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# Making offices and construction sites safer from SARS-CoV-2

- The COVID-19 pandemic will likely alter necessary workplace safety precautions until the disease is contained.
- Construction companies can employ various safety measures to protect their employees from COVID-19.
- The CDC and OSHA provide guidance for keeping employees safe from COVID-19.

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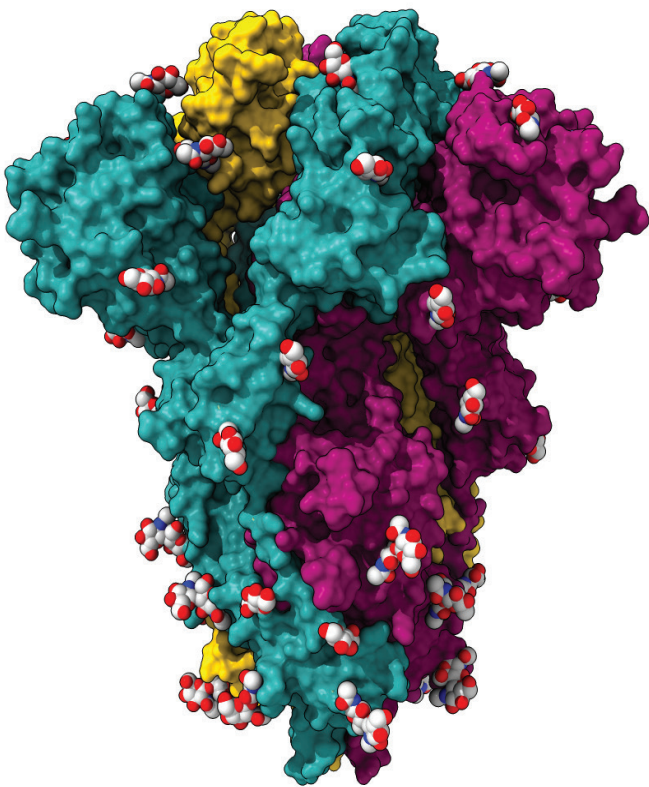
**E** pluribus unum—out of many, one. It is the de facto Latin motto of the United States and was proposed in 1776 to signify the joining of states to form one national government. At the time, it was a difficult concept for people to accept because it meant that states and individuals would have to give up some of their personal rights to serve a greater cause. Today the threat to life posed by SARS-CoV-2, the virus that causes COVID-19, brings the “e pluribus unum” concept back into sharp focus as the country and its people weigh their personal rights versus their responsibility to others.

Humans are social beings, and this pandemic preys on our natural instincts to be close to friends and family and it challenges our ability to work and earn a living. As time passes, it is hard to know if the first tool for fighting a pandemic—distancing ourselves from one another—is working. Millions of people in the United States have tested positive for COVID-19, and an end, the development and dissemination of an effective vaccine, is not in sight.

Construction is regarded as an essential industry, at least in a limited capacity, in many states, and it is currently challenged to keep workers safe on the jobsite. Social distancing, the first line of defense, requires workers to be a minimum of 6 ft (2 m) apart. But construction, especially concrete construction, often requires teams to be much closer together for some work functions, so other measures become important. Here is how work on construction sites is being made safer.

## How SARS-CoV-2 spreads

Rick Stevens, associate laboratory director for computing, environment and life sciences at the Argonne National Laboratory in Lemont, Ill., says that SARS-CoV-2 is a member of the SARS coronavirus family and is, at 100 nanometers, one-thousandth the width of a human hair. Scientists have established that the virus originated with bats and has a ribonucleic acid (RNA) structure, as opposed to a DNA structure. Viruses aren't alive and require a host to multiply. Stevens says that a major advantage that RNA viruses have is being able to multiply quickly once they occupy a host. Each virus is capable of generating 1300 viruses over a 10-hour period.



This is one of the protein structures that make up the SARS-CoV-2 virus. Argonne National Laboratory scientists in Lemont, Ill., are studying these proteins to better understand the virus. Courtesy of Argonne National Laboratory.

