Installation of a Noise Barrier along I-93

Background & Existing Conditions

SOMERVILLE TRANSPORTATION EQUITY PARTNERSHIP

The Welcome Project
Education and advocacy with Somerville's immigrant communities

MAPC
METROPOLITAN AREA PLANNING COUNCIL

COMMUNITY ASSESSMENT OF FREEWAY EXPOSURE & HEALTH

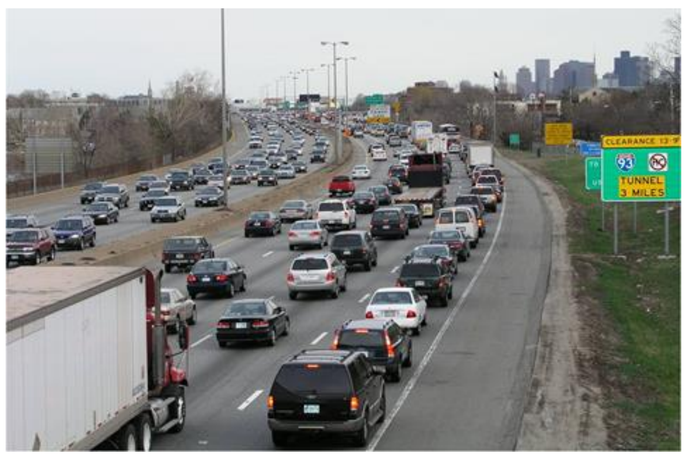
1852 Tufts UNIVERSITY

Context
I-93 in Somerville

When I-93 was built through Somerville in the 1970s, there was significant community resistance. I-93 cut through an existing neighborhood and business district in Somerville and would primarily serve the residents of new suburban communities.

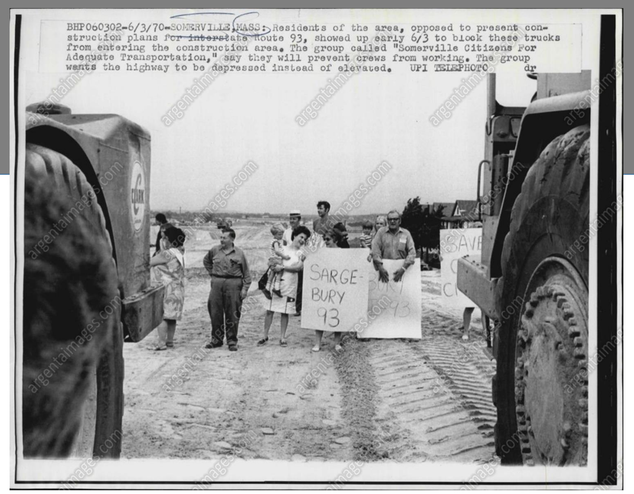
In response to protest and evidence of I-93's impact, the state agreed to build a community center, plant trees, and erect barriers along the highway to partially reduce noise and air pollution for people living near the highway.

It Never Happened.



Traffic along 1-93 in Sommerville

Today, many Somerville residents face potential health risks because they live near I-93 and are exposed to high noise and air pollution levels.



Somerville residents in protest 1-93

MassDOT Noise Barrier Programs

The MassDOT will consider noise barriers for highways that meet one of the following criteria:

1. New highways or substantial alteration where noise exceeds the threshold standard (Type I Projects)
2. Existing highways where noise exceeds the threshold standard (Type II Projects)

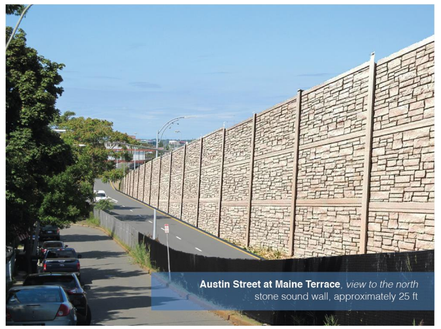
As an existing highway, **I-93 meets the criteria for a Type II project**.

References: Shelton, William C. (2007, December 27). *Holding our breath.* http://www.thesomervilletimes.com/archives/2720
Shelton, William C (2017, January 22) *We've already paid for the GLX.*
http://www.thesomervilletimes.com/archives/64688

Context

Noise Barrier along I-93

What might noise barriers look like?

