Public Comments Submitted to the Boston Region MPO

March 25, 2021

The following written comments were submitted to the MPO after meeting materials had been posted to the MPO website and shared with board members in advance of the March 25, 2021, MPO meeting:

- **Belmont:** Community Path, Belmont Component of the MCRT (Phase 1) (#609204) (Scored for FFYs 2022—26 TIP)
- **Norwood:** Intersection Improvements at Route 1 and University Avenue/Everett Street (#605857) (Currently programmed in FFY 2022)
- **Swampscott:** Swampscott Rail Trail (#610666) (Scored for FFYs 2022—26 TIP)

Belmont (#609204): Community Path, Belmont Component of the MCRT (Phase 1)

March 23, 2021

Matt,

I also want to bring to your attention to this recent study by researchers at Harvard and Boston University in case this helps to make the case for a bike path. In a nutshell:

The analysis shows that the economic benefit of lives saved from increased walking and cycling far exceeds the estimated annual investment to promote such infrastructure, without even considering the added benefits of reducing air pollution and increasing access to climate-friendly transportation modes.

http://www.bu.edu/articles/2021/improved-walking-and-bicycling-infrastructure-could-save-hundreds-of-lives-billions-of-dollars-northeast/?utm_campaign=bu_today&utm_source=email_20210323_faculty_staff_others&utm_medium=1_featured_story&utm_content=research_environment

The academic article is attached. Thank you for your efforts on this important upgrade.

Katharine Canfield

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Mortality Implications of Increased Active Mobility for a Proposed Regional Transportation Emission Cap-and-Invest Program

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Abstract The transportation sector is now the primary contributor to greenhouse gas emissions in the USA. The Transportation Climate Initiative (TCI), a partnership of 12 states and the District of Columbia currently under development, would implement a cap-and-invest program to reduce transportation sector emissions across the Northeast and Mid-Atlantic region, including substantial investment in cycling and pedestrian infrastructure. Using outputs from an investment scenario model and the World Health Organization Health Economic Assessment Tool methodology, we estimate the mortality implications of increased active mobility and their monetized value for three different investment allocation scenarios considered by TCI policymakers. We conduct these analyses for all 378 counties in the TCI region. We find that even for the scenario with the smallest investment in active mobility, when it is fully implemented, TCI would result in hundreds of fewer deaths per year across the region, with monetized benefits in the billions of dollars annually. Under all scenarios considered, the monetized benefits from deaths avoided substantially exceed the direct infrastructure costs of investment. We conclude that investing proceeds in active mobility infrastructure is a cost-effective way of reducing mortality, especially in urban areas, providing a strong motivation for investment in modernization of the transportation system and further evidence of the health co-benefits of climate action.

Keywords Physical activity · Transportation · Active transport · Bicycling · Walking · Mortality

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Introduction

In the USA, the transportation sector produces the largest share (28.2%) of greenhouse gas (GHG) emissions [1]. In the Northeast and Mid-Atlantic states, transportation accounts for an even greater share (34.5%) of CO_2 equivalent emissions [2]. Building upon existing programs (e.g., the Regional Greenhouse Gas Initiative) [3], 12 states and the District of Columbia are currently in discussions to create a program called the Transportation Climate Initiative (TCI). The TCI is a regional cap-and-invest program that is intended to limit GHG emissions from the transportation sector and further reduce emissions through investment of proceeds in sustainable transportation initiatives.

Actions to reduce GHG emissions from the transportation sector present an opportunity to both mitigate climate change and provide near-term health co-benefits, which could be important motivation for policymakers and stakeholders. Strategies to reduce transportation GHG emissions will reduce emissions of other air pollutants shown to be harmful to health

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[4, 5]. In addition, TCI is expected to have significant impact on mobility choices across the region both by internalizing the negative externalities of personal occupancy vehicle travel through a price signal and by improving alternative transportation options through investment in sustainable transportation. One of the most prominent opportunities to simultaneously reduce transportation emissions and improve health, particularly in urban areas, is investment in active mobility.

Active mobility, defined as transportation modes that are human-powered (primarily walking and cycling), is associated with improved health outcomes, including reduced risk of all-cause mortality [6], lower incidence of cardiovascular disease [7] and diabetes [8], and improved mental health [9]. Further, research suggests that investing in cycling [10] and pedestrian [11] infrastructure can increase the likelihood of active mobility trips. By investing some of the proceeds from the TCI program in active mobility infrastructure, there is the potential to shift residents to active modes that will improve health and create a virtuous cycle of further reductions in GHG emissions.

In this study, we quantified the potential mortality impacts of increased active mobility under illustrative TCI cap-and-invest scenarios in the 13 jurisdictions. As inputs, we used estimates of the change in personal miles traveled (PMT) cycling and walking under three different investment scenarios developed by state policymakers in the TCI region. We implemented the World Health Organization (WHO) Health Economic Assessment Tool (HEAT) methodology to estimate the mortality implications from increased active mobility for all 378 counties in the region, taking into account deaths avoided from increased physical activity and additional traffic fatalities incurred from increased PMT walking and cycling. Finally, we present results for net deaths avoided and monetized benefits by county, highlighting the potential health benefits of the illustrative TCI scenarios particularly within urban areas.

Methods

Greenhouse Gas Reductions and Investment Policy Scenarios

As currently envisioned in the draft TCI Memorandum of Understanding [12], fuel suppliers of on-road diesel fuel and finished motor gasoline will be required to hold allowances for each ton of GHG emissions based on the carbon content of the fuel they sell. As with other emission cap programs, the number of allowances will be determined based on a target emission level (or "cap") that can be ratcheted down to reduce emissions over time. Fuel suppliers would need to purchase allowances on the market each year, which would influence the price of gasoline and generate revenue for states to invest. Each state that is a signatory to the final TCI program would receive a share of the allowance auction proceeds and maintain discretion to invest proceeds as desired, with the overall understanding that states will prioritize sustainable transportation and equity [12].

TCI would generate revenue by implementing a price on transportation CO_2 emissions, of which a portion would be invested in cycling and pedestrian infrastructure improvements. State policymakers have considered a number of different scenarios, including various caps and allocations of proceeds. Here, we evaluate the mortality implications of changes in active mobility from three illustrative investment scenarios ("A," "B," and "C") under a 25% GHG emission cap in 2032. Each investment scenario has a different mix across six buckets, including fleet electrification and alternative fuel incentives, vehicle travel reduction, road infrastructure improvements, urban transit expansion, transit vehicle investment, and indirect non-GHG reducing investment (see Table 1) [13]. Investment in pedestrian and cycling infrastructure is found within the travel reduction bucket. While the emission cap is the same across all three scenarios considered here, total proceed to be allocated is not, as the total revenue generated by a cap is the product of the interaction between the investment allocation and petroleum fuel demand (a detailed breakdown of investment allocation under each scenario and the impacts of six additional emission cap-and-invest scenarios can be found in the appendix and demonstrate that benefits scale roughly linearly across the various investment levels).