Erin Bromage, associate professor of biology at the University of Massachusetts Dartmouth, discusses the virus in his May 6, 2020, blog post “The Risks—Know Them—Avoid Them.” He says that SARS-CoV-2 resides in droplets of water and does not survive outside that environment very long. It spreads among humans primarily in droplets of water, possibly aerosolized, that move through the air from person to person when they breathe, talk, shout, sing, cough, or sneeze. SARS-CoV-2 is similar to SARS-CoV and MERS-CoV viruses. Estimates for the amount of virus required for people to become infected vary. “Breathing is Enough: For the Spread of Influenza Virus and Sars-CoV-2 by Breathing Only” by Gerhard Scheuch says that people must be exposed to approximately 1000 virus

particles to become infected while other research suggests the range is 300 to 3000 virus particles needed to start an infection. Exposure to 1000 virus particles could happen if you inhaled them all in one breath, inhaled 100 viral particles in 10 breaths, or inhaled 10 viral particles in 100 breaths.

The formula for successful transmission of COVID-19 is equal to the amount of exposure to the virus multiplied by the length of time of the exposure. Following are examples from Bromage of differing amounts of exposure, assuming that 1000 particles are required for infection:

- A single breath can release 50 to 5000 droplets of water of various sizes traveling at low velocity. For example, if 20 copies of the virus were expelled each minute, it would require 50 minutes for another person to be infected.
- Speaking increases the production of respiratory droplets by 10 times, which could mean 200 copies of the virus are expelled per minute. At this rate, it would require people speaking face to face only five minutes to receive the required dose.
- A single cough can release as much as 3000 droplets traveling as fast as 50 mph (80 kmh). Most droplets are large and quickly fall onto surfaces, but smaller ones can travel across an average room in just a few seconds.
- A single sneeze can release 30,000 droplets traveling up to 200 mph (322 kmh), easily contaminating an entire room. These droplets may contain as many as 200 million virus particles, including viruses from the deep lungs. “Reducing Transmission of SARS-CoV-2” in *Science* says that the smallest of these droplets can remain airborne several hours, so others can be contaminated even though they aren't standing near the person or after the person with COVID-19 leaves the area.

Because SARS-CoV-2 is relatively new to us, scientists and epidemiologists are scrambling to learn as much as they can about it; however, some of what is known about the behavior of related viruses, such as SARS-CoV, helps. Experts suggest that the primary way the disease spreads is by people breathing contaminated droplets of water containing virus particles. We also know that SARS-CoV-2 can exist for varying lengths of time depending on surfaces. Less is known about how many cases develop by touching these surfaces, but the Centers for Disease Control and Prevention (CDC) has recommended acting on the side of caution.

The greatest risk for infection, approximately 90% of cases, occurs indoors and in enclosed spaces, Bromage writes. The highest risk for catching the disease is at home, in the workplace, on public transportation, at social gatherings, and at restaurants. Outbreaks resulting from shopping for groceries for instance are few because the contact time between people is so short, except for cashiers who have brief contacts with different people all day long.

The CDC says that symptoms may appear 2 to 14 days after people are exposed to SARS-CoV-2 and notes that an unknown number of people may never experience symptoms. During this critical 2- to 14-day time frame, people can spread the disease without their knowledge.

## The tools for fighting pandemics

For public health professionals who focus on fighting pandemic diseases, there are four basic tools of the trade: social distancing, testing, tracing, and modeling. Keeping people separated from one another is the major first step in preventing wide spread of the disease. Distancing has been a tactic for preventing communicable diseases from spreading for thousands of years, often with the diseased person being separated from the group. But when it isn't known who has the disease, the first preventive measure involves isolating each person from every other person.

Developing accurate tests to quickly determine who has the virus and who doesn't followed by tracing makes it possible to quarantine only those at risk of infecting others. By tracing and quarantining everyone they were in contact with the spread of the disease can be limited. Various articles discuss Iceland's successful measures, which include testing citizens, quarantining those exposed, and using contact tracing to battle new waves of infection and keep COVID-19 death counts extremely low.

