



bacc on board

a guide to  
safe(r) transit  
in the era  
of COVID-19

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## TRI-STATE TRANSPORTATION CAMPAIGN



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# INTRODUCTION

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During the apex of the coronavirus pandemic in March and April, ridership on U.S. public transit systems plummeted. In New York City, the MTA reported a 95 percent dropoff in ridership; in San Francisco, ridership has fallen by 85 percent; in Chicago, bus and train ridership has seen an 80 percent decrease. Shelter-in-place orders, business closures, and, sadly, layoffs and furloughs meant millions of workers no longer needed transit to get to and from work.

Despite the dramatic dropoff in transit use, however, one group of workers continued to ride our subways, buses, light rail and commuter rail: our nation's essential workers. Census data shows that 36 percent of transit users are essential workers,<sup>1</sup> and a survey of remaining users by mobile app Transit revealed that regular riders during the height of the pandemic were overwhelmingly women and people of color, with some cities shifting from fifty-fifty gender splits to almost 70 percent women. The top two professions among remaining riders are healthcare workers, at 35 percent, and food service employees, at 20 percent. The data is clear: doctors, nurses, emergency medical

technicians, delivery persons, transit workers, grocery workers, and other workers braved a virus with then-unknown transmission characteristics so the rest of us could shelter at home.

Now, as the first wave of cases ebbs in many major cities, mayors and governors are charting paths to reopening and adjusting to our new reality. Even though many of us continue to shelter in place, some segments of the economy are opening up, and with them a return to transit is already beginning: the MTA, for instance, has already seen a fifty percent increase in ridership compared to passenger numbers during the worst of the pandemic, and bus service in New York City is already back to 40 percent of pre-COVID levels. Peak ridership may not return immediately, but as was true before COVID-19, cities around the world will still depend on transit to move millions of workers every day.

It's not just transit workers who are essential: transit itself is essential as well. It was essential at the height of the pandemic, and it will continue to be so as we reopen

economies and bring workforces back from quarantine. It powers regional economies, provides opportunities for low-income communities, reduces pollution and combats climate change, and ensures car-free households have access to jobs and services we all rely on. This is true in rural areas, suburbs and cities alike—and in our cities, mass transit carries millions of workers over and underneath streets that simply cannot handle an influx of new vehicles: according to INRIX, drivers in Boston, Chicago, New York, Los Angeles, Washington DC, and Philadelphia already spend more than 100 hours a year stuck in traffic.

Much has been made of whether major cities' reliance on transit, or their density, acted as catalysts for the coronavirus's spread, much like accelerants to a fire. The reality is both more complex and more intractable: dense, transit-oriented cities like Singapore, Tokyo, and Seoul have mediated or escaped large outbreaks, while highly rural, transit-poor areas like the Navajo Nation or exurban prisons and meatpacking facilities have seen alarmingly high rates of per-capita transmission. Hardening transit systems against viral spread further reduces any role transit might play in the pandemic: in Paris and Vienna, for example, no outbreaks have been traced back to public transit since mitigations were put in place. It appears that density and transit are poorly correlated with COVID outbreaks. Instead, governmental policies, workplace standards, and—perhaps above all—socioeconomic status have proven to be far more determinative factors in both your likelihood of contracting COVID-19 and becoming seriously ill from it.

We rightly celebrate the bravery of those who continued to work in hospitals, processing plants, factories, grocery stores, and

warehouses. But that adulation obscures the unsettling truth: millions of essential workers did so because they had no other recourse. This does not take away from the courage of frontline workers, but rather highlights the injustices they experience. It is important to note that many did not sign up to be on the front lines of the pandemic, and far too often they lack health-care, paid sick leave, or even homes that allow for social distancing if they fall ill. The result: COVID-19 spreads much more quickly among low-income households and households of color, and poor health caused by economic and environmental stressors like pollution and poverty makes them sicker when they do fall ill. Sick workers, asymptomatic carriers, and susceptible people have been forced to commingle, whether in homes, workplaces, or on transit—and this frequent contact amongst those unable to stay home is how the virus spread rapidly in communities that have seen the worst impacts from COVID-19.

These conditions of poverty, then, are much more significant contributors to the spread of coronavirus than density or transit use. Even so, many cities that have extensive transit systems, but have had limited COVID outbreaks, generally have something in common: transit systems and riders that have taken precautionary steps to prevent such outbreaks in the first place. If cities are to prepare for later waves of COVID, as well as future pandemics, they must work to make public transit as safe as possible for essential workers and, as states reopen, the returning workforce that will spur our economic recovery.

While this is true in the New York City region, which has been the hardest-hit area of the country to date, it is just as true in cities

across the U.S., whether we're discussing thousands of Amazon workers in Seattle who rely on buses to get to work or Congressional staffers who ride DC's metro every single day. And unlike essential workers, many white-collar people returning to their jobs in the coming months will have the option to continue to work remotely, or purchase cars or rely more heavily on for-hire vehicles. The negative environmental and socioeconomic consequences of such a shift would be profound. In order to return to transit, they will need to trust that public transit is safe again. This white paper will detail several critical interventions transit agencies, elected officials, and the public can take to ensure transit is safe for all users. We have already seen cities around the world continue to see high mass transit use and low rates of COVID-19, so we know it's possible. Here, we outline how we can achieve it in U.S. cities as well.

## A SURVEY OF TRANSIT USERS

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Much as we have not all experienced the same pandemic in America—or even within the same city—so too must our recoveries be tailored to our communities' needs. In order to understand the ways the pandemic has affected transit use among residents in the Northeast, we surveyed over one thousand public transit users in New York, New Jersey, Pennsylvania, and Connecticut.

Our survey, conducted in April and May of 2020, was conducted online and received 1,074 respondents. All are regular transit users, and 108 are still actively using transit during the pandemic and resulting



Figure 1 Percentage of Survey Respondents who are Active Riders

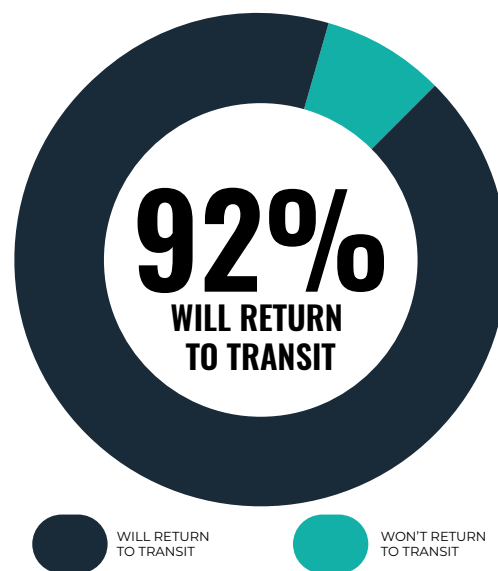


Figure 2 Percentage of non-active riders who say they will return to Public Transit Post-COVID-19



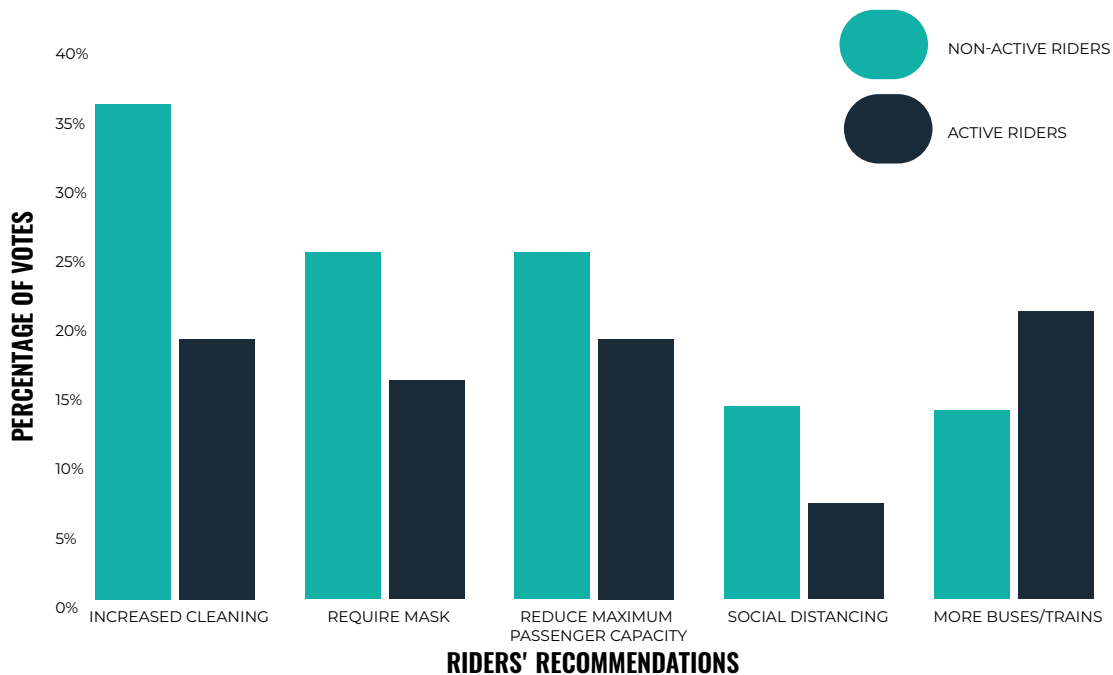
shutdown.<sup>2</sup> (See Appendix for the complete report and methodology of the survey). Our survey was open-ended, asking riders to self-report what measures could be taken to make them feel safer on transit—or if nothing could be done to make them feel safe riding subways, buses, and rail. In what agencies should see as a positive sign, riders clearly expect to return to public transit: ninety-two percent of riders responded with policies that transit agencies can implement to help them feel comfortable returning. Only eight percent of respondents said only a vaccine would make them feel safe, or that they do not plan to return to transit at all.

The clear implication of these findings is that, with the right precautions taken to reduce risk and a corollary public awareness campaign from transit agencies and elected officials to educate riders as to the preventative measures agencies have taken and the steps riders can take themselves, riders

will come back to public transit in numbers comparable to pre-shutdown ridership.

Riders offered a range of responses as to measures that would induce them to return to transit. While no one single precaution was recommended by a majority of write-in responses, clear patterns emerged, and many of the recommendations are in line with those offered by the many experts in public health, epidemiology, and social behavior that we spoke to for this white paper.

Significant percentages of both current riders and those who rode pre-pandemic want frequency increases and reduced numbers of passengers per train and bus, increased cleanings, and mask requirements. The positive sign for many transit agencies is that much of the precautions riders want to see, including increased cleanings and mask requirements, are already in place. Better rider education about the



**Figure 3 Percentage of Votes Per Rider Recommendations**

steps already underway would help riders feel that transit is safe for use.

Some agencies, like Charlotte Area Transit System, San Francisco Metropolitan Transportation Authority, Los Angeles Metro and New York’s Metropolitan Transportation Authority, have attempted to maintain high service levels at various points during city or state shutdowns, while others have been forced to reduce service in the face of severe operations budget shortfalls. In order to maintain high levels of service to allow for more physical distancing between passengers, additional support from local, state, and federal budgets, in many cases beyond federal funding already offered by the CARES Act, will be necessary.

## RIDERSHIP TRENDS

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In the tri-state region and across the country, public transit ridership fell dramatically as locales were put on “pause” and people were asked to shelter from home, with exceptions made only for essential workers or for “absolutely necessary” trips. During this period, it has been common for transit ridership to fall to between 90-98 percent fewer riders than normal. With many transit workers and operators affected at the pandemic’s peak, some transit agencies also faced employee shortages. Some agencies closed portions of their system altogether or reduced service as they struggled to keep up with a quickly evolving public health crisis.

