morning and late-night service hours, it would be possible to only use a second vehicle during peak commuting hours—although this would mean having every-other-hour service during much of the day.
- **Phased Expansion:** Unless heavy ridership demands it, or increasing traffic congestion increases travel times and therefore reduces frequency, neither this route nor the Boston Express are good candidates for scaling up service.

EXECUTIVE SUMMARY

proposed route 4: boston express

- Provides service to:
  - **Seaport/World Trade Center**
  - **South Station**
- **Service details and scaled schedule options are equivalent to Cambridge Express**.
- **On-Demand Routing:** The problem with on-demand routing is that shuttle availability, pick-up times, and on-board duration would vary from day-to-day—making on-demand routing an unreliable solution for riders who are commuting to and from work or for other repetitive, time-sensitive trips. However, on-demand routing could be worth exploring for off-peak trips, especially on weekends. For example, a combined on-demand Cambridge/Boston service during off-peak hours could integrate more stop locations (like Copley Square).

achievable ridership goals

Extrapolating from the limited data available and reflecting upon past service metrics, 128bc believes that an achievable ridership goal would be to reach 75% capacity for on-peak runs and 30% capacity for off-peak runs after 6-12 months for Route 1, and 60% capacity for on-peak runs and 20% capacity for off-peak runs for Routes 2, 3 and 4. (Note that Route 2 only has on-peak service.)

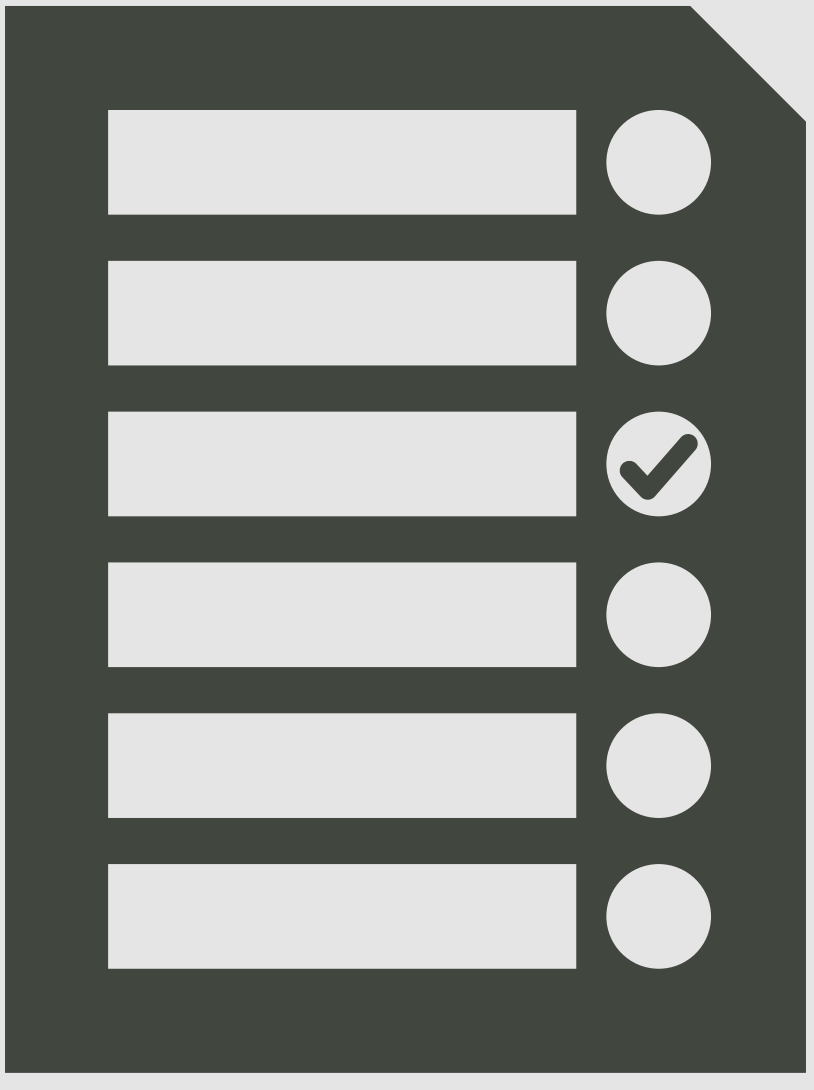
This goal can be used as a benchmark by which to consider making adjustments to timetables, stops, routing and communications & advertising, all of which will be periodically evaluated and recalibrated in order to better reach the Northland Newton Development's congestion reduction goals.

Assuming implementation of the full schedule for each route, here's what meeting these ridership goals would look like:

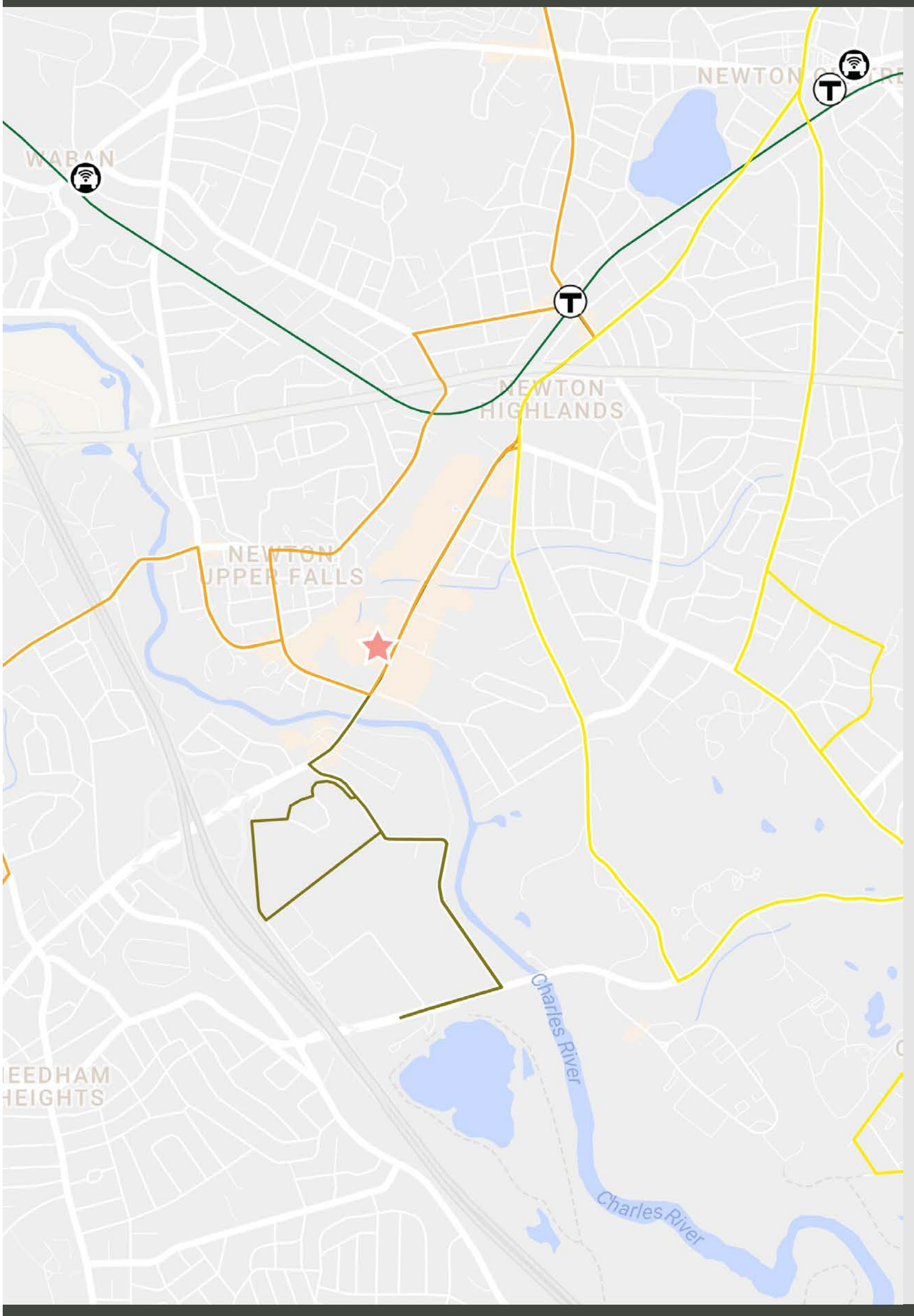
	Route 1	Route 2	Route 3	Route 4	
weekday on-peak capacity	1378	736	672	672	3458
on-peak ridership goal	1033.5	441.6	403.2	403.2	**2281.5 trips**
weekly off-peak capacity	1344	--	512	512	2368
off-peak ridership goal	403.2	--	102.4	102.4	**608 trips**
total capacity	2722	736	1184	1184	5826
total weekday ridership goal	1436.7	441.6	505.6	505.6	**2889.5 trips**

When combined with other transportation mode shifts (public transportation, bikeshare, carpool), meeting or exceeding these ridership goals would make a significant impact in terms of offsetting new trips and reducing pre-existing congestion.

PRE-EXISTING CONDITIONS



ANNOTATED MAPS



The Northland Newton Development

MBTA stations included in proposed routes

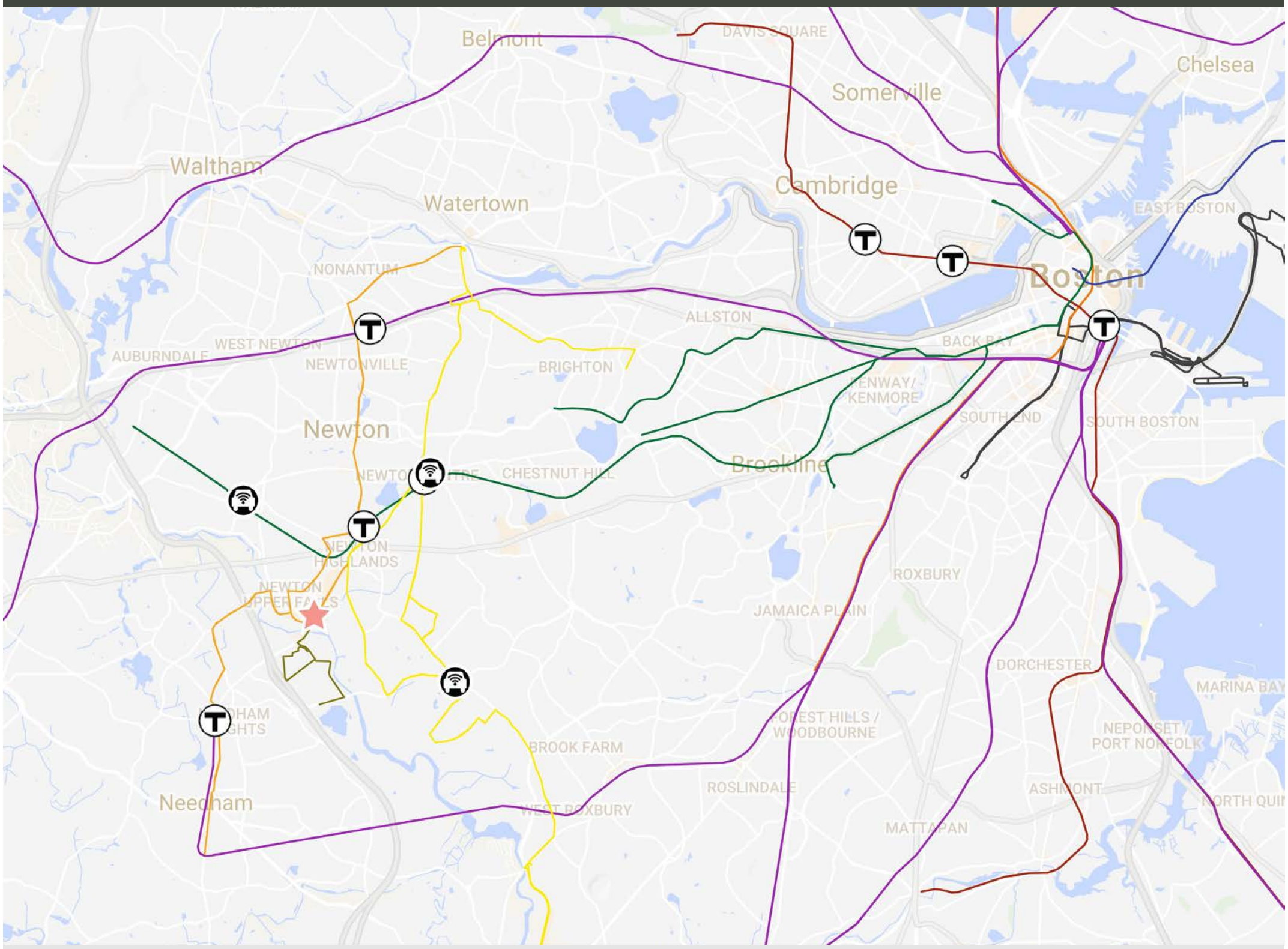
128bc's Needham Shuttle

MBTA Route 59 Bus, including extensions

MBTA Route 52 Bus, including extensions

MBTA Green Line (D-Riverside Branch)

ANNOTATED MAPS



Closest preexisting carshare locations
Top left: Zipcar hub at Waban Green Line Station, 1.9 miles from Development
Top right: Zipcar hub at Newton Center, 2.1 miles from Development
Bottom right: Zipcar hub at UMass Amherst—Mount Ida, 2.8 miles from Development

MBTA Commuter Rail Lines
Immediately above Development: Worcester/Framingham Line
Immediately below Development: Needham Line

As shown in these maps, the preexisting alternative transportation options do not make it particularly easy for commuters to (a) reach major transportation hubs or (b) make north-south trips more generally from the Development area.

