



**The American
Institute
of Architects**

Re-occupancy Assessment Tool V2.0

May 28, 2020

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Background

Stay-at-home orders that began in California on March 19, 2020, quickly swept the nation. More than a month later, federal and state governments are debating the process by which businesses, schools, and other non-essential facilities can reopen. The CDC, WHO, OSHA, ASHRAE, and others have already developed administrative and behavioral resources for reoccupying buildings; however, guidance that holistically addresses the [CDC's Hierarchy of Controls](#) is needed to ensure the public's health, safety, and welfare.

Architects and allied professionals are in a unique position to coordinate a range of mitigation strategies that, in aggregate, reduce the risk of exposure to and transmission of COVID-19 within non-health care settings. Our goal is to promote best practices that protect the health, safety, and welfare of the public while creating opportunities for businesses, schools, restaurants, and other non-essential facilities to provide services.

The purpose of this document is to provide architects, private clients, and civic leaders a framework of strategies for reoccupying buildings and businesses that are in the process of transitioning from being fully closed to fully open. This document aims to provide a range of general mitigation measures to consider, with the understanding that the risk of infection can only be reduced and not eliminated entirely. Effective solutions require a coordinated approach between building features and operational practices.

It should be noted that certain COVID-19 measures listed within this assessment tool may be inconsistent with other site needs, such as security, accessibility, resilience, and sustainability; the totality of these considerations must be prioritized during this public health emergency. Furthermore, decision makers and design professionals are encouraged to evaluate the vulnerability of these buildings with a biological and natural disaster confluence.¹

1. It is recommended that businesses perform a rapid assessment to provide an initial determination of the ability and capacity of a building and its spaces to respond to and accommodate its occupants and the community in the event of a natural disaster as well as a biological disaster.

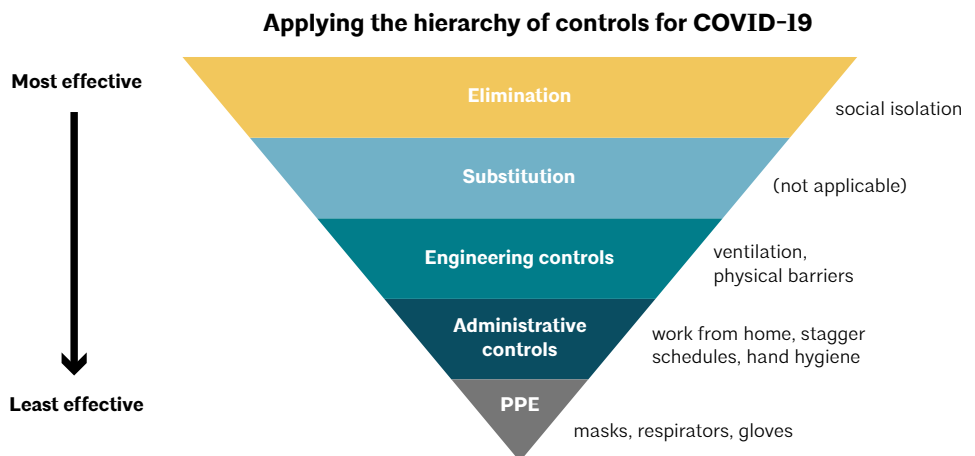
About the Re-occupancy Assessment Tool²

The following assessment tool is structured on the Occupational Safety and Health Administration’s “Guidance on Preparing Workplaces for COVID-19, OSHA Document 3990-03-2020.” This planning guidance is based on both traditional infection prevention and industrial hygiene practices; it is advisory in nature and informational in content. The intent of the assessment tool is to describe considerations to reduce the risk of occupant exposure to SARS-CoV-2, the virus that causes COVID-19 disease cases, in workplaces and places of public accommodation. Fundamental to the assessment considerations are:

- Developing infectious disease preparedness and response plans.
- Preparation to implement basic infection prevention measures.
- Developing policies and procedures for prompt identification and isolation of symptomatic people, if appropriate.
- Developing, implementing, and communicating about workplace flexibilities and protections.
- Implementing workplace controls.

The assessment tool uses the CDC framework of “hierarchy of controls” to select ways of controlling workplace hazards. It proposes that the best ways of controlling the hazards are to systematically remove them rather than primarily relying on workers or the public to reduce their own exposure. In most cases, a combination of control measures will be necessary.

Figure 1: Applying the hierarchy of controls for COVID-19 (adapted from NIOSH)



2. This tool was prepared during the COVID-19 pandemic response including continuous outbreak cycles influencing business closures, re-openings, and potential business re-closure. The scientific evidence about SARS-CoV-2 is in a continuous process of discovery as researchers around the globe develop studies and report findings that subsequently impact public health policy. Therefore, it’s important to review this tool in the context of any new scientific evidence published or public health policy updates after the publication date of this document.

The AIA Re-occupancy Assessment Tool is a list of considerations that includes engineering (and architectural) and administrative controls, as well as PPE, that apply to both essential businesses operating under restrictive orders and for closed non-essential facilities that are in the process of re-opening.

The following public health findings informed the AIA Re-occupancy Assessment Tool considerations.

Physical distancing. COVID-19 is thought to spread mainly through close contact (within about six feet) from person to person in large respiratory droplets.^{i ii}

Contact transfer. While the CDC has stated that contact transfer is not thought to be the main way the virus spreads, it may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or eyes.ⁱⁱⁱ Based on studies of SARS and MERS-CoV, preliminary data on SARS-CoV-2, and CDC recommendations, evidence suggests that SARS-CoV-2, the virus that causes COVID-19, can potentially persist on fomites (abiotic surfaces) ranging from a couple of hours to five days.^{iv v vi} There is also developing research on fecal/oral transmission of COVID-19, which makes bathroom environments especially important to consider from an occupancy, cleaning, and maintenance standpoint.^{vii viii ix x}

Aerosols. Transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled.^{xi}

Waterborne contaminants. The virus that causes COVID-19 has not been detected in drinking water. Conventional water treatment methods that use filtration and disinfection, such as those in most municipal drinking water systems, should remove or inactivate the virus that causes COVID-19.^{xii} However, other public health risks—such as *Legionella*—may develop in the stagnant water of unoccupied buildings.^{xiii}

Business owners are encouraged to communicate their mitigation measures to occupants to foster a transparency that could help the public make informed decisions about their own health and safety. Reduced public uncertainty may help bolster economic and civic activities.^{xiv}

General conditions— baseline parameters

If the intended operation of the facility cannot satisfy certain prerequisites, then the facility is likely not a good candidate for utilizing the following reopening considerations for minimizing the risk of spreading SARS-CoV-2. The below goals, operating authority, facility authority, and risk management categories are set forth as baseline prerequisites. The facility under evaluation may have additional prerequisites.