In general, bus ridership fared slightly better than subways and much better than commuter rail, which saw the largest overall

declines in ridership. In April, the MTA, the nation’s largest transit system, maintained 20 percent of its regular daily bus ridership—approximately 440,000 daily riders compared to 2.2 million in 2019. The milder decrease in bus ridership can be explained by the spatial distribution of riders—many essential workers (who are generally in low-paid jobs) live in less expensive areas on the outskirts of the city, in areas that are mostly only served by buses. The needs of essential workers using transit during this period are different from those of pre-COVID-19 commuters. There is a higher concentration of essential workers in peripheral neighborhoods, further from rail or subways and they have longer commutes than many city-wide averages (in NYC for example, 45 minutes each way, compared to 36 minutes for the average New Yorker). Essential workers travel patterns differ from the 9-to-5 workforce, with 50 percent of essential workers relying on public transit during off-peak commutes. This means that simply running traditional transit service, wherein frequency tapers off after peak hours, does not necessarily meet essential workers’ needs; in order to assist essential workers in social distancing, agencies may need to increase service during off-peak hours and overnight as hospital shifts change as well. Because of this, and with farebox, toll, and tax revenues for transit at historic lows, it is incumbent on elected officials to fund transit agencies so they can maintain service and keep essential workers moving.

# THE SCIENCE OF COVID-19

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It is important to note that our scientific understanding of the novel coronavirus SARS-CoV-2 is evolving rapidly, and with it our understanding of transmission and prevention. Transit agencies' health interventions should be based on the growing body of knowledge and research literature about SARS-CoV-2, in consultation with public health professionals, in order to best mitigate the risk of spreading and catching COVID-19. To develop this report, the authors, who in part are themselves public health specialists, consulted with a range of public health experts, epidemiologists, medical professionals, and published and pre-print literature. Here is what we do know.

COVID-19 is thought to spread primarily from close person-to-person contact. Asymptomatic individuals (people without visible symptoms) may also be able to spread the virus, and as many as one-third of all cases may be asymptomatic. Critically, COVID-19 patients appear to be most infectious

in the early days of the disease<sup>3</sup>—a time when they present few or no symptoms. Person-to-person transmission occurs from spreading respiratory droplets<sup>4</sup> generated when we expel air from our respiratory system—particles generated when we sing, speak, sneeze, or even breathe.<sup>5</sup> The larger droplets (>5 microns) fall faster and travel less than one meter, but the virus may be able to survive in smaller aerosolized particles that stay suspended in the air longer (at least three hours in lab conditions)<sup>6</sup> and can travel distances greater than one meter. One study found that talking can generate thousands of droplets that linger in the air for up to 14 minutes.<sup>7</sup>

The virus is also thought to spread if a person touches a fomite—any surface or object that can transmit the virus—and then touches their mouth, nose, or eyes. However, it should be noted that the CDC has stated that “This is not thought to be the main way the virus spreads, but we

are still learning more about how this virus spreads.”<sup>8</sup> It is important to note the amount of virus that remains active on fomites: while the virus can last as long as three days<sup>9</sup> on plastic, less than 0.1% of the starting material was present after 72 hours. On the other end of the transmission spectrum, measurable quantities of the virus survive as little as three to four hours on copper surfaces.

To quantify a disease’s capacity to spread, epidemiologists build models of the disease based on past data to predict and simulate how the disease might spread in the future. Some important parameters include the “effective reproduction number,” or  $R$ , to quantify how many new infections a single infectious individual creates.  $R$  is not a fixed number; it can be affected by a range of factors, including interventions like mask usage. Keeping the  $R$  value below 1 is crucial—values above 1 indicate that the epidemic is growing, while values below 1 indicate that it is declining. In the early phases of the outbreak, the basic reproduction number was estimated to be 2.4 by Imperial College researchers, but some have estimated that the  $R$  value could be as high as 5.7 in the initial outbreak.<sup>10</sup> In short, absent countermeasures, COVID-19 spreads far and fast. Fortunately, proper interventions can reduce the  $R$  value. As of early June, the  $R$  value for New York State is 0.7;<sup>11</sup> as economies begin to reopen, states and cities should endeavor to keep this number as low as possible.

Current estimates of  $R$  values for individual states can be found at <https://rt.live>.<sup>12</sup> We urge officials to monitor the appropriate data sources and consult experts as the pandemic progresses and develop plans accordingly to keep  $R$  values below 1.

## TWO CRITICAL INTERVENTIONS: MASKS AND VENTILATION

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The need for sanitization and social distancing has been widely understood and adopted since the start of the outbreak, but adoption of masks and face coverings has been slower. The most recent science, however, supports the position that masks, source control, and improved ventilation form a vital component of the public health response to COVID-19.

### **MASKS AND SOURCE CONTROL**

Mask usage plays a critical role in keeping everyone safe and lowers the overall risk of spreading COVID-19 through “source control”, the reduction of the spread of droplets at the source as they leave the infected person’s mouth. In a preprint paper that models mask compliance and effectiveness for COVID-19, researchers found that 80 percent of the population wearing a 60 percent effective mask (i.e a cloth mask)<sup>13</sup> results in an  $R$  below 1.<sup>14</sup> In combination with contact tracing and physical distancing, mask wearing is even more effective, and it is a particularly important intervention in areas where we can’t maintain six feet of physical distancing.

During the current pandemic, scientists have observed a correlation between countries with high levels of mask-wearing and success in containing the virus.<sup>15</sup> There are a number of other sociopolitical factors to consider when comparing case numbers

between countries, but mask usage is theorized to have played a role in South Korea's success. For example, both Italy and South Korea had a similar trajectory in nationwide cases in the initial weeks. But in late February 2020, the South Korean government provided a regular supply of masks to every citizen. After that point, South Korea's cases started to flatten and actually decreased, whereas Italy's case count skyrocketed upwards. Figure 4 shows South Korea's number of reported cases (red), and Italy's (blue), as the impact of the mask distribution kicked in.

To observe the impact of social distancing with and without masks, we can turn to European neighbors Czechia and Austria. Both nations introduced social distancing requirements on the same date, but Czechia also introduced mandatory mask wearing. Austria's case rate continued to climb upwards, while Czechia's case rate flattened

out. Weeks later, we can see the countries return to a similar trajectory after Austria also introduced mask laws. While there are a litany of other social-political factors to also consider when drawing conclusions from individual case studies, these findings are consistent with the growing body of literature and models that emphasizes the importance of mask wearing.

The science and the data show that mask usage is a vital part of managing the current pandemic. The good news is that the MTA has found that on average there was 92 percent mask compliance with riders from an initial system-wide survey during late May and early June.<sup>18</sup> It is important to note that some people with medical conditions cannot wear masks without compromising their health and safety. This reinforces the importance of high mask compliance: those who are able to wear masks help protect others who cannot do so for medical

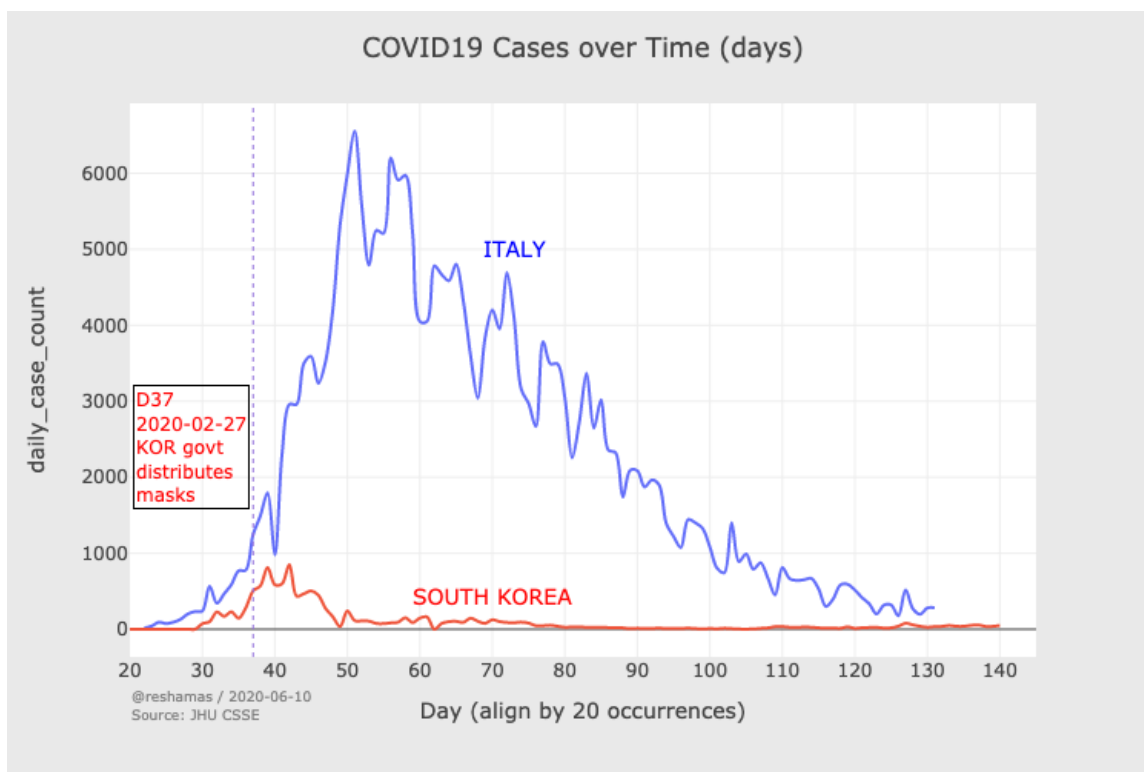
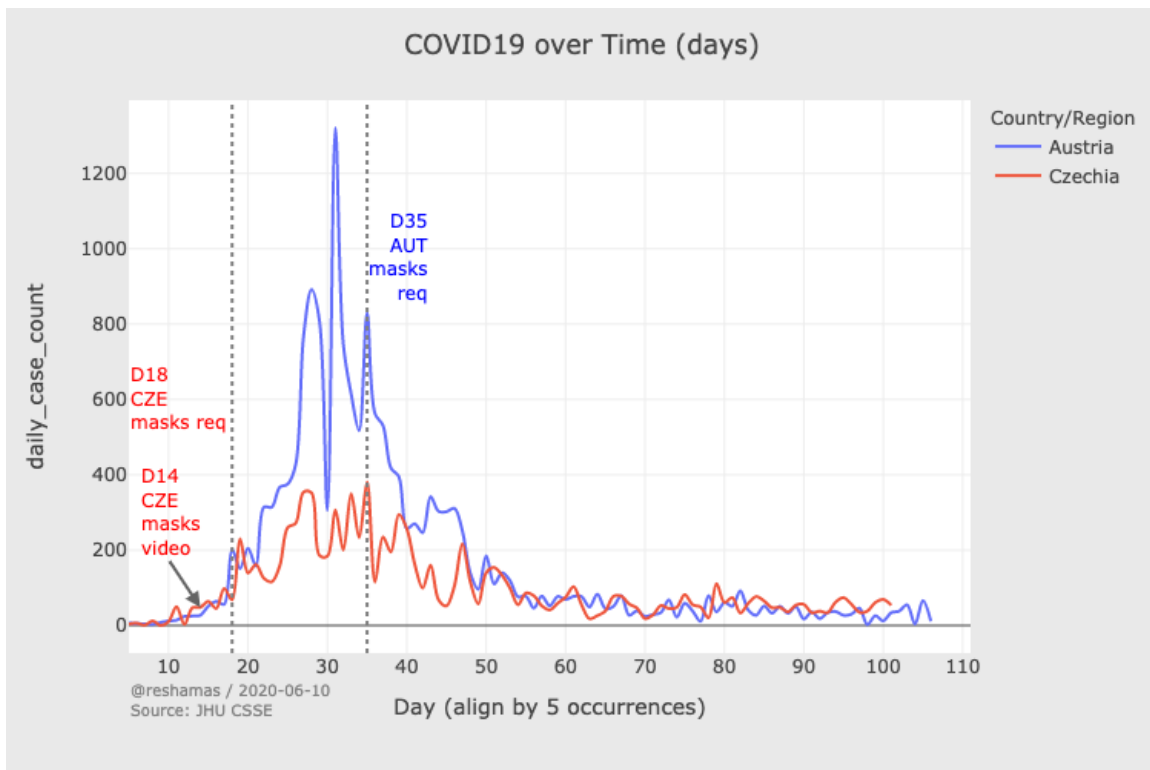


Figure 4 COVID-19 cases between Korea (red) and Italy (blue).<sup>17</sup>



**Figure 5 COVID-19 cases between Czechia (red) and Austria (blue). Visualization by Reshama Shaikh (@reshamas).<sup>18</sup>**

reasons. So the bottom line for riders is simple: the most important intervention of all is to always wear a face covering while using public transit; even simple cloth masks appear to be highly effective at protecting the people around an infectious individual.