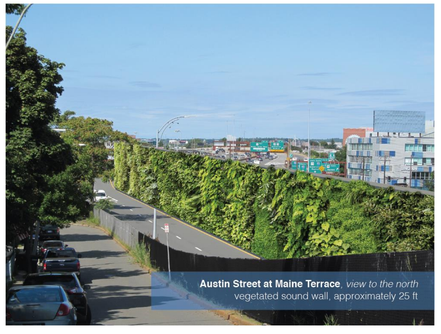


Austin Street at Maine Terrace, *view to the north*
stone sound wall, approximately 25 ft

Rhode Island Ave at Connecticut Ave, *view to the north*
vegetated / transparent sound wall, approximately 25 ft

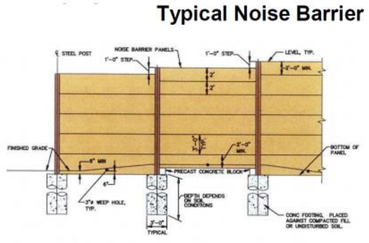
Austin Street at Maine Terrace, *view to the north*
vegetated sound wall, approximately 10 ft

Route 38 at Temple Street, *view to the north*
transparent sound wall, approximately 25 ft



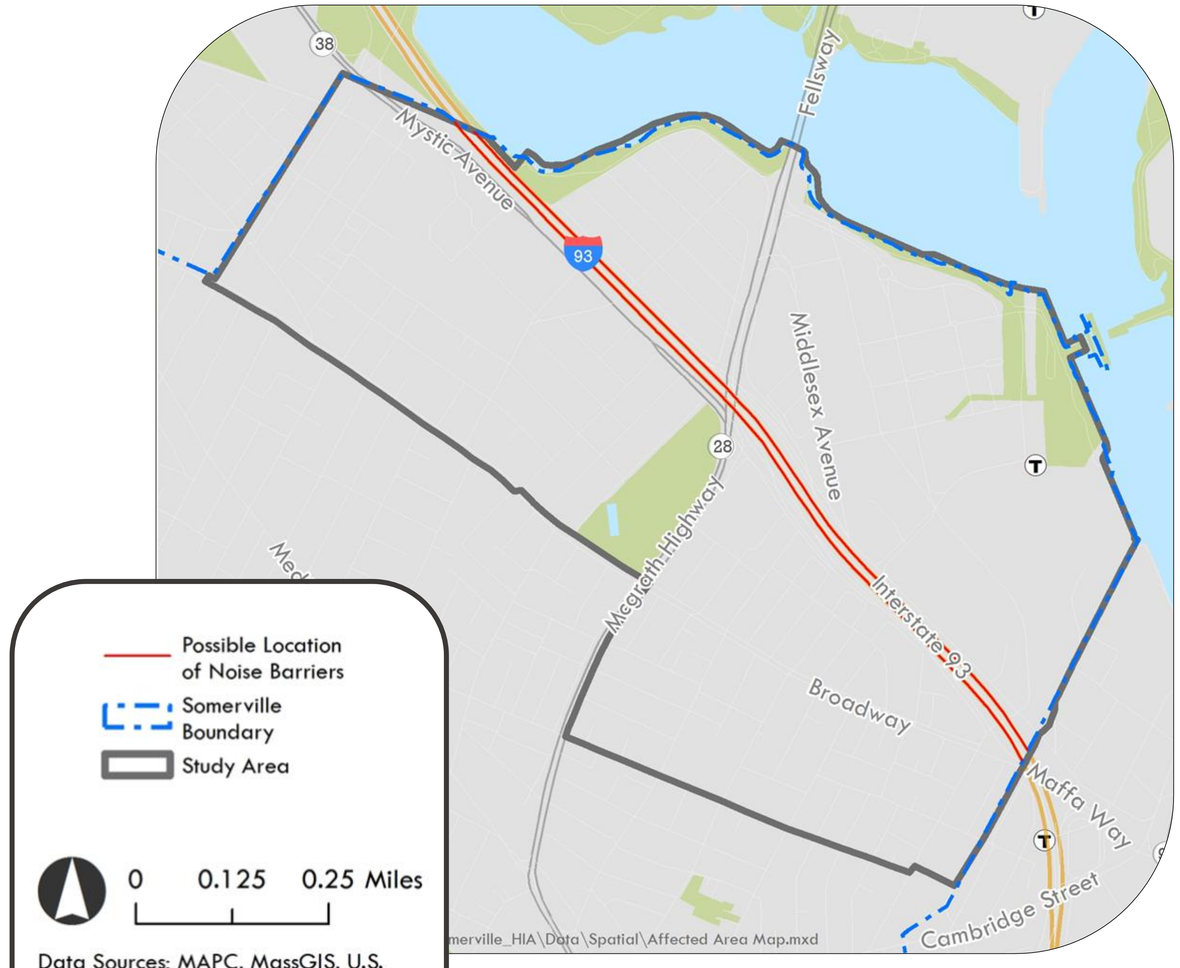
Austin Street at Maine Terrace, *view to the north*
vegetated sound wall, approximately 25 ft

