

Maintaining essential mass transit in cities during COVID-19: A public health framework

OVERVIEW AND PURPOSE

COVID-19 has affected almost every aspect of daily life, and transportation is no exception, especially in cities that rely on mass transit. This guide is designed to help cities reduce the risk of COVID-19 transmission within urban mass transit systems—whether publicly or privately operated—while continuing to provide safe mobility for essential workers and access to essential services. This guide describes how community-wide public health strategies should be combined and coordinated with measures by mass transit operators to reduce COVID-19 transmission in transit vehicles such as trains, buses, trams (streetcars or trolley cars) or minibus taxis, and related facilities like stations and stops, enabling mass transit systems to continue to provide this essential service. Cities will need to adapt principles from this guide to local resource constraints. Some implementation challenges and adaptations for low-resource settings are noted in the recommendations.

Key Messages

- Urban mass transit is an essential service in cities, and it should be maintained for essential workers and trips in the context of an overall adaptive response to COVID-19.
- Robust community-wide public health and social measures and disease control activities help reduce unnecessary trips and avert infected people from entering the transit system.
- To prevent a shift to private motorized transport and serve those who cannot access it, transit users should be provided with safe alternatives, such as enhanced bus service, cycling on protected bikeways, and more pedestrian space through repurposing streets and lanes normally mainly used by single-occupancy vehicles.
- Within the transit system, measures to protect workers and passengers should be put in place, including engineering and operational changes, passenger behavior change cues and more frequent cleaning.
- Maintaining essential urban mass transit now and enhancing it for the future will help support healthy, equitable recovery in in cities.

This guide will help you to:

Understand the rationale behind the need to maintain essential transport during COVID-19 and suggest some practical guidance based on lessons that have already been learned.

Who is this guide for?

This guide is for city executives and health and transit agencies planning and coordinating mass transit operations as part of an overall, coordinated COVID-19 response.

WHY IS MASS TRANSIT AN ESSENTIAL SERVICE IN CITIES?

People in cities need to access livelihoods, schools, health services, food and recreation, all of which are essential to the physical, social and economic health of people and communities. In cities, mass transit (including rail, bus, streetcar or minibuss) is essential for efficient movement of large numbers of people through limited street space. One lane of street space dedicated to mass transit (e.g., a bus lane or streetcar) can move roughly six to 40 times more people per hour compared to a lane used by private motor vehicles. Mass transit is especially important for lower-income people and others without affordable access to privately-owned vehicles, taxis or ride-share vehicles.

In cities with robust mass transit systems, residents come to depend on them to the point that they are as essential as other basic services such as water and power. In cities with insufficient mass transit, traffic congestion, delays, crashes and air pollution exact a huge health and economic toll.

HOW HAS URBAN MASS TRANSIT BEEN AFFECTED BY COVID-19?

Before the threat from COVID-19 was fully acknowledged by authorities, efficient intercity rail and air travel helped to spread COVID-19 among Chinese cities² and global air travel rapidly carried infected people to all continents.

However, the pandemic has led to a rapid movement away from the use of urban mass transit. In some places, mass transit shutdowns were part of broader movement restrictions and lockdown measures.^{3,4} Even before lockdowns started, people stopped using subways and buses in an attempt to reduce their exposure to the virus. As public health and social measures and lockdowns were put in place, many people in occupations compatible with remote work were directed to or opted to work from home. When schools were closed, children who were able began tele-schooling.

This has led to dramatic reductions in the use of public transport; in many cities, service was also curtailed in response to reduced demand and decreased fare revenue. For those dependent on mass transit for access to essential services, goods and jobs—including essential health workers and others unable to work from home—fewer passengers could mean less crowding and reduced risk of transmission. On the other hand, decreases in transit service could lengthen commutes, increasing crowding and risk. Mass transit shutdowns or reduced service could cut off access to essential goods, services and livelihoods or increase use of less safe modes, such as crowded taxis or jitneys. These impacts fall especially hard on the large number of informal sector workers in many low- and middle-income countries. For example, in one survey of people in 12 African countries about the COVID-19 outbreak, only 20% were working from home and only 18% were avoiding public transit.⁵ In Nigeria, limits on public transit were strongly linked to economic and social impacts from COVID-19.⁶

Even as it has been impacted by the pandemic, urban mass transit has adapted to support the response, providing mobility for many essential workers.⁷ During pandemic recovery in cities, mass transit will continue to play an essential role in providing equitable and efficient access to livelihoods and services.

WHAT ARE THE HEALTH BENEFITS OF URBAN MASS TRANSIT?