## VENTILATION

Ventilation as defined for the purposes of this report is the flow of outdoor air into an environment to create an exchange of fresh air and flush out indoor air. Past studies and experiences with similar respiratory viruses such as SARS-CoV-1 found ventilation and clean air to be key interventions in creating a safer environment.<sup>19</sup> Several health experts have suggested similar approaches to improving ventilation as mitigation strategies for COVID-19.<sup>20</sup> Solutions range from

low-cost mitigations like opening windows, to using environmental controls like HVAC and filtration systems to introduce fresh air and disperse stagnant air that has accumulated droplets.

An oft-cited case study of a late January 2020 outbreak in a Guangzhou restaurant illustrates the importance of proper ventilation and airflow. In this case study, the outbreak was limited to ten people who sat down for lunch at three neighboring tables. While larger respiratory droplets (>5 microns) typically settle quickly and travel short distances (<1 m) before doing so, it is likely that airflow patterns from the air conditioning help spread these larger droplets amongst the tables.<sup>21</sup> No other waitstaff or patrons were infected from this event, and no close contact or fomite contact was

\*The analyses and visualizations of the two case studies (Austria/Czechia and Italy/South Korea) were performed by Resham Shaikh (<https://reshamas.github.io>), a statistician/data scientist with over a decade of experience in clinical trial work.

observed. Smear samples of the air conditioning unit for the virus proved negative. Because a positive result in such a test is often consistent with finer, smaller droplet transmission, this suggests that large droplets lofted by the air conditioning, rather than fine droplets that naturally spread farther on their own, were potentially the source of the outbreak. While there was high air flow from the air conditioning system, the ventilation rate was only 0.75–1.04 Liter per second (L/s) per person.<sup>22</sup> For context, an “acceptable” indoor air quality level recommended by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) in private homes is a minimum of 7.1 L/s per person.

This particular case demonstrates the importance of proper ventilation and air flow considerations for our public transit spaces. In some cases, simply circulating air without sufficient ventilation could actually aid in spreading SARS-CoV-2. It also underscores the importance of mask usage for source control of droplet transmission.

## PUBLIC TRANSIT AND THE PANDEMIC

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At first glance, riding public transit appears to be a high-risk activity—and without appropriate intervention, crowded trains and buses do present an opportunity for viral transmission. While the risk of contracting the virus in public settings is never zero, it is possible to significantly mitigate individual risk by following public health guidelines.<sup>23</sup> Safeguarding public transit and reducing the risk of infection is a collective

effort between transit agencies, riders, businesses, governments, and elected officials, and each has a role to play to make transit a safer ride for everyone.

Japanese epidemiologists have noted that clusters of cases appear where the “Three C’s” overlap—closed-off spaces with poor ventilation, crowded places, and close-contact conversations.<sup>24</sup> Reassuringly, Japan has yet to trace an outbreak back to its notoriously packed commuter rail.<sup>25</sup> While public transit is certainly crowded, we can reduce our risk by addressing the other “C’s” by increasing ventilation, wearing masks, and keeping conversations to a minimum.

## THE ROLE OF RIDERS

Transit agencies’ ability to control the transmission of the novel coronavirus is heavily dependent on individual riders’ compliance with simple interventions to reduce opportunities for the virus to spread. This means that it is critically important for individual riders to wear face masks, especially in more crowded environments, to contain and prevent contact with the virus-laden droplets and aerosolized particles that cause person-to-person transmission. Staying six feet apart from others where possible also helps people avoid contact with these droplets and lowers the risk of infection. To address transmission from surfaces, individuals should engage in proper hygiene measures, such as hand-washing, wearing gloves, avoiding contact with high touch surfaces, and refraining from touching one’s face. It is also incumbent on riders to plan to travel on non-peak hours or reduce the number of total trips they take to reduce crowding.

Changing norms around public transit, or public behavior writ large, is a challenging task. Local governments should consider enlisting the aid of trusted community leaders, clergy, and community-based organizations to promote interventions that are proven to be effective, as New York State has done with Black and Latinx churches in hard-hit areas of New York City.<sup>26</sup>

## **THE ROLE OF TRANSIT AGENCIES**

Transit agencies have a number of measures at their disposal to implement health interventions. In this report, we recommend a suite of interventions categorized by infrastructure upgrades, public health and prevention, operations, planning with external partners, sanitation, and communications with riders. Deploying a combination of these interventions will promote a safer environment for riders and workers alike. It also means that when a particular intervention is infeasible, others will still be available. For instance, on a vehicle where crowding is a concern, mask wearing and ventilation will help mitigate risk.

At a baseline level, all transit agencies should mandate mask usage to address droplet transmission and adapt environmental engineering controls to diffuse and filter out droplets. Based on the science, modified quiet car policies would reduce risk by encouraging commuters to refrain from spreading droplets via speech, especially if everyone was wearing a mask. Conversely, riders' transmission risk would be much higher if commuters spent their whole commute chatting with nearby riders without wearing a mask.<sup>27</sup>

To address crowding on transit, this report recommends making as much space available as possible on vehicles and on platforms to allow riders to spread out. This can be done by increasing service frequency, altering station flow, and reducing maximum occupancy limits. Through modifying schedules and instituting incentivized fare structures, including discounts for off-peak use, agencies can incentivize riders to spread trips over the course of the day and avoid rush hour commutes.

For many transit agencies, the focus of early efforts to combat the spread of the novel coronavirus came through increased cleanings, the use of sprayers and foggers, and UV disinfecting equipment. While respiratory spread appears to be the most common method of transmitting COVID-19, these efforts should continue, along with efforts to minimize contact with surfaces, such as the adaptation of contactless entry systems and virtual and app-based assistants.

## **THE ROLE OF GOVERNMENTS AND ELECTED OFFICIALS**

As the varying responses and resulting outcomes have clearly demonstrated, governments and elected officials can limit the severity of a pandemic—or dramatically accelerate its pace. One need only look at the robust public health response in countries like South Korea or New Zealand (the latter of which last reported a case of COVID-19 on May 22nd, 2020 as of this writing) on the one hand and the United States, United Kingdom, and Brazil, where the disease has killed nearly two hundred thousand people, on the other.



Where public transit is concerned, elected officials and state and federal governments must support agencies with necessary funding to ensure high levels of service and the ability to undertake sometimes-costly interventions to limit the spread of coronavirus. Additionally, elected officials play powerful roles as communicators and examples of good (or bad) practices. They must take this role seriously and help convey the importance of public health interventions—and explain the underlying science so riders and residents can make informed decisions when confronted with novel circumstances. Lastly, they must model those interventions themselves.

## **THE ROLE OF BUSINESSES**

We already know that workplaces that require close proximity and offer poor ventilation contribute dramatically to the spread of COVID-19. Because of the potential for workers to contract COVID-19 from their workplaces and then disseminate it on public transit, businesses, which we use here as a shorthand to refer to employers, whether private or public, must undertake a number of interventions and significant systemic reforms to limit the pandemic.

As a bare minimum requirement, businesses must provide both critical public health information and personal protective equipment, or PPE, to their workforces. They must also encourage hand-washing and other hygiene measures as workers arrive and depart workplaces. In conjunction with local governments, businesses should promulgate policies that allow for flexible work schedules, including remote work, staggered work hours and weekly schedules, non-peak shift

starts, and cessation of penalization of tardiness due to traffic or transit. Workplaces should also create a worksite-wide plan for outbreaks, including screening employees for symptoms while creating mechanisms to preserve privacy.

But most importantly, national employer policies and practices writ large must change. Many workers deemed “essential” during the pandemic lack access to employer-sponsored healthcare, paid sick leave, paid vacation, or even assurances that they will not be fired for taking leave due to illness. These inequities accelerated the pandemic by forcing workers to commute and work while ill and limiting their ability to seek appropriate healthcare.

## **A SHARED RESPONSIBILITY**

Around the world, cities and their residents are making public transit work in the middle of the pandemic. We have already seen cities like Tokyo, Seoul, and Vienna successfully restart their economies, with residents taking transit, businesses and restaurants reopening, and even starting sporting events again, albeit in empty stadiums.<sup>28</sup>

A key foundation for their success is robust public health systems that use frequent testing and contact tracing to contain outbreaks and hotspots as they arise, in tandem with cultures that embrace health measures like mask wearing. But it is also important that government and agency leaders continue to build a transit system that understands and implements the best public health interventions to keep riders and workers safe while enabling the public freedom of movement.

No one knows how long this pandemic will last, but we do know what we must do. 2020 has taught us that we are only as safe as our most vulnerable members. To safeguard public transit, and public spaces more generally, requires a unified society committed to a set of shared, collective health and safety goals. By modifying our practices and behaviors temporarily, we can reduce our shared risks, decrease the likelihood of transmitting and contracting COVID-19, and make public transit a safer ride for all users.

# RECOMMENDATIONS

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Fortunately, many transit agencies around the country are already taking immediate steps to curb the spread of COVID-19. In this report, we detail those immediate recommendations, offer a suite of medium-term interventions to be taken over the coming year to eighteen months, and a set of long-term, future-proofing recommendations that are more time or capital-intensive, but will help secure our public transit systems from this and future pandemic threats.

Our recommendations to transit agencies, riders, elected officials, and businesses are categorized as follows:

- Health & Prevention
- Sanitation
- Operations
- Partnerships & Planning
- Infrastructure & Technology
- Communications

The following recommendations are the result of an extensive review of published and pre-print research; interviews with subject matter experts in public health,

epidemiology, social behavior, engineering, and emerging and current technologies; current public health recommendations; and existing transit resources. It is our hope that this list provides a roadmap to safer transit that offers options to best suit each transportation authority's needs and the needs of the communities they serve.

Once our communities adjust to the immediate precautions needed to maintain a safer environment using the resources at hand, medium-term and long-term safety will be contingent on advocacy from elected officials for sustained funding and policymaking to transform transit. Broad stakeholder engagement through all communications channels will help inform riders and the general public on what steps transportation agencies are taking to keep customers healthy and restore confidence in public transit.