## Modeling

There are hundreds of models around the world designed to predict pandemic movement, some more detailed than others. The goal is to give decision makers information about how a pandemic is likely to grow and move based on people's behavior so they can make informed decisions with an understanding of the consequences. Modeling is the hope for the future because we have the technology now to make accurate predictions: super-fast computers, statistics, algorithms, and big data. For example, Argonne National Laboratory is developing a model using its large open science supercomputer to process trillions of bits of information to develop accurate models for predicting and managing pandemics.

Jonathan Ozik is a computational scientist at Argonne and is part of a team developing a simulation model funded by the Federal Department of Energy called CityCOVID. It's a city-scale model that includes all of the individuals making up the synthetic population of a city, a population that statistically matches the real population of a city. The individuals, or agents, interact with other individuals based on their hourly activity schedules and can be infected through interactions with individuals who have COVID-19. The model provides the ability to run large numbers of detailed what-if scenarios on the Argonne supercomputer to understand the consequences of implementing different public health interventions before they are rolled out to the real

population. Ozik says they are searching through the complex behaviors of their model to uncover patterns. "Using the City of Chicago and its population of 2.7 million people (not including suburban areas) we are able to discover how COVID-19 spreads through the city and to create realistic population-level forecasts of future COVID-19 cases and resource requirements," Ozik says.

Argonne is in the process of extending CityCOVID beyond Chicago and Illinois so that it can eventually be applied anywhere in the world, but right now their predictions and what-if scenarios are being provided to the city of Chicago and the state of Illinois. For example, the mayor and governor can make decisions about phasing the return to work in various industries with better knowledge of the consequences, the number of expected new COVID-19 cases that will result, how many hospital beds will be needed, and how many people are likely to die as a result.

## Agency recommendations

The Occupational Safety and Health Administration's (OSHA's) recommendations for construction are available at <https://www.osha.gov/SLTC/covid-19/construction.html>. Unions and sometimes owners of construction sites can also require that contractors provide safe work conditions based on CDC and OSHA recommendations. For more information visit <https://www.cdc.gov/coronavirus/2019-ncov/community/guidance-business-response.html> for business and employer guidance from the CDC.

CDC recommendations for contractors and businesses adopting their own company guidelines and policies include the following:

- Employers should have a COVID-19 response plan to protect workers.
- Workers should notify their employers if they are experiencing COVID-19 symptoms and should stay home. Employees should not return to work until the criteria determined by their employers, healthcare providers, and state and local health departments are met.
- As per the CDC, workers should notify their supervisors if they have a family member with COVID-19 living at home.
- Contractors should limit contact between employees and maintain 6 ft (2 m) distances between them as much as possible. The number of workers sharing small areas, such as spaces under construction, elevators, trailers, and vehicles, should be limited if possible.
- Workers should wear cloth face coverings where social distancing isn't possible. Cloth coverings shouldn't be substituted for respirators where they are recommended or required.

- Frequently touched surfaces should be regularly cleaned and disinfected. On jobsites, this includes shared tools, machines, vehicles, handrails, door knobs, and portable toilets. Cleaning should be done periodically throughout the workday and also before and after every shift and after anyone uses a vehicle or workstation.
- Tool sharing should be limited as much as possible.
- Workers should wash their hands regularly with soap and water for at least 20 seconds or use an alcohol-based hand sanitizer that contains at least 60% alcohol. Contractors should supply handwashing stations with clean running water, soap, and disposable towels or conveniently placed hand sanitizer stations.
- Workers should clean their hands before and after work shifts and breaks; after blowing their noses, coughing, or sneezing; after using the restroom; before eating; before donning and after removing work gloves; after putting on, touching, or removing cloth face coverings; before donning or doffing eye or face protection (safety glasses, goggles, face shields); and after touching objects that have been handled by others.
- Use disposable tissues when you cough, sneeze, or touch your face.
- Employers should provide workers with the basic facts about COVID-19, such as how it spreads and what the risks are, and explain protective measures.
- Employers should limit face-to-face contact by limiting in-person meetings or holding them via teleconference, using internet training options, and working remotely when possible.
- Employers should consider increasing the distance between employees by staggering work schedules, limiting access to work areas such as trailers and break areas, rearranging tables and chairs in office areas, and reducing the number of workers at in-person meetings.