Scenario A represents a diversified investment portfolio where each of the six buckets receives a balanced allocation of the revenue. In this scenario, walking and cycling infrastructure both receive an average annual allocation of $320 million. Scenario C prioritizes investments that achieve the greatest reductions in GHG emissions per dollar invested. Finally, scenario B is a middle ground mix between the other two scenarios. In the TCI investment model

Table 1 TCI investment scenarios for a 25% cap on regional GHG emissions with active mobility investments broken down; annual investment presented is averaged over the 2022–2032 period. See Appendix Table 4 for a complete breakdown of all investment buckets

Investment bucket	Scenario A		Scenario B		Scenario C	
	Share of total	Avg. annual investment (millions)	Share of total	Avg. annual investment (millions)	Share of total	Avg. annual investment (millions)
Fleet EV/Alt. fuel Incentives	25.9%	$2000	52.7%	$3300	81.3%	$3700
Vehicle travel reduction	16.2%	$1200	13.9%	$870	10.5%	$480
Bicycle investment	4.2%	$320	5.1%	$320	6.0%	$280
Pedestrian investment	4.2%	$320	3.0%	$190	0.0%	$0.0
Other	7.8%	$560	5.8%	$360	4.5%	$200
Road infrastructure	7.0%	$530	7.6%	$480	0.8%	$36
Urban transit expansion	24.2%	$1800	12.4%	$780	0.0%	$0.0
Transit vehicle investment	10.0%	$760	5.0%	$310	0.0%	$0.0
Indirect non-GHG reducing	16.7%	$1300	8.3%	$520	7.4%	$340
Total	100.0%	$7600	100.0%	$6300	100.0%	$4600

(described below), pedestrian infrastructure is less cost-effective at reducing GHG emissions compared to electrifying public transit, cycling infrastructure, and several other investment options. As a result, pedestrian infrastructure is deprioritized in scenario B compared to scenario A, and eliminated altogether from scenario C.

Estimating the Impact of TCI Investment on Active Mobility

To compare illustrative scenarios under consideration by the policymakers, the TCI implemented an input-output tool [14] ("Investment Strategy Tool") to model how investment of TCI proceeds in various sustainable

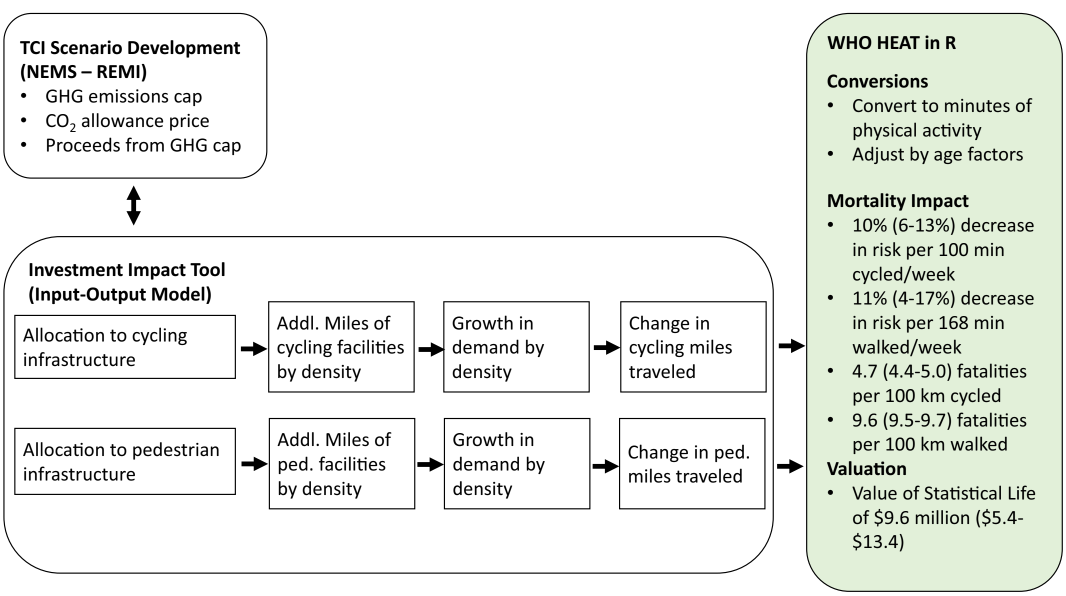

Fig. 1 Schematic of multi-model study design

transportation strategies might shift vehicle and personal miles traveled. In the case of active mobility, the model estimated the change in PMT walking and cycling from investment in cycling and pedestrian infrastructure. We use the output from this tool (county-level change in PMT) as the input for our mortality assessment from estimated increased activity (see Fig. 1). Below, we briefly describe the modeling assumptions for the Investment Strategy Tool pertaining to active mobility investment. (For a more comprehensive description of the Tool methodology, please see the documentation on the Transportation Climate Initiative website [15].)

Investment of TCI Proceeds in Cycling Infrastructure

The investment tool is based on the assumption that investment in cycling infrastructure (specifically four facility types: bike lanes, separated bike lanes, shared-used paths, and bike boulevards) will incent mode shift to cycling and increase the number of personal miles cycled across the region. The estimated increase in bicycle PMT from a dollar invested in cycling infrastructure is a function of both (1) the cost per facility mile and (2) the change in miles traveled from the construction of a new facility mile. Both of these factors themselves are a function of county population density and facility type. Put differently, the tool assumes that a mile of bike lane differs in cost ($25,000) from a mile of grade-separated protected bike lane ($500,000), and the impact of a mile of newly constructed bike lane on PMT per capita is assumed to be different for an urban county compared to a rural one. The increase in bicycles' miles traveled per new facility mile is based on various studies in US cities examining the relationship between bicycle infrastructure and bicycling [10, 16, 17]. Maximum network density assumptions (quarter-mile spacing for bike lanes, one-mile spacing for separated paths) limit the extent of the network. Funding is initially allocated across population density categories in proportion to the population in each category, but is capped once the network is built out in a county density type, which happens in the more densely populated counties.

Investment of TCI Proceeds in Pedestrian Infrastructure

The pedestrian investment model is based on a "Complete Streets" framework [18], which assumes that investment in sidewalks, traffic calming, and other pedestrian-focused strategies will make walking safer and more attractive, leading to increased PMT walking. As with the cycling investment model, it is assumed that the construction of Complete Streets projects will increase walking trips as a function of county population density. Pedestrian infrastructure is assumed to have greater impact on the number of walk trips in urban areas compared to rural areas; however, the capital cost of an additional facility mile of Complete Streets projects (incremental to the cost of other roadway improvements) is assumed to be more expensive in urban core areas ($900,000) compared to rural areas ($250,000). The TCI tool does not implement a maximum build-out for pedestrian infrastructure, but it does take into account existing pedestrian mode share.

In addition, separate investment in public transit is assumed to generate an increase in walk PMT due to the multi-modality of transit commuting. The investment model applies the blanket assumption that all new transit trips from TCI investment will include a ¼-mile walk on each end. The tool assumes that cycling and walking investments are made independently and do not affect change in PMT of each other. In practice, it is conceivable that TCI investment in shared use paths (a type of cycling investment) might increase pedestrian PMT as well as cycling PMT, making this a conservative assumption regarding pedestrian PMT.

Time Horizon

For both cycling and pedestrian infrastructure investment, a 1-year time lag is assumed to occur between investment and completion of construction. While the TCI initiative is expected to be implemented in 2022, with revenue invested annually thereafter in new cycling and pedestrian infrastructure, for our analysis, we assume full build-out of TCI-funded cycling and pedestrian infrastructure will occur in 2032. We estimate annual mortality benefits starting in 2032 and going forward, ignoring partial benefits occurring during the build-out period.