# TRANSIT AGENCIES

# RIDERS

# ELECTED OFFICIALS

# BUSINESS

## IMMEDIATE

- Require and provide masks to enter any public transit service.
- Establish a Decision Support System and playbook of recommended operations options for various crowding and service scenarios.
- Increase cleaning frequency in high-traffic areas, especially high-touch surfaces.
- Install spacing indicators on the floors of platforms, trains, and buses for physical distancing.
- Train and continually update all transit staff on disease transmission and protocols to reduce its spread.
- Use all communication channels to urge compliance with agency and city COVID guidelines.
- Improve communication with riders with accessible wayfinding, transit ambassadors, and clear service alternatives.
- Supply PPE for all transit staff and contract staff; improve ventilation where possible.
- Provide safe, clean restroom facilities for workers throughout the system.
- Ensure contractors and vendors provide PPE, testing, and healthcare to their workers.
- Open windows on buses and train cars where feasible to improve airflow.
- Install hand sanitation stations at bus stops, subway entries, and platforms.
- Create opportunities for two-way communications so riders can report non-compliant conditions.
- Create virtual forums soliciting input from riders regarding their transportation needs.
- Increase bus service on routes along train lines to reduce crowding. Increase bus frequencies on high-demand routes. Utilize TSP to improve bus speeds.
- Coordinate with DOT to deploy emergency bus lanes in key corridors to increase service and reduce crowding.
- Explore far-UVC sanitization for stations, trains, buses, and air ventilation systems.
- Utilize electrostatic sprayers for rapid surface cleaning.
- Aggregate and make public station and train crowding data in real time using proprietary and third-party data.

- Wear a mask at all times while on transit, talk quietly to avoid spread by vocalization, and keep six feet between you and other riders when possible.
- Sanitize your hands before and after using public transit. When you arrive at your destination, wash your hands with soap and water.
- Do not ride transit if you have symptoms of or have been exposed to COVID-19.
- Plan more time for your commute to reduce the need to enter crowded trains or buses, or utilize an alternate form of transportation.

- Allocate emergency funding to transportation authorities to allow for continued public transit operations and COVID-19 response.
- Communicate with residents and riders new transit rules via TV, radio, and social media.
- Ensure culturally competent communications and include translations in locally spoken languages.

- Supply PPE to any employees that must return to the workplace or work in a public-facing capacity. Encourage hand-washing immediately upon arrival.
- Screen employees for symptoms and exposure. Have a plan for when an employee tests positive, including disallowing use of public transit for exposed employees.
- Provide information to employees on how to safely commute, travel to work, and maintain a safe working environment.

## MEDIUM

- Develop a smart messaging system for real-time crowding and service alternatives alerts.
- Work with Departments of Health to monitor surface and air samples for viral load in stations, trains, and buses.
- Implement turnstyle passenger count tracking to monitor physical distancing in stations.
- Reduce touchpoints at vending and other machines by installing virtual, voice, and camera-activated technologies; disinfect remaining touchpoints between customers.
- Log and display most recent train, bus, and platform cleaning time and date.
- Test the use of increasing heat to 133 degrees in train cars and buses regularly to sanitize and reduce the viral load.
- Partner with micromobility providers to offer alternative transportation options.
- Collaborate with partner systems to share best practices.
- Explore installation of thermal and video camera technology for automated temperature checks and mask compliance.
- Review and modify off-peak and peak fares and schedules to create incentives for off-peak travel.

- Limit single occupancy vehicle traffic within city limits to allow for efficient bus and bicycle mobility.
- Implement incentives for carpooling and raise tolls on solo drivers to reduce congestion.

- Implement paid sick leave and time off for all employees to prevent commuting while sick.
- Issue an on-site employee reduction plan to allow for flexible schedules, telework, and staggered work hours.

## FUTURE-PROOFING

- Speed up deployment of app-based fare collection to reduce touchpoints.
- Deploy UWB with CBTC to permit high service frequency and better coordination between service and track work.
- Fast-track CBTC construction to reduce headways and passenger volume.
- Install antimicrobial surfaces on high-touch surfaces in stations and rolling stock.
- Install cashless payments at all bus doors and impermeable barriers for drivers.
- Deploy pass products, fare capping, and other incentives to encourage rider use of contactless fare media.
- Leverage app-based turnstyle technology for passenger counts and emergency lockouts when platforms are above capacity.
- Improve air quality by upgrading ventilation systems in vehicles and indoor spaces.
- Include anti-microbial ventilation systems in all future procurements for rolling stock and station improvements.
- Deploy Automated Train Control to increase worker safety.

## LEGEND

HEALTH AND PREVENTION RECOMMENDATIONS

SANITATION RECOMMENDATIONS

OPERATIONS RECOMMENDATIONS

PLANNING RECOMMENDATIONS

INFRASTRUCTURE AND TECHNOLOGY RECOMMENDATIONS

COMMUNICATIONS RECOMMENDATIONS

**Text** PRIORITY 1 RECOMMENDATIONS

**Text** PRIORITY 2 RECOMMENDATIONS

## HEALTH AND PREVENTION

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Given that the predominant effort to keep riders and transportation authority staff safe comes from preventing COVID-19 transmission, most of the health and prevention recommendations are top priority for all transit stakeholders. First and foremost, all transit riders must wear a mask or face covering to enter transit services unless they have a disability that prevents mask-wearing—and no one should ride transit if they are knowingly infected with COVID-19 or experiencing COVID-19 symptoms, even with a mask.<sup>29</sup> Before and after riding transit, riders should use hand sanitizer and wash their hands with soap and water once they have arrived at their destination.<sup>30</sup>

Businesses with employees that utilize transit for their jobs or otherwise have public facing roles should supply their staff with personal protective equipment (PPE) and consider what options they have to stagger their workforce or reduce the need for their employees to travel during peak hours.

It is imperative that all public transit authorities provide PPE to all of their operators, maintenance staff, and other frontline workers, including but not limited to: N95 masks, gloves, disinfecting wipes, hand sanitizer, plastic protective barriers between operators and passengers, and improved ventilation where possible.<sup>31</sup> Any transportation authority contractors must provide the same level of protection to their employees as well.<sup>32</sup> Additionally, transportation authority staff should be trained

on disease transmission and prevention and updated as guidelines change or new information becomes available. All transportation authority staff must have access to paid sick leave, paid time off, and health insurance to reduce the need for employees to work while sick.

Transportation infrastructure should be restructured or repurposed to reduce transmission as well. Adding social distancing guides on train platforms, bus stops, and in rolling stock helps passengers visualize what a safe distance looks like and determine if an area is too full or bus or train car occupancy is too high to safely board.<sup>33</sup> Opening bus and train car windows where possible improves air circulation instead of relying on air conditioning, which often recirculates air in a cabin.<sup>34</sup> Designating train cars as “quieter cars” and discouraging talking, especially without a mask, thus limiting vocalization and droplet spread, may also reduce risk.

More broadly, many transportation authorities have access to data metrics to monitor crowding, such as turnstile counts, platform cameras, or WiFi usage, to identify hot spots where social distancing may be impossible. Preventing transmission is an immediate need, but is also a permanent reorienting of priorities that transportation agencies will be required to continue even after the immediate threat is addressed. Long term collaboration to reduce crowding, maintain rider and employee safety, and use existing technology infrastructure to manage transit usage are all important strategies to keep transit safe and open.

# HEALTH AND PREVENTION RECOMMENDATIONS

## IMMEDIATE

### *Riders*

Wear a mask at all times while on transit, speak quietly to avoid spread by vocalization, and keep six feet between you and other riders when possible.<sup>35</sup>

Do not ride transit if you have symptoms of COVID-19, or if you have been exposed to COVID-19 either at home or otherwise.<sup>36</sup>

Sanitize your hands before and after using public transit using hand sanitizer containing at least 70% alcohol. When you arrive at your destination, wash your hands with soap and water for at least 20 seconds.<sup>37</sup>

### *Agency*

Require and provide masks to enter any public transit service.<sup>38</sup>

Supply and replenish appropriate PPE for depot staff, transit operators, and cleaning/maintenance staff, as well as guidelines for use, including but not limited to: N95 masks, gloves, disinfecting wipes, hand sanitizer, plastic protective barriers between operators and passengers, and improve ventilation where possible.<sup>39</sup>

Install hand sanitation stations at bus stops, subway entries and platforms.

Install visible, durable spacing indicators on the floors of subway platforms, train cars, and buses to guide riders on necessary distancing measures.

Provide safe, clean restroom facilities for workers throughout the system, including hand sanitation stations.

Open windows on buses and train cars where feasible to improve airflow.<sup>40</sup>

Train all staff on disease transmission and protocols to reduce its spread and update them as new information becomes available.<sup>41</sup>

### *Business*

Supply PPE to any employees that must return to the workplace or work in a public-facing capacity. Require hand washing in common area bathroom upon arrival and before entering office space if possible.

Screen employees for symptoms and exposure as appropriate. Have a workplace-wide plan for when an employee tests positive, including immediate cessation of commuting via public transit for potentially exposed employees.

(continued next page)

# HEALTH AND PREVENTION RECOMMENDATIONS

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## MEDIUM-TERM

### *Agency*

Implement crowding tracking using turnstile counts, contactless payment data, platform cameras, or wifi usage to monitor physical distancing in stations.

Work in conjunction with state and local Departments of Health and their labs to monitor surface and air samples for viral load in train stations, train cars, and buses.

### *Business*

Implement appropriate paid sick leave and paid time off for all employees to prevent people working/commuting while sick.

Issue an on-site employee reduction plan to allow for flexible scheduling, telework, and staggered working times. Do not penalize employees who experience travel delays.

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## IMMEDIATE

### *Business*

Provide industry and location-specific information to employees on how to safely commute, travel for work purposes, and maintain a safe working environment.



Image source: Metropolitan Transportation Authority

## SANITATION

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Many transportation authorities began increasing cleaning frequency as COVID-19 became prevalent, and cleaning protocols should continue as transit reopens. “High-touch” surfaces, such as elevator buttons and turnstiles are of particular concern.<sup>42</sup> New technology and strategies to decontaminate surfaces are emerging, given the amount of labor needed to clean every surface of public transit infrastructure by hand. Rolling stock with climate control may be able to reduce viral load by increasing the heat inside to 133 degrees, similar to technology now available in police cars and other vehicles.<sup>43</sup> Transportation authorities should investigate the feasibility of investing in new cleaning products. Ongoing research

theorizes that far-UVC light in the 207-222 nm range might destroy SARS-CoV-2. This range of UVC is harmful for human contact and used only for sanitization without people present. The results of these pilots and research should be followed closely and implemented with the appropriate precautions.<sup>44</sup> Electrostatic sprayers are useful for quick turnaround times, such as during layover times for buses and trains.<sup>45</sup> Moving forward, capital investments for improved sanitation equipment will be essential to maintain clean infrastructure and to allow for flexibility if improved techniques become available.



# SANITATION RECOMMENDATIONS

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## IMMEDIATE

### *Agency*

Increase cleaning frequency in high traffic areas, especially high-touch surfaces such as elevator buttons, touch screens, turnstiles, etc.