	Yes	No
Goals		
Provide a clear path for the restart of businesses to restore the economy.		
Mitigate the risk of spreading pathogens, including SARS-CoV-2, among the business workers and the general public.		
Operating authority		
Verify that the facility re-establishment orders come from the proper governing authorities.		
Evaluate whether the authority instructions may or are intended to change over the implementation period.		
Facility authority		
Verify that the business facility management has the legal authority to make physical alterations to the premises.		
Determine the Authority Having Jurisdiction (AHJ) requirements for permitting facility alterations.		
Risk management		
Comply with federal, state, and local laws including ADA, OSHA, and Department of Health regulations and requirements.		
Evaluate the building owner's risk tolerance. For more on the risk management process, see AIA's Risk Management Plan for Buildings .		

Workplace controls

- E Education
- O Office
- F Restaurant
- S Senior living
- R Retail
- H Housing

The assessment tool does not describe mandatory requirements but lists general controls applicable to building attributes that architects may adjust depending upon the differing building typologies and scale of operations. This listing of controls, ranked by efficiency, may be applied to essential facilities needing to expand their services when governmental restrictions are removed. It also applies to closed non-essential facilities that are to initially reopen with required limitations (short-term) and eventually operate without imposed restrictions (long-term). Not all controls may be applicable to all building types under all situations. Additional controls specific to the building type under evaluation may be required. The relevant controls may be further identified as “essential” or “desirable” to create a list of identified design considerations.

Considerations organized by CDC priority	Essential	Desirable
<p>1. First priority: Elimination Institute social isolation. Wherever possible, occupants should work or access the business from home. This should include restructuring responsibilities to minimize the number of occupants that need to be physically present.^{xv}</p> <p>2. Second priority: Substitution Replace the hazard. There is no available substitution for COVID-19; thus the control measure is not applicable.^{xvi}</p> <p>3. Third priority: Architectural and engineering controls Isolate persons from workplace-related SARS-CoV-2 exposure. Where appropriate, these controls reduce exposure to hazards without relying on occupant behavior and can be cost-effective to implement.³</p> <p>3.1 Programming</p> <p>3.1.1 Adapt space to meet public health needs.</p> <ul style="list-style-type: none"> E Utilize large interior, traditionally active, spaces (ie. gymnasium), as extended, passive instructional space and move active programming outside. H S Provide dispersed, temporary work surfaces for outdoor working/dining to reduce quarantine fatigue. H S Identify ad hoc space for package storage overflow. F Utilize the parking lot as a waiting area to avoid congregating in restaurant waiting areas or wandering throughout the dining room. 	<p>N/A</p>	

3. Considerations are associated with a wide range of costs. The ROI of each design intervention will vary by building.

- E Education
- O Office
- F Restaurant
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Considerations organized by CDC priority

Essential Desirable

S Provide an in-room dining area for family visitation to reduce isolation.^{xvii}

S Identify a designated space for visitation, preferably with direct access to outdoors.

3.1.2 Provide biophilic amenities that promote mental health and wellbeing.

3.1.3 Provide outdoor programming space.^{xviii}

E O F S Provide outdoor seating to supplement indoor seating.

R Promote outdoor shopping.

S Designate outdoor area for family visits that can accommodate physical distancing.

3.2 Space planning

3.2.1 Reduce density and/or increase spacing of furniture.

E Use cubbies, shelf units, and other classroom furniture as low barriers adjacent to student desks and, adjacent to teaching area.

E O Stagger work stations where possible and rotate to face the same direction.

E O Provide or retrofit locking casters to limit furniture mobility where mobility could pose an issue for physical distancing.

E O F S Retrofit dining room layout to increase spacing between tables and limit number of seats to allow for adequate spacing apart of people, measurement taken minimum six feet from shoulder outward.^{xix xx xxi}

3.2.2 Reduce amount of equipment to provide more spacing.

E Remove/relocate corridor lockers to provide a wider path for common travel.

3.2.3 Restrict access to restroom fixtures to provide minimum six-foot spacing between fixtures.

3.2.4 Ensure additional trash cans are placed near entrances, doors, and PPE stations.

3.2.5 Consider one-way traffic flow.^{xxii xxiii}

- E Education
- O Office
- F Restaurant
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- H Housing

Considerations organized by CDC priority

Essential Desirable

3.2.6 Determine ingress/egress to and from restrooms to establish paths that mitigate waiting, proximity for occupants, and face-to-face convergence between those entering and exiting.

3.2.7 Expand interior queuing spaces where throttling circulation is required; using barriers as necessary to ensure physical distancing.

3.2.8 Relocate some taxi/ride sharing/drop-off stops to increase physical distancing.

3.3. Non-structural partitions and openings

3.3.1 Consider an exit separate from the entrance.

3.3.2 Limit number of entrances where appropriate.^{xxiv}

3.3.3 Identify separate entrances for staff and students, visitors, and/or deliveries.

3.3.4 Create touchless entry capability.

- Set revolving doors to continual movement.
- Sliding doors: Elbow-to-push plate activated, voice activated, mobile phone activated, proximity device activated.
- Entry door on motion, proximity sensor or bluetooth command.
- Replace doors with hands-free doors and hardware.
- Remove unnecessary doors and use alarm-releases on fire doors in the path of travel.
- Provide automatic door openers/proximity sensors.
- Eliminate restroom doors where possible by providing long corridors/vestibule to screen views or reverse restroom doors to swing out, enabling a touch free exit after washing hands.
- Consider temporarily disabling door latches.