ANNOTATED MAPS

mbta rapid transit

The closest MBTA rapid transit line to the Northland Newton Development is the Green Line (D-Riverside Branch), and the closest station as the crow flies is Eliot Station. However, without the addition of a pedestrian route, the walk from the Development to Eliot increases from 0.85 miles to 1.6 miles. The next closest Green Line station is Newton Highlands, which is ~1.2 miles from the Development by foot or car.

The Green Line D-Riverside Branch offers service seven days/week, with service spanning from roughly 5:00 A.M. until 12:15 A.M. daily. Trains arrive every 5-7 minutes during rush hour, with frequency falling to every 6-12 minutes during off-peak hours.

mbta commuter rail

The closest commuter rail line to the Development is the Needham Line via Needham Heights Station, which is 1.75 miles away regardless of transit mode. It offers sixteen round trips weekdays to Ruggles, Back Bay, and South Station, and nine round trips on Saturdays. (There is no Sunday service.) The travel time via the Needham Line from South Station to the Development is around 45 minutes.

mbta buses

The Route 59 bus, which runs from Needham Junction to Watertown Square, provides the closest bus service. The closest stop on the main route (at the intersection of Chestnut and Oak) is immediately adjacent to the Development. This main route makes 22 round trips on weekdays and 8-9 on weekend days, with the maximum weekday frequency around 35-45 minutes.

Route 59a provides service directly to Needham street, but currently only offers limited trips (with 60-90 min wait times), weekdays only.

The Route 52 bus, which runs from Dedham to Watertown Yard, operates slightly outside the immediate Needham Street area, but does connect with some potential shuttle routes. The closest stop on the main route (at Parker and Dedham) is a 1.3 mile walk from the Development. Route 52 offers significantly less frequent weekday service than Route 59, and no weekend service.

Route 52e provides service closer to the Development out of Newton Centre, via Centre and Winchester Streets, but offers only limited, one-way trips—again, weekdays only.

128bc needham shuttle

128 Business Council already runs one route within the Needham Street area. The service runs from the Newton Highlands Green Line station to major Needham developments, with seven trips running from Newton Highlands in the morning and six inbound trips returning to Newton Highlands in the evening. It operates on weekdays only.

SURVEY DATA

128 Business Council conducted an extensive survey of commuters into and out of the Newton-Needham area, collecting information about demographics, commuting origins and destinations, and transportation usage, modes, and attitudes.

Relative to the Northland Newton Development, the most important aspect of this survey was the analysis of **trip zip code data**, which was used to create frequency maps of the origins, destinations, and most common trips taken by the 1320 survey participants. The 30 most common trips are summarized in the table below.

	origin	destination			
1	Needham	Needham Heights	16	Newton Highalnds	Needham Heights
2	Newton Center	Newton Center	17	Ashland	Newton Center
3	Newton Center	Needham Heights	18	Norwood	Newton Center
4	Newtonville	Newton Center	19	Waltham	Newton Center
5	Needham	Needham	20	Waltham	Newton Center
6	Needham Heights	Needham Heights	21	Newton Center	Needham
7	Needham	Newton Center	22	Newtonville	Needham Heights
8	Brighton	Newton Center	23	West Newton	Newton Highlands
9	Needham Heights	Newton Center	24	Needham	Newton Upper Falls
10	Newton Highlands	Newton Center	25	Needham Heights	Newton
11	Newton	Newton Center	26	Framingham	Newton Center
12	Newton Upper Falls	Newton Center	27	Natick	Newton Center
13	West Newton	Newton Center	28	Allston	Needham Heights
14	West Newton	Needham Heights	29	Auburndale	Needham Heights
15	Brighton	Needham Heights	30	Needham Heights	Needham

Newton | Needham | Outside Newton/Needham

This origin/destination analysis highlights the fact that shuttle routes that particularly focus on getting single-occupancy vehicles off the road for **internal trips (trips between and within Newton and Needham) would have the greatest impact on congestion reduction.** That said, for shuttle routes to have a genuine impact on congestion, they must be part of a broad plan to encourage a **car-free transportation lifestyle**. It is therefore important to plan for a wide range of trip types—not just those trips that are anticipated to be highest frequency.

THE TRANSPORTATION HUB

The four routes recommended here will all depart from and return to a ***central transportation hub****, with interior and exterior real-time signage, curb cutouts for staging multiple shuttles, and a pleasant indoor waiting area. The hub will serve as a clearly visible sign of the Development's commitment to all modes of alternative transportation.*

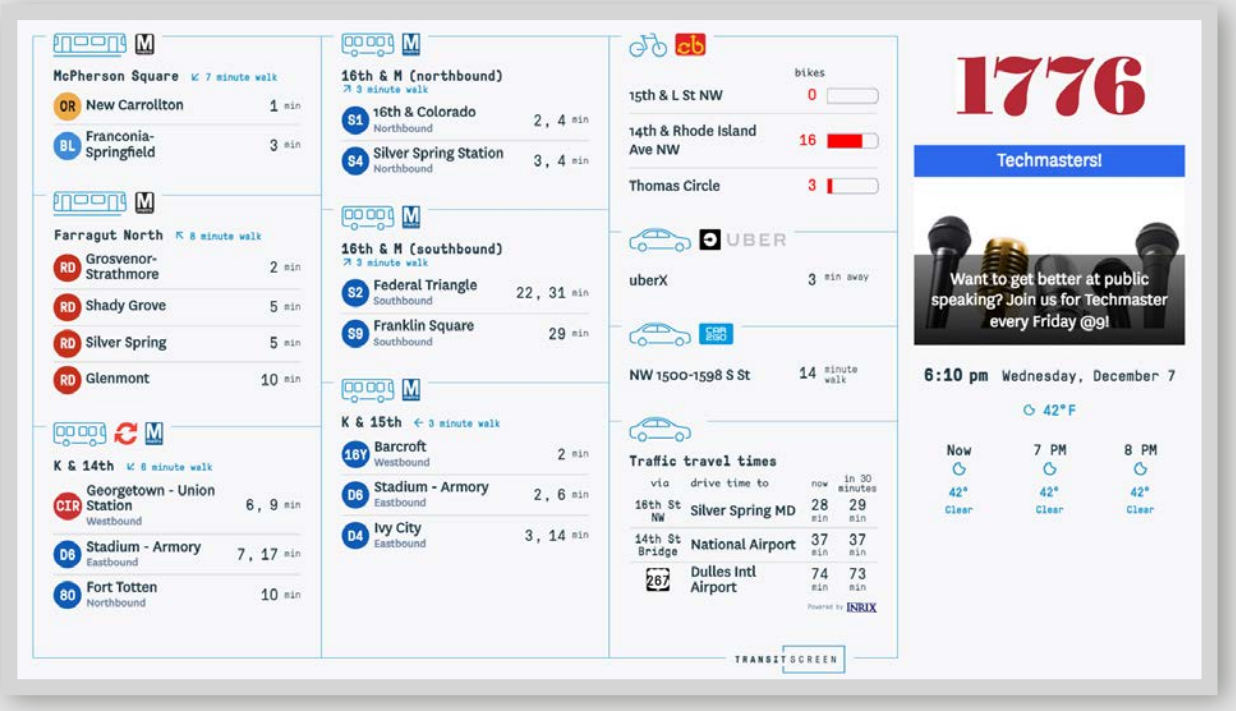
POSSIBLE EXTERIOR FEATURES

A shuttle stop for the connected rider could include a **custom-branded bus shelter** that would protect riders from the elements, with integrated large-scale, **weatherproof maps** of the entire shuttle system, displaying MBTA connections and other points of interest for the alternative commuter.

A **Soofa Sign** is a 42" outdoor electronic display that allows communities to share events, local businesses to engage with customers, and transit operators to provide travel information. It's self-contained, using solar power and wireless connectivity.

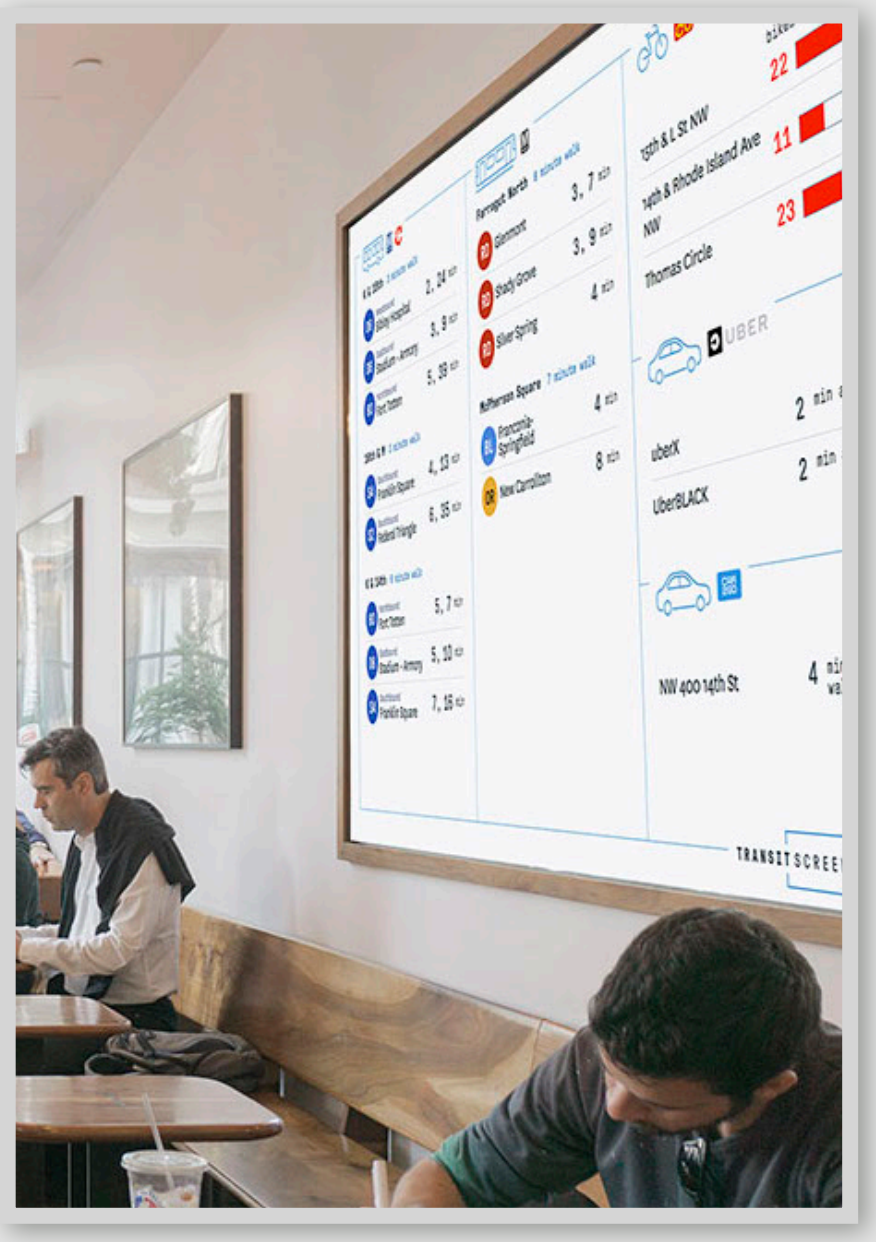
A **Soofa Bench** is a solar-powered phone charging station that also uses sensors to measure activity in outdoor spaces—perfect for parks, downtown plazas, and bus stops.

POSSIBLE INTERIOR FEATURES



TransitScreen is a location-specific digital information board providing customized transportation updates and more.

Data points regarding riders' transportation choices are displayed at a glance, live and in real-time.



All of these forms of digital and static signage will point residents and customers toward the Development's shuttle, MBTA, bike & bikeshare, carshare, carpool/vanpool, and TNC connection points.