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## IMMEDIATE

### *Agency*

Explore far-UVC lighting cleaning systems for stations, trains, buses, and air ventilation systems.<sup>46</sup>

Utilize electrostatic sprayers for surface cleaning requiring quick turnaround times.<sup>47</sup>

## MEDIUM-TERM

### *Agency*

Test the use of increasing heat to 133 degrees in train cars and buses regularly to sanitize and reduce the viral load.<sup>48</sup>



Image Source: Mango Pear Creative

## OPERATIONS

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While riders should supply their own masks, transit agencies can remove the burden on riders to procure their own masks and encourage wearing masks by offering free masks throughout the system. While masks must be a requirement to ride transit, measures to distribute masks should take priority over punitive measures like additional policing or citations, as policing too often targets riders of color and lower-income riders. Additionally, transit agencies must reinforce protecting staff by requiring vendors and contractors to provide appropriate protective personal equipment (PPE), testing, healthcare, and other protection for contracted workers. Transit agencies cannot accomplish this task alone and will need additional funding from state and federal governments to cover these expenses.

As ridership increases, to build on efforts of reducing crowding, transit agencies must modernize their train system by combining ultra-wideband technology (UWB) and communications-based train control (CBTC). Furthermore, transit agencies should work with local Departments of Transportation to retrofit streets to build designated bus lanes, especially along train lines, to increase bus service frequency and reduce crowding on buses. Lastly, it's important for transit agencies to expand and build contactless fare payments to acquire appropriate data on crowding at stations and on buses and trains.

# OPERATIONS RECOMMENDATIONS

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## IMMEDIATE

### *Agency*

Ensure contractors and vendors provide healthcare to their workers, including PPE, testing, and other protections.<sup>49</sup>

Establish a Decision Support System and playbook of recommended operations options for various crowding and service scenarios to encourage standardization of response and accountability to riders.<sup>50</sup>

### *Elected Officials*

Allocate emergency funding to transportation authorities to allow for continued public transit operations and COVID-19 response expenses.<sup>51</sup>

## FUTURE-PROOFING

### *Agency*

Deploy Communications-based train control (CBTC) and ultra-wideband technology (UWB) to allow for visibility of full common operating picture, allowing for high service frequency, reduced crowding, and reduced delays due to streamlining of service and track work.<sup>52</sup>

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## IMMEDIATE

### *Agency*

Coordinate with DOT and other partners to delineate additional and emergency bus lanes in key corridors to reduce bus congestion and time in traffic.<sup>53</sup>

Increase bus service on routes along train lines to provide duplicate service and reduce crowding on both modes. Increase bus frequencies on high-demand routes. Prepare for deployment of emergency bus lanes when needed to reduce rider crowding. Utilize Traffic Synchronization Programs (TSP) where signaling technology is pre-installed to speed bus times.<sup>54</sup>

Aggregate and make public station and train crowding data using existing, indirect metrics, including: turnstile counts, contactless payment media, wifi/cellular, or Google/Apple's bluetooth contact tracing programs.<sup>55</sup>

## MEDIUM TERM

### *Agency*

Review and modify off-peak and peak fares and schedules to create incentives for off-peak travel.

## FUTURE-PROOFING

### *Agency*

Deploy pass products, fare capping, and other incentives to encourage rider use of contactless fare media.<sup>56</sup>



Image Source: Jeremiah Higgins

## PARTNERSHIPS & PLANNING

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Transit agencies must recognize that they are not alone in the fight to rebuild ridership. Other agencies across the nation will face similar challenges and it would be wise for transit agencies to partner together to share practices. Moreover, agencies should look to collaborating with micromobility providers in the area to offer alternative, equitable, and affordable transportation options to decrease crowding on public transit. Many bike and e-scooter companies have seen significantly increased ridership during the

pandemic, and that trend is likely to accelerate as people return to work. Elected officials will be charged with rebuilding constituents' confidence in public transit, expanding micromobility options like e-bikes and e-scooters and bike lanes to facilitate safe travel, and disincentivizing solo car use where possible by raising tolls to help fund transit operations and limiting single-occupant vehicles in cities.

# PARTNERSHIPS & PLANNING RECOMMENDATIONS

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## IMMEDIATE

### *Agency*

Create virtual forums (town halls, live social media events, surveys, etc.) soliciting community input from riders regarding their transit experience, transportation needs, feedback, requests for service, and needs for improvement.

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## IMMEDIATE

### *Riders*

Plan more time for your commute to reduce the need to enter crowded trains or buses, or utilize an alternate form of transportation.<sup>57</sup>

## MEDIUM TERM

### *Agency*

Collaborate with partner systems across the United States and abroad to share best practices.<sup>58</sup>

Manage partnerships with micromobility providers to offer equitable, affordable alternative transportation options.<sup>59</sup>

### *Elected Officials*

Limit single occupancy vehicle traffic and expand bus and bike/micromobility lanes within city limits to allow for efficient bus and bicycle mobility.

Implement incentives for carpooling and raise tolls on solo drivers to reduce congestion.<sup>60</sup>



Image Source: Sergio Souza

## INFRASTRUCTURE AND TECHNOLOGY

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Existing and emerging technologies should be leveraged to reduce system touchpoints; speed movement of riders through turnstiles, checkpoints, and platforms; and aid in wayfinding and alternate routing when trains and buses are delayed. Where possible, and in conjunction with a staffed Decision Support System center, existing automated turnstile systems should be enabled to lock out passengers outside of stations as a measure of last resort to reduce extreme crowding. New, relatively low-cost thermal and video cameras installed at the turnstile can monitor temperature and mask compliance, allowing agencies to collect data on rider compliance measures in order to enable effective communications with riders, like updated public service announcements

that inform riders as to the percentage of mask compliance.

Longer-term, more capital-intensive future-proofing endeavors should also be undertaken as either emergency procurements or part of agencies' capital planning processes. Deployment of modernized signaling systems like communications-based train control (CBTC) and ultra wide-band (UWB) technologies allow for dramatically reduced train headways as well as instantaneous communication between trains, dispatchers, the Decision Support System staff, and even passengers. UWB also allows agencies to see the full common operating picture and coordinate between transit operations and maintenance crews who might be on tracks.

Automated train control reduces the need for dedicated transit operators, protecting transit workers from direct contact with the public. Given the high illness and fatality rate among transit operators, automating more functions and retraining staff helps to protect frontline workers. Lastly, upgraded ventilation, including antimicrobial filtration systems in future railcar and bus procurements, and the installation of antimicrobial surfaces on high-touch locations like handrails and doors, can ensure that viral particles are filtered and destroyed rapidly without the need to take rolling stock out of service for cleaning. While some of these interventions are costly, fortunately, many of the mitigations mentioned here are already agency priorities: as systems modernize, they increasingly look toward app-based and contactless solutions to move passengers more quickly through their systems.

While some privacy advocates have raised concerns about digital contact tracing methods, the technological interventions necessary to limit the transmission of COVID-19 and guard against future pandemics do not require additional surveillance beyond data that is already commonly shared. The technological interventions described herein can and should be implemented in a way that safeguards user privacy. For example, a system displaying real-time estimates of station crowding might use turnstile and wifi network data, interfacing with those systems through API endpoints. Such a system should make its estimates using only summary counts of recent entrances and the total number of devices connected to wireless networks, and should not be given access to any of those systems' internals. None of the proposed systems require the collection of individual-level data by transit agencies, except where they are already used in existing systems.

# INFRASTRUCTURE & TECHNOLOGY RECOMMENDATIONS

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## FUTURE-PROOFING

### *Agency*

Speed up deployment of app-based fare collection across all public transit, including cross-system integration, to reduce touchpoints.

Deploy Ultra-Wide Band (UWB) with CBTC (communications-based train control) to allow for visibility of full common operating picture, allowing for high service frequency and reduced delays due to streamlining of service and track work.

## MEDIUM TERM

### *Agency*

Explore installation of thermal and video camera technology that allows for automated temperature checking and mask compliance.<sup>61</sup>

Reduce touchpoints in stations by installing virtual ticket agents and voice or camera-activated technologies; where touchpoints remain, explore use of UVC lighting to disinfect between customers.

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## FUTURE-PROOFING

### *Agency*

Leverage contactless turnstile technology for passenger counts and emergency lockouts when platforms are above capacity.

Improve air quality by reassessing and upgrading ventilation systems for underground subway stations, buses, trains, subways, and other indoor spaces, including elevators and elevator-accessible stations.<sup>62</sup>

Fast-track CBTC construction to reduce headways and passenger volume.<sup>63</sup>

Include anti-microbial ventilation systems as a requirement in all future procurements for rolling stock and real estate investments.<sup>64</sup>

Install antimicrobial surfaces, such as copper coating or antimicrobial metal, on high-touch surfaces in stations and all rolling stock.

On buses, limit driver/passenger interactions through all-door boarding, cashless payments at all doors, and impermeable barriers between driver and passengers.

Deploy Automated Train Control to increase worker safety.<sup>65</sup>



# COMMUNICATIONS

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Communications with riders are important to slowing the spread of coronavirus by conveying critical public health interventions, rapidly disseminating information during emergencies and service changes, and building trust with riders and businesses. The more coordinated communications are between agencies, elected officials, and businesses, the more effective they will be in supporting building new habits among riders and explaining measures being taken to make transit safer.

Restoring ridership in the new era of coronavirus necessitates inculcating in riders a new culture of transit use: mandatory masks, hygiene routines, and physical distancing may be with us far longer than we care to admit. Even when the pandemic ebbs, mask use is an effective tool to reduce transmission of seasonal influenza and rhinoviruses; in many Asian cities that experienced the SARS outbreak, mask-wearing became ingrained as a cultural norm and has likely played a significant role in limiting the spread of SARS-CoV-2. That same establishment of new norms here in the U.S. can only be accomplished through effective communication with the riding public to express urgency, explain the science behind the requirements, give riders a sense of efficacy and personal responsibility, utilize common values and frames, and build a sense of collective effort toward a shared purpose.

PSAs via station and rolling stock audio/visual systems, apps, and other digital devices and signage should be used to

reinforce the importance of simple tools to mitigate risk and reduce spread. Saturating the transit environment with messaging is an effective technique to build social pressure to maintain new habits, especially as fear subsides and riders begin to revert to pre-pandemic routines. Part of building that sense of collective effort is cultural competence: messages must be in multiple languages, in a variety of specialized media markets, and be reflective of the full diversity of the community.

Elected officials have a clear role to play in the dissemination of information and building a set of new cultural norms around shared spaces. Even more than transit agencies themselves, elected leaders should prioritize science-based messaging, explanations of public health interventions, the importance of individual responsibility and collective action, and our larger common goal of ending the pandemic and saving lives. Officials should also work with local community leaders to disseminate public health messages, especially in communities that may not be easily reached by official communications from state and local health agencies. The power of the bully pulpit is real, and its impact radiates farther than public officials often realize. We as a society must harness its power in the defense of life and livelihood, grounded in science and data, to protect the lives of riders, their families, and all our communities.

# COMMUNICATIONS RECOMMENDATIONS

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## IMMEDIATE

### *Agency*

Utilize communication channels, including social media, digital screens in stations, and MTA staff, to urge compliance with agency and city guidelines on COVID mitigations and share CDC recommendations. Display PSAs detailing MTA safety and sanitizing procedures for customer peace of mind.<sup>66</sup>

Improve communication with riders with accessible wayfinding, transit ambassadors, and clear service alternatives to reduce the amount of time riders must spend in stations or on public transit. Retrain booth agents to provide assistance, assist with monitoring crowding, and provide masks.<sup>67</sup>

Create opportunities for two-way communications providing for community input and feedback so that riders can use apps or social media to report crowding, long waits, large-scale lack of mask wearing, lack of cleanliness, etc. to transit agencies.