Typical Noise Barrier



Proposed Height: 12' - 18'
Proposed material: Pre cast concrete
Installation: At edge of roadway (or as close as possible given site characteristics)
Noise Abatement Criteria (NAC) B** - 67 (Exterior) Residential.

Where might noise barriers go?



Possible Impact

Noise Barriers along I-93

Noise barriers can reduce noise when they are tall enough to break the line of sight from the highway. Increasing barrier height above the line of sight can further decreases noise levels. The reduction to environmental noise from barriers is easily noticeable.

But! Geographic conditions may limit barrier installation and efficacy.

Noise barriers can have a positive effect on their community. Attractive barriers improve impressions of an area. Effective-looking noise barriers can also lessen the perception of noise.

But! There is no consensus on the impact of noise barriers on housing prices

Noise barriers can reduce air pollution. In general, the higher the barrier, the higher the reduction in downwind (the direction the wind is blowing) air pollution.

But! In non-perpendicular winds, pollutants will build up at the edges of noise barriers. Wind can also increase on-road pollution and any breaks in the barrier will lead to higher pollution levels at gaps.

Environments with vegetation like trees, bushes or flowers can reduce noise annoyance. In certain conditions, plant barriers can reduce noise and air pollution itself. In combination, plants and solid noise barriers may reduce more air pollution than either barrier alone.

But! To reduce noise and air pollution with plants alone, plant barriers must be 100ft thick, 20ft high, with no gaps in foliage. These conditions are difficult to design and maintain.

Sources: Baldauf, R (2016) “Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality”; FHWA, 2011 Highway Traffic Noise: Analysis and Abatement Guidance; FHWA, 1980; Joynt and Kang, 2010 “The influence of preconceptions on perceived sound reduction by environmental noise barriers” ; Hong and Jeon, 2013 “The effects of audio-visual factors on perceptions of environmental noise barrier performance”

Background

Traffic-Related Air Pollution

What do we know about air pollution?

All air includes air pollution, but people who live, work or go to school near busy roadways face increased exposure. Air pollution is often elevated near busy roadways, especially within first 100-300 meters.

This elevated air pollution near busy roadways is called traffic-related air pollution, or **TRAP**. TRAP is made up of the particles and gases from cars, trucks, and other vehicles.

We focus on Ultrafine Particles (UFP), the smallest of particles in TRAP. We chose this focus for 2 reasons;

1) Of the particles and gases in near roadway air pollution, we think UFP are the largest concern; UFP are so small they easily get into people's lungs, blood and brains.

2) We have over 10 years of site-specific, peer-reviewed research on UFP and their impact on the health of Somerville's residents; this is an incredible resource.

What health conditions are we worried about?

People with higher exposure to UFP tend to have higher levels of inflammation and swelling in their blood. There is evidence connecting UFP exposure to diseases caused by inflammation and swelling, such as:

- **Heart Disease**
  - Heart Attack
  - Stroke

- **Respiratory Disease**
  - Childhood Asthma
  - Lung Cancer
  - Chronic obstructive pulmonary disease (COPD)

- **Neurological Health Conditions**
  - Childhood Autism

References:

Lane KJ, Levy JI, Scammell MK, Peters JL, Patton AP, Reisner, Lowe L, Durant JL, Zamore W, Brugge D. Association of modeled long-term individual exposure to ultrafine particles with inflammatory and coagulation biomarkers, *Environment International*, 2016, 92–93: 173–182.

Patton AP, Collins C, Naumova EN, Zamore W, Brugge D, Durant JL. An hourly regression model for ultrafine particles in a near-highway urban area. *Environmental Science and Technology*. 2014, 48:3272−3280.