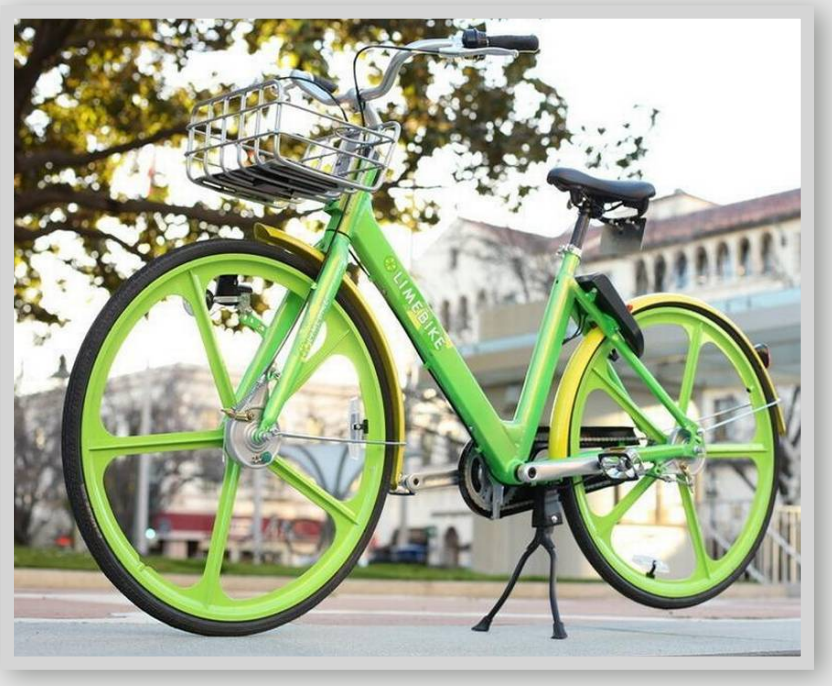
public transportation

The interior square footage devoted to the Northland Newton Development's Transportation Hub will be useful not only to shuttle riders, but also to riders of the 59 bus, as well as other nearby MBTA services. TransitScreens (or similar information screens) and other forms of realtime connectivity will provide information regarding all of these modes.

Routes 52 & 59 are both under-utilized services, with buses rarely reaching 40% capacity even during peak hours. In fact, buses often run nearly empty. The placement of the Transportation Hub adjacent to preexisting MBTA stops may help increase traffic to these routes.

bikeshare

Limebike, one of the vendors for the statewide bikeshare RFP which includes the Development area, is open to targeting interested developments for bike drops and has already established a dialogue with 128 Business Council about partnering with member companies to increase bikeshare participation.



The biggest issue with dockless bikeshares is the perception of 'nuisance' – meaning that users can drop the bikes anywhere and thus may chose to drop them in walkways or business access points, thereby inconveniencing others and even creating accessibility issues.

128bc has therefore suggested the creation of **designated drop-off/pick-up points**, which will reduce this perceived unpredictability and nuisance – one point within view of the transportation hub and one adjacent to the Greenway. The only 'infrastructure' required would be weatherproof paint.

carshare

ZipCar has offered to place vehicles within the Development, even though it lies outside of their established market.

128bc recommends that the Development begin with **four vehicles for a pilot period of six months**, allowing carshare users to establish demand. More vehicles can always be added during this trial period, as demand grows.

The ZipCar fleet ("pod" in their lingo) could be located in the garage or in on-street parking spaces. Either way, its location will be included in the central transportation hub's signage.

On-site and clearly visible ZipCars are an excellent way of making car-free living feasible for residents, and will be particularly convenient for executing 128bc's Emergency Ride Home program (see information below).

carpool/vanpool

Designating parking for carpools and vanpools is a relatively minor incentive in terms of infrastructure investment, but sends a clear signal regarding the Northland Newton Development's commitment to alternative transportation. 128 Business Council will provide marketing for the Development's carpool initiative, and can provide advice regarding technological facilitation.

transportation network companies (tnc's)

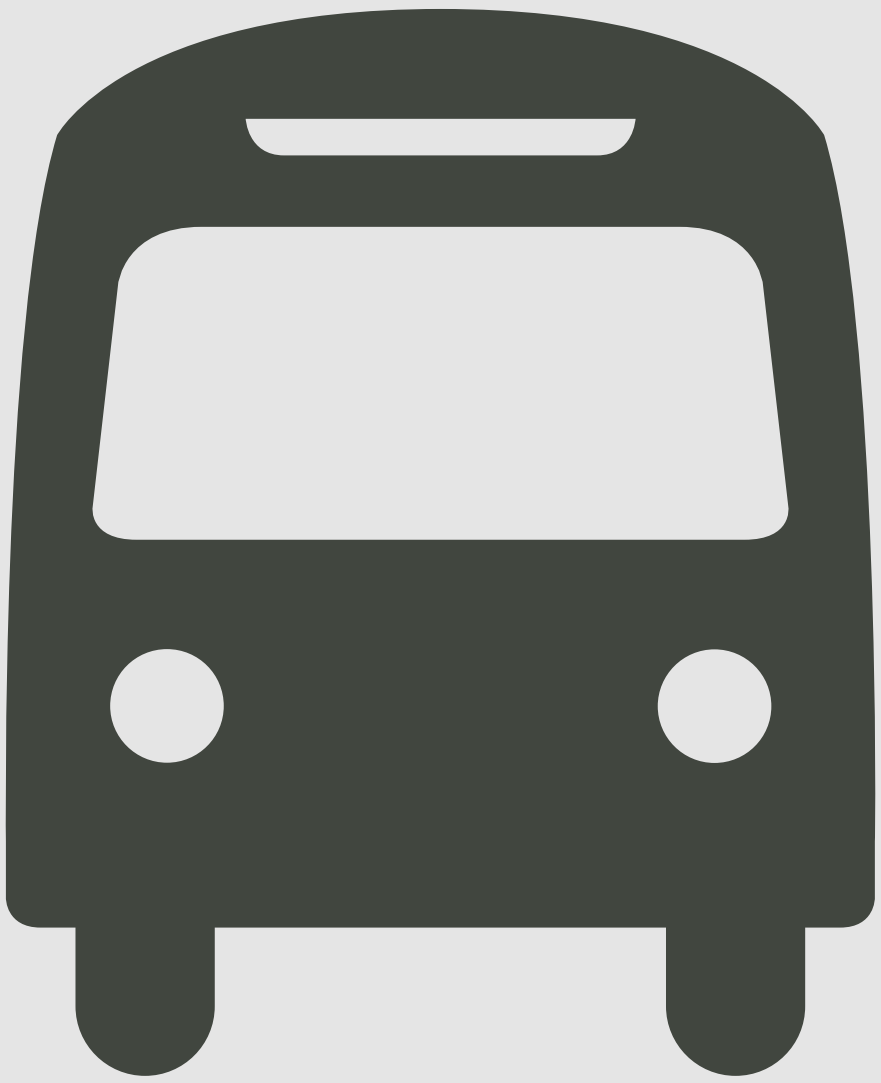
Uber, Lyft, and other TNCs present a challenge to any congestion-conscious project. On the one hand, they offer convenience and flexibility to residents, tenants, and shoppers. On the other hand, they introduce high rates of curbside traffic and often tempt would-be public transportation users back into single-occupancy vehicles.

*In 2017, TNC users completed **1,051,030** trips just within Newton.*

Managing TNC usage, therefore, must be seen as a priority for the Northland Newton Development. This will be achieved through the establishment of TNC-specific pick-up/drop-off points, which need to be isolated from the shuttles' path of travel and from other high-traffic areas, while still offering sufficient convenience to actually be used. As with the ZipCar fleet, the location of these pick-up/drop-off points will be included on all Transportation Hub signage.

Trip counts are aggregates from 2017 for the following TNC companies: Lyft, Uber, Wuleeb, Zemcar, Fasten, and Embarque. Data provided by the TNC companies to The Executive Office of Energy and Environmental Affairs, Department of Public Utilities under 220 CMR 274.12(2)(a) Issued 5/1/2018.

THE FLEET



FLEET OPTIONS

What type of bus does the Northland Newton Development need?

When you choose a bus, you are making a decision about much more than just what the bus "looks like." Buses differ by capacity, size, fuel type, and amenities offered. As a result, you have to consider population demographics, accessibility needs, operational environment, scalability, and customer experience. Furthermore, you need to weigh your current needs against what might be needed in future phases of the Development.

Berkshire Hathaway Berkshire Bus

Eldorado EZRider

ARBOC Spirit of Freedom

Gillig Low Floor BRT

Does my bus have to look like that?!

There are a lot of ugly buses rolling around the streets of Massachusetts. But the way that a bus looks has nothing to do with the bus model. Rather, an ugly bus is the result of improper branding and insufficient style guidelines. Ahead of manufacturing, 128bc can help you move beyond standard factory paint schemes and add additional vinyl graphics that will take a bus from typical to a work of art.

FLEET OPTIONS

When calculating capacity, etc., the use of this vehicle is assumed:

Turtle Top "Terra Transit" Ford F550 V10

32 passenger, with ADA accessibility options

Modified equipment, including bike rack, digital destination signs & upgraded interior

Premium paint & shuttle wrap on exterior

128bc's current fleet is primarily composed of this type of vehicle. Here is an example of what one of these vehicles looks like after being painted and custom wrapped, with a bike rack and digital destination signs installed:

CONNECTED TRANSPORTATION

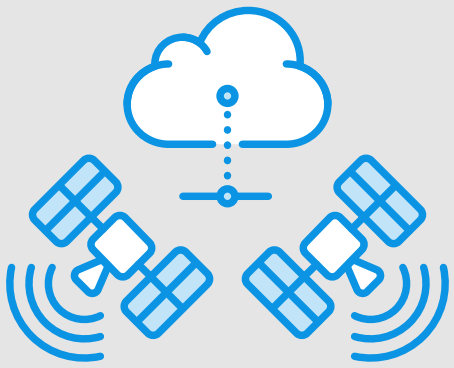
Operational & Management Services

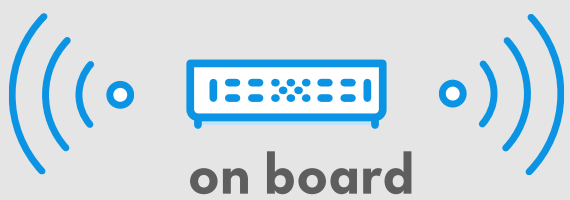
control center

operational data

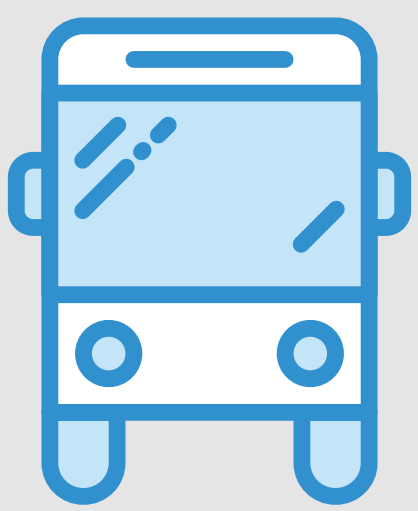
ELD/APC on-board diagnostics

mobile CCTV





on board server



Customer Services

data center

passenger WiFi

real-time info

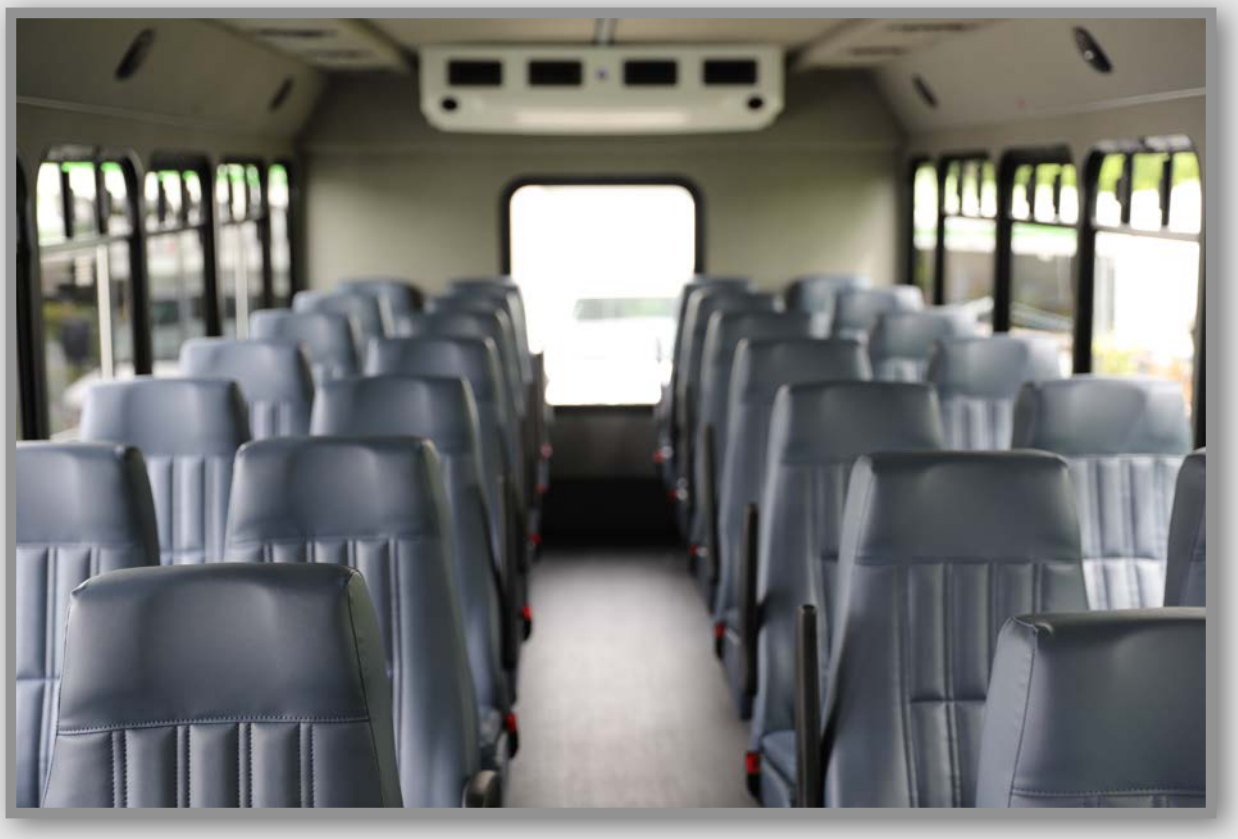
mobile commerce

Why connect?

