Q1: What can I do as a rider of mass transit to help reduce the risk of COVID-19 spread?

A: The easiest way to avoid becoming infected while traveling is to not travel in the first place. If travel is not essential, it is advisable to reconsider your travel plans. However, many workers in essential services still require the use of public transportation systems, and riders of mass transit should factor this into their plans. Please see Technical Guidance for Transportation – Guidance for Mass Transit Riders for more information.

Q2: What guidance is available for air passengers to help reduce the risk of COVID-19 spread?

A: Air passengers can help reduce the spread of COVID-19 by wearing facemasks, practicing social distancing, and travelling only if the travel is necessary. Please see Technical Guidance for Transportation – Guidance for Air Passengers, for detailed suggestions.

Q3: Is there guidance available for Transportation Facility Operation? Is guidance for similar commercial buildings appropriate?

A: Many transportation facilities are very much like other buildings that superficially share usage types. But there are very important differences between transportation facilities and other similar commercial buildings (office buildings, malls, etc.):

1. Occupants of the facility are often on their way to or have come from other locations (other neighborhoods, cities, states, and countries).

2. The facility may be subject to a great deal more regulation.

3. The facility may have tenants (operators of the transport services using the facility) that are subject to even more regulation by a different set of agencies or bodies.

ASHRAE recommends following the guidance in the Task Force's Technical Guidance for Transportation – Guidance for Transportation Facility Operation.

Q4: What is the best/safest place to sit on an airplane?

A: Experimental data show there are no particularly good or bad seat locations in typical airliners with respect to risk for airborne disease transmission. The primary factor in this risk is how well ventilation air is supplied to a given location as it is this ventilation air that flushes airborne pathogens out of the cabin. The more quickly and effectively this supply air flushes airborne pathogens from the air, the lower the risk, all other factors being equal.

Airliners are designed to supply ventilation air uniformly along the length of the cabin. However, that feature alone does not ensure that every seat gets the same ventilation. Experiments were conducted in full-sized mockups of both wide-body and narrow body aircraft using actual aircraft air delivery systems and design flow rates. 1,2 Effective local ventilation rates were measured at each seat, 30 seats in the narrow-body and 77 seats in the wide-body. Effective local ventilation is a measure of the amount of air supplied to the cabin adjusted by the effectiveness with which it reaches a given location. For the narrow body aircraft, the effective local ventilation rates varied from 29 to 32 air changes per hour (Note: Since HEPA filtration of recirculated air is standard practice in nearly all airliners, effective ventilation rate is based on total airflow, not outside airflow, for airborne pathogen applications.). For the wide body, it varied from 24 to 28 air changes per hour. These differences within an aircraft are not of practical importance and there was no discernable pattern as to which seats had the higher values (e.g. window versus aisle).

Another study showed that the biggest factor in exposure risk, not surprisingly, is distance from the infected person. 3 The further you are from the infected person in any direction, the better. While it is not possible to know in advance the location of infected people, the fewer people in the general vicinity of a seat and especially the fewer people within 2-3 seats in any direction, front-back, right-left, the lower the risk. This same study indicated the worst place to be for airborne transmission may be directly in front of an infected person.

Since seats are spaced further apart in both directions in business and first-class sections, the risk in these sections is likely somewhat less in a fully loaded aircraft. However, a fully loaded first class section may have a higher occupant density than a lightly loaded main cabin, thus, there is no guarantee that a 1st class seat will reduce exposure.

References:

1) J. Patel, B. Jones, and M. Hosni, Experimental Analysis of Ventilation Effectiveness and Tracer Gas Dispersion in a Boeing-737 Mockup Cabin, *Proceedings of the Second International Conference on Energy and Indoor Environment for Hot Climates, ASHRAE, February 2017, Doha, Qatar.*

2) J. Patel, B. Jones, M. Hosni, A. Keshavarz, Experimental Investigation of Ventilation Effectiveness in an Airliner Cabin Mockup, *Proceedings of the ASME 2016 International Mechanical Engineering Congress and Exposition*, IMECE2016, Phoenix AZ, November 12, 2016

3) J.S. Bennett PhD , B.W. Jones, M.H. Hosni, Y. Zhang, J.L. Topmiller, and W.L. Dietrich, Airborne Exposure Patterns from a Passenger Source in Aircraft Cabins, *HVAC&R Research*, 22 Nov 2013.