3.3.5 Utilize natural daylight where possible.^{4 xxv xxvi xxvii}

3.3.6 O F R Install drive-thru and/or pick-up service windows.^{xxviii}

4. Warmer temperatures and exposure to sunlight will reduce the time the virus survives on surfaces and objects.^{cx}

- E Education
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Considerations organized by CDC priority

Essential Desirable

3.4 Signage⁵

3.4.1 Post COVID-19 mitigation signage on the building’s exterior to convey actions taken to protect public health.

3.4.2 Post hygiene, cleaning, and sanitizing signage.

3.4.3 Implement floor/pavement markings (i.e., paint/tape) to visualize recommended spacing among occupants.^{xxix}

3.4.4 Install markings/signage encouraging one-way travel where practical.

3.4.5 Map the floor surface to delineate circulation and/or furniture location.

3.4.6 Place conspicuous signage at entrances and throughout the space alerting occupants to the required occupant limits, minimum physical distances, use of PPE, and other risk management policies.^{xxx}

3.4.7 Use communication boards and digital messaging to convey pre-shift information.

3.4.8 Place signs indicating that toilet lids (if present) should be closed before flushing.^{xxxi}

3.5 Plumbing and plumbing fixtures

3.5.1 Consider implementation of water management program for building operations per CDC guidance.^{xxxii}

3.5.2 For buildings experiencing extended closure, flush and test potable water systems.^{xxxiii}

3.5.3 Replace flush valves and faucets with hands-free devices.

3.5.4 Add touchless handwashing/hygiene stations.

3.5.5 Eliminate drinking fountains, replace with touchless glass/drinking bottle filling stations.

3.5.6 Install toilet lids.

3.6 Mechanical and passive ventilation⁶

3.6.1 Utilize operable windows for outside air intake if possible.^{7 xxxiv xxxv xxxvi}

5. All signage is recommended to be multi-lingual.^{xi}

6. For additional guidance on HVAC systems, refer to [ASHRAE’s COVID-19 \(Coronavirus\) Preparedness Resources](#).

7. There are multiple side effects of altering or increasing the airflow in a space. Higher airflow rates could increase resuspension from fomites and increase the potential for contamination throughout the building by distributing indoor air more quickly, at higher velocities and volumes, potentially resuspending more ultrafine particles.^{xvii}

- E Education
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Considerations organized by CDC priority

Essential Desirable

3.6.2 Ensure ventilation systems operate properly and provide acceptable indoor air quality for the current occupancy level for each space.^{xxxvii}

3.6.3 Monitor relative humidity, temperature and CO₂ levels regularly to identify and resolve issues quickly.

3.6.4 Increase ventilation rates and air changes.^{8 xxxviii}

3.6.5 Prioritize mechanical fresh air intake versus recycled air where possible by adjusting dampers, economizers, and AHUs.^{9 xxxix}

3.6.6 Commission each restroom for negative air pressure.^{xi}

3.6.7 Consider a fixed maximum number of occupants per HVAC zone.

3.6.8 Check filters to ensure they are within service life and appropriately installed.^{xii}

3.6.9 Align HVAC filter selection, cleaning schedule and replacement cycles with ASHRAE recommendations.

- Install HEPA/MERV filters for recirculated air ducts.
- Install filters with at least MERV-13 rating (or highest compatible with the filter rack).^{xiii 10}
- Seal edges of filter to limit bypass.^{xliii}

3.6.10 Clean HVAC intakes daily.^{xliv}

3.6.11 Flush the building for two hours before occupancy in the morning and after occupancy in the afternoon/evening.^{xlv}

3.6.12 Monitor and maintain relative humidity levels, preferably to RH 40–60%.^{11 xlvi xlvii}

3.6.13 Disable demand-controlled ventilation (DCV).^{xlviii xlix}

3.6.14 Consider the use of portable room air cleaners with HEPA filters.ⁱ

3.6.15 Consider temporary bypass of energy recovery systems.

3.6.16 If fans are utilized in space, take steps to minimize air from fans blowing from one person directly at another individual.^{li}

8. Increased ventilation rates and increasing fresh air intake can be helpful if the outdoor air quality and thermal conditions are acceptable. Air pollution is a complication; microbes can be found on particulate matters in the air, and can travel with the particulate matters.^{cxiii}

9. Higher outside air fractions and higher air exchange rates in buildings may help to dilute the indoor contaminants, including viral particles, from air that is breathed within the built environment. Higher outside air fractions may be achieved by further opening outside air damper positions on air-handling units, thus exhausting a higher ratio of indoor air and any airborne viral particles present. Regional climate and air pollution conditions may limit this technique.^{cxiv}

10. ASHRAE recommends increasing the level of filtration in the Air Handling Units (AHUs) upon opening the building to the extent that the air handling systems and fans can overcome the additional pressure drop of the new filters and still maintain air flow at acceptable levels.^{cxv cxvi}

11. Based on studies of SARS-CoV-2 and MERS, the viability of the COVID-19 virus in aerosol form and on surfaces is highest at low relative humidity levels (i.e., 30–40 percent RH). Relative humidity (RH) above 40 percent is detrimental to the survival of many viruses, including CoVs in general.^{cxvii}

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Considerations organized by CDC priority

Essential Desirable

3.6.17 Consider installing UV germicidal irradiation (UVGI) in mechanical ventilation paths or in upper-room applications to indirectly treat air through convective air movement.¹²

3.6.18 Consider utilizing ultraviolet C (UVC) during non-occupied hours for sterilization.

3.6.19 For larger buildings, check cooling and water tower condensate for bacterial growth.¹³

3.7 Electrical, lighting, and communications

3.7.1 Utilize IoT technology (RFIDs/key fobs) to reduce touch points.

- Touch-free door locks

O Touch-free turnstiles (OFF)

O R F S Touch-free time cards

3.7.2 Replace light switches with motion sensor controls or phone-based application controls.ⁱⁱⁱ

3.7.3 Program elevators to pick up on only one floor and go to only one floor.

3.7.4 Change elevator controls to voice or mobile phone-actuated.

3.7.5 Increase data security protocols and protections.

3.7.6 Improve conferencing and “shareware” software to facilitate optimal computer-based communications.

3.8 Appliances, equipment, and accessories

3.8.1 Install non-touch body temperature detection through Infrared Fever Screening Systems (IFSS).

3.8.2 Add easy to clean vending machines.

3.8.3 Provide dishwasher to sanitize reusable utensils/cookware.

3.8.4 Provide equipment that supports physical distancing and decreases the spread of pathogens.

O Provide an extra monitor dedicated to video ability without taking away screen workspace.