Utilizing an on-board server allows both riders and the shuttle itself to run any application that harnesses WiFi, and this mobile connectivity means better vehicle efficiency, better vehicle safety, increased rider productivity, and a heightened customer experience.

THE RIDER EXPERIENCE

ON THE SHUTTLE

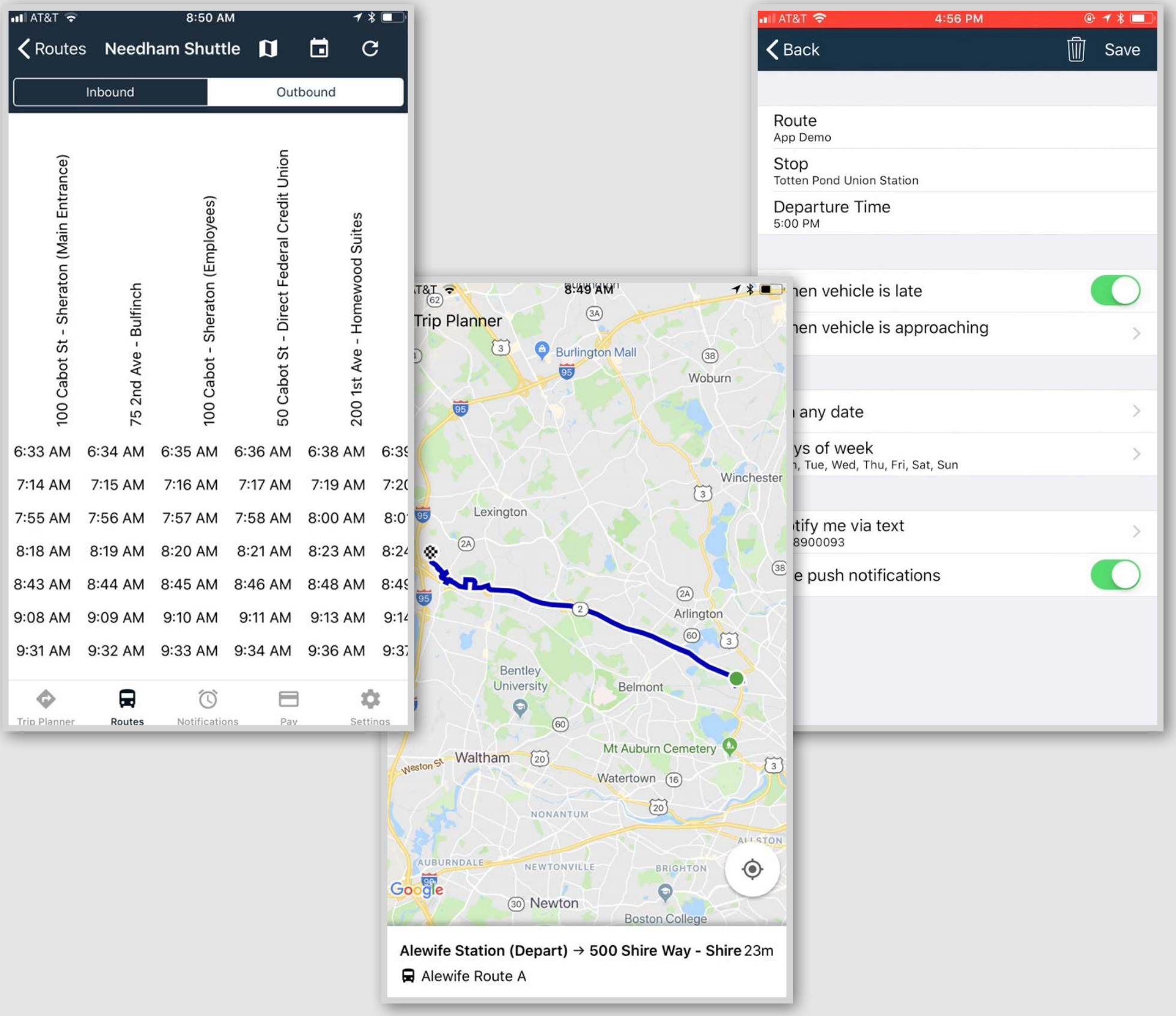


128bc cares about the details that affect riders, like:

- non-slip wood floors that look better, improve safety & reduce noise.
- under-seat USB charging ports and on-board Wifi.
- upgraded overhead lighting that individually adjusts from ambient blue to reading-friendly white.
- the most comfortable seats in the industry.

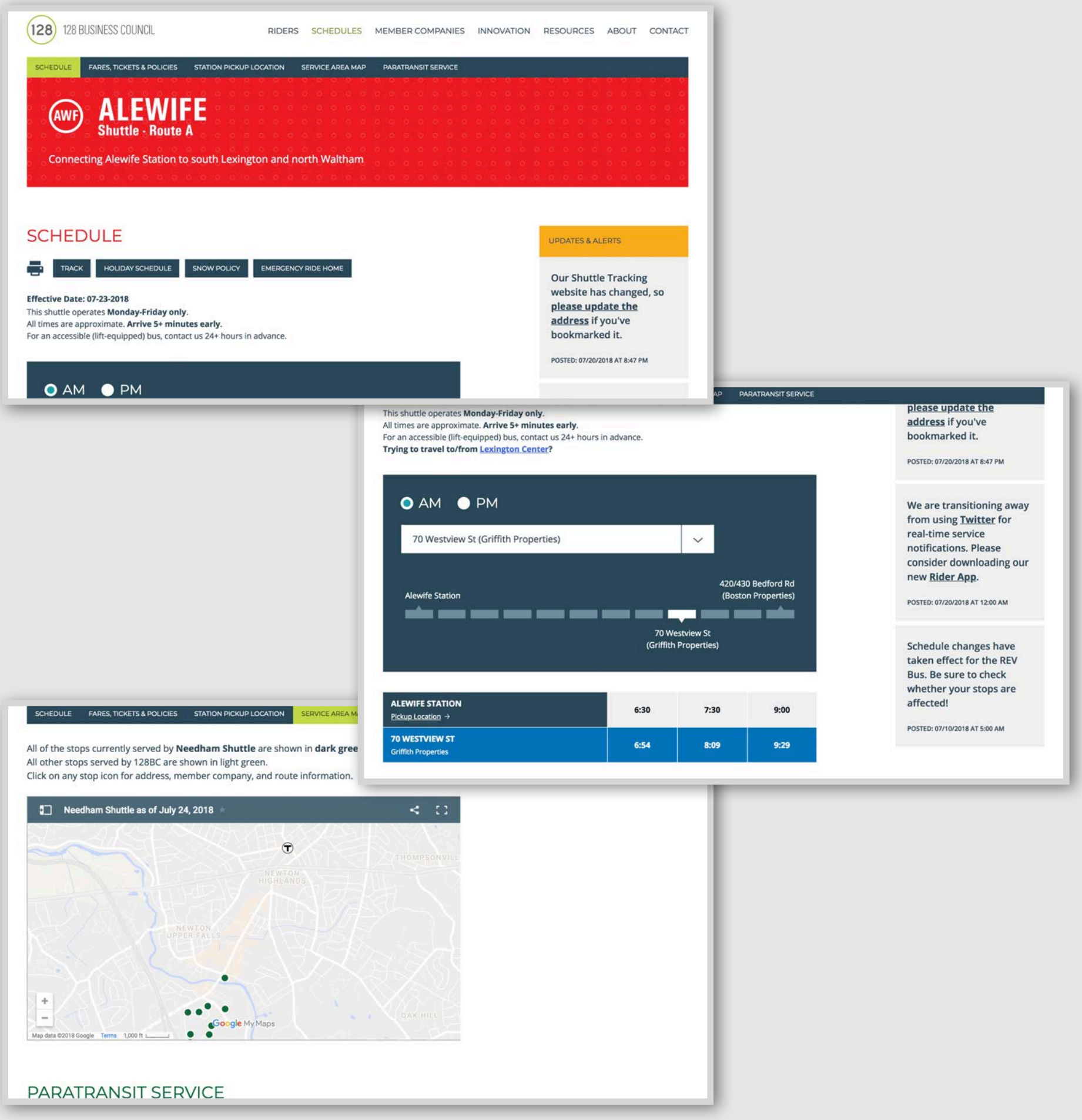
RIDER APP

Our Rider App (made by Tripshot) integrates AVL, GPS, trip planning, shuttle tracking, fare collection, ridership counting, and rider-facing communication. In addition to planning out and paying for their trip through the App, riders can subscribe to receive automated text and/or push notifications specific to their route and even specific to their preferred departures.



DEDICATED ROUTE PAGES

Every route 128bc runs has its own dedicated webpage, where riders can see schedule and fare information, map out the shuttle's stops, purchase tickets (if applicable), view a map and video of the station pickup location, track their shuttle and watch for route-specific shuttle notifications.



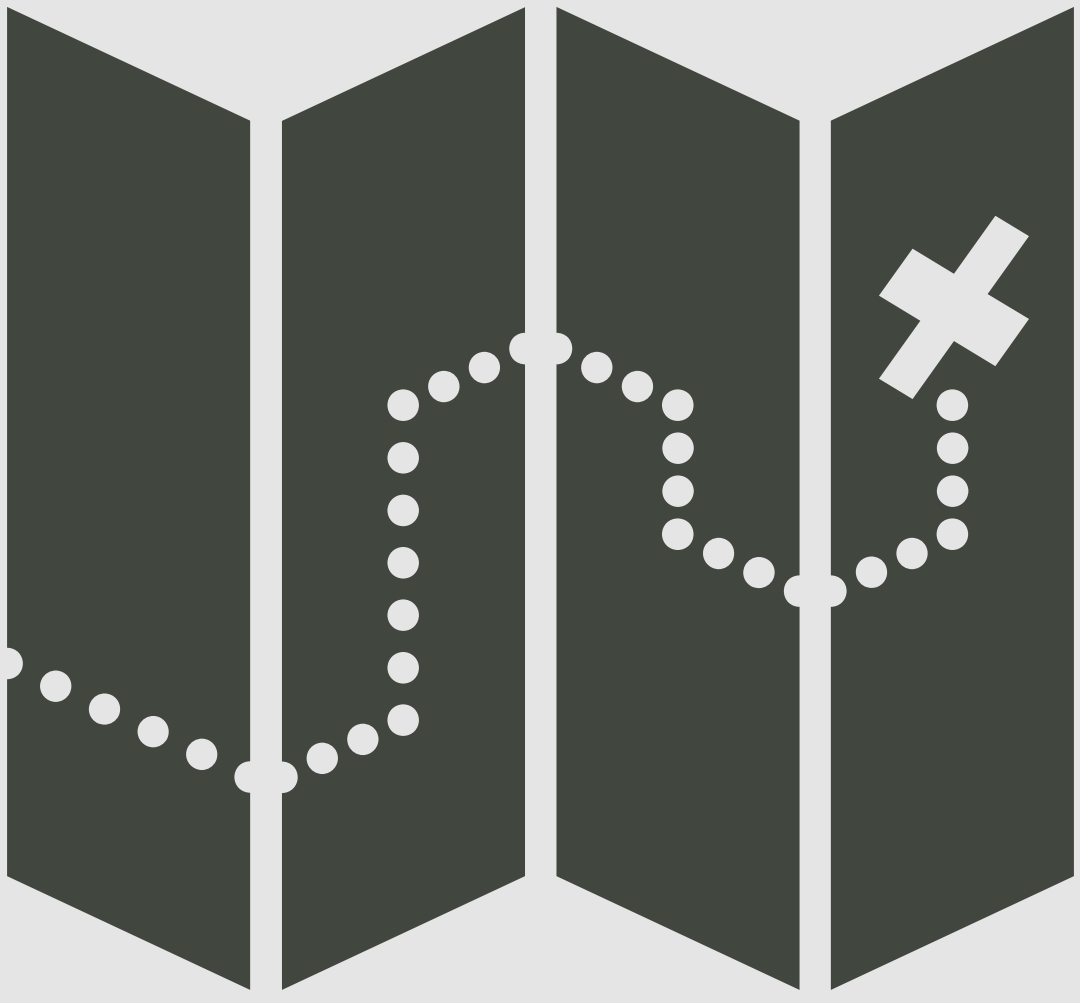
EMERGENCY RIDE HOME

Riders can escape their single-occupancy vehicles... without getting "stuck" in the case of an emergency.