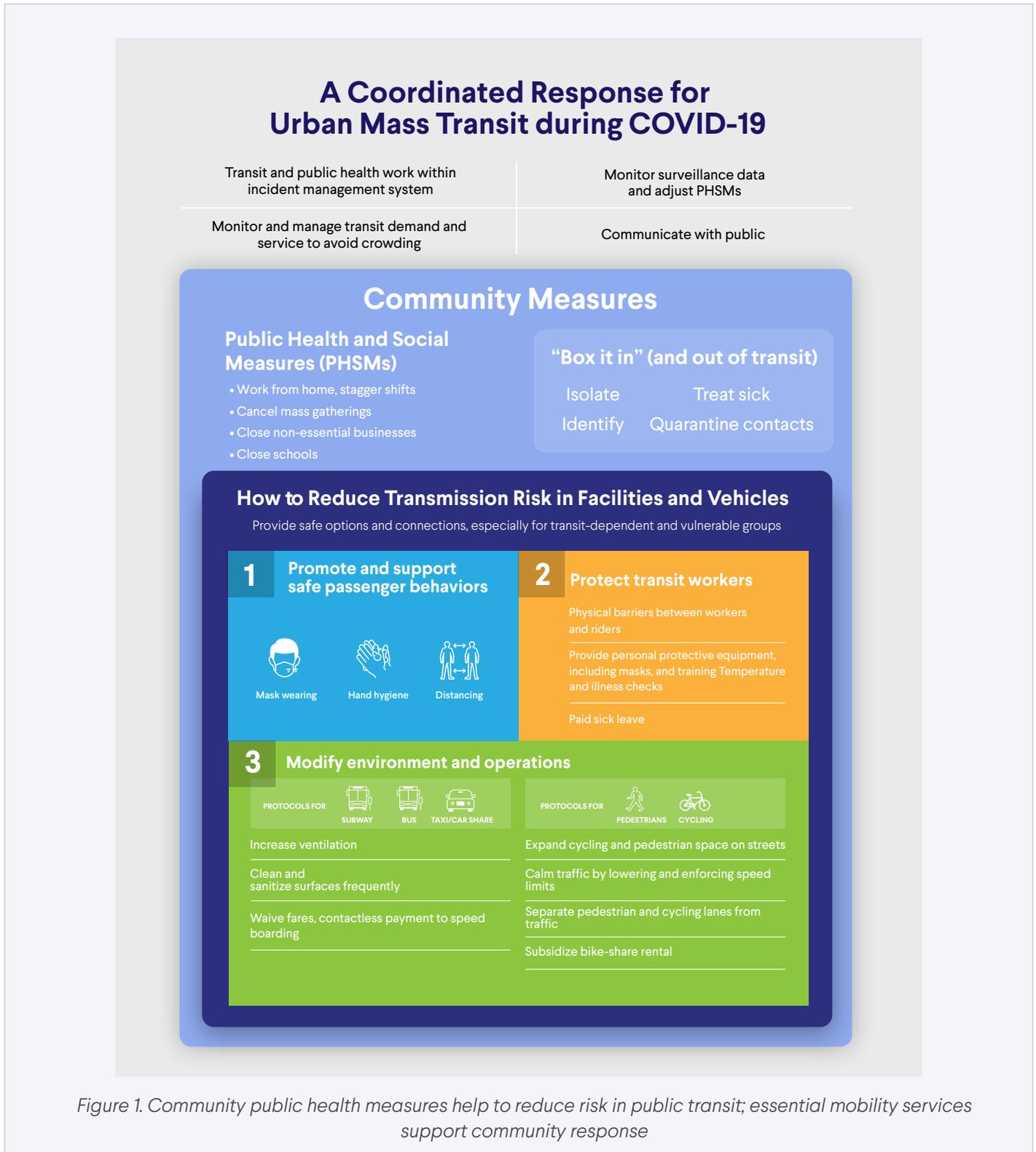
- Mass transit complements other efficient and healthy transport modes, such as walking and cycling, by carrying riders across distances too great for these active modes, which are used for the first and last leg of transit trips. Habitual physical activity from routine use of active transport modes—with or without mass transit—has enormous health benefits, reducing the risk of multiple noncommunicable diseases and mortality from them.^{8–10}
- Mass transit can be much safer per mile traveled compared to driving, reducing road traffic collisions, a major cause of premature death and disability.
- Mass transit use can help reduce motorized vehicle miles traveled and emissions of traffic-related pollutants that harm health, crops and the climate.
- By moving more people with less space needed for roads and parking, mass transit can help reduce the amount of paved over land that contributes to the urban heat island effect (higher temperatures in cities compared to surrounding areas) and flooding in cities.