O Utilize personal headsets instead of shared desk phones.

12. UV light in the region of shorter wavelengths (254-nm UV C [UVC]) is particularly germicidal, and fixtures tuned to this part of the light spectrum are effectively employed in clinical settings to inactivate infectious aerosols and can reduce the ability of some viruses to survive. However, UV germicidal irradiation (UVGI) has potential safety concerns if the room occupants are exposed to high-energy light. For this reason, UVGI is safely installed in mechanical ventilation paths or in upper-room applications to indirectly treat air through convective air movement.^{cxviii}

13. Such conditions may pose a *Legionella* risk.

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Considerations organized by CDC priority

Essential Desirable

S Add built-in technology into resident rooms to enable virtual connection to mitigate the effects of isolation.

3.8.5 Retrofit or replace existing kiosks with touchless kiosks.

3.9 Finishes and furnishings

3.9.1 Install physical barriers such as clear plastic partitions or sneeze guards.^{liii liv lv}

E O F S Dining area separations; install temporary partitions or tall booths.

O Utilize temporary, movable partitions to subdivide large working spaces.

3.9.2 Replace or modify restroom stalls/partitions to make partitions floor to ceiling.

3.9.3 Minimize use of high-touch furniture (rugs, mobile whiteboards, etc).

3.9.4 Retrofit existing trash cans or install new no-touch trash cans.

3.9.5 Provide touchless hand soap and towel dispensers.^{lvi lvii}

3.9.6 Provide cleanable, transparent films over surfaces such as elevator buttons.

3.9.7 Prioritize easy to clean materials when selecting replacement furnishings.

3.9.8 Enhance acoustic treatment so occupants can hear/be heard through masks.

3.10 Site work

3.10.1 R Reconfigure parking and/or access lanes to accommodate curbside pickup.^{lviii}

3.10.2 Provide area for customer physical distancing exterior queuing not subject to winds.

3.10.3 Provide temporary or permanent outdoor sun/rain covering to allow queuing outside of front door.

3.10.4 Ensure the designated building/space ingress and egress pathways support clearly separated directional traffic that also provide ADA accessibility.¹⁴

14. Multiple paths will require consideration of supplemental surveillance/security provisions to address the public's proper usage, loss-prevention, and possible violent intruders (active-shooter scenario).

- E Education
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Considerations organized by CDC priority

Essential **Desirable**

3.10.5 Consider providing outdoor heating and/or shading to support exterior programming.

3.10.6 S H Identify ad hoc space for farming and/or biophilic plantings to promote mental wellbeing and enhance food security.

4. Fourth priority: Administrative controls

Requires action by the person or business and are typically changes in work policy or procedures to reduce or minimize exposure to hazard.

4.1 Policies

4.1.1 Develop an emergency communications plan.

4.1.2 Develop escalation procedure to report potential cases of COVID-19.

4.1.3 Identify necessary revisions to human resources policies.¹⁵

4.1.4 Develop organizational policies to guide what happens if and when a person at the workplace is found to be COVID-19 positive.¹⁶

4.1.5 Provide up-to-date education and training on COVID-19.

4.1.6 Identify and accommodate occupants in CDC-defined higher health risk categories.

4.1.7 Convey recommended guidance for ride-sharing services, delivery services, and taxi services that define cleanliness standards and protocols.¹⁷

4.2 Procedures to reduce the spread of pathogens (human)¹⁸

4.2.1 Establish a protocol for symptomatic persons; including a holding area and procedure for safe transport.¹⁹

4.2.2 Establish protocol for immediately isolating those who have signs or symptoms of COVID-19.

4.2.3 After an employee is suspected or confirmed to have COVID-19, close off areas used for prolonged periods of time by the sick person. Preparedness planning should allow for alternate work areas for other employees. Conduct thorough cleaning of affected area per CDC guidelines.²⁰

15. Policies may include hazard pay, paid sick time, the identification of essential personnel, flexible work schedules for caregivers, revised PTO carryover policy and/or travel policy, etc.

16. Strategies might include isolation, enhanced cleaning and sanitization, temporary office closure, contact tracing, etc.

17. In recent years, the sharing economy has created environments and added new components related to how multiple people share the same spaces. Shared spaces and items, such as co-work environments, rooms in homes, cars, bikes, and other elements of the built environment, may increase the potential for environmentally mediated pathways of exposure and add complexity to enacting physical distancing measures.²¹

18. Refer to CDC guidance for optimal cleaning products, wet times, contact times, and procedures.

- E Education
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Considerations organized by CDC priority

Essential Desirable

- 4.2.4 Establish procedures for returning to work after COVID-19 positive infections.
- 4.2.5 Institute entrance screening on-site.¹⁹
- E Schools are not expected to screen students or staff to identify cases of COVID-19.^{lxi}
- 4.2.6 To maintain Title I ADA requirements and to prevent stigma and discrimination, make employee health screenings as private as possible.^{lxii lxiii}
- 4.2.7 Encourage self-monitoring for symptoms.
- 4.2.8 Require occupants to participate in contact tracing protocols.
- 4.2.9 Promote hand washing, personal hygiene, and respiratory etiquette.^{lxiv}
- 4.2.10 Disconnect or tape-off hand air dryers.^{lxv}
- 4.2.11 Provide alcohol-based hand rubs containing at least 60% alcohol disinfectants.^{lxvi}
- 4.2.12 Provide tissues.
- 4.2.13 Cohort at risk individuals in the same area and/or during similar times of day.
- 4.2.14 Where interpersonal interaction is needed, group occupants into smaller cohorts within the same area, especially at-risk individuals.
- E If classroom uses distributed learning model/center-based learning, limit number of children in an area to 2 or 3 depending on size.
 - S Cohorting: diners from same “wing” or area of facility sit in same area to eat each day and have the same staff attendants if waited on.
 - S Permit small cohorts to utilize assembly areas to reduce social isolation.
 - S Eliminate staff rotations between multiple sites, buildings, and wings.
- 4.2.15 Limit areas of public visitation.
- S Open up wing entrances to limit location of outside visitors.