Lane KJ, Levy JI, Scammell MK, Patton AP, Durant JL, Mwamburi M, Zamore W, Brugge D. Effect of time-activity adjustment on exposure assessment for traffic-related ultrafine particles. *Journal of Exposure Science and Environmental Epidemiology*. 2015; 25:506–516.

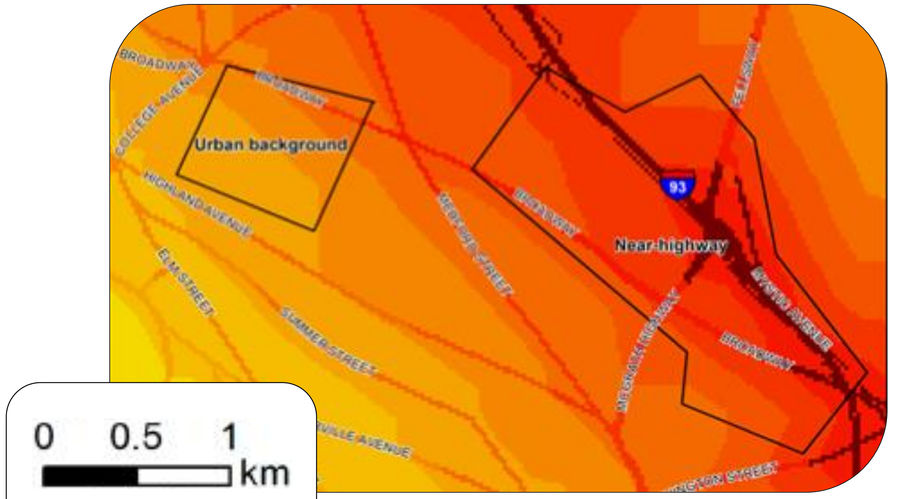
Existing Conditions
Traffic-Related Air Pollution

What do we know about the health of residents?

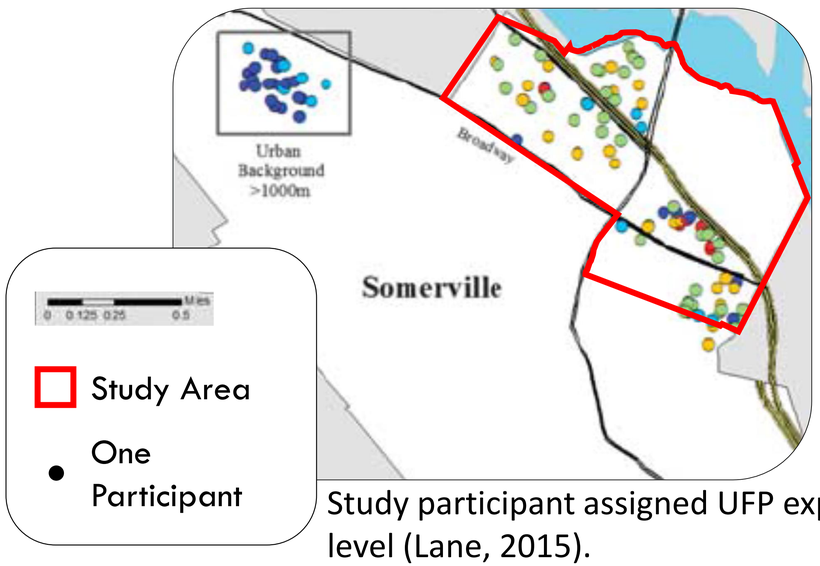
We have evidence from Somerville, developed through rigorous environmental studies, that:

- On average, UFP levels are greater the closer you are to I-93;
- Residents who live in Winter Hill, East Somerville, and Ten Hills neighborhoods neighborhoods are being exposed to more UFPs;
- These same residents have greater amounts inflammation and swelling in their blood; and
- Long-term, high levels of inflammation puts them at risk for diseases such as heart disease, respiratory disease, and neurological health conditions

In summary, **the residents of the Mystic Ave and states avenues areas and the Ten Hills neighborhood are at increased risk for bad health due to UFP exposure from near-highway air pollution.**



Predicted UFP levels in air based on statistical modeling for the Somerville areas (Patton, 2014 and 2015).