Estimating the Impacts of Additional Active Mobility on Mortality

We developed an R [19] version of the WHO HEAT [20] tool to estimate how the change in PMT in each investment scenario would impact mortality incidence at the county level. We estimated both deaths avoided from increased physical activity and additional traffic fatalities incurred from increased cycling and biking.

We used the concentration-response functions for deaths avoided from increased walking and cycling activity that were agreed upon by the WHO after reviewing the literature (RR: 0.89; 95% CI: 0.83, 0.96 for walking and RR: 0.90; 95% CI: 0.87–0.94 for cycling per 11.25 metabolic equivalents (MET) hours, a measure of physical activity exertion, per week from a meta-analysis of the existing literature) [6]. We applied the traffic fatalities per 100 million kilometers cycled (4.7; 95% CI: 4.4–5.0) and walked (9.6; 95% CI: 9.5–9.7) found in Buehler and Pucher (2017) [21] to estimate the increase in traffic fatalities from additional PMT under each scenario. Finally, we employed travel speed assumptions and minutes per MET-hour of activity used by the WHO to convert miles traveled to minutes of activity for use in the HEAT functions. Pulling these assumptions together, we related a change in minutes of activity to a change in net deaths through the following relationships at the county level:

$$\text{deaths avoided} = (1{-}\text{RR}) * \frac{\text{change in minutes of activity}}{\text{reference activity value}} * \text{baseline mortality rate}$$

$$\text{traffic fatalities} = \left(\frac{\text{change in PMT}}{100\ \text{million}}\right) * \text{fatality rate per 100 million miles traveled}$$

$$\text{net deaths avoided} = \text{deaths avoided}{-}\text{traffic fatalities}$$

where the change in minutes of activity is calculated assuming a cycling speed of 8.7 mph and walking speed of 3.3 mph, and the reference activity level needed to achieve the full protective effect is 100 min for cycling and 168 min per week for walking based on the MET-to-minutes conversion.

The concentration-response functions for deaths avoided from increased physical activity are specifically for adults, aged 20–64 for cycling and 20–74 for walking [20]. To be conservative, we assume that only a portion of the change in PMT would occur within these relevant age groups. We used the 2017 National Household Travel Survey [22] to estimate the share of survey-weighted bike miles (80%) and pedestrian miles (72%) traveled by each age group and applied these factors to our PMT inputs.

Mortality rate is correlated with age, race/ethnicity, income, and many chronic conditions. Most notably, mortality rate increases exponentially with age even within the 20–64 years old group. Using the HEAT methodology, given the same change in activity, areas with older populations and thus higher baseline mortality will see larger reductions in mortality from increased activity. While we incorporate differential baseline mortality rates *between* age groups, we assume homogeneity of mortality risk *within* age groups. We also assume homogeneity across the age range for the distribution of change in PMT. Data from the 2017 National Household Travel Survey suggest that the current cycling and walking rate is relatively consistent across the age groups considered, though it is not necessarily the case that current adoption by age is a good proxy for behavior change by age [22].

To estimate the monetized benefits of net deaths avoided, we applied a value of statistical life (VSL) of $9.6 million (2016 USD), with a range of ($5.4 million–$13.4 million) and a uniform distribution, based on the U.S. DOT guidance [23]. We performed a Monte Carlo analysis to construct confidence intervals that combine uncertainty for the estimates of physical activity mortality impacts, traffic fatalities, and monetized benefits.

Data Sources

To estimate the change in personal miles traveled for both walking and cycling, we used the county-level outputs from the investment tool for each of the proposed scenarios. For the county-level baseline mortality rate, we used all-cause mortality from CDC WONDER [24] averaged across the 1999–2016 period for the 20–64 age group (for cycling) and 20–74 age group (for walking), and population data from the 2019 U.S. Census Bureau's Population Estimates Program [25].

Results

Change in Active Mobility by Investment Scenario

We estimated the change in activity that would result from TCI investment in cycling and walking infrastructure for the three investment scenarios: "A," "B," and

"C" under a 25% GHG emission reduction cap for on-road transportation.

Cycling infrastructure improvements would receive in the range of $280–$320 million per year over the 10-year investment period (2022–2032), which would result in an estimated 18,000–22,000 miles of additional cycling infrastructure across the region (see Fig. 2). We estimate that this increase in cycling infrastructure would generate around 1 billion additional cycling PMT per annum starting in 2032 after full build-out.

Investment in pedestrian infrastructure has more variation across the scenarios. In scenario "A," TCI investment is estimated to produce 6000 miles of pedestrian facilities in the region and an estimated 230 million additional PMT per year. Scenario "B" would produce around 3500 miles of Complete Streets leading to 180 million miles of additional pedestrian PMT per year. Scenario "C" includes no investment in pedestrian infrastructure.

Impact of Investment Scenarios on Mortality across TCI Region

We found that regardless of the investment scenario, hundreds of deaths could be avoided annually from TCI investment in active mobility infrastructure (see Table 2). Scenario "A," the balanced portfolio approach, would net the largest number of deaths avoided, 710 (95% CI: 450, 970), corresponding with its greater investment in active mobility measures, including equal investment in cycling and walking infrastructure. The middle-of-the-road scenario "B" would result in an estimated 580 (95% CI: 380, 790) net deaths avoided per year, and the maximum GHG reduction scenario ("C") is estimated to generate 390 (95% CI: 240, 550) net deaths avoided per year. Across all three scenarios, mortality disbenefits from traffic fatalities are approximately an order of magnitude smaller than the mortality benefits of increased physical activity.

Distribution of Mortality Benefits by County Population Density

We found that mortality benefits are likely to be concentrated in denser counties. For example, in the middle-of-the-road scenario "B," 83% of net deaths avoided from TCI investment in active mobility would occur in counties with a density of 4000 persons or greater per square mile (Urban, Urban Core, or NYC; see Table 3). Denser counties would see both the largest nominal change in activity and the largest change per capita from TCI investment in active mobility. The concentration of activity impacts in denser areas extends to a concentration of net deaths avoided in urban counties. Notably, "Urban" counties (4000–10,000 persons per square mile) present the most efficient mix of population size, utilization, and facility cost, and would likely see the greatest change in both cycling and walking activity per capita aside from New York City given the assumptions made (see below). The relatively lower baseline mortality rate in "Urban" counties compared to "Urban Core" counties, however, attenuates the relationship between net deaths avoided per capita and density. We see the same pattern emerge in rural counties compared to suburban counties due to relatively higher baseline mortality rates in rural areas (see Appendix Table 15).

The 11 counties in New York State and New Jersey near New York City (see Fig. 3) would account for the majority of the net deaths avoided from TCI investment in active mobility (i.e., ~60% in scenario "B" investment scenario) though they only account for 19% of the TCI region by population. The Greater New York area is unique in the TCI region with regard to population density, non-car mode share, county baseline mortality rates, and other factors that contribute to the concentration of active mobility benefits within its limits. Net deaths avoided are estimated to be greatest in New York County, New York (Manhattan), where an estimated increase of 220 million cycling PMT and 86 million walking PMT would result in 130 (95% CI: 78, 180) annual net deaths avoided in scenario "B."