### *Elected Officials*

Communicate with residents and riders new transit rules: follow CDC guidelines, allow more time for transit, and stay home if experiencing symptoms. Do so via TV, radio, and social media. Explain the underlying science so riders can make smart decisions in new situations and develop high, lasting compliance with guidelines.

Ensure all public communications are culturally competent and include translations into the most commonly spoken languages for the communities you serve.<sup>68</sup>

## MEDIUM TERM

### *Agency*

Create opportunities for two-way communications providing for community input and feedback so that riders can use apps or social media to report crowding, long waits, large-scale lack of mask wearing, lack of cleanliness, etc. to transit agencies.

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## MEDIUM TERM

### *Agency*

Log cleaning crew's dates and times each train car, bus, and platform was cleaned and display it visibly in each facility and on open data platforms.<sup>69</sup>

# INTERNATIONAL CASE STUDIES

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As we consider how to best prepare our transit for increases in ridership and a new normal in post-COVID 19 local travel, it is useful to look at some of the best practices happening in transit-rich regions across the world.

## LONDON

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After the national coronavirus lockdown was implemented in the United Kingdom, passenger numbers on the London Underground plummeted 95 percent, and 85 percent on the bus network.<sup>70</sup> Since April 20th, London's mayor has temporarily made all bus travel free and implemented rear-door-only boarding to protect transit workers.<sup>71</sup> Transport for London (TfL) is running services at 10 percent of normal capacity to comply with social distancing measures, urging all commuters to wear face masks, making

hand sanitizing points available across all stations, and encouraging employers to stagger work shift schedules.<sup>72</sup> Work is also underway to reconfigure London's streets, with TfL adding temporary bike lanes and 54,000 square feet of extra sidewalk space throughout the city. Authorities are encouraging Londoners to walk and cycle more to prevent trains and buses from overcrowding.<sup>73</sup>

The coronavirus pandemic hit London's public transit system in the pocketbook, causing a 90 percent drop in TfL fare revenue as lockdown orders kept most people home.<sup>74</sup> To keep London's transit system operating, the U.K. government passed a £1.6 billion (\$1.95 billion) funding package. The bailout comes with several conditions, including a requirement to increase service levels as soon as possible. As part of the agreement, TfL will increase fares next year on all modes by inflation plus one percent. After a temporary suspension, London's

Congestion Charge, Ultra Low Emission Zone and Low Emission Zone have been reinstated to discourage a spike in driving. The government also proposed raising the Congestion Charge from £11.50 to £15 a day, with its hours extended to between 7:00 a.m. and 10:00 p.m.<sup>75</sup>

Although London's transit ridership is slowly increasing as some parts of the economy reopen, a return to normal utilization is "highly unlikely" in the next few months, according to an analysis by the credit rating agency Moody's.<sup>76</sup>

## SINGAPORE

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Singapore has managed to contain the spread of COVID-19 within its borders due to extensive preparation in the wake of the severe acute respiratory syndrome (SARS) outbreak in 2003, aggressive testing and transparent reporting, swift interventions to impose social distancing, as well as frequent and consistent public health communications.<sup>77</sup> After a partial lockdown came into effect in Singapore in early April, subway ridership there fell by 84 percent.<sup>78</sup> In response to the COVID-19 outbreak, Singapore's Mass Rapid Transit (MRT) implemented a number of measures aimed at reducing the spread of coronavirus and keeping riders and workers safe. High-contact areas in stations are cleaned every two hours, toilets are cleaned four times a day, and every train is cleaned and disinfected before departure. The agency checks employee temperatures twice a day, tracks overseas travel of staff and contractors, and even provides employees with Vitamin C tablets

for immune system support. Non-essential visitors are forbidden from entering operations control centers, and air circulation systems in headquarters offices are being improved. In addition, a split team plan has been implemented to minimize cross-team/zone/depot coverage of duties.

MRT is also working with local authorities and businesses to cancel or defer large events, provide flexible work arrangements, and ensure there is sufficient supply of masks and disinfectants. Riders will benefit from increased external communication through social media and digital screens—debunking fake news, videos on cleaning efforts, and reminders about good personal hygiene practices.<sup>79</sup> Today, Singapore has a remarkably low case fatality rate, with 37,000 infections and only 24 deaths attributed to COVID-19.<sup>80</sup>

## VIENNA

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The Viennese Lines (Wiener Linien) is the company running most of the public transportation services in Vienna, Austria, and 38 percent of people living in Vienna—roughly 2.6 million passengers daily—use the city's transit network. At the start of the pandemic, Vienna implemented a strict lockdown order to prevent the spread of COVID-19, leading to a subsequent 80 percent drop in transit ridership. As a result, Wiener Linien took steps to restore a sense of safety and security for riders in advance of the phased reopening of the city's economy. Transit vehicles are disinfected frequently, face masks are required for all passengers, and rear door boarding is required on buses and trams. In addition, a distance of at least one

meter is encouraged between people who do not live in the same household. Service and security employees dispersed throughout the transit network are also instructed to inform riders about the regulations.<sup>81</sup>

As of May 18th, transit operations have returned to pre-COVID service levels and ridership has started to rebound, reaching 65 percent of normal ridership by early June. Although the company cannot increase service frequency any further without a long procurement process for new vehicle orders, overcrowding has so far not been an issue for Vienna's public transport network. Passengers have adapted to the new measures quite well and a large majority of riders voluntarily comply.<sup>82</sup>

Today, Austria's COVID-19 infection rate continues its downward trend. At the beginning of April, there were 9,200 known active infections in Austria; at the beginning of May, there were 1,800 patients; now, at the beginning of June, this number fell to 378 active infections.<sup>83</sup> Furthermore, no cases in Austria have been traced back to public transport.<sup>84</sup>

## TOKYO

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In Tokyo—a city much larger than New York City—public transit riders pay attention to safety guidelines and are diligent about mask-wearing and safe distancing.<sup>85</sup> During the pandemic, scientists found a correlation between high levels of mask-wearing and success in containing the virus. In Japan, where mask-wearing has been a standard part of the culture for hundreds of years, there were over 17,000 COVID-19 infections

and 900 deaths. Despite having a population only two and a half times larger, the United States by comparison has over 1.9 million infections and 110,000 deaths.<sup>86</sup> Japan's containment strategy focused primarily on mass testing, social distancing, and identifying COVID-19 clusters instead of sweeping lockdown measures. The clusters that were identified were most often connected to gyms, bars, nightclubs and karaoke rooms, but none were linked to Japan's crowded transit system.<sup>87</sup>

## PARIS

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When the coronavirus reached France, the country suspended access to certain transit stations and service on some, but not all, rail lines.<sup>88</sup> France's government mandated that all public transit passengers nationwide must wear a face mask or risk a €135 (roughly \$150) fine. By mid-May, the government announced it would be supplying 10 million masks to local transport operators to distribute to passengers, including 4.4 million for the Paris region. Additionally, passenger capacity was limited to allow for safe distancing, with Paris metro, bus, and suburban rail lines aiming to limit initial capacity to 15 percent of normal levels.<sup>89</sup> To help reduce crowding on transit, Paris added 30 miles of cycling lanes and also closed 30 streets to pedestrians.<sup>90</sup> With these measures in place, transit passengers have been following strict safety guidelines, resulting in not a single COVID-19 cluster emerging on France's six metro systems, 26 tram and light rail networks, or numerous urban bus routes for nearly a month.<sup>91</sup>

# FINANCIAL CONSIDERATIONS & COVID-19 MITIGATIONS

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Although economic activity is now gradually resuming across the country, demand for public transit is not expected to fully rebound by the end of the year. Given the existing funding mechanisms, which often rely heavily on fare revenue, transit agencies will need continued cash infusions from federal and state governments to ensure safe, reliable, and quality service. Heavy dependence on fare revenue, sales taxes, and toll monies has been a historic problem for transit agencies, and especially now as the COVID-19 pandemic has essentially dried up all traditional funding streams. In a depressed economy, using public funds to close transit funding gaps is not typically a viable solution. Municipal and state governments must explore new and innovative approaches to revenue, including congestion pricing, parking management, and emissions cap-and-invest models like

the emerging Transportation and Climate Initiative in the Northeastern U.S., which can generate money, reduce traffic congestion, and encourage use of public transit.

The pandemic has exposed the fact that public transportation is really an essential service, and as a result, funding for transit must now become a higher priority for the federal government and state and local elected officials. Outside of major cities, those who viewed public transit as a social program for low-income individuals may now see it as a crucial service for moving front-line workers and keeping the economy functioning. In the end, the COVID-19 era could prove to be the tipping point for long-term federal investment in public transit—but achieving this will require sustained pressure from riders, advocates, and elected officials.

# CONCLUSION

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Public transportation faces an existential crisis that requires a coordinated response from a wide array of actors if it is to continue to serve riders and keep them safe. The COVID-19 pandemic forced the United States to temporarily shut down its economy and ask millions of people to stay home for months until the crisis was under control. The shutdown, while necessary for flattening the curve, delivered a devastating blow to every public transit agency in the United States: ridership fell to record lows and many traditional revenue sources, like taxes and tolls, dried up quickly. In response, the Federal government provided a lifeline for transit by passing the Coronavirus Aid, Relief, and Economic Security (CARES) Act in March, which directed \$25 billion to transit agencies to help prevent, prepare for, and respond to the pandemic. The federal bailout temporarily kept transit service operating, which was particularly helpful for millions of frontline workers who, despite the crisis, still rely on a well-functioning transit system for commuting. However, public transit agencies across the country, and particularly in the hardest-hit regions like the New York metropolitan area, will need

additional federal support to continue to run high-quality service.

Now, as cities are lifting lockdown orders and cautiously allowing businesses to reopen, transit agencies must develop a comprehensive plan for providing safe, clean, and efficient service to ensure commuters will feel safe taking transit. Without the public's trust, transit agencies risk a much longer rebound for ridership levels and revenue dollars, and cities risk being paralyzed by traffic congestion caused by too many people eschewing transit for commuting by car.

What riders need to feel safe is fairly clear, and in line with current science: the results of our survey of over 1,000 "active" and "non-active" transit riders point to the desire for frequent service, limiting capacity at stations and onboard trains and buses, consistent cleanings, and mask-wearing requirements. Fortunately, these are steps that many agencies are already taking. They will need to double down on these efforts and on educating riders so that they feel safe returning to our nation's buses, subways, and commuter rail services.

The real test will come when more businesses reopen and more people leave their homes. In the near term, transit agencies need to prepare for a surge of ridership while also maintaining public health measures designed to reduce the spread of coronavirus. Furthermore, agencies must rebuild public trust by developing stronger external communication strategies that inform riders of new policies and provide important service information. We should look to examples from other countries, including many urban transit systems in Asia that were prepared for COVID-19 because of their past efforts to safeguard their systems in the wake of SARS.

The good news is that the pandemic has made many Americans realize something that citizens of other countries already know: public transportation is an essential service that needs more reliable funding and greater federal support.