Study participant assigned UFP exposure level (Lane, 2015).

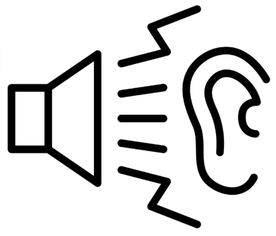
Higher UFP Levels

Lower UFP Levels

Background
Sound Levels

What do we know about noise pollution?

The traditional definition of noise is “unwanted or disturbing sound”. Sound becomes unwanted when it either interferes with normal activities such as sleeping, talking, or reduces one’s quality of life.



Noise can be pervasive in urban environments, causing annoyance, sleep problems, and stress.

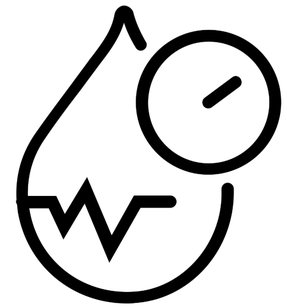
Taken together, there is a growing body of evidence that traffic-related air pollution and noise can cause heart disease.

Long-term exposure to traffic-related noise above 60 dB has been linked to poor health outcomes. We used this sound level as our health threshold. The Federal Highway Authority uses noises above 67 dB during the nosiest hour of the day as their action threshold for residential noise abatement.

What health conditions are we worried about?

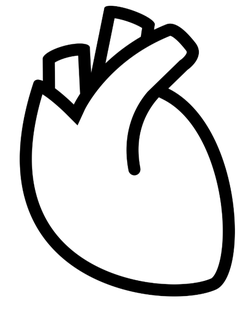
Annoyance from noise pollution increases the risk for chronic stress.

Night-time noise pollution can disturb sleep, causing increased blood pressure.



Extended exposure to very high noise can lead to inflammation or swelling throughout the body. Long-term inflammation can increase your risk for **heart disease**, including:

- Coronary Artery Disease
- Hypertension
- Stroke
- Diabetes
- Heart Failure



References:
Münzel, T., Herzog, J., Schmidt, F. P., & Sørensen, M. (2017). Environmental stressors and cardiovascular disease: the evidence is growing.
Münzel, T., Schmidt, F. P., Steven, S., Herzog, J., Daiber, A., & Sørensen, M. (2018). Environmental noise and the cardiovascular system. *Journal of the American College of Cardiology*, *71*(6), 688-697.
Haralabidis A.S., Dimakopoulou K., Vigna-Taglianti F., et al. *(2008) Acute effects of night-time noise exposure on blood pressure in populations living near airports. Eur Heart J 29:658–664*
Environmental Protextion Agency, **Clean Air Act Title IV - Noise Pollution.** https://www.epa.gov/clean-air-act-overview/clean-air-act-title-iv-noise-pollution
FHWA (2018) *Noise Measurement Handbook*

Existing Conditions

Sound Levels

What do we know about noise pollution in this area?

Average noise levels are above the health-risk and the FWHA action-level threshold for the entire monitoring period in both the Mystic View and states avenues areas. At several sites, noise became greater as elevation increased.

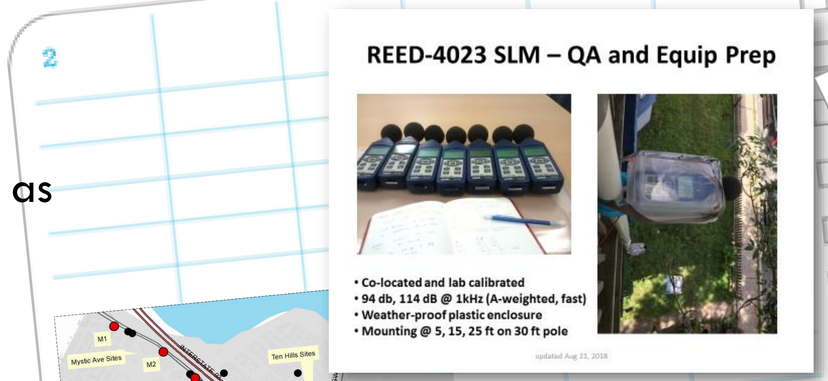
Existing sound barriers in the Ten Hills neighborhood helped, but still left some locations above the health threshold.