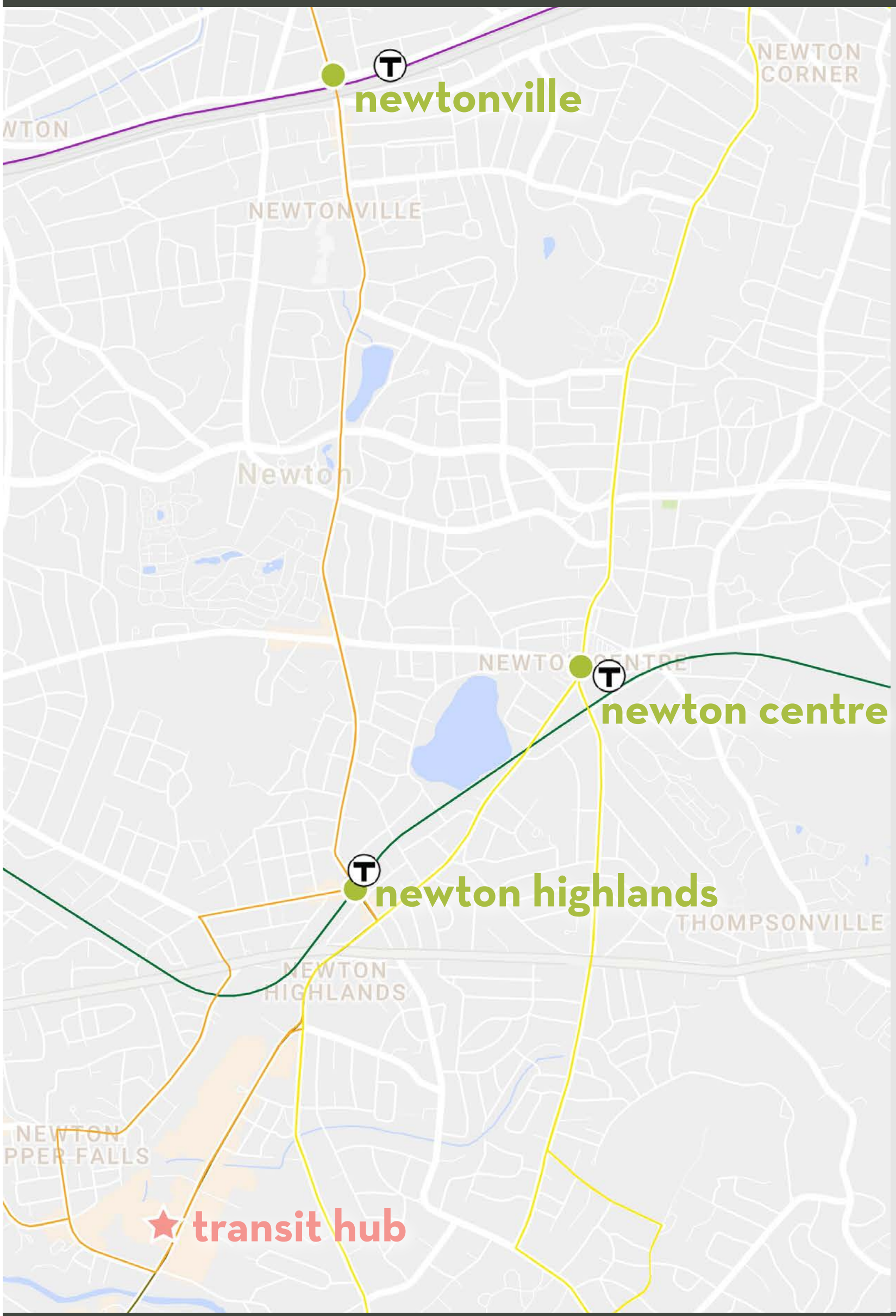
The ERH program provides commuters who use alternative transportation with a guaranteed ride home in the event of an emergency. This program encourages the use of alternatives to driving alone by ensuring that, if there is an emergency during the work day, commuters will not be stranded at work. By way of example, the following scenarios are all covered by the ERH program:

- You're at work and you receive a phone call telling you that a family member has fallen ill, so you need to get home as soon as possible... but you got to work by making multiple transit connections.
- You become sick while at work and need to go home early... but you walked and now you're too ill to walk home.
- Your carpool driver has to leave early... leaving you behind.
- You pop a tire or otherwise damage your bicycle on your way to work... and now you're stranded.
- Your supervisor unexpectedly asks you to work late... meaning that you'll miss the last scheduled shuttle.

THE PROPOSED ROUTES



ROUTE 1: NEWTON CIRCULATOR



Shuttle routes are usually designed on the assumption that their purpose is to take commuters to a major transit hub so they can reach more distant locations. However, the results of our surveying indicated that trips *internal* to Newton and Needham themselves are the largest source of congestion, and so, to actually reduce single-occupancy vehicle use, **targeted local service needs to be a priority**. Also, when 128bc analyzed the preexisting public transit service and compared it to the most frequent trips reported on the survey, it was very obvious that **north-south internal trips** would meet a significant preexisting need. This route is meant to respond to both of these needs.

ROUTE 1: NEWTON CIRCULATOR

Newton Highlands

primary connections

Newton Highlands represents the closest, most convenient location by which to connect the Development to the Green Line (D-Riverside Branch), and also offers primary access to the Route 59 bus.

Newton Highlands is already an established shuttle transfer location for 128 Business Council's existing Needham Shuttle, as well as TripAdvisor's shuttles.

mbta service hours

Eastbound to Gov Center: First Departure from this stop at 05:03 a.m. Last Departure at 12:13 a.m.

Westbound to Riverside: First Departure at 06:15 a.m. Last Departure at 01:24 a.m. (Last departure of Green Line-D begins at Gov Center at 12:49 a.m.)

accessibility

Significant accessibility barriers exist at Newton Highlands, but customers can board/exit the train using a mobile lift.

stop utility

Following our assessment of all possible Green Line connection points, this stop was judged to be the most functional, in terms of distance, at-station parking, and service frequency/flexibility.

stop logistics

Stop areas at Newton Highlands are on-street and thus will require City of Newton approval, but there is sufficient curb space for shuttles to wait at the pick-up location. The drop-off location may require the taking of parking spaces on Walnut Street or, alternatively, on Station Avenue.

Newton Centre

primary connections

This location offers primary access to both the Green Line (D-Riverside Branch) and the Route 52 bus, as well as a preexisting ZipCar hub. Both the Route 59 bus and the Route 52 bus connect to Watertown, but the latter operates on a more limited schedule.

mbta service hours

Eastbound to Gov Center: First Departure at 05:05 a.m. Last Departure at 12:15 a.m.

Westbound to Riverside: First Departure 6:13A. Last Departure at 01:22A. (Last departure of Green Line-D begins at Gov Center at 12:49AM.)

accessibility

Newton Centre is accessible, which makes it a good way to get into Boston for riders with accessibility needs. (Otherwise, Newton Highlands would be the first drop-off point for the shuttle.)

Newton Centre (continued)

stop utility **Why two Green Line connections on one route?** Beyond just connecting riders to the Green Line, these stops are meant to reduce local trips in single-occupancy vehicles. Not only are local trips the most efficient use of Project resources, they can be highly effective in terms of congestion reduction—if coordinated with effective community education.

stop logistics Due to difficult exit access from Union Street, 128bc recommends that shuttles stop on Centre Street near Beacon, rather than attempting to travel directly to the station. Walking distance from these potential shuttle stops on Centre Street to the Green Line platform is approximately 850 feet.

If shuttles were to travel directly to the station on Union Street, they would be forced to make an unsafe, unsignaled left turn onto Langley Road, or to take a circuitous return route via Langley Road and Route 9 westbound—adding over one mile of driving distance and exposing shuttles to Route 9 traffic.

Newtonville

primary connections Newtonville provides the closest access to the Worcester/Framingham Line. The other stops on the route already provide primary access to the Green Line (D-Riverside Branch) and the Route 59 bus, but the Newtonville Commuter Rail stop would also add primary access to MBTA Express Bus Routes 553, 554, and 556.

mbta service hours No "reverse commute" service, and station is a "flag only" stop off-peak and weekends, as reflected in the shuttle schedule.

Terminates inbound at South Station.

accessibility Significant accessibility barriers exist at Newtonville.

stop utility In the morning, the Newtonville shuttle stop would primarily pick up passengers coming into Newton from Framingham/Worchester, but the shuttle could also serve passengers heading into and out of Boston.

In the evening, the stop would drop off passengers returning to Framingham/Worchester, and could, again, also serve Boston trips.

However, the Newtonville stop could *also* be used by local commuters who are not actually taking the commuter rail, but for whom Newtonville is a convenient hub, thereby reducing congestion generated by local trips. Building this kind of ridership in particular would require effective community education. Once service has started, 128bc can measure local-trip usage at this stop and, if demand seems to justify it, expand shuttle service hours to this stop.

ROUTE 1: NEWTON CIRCULATOR

Monday - Friday	morning										afternoon		
depart northbound Transit Hub	5:15	**5:45**	6:15	**6:45**	7:30	**8:15**	9:00	**9:45**	10:30	11:15	12:00	12:45	1:30
depart northbound Newton Highlands	5:25	**5:56**	6:26	**6:56**	7:43	**8:29**	9:12	**9:57**	10:42	11:27	12:12	12:57	1:42
depart northbound Newton Centre	5:34	**6:05**	6:36	**7:07**	7:55	**8:41**	9:24	**—**	—	—	—	—	—
depart southbound Newtonville	5:45	**6:17**	6:49	**7:25**	8:15	**9:01**	9:44	**—**	—	—	—	—	—
depart southbound Newton Centre	5:56	**6:28**	7:02	**7:41**	8:33	**9:19**	10:02	**10:07**	10:52	11:37	12:22	1:07	1:52
depart southbound Newton Highlands	6:03	**6:35**	7:10	**7:51**	8:44	**9:28**	10:10	**10:15**	11:00	11:45	12:30	1:15	2:00
arrive Transit Hub	6:12	**6:45**	7:20	**8:03**	8:56	**9:40**	10:22	**10:27**	11:12	11:57	12:42	1:27	2:12

				evening										
2:15	3:15	**4:00**	4:45	**5:30**	6:15	**7:00**	7:45	8:30	9:15	10:00	10:45	11:30	12:15	Transit Hub
2:27	3:27	**4:12**	4:57	**5:43**	6:28	**7:12**	7:57	8:42	9:26	10:11	10:55	11:40	12:25	Newton Highlands
—	3:37	**4:23**	5:08	**5:54**	6:40	**7:22**	—	—	—	—	—	—	—	Newton Centre
—	3:54	**4:40**	5:25	**6:11**	6:57	**7:36**	—	—	—	—	—	—	—	Newtonville
2:37	4:12	**4:58**	5:43	**6:31**	7:17	**7:50**	8:09	8:54	9:36	10:21	11:05	11:50	12:35	Newton Centre
2:45	4:23	**5:09**	5:54	**6:42**	7:27	**7:58**	8:17	9:02	9:44	10:29	11:13	11:58	12:43	Newton Highlands
2:57	4:37	**5:24**	6:10	**6:56**	7:39	**8:10**	8:29	9:13	9:54	10:39	11:23	12:08	12:53	Transit Hub

Out-and-back trips shown in blue would be covered by second shuttle.