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# APPENDIX I: RIDER SURVEY REPORT

## RIDERS' RECOMMENDATIONS for the POST-COVID COMMUTE

### INTRODUCTION

The new coronavirus pandemic has nearly brought transportation to a screeching halt. As state governors began to institute stay at home orders for all but essential workers, transit agencies around the country began recording staggering declines in ridership. Since the start of the outbreak, the MTA lost 90% of its ridership, NJ Transit lost a whopping 98% of its ridership, and PATH saw 95% of its ridership disappear. As regions, states, and cities begin to reopen, transit agencies are rushing to restore service in line with state reopenings and quickly address the challenges that will arise during their own recovery. An important element of reopening state economies is restoring confidence that ending stay-at-home orders is safe, and transit users will expect that buses, subways, and trains will be safe as well.

To help give elected leaders and transit agencies a sense of what riders will need to feel confident that transit is safe, we asked over one thousand regular transit users in New York, New Jersey, Connecticut, and Pennsylvania what new, rider-focused changes they want to see before they return to transit.

Recognizing the economic and environmental impacts of gridlock and congestion, many cities across the U.S. were implementing or studying traffic-reduction policies in the months before the pandemic began. Now, as other countries are beginning to relax their stay at home restrictions, a concerning trend has arisen in commuters' preferred modes of transportation: a significant number of people are turning to cars for local travel in lieu of transit. Wuhan, for example, has seen an uptick in new vehicle purchases as residents opt to commute via car. Transit agencies' efforts to bring riders back to transit are critical to real economic recovery in our cities. But the trend toward increased car ownership is particularly detrimental not only to cities, but to the bottom line of transit budgets, as transit agencies across the U.S. are heavily reliant on passenger fares, or "the farebox," as a significant fraction of their operations budgets. During the pandemic's peak, agencies saw massive budget shortfalls due to ridership declines and farebox revenue drops. Should that trend continue, transit agencies will be forced to dramatically cut service and raise fares—or may collapse entirely. Increases in car use and resulting emissions also create devastating environmental and public health problems.

While our survey reflects the severe dropoff in transit use, with under ten percent of total respondents reporting that they were actively taking transit during the pandemic, our survey results also show that the vast majority of riders expect to return to transit if agencies take the right precautions, with only eight percent of respondents reporting that they would not return to transit or would only return in the case of a vaccine.

Lastly, many of the percentage of respondents currently riding transit represent essential workers, and many are from communities of color. Without public transit, these workers would not have been able to perform essential work needed to keep society functioning. First-person recommendations from these riders will be particularly vital as transit agencies look to rebuild.

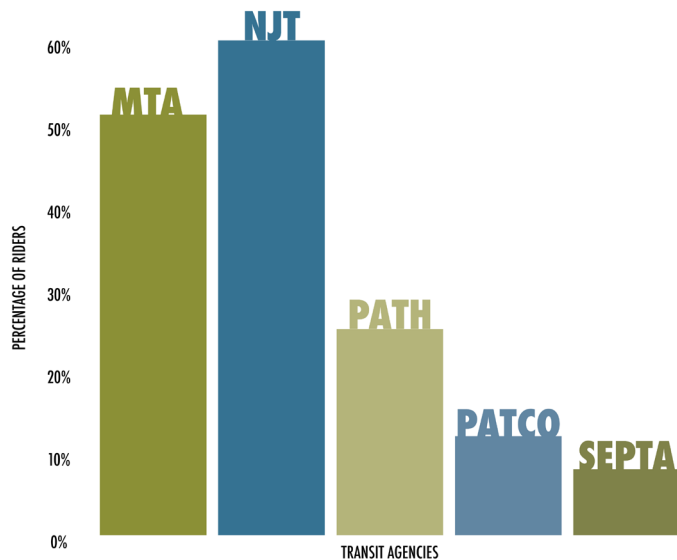


Figure 1 Transit Agencies used by Survey Respondents

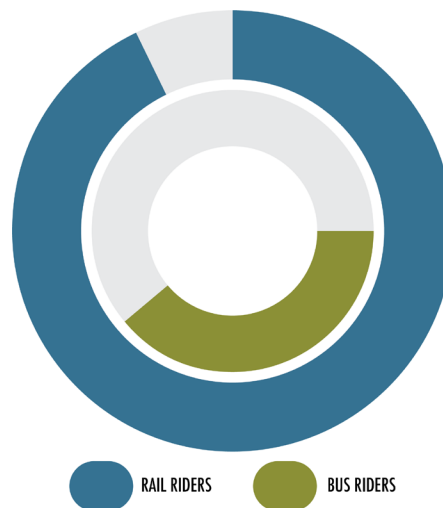


Figure 2 Percentage of Survey Respondents who use Rail and Bus

## RESULTS

We disseminated our online survey in May and received over a thousand responses from riders who use Metropolitan Transit Authority (MTA), New Jersey Transit, Port Authority Trans-Hudson (PATH), Southeastern Pennsylvania Transportation Authority (SEPTA), Port Authority Transit Corporation (PATCO) Speedline, and many other bus and rail services throughout the region. Respondents included those who are still riding public transit during this uncertain time, whom we refer to as **active users** in this report, as well as those who have halted their use of transit as a result of the stay at home mandates, whom we refer to as **non-active users**. Full methodology is below.

Riders, both active and non-active, offered a range of responses on what measures they expect agencies to take to make transit safe for everyday use. Responses from the vast majority of riders fell into three primary categories of concern: cleanliness, frequency of service, and masks and social distancing. Each of these categories relates to riders' actual and perceived safety from transmission of the coronavirus.

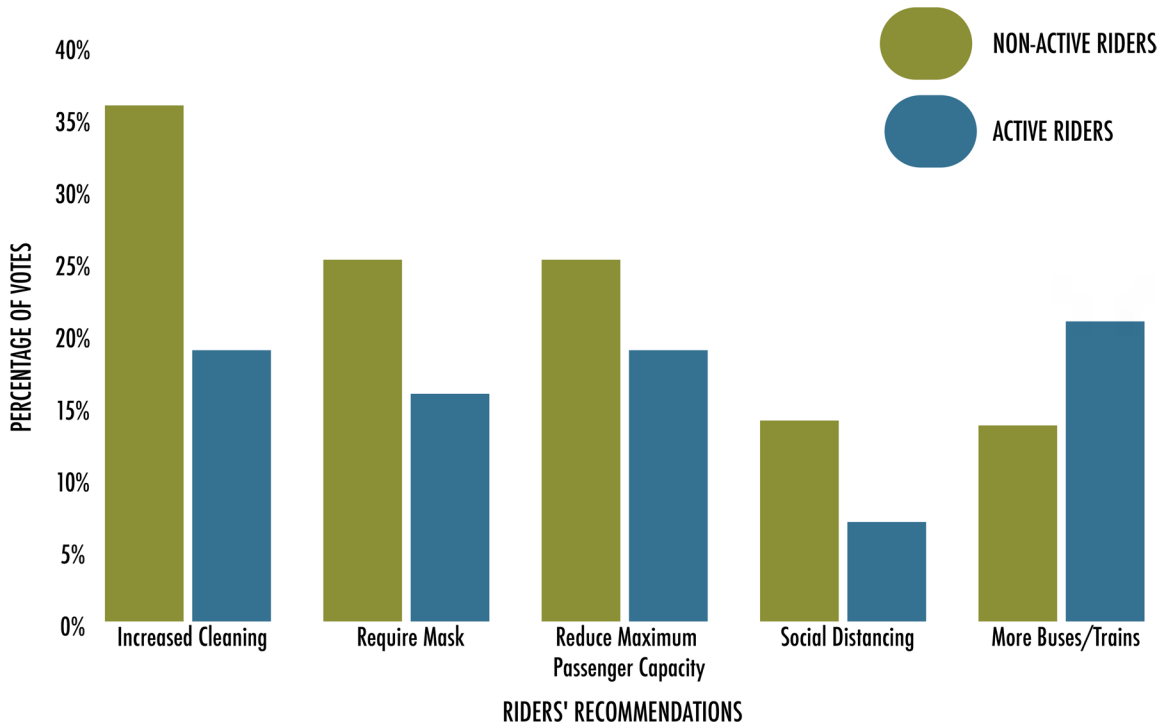


Figure 3 Percentage of Votes Per Rider Recommendations

## CLEANLINESS

By far the top recommendation from non-active riders was bus, train, and station cleanliness, with over 35 percent of non-active riders responding that improved sanitation and cleaning procedures will make them feel more comfortable in returning to ride public transit. These riders noted that the frequency of cleaning is critical to establish trust in their safety and subsequent comfort with using transit, with many respondents calling for cleaning vehicles at the end of every run. Meanwhile, 19 percent of active riders echoed the call for greater cleanliness. While still a common response, the disparity between the two groups suggests that perhaps active riders are seeing the results of increased cleanings and are prioritizing other interventions accordingly.

Riders' requests for greater cleanings should be seen as a positive sign for transit agencies, which have been quick to respond at the start of the pandemic by improving cleaning processes. While the latest public health recommendations indicate that transmission of the novel coronaviruses from surfaces is less frequent than initially reported, transit agencies should continue their enhanced cleaning procedures and explore new cleaning and sanitization processes. As transit agencies undertake increased cleaning procedures, however, agencies must also continue to provide reliable service in the interim. While the MTA has shut down subway service between the hours of 1 AM - 5 AM to do proper cleaning, they have provided replacement bus service for riders during the pandemic, and will surely need to return the subways to regular 24-hour service as ridership increases.

## REDUCED PASSENGER VOLUMES AND INCREASED FREQUENCY OF TRANSIT

Both non-active and active riders highlighted the need for higher service frequency to complement a reduction in maximum passenger capacity on buses and trains and at stations. Among active riders, the desire for more frequency was the most common response, at 21 percent. Nearly 14 percent of non-active riders called for greater frequency.

The desire for higher frequency dovetails with requests for reduced maximum passenger capacity to accommodate physical distancing, which is a core recommendation of the Centers for Disease Control. In fact, 20 percent of active riders and 25 percent of non-active riders echoed those recommendations, responding that a reduction in maximum passenger capacity would make them feel safer while riding public transit. One rider captured the sentiment with the following response: “More frequent service to alleviate rush-hour crowding.”

Without an improvement in frequency, riders are left to decide whether to ride a bus or train that may be close to capacity or seek another mode of transportation. A reduction in headway times will allow riders to continue to maintain physical distance while riding, which is critically important as riders begin to return to transit as shutdowns end: increases in bus and train frequency will need to be paired with reductions in passenger capacity to continue to combat the spread of the virus.

## FACE COVERINGS & SOCIAL DISTANCING

Both current and non-active riders want to see increased compliance with face covering requirements, showing broad awareness among riders that face coverings help combat the spread of COVID-19. Studies show that this is especially true in enclosed spaces, such as trains and buses, and many countries in Asia that have face covering compliance in the high 90th percentile have very low rates of COVID even as ridership on transit has remained relatively stable.

While 25 percent of non-active riders indicated that requiring masks will make them feel more comfortable returning to riding transit, and 16 percent of active riders agreed, compliance will have to be much higher than 25 percent to ensure it is an effective strategy against the spread of COVID-19. Fortunately, many state governments have already signed executive orders requiring face masks on public transit, including in New York and New Jersey. It is critical that transit agencies without state mandates require masks for all riders and that all agencies communicate this requirement clearly and repeatedly as ridership begins to rebound.

