

**ENGINEERING AND CONSTRUCTION INDUSTRY
RESPONSE TO COVID-19**

RESTARTING WORK SAFELY AND EFFICIENTLY

**IN COLLABORATION WITH
THE WORLD ECONOMIC FORUM**



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The World Economic Forum, committed to improving the state of the world, is the international organization for public-private cooperation. The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.

Boston Consulting Group and the World Economic Forum have partnered with global leading engineering and construction organizations to establish the Engineering and Construction Industry Action Group. The purpose of the group is to generate a multistakeholder dialogue among the most senior leaders of the engineering and construction industry to help ease the impact of disruptions relating to the COVID-19 crisis, collaborating on a global, collective response to the COVID-19 pandemic and the post-crisis recovery.



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FOREWORD

THE ENGINEERING AND CONSTRUCTION (E&C) industry is a powerful vector for social and economic development and thus has a critical role to play in restoring some of the value that has been lost in a tough year. For that purpose, it is now crucial to keep working to guarantee a safe and efficient environment as lockdowns start to lift around the globe and activity reopens after a period of activity stoppage or slowdown.

Recent experience has shown that our industry has found innovative and successful solutions to respond to the immediate crisis and face the return to work, while dealing with the inherent particularities regarding human interaction, space limitations, and the physical nature of work.

In this unprecedented context, we are pleased to share a series of selected recommendations—illustrated by global best-practice examples arising from discussions with more than 15 industry leaders—to arm companies with the tools they will need to create a safe and efficient working environment.

Current conditions also represent a unique opportunity to accelerate the digital transformation of the E&C industry and unlock its benefits. Some companies are beginning to act, and we encourage others to think and prepare for a transformation that is bound to happen. We strongly believe that safety and efficiency can go hand in hand, and COVID-19 represents a test field to foster the adoption of digital technologies that limit human interaction and the time spent at construction sites, while helping to promote health and safety prevention and monitoring. IoT and sensors for contact tracing, drones for social-distancing tracking and BIM solutions for project planning are just a few of the digital technologies that will keep workers safe and unlock productivity.

The path forward will require open dialogue and collaboration among key stakeholders—customers, regulators, subcontractors, suppliers, labor unions, and other organizations. Now this is more important than ever, and it will help us to effectively implement the proposed recommendations.

This report aims to shed light and outlines a set of recommendations for the implementation of a safe and efficient return to work. We hope this work will help our industry and individual companies prepare to better navigate the crisis and emerge stronger in the aftermath, as well as set the foundation for meaningful conversations between the private and public sectors on how best to continue building in times of coronavirus and beyond.

We would like to acknowledge and thank all members of the steering and working committees, who have dedicated their expertise and time to this report. We also thank the Forum team for their extraordinary engagement, contribution, and support, and especially Boston Consulting Group for its critical insights and leadership in sharing these findings. We look forward to continuing this collaboration to transform our industry and to create future growth opportunities.



Steve Demetriou,

Chair of the World Economic Forum's Engineering & Construction Industry Action Group, and Chair & Chief Executive Officer at Jacobs Engineering Group Inc.

EXECUTIVE SUMMARY

A SAFE AND PRODUCTIVE ENGINEERING and construction (E&C) industry is critical for the economy and society. This industry generates 6% of global GDP and employment¹, and good-quality, affordable, and sustainable built assets are required for healthy economic and social activity.

COVID-19 IS POSING SEVERE OPERATIONAL AND FINANCIAL CHALLENGES TO THE E&C INDUSTRY

The COVID-19 crisis is already impacting the industry in several ways, and it will have an even more profound impact over the coming years. BCG estimates construction activity will decrease by 10% to 25% in 2020 compared with 2019.

The severe implications of COVID-19 vary widely across countries depending on the virus spread. However, three shared pain points stand out: (1) project delays due to nationwide lockdowns or construction slowdowns that are generating a 20% to 60% activity loss; (2) productivity losses of approximately 25% to 40%² and cost increases of €300 to €350 per worker and per month³ from the implementation of new health and safety protocols; and (3) supply chain disruptions as a consequence of border shutdowns and SMEs' weak financial health.

After a period of activity stoppage or slow-

down, governments have mandated that construction activity restart, putting into place initiatives that ensure safe working conditions and that help contain the virus spread. Compliance is monitored by public authorities through recurrent onsite inspections.