19. Screening may include practices such as non-touch body temperature detection through Infrared Fever Screening Systems (IFSS) and symptom identification.

- E** Education
- O** Office
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Considerations organized by CDC priority

Essential Desirable

4.2.16 Establish an official guide of an approved protocol to manage occupant and visitor safety and provide related training.

4.2.17 Restrict permitted activities to reduce exposure risk.

E Change physical education programming to reduce breathing volume/intensity and eliminate the use of shared objects/surfaces.

O **H** Limit activity types in amenity spaces to reduce the reach of droplets (e.g., no exercise, singing, etc.).

4.3 Procedures to reduce the spread of pathogens (fomites)²⁰

4.3.1 Consider periodic operational break(s) during business hours to allow for increased scope and frequency of cleaning and waste removal.^{lxvii lxxviii lxxix}

R Adjust or modify store hours to provide adequate time for regular, thorough cleaning and product stocking.^{lxx}

4.3.2 Regularly clean and disinfect high touch surfaces.

S **R** Provide places and disinfectants with which to clean wheelchairs and assistance with the cleaning.

R Carts, racks, shelving, hangers, and other items on the sales floor should be visibly clean and consider marking them as “clean” or “disinfected”.^{lxxi}

R Sanitize fitting rooms after customer use.^{lxxii}

4.3.3 Relocate materials to make rooms easily cleanable.

4.3.4 Where known symptomatic persons were present, consider third-party deep cleaning (sterilization) services.^{21 lxxiii}

4.3.5 Provide disposable towels and disinfectants for occupants to clean work surfaces prior to use.

4.3.6 Replace collateral hard copy media provided in waiting areas with televisions or monitors for entertainment, news, and advertisement.

4.3.7 Avoid and/or greatly limit the use of common equipment.^{22 lxxiv}

E Eliminate contact sports and use of shared sporting equipment.

20. Refer to CDC guidance for optimal cleaning products, wet times, contact times, and procedures.

21. Sterilization services are ideally performed by an IICRC-certified mitigation company.

22. Common equipment may include coffee pots, refrigerators, and drinking fountains as well as conference room technology and other shared devices.

- E** Education
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Considerations organized by CDC priority

Essential Desirable

- E O S** Eliminate use of intracompany transport and company vehicles.
- E O F S** Eliminate shared serving utensils or bins of cutlery; mandate use of disposable utensils/plates/bowls.
- E F S** Eliminate self-service salad bars and buffets.
- F R** Institute options for contactless payment processes for retailers to further limit contact with cash, credit card readers, pens, or surfaces.^{lxxv}
- R** Discontinue product sampling.^{lxxvi}
- R** Close bulk-bin options.^{lxxvii}

4.3.8 Where common equipment must be used, perform frequent sanitation.

4.3.9 Develop policies to reduce risk related to high-touch practices.²³

- R** Discourage customers from touching items unless intending to purchase.^{lxxviii}
- R** Allow suspension or extension of the merchandise return period.^{lxxix}

4.4 Procedures to support physical distancing

4.4.1 Institute strategies that promote physical distancing.

- R** Avoid types and dispersion of displays and service areas that result in close public proximity.
- E F S** Close dining areas and make orders available for pick up or delivery only.^{lxxx}
- R** Adjust business practices to reduce close contact with customers (e.g., drive-thru service, click-and-collect online shopping, shop-by-phone, curbside pickup, and delivery options, where feasible).^{lxxxi}
- R** Provide dedicated staff member(s) to retrieve goods for customers in retail settings.
- R** Create methods to receive returns and exchanges to minimize contact between customer and employee.^{lxxxii}
- R** Stagger stocking so that associates are in different aisles.^{lxxxiii}

23. High touch practices might include eliminating in-store trying on, cleaning garments put on but not bought, alternations being permitted after a confirmed purchase, "quarantining" products that come back to the retailer through exchanges or returns for a sufficient period of time, etc.

- E Education
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Considerations organized by CDC priority

Essential Desirable

4.4.2 Limit entry to only essential staff and visitors.^{lxxxiv}

4.4.3 Implement occupancy-reduction policies for all areas of the building; including but not limited to work areas, public waiting areas, break areas, and restrooms.

R Schedule customer appointments to avoid waiting groups.

E O S Limit occupancy through staggered shift assignments or entrance times.

F R Limit the number of customers in a space at any one time.

R Shorten public time within the facility by encouraging the use of shopping lists, pre-ordering, and designated pick-up within or outside.

E O F R Limit delivery services (loading/unloading) schedule to one vendor at a time.

E Promote teacher rotation rather than class rotation.

R Shift primary stocking activities to off-peak or after work hours, when possible, to reduce contact with customers.^{lxxxv}

R Establish hours of operation, wherever possible, that permit access solely to high risk individuals, as defined by the CDC. Preferably at a time following a complete cleaning.^{lxxxvi}

S Partition long wings into smaller households, with separate dining and activity areas.

4.4.4 Provide dedicated staff member(s) at building entrance to guide queuing of incoming occupants.

4.4.5 Design a process to ensure occupants stay distanced while waiting.

R Manage the check-out line process to reduce COVID-19 transmission.