Saturday - Sunday	morning								afternoon				
depart northbound Transit Hub	6:15	7:00	7:45	8:30	9:15	10:00	10:45	11:30	12:15	1:00	1:45	2:30	3:15
depart northbound Newton Highlands	6:26	7:11	7:56	8:42	9:27	10:12	10:57	11:42	12:27	1:12	1:57	2:42	3:27
depart southbound Newton Centre	6:36	7:21	8:06	8:52	9:37	10:22	11:07	11:52	12:37	1:22	2:07	2:52	3:37
depart southbound Newton Highlands	6:44	7:29	8:14	9:00	9:45	10:30	11:15	12:00	12:45	1:30	2:15	3:00	3:45
arrive Transit Hub	6:54	7:39	8:24	9:12	9:57	10:42	11:27	12:12	12:57	1:42	2:27	3:12	3:57

		evening										
4:00	4:45	5:30	6:15	7:00	7:45	8:30	9:15	10:00	10:45	11:30	12:15	Transit Hub
4:12	4:57	5:42	6:27	7:12	7:57	8:42	9:26	10:11	10:55	11:40	12:25	Newton Highlands
4:22	5:07	5:52	6:37	7:22	8:07	8:52	9:36	10:21	11:05	11:50	12:35	Newton Centre
4:30	5:15	6:00	6:45	7:30	8:15	9:00	9:44	10:29	11:13	11:58	12:43	Newton Highlands
4:42	5:27	6:12	6:57	7:42	8:27	9:12	9:54	10:39	11:23	12:08	12:53	Transit Hub

ROUTE 1: NEWTON CIRCULATOR

recommended initial number of buses	**2** 2nd bus only comes on service during rush-hour when extending service to Newtonville
potential initial service hours	5:15am - 1:00am weekdays 6:15am - 1:00am weekends
potential initial frequency	30 or 45 minutes during rush-hour service 45 minutes rest of weekday and all weekend
weekly bus hours	**181.25**
potential weekly rides	**18,410**

scaled schedule

When considering the possibility of running a scaled version of this route, the following factors need to be kept in mind:

- Decreasing **service frequency** (i.e. inserting more time between each run) would not actually reduce daily bus hours, and so there is no reason to do so.
- The **second shuttle** during rush-hour commuter service could be removed, but this would significantly decrease the usefulness of the shuttle for commuters, since they would only have access to every other train arrival/departure. Doing so would also reduce the frequency to 60-90 minutes during potentially the most highly-utilized service period. *That said, an argument could be made for waiting to put a second shuttle on the road until ridership is established, and this option is reflected in scaled schedule #2.*
- The best option for scaling the schedule would be to limit the **service hours**. One seemingly obvious option would be to focus on peak commuting hours, Monday-Friday only. **However, limiting service to this extreme obviously limits the usefulness of the route for non-commuting trips, thereby making it virtually impossible for residents of the Development (and others) to go car-free.**

> *If someone owns a car, they will use it—even when other transportation modes are available, and possibly faster! You can thus make a much stronger argument for the congestion-reduction impact of your planned shuttle routes if those routes create the conditions for car-free living.*

- **Thus, the two scaled schedules shown below trim early-morning and late-night service hours, but still provide provide full-day service.**

scaled schedule #1

only trimming service hours

recommended initial number of buses	2 2nd bus only comes on service during rush-hour when extending service to Newtonville
potential initial service hours	**5:45am - 10:45pm weekdays** **7:00am - 10:45pm weekends**
potential initial frequency	30 or 45 minutes during rush-hour service 45 minutes rest of weekday and all weekend
weekly bus hours	**159**
potential weekly rides	**15,672**

ROUTE 1: NEWTON CIRCULATOR

Monday - Friday	morning										afternoon		
depart northbound Transit Hub	X	5:45	6:15	6:45	7:30	8:15	9:00	9:45	10:30	11:15	12:00	12:45	1:30
depart northbound Newton Highlands	X	5:56	6:26	6:56	7:43	8:29	9:12	9:57	10:42	11:27	12:12	12:57	1:42
depart northbound Newton Centre	X	6:05	6:36	7:07	7:55	8:41	9:24	—	—	—	—	—	—
depart southbound Newtonville	X	6:17	6:49	7:25	8:15	9:01	9:44	—	—	—	—	—	—
depart southbound Newton Centre	X	6:28	7:02	7:41	8:33	9:19	10:02	10:07	10:52	11:37	12:22	1:07	1:52
depart southbound Newton Highlands	X	6:35	7:10	7:51	8:44	9:28	10:10	10:15	11:00	11:45	12:30	1:15	2:00
arrive Transit Hub	X	6:45	7:20	8:03	8:56	9:40	10:22	10:27	11:12	11:57	12:42	1:27	2:12

				evening										
2:15	3:15	4:00	4:45	5:30	6:15	7:00	7:45	8:30	9:15	10:00	X	X	X	Transit Hub
2:27	3:27	4:12	4:57	5:43	6:28	7:12	7:57	8:42	9:26	10:11	X	X	X	Newton Highlands
—	3:37	4:23	5:08	5:54	6:40	7:22	—	—	—	—	X	X	X	Newton Centre
—	3:54	4:40	5:25	6:11	6:57	7:36	—	—	—	—	X	X	X	Newtonville
2:37	4:12	4:58	5:43	6:31	7:17	7:50	8:09	8:54	9:36	10:21	X	X	X	Newton Centre
2:45	4:23	5:09	5:54	6:42	7:27	7:58	8:17	9:02	9:44	10:29	X	X	X	Newton Highlands
2:57	4:37	5:24	6:10	6:56	7:39	8:10	8:29	9:13	9:54	10:39	X	X	X	Transit Hub

Out-and-back trips shown in blue would be covered by second shuttle.

Saturday - Sunday	morning								afternoon				
depart northbound Transit Hub	X	7:00	7:45	8:30	9:15	10:00	10:45	11:30	12:15	1:00	1:45	2:30	3:15
depart northbound Newton Highlands	X	7:11	7:56	8:42	9:27	10:12	10:57	11:42	12:27	1:12	1:57	2:42	3:27
depart southbound Newton Centre	X	7:21	8:06	8:52	9:37	10:22	11:07	11:52	12:37	1:22	2:07	2:52	3:37
depart southbound Newton Highlands	X	7:29	8:14	9:00	9:45	10:30	11:15	12:00	12:45	1:30	2:15	3:00	3:45
arrive Transit Hub	X	7:39	8:24	9:12	9:57	10:42	11:27	12:12	12:57	1:42	2:27	3:12	3:57

		evening										
4:00	4:45	5:30	6:15	7:00	7:45	8:30	9:15	10:00	X	X	X	Transit Hub
4:12	4:57	5:42	6:27	7:12	7:57	8:42	9:26	10:11	X	X	X	Newton Highlands
4:22	5:07	5:52	6:37	7:22	8:07	8:52	9:36	10:21	X	X	X	Newton Centre
4:30	5:15	6:00	6:45	7:30	8:15	9:00	9:44	10:29	X	X	X	Newton Highlands
4:42	5:27	6:12	6:57	7:42	8:27	9:12	9:54	10:39	X	X	X	Transit Hub

scaled schedule #2

trimming service hours and cutting second shuttle

initial number of buses	**1**
potential initial service hours	5:45am - 10:45pm weekdays 7:00am - 10:45pm weekends
potential initial frequency	**60-90 minutes during rush-hour service** 45 minutes rest of weekday and all weekend
weekly bus hours	**116.5**
potential weekly rides	**12,492**

ROUTE 1: NEWTON CIRCULATOR

Monday - Friday		morning										afternoon		
depart northbound	Transit Hub	X	5:45	X	6:45	X	8:15	X	9:45	10:30	11:15	12:00	12:45	1:30
depart northbound	Newton Highlands	X	5:56	X	6:56	X	8:29	X	9:57	10:42	11:27	12:12	12:57	1:42
depart northbound	Newton Centre	X	6:05	X	7:07	X	8:41	X	—	—	—	—	—	—
depart southbound	Newtonville	X	6:17	X	7:25	X	9:01	X	—	—	—	—	—	—
depart southbound	Newton Centre	X	6:28	X	7:41	X	9:19	X	10:07	10:52	11:37	12:22	1:07	1:52
depart southbound	Newton Highlands	X	6:35	X	7:51	X	9:28	X	10:15	11:00	11:45	12:30	1:15	2:00
arrive	Transit Hub	X	6:45	X	8:03	X	9:40	X	10:27	11:12	11:57	12:42	1:27	2:12

				evening										
2:15	3:15	X	4:45	X	6:15	X	7:45	8:30	9:15	10:00	X	X	X	Transit Hub
2:27	3:27	X	4:57	X	6:28	X	7:57	8:42	9:26	10:11	X	X	X	Newton Highlands
—	3:37	X	5:08	X	6:40	X	—	—	—	—	X	X	X	Newton Centre
—	3:54	X	5:25	X	6:57	X	—	—	—	—	X	X	X	Newtonville
2:37	4:12	X	5:43	X	7:17	X	8:09	8:54	9:36	10:21	X	X	X	Newton Centre
2:45	4:23	X	5:54	X	7:27	X	8:17	9:02	9:44	10:29	X	X	X	Newton Highlands
2:57	4:37	X	6:10	X	7:39	X	8:29	9:13	9:54	10:39	X	X	X	Transit Hub

Out-and-back trips shown in blue would be covered by second shuttle.

Saturday - Sunday		morning								afternoon				
depart northbound	Transit Hub	X	7:00	7:45	8:30	9:15	10:00	10:45	11:30	12:15	1:00	1:45	2:30	3:15
depart northbound	Newton Highlands	X	7:11	7:56	8:42	9:27	10:12	10:57	11:42	12:27	1:12	1:57	2:42	3:27
depart southbound	Newton Centre	X	7:21	8:06	8:52	9:37	10:22	11:07	11:52	12:37	1:22	2:07	2:52	3:37
depart southbound	Newton Highlands	X	7:29	8:14	9:00	9:45	10:30	11:15	12:00	12:45	1:30	2:15	3:00	3:45
arrive	Transit Hub	X	7:39	8:24	9:12	9:57	10:42	11:27	12:12	12:57	1:42	2:27	3:12	3:57

		evening										
4:00	4:45	5:30	6:15	7:00	7:45	8:30	9:15	10:00	X	X	X	Transit Hub
4:12	4:57	5:42	6:27	7:12	7:57	8:42	9:26	10:11	X	X	X	Newton Highlands
4:22	5:07	5:52	6:37	7:22	8:07	8:52	9:36	10:21	X	X	X	Newton Centre
4:30	5:15	6:00	6:45	7:30	8:15	9:00	9:44	10:29	X	X	X	Newton Highlands
4:42	5:27	6:12	6:57	7:42	8:27	9:12	9:54	10:39	X	X	X	Transit Hub

alternate off-peak routing

This shuttle route could be adjusted during off-peak hours (midday, late evening, weekends) in order to drive more shopping and dining business to the Development (for example, from the Wells Ave business park), to better connect the Development's residents to high-interest locations, and to better serve the surrounding community.

However, 128bc advises waiting to plan out such alternate routing until further along in the process when alternative stops could be identified based upon more up-to-date information regarding commercial trends, building occupancies, and other shuttle routes that are also in the early planning stages. More complicated routes have a higher chance for success and require less resource investment when done through partnerships.

While not necessary for getting wheels on the ground, connecting the Development with nearby corporate and municipal partners would lead to greater congestion mitigation and deepen the transportation infrastructure, thereby increasing the impact of client resources.

phased expansion

The Newton Circulator would be the most efficient option for scaling services up in order to increase overall system capacity — although it would make the most sense to scale up in several discrete stages, as ridership builds. Among other reasons, it is the most multi-functional of the routes, thanks accommodating local, Green Line, and commuter rail connections.

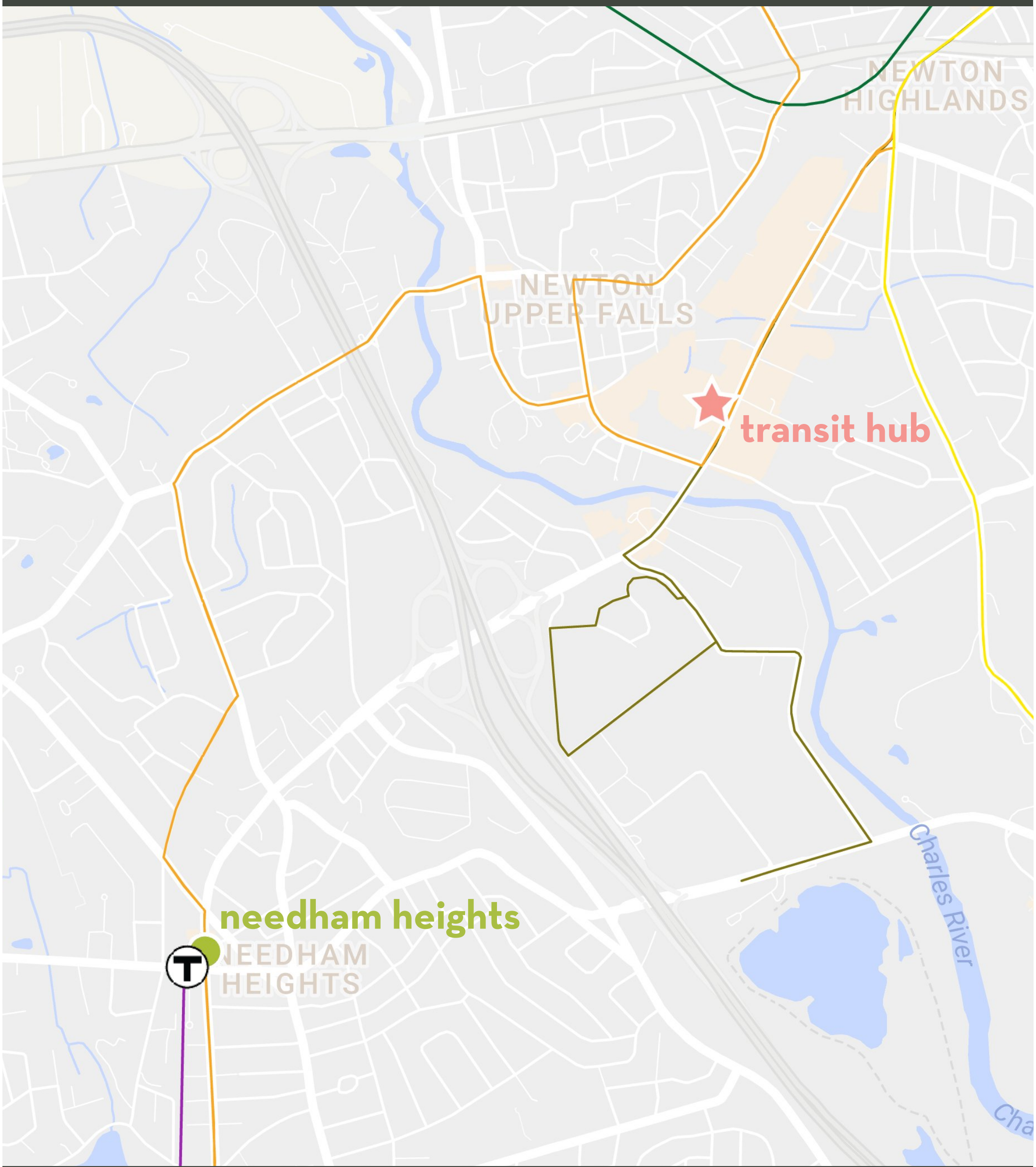
In terms of how to scale up service, service frequency could be increased (i.e. reducing the time between each run) by adding vehicles, particularly during the busiest periods of service—mainly:

- during peak commuting hours when the route extends to Newtonville. 128bc obviously cannot increase the commuter rail's frequency, but providing additional connections would reduce the chance of a commuter having to wait at Newtonville for an undesirably long period because of a late train. It would also allow for more internal trips over these periods, and reduce the chance of local riders being unable to fit on the shuttle because it's full of commuters heading into Boston.
- over the lunch period.
- as discussed above, potentially extending service to Newtonville past the commuter rail stop's service period if local community ridership seems to merit it.