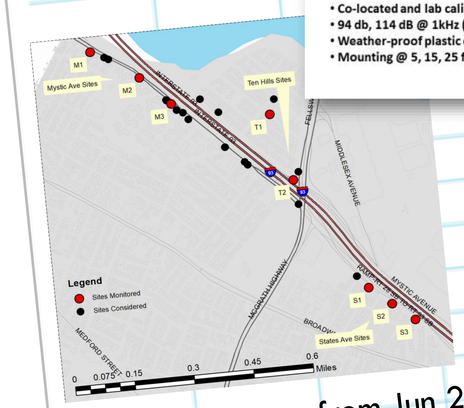
Sound barriers on the highway in the states avenues area, where the barriers can be continuous, would reduce noise pollution.

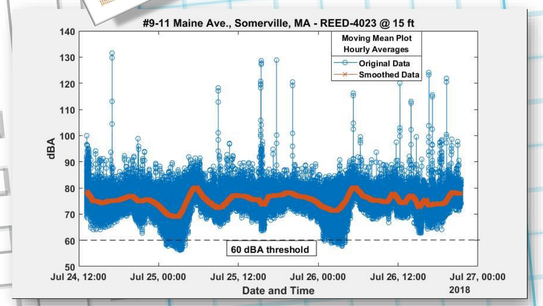
Barriers near Mystic View, whether located on the highway or along Mystic Ave, would be interrupted often due to intersections, and therefore probably not very effective for noise pollution.

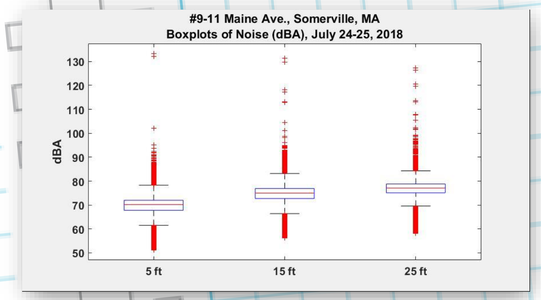
We don't yet have the data to predict the impact of noise barriers at Foss Park.

How did we measure existing conditions?









Monitored noise from Jun 27 to Aug 17, 2018
Eight (8) sites monitored to date (map)
Three (3) monitoring heights: 5ft, 15ft, 25ft
Equipment: REED-4023 Sound Level Meters (SLM)
Other Data:
- Meteorology data from KBOS/Logan records
- Traffic flow diagrams from CTPS.

Background

Quality of Built Environment

What do we know?

Exposure and access to **green spaces** is associated with improved mental well-being and reduced stress as well as higher levels of outdoor physical activity.

The quality, availability and accessibility of **outdoor public spaces** is associated with residents reporting positive social interactions among themselves and neighbors.

Public art, such as murals and sculptures, has been found to have beneficial effects on mental health and improved feelings of control over one's life.

In relation to the items above, **feelings of ownership of neighborhood streets and outdoor spaces** is associated with improved perceptions of safety and security. Residents who feel safer are more likely to meet daily physical activity recommendations.

What are the related health conditions or risk factors?

- Participants in earlier meetings reported a lack of trees along neighborhood streets and green open spaces in the neighborhoods adjacent to the interstate.
- Participants expressed positive feelings of views of the Mystic River; residents did not like the sight and noises related to the highway.
- The recent improvements to Harris Park and Playground were cited positively by participants.
- According the Wellbeing of Somerville report (2018):
  - 31% of high school students self-report mental health issues, including depression.
  - Mental health historically is a top cause of hospitalizations among residents 25-39 years old; indications of racial/ethnic disparities.
  - Heart disease has historically been a leading cause of death among residents 40-64 years old.
  - Historically, lung cancer is leading cause of cancer death. Lung cancer is higher in Somerville than the rest of the state, even though Somerville has lower smoking rates.