## Cloth face coverings

In public settings where social distancing measures are difficult to maintain, the CDC recommends wearing cloth face coverings, which are covered on the CDC website at <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html>. This is especially important in areas that have significant community-based transmission of COVID-19. When cloth masks are worn all day or to a location where the wearer may have been exposed, they should be washed with soap and water before their next use.

Cloth face coverings are not surgical masks or respirators and are not appropriate substitutes for them in workplaces where surgical masks or respirators are recommended or required.



The current pandemic is changing the way we organize for work on construction jobsites. Along with a hardhat, safety vest, steel-toed boots, and safety glasses, workers must now wear a cloth face covering or an N95 respirator or equal. Wearing a mask helps to trap tiny water droplets that you exhale so that others don't inhale them. Others wear masks to protect you from their exhaled air. When people exposed to SARS-CoV-2 breathe, the droplets they create contain virus particles. Courtesy of Joe Nasvik.

## Personal protective equipment

Due to the shortage of N95 respirators, some contractors are using KN95 respirators. They are made in China and in most ways are considered equal to N95 respirators. KN95 respirators are generally recommended for occupational use in situations that would typically require an N95; however, be careful to choose a reputable KN95 supplier because there are counterfeit products on the market that don't meet the standards they claim to meet. The CDC has a webinar at <https://www.youtube.com/watch?v=w7tVnjrmAmc> with information about what to look for when purchasing respirators from international sources and also covers this topic at <https://www.cdc.gov/niosh/npptl/usernotices/counterfeitResp.html>. To protect against occupational respiratory hazards, respirators, including N95s and KN95s, should be incorporated as part of a regular respiratory protection program that includes fit testing.

The primary purpose of a mask is to inhibit the spread of droplets of water containing the virus. Bromage writes that virus particles by themselves are too small to be trapped in the filtering material of the mask. Wearing a mask protects others from inhaling droplets of water containing the virus expelled by the wearer as they breathe, talk, shout, sing, cough, or sneeze. Others wear their masks to protect you. Valves are another consideration. The CDC says that N95 masks that

have exhalation valves protect the wearer but might allow unfiltered exhaled air to escape into the environments.

N95 respirators also offer some protection to the wearer from bioaerosols such as bacteria, viruses, fungi, and pollen if they are fit carefully around the nose and mouth. They should be replaced when they are physically damaged, there is increased breathing resistance, or for other hygiene issues. NIOSH and the CDC offer use guidelines in “Filtering out Confusion: Frequently Asked Questions about Respiratory Protection, Respirator Reuse and Extended Use” at <https://www.cdc.gov/niosh/docs/2018-128/>.

Some contractors believe that face shields can be substituted for respirators or masks. Although these shields can block splashes or sprays, they do not provide respiratory protection. The shields can be easily cleaned and reused, but they aren’t currently rated as a replacement for face masks or respirators. Therefore, if they are used, they should be considered as an additional protection.

For more information about each of these different tools, see the CDC infographic on surgical masks and N95 respirators at <https://www.cdc.gov/niosh/npptl/pdfs/UnderstandDifferenceInfographic-508.pdf>.