Distribution of Monetized Benefits

The potential annual monetized benefits from investment of TCI proceeds in active mobility vary by investment scenario from $3.8 billion (95% CI: $1.5 bn, $6.1 bn) in scenario "C" up to $6.8 billion (95% CI: $2.7 bn, $11 bn) in scenario "A." Monetized benefits are also greatest in states with the highest share of population located in denser counties, namely New York and New Jersey (see Fig. 4). Again, using the middle-of-the-road scenario "B" as an example, the annual monetized benefits for New York County alone are estimated to be $1.2 billion (95% CI: $0.48 bn, $2.0 bn).

While not intended to be a complete cost-benefit analysis—we do not consider costs beyond infrastructure investment (e.g., consumer costs), or benefits beyond physical activity-based mortality (e.g., air quality and

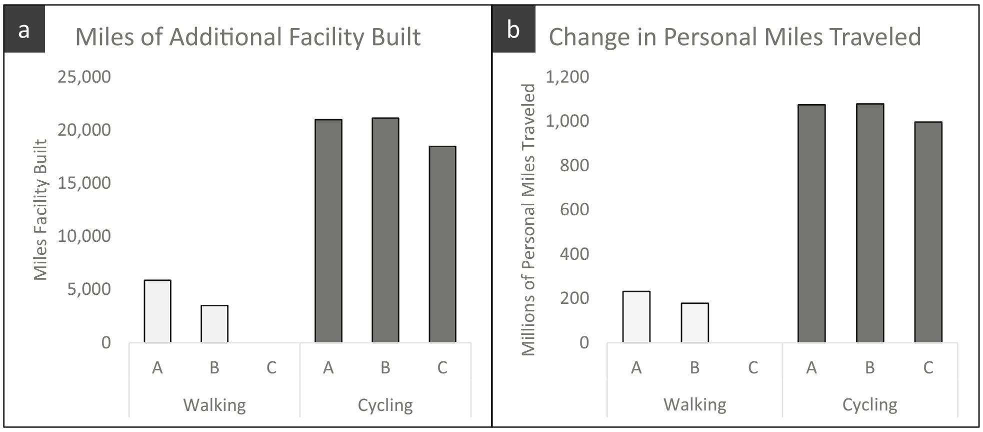

Fig. 2 Miles of active mobility infrastructure built with TCI investment (**a**) and resulting change in active mobility (**b**) for walking and cycling under the three scenarios starting after build-out (2032)

climate effects)—it is possible to compare direct infrastructure investment with estimated monetized net benefits from active mobility. In all scenarios, the annual monetized benefits from net deaths avoided would exceed infrastructure investment even after applying a 7% discount rate to account for the 10-year build-out lag from 2022 to 2032. The central estimate for monetized benefits per dollar invested in active mobility was as follows: $5.4 ("A"), $5.6 ("B"), and $6.9 ("C"). Scenario "C" interestingly has the lowest value of monetized benefits, but has the highest benefits per dollar invested. This is due to the relative cost-effectiveness of cycling investment and the elimination of pedestrian investment in that scenario. The magnitude of benefits compared to costs after discounting suggests that these results are likely to hold with all but the most extreme assumptions.

Discussion

We estimated the mortality implications of increased active mobility under three investment scenarios that could result from the implementation of the TCI. We find that, regardless of the investment scenario implemented, TCI-induced active mobility would result in hundreds of deaths avoided per year across the region, with benefits highly concentrated in urban counties. The annual monetized benefits of net deaths avoided are estimated to be in the billions of dollars at full build-out. These results highlight that climate action on transportation directed at reducing GHG emissions can also achieve near-term health co-benefits through physical activity when cap-and-invest proceeds are invested in active mobility infrastructure.

Table 2 Annual mortality implications from increased active mobility under TCI investment scenarios starting in 2032. Totals may differ from the sum of the data presented due to rounding for two significant figures

	Scenario A		Scenario B		Scenario C	
	Est.	95% CI	Est.	95% CI	Est.	95% CI
Deaths avoided, activity (cycling)	490	(320, 660)	490	(320, 660)	450	(300, 610)
Deaths avoided, activity (walking)	320	(130, 510)	180	(74.0, 280)	0.00	0.00
Fatalities (cycling)	−65.0	(−61.0, −69.0)	−65.0	(−61.0, −69.0)	−60.0	(−56.0, −64.0)
Fatalities (walking)	−36.0	(−35.0, −36.0)	−20.0	(−20.0, −20.0)	0.00	0.00
Net deaths avoided*	710	(450, 970)	580	(380, 790)	390	(240, 550)
Monetary value ($2016 millions)	$6800	($2700, $11000)	$5600	($2300, $8900)	$3800	($1500, $6100)

*These results do not include safety-in-numbers from increased active mobility volume, which may attenuate the relationship between miles traveled and traffic fatalities. Including this effect would increase net deaths avoided estimates to 770, 630, and 430 for scenarios A–C, respectively (see "Discussion")

Table 3 Change in annual active mobility and net deaths by county population density per capita (p.c.) for the 25% GHG reduction cap, scenario "B" starting in 2032

County type	Pop. density per Sq Mi	Change in bike PMT (millions)	Change in walk PMT (millions)	Change in mike miles p.c.	Change in walk miles p.c.	Net deaths avoided	Net deaths avoided p.c.
NYC	72,000	220	86	160	50	130	10
Urban Core	>10,000–72,000	250	48	31	4.8	160	2.2
Urban	4000–10,000	380	27	95	5.2	190	5.3
Suburban	500–3999	200	12	8.0	0.38	88	0.37
Rural	<500	27	5.3	1.8	0.27	18	0.13

Variation in estimated net deaths avoided across the region is driven primarily by population density, which, in this analysis, is a key input to investment allocation, infrastructure usage, and growth in active mobility, and ultimately the estimated cycling and pedestrian PMT change, which we use as the input to our health impact assessment. Our finding that the change in activity from walking and cycling investment would be concentrated in urban areas is consistent with other datasets: only 8.4% of cycling miles traveled in the USA and 13.9% of pedestrian miles traveled occurred in rural Census Block Groups in the recent 2017 National Household Travel Survey [22].

The monetized benefits per dollar invested in active mobility were greater than 1 for all three scenarios when considering exclusively infrastructure investment and active mobility-related mortality. The magnitude is inversely related to the share of investment in pedestrian infrastructure, suggesting that cycling infrastructure investment is more cost-effective. When considering investment strategies, however, cost-effectiveness should be augmented with equity considerations and investing exclusively in cycling may not be equitable. There is evidence to suggest that even after adjusting for cycling demand in urban areas, bike lanes tend to be inequitably placed in higher socioeconomic zones [26–28]. Bike lanes are most effective in dense urban areas; however, the suburbanization of poverty may result in income disparities in access to, and use of, cycling infrastructure if placement is exclusively driven by cost-effectiveness [26, 29]. To compound this, analysis of the US National Household Travel Survey has highlighted that the lowest income households (those with income less than $25,000) are ten times less likely to own a vehicle compared to those with higher incomes, and more likely to use public transit and cycling to commute to work