The second vehicle could also be kept on throughout the day in order to accommodate more local stops while maintaining 45-minute frequencies.

Finally, service also could be extended later into the night or started earlier in the morning, but there is little preexisting data that would suggest that this would be an efficient use of resources.

ROUTE 2: NEEDHAM COMMUTER



ROUTE 2: NEEDHAM COMMUTER

Needham Heights

connections Commuter Rail—Needham Line and Route 59 Bus

mbta service hours Commuter rail service runs Monday-Saturday. Does allow for several rush-hour reverse commute trips, so the schedule is arranged accordingly.

Terminates inbound at South Station.

accessibility Needham Heights is accessible.

stop utility Needham Heights is the end of the line, so the shuttle would exclusively offer service in and out of Boston.

In the morning, the Needham Heights shuttle stop would allow the shuttle to drop off commuters heading into Boston and pick up commuters coming into Newton.

In the evening, the shuttle would drop off riders heading into Boston (for late-shift work or recreational purposes) and then pick up commuters returning to Newton.

Since Needham Heights is the only stop on this route, it's possible to arrange the schedule such that the shuttle arrives in time to drop off riders prior to departures into Boston and then wait at the station to pick up riders heading back to the Transit Hub, rather than having one stop time that splits the difference between the two.

The shuttle could also pick up local-trip commuters, who would just be using Needham Heights as a convenient hub.

stop logistics Needham Heights Station is located in a neighborhood commercial center. The shuttle drop-off/pick-up location would be on Avery Square, immediate adjacent to the train platforms, and the station features a loop for easier turn-arounds.

	morning					
depart southbound Transit Hub	5:50	6:30	7:10	7:45	8:30	9:45
arrive Needham Heights	5:56	6:38	7:18	7:54	8:39	9:54
depart northbound Needham Heights	6:10	6:45	7:25	8:07	8:50	10:10
arrive Transit Hub	6:20	6:57	7:39	8:23	9:06	10:24

	afternoon/evening					
depart southbound Transit Hub	4:30	5:10	5:55	6:30	7:05	7:40
arrive Needham Heights	4:42	5:22	6:05	6:40	7:13	7:47
depart northbound Needham Heights	4:52	5:37	6:14	6:50	7:25	8:15
arrive Transit Hub	5:08	5:53	6:28	7:02	7:37	8:27

ROUTE 2: NEEDHAM COMMUTER

recommended initial number of buses	1
potential initial service hours	5:45am - 10:30 and 4:30 - 8:30, Monday-Friday
potential initial frequency	35-45 minutes variable to better accommodate commuter rail schedule
weekly bus hours	43.75
potential weekly rides	3,680

phased expansion

Expansion option #1: Adding an additional vehicle during peak hours would allow riders to more accurately meet several trains, thereby decreasing their wait time at Needham Heights.

Expansion option #2: The route shown here focuses on rush-hour service. However, the Needham Line does run all day and on Saturdays from Needham Heights, so an expanded version of this route could serve local riders heading into and out of Boston.

In fact, expanding connections to the Needham Line might be a good supplement to the shuttle to South Station. Especially if that shuttle switches to an on-demand model some times of day (see more info below), connecting to South Station via the Needham Line would provide a fixed-route counter-balance.

That said, commuting into Boston via the Needham Line would be slower some times of day, requires an additional transfer, and does not offer Sunday service.

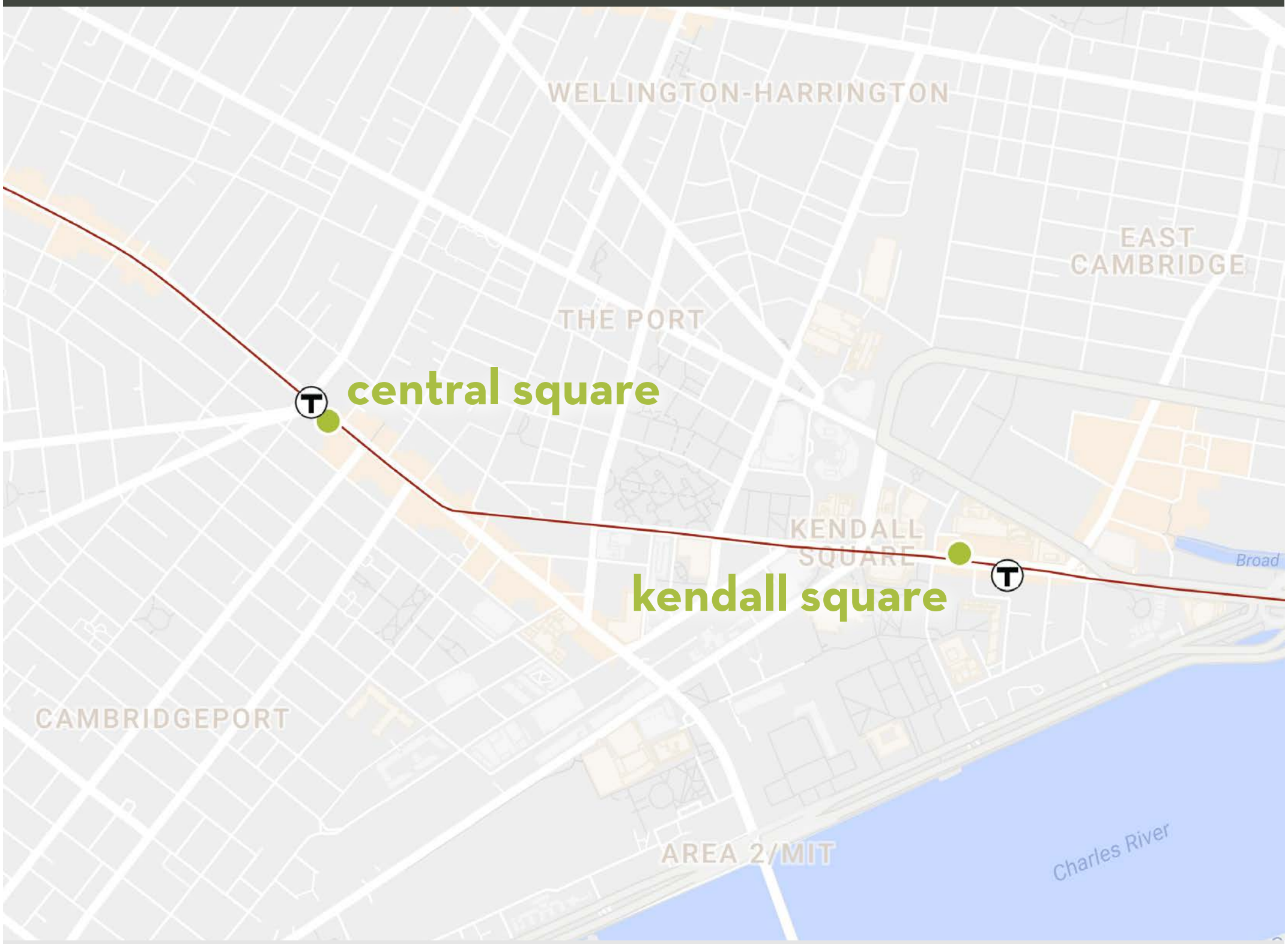
Expansion option #3: Since the Newton Circulator (Route 1) focuses on northbound stops, this route could be expanded—both in terms of service hours and number of stops—to create connectivity with additional locations south of the Development. This would effectively turn the Needham Commuter route into a second local circulator. However, structuring a local circulator around the Needham Line would only make sense if and when commuter rail ridership has been established.

should this route be included at all?

While large-scale need for a connection to the Needham Line cannot be confirmed by our survey data, developers, tenants, and residents in the Development area frequently *request* a connection with Needham Heights. As already noted, beyond its potential utility for bringing work commuters in and out of Boston, this route may also prove useful for local trips within Needham and Newton.

Ultimately, the utility of this stop will depend upon its role within the shuttle system as a whole. Service will be launched on a trial basis, and if ridership does not build, the route can be adjusted or the shuttle can be taken off that route entirely and devoted to expanding a higher-demand route.

ROUTE 3: CAMBRIDGE EXPRESS



route feasibility

There are many 'invisible details' that underlie the schedule and map summaries shown here. In order to guarantee that these routes are feasible, 128bc built turn-by-turn plans that identify potential stop locations down to the curb spot, specify the timing necessary for vehicles to transition, and even consider the timing necessary for passengers to transition from one mode to another. As each route is phased into service, these details will have to be regularly revisited to ensure a consistent quality of service.

ROUTE 3: CAMBRIDGE EXPRESS

Central Square

connections

Red Line

Route 1, Route 47, Route 64, Route 70/70A, Route 83, Route 91, and CT1 buses

mbta service hours

Southbound to Braintree/Ashmont: First departure from Central at 5:26 a.m. Last Departure at 12:32 a.m.

Northbound to Alewife: First Departure from Central at 5:43 a.m. Last Departure at 12:57 a.m.

accessibility

Central is accessible.

stop utility

Despite the fact that short trips are the biggest contributor to the Newton-Needham area's congestion, longer trips still need to be planned for—both to allow car-free Development residents to travel into Boston and Cambridge and to help Development businesses and organizations recruit talent from outside the Newton-Needham area. However, 128bc has made it a priority to make maximum use of preexisting MBTA service—especially when that service is actually faster.

Without a dedicated shuttle, getting to Central Square or Kendall from the Development would require riders to take the circulator shuttle to Newton Highlands, then transfer from the Green Line to either the Red Line or a bus. Even before accounting for delays, the trip would take a minimum of 65 minutes and two transfers, which makes it an unlikely sell for commuters.

128bc judges this to be the highest priority among the express shuttle services analyzed.

Kendall Square

primary connections

Red Line

Route 64, Route 68, Route 85, and CT2 buses

mbta service hours

Southbound to Braintree/Ashmont: First departure from Central at 5:26 a.m. Last Departure at 12:32 a.m.

Northbound to Alewife: First Departure from Central at 5:43 a.m. Last Departure at 12:57 a.m.

accessibility

Kendall/MIT is accessible.