4.4.6 Encourage walking, cycling, or other modes of personal transportation that do not promote close interaction with others as in mass public transit.^{lxxxvii}

- E Education
- O Office
- F Restaurant
- S Senior living
- R Retail
- H Housing

Considerations organized by CDC priority

Essential Desirable

5. Fifth priority: Personal protective equipment (PPE)

Properly used PPE may be needed to prevent certain exposures but should not take the place of other preventative measures.

5.1 PPE policies

5.1.1 Utilize CDC guidelines to identify when and what type of protection is to be used.

5.1.2 Regularly inspect, maintain, and replace supplies.

5.1.3 Secure necessary supplies and proper on-site storage facilities.

5.1.4 Limit access to supply storage spaces. Centralize distribution.

5.2 PPE procedures

5.2.1 Wear PPE based on hazard to worker.

5.2.2 Train workers on proper use of PPE.

5.2.3 Require hand washing/sanitizing before putting on gloves.

5.2.4 Ensure proper fit and periodically refit.

5.3 PPE

5.3.1 Provide gloves.^{bxxxviii}

5.3.2 Provide goggles.

5.3.3 Provide face shields.

5.3.4 Provide face masks.^{bxxxix}

5.3.5 Provide respiratory protection.

Definitions

AIHA: The American Industrial Hygiene Association

ASHRAE: The American Society of Heating, Refrigerating and Air-Conditioning Engineers

CDC: The Centers for Disease Control and Prevention

Coronavirus: A member of a family of single-stranded RNA viruses that infect people and animals. The disease COVID-19 is caused by a newly discovered coronavirus called SARS-CoV-2.^{xc xci}

COVID-19: Novel coronavirus disease-2019 is the disease.^{xcii}

Essential and desirable: Planning actions depending on the level of priorities and resources generally required to implement them. This is for guidance only. State and national authorities should determine which actions are truly essential and desirable in their context, based on their own vulnerability profile and level of available resources.^{xciii}

High risk: Persons with high potential for exposure to known or suspected sources of COVID-19. Includes health care delivery and support staff, medical transport workers, and mortuary workers involved in preparing bodies.^{xciv}

IoT: Internet of things

Isolation: The separation of sick people with a contagious disease from people who are not sick.^{xcv}

Low risk: Persons who do not require contact with people known to be, or suspected of being, infected with SARS-CoV-2 nor in frequent contact with the general public. Includes those with minimal occupational contact with the public and other coworkers.^{xcvi}

Medium risk: Persons who require frequent and/or close contact with people who may be infected with SARS-CoV-2 but who are not known or suspected COVID-19 patients. Include persons who are in frequent contact with travelers, often in areas of ongoing community transmission, involved with schools, in high-population-density work environments, and in some high-volume retail settings.^{xcvii}

NIOSH: The National Institute for Occupational Safety and Health

OSHA: The Occupational Safety and Health Administration

PPE: Personal protective equipment, commonly referred to as “PPE”, is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. PPE may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests and full body suits.^{xcviii}

Quarantine: The separation and restriction of the movement of people who were exposed to a contagious disease to see if they become sick.^{xcix}

RFID: Radio-frequency identification

SARS: Severe acute respiratory syndrome illness.^c

SARS-CoV: The virus that causes SARS.^{ci}

SARS-CoV-2: The virus that causes COVID-19.^{ci}

Symptomatic person: Individual exhibiting fever, cough, shortness of breath, or other symptoms of COVID-19.

Very high risk: Persons with high potential for exposure to known or suspected sources of COVID-19 during specific medical, postmortem, or laboratory procedures. Includes health care workers, laboratory personnel, and morgue workers performing autopsies.^{ciii}

WHO: The World Health Organization

Annotated bibliography

[2019 Novel Coronavirus \(COVID-19\) Outbreak: A Review of the Current Literature and Built Environment \(BE\) Considerations to Reduce Transmission](#)

Researchers from University of Oregon's Biology and the Built Environment (BioBE) Center and the CDC's online pathogen identification database, named MicrobeNet, moved quickly to aggregate multiple sources of both developing knowledge of COVID-19 and previous research focused on SARS-CoV-2. It also provides basic guidance for users and managers of the built environment (BE) to more effectively deal with pathogens in the built environment. This paper forms a critical text for this checklist in its interdisciplinary literature review, which aggregates a myriad of relevant sources from around the world, leveraging the diverse research team. We have used this source to help translate and coalesce developing COVID-19 research from multiple parties into actionable guidance that bases recommendations on minimizing infectious disease transmission through environmentally mediated pathways.

[Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1](#)

An evaluation of the stability of SARS-CoV-2 and SARS-CoV-1 in aerosols and on various surfaces with estimates of their decay rates.

[CDC: Implementation of Mitigation Strategies for Communities with Local COVID-19 Transmission](#)

This document provides a framework for actions that local and state health departments can recommend in their community to prepare for and mitigate community transmission of COVID-19. Major building types are put forward as mitigation examples: individuals at home, schools and child care, assisted living, and workplaces. These mitigations are divided among three degrees of intensity: minimal, moderate, and substantial.

CDC: Interim Guidance for Businesses and Employers Responding to Coronavirus Disease 2019 (COVID-19)

The CDC provides interim guidance based on what is currently known about COVID-19. The guidance is particularly focused on workplaces in non-health care settings. The key sections in this document include preparing workplaces for a COVID-19 outbreak, reducing transmission among employees, maintaining healthy business operations, and maintaining a healthy work environment.

WHO: Checklist for Pandemic Influenza Risk and Impact Management

This document provides the WHO's most recent pandemic guidance and recommendations prior to the COVID-19 outbreak. Section 4.1.2 "Facilities" mentions developing facility-level plans, including floor plans for essential facilities. Other key principles in this document provide the basis for more detailed guidance from other specialist groups.

Considerations for Large Building Water Quality after Extended Stagnation

This paper was created to help public health officials, building owners, and water utilities managers better understand building water quality due to low or no occupancy. This will be a pertinent issue for buildings that were not completely decommissioned or have sat stagnant for long periods of time.