WHY IS COVID-19 TRANSMISSION A CONCERN IN URBAN MASS TRANSIT?

Requirements for physical distancing can be especially challenging to implement in urban mass transit vehicles and facilities. The risk of transmission can be amplified by large numbers of people in a confined space, limited ventilation, difficulties excluding infected people, and the number of high-touch surfaces, such as ticket machines, currency, handrails and turnstiles, where virus-containing droplets can be deposited and transferred to the hands of other passengers. Workers, such as bus drivers, conductors and station attendants can be at greater risk than passengers because of the much greater time spent in the system and greater number of potential close contacts. Informal forms of urban mass transportation such as minibus taxis (e.g., matatus, trotros, etc.), motorcycle taxis (boda-bodas) and auto-rickshaws present additional challenges because of the close proximity of operators and passengers.

In considering urban mass transit systems, vehicles and facilities, it is important to recognize them as one among many settings where people can come together and potentially transmit COVID-19 and other infections. Explosive COVID-19 transmission has occurred in communities with and without large mass transit systems. Some cities with large mass transit systems have maintained modified transit operations after using public health and social measures to avoid or reverse widespread, explosive community transmission. While transit ridership decreased to varying degrees as intended as business and school closures and other public health and social measures were implemented, large and increasing transit ridership in these same cities has not triggered new outbreaks.^{11, 12, 13–16, 17} The weight of available evidence (summarized in [Annex A](#)) suggests that urban mass transit systems do not account for a large share of transmission, relative to other settings, even in cities with large numbers of transit riders.

REDUCING TRANSMISSION RISK WITHIN URBAN MASS TRANSIT SYSTEMS WHILE SUPPORTING ESSENTIAL MOBILITY—A PUBLIC HEALTH FRAMEWORK



During the COVID-19 pandemic, neither a business as usual approach to transit, nor a reflexive shutdown or curtailment of service that might strand essential workers and others, is appropriate. Available evidence suggests that factors modifying transmission risk in other community settings can also work in mass transit. Actions already

being taken by many mass transit systems to reduce transmission risk and available guidance for formal transit system operators^{11,18} are broadly consistent with measures to reduce transmission risk in other community settings¹⁹. Furthermore, the risk of person-to-person transmission of COVID-19 in mass transit is a function of the prevalence of COVID-19 infections in a community. As rates of infection fall, and measures such as contact tracing, isolation and quarantine are implemented, the risk of encountering an infected person on mass transit falls.

COVID-19 control in mass transit should be addressed in the context of a community-wide, adaptive, coordinated response, with close cooperation between public health and transportation agencies within an incident management system (see Figure 1). An overarching goal should be risk and harm reduction: layering measures to reduce transmission risks of essential mass transit use and avoiding actions that increase health risks by forcing people into less safe modes or eliminating access to essential services. The mix of approaches for providing safe alternatives and measures to reduce transmission risk in transit vehicles and facilities will need to be adapted to the local transportation context and the resources and the epidemiologic situation in each city. Implementation examples from low- and middle-income countries are being compiled and will be published as a resource to supplement this guide.

- **Use adaptive, layered community level public health and social and disease control measures²⁰ as the first lines of protection for the transit system (Figure 1-1) by:**
 - › Reducing unnecessary transit demand and traffic congestion, such as through remote work options and staggered work schedules that reduce travel and crowding during peak hours. This will allow less crowded and traffic-slowed trips by essential workers and others needing mass transit to access livelihoods and essential services,
 - › Using testing, isolation, contact tracing and quarantine to reduce the possibility of infected passengers and workers entering the transit system.
 - › Monitoring local epidemiology and tightening or loosening public health and social measures accordingly while adapting transit measures described below to changes in ridership.

- **Provide safer options and connections (see Figure 1-3) to further reduce crowding for those reliant on mass transit for essential trips by:**
 - › Monitoring occupancy and crowding, increasing frequency of service and providing traveler feedback to limit occupancy and maintain physical distancing.
 - › Supplementing or replacing subway service with modified bus service. Outdoor bus stops facilitate distancing and provide natural ventilation while riders are waiting and queuing.
 - › Expanding cycling and pedestrian space on streets, with effective separation of these vulnerable street users from motor vehicles.²¹
 - › Considering additional traffic calming, speed limits and enforcement to provide an added layer of protection for the increased numbers of vulnerable street users, especially since increased speeding by motorists has been observed in some cities.