ROUTE 3: CAMBRIDGE EXPRESS

	morning							afternoon		
depart eastbound Transit Hub	—	6:00	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00
depart eastbound Central Square	5:45	6:45	7:45	8:45	9:45	10:45	11:45	12:45	1:45	2:45
depart westbound Kendall Square	5:55	6:55	7:55	8:55	9:55	10:55	11:55	12:55	1:55	2:55
arrive Transit Hub	6:40	7:40	8:40	9:40	10:40	11:40	12:40	1:40	2:40	3:40

		evening							
3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	Transit Hub
3:45	4:45	5:45	6:45	7:45	8:45	9:45	10:45	11:45	Central Square
3:55	4:55	5:55	6:55	7:55	8:55	9:55	10:55	11:55	Kendall Square
4:40	5:40	6:40	7:40	8:40	9:40	10:40	11:40	12:40	Transit Hub

recommended initial number of buses	2
potential initial service hours	5:45am - 12:45am, Monday-Sunday
potential initial frequency	60 minutes
weekly bus hours	257.25
potential weekly rides	8,288

ROUTE 3: CAMBRIDGE EXPRESS

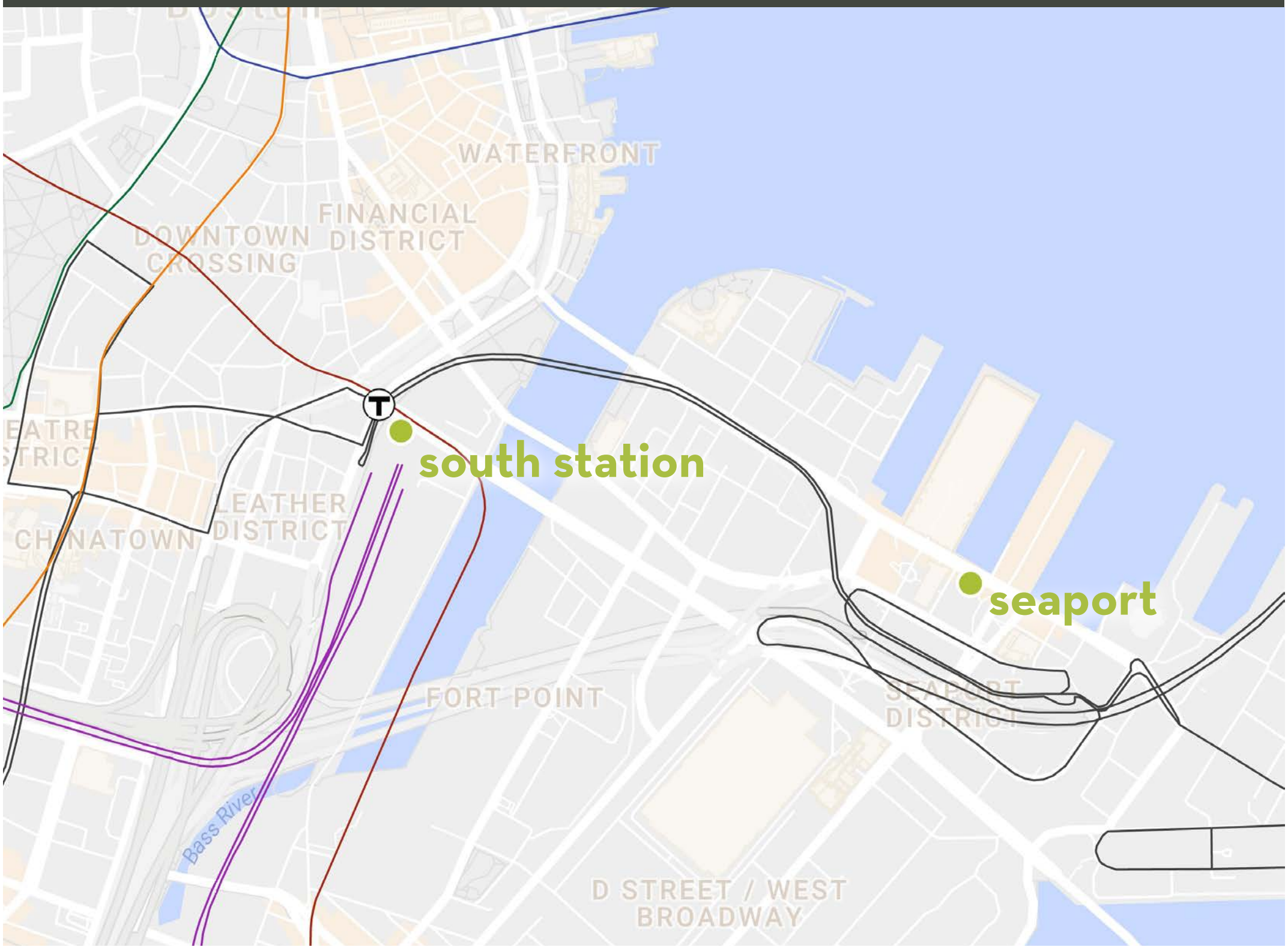
scaled schedule

		morning							afternoon		
depart eastbound	Transit Hub	—	6:00	7:00	8:00	9:00	10:00	X	12:00	X	2:00
depart eastbound	Central Square	X	6:45	7:45	8:45	9:45	10:45	X	12:45	X	2:45
depart westbound	Kendall Square	X	6:55	7:55	8:55	9:55	10:55	X	12:55	X	2:55
arrive	Transit Hub	X	7:40	8:40	9:40	10:40	11:40	X	1:40	X	3:40

		evening							
X	4:00	5:00	6:00	7:00	8:00	9:00	X	11:00	Transit Hub
X	4:45	5:45	6:45	7:45	8:45	9:45	X	11:45	Central Square
X	4:55	5:55	6:55	7:55	8:55	9:55	X	11:55	Kendall Square
X	5:40	6:40	7:40	8:40	9:40	10:40	X	12:40	Transit Hub

recommended initial number of buses	2
potential initial service hours	6:00am - 12:45am Monday-Sunday
potential initial frequency	60 minutes on-peak, 2 hours off-peak
weekly bus hours	190.75
potential weekly rides	6272

ROUTE 4: BOSTON EXPRESS



	morning							afternoon		
depart eastbound Transit Hub	—	6:00	7:00	8:00	9:00	10:00	11:00	12:00	1:00	2:00
depart eastbound Seaport/WTC	5:45	6:45	7:45	8:45	9:45	10:45	11:45	12:45	1:45	2:45
depart westbound South Station	5:58	6:58	7:58	8:58	9:58	10:58	11:58	12:58	1:58	2:58
arrive Transit Hub	6:43	7:43	8:43	9:43	10:43	11:43	12:43	1:43	2:43	3:43

		evening							
3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	Transit Hub
3:45	4:45	5:45	6:45	7:45	8:45	9:45	10:45	11:45	Seaport/WTC
3:58	4:58	5:58	6:58	7:58	8:58	9:58	10:58	11:58	South Station
4:43	5:43	6:43	7:43	8:43	9:43	10:43	11:43	12:43	Transit Hub

ADDING COPLEY SQUARE?

Depending on traffic patterns throughout the day, the Boston Express shuttle will periodically exit and drive directly through Copley Square en route to the Seaport stop. This makes the idea of adding Copley Square as an additional stop particularly tempting.

However, adding an additional stop to a longer-distance, high-traffic route—even a stop that *appears* to be minimal impact—reduces shuttle routing flexibility and therefore makes it much more difficult to stay on schedule. In this instance, it would mean that the shuttle *always* had to route through Copley Square, regardless of the relative congestion levels of the surface streets versus the turnpike.

Furthermore, adding an additional stop entails not only additional driving time, *but also additional boarding and waiting time*. This extra time would make it nearly impossible for the Boston Express to achieve an hourly or bi-hourly frequency, creating a less rider-friendly schedule.

However, it would be possible to integrate Copley Square into a on-demand or *semi*-on-demand routing system. (See below.)

ON-DEMAND ROUTING

what is on-demand routing?

With traditional fixed-route transit, some routes might have empty buses, while other routes are packed. With on-demand dispatching capability, buses go directly to riders—meaning the system adapts to what's happening in real time.

how does it work for riders?

Riders request service using a rider-facing app. An algorithm calculates the optimal path to pick up and drop off multiple riders going in the same direction.

how does it work for drivers?

Drivers can view all of the pending ride requests in real time on a map, and simply tap which riders they intend to pick up. Drivers can then automatically notify those riders of how long it will take to reach them.

how does it work for dispatch?

When riders use an on-demand application, their ride requests go straight to the driver, saving dispatch valuable time juggling phone calls. Instead, dispatch can focus on monitoring the system and never needs to wonder about a given driver's location. **However, on-demand routing can also be handled by dispatch, rather than being automated.**

would on-demand routing work for these routes?

The problem with on-demand routing is that, from a daily commute (rather than single trip) perspective, it is not predictable. Shuttle availability, pick-up times, and on-board duration would vary from day-to-day, making on-demand routing an unreliable solution for riders who are commuting to and from work, or for other repetitive, time-sensitive trips.

However, on-demand routing would be worth exploring for off-peak trips—especially on weekends. **For example, a combined on-demand Cambridge/Boston service during off-peak hours could integrate more stop locations (like Copley Square).**

other possible green line connections

- Waban, Woodland, and Riverside were all discussed in the Overview & Concepts document and rejected at that point. In the process of analyzing the trip data generated by our survey, 128bc did not encounter any factors that would encourage the use of these stops.

express route to north station

- Comparing a Boston Express route that connects with North Station to one that connects with the Seaport and South Station, the latter is able to connect with two major commuting and commercial hubs without actually sacrificing frequency.
- 128bc also tested the addition of North Station as a third stop on the Boston Express route, but the timing is too tight to guarantee a frequency of 60-minutes or less.

Staying at frequencies at or under an hour is a good baseline for creating a service that will be flexible enough to attract and sustain ridership.

express to longwood medical area

- The Longwood Medical Area is directly served by Longwood stop on the Green Line-D (seven stops inbound from Newton Highlands) without additional transfers and therefore not a good use of resources. **Especially during peak commuting hours, taking the Newton Circulator to Newton Highlands and then taking the Green Line would actually be 5-10 minutes faster than driving directly.** Convincing commuters to deal with transfers will require some community education, but a single transfer is generally palatable.

ROUTE IMPACT

Potential weekly rides are an estimate of the maximum number of single-occupancy trips that can be prevented by a shuttle route.

When a route only has one stop, potential weekly rides are simply calculated by multiplying the number of one-way trips created by a route during the week by the maximum capacity of the shuttle.

Things get a little more complicated when a route has multiple stops *if the route is intended to serve local trips*. This is because, at each stop, some riders will exit and some new riders will board. For the purposes of this calculation, which is meant to be a *reasonable* maximum, it is assumed that on a three-stop route, an average of one-third of the riders will get off at each stop and then their seat will be taken by other riders.

(It is theoretically possible that more than one-third of the riders – maybe even all of the riders – could get off at a stop and then immediately be replaced with entirely new riders, but this scenario is too unlikely to be considered as a reasonable maximum.)

Please note that potential weekly rides are not a projection of actual ridership. In fact, in an ideal scenario, ridership would always stay slightly below this number, so that riders would never have to wait for the next shuttle because of insufficient capacity.

PROJECTING RIDERSHIP

Here are some relevant facts.

- According to the Metropolitan Area Planning Council (MAPC), between 2010 and 2014 only 7% of those who work in Newton and only 13% of those who live there reported using public transportation to get to work. For comparison, 39% of Boston residents used public transportation to get to work during this period.
- 128bc's more recent survey data basically corroborated these rates: Among the 1320 respondents, 15% reported using public transportation at least twice per week, but these numbers also include trips that are not work-related. Rather than using public transportation, most commuters are using their personal vehicles for most trips—and more than 95% of them own at least one personal vehicle.

It is extremely difficult to project ridership for a population that is not already using public transportation.

- However, 128bc knows from prior experience that it **is** possible to build shuttle ridership from a population that primarily depends upon personal vehicles. **128bc's Needham shuttle regularly reaches 70-80% capacity during peak periods—despite the fact that only 2% of those who work in Needham and only 12% of those who live there actually report using public transportation**, according to MAPC.
- When comparing the populations of Needham and Newton, a higher percentage of Needham residents *and* workers primarily commute by personal vehicle: Again according to MAPC, 96% of Needham's workforce and 86% of Needham's residents primarily commute by personal vehicle, compared to 85% and 79% for Newton. Based upon the principle that those with a personal vehicle will use it (even when they don't need to) the lower rates of car ownership in Newton should imply that Newton-based shuttles have an even higher chance for success than those based in Needham.

Keys for success.

- Returning to 128bc's recent survey data, 48% of respondents agreed that "driving is a waste of time," but 67% said that they "felt more in control when driving". Helping riders to feel more in control when on a shuttle is partially a matter of rider education—mainly, emphasizing the ability to control *non-driving tasks* while riding. However, maintaining a predictable schedule with frequent departures also contributes to a sense of control.
- In terms of respondents' issues with public transportation, most hold positive impressions of their public transportation service's safety and its fare structure, but respondents expressed greater dissatisfaction with the frequency of service and the facilities at their stop or station. The Transportation Hub should particularly address the latter concern.

PROJECTING RIDERSHIP

Achievable ridership goals

Extrapolating from the limited data available and reflecting upon past service metrics, **128bc believes that an achievable ridership goal would be to reach 75% capacity for on-peak runs and 30% capacity for off-peak runs after 6-12 months for Route 1, and 60% capacity for on-peak runs and 20% capacity for off-peak runs for Routes 2, 3 & 4.** (Note that Route 2 only has on-peak service.) This goal can be used as a benchmark by which to consider making adjustments to timetables, stops, routing and communications & advertising, all of which can be periodically evaluated and recalibrated in order to better reach the Northland Newton Development's congestion reduction goals.

Assuming implementation of the full schedule for each route, here's what meeting these ridership goals would look like:

	Route 1	**Route 2**	**Route 3**	**Route 4**	
weekday on-peak capacity	1378	736	672	672	3458
on-peak ridership goal	1033.5	441.6	403.2	403.2	**2281.5 trips**
weekday off-peak capacity	1344	--	512	512	2368
off-peak ridership goal	403.2	--	102.4	102.4	**608 trips**
total capacity	2722	736	1184	1184	5826
total weekday ridership goal	1436.7	441.6	505.6	505.6	**2889.5 trips**

When combined with other transportation mode shifts (public transportation, bikeshare, carpool), meeting or exceeding these ridership goals would make a significant impact in terms of offsetting new trips and reducing pre-existing congestion.