## How one contractor is making its jobsites safer

Mark Stadalsky, vice president of Lindblad Construction in Joliet, Ill., says his company specializes in industrial concrete in several states, serving the pipeline industry, electrical power distributors, and heavy industrial companies. In Illinois, construction is considered an essential industry, so Lindblad has been able to work throughout the pandemic. Stadalsky says he became curious when news of the COVID-19 pandemic first appeared and decided it would become a major threat to the construction industry and his workforce. The company’s management, safety experts, and consultants engaged in six weeks of collaborative discussions to work out a company protocol with carefully defined pathways to use as a guide to help them decide how worker health concerns should be treated. For example, if employees call in to say they’re ill but don’t have COVID-19 symptoms, company protocol defined a pathway to follow. If an employee has COVID-19 symptoms but hasn’t been tested, there is other guidance. If an employee tests positive for COVID-19, there is yet another set of procedures to follow.

Lindblad also correctly predicted early on that wearing breathing masks would become mandatory, so it bought a supply of N95 respirators before they were scarce and then explored possible sources for securing a steady supply of KN95 respirators. At the same time, the company hired people to make cloth masks for all employees to use.

Some of Lindblad’s clients specify how workers on their jobsites will be protected from SARS-CoV-2, and Lindblad

provides what they specify as long as it meets its own protocol. “For example, one of our clients requires workers to wear N95 or KN95 masks instead of cloth masks, so we follow their requirements,” he says.

Lindblad protocol includes the following:

- They developed a network of guidelines for their office staff.
- In their construction yard, everyone must wear a mask.
- As much as they can, workers on jobsites distance themselves from others.
- On jobsites, Lindblad regularly cleans all touch points and common areas.
- They have full-time and part-time safety inspectors in the field at all times.
- During the first six weeks of the pandemic they sent out a daily COVID-19 message designed to give workers accurate information and put them more at ease.
- They provide daily wellness checks for all employees, which vary by job, and send them home if symptoms dictate.
- They are planning for the possibility of another wave of COVID-19.

## Where to get help

Working out a plan for increased jobsite safety with regard to pandemics is a complex process. There are guidelines from the CDC, OSHA mandates and legal requirements, and state government and local health department requirements.

The Associated General Contractors of America (AGC) is a contractor resource. Mike Hampson, the executive secretary for Chicagoland AGC chapter, says that AGC listens to members’ needs and gathers information about their situations and what they are doing. It provides its members with information from its national office as well as from the CDC and OSHA for PPE gear. AGC hosts conference calls each week so that contractors can learn from each other, and it conducts webinars to provide additional information to members. AGC can offer labor leader and legal staff help too.

The American Society of Concrete Contractors also hosts a weekly online meeting for its members so they can learn from each other and discusses common issues. Discussions focus on how to maintain distance on jobsites, working remotely, eating and drinking on the job, worker health checks, staggering work schedules, overheating concerns related to wearing masks and respirators in warm weather, managing jobsite owners who don’t observe the requirements and put employees at risk, using new technologies such as UV-C lamps to kill

viruses, maintaining emotional fitness, using different face coverings, and developing company guideline statements.

## A second wave and future pandemics

Some models have predicted another wave of COVID-19 infections in the fall, the result of people going back to school

and work and relaxed restrictions. The annual influenza season will add to the number of people sick, too. Planning for that is underway at all levels.

The COVID-19 threat will remain at least until an effective vaccine is discovered. Until then, the construction industry's responsibility is to minimize the loss of life.

### About the author



Joe Nasvik was a concrete contractor in the Chicago, Ill., area for almost 20 years and an editor for 20 years, writing for *Concrete Construction*, *Concrete Contractor*, and *Concrete International*.

His articles include a wide range of topics and issues that concern the concrete industry.

### Abstract

Construction is regarded as an essential industry, at least in a limited capacity, in many states, and it is currently challenged to keep workers safe on the jobsite. Social distancing, the first line of defense, requires workers to be a minimum of 6 ft (2 m) apart. But construction, especially concrete construction, often requires teams to be much closer together for some work functions, so other measures become important. Work on construction sites is being made safer through health screening, respirators and other face coverings, and frequent cleaning, among other things.

### Keywords

Cloth mask, construction, COVID-19, jobsite safety, KN95, N95, pandemic, respirator, safety, SARS-CoV-2, surgical mask.

### Reader comments

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