- **Prioritize and subsidize maintaining and increasing transit service to relieve crowding for transit-dependent communities, essential workers, destinations like health facilities, and the busiest routes.**
 - › For example, in San Francisco, transit authorities have been responding to the COVID-19 situation by allocating workers and modifying bus service to prioritize essential service to transit-dependent communities and to help reduce crowding on busy routes.²²

- › Restricting private or single occupancy vehicles on key bus corridors can be a relatively cost-effective and rapid way to speed bus trips and reduce crowding and shared onboard time.²³
 - › In many cities in low- and middle-income countries, informal, independent transit such as minibus taxis are common. These provide service with low fares and depend on full occupancy to maintain earnings for drivers. Government subsidies may be needed to sustain this essential transit system under capacity restrictions for social distancing⁶ and avoid driver strikes²⁴ and other disruptions.
- **Use, adapt and augment evidence-based hygiene, physical distancing and environmental measures (Figure 1-3) appropriate to other community and workplace settings¹⁹ in transit vehicles and facilities along with operational changes to further reduce risk of transmission. These measures include:**
 - › **Passenger behavior cues, signs and announcements including:** not traveling when sick; avoiding unnecessary transit trips; avoiding peak hour travel, busier stations and crowded cars; maintaining distance at stops and in vehicles (clearly mark seats and floors); hand hygiene (sanitizer use on entry and departure from the system); wearing face coverings at all times; and refraining from eating, drinking and loud or extended conversations. Consider providing hand sanitizer and masks at entry and exit points.
 - › **Environmental interventions,** including increased ventilation (e.g., opening operable windows on buses and minibuses) and increased daily cleaning and disinfection in vehicles, stations and employee areas, emphasizing high-touch surfaces
 - › **Operational changes,** including rear-door-only boarding on larger buses, waiving fares or implementing contactless payment.²⁵ In low- and middle-income settings where bank cards are less common, mobile phone payment systems for formal and informal transit operators should be explored. These are increasingly available and used by even low-income households, for example, to pay for household energy services.²⁶
 - › **Monitoring of crowding,** adherence to mask wearing and distancing requirements and adjustments to operations, crowd management and communications as needed.
- **Prioritize added worker protections (Figure 1-2), including physical barriers such as plexiglass between operators and passengers, personal protective equipment and training in proper use, pre-shift illness checks and paid sick leave, as well as hygiene and distancing measures for shared worker facilities (locker rooms, break rooms and bathrooms).**
 - › **Communicate regularly** with passengers, businesses and the general public at all stages of the pandemic about measures taken to make public transport safer, steps to manage demand and avoid peak hour crowding, service changes, and passenger responsibilities (see example from the U.K. government , Figure 2). Ideally communication should be in all locally common languages.



Figure 2. Example of mass transit user guidance

- **Link public communication about mass transit to an overall community COVID-19 alert level system²⁷**
 - › **Advise the public to plan travel in advance**, travel at off-peak times, use quieter stations and stops, keep carried bags and luggage to a minimum, walk or cycle for parts of journey when possible, and use mobile apps to aid trip planning where available. These are widely available in high-income countries and increasingly across low- and middle-income countries.²⁸

ANNEX A

BRIEF SUMMARY OF EVIDENCE ON TRANSMISSION OF COVID-19, INFLUENZA AND OTHER RESPIRATORY INFECTIONS IN MASS TRANSIT

Because of known and suspected transmission modes for COVID-19—through large respiratory droplets and possibly aerosols released by infected people—all public settings that normally involve close contact between people, especially indoors, pose a risk of transmission. Mass transit vehicles and stations are no exception. While transmission of COVID-19 in mass transit settings has been documented, the overall importance of mass transit in transmission has not been well established. Rapid turnover of passengers in mass transit, with potential for many brief contacts, makes it a difficult venue for studying transmission. Poorly designed studies and misperceptions have led some to overstate the role of mass transit and even suggest—despite contrary evidence—that it cannot be operated safely because of the risk of community spread of COVID-19. The evidence summarized below includes case studies and simulations using models. Because of the limited evidence for COVID-19, studies of influenza and other respiratory viruses are also cited.