A SAFE AND EFFICIENT WORK ENVIRONMENT CAN BE ACHIEVED IN THE E&C INDUSTRY BY IMPLEMENTING A SET OF SIX ACTIONS

Through the observation of best practices enacted by leading E&C companies to comply with and enhance new working regulations, we have identified a set of six actions that have proven effective across projects and geographies: (1) increased sanitation, (2) pre-screening of employees at entry points, (3) enforcement of social distancing, (4) contact tracing, (5) symptoms communication and self-reporting, and (6) compliance assurance and monitoring.

Beyond these general health and safety actions, the COVID-19 lockdown period has also heightened employers' concerns regarding workers' mental well-being. Research shows that after periods of lockdown, about 25% of employees may experience toxic levels of stress, and employees suffering from stress who continue working report a loss in productivity of approximately 35%. Organizations should seek to address this matter by

setting up mental well-being plans, raising awareness onsite, monitoring the well-being of their employees, and ensuring sustainable working conditions. Ultimately, these initiatives will help prevent a secondary wave of burnouts and stress-related absenteeism later in 2020.

PARTICULAR CHALLENGING CONDITIONS HAVE BEEN IDENTIFIED, WHICH REQUIRE SPECIAL SOLUTIONS BEYOND THE APPLICATION OF GENERAL HEALTH AND SAFETY PROTOCOLS

The E&C industry is facing particularly challenging working conditions, which are determined by two main factors: space limitations and the degree of human interaction required. This report offers a framework to help industry organizations identify construction site risks, and provides examples of recommendations to manage three specific situations that are commonly experienced: (1) workforce mobility, (2) common areas, and (3) buildings' fit-out and industrial precommissioning.

CURRENT CHALLENGING CONDITIONS OFFER A UNIQUE OPPORTUNITY TO ACCELERATE ADOPTION OF TECHNOLOGY TO ENHANCE A SAFE AND EFFICIENT E&C WORKING ENVIRONMENT

In the current context, certain new technologies can unlock productivity gains and enhance safety, compensating for COVID-19 operational challenges.

This report offers a set of digital use cases that have been prioritized, taking into account their potential impact in the COVID-19 context and the timing required for the implementation of the respective technologies involved.

The set of digital use cases selected could help organizations carry out general health and safety measures, such as prescreening of workers, monitoring social distancing, and offsite inspection of project progress. They can also help improve productivity, such as, by enhancing collaboration and communication, digital planning, or addressing employees' mental well-being. These digital use cases leverage already mature technologies, such as mobile apps, BIM, and planning software, in addition to less widely implemented tools and technologies, such as augmented or virtual reality, aerial drones, or IoT wearables.

A successful rollout of the proposed health and safety measures and new ways of working will highly depend on close collaboration and communication with all stakeholders involved. Engaging with public and private clients, subcontractors, public authorities, labor unions, and suppliers, among others, will ensure that organizations have a safe and efficient transition in their return toward normal activity levels.

INTRODUCTION

C OVID-19 IS ALREADY IMPACTING the engineering and construction industry in several ways, and it will have an even more profound impact over the coming years. The implications vary widely across countries depending on the virus spread. Three common factors, however, have been identified.

PROJECT DELAYS

Nationwide lockdowns have triggered the shutdown or slowdown of construction-related activities, reducing construction activity by 20% to 60%, depending on country-specific restrictions.

PRODUCTIVITY LOSS

Between 20% to 30% productivity is perceived across sites. Together with the cost increases arising from new health and safety (H&S) protocols—for example, social distancing, protection material and equipment, and other changes in operational procedures—this is putting pressure on organizations' financial viability.

SUPPLY-CHAIN DISRUPTIONS

Industry supply chains are being challenged as a consequence of nationwide lockdowns, either due to border shutdowns or due to suppliers' financial weakness, ultimately impacting a project's viability.

In addition to these shared pain points, selected geographies are suffering from country-specific issues that could further dampen the recovery of the construction industry across regions. For instance, India's construction industry recovery will be particularly challenged by the reverse migrations of construction laborers and the oncoming monsoon season.

After several governments mandated construction activity to stop or slow down, different initiatives have been put into place to ensure a safe return to work. For example, the UK and the Construction Leadership Council, UK have issued guidelines that include new operating recommendations and COVID-19 compulsory restrictions in order to ensure a safe reopening.

Furthermore, selected governments are engaging in discussions with industry organizations to assess the implications of these new restrictions and to identify industry best practices to accelerate the return to work and, ultimately, the industry's recovery. For instance, the government of Qatar has agreed to relocate the workforce to new shovel-ready projects, ensuring that people can go back to work instead of waiting for project reopening or staying under lockdown in construction camps, which could pose an even bigger threat to virus spread.