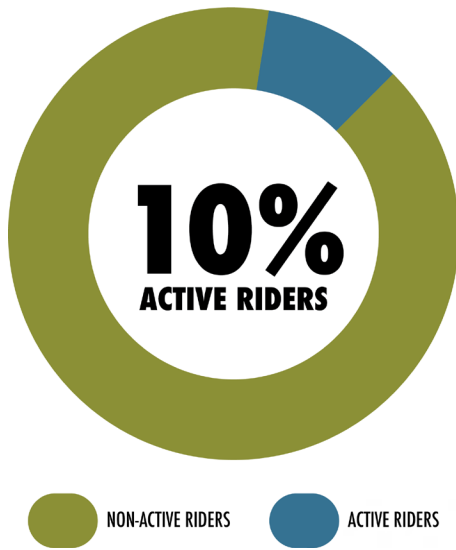


Figure 4 Percentage of Survey Respondents who are Active Riders

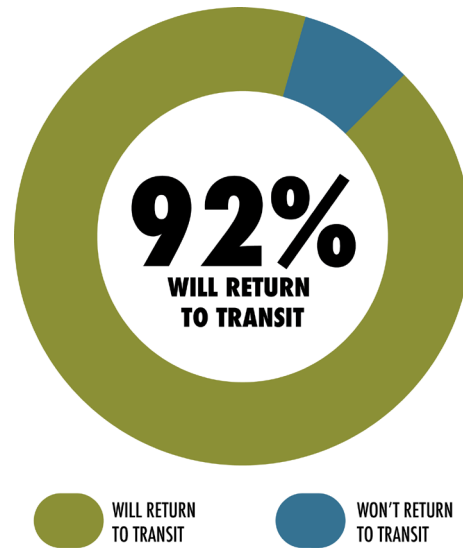


Figure 5 Percentage of Survey Respondents who say they will return to Public Transit Post-COVID-19

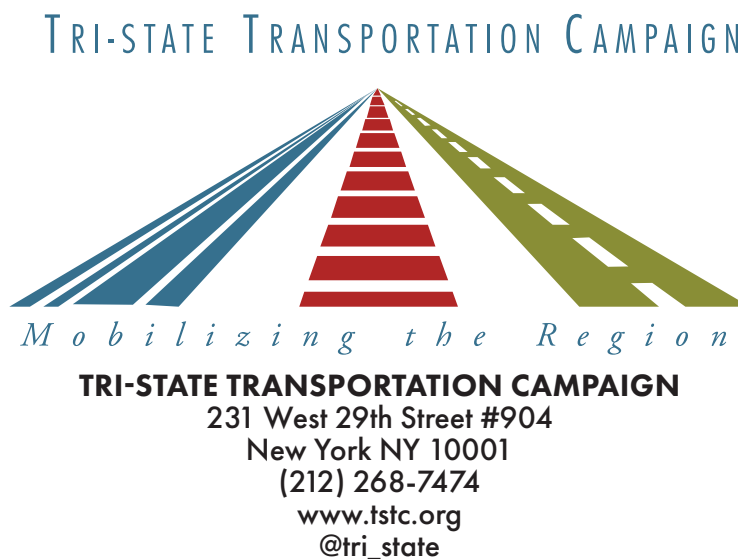
## POST-COVID

Above all, our survey findings illustrate that riders are aware of efforts to combat the spread of the virus and have plenty of valuable suggestions to help transit agencies redesign their ridership experience to accommodate the post-pandemic “normal.” Some transit agencies have already implemented many of these recommendations, including requiring riders to wear face coverings, upgrading their cleaning procedures, and cleaning more regularly. Moreover, agencies have been providing adaptive schedules to accommodate essential workers. Combining this with a reduction in passenger capacity and increasing frequency of service can allow transit agencies to provide reliable service as well as create the opportunity for riders to distance themselves as people return to their commute.

Unfortunately, encouraging riders to return is but one piece to the puzzle, and transit agencies cannot accomplish this feat alone. To successfully implement and maintain these changes, agencies will require additional funding from state and federal governments. The financial burden of these practices will compound as time progresses and ridership returns. The CARES Act served as a great starting point for transit agencies at the start of the pandemic, but with low ridership projected for much of 2020, continued federal aid in subsequent stimulus packages will be necessary to ensure transit continues to function.

## METHODOLOGY

Tri-State Transportation Campaign developed this survey to ask riders directly what they need to feel safe on public transit or return to riding transit as restrictions ease. Our survey asked riders what mode of transit they use, what agency or agencies they rely on, and allowed them to write in their preferred safety measures. Our online survey received 1,074 survey responses, including 108 riders who are currently still riding public transit. While there is an overlap of which systems riders use, over 50% of respondents use some form of MTA bus or rail service, 60% of riders use some form of NJ Transit service, about 24% of riders use the PATH system, and about 10% of respondents use some form of SEPTA and or PATCO service. Additionally, while there is an overlap of which mode riders use, across all modes of transportation, 93% of respondents were rail riders (including commuter rail, subway, and light rail) and about 39% were bus riders.



# APPENDIX II: LIST OF RECOMMENDATIONS

Category	Target	Priority Ranking	Timeline	Recommendation Text
Communications	Agency	1	Immediate	Use all communication channels to urge compliance with agency and city COVID guidelines.
Communications	Agency	1	Immediate	Improve communication with riders with accessible wayfinding, transit ambassadors, and clear service alternatives.
Communications	Agency	1	Immediate	Create opportunities for two way communications providing for community input and feedback so that riders can use apps or social media to report crowding, long waits, large-scale lack of mask wearing, lack of cleanliness, etc to transit agencies.
Communications	Elected Officials	1	Immediate	Communicate with residents and riders new transit rules via TV, radio, and social media.
Communications	Elected Officials	1	Immediate	Ensure culturally competent communications and include translations in locally spoken languages.
Communications	Agency	1	Medium	Develop a smart messaging system for real-time crowding and service alternatives alerts.
Communications	Agency	2	Medium	Log and display most recent train, bus, and platform cleaning time and date.
Health/Prevention	Agency	1	Immediate	Install hand sanitation stations at bus stops, subway entries and platforms.
Health/Prevention	Agency	1	Immediate	Provide safe, clean restroom facilities for workers throughout the system.
Health/Prevention	Agency	1	Immediate	Supply PPE for all transit staff and contract staff; improve ventilation where possible.
Health/Prevention	Agency	1	Immediate	Open windows on buses and train cars where feasible to improve airflow.
Health/Prevention	Agency	1	Immediate	Train and continually update all transit staff on disease transmission and protocols to reduce its spread.
Health/Prevention	Agency	1	Immediate	Install spacing indicators on the floors of platforms, trains, and buses for physical distancing.
Health/Prevention	Agency	1	Immediate	Require and provide masks to enter any public transit service.
Health/Prevention	Business	1	Immediate	Supply PPE to any employees that must return to the workplace or work in a public-facing capacity. Encourage hand-washing immediately upon arrival.
Health/Prevention	Business	1	Immediate	Screen employees for symptoms and exposure. Have a plan for when an employee tests positive, including disallowing use of public transit for exposed employees.
Health/Prevention	Riders	1	Immediate	Sanitize your hands before and after using public transit. When you arrive at your destination, wash your hands with soap and water.
Health/Prevention	Riders	1	Immediate	Do not ride transit if you have symptoms of or have been exposed to COVID-19.
Health/Prevention	Riders	1	Immediate	Wear a mask at all times while on transit, talk quietly to avoid spread by vocalization, and keep six feet between you and other riders when possible.
Health/Prevention	Agency	1	Medium	Implement turnstyle passenger count tracking to monitor physical distancing in stations.
Health/Prevention	Agency	1	Medium	Work with Departments of Health to monitor surface and air samples for viral load in stations, trains, and buses.
Health/Prevention	Business	1	Medium	Implement paid sick leave and time off for all employees to prevent commuting while sick.
Health/Prevention	Business	2	Immediate	Provide information to employees on how to safely commute, travel to work, and maintain a safe working environment.
Health/Prevention	Business	2	Medium	Issue an on-site employee reduction plan to allow for flexible schedules, telework, and staggered work hours.



Category	Target	Priority Ranking	Timeline	Recommendation Text
Infrastructure	Agency	1	Future-Proofing	Speed up deployment of app-based fare collection to reduce touchpoints.
Infrastructure	Agency	1	Future-Proofing	Deploy UWB with CBTC to permit high service frequency better coordination between service and track work.
Infrastructure	Agency	2	Medium	Explore installation of thermal and video camera technology for automated temperature checks and mask compliance.
Infrastructure	Agency	2	Medium	Reduce touchpoints at vending and other machines by installing virtual, voice, and camera-activated technologies; disinfect remaining touchpoints between customers.
Infrastructure	Agency	2	Future-Proofing	Leverage app-based turnstyle technology for passenger counts and emergency lockouts when platforms are above capacity.
Infrastructure	Agency	2	Future-Proofing	Improve air quality by upgrading ventilation systems in vehicles and indoor spaces.
Infrastructure	Agency	2	Future-Proofing	Fast-track CBTC construction to reduce headways and passenger volume.
Infrastructure	Agency	2	Future-Proofing	Include anti-microbial ventilation systems in all future procurements for rolling stock and station improvements.
Infrastructure	Agency	2	Future-Proofing	Install antimicrobial surfaces on high-touch surfaces in stations and rolling stock.
Infrastructure	Agency	2	Future-Proofing	Install cashless payments at all bus doors and impermeable barriers for drivers.
Infrastructure	Agency	2	Future-Proofing	Deploy Automated Train Control to increase worker safety.
Operations	Agency	1	Immediate	Ensure contractors and vendors provide PPE, testing, and healthcare to their workers.
Operations	Agency	1	Immediate	Establish a Decision Support System and playbook of recommended operations options for various crowding and service scenarios.
Operations	Elected Officials	1	Immediate	Allocate emergency funding to transportation authorities to allow for continued public transit operations and COVID-19 response.
Operations	Agency	2	Immediate	Coordinate with DOT to deploy emergency bus lanes in key corridors to increase service and reduce crowding.
Operations	Agency	2	Immediate	Aggregate and make public station and train crowding data in real time using proprietary and third-party data.
Operations	Agency	2	Immediate	Increase bus service on routes along train lines to reduce crowding. Increase bus frequencies on high-demand routes. Utilize TSP to improve bus speeds.
Operations	Agency	2	Medium	Review and modify off-peak and peak fares and schedules to create incentives for off-peak travel.
Operations	Agency	2	Future-Proofing	Deploy pass products, fare capping, and other incentives to encourage rider use of contactless fare media.
Planning	Agency	1	Immediate	Create virtual forums (town halls, facebook live events, surveys, etc) soliciting community input from riders regarding their transit experience, transportation needs, feedback, requests for service, and needs for improvement.
Planning	Riders	2	Immediate	Plan more time for your commute to reduce the need to enter crowded trains or buses, or utilize an alternate form of transportation.
Planning	Agency	2	Medium	Collaborate with partner systems to share best practices.
Planning	Agency	2	Medium	Partner with micromobility providers to offer alternative transportation options.

Category	Target	Priority Ranking	Timeline	Recommendation Text
Planning	Elected Officials	2	Medium	Limit single occupancy vehicle traffic and expand bus/bike lanes within city limits to allow for efficient bus and bicycle mobility.
Planning	Elected Officials	2	Medium	Implement incentives for carpooling and raise tolls on solo drivers to reduce congestion.
Sanitation	Agency	1	Immediate	Increase cleaning frequency in high-traffic areas, especially high-touch surfaces.
Sanitation	Agency	2	Immediate	Explore far-UVC sanitization for stations, trains, buses, and air ventilation systems.
Sanitation	Agency	2	Immediate	Utilize electrostatic sprayers for rapid surface cleaning.
Sanitation	Agency	2	Medium	Test the use of extreme heat train cars and buses regularly to sanitize vehicles.