Documented outbreaks, clusters and investigation of transmission in urban mass transit

Direct evidence of COVID-19 spread in mass transit vehicles or facilities is rare. Clearly, modern mass transportation, including air and rail transport, has played an important role in the movement of people infected with COVID-19 between cities where they can seed more local outbreaks,²⁹ a conclusion confirmed by a cluster analysis of more than 700 cases in Northeast China before March 8, 2020.³⁰ However, this same study suggests that transmission *within* mass transit vehicles was quite *infrequent*, a finding consistent with an investigation of 150 COVID-19 case clusters in France, which linked none to transport.³¹ The limited evidence available from transmission in transit vehicles is consistent with evidence from other indoor settings identifying factors that increase risk: 1) prolonged shared occupancy with infected people (trip length);³⁰ 2) poor ventilation (closed windows and air conditioning in recirculation mode); and 3) a lack of mask wearing.³²

Epidemiologic studies, non-COVID-19 respiratory infections

A study of SARS cases in Beijing in 2003 found that regular use of a taxi was associated with higher risk, but bus or subway use were not significantly associated when controlling for other variables.³³ A study in the U.K. during the 2008–09 flu season found an association between recent tram or bus use and acute respiratory illness, but that regular public transport users were less likely to have acute respiratory illness.³⁴

Indirect evidence: Ecologic and modeling studies

Ecologic studies do not involve individual-level data on transit ridership and infection, but instead look for associations at the community level between indicators of mass transit access (e.g., the proximity to stations) or mass transit use (e.g., surveys or ridership data) and community-level rates of illness. These studies are inherently limited in their ability to distinguish transmission occurring in transit vehicles or facilities from transmission in other community settings. One reason is that transit use tends to be higher in communities exposed to other high-risk settings, such as crowded housing, offices, markets, bars and restaurants. Another is that public health and social measures cause reduced transit ridership or shut down transit and, at the same time, reduce high-risk physical and social contacts in many non-transit, non-residential settings.

Intracity public transit closures in China along with banning gatherings, entertainment and other measures were associated with significantly fewer cases. Combined interventions and nature of study make it unclear how much transmission was occurring or reduced within transit as opposed to transit being one form of mobility to other settings for transmission.³⁵ An ecologic study in New York City found that the percentage of people commuting by transit, walking or carpooling and distance traveled were associated with higher COVID-19 rates. However, this ecologic study found that poverty was protective, suggesting important missing variables or other biases.³⁶ A similar ecologic study presented temporal and spatial correlation of subway ridership and claimed that New York City subways played a singular role in seeding explosive community spread of COVID-19³⁷, a claim that was widely echoed by political leaders and others.³⁸ Among the flaws of this study pointed out by critics was that it did not consider that spatial and temporal patterns of decreased subway ridership was a consequence of other public health and social measures³⁹ and of New York City residents leaving the city at different rates in different neighborhoods.

An agent-based computer simulation model for New York City, calibrated with historical data from the 1957-58 influenza pandemic and New York City travel survey data, estimated that only about 4% of pandemic influenza spread would occur on the subway.⁴⁰ A diary-based study of more than 7,000 participants in eight European countries was used to collect data for influenza modeling and did not measure transmission. It did find that only 3% of regular contacts (either direct skin-to-skin or a conversation of three or more words) were in transport settings and these were less likely to involve direct physical contact than contacts in other settings.⁴¹ While the large numbers of briefer contacts in transit systems cannot be assumed to be risk-free, they are probably far less likely to cause transmission than contacts with prolonged conversation, singing or exercise with increased respiration, which were observed to cause large COVID-19 clusters in Japan.⁴²

Indirect evidence: Continued, restarted or modified mass transit and contained community transmission

Wide variation in risk among cities with large transit systems may be explained by how robust community disease control and public health and social measures are, as well as by differences in facilities, cleaning and passenger behaviors and by how promptly transit systems implement measures to reduce transmission risk in vehicles and facilities.^{11, 12, 13-16, 17} At the same time, explosive transmission in cities and suburbs with limited transit ridership⁴³⁻⁴⁵ suggests that even complete shutdown of urban mass transit is not, by itself, an effective public health and social measure.

RESOURCES:

The International Road Transport Union has a coronavirus (COVID-19) information hub for transport and transporters, see <https://www.iru.org/covid19>.

The U.K. government has a checklist for safer travel, see <https://www.gov.uk/guidance/coronavirus-covid-19-safer-travel-guidance-for-passengers#checklists-for-safer-travel>.

The WHO has a website on when and how to use face coverings, see <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public/when-and-how-to-use-masks>.

NACTO's COVID-19 Response Center provides guidance for cities including for transit systems, and examples of actions being taken by urban mass transit agencies: <https://nacto.org/program/covid19/>.

The New York City metro area Tri-State Transportation Campaign has produced detailed guidance on COVID-19 safety measures for transit operators and case studies. <http://www.tstc.org/wp-content/uploads/2020/06/Back-on-Board.pdf>

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