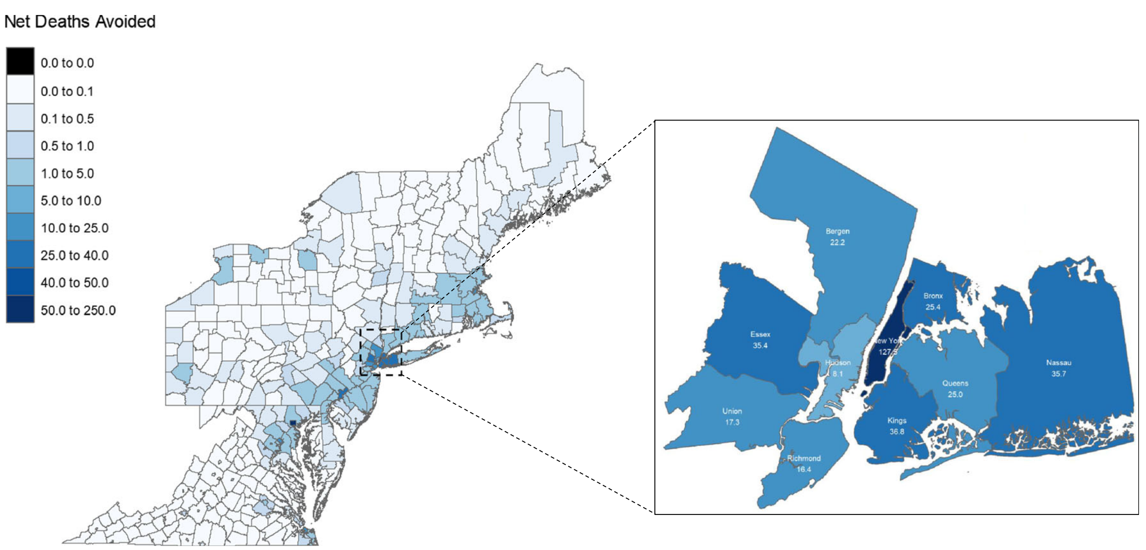

Fig. 3 Net deaths avoided by county from increase active mobility, scenario "B" investment allocation, with pop-out for the Greater New York City area

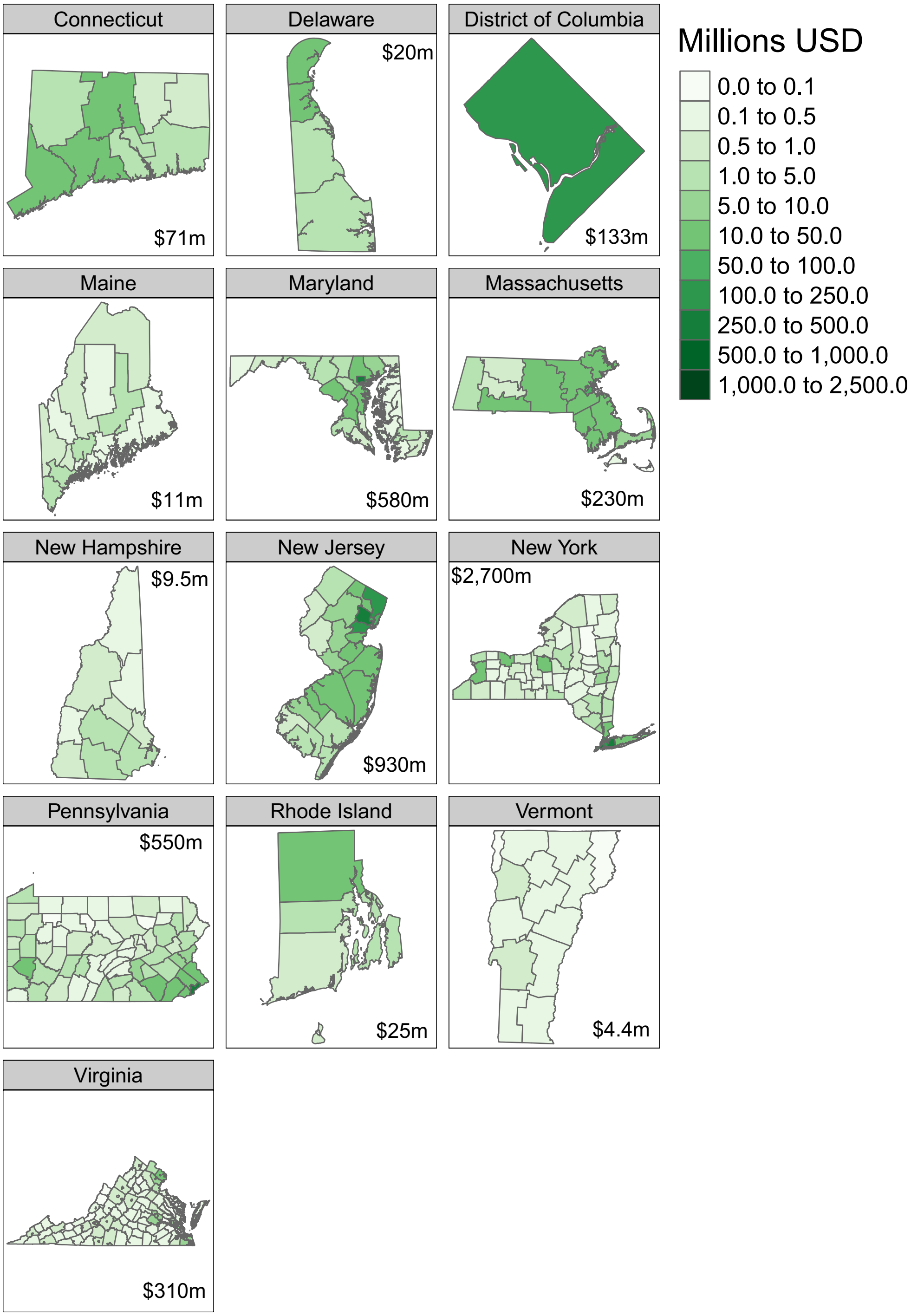

Fig. 4 Distribution of annual monetized value of mortality benefits across states and counties for scenario “B” investment scenario starting in 2032

than the nation on average [30]. Perpetuating investment in active mobility infrastructure in wealthier urban areas may not only fail to support the most marginalized among us but also underinvest in areas where there is likely to be greater utilization. These disparities in infrastructure placement could also lead to disparities in health benefits from active mobility, as disparities in baseline mortality rate exist by race and income [31]. Ultimately, the allocation of TCI proceeds is a complex process that must weigh these issues and more, including other equity considerations (e.g., rural-urban).

We have clearly underestimated the health co-benefits of TCI in this analysis by omitting air quality benefits and the direct public health benefits of GHG emission reductions. The existing literature suggests that the mortality benefits of increased activity from reducing car trips typically exceed the associated mortality benefits of improved air quality in health impact assessments. James et al. (2014) examined the impact of proposed transit fare increases in Boston and found that physical activity disbenefits from additional car trips were substantially higher (more than 10 times) than the disbenefits from air pollution and carbon emissions [32]. Grabow et al. (2012) assessed the impact of eliminating short-distance car trips in the Midwest on health through air quality and physical activity and found that the number of deaths avoided from additional activity was about 13% higher than the number of deaths avoided due to improved air quality ($PM_{2.5}$ and O_3) [33]. While both papers used the WHO HEAT methodology to assess activity benefits, they used different approaches to model air quality impacts, highlighting the sensitivity of results to the methods and assumptions made.