Industry players face a variety of challenges when incorporating H&S protocols, depending on the environmental context of the project, the work stage, and the type of activity to be performed. Compliance with these new protocols is being monitored by public authorities through recurrent onsite inspections.

Consequently, industry organizations are facing an unplanned cost increase resulting from the loss of productivity, the need for protection equipment, and the new processes. In general, this increase is not being offset by their clients.

Moreover, the COVID-19 crisis and its implications are expected to have a severe impact on workers' mental well-being, posing additional challenges to the industry.

Recovery will depend, among other factors, on the ability of industry organizations to catch up with pre-COVID-19 productivity levels. Organizations will have to adapt quickly, putting in place the right initiatives to ensure a safe and fast reopening, as well as increase workers' productivity to compensate for the effect of the new operational challenges.

In this regard, the objective of this report is to share a set of actions and recommendations that can support industry organizations as they prepare to accelerate toward a safe and efficient return to work in the COVID-19 context.

RECOMMENDATIONS FOR A SAFE AND EFFICIENT REOPENING IN CONSTRUCTION

SELECTED RECOMMENDATIONS AND BEST practices have been identified that can help E&C organizations accelerate a safe and efficient return to work. (See Exhibit 1.) These recommendations are structured in four categories:

- E&C health and safety protocols and guidelines.
- Specific measures for challenging situations.
- Digital technologies to enable a safe and efficient working environment.
- Coordination among key stakeholders to ensure effective implementation of the proposed actions.

H&S Protocols and Guidelines Specific to Construction Activity

General H&S protocols and guidelines can sometimes be adopted by contractors, who then make sure these are passed on to clients, subcontractors, and suppliers, as well as their own employees. On the other hand, in already existing facilities, clients typically set the protocols, and contractors and other third parties are mandated to follow them.

Since the declaration of the COVID-19 pandemic, governments and industry associations have released multiple H&S recommendations, from which a set of six initiatives stand out for their relevance and proven effectiveness across projects and geographies. (See Exhibit 2.)

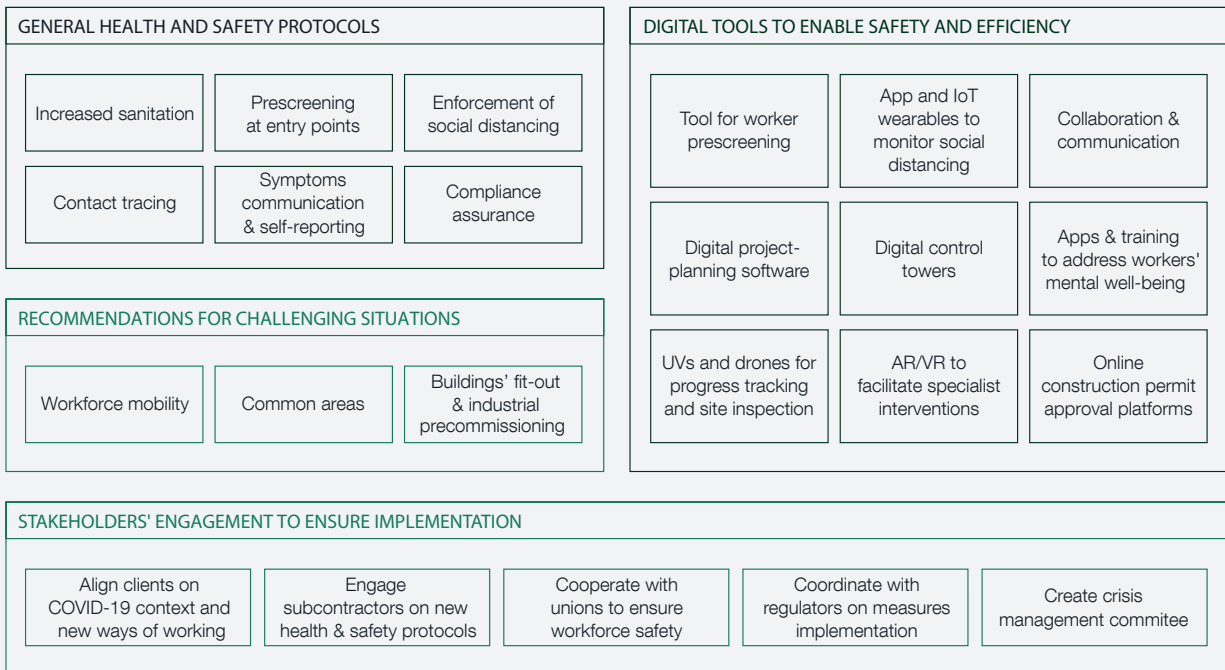
1. Increased Sanitation:

- Before reopening, make sure that any worksite (closed or partially operated) is disinfected.
- Introduce enhanced cleaning procedures across the site and points of worker contact (for example, tools, machinery, vehicles).
- Encourage good hygiene throughout the working day in common areas (for example, sanitation facilities, changing rooms, showers, and toilets).
- Stress the use of mandatory personal protective equipment (PPE) in all worksite areas and conditions.

