

2021 Daniel W. Mead Prize for Younger Members

## **COVID-19: Redesigning Our Built Environment**

Catherine M. Martsof, EIT, LEED AP BD+C, A.M.ASCE

What would the world look like without civil engineers? If engineers disappeared for a day, virtually everything that makes modern life possible would come to a halt. People need safe roads, bridges, and traffic control for ambulances and delivery of food and materials. People need safe drinking water and secure utilities to heat homes, charge cell phones and call loved ones. Infrastructure makes modern life possible. The ASCE Code of Ethics is more important now than ever as COVID-19 presented limitations on the built environment as we know it.

This is not the first time civil engineers have had to re-imagine designs to meet public health standards and infrastructure demands. During the industrial era, cholera and typhoid outbreaks influenced modern sanitary systems. Epidemics contributed to developing water and sewage systems to fight pathogens, which required streets to be straighter, smoother, and wider to install underground pipe systems.

As civil engineers, we need to be agents of change and commit to our code of ethics. We should not only design equitable infrastructure that safeguards the public from contracting viruses and evolving strains, but also advocate for infrastructure investment with legislators. We need to be able to build a consensus with the legislative community and be inclusive of engineers with diverse perspectives. In particular, we need to be agents of change with regard to: accessibility, sustainability, and public policy.

### **Accessibility**

In many ways, COVID-19 has exacerbated inequities that previously posed threats to the public. For example, with students learning from home, inequities in broadband service and residential living have become even larger barriers to success. Public libraries, which provide access to local and affordable resources, have been closed. According to the World Health Organization, two billion people don't have access to a healthcare facility that has water and sanitation. According to the Centers for Disease Control and Prevention, washing your hands is the best line of defense against the virus, but even the staff in some global healthcare facilities do not have proper utilities to properly wash their hands.

With redesigning spaces also comes social ethos and ethical responsibility to the public, including the most vulnerable populations. As public health standards impact businesses and infrastructure, it is important to remember the spaces civil engineers design are being overhauled by additional 6 feet needed for people to utilize space or patronize a business. This poses a particular concern to the Americans with Disabilities Act and individuals with physical disabilities. This ethical responsibility also includes transport of materials, such as vaccines, to reach rural and city populations. Future World Vision alluded to rural cities struggling with delivery of food and materials and Mega Cities embracing driverless or robotic delivery of goods. As civil engineers,

we need to account for those on both sides of the digital divide and those who rely on public transportation.

Public transit ridership has fallen 70 to 90 percent in major cities across the world, and civil engineers will need to rethink where and how transit performs. We need to be looking at how to better integrate Transportation Network Companies into first and last mile connections, ensure routing to where essential workers live and work in rural areas, ensure operators are safe and not burdened, and the impact of behavioral changes in virtual shopping. Solutions include building more transit-only lanes than mixing those lanes with freight or other special uses.

Redesigning spaces to ensure equitable access also refers to low-income areas characterized by high population densities, poor environmental conditions and lack of access to basic services. For example, homeless populations have to congregate at communal water points and poorly maintained public toilets, thereby increasing the risk of further spread of viral infections. Limited access to electricity also reduces the effectiveness of public health campaigns that rely on social media. Designing spaces while keeping in mind our ethical responsibility will be imperative in meeting their needs and keeping them safe.

### **Sustainability**

The ASCE Code of Ethics states we are entrusted by society to create a sustainable world and enhance the global quality of life. Engineers are expected to first and foremost, consider the capabilities, limitations, and implications of current and emerging technologies. We are entrusted to mitigate adverse societal, environmental, and economic effects; and use resources wisely while minimizing resource depletion. While this code of ethics is not the standard of care, it is the rudimentary level of ethics an engineer should have.

A transformative approach to reinventing offices and schools will be necessary to create equitable and sustainable infrastructure. Instead of adjusting the existing footprint incrementally, civil engineers should take a fresh look at renewable energy opportunities in spaces that foster desired outcomes for safe collaboration, productivity, and culture for everyone, especially students with physical and learning disabilities. It is imperative to utilize current and emerging technologies that improve sustainability efforts, such as "biomimicking" treatment systems and water-recycling programs that accelerate the shift from gray to green infrastructure. Designers and engineers should have digital collaboration tools, such as building-information modeling (BIM), readily available and widely used.

It is also important for civil engineers to use mobile technology to foster a seamless transition and implement project virtually, without risking the health of other engineers and essential workers. For example, digital back-office and workforce-management systems to improve staff efficiency and exploring predictive-maintenance systems, driverless vehicles, and energy-efficiency upgrades to lower the cost of operations.

## **Public Policy**

Civil engineers cannot do this alone. Due to economic pressures and opportunities, government and industry will be incentivized to find new ways to innovate together to meet infrastructure demands and investments. The appetite and urgency to deploy private dollars into public assets will likely increase. Ideas such as bundling projects have been attempted on limited scale before, but the new paradigm brought by the COVID-19 crisis could trigger their resurgence and attractiveness. Civil engineers have an ethical responsibility to guide this motivation in the direction that includes equitable infrastructure investments. Bolstered by federal government stimulus for infrastructure, a strategic refresh will be necessary to the rebuilt and redesign America's infrastructure.

The effect COVID-19 is going to have on our transition to electric modes of transportation is unknown, as it has the largest impact on sustainability efforts and reducing emissions. This is where public policy can be very effective. For example, the passing of the \$25 billion in CARES Act funding was a lifeline to public transit projects. Civil engineers rely on advocacy and infrastructure investment; civil engineers should be actively involved in congressional outreach to defend infrastructure investment.

In conclusion, ASCE calls upon civil engineers to innovate solutions that significantly enhance the performance and value of infrastructure projects, in a sustainable and ethical manner, and advocate for infrastructure investments. The pandemic was a horrific wake-up call, however, it has also given civil engineers the chance to reimagine infrastructure to build a more resilient, sustainable and inclusive future.

*References:*

ASCE Code of Ethics. (2020). Retrieved from <https://www.asce.org/career-growth/ethics/code-of-ethics>

Coronavirus Aid, Relief, and Economic Security (CARES) Act. (2020). Retrieved from <https://www.transit.dot.gov/cares-act>

World Health Organization (2020). Retrieved from <https://www.who.int/>