Our results may also underestimate the health benefits of investment in active mobility infrastructure because we do not estimate benefits for those under age 20 and we do not consider morbidity endpoints, including potential mental health benefits from increased activity. While physical activity has not been shown to reduce the likelihood of onset of depression and anxiety, research suggests that regular exercise (such as a daily bi-directional cycling commute) can reduce depressive symptoms and acute anxiety [34]. There is also evidence from cohort studies of a negative association between level of physical activity and risk of development of neurological disease, including dementia, Alzheimer's, and Parkinson's [35]. In order to remain consistent with the underlying epidemiological studies supporting the relationship between increased physical activity and mortality [6], we limited our analysis to the 20–64 age group for cycling and 20–74 age group for walking. We only had access to modeled estimates of the change in PMT for each scenario and did not have data on baseline activity levels. We thus lacked inputs necessary to estimate morbidity outcomes using physical activity modeling tools like Integrated Transport and Health Impact Modelling Tool [36].

In our analysis, we utilize one of the only exposure-based estimates available of the number of traffic fatalities per distance traveled walking and cycling in the USA [20]. This assumes that historical traffic fatality rates will apply in the future, after large-scale investment in walking and cycling infrastructure, which is a conservative assumption. There is emerging literature suggesting that as the volume of cyclists and pedestrians increases, a safety-in-numbers effect may attenuate the miles traveled-traffic fatalities relationship. As a supplemental analysis, we applied a safety-in-numbers effect estimate of 0.459 for cycling and 0.409 for walking from Elvik and Goal (2019) to our main results [37]. After incorporating the safety-in-numbers effect, we estimate that annual net deaths avoided from a 25% GHG emission cap would increase from 710 to 770 lives in scenario A, 580 to 630 in scenario B, and 390 to 430 in scenario C with total monetized benefits with safety-in-numbers of $7.4, $6.0, and $4.1 billion (USD 2016), respectively (see Appendix Table 6 for a state-by-state breakdown of net deaths avoided including the estimated impact of safety-in-numbers).

Our estimates of deaths avoided from increased active mobility vary geographically in part because of varying county baseline mortality rates. This is appropriate within the model, as it follows that the areas with the lowest mortality rate should, on average, benefit the least from additional activity given that they are relatively healthier and given the assumption of uniform relative risk across the population. As noted, baseline mortality rates can be different between counties both because of age distribution differences within the age group considered and because of differences in health conditions. The impact of overall health can be illustrated by comparing two counties that are composed entirely of urban environments, for example, Baltimore City County, Maryland (a county comprised of Baltimore City), and New York County, New York (a county comprised of Manhattan). While the cumulative change in activity is much greater for New York County than for Baltimore City, the impact of TCI investments on net deaths avoided per capita is similar for the two counties. While the two counties have similar age distributions (in 2018, median age in New York County was 2 years higher than that in Baltimore City), the baseline all-cause mortality rate is much higher in Baltimore City (921 deaths per 100,000 for the 20–70 year old group) than in New York County (366 deaths per 100,000 for the 20–70 year old group).

Within a geography, the higher risk of mortality for older ages compared to younger ages means that our mortality estimates are driven by assumed benefits to older individuals within each age group. There is limited evidence to suggest that the benefits of physical activity may actually increase with age within the 20–74 year old group [38], suggesting that this may be appropriate. We believe that this approach is acceptable for population studies like this one, but recognize that future studies could develop more refined estimates of the health impacts of specific TCI-funded projects using cause-specific mortality rates and smaller age groups for both exposure and mortality estimates.

We presented results from the three different investment scenarios under the assumption that all states will implement the same investment allocation (e.g., scenario “A”). All states, however, are not required to implement the same approach to allocating proceeds from TCI. For example, Rhode Island could opt to allocate 25% of its proceeds to active mobility and Maryland could opt to allocate none. It is also necessary to recognize the limitations of the TCI Investment Tool within the context of the fluidity of current policymaking. The input-output tool is designed to estimate the regional- or state-level impacts on miles per travel mode from investment in various low-carbon transportation strategies. Based on assumptions derived from the transportation and epidemiological literature, this approach is effective for understanding population-level average effects that might occur from the illustrative TCI investment scenarios considered during the current policy development period.

This approach, however, does not and cannot account for the impacts of specific investments and their placement (e.g., a 5-mile separated bike lane in a specific neighborhood or a sidewalk upgrade at a specific intersection), or reliably estimate the impacts of investment on specific demographic subgroups (e.g., age, urbanity, or sex), as access and utilization of active mobility infrastructure are highly sensitive to project placement. This is a limitation, as there is reason to believe that physical activity [39] benefits and traffic fatalities [40, 41] may differ by these demographic characteristics. In this analysis, we aim to walk the line between making the assumptions necessary to estimate regional effects to inform ongoing policymaking, while avoiding excessive precision that might connote a false sense of certainty given the fluidity of policymaking, resource allocation, and project planning.

We were not able to estimate uncertainties related to the transportation investment tool, such as the relationship between dollars invested and miles of new infrastructure built. Our analysis also does not incorporate the potential impacts of the novel coronavirus on transportation, which are uncertain at this time, including a possible sustained increase in work-from-home behavior, reduced transit use, and increased cycling mode share [42]. As such, confidence intervals presented here reflect uncertainty only from the relative risk associations used in the health impacts analysis and the VSL estimate. Finally, the results estimate the benefits of specific cap-and-invest scenarios and are intended to inform decision-making, but not to predict the actual benefits of the program given that proceeds may vary, and investment allocations have not yet been determined. By evaluating several different illustrative investment scenarios, we do inherently provide some consideration of the sensitivity of the mortality results to varying levels of investment; however, the true uncertainty is likely greater than that captured here.

We believe our results have the potential to inform policymaking currently underway, as states are in the process of designing the TCI program and determining how proceeds will be invested. Our results convey a subset of the health co-benefits associated with sustainable transport investment. By putting a price on GHG emissions from the transportation sector, TCI can both reduce the sector’s contribution to climate change and generate resources that can be invested to accelerate climate action and improve health. We find that investing proceeds in active mobility infrastructure is a cost-effective way of reducing mortality, especially in urban areas, providing a strong motivation for investment in modernization of the transportation system.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11524-020-00510-1.

Acknowledgments The cap-and-invest scenarios analyzed in this paper were developed by the states and jurisdictions in the Transportation Climate Initiative in collaboration with the Georgetown Climate Center. The associated estimates of the change in personal miles traveled for the scenarios were produced by Cambridge Systematics.

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Belmont (#609204): Community Path, Belmont Component of the MCRT (Phase 1)

March 23, 2021

Dear Mr. Genova,

I am writing in support of the Belmont Community Path and to request that the Boston Region Metropolitan Planning Organization provide Transportation Improvement Program funding for the project as soon as possible.

My wife and I have lived in Belmont Winn Brook neighborhood for over 20 years. We are avid recreational walkers and bikers, and make frequent use of the Fitchburg Cutoff, the Minuteman Bikeway, and other paths in the region. We also use the path for non-recreational purposes, walking to Alewife station to take the T to Boston. Judging from the constant high number of people on the path, it is a very popular route.

In addition to convenience, this project will greatly improve safety for bicyclists and pedestrians. We have been eagerly anticipating the railroad underpass for easier and safer access to the library and the post office; it is also very important for students' safe access to the new middle/high school from our neighborhood on the other side of the tracks. We wish this underpass had been available when our kids attended Belmont High, and hope it becomes available soon to the many young people that currently live in the Winn Brook neighborhood.