AIHA: Recovering from COVID-19 Business Closures

This document provides practical recommendations for preparing a closed building for re-occupancy, including maintaining mechanical and plumbing systems as well as cleaning and disinfecting surfaces.

OSHA: Guidance on Preparing Workplaces for COVID-19

While this seminal document creates no new legal obligations, its recommendations and informational content are intended to assist employers in providing a safe and healthful workplace. Important sections include: Engineering Controls, Administrative Controls, Safe Work Practices, and other administrative best practices for a facility's workforce.

AIHA: Back to work safely

This site provides industry-specific guidance on re-occupancy for a wide-range of building types.

Appendix

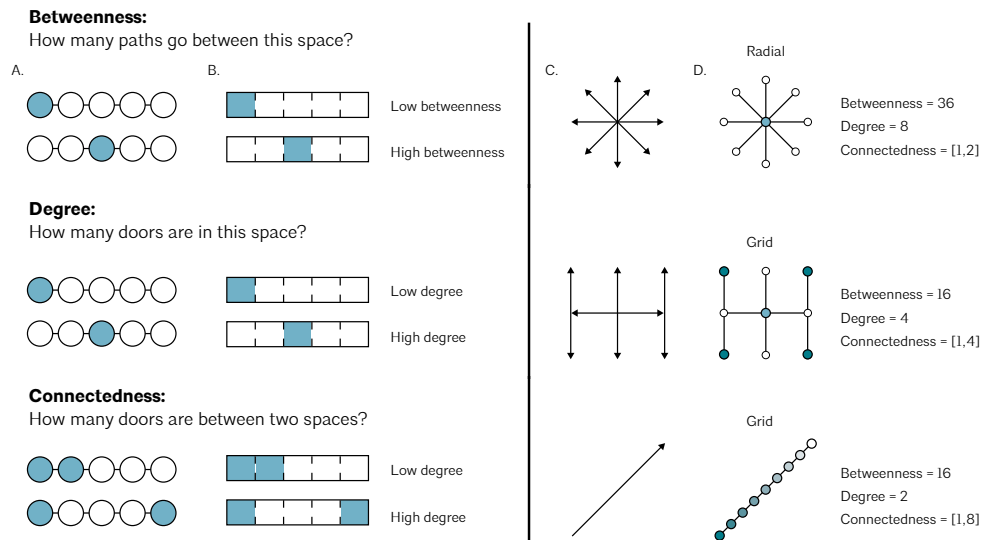
This appendix includes design tools and methods to support physical distancing guidelines.

Space syntax diagrams

While initially developed as a graphical tool to investigate the privacy, security, or connectivity/division of space at the urban to the building scale, the term “space syntax” is in actuality the combination of theories and techniques developed by Julienne Hanson,^{civ} Bill Hillier,^{cv cvi cvii} and colleagues at The Bartlett, University College London, in the late 1970s to early 1980s. As space syntax has evolved, certain measures have been found to correlate with human spatial behavior, and space syntax is now used to forecast likely effects of architectural and urban space on users.

In the paper *2019 Novel Coronavirus (COVID-19) Outbreak: A Review of the Current Literature and Built Environment (BE) Considerations to Reduce Transmission*,^{cviii} the authors utilize this type of analysis to graphically describe the connectivity or exclusivity of certain spaces from one another from a vector-control perspective. Within complex built environments, this diagrammatic strategy could begin to base its operational flow models on rules gleaned from diagramming spaces in this way.

Figure 2: Spatial connectivity, highlighting betweenness and connectance of common room and door configurations



This figure about spatial connectivity, highlighting betweenness and connectance of common room and door configurations is from *2019 Novel Coronavirus (COVID-19) Pandemic: A Review of the Current Literature and Built Environment (BE) Considerations to Reduce Transmission*. (A) Circles and lines follow the classic network representation. (B) The rectangles follow the architectural translation of networks. Shaded areas correspond to a measure of betweenness (the number of shortest paths between all pairs of spaces that pass through a given space over the sum of all shortest paths between all pairs of spaces in the building), degree (the number of connections a space has to other spaces between any two spaces), and connectance (the number of doors between any two spaces). (C) The arrows represent possible directions of microbial spread

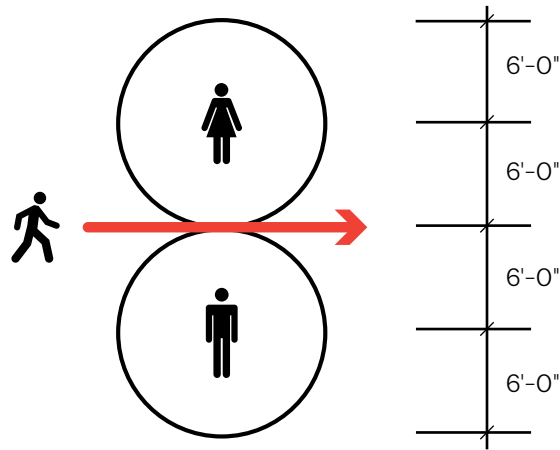
as determined by the layout of the BE. (D) The circles represent the current knowledge of microbial spread based on microbial abundance through BEs as determined by layout. Darker colors represent higher microbial abundance, and lighter colors represent lower microbial abundance.

Occupancy evaluation²⁴

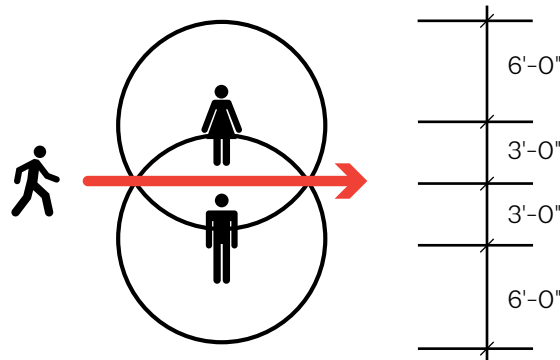
The following six-foot physical distancing and related square footage per person analysis are intended to describe the implications of the allowable occupancy levels in current building codes given the recommended six feet physical distancing. The purpose of this analysis serves to better inform government decision makers and building owners as to how many people should be allowed in a given space - as a rule of thumb.