References:
Urban Design and Mental Health. **How Urban Design can Impact Mental Health.** https://www.urbandesignmentalhealth.com/how-urban-design-can-impact-mental-health.html
Tebes JK, Matlin SL, Hunter B, et al. Porch Light Program: Final evaluation report. The Consultation Center at Yale. Yale School of Medicine; 2015. *Accessed on February 4, 2016*

Existing Conditions

Quality of Built Environment

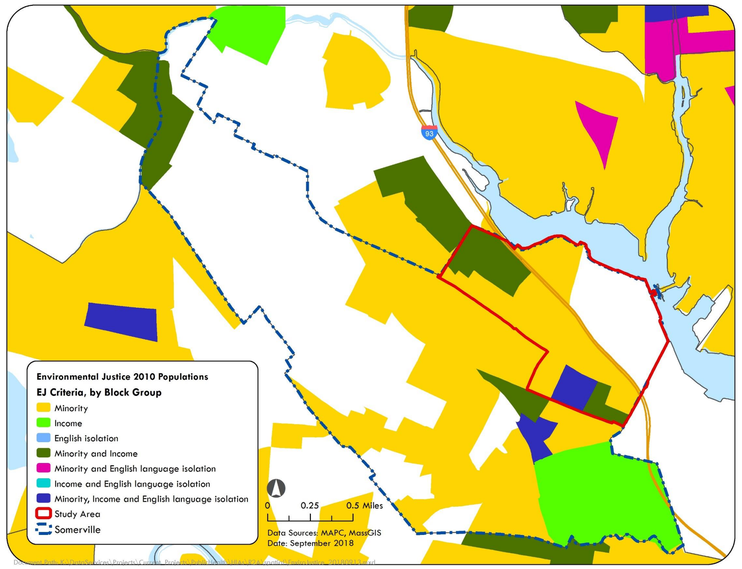
What do we know about the quality of the built environment?

Somerville data indicates that crime has been decreasing since 2010 and that, in general, **crime rates in Somerville are 20% lower than the U.S. rates**.

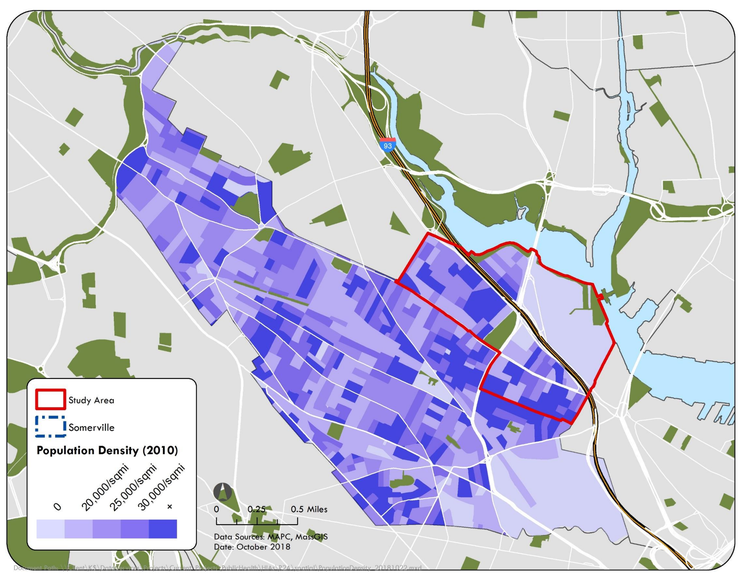
Nearly **two thirds of housing in the study area was built before 1940**. Older housing allow pollutants to accumulate when too much outdoor air enters indoors.

Approximately 65% of homes in the study area are rented. Since 2000, median rent increased by 43%. **The average market rate rent in 2015 was $2,567 for a two-bedroom apartment**, an amount requiring a household income of approximately $90,000. The median household income for the Somerville is $78,673.

Despite having small parks spread across the city, open space in Somerville is limited. **There are roughly 2 acres of open space for every 1,000 Somerville residents.** This is one of the lowest ratios of open space to residents in Massachusetts.



Environmental Justice communities



Population density and Open Space

References:
The Trust for Public Land, ParkServe; FBI, Uniform Crime Reporting Program and Somerville Police; The Wellbeing of Somerville Report, 2017; The U.S. Census Bureau

Taking Action

Possible Next Steps

Sources of Funding

- MA Department of Transportation Highway Department (*see Context board for criteria*)
- State transportation bond (*requires legislative approval*)
- MA Gaming Commission
- Developers of new housing and commercial sites
- **Other suggestions?**

Stakeholders to Involve

- Local elected officials
- Community advocacy groups
- Conservation Law Foundation
- **Who else?**

Advocacy and Education Strategies

- More community outreach
- Publicity for the issue in local and regional media
- **What else?**

Your Feedback

Questions and Comments

Please share your thoughts on sound barriers and any questions you might have in the space above