Thank you very much for your consideration.

Sincerely,

James Sheldon
99 Cross Street
Belmont, MA 02478
617-894-9923

Belmont (#609204): Community Path, Belmont Component of the MCRT (Phase 1)

March 23, 2021

Hello - I'm a day late, I just learned, but I hope you'll read my brief letter of support for the Belmont Community Path.

We are both avid walkers and Peter bikes most days. We use the paths in nearby town - Arlington, Cambridge, Somerville, Weston — and find them a wonderful escape to a pedestrian and cyclist friendly outdoors, a tremendous asset that allows safe walking and biking along a path with plants and trees, some exceptional view, yet convenient to the town we live in.

Belmont has long wanted this path, and the pandemic has made it's potential benefits clear. Please support this much needed benefit to human health and mental health! as well as adding to the beauty of our town and our connection with adjacent towns.

Thank you,
Ruth Smullin
Peter Grey
7 Linden AVe
Belmont MA 02478

Belmont (#609204): Community Path, Belmont Component of the MCRT (Phase 1)

March 24, 2021

Dear Mr. Genova:

I'm writing to voice my support for the Belmont Community Path and request that the Boston Region Metropolitan Planning Organization provide Transportation Improvement Program funding for the project as soon as possible.

The home that my husband and I purchased in 2016 backs onto the proposed trail. We were excited to know that we might have easy access to a walking and biking trail. We lived in Pennsylvania prior to moving to Belmont. A walking-biking trail was built in our Pennsylvania town over vocal opposition. Once built, the trail was extremely popular and became one of the jewels of the town.

I'm looking forward to the Belmont Community Path for a number of reasons. The path and railroad underpass will provide much-needed safe routes to school for children. The underpass will provide much better access to the Belmont Public Library, the Belmont Underwood Pool, and the Belmont Center Post Office. The path will also provide a direct and safe connection to Alewife Station and to Belmont Center. In addition, the path will fill a critical gap, connecting Belmont with the region's bicycle and pedestrian network. The path will increase safety by getting cyclists off the surface streets and will reduce auto usage and carbon emissions

Thank you for your consideration.

Anne Poulin
219 Channing Road
Belmont, MA 02478

TOWN OF NORWOOD
DEPARTMENT OF PUBLIC WORKS
One Lyman Place, Norwood, MA 02062
Phone 781-762-1413 Fax 781-762-9378
Email mryan@norwoodma.gov

Mark P. Ryan
Director of Public Works and Town Engineer

March 23, 2021

Matt Genova
Transportation Improvement Program Manager
Central Transportation Planning Staff
10 Park Plaza, Suite 2150
Boston, Ma 02116-3968

RE: Norwood (605857)
Intersection Improvements at Route 1 and University Avenue/Everett St

Dear Mr. Genova,

On behalf of the Town of Norwood, I urge the Boston MPO to provide construction funding in FFY 2025 and FFY 2026 for the proposed intersection improvements at Route One and University Avenue/Everett Street as shown of the Draft FFY 2022 – 2026 Transportation Improvements program (TIP).

While we are disappointed that the project could not be ready for FFY 2022, we understand the complexities involved to bring this project to readiness. After discussing the project with the MassDOT Project Manager, we are certain that this extremely important project is on a realistic schedule and will be ready for construction to commence in FFY 2025.

Respectfully, on behalf of the Town of Norwood, I urge the Boston MPO to support keeping the construction funding for this project in FFY 2025 and FFY 2026 and, for MassDOT to keep the project on schedule.

If you have any questions, please do not hesitate to contact me at 781-760-8341 or by email at mryan@norwoodma.gov

Regards,

Mark P. Ryan
Director of Public Works and Town Engineer

CC:
Norwood Board of Selectmen
Tony Mazzucco
Rep. John Rogers
Sen. Mike Rush
Thomas O'Rourke
File

- Page 2

Swampscott (#610666): Swampscott Rail Trail

March 23, 2021

Nason Road Neighborhood Association
Swampscott, MA 01907

David Mohler, Chair
Boston Region Metropolitan Planning Organization
State Transportation Building
10 Park Plaza Boston, MA 02116

Dear Mr. Mohler and Boston Region Metropolitan Planning Organization members,

Before we detail our opinions of the Swampscott rail trail funding request, we are puzzled that this project is being considered a Transportation Improvement Project. Don't be mislead by the transportation uses the proponents of this trail have presented. This path is a political football,in the town of Swampscott, that has been heatedly debated for 25 years. This project is nothing more than a poorly planned recreational path and an unwanted project by almost half the residents of the town. It will be used minimally by elementary students who have always been, and always will be, driven and picked up from school. It will not connect to the train station as planned and nor the ocean as suggested. It is being presented to MPO, as it has been presented to the residents of swampscott....inaccurately. Please scrutinize its promotion and value as compared to other more worthy,critical and actual transportation projects around the commonwealth.

The town of Swampscott has submitted or requested state funding to complete this recreational rail trail project, that up until several months ago was **supposedly** shovel ready, according to town officials. This project was initially presented to town voters guaranteeing no cost or increase in taxes to residents of Swampscott, the Commonwealth or the federal government. It was presented for approval to town meeting members and voting residents as a 100% privately funded project. We are now informed the town is asking for seven million plus tax dollars to proceed. This is a total contradiction to what the proponents have proposed and guaranteed to Swampscott residents for years. Yet another example of the lack of transparency that has riddled this trail campaign from the start. It appears that the taxpayers of Swampscott and the other 350 cities and towns of the Commonwealth have been sold a bill of goods.

Proponents of the rail trail will suggest this project was widely supported by the residents of Swampscott. The town vote was one of the most contentious votes in the history of Swampscott elections.The final tally resulted in a narrow vote for the trail with a record number of votes (2200 residents) voting against the construction of the trail. In addition, several members of the town finance committee voted against the project due to the vagueness of the plan, lack of financial details and its undetermined ultimate cost. The estimated trail costs have gone from an estimate of $1.5 million dollars to now over $8 million and counting. It appears that several members of the town's finance committee who voted **no** were well aware of the exorbitant costs required to build such a project.

The biggest falsehood propagated by town officials, and a significant reason many residents voted for the trail,was that the land being used for the rail trail was not owned by any Swampscott residents. Voters were told there would be no cost to obtain the land. It was stated that the town would request an easement from National Grid, the company the town claimed "owned all the property". The fact of the matter is that for years National Grid acknowledged,in writing, they did not own the trail in its entirety. At significant expense to land owners, it was eventually determined that many residents legally owned the land on the path. Approximately 40+ lots have officially claimed title. As a result of their own title searches, the town was well aware of the fact that National Grid did not own all the parcels. Even though the town did title searches, they refused to share the findings with interested residents. Their intention was to let voters believe eminent domain would never be used. The cost of the town acquiring these properties and paying depreciation damages could run in the millions of dollars and negotiations are at ground zero.

The part of the trail that the town wanted to develop immediately ran from Humphrey Street to the Swampscott Middle School; a very small portion of the trail in its entirety, yet a valuable and pristine conservation environment. To date, even the towns conservation committee can not solve the conservation challenges that exist. Due to its conservation status and National Grid's 25 year opposition to the trail, the town had to halt any plans to proceed. Again, sloppy and unprofessional planning. The requirements to build this trail, as explained by town officials, is a monumental task both physically and financially. The real costs of the project, its impact on conservation lands, safety concerns involved, and National Grids concerns regarding their equipment and high tension wires and continue to plague the "big dig" of Swampscott.