The common measure recommended by the CDC for physical distancing during the COVID-19 pandemic is to keep six feet between yourself and others.^{cix}

The following analysis uses a radius of six feet. A six-foot radius allows for people to move through and navigate a space at the perimeter/circumference of the physical distancing circle formed by the six-foot radius. That allows for the dynamic movement of people in a space.



If the physical distance between each person was exactly six feet, then the physical distancing would be violated when people move through the space because the person moving through a space would have, at the most, only three feet of physical distancing between the two people who are six feet apart.



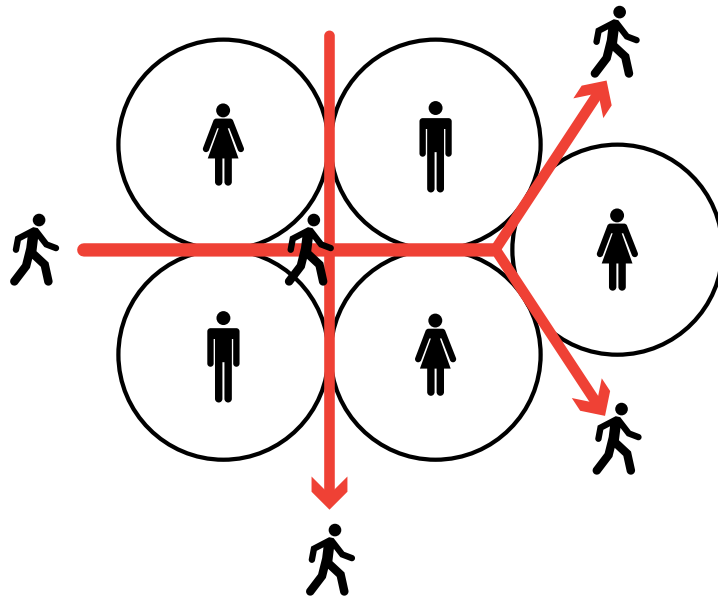
24. This evaluation does not account for the implementation of architectural and engineering controls nor the use of PPE which may alter the necessary physical distance.

The area of a six-foot physical distance radius allows, and accounts for, human movement and navigation through a space. It is dynamic.

When only a six-foot physical distance between each person is used, the physical distancing space is static. It is only applicable when people are standing in a line, or when people are seated six feet apart from each other. It is linear. It does not account for human movement through a space.

Accounting for the dynamic nature of human behavior, a six-foot radius is utilized in this analysis to denote the circle of an individual's physical distance space. That physical distance circle can be a starting point for determining appropriate occupancy levels for a given space based on square footage.

The area of a 6-foot radius circle is 113.097 square feet ($\text{Pi} \times 6\text{-foot radius squared}$), which is a larger area than the 100 square feet area of a 10-foot by 10-foot room. As described previously, the six-foot radius of physical distancing allows for human access (i.e., travel) through an occupancy at the tangents of the circles formed by the radius, including that of a close-packing arrangement of the circles.



This principle can be used as a guide to identify the building and fire code occupancies, and their respective occupant levels, that would be affected by using the CDC-recommended physical distancing of six feet. To simplify the calculations and for purposes of this exercise, a nominal area of 100 square feet per person is used rather than the area of a 6-foot radius circle of 113.097 square feet, as a comparison for the stated allowable occupancy levels in the building code.

Example:

Using the building code Assembly occupancy for an unconcentrated space which has tables and chairs—such as a restaurant—of 15 square foot per person, it can easily be calculated that a restaurant occupancy designed to accommodate 100 people would be allowable with 1,500 square feet of floor space (100 occupants x 15 square feet per person as per existing code).

That same 1,500 square foot restaurant, with the six-foot radius of physical distancing, would only be able to accommodate 15 people seated in the restaurant (1,500 square feet divided by 100 square feet physical distancing per person). It should also be pointed out that in a restaurant, with tables placed six feet apart, the physical distancing would be violated when restaurant staff or others entered into space of the six foot table separation as there would only be three feet of separation at the most.

Another point to consider is that in re-opening the economy the occupant levels of different types of uses should not be determined by simply stating that the allowable occupancy levels will be 50% of their normal occupant capacity, 25%, or any other percentage calculation. Simply stating a percentage of the former allowable occupancy, or staging an absolute number, such as no more than 25 or 50 people in a space, does not adequately account for the required spatial area for physical distancing.

If 100 square feet is used as a nominal physical distancing measure, the occupancies that are impacted the most are the following, with their respective current maximum floor area allowances per occupancy (International Building Code, Table 1004.1.1, various editions). Occupancies with a maximum floor area allowance of 100 gross or net square feet per occupant or more, are not listed here since they can be considered to meet a nominal 100 square foot physical distancing.

- Airport: baggage claim - 20 sq. ft. gross; waiting areas - 15 sq. ft. gross
- Assembly: gaming floors - 11 sq. ft. gross
- Assembly with fixed seats: refer to 1004.7 of International Building Code
- Assembly without fixed seats: concentrated - 7 sq. ft. net; standing space - 5 sq. ft. net; unconcentrated (tables and chairs) - 15 sq. ft. net
- Bowling centers: 7 sq. ft. net; check with allowances of five persons/lane including 15 feet of runway
- Courtrooms: 40 sq. ft. net
- Daycare: 35 sq. ft. net
- Dormitories: 50 gross
- Education: classroom area - 20 sq. ft. net; shops, vocational rooms - 50 sq. ft. net
- Exercise rooms: 50 sq. ft. gross
- Library: reading rooms - 50 sq. ft. net
- Locker rooms: 50 sq. ft. gross
- Mercantile: areas on other floors - 60 sq. ft. gross; basement and grade floor areas - 30 sq. ft. gross
- Skating rinks, swimming pools: rink and pool - 50 sq. ft. gross; decks - 15 sq. ft. gross
- Stages and platforms: 15 sq. ft. net

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