-Proponents of the trail will tell you how many children will use this trail to go to school. The majority of K-4 children are driven to school and will continue to be...trail or no trail.

-Proponents will tell you the trail will enable a path to the train station. Unless the town comes up with millions for property acquisition, no trail can exist from Marblehead to Humphrey Street. Also, serious concerns have been expressed concerning the danger of running the trail and exposing user,s especially children, to high-speed commuter trains.

-Proponents will tell you a pedestrian bridge must be built to cross Paradise Road, a highly trafficked, state highway. This will likely include additional costs.

- Proponents claim the trail will be safe for all pedestrians. However, safety vehicles will never be able to access parts of the trail due to the rocky terrain and narrowness in many sections.

-once again, proponents have told us this trail will cost the taxpayers **zero dollars!!!**

This trail is an ill-conceived idea with extremely poor planning, cost overruns and very little attention to the difficulties and challenges faced. National Grid was appalled at the lack of a detailed plan which would jeopardize their ability to deliver services. As a taxpayer in the Commonwealth, I am appalled that the state would even consider such a request. Seven million dollars is an extremely significant amount of funding for a trail that may be 2 miles at best, but most likely not. In terms of recreation and improving the quality of life, Swampscott is blessed being a small town with access to the ocean, providing numerous recreational walking and biking paths. This environment offers access and recreational facilities like no other. The trail is more of a wish than a need and has resulted in the most decisive and bitter campaign in the history of the Swampscott community. Don’t be fooled like the voters of Swampscott were.

Finally, don’t be deceived by the number of letters you may receive from the proponents of the Swampscott trail. It is a highly organized machine housed within town government and officials. Additional documentation exists and is available regarding the misleading and ambiguous promotion of this trail by its proponents over the years. The objections for building the trail are real and extremely concerning. The proponents of the trail continually dismissed significant concerns and problems in designing this project as evidenced in letters you will receive from concerned residents and taxpayers, as well as the position of NATIONAL GRID........an opponent of the trail since since the late 1990’s. This trail was sold to the residents of Swampscott on mistruths and deception. In this era of badly needed political transparency, such a request should be highly scrutinized and ultimately not rewarded any funding.

Thank you for your consideration.

From Concerned Swampscott residents seeking a more honest and transparent government.

SWAMPSCOTT RAIL TRAIL

Community open space & recreation

March 24, 2021

Mr. David Mohler, Chair
Boston Region Metropolitan Planning Organization
State Transportation Building
10 Park Plaza, Suite 2150
Boston, MA 02116
c/o Matt Genova <mgenova@ctps.org

Dear Mr. Mohler:

RE: Swampscott Rail Trail Construction Project 610666

I'm writing today on behalf of the community organization Friends of the Swampscott Rail Trail to express our support of the Swampscott Rail Trail construction project. A rail trail for our community has long been a goal of the town and we are thrilled that it now is becoming a reality. As proposed, the trail winds through an established green corridor across the community - linking our many neighborhoods via a linear park with safe connections to the MBTA commuter rail, schools, conservation lands and multiple recreational areas.

The Friends of the Swampscott Rail Trail organization is currently made up of over 50 resident volunteers who donate their time to fundraise and advocate for the construction and use of the Swampscott Rail Trail. In the last year alone, we have fundraised over $150,000 from residents and local businesses who are eager to see the completion of the Swampscott Rail Trail. These donations to the Friends of the Swampscott Rail Trail fund, held by our 501c3 fiscal partner the Essex County Community Foundation, will be used for additional design work, matching funds for grants, beautification projects, maintenance, and community events. For example, on May 16, we are planning a Family Bike Ride event that will feature a ride on the two completed segments of the Swampscott Rail Trail as well as bicycle safety activities and bike and helmet safety checks in partnership with the Swampscott Police Department.

In addition to the creation of new community open space and safe off-road transportation that the Swampscott Rail Trail will provide our residents, our trail will be part of a larger network of trails linking us with our neighboring communities of Marblehead, Lynn, Salem, and beyond. The Swampscott Rail Trail is also now a designated segment of the East Coast Greenway, a safe walking and biking route linking Florida to Maine. These off-road networks exponentially increase the opportunities for all Massachusetts residents for non-motorized commuting, recreation, and safe routes to schools and other community destinations.

With the successful completion of two segments of the Swampscott Rail Trail in the last year, the level of support for the completion of the trail by Swampscott residents and trail users in our neighboring communities has never been higher. Since 2017 when the Friends of the Swampscott Rail Trail was formed after the community decisively voted to create the Swampscott Rail Trail, we have been dedicated to working with the town to help build an accessible trail that can be used and enjoyed by all.

We hope that you will support the Swampscott Rail Trail Construction Project for the lasting benefit it will bring to the community of Swampscott and all of Massachusetts. Thank you for your consideration.

Sincerely,

Alexis Runstadler, Fundraising Chair
Friends of the Swampscott Rail Trail

cc: Marzie Galazka, Director of Community and Economic Development, Town of Swampscott

Friends of the Swampscott Rail Trail
617-949-1107
info@swampscottrailtrail.org
swampscottrailtrail.org

Swampscott (#610666): Swampscott Rail Trail

March 24, 2021

Mr. David Mohler, Chair
Boston Region Metropolitan Planning Organization
State Transportation Building
10 Park Plaza, Suite 2150
Boston, MA 02116
c/o Matt Genova <mgenova@ctps.org

Dear Mr. Mohler:

RE: Swampscott Rail Trail Construction Project 610666

We are writing in support of the Swampscott Rail Trail Construction Project, and we hope to see the completion of this community trail as soon as possible. Our home at 5 Banks Court directly abuts the utility corridor where the Swampscott Rail Trail will run. The segment of the corridor adjacent to our property is unique in that it is raised above our yard, and privacy was initially a concern of ours. Throughout the design and planning process, the Town of Swampscott and its Rail Trail Design and Construction Advisory Committee has held many community forums and design charrettes to address our concerns and answer questions about the project. In addition, the Town Meeting vote and subsequent townwide vote in 2017 were both overwhelmingly in favor of creating the Swampscott Rail Trail, which demonstrates that this project has the full support of the majority of Swampscott residents.

As parents of three young children, we are excited about and look forward to safe routes to neighboring elementary schools, the middle school, the high school, the commuter rail station, sports fields, and other recreational and commercial destinations that the Swampscott Rail Trail will provide. In addition, we look forward to family walks and bike rides on the trail and are excited to further explore Marblehead and Salem by bike with the Swampscott Rail Trail's direct connection to the popular Marblehead Rail Trail.

During this past year quarantining at home, the need for increased open space and recreational opportunities in our small and dense community has never been more apparent and urgently needed. The two completed segments of the Swampscott Rail Trail near the Marblehead line are already being enjoyed by many and are a clear demonstration of how lovely and accessible this trail will be when completed.

We very much hope you will support the Swampscott Rail Trail Construction project so that all Swampscott residents and neighboring residents can begin to use and enjoy this wonderful community resource for access to recreation, educational facilities, and public transportation.

Sincerely,

Scott and Christine Saunders
5 Banks Court
Swampscott, MA 01907