2. Prescreening at Entry Points:

- Testing points must be set up at the worksite entry, and a specific site access protocol must be created on the basis of

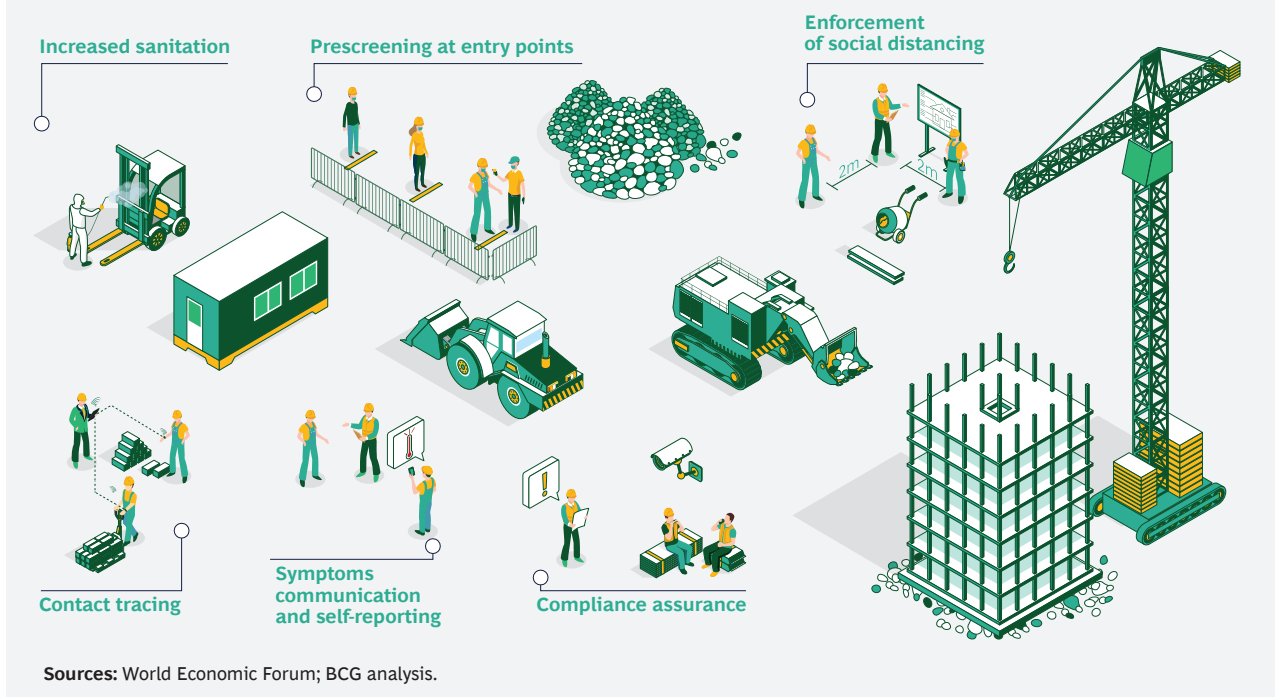
EXHIBIT 1 | Framework for Restarting Work Safely and Efficiently



Sources: World Economic Forum; BCG analysis.

- testing requirements (for example, in-situ diagnostic or serological).
- Testing staff must wear appropriate PPE.
- All staff, physicians, and contractors working on the site, regardless of role or patient contact, should be subject to screening to ensure that they are not showing influenza-like symptoms, thus increasing the chance of spread.
- Testing protocol should include workers completing a standard questionnaire to assess health risks (for example, exposure to positive cases, self-reporting any symptoms); temperature checks recorded in a logbook; and classifying people tested by stakeholder group (for example, contractors, subcontractors, suppliers and government officials).
- All staff, physicians, and contractors exiting the worksite and reentering the same day will be required to repeat entry prescreening.
- Identify clinically vulnerable workers and set up increased prescreening and monitoring protocols.
- Set up a clear response protocol in case any prescreened employee tests positive or displays COVID-19 symptoms. For instance, the government of Alberta has issued operating guidelines for safe reopening in industrial work camps, particularly emphasizing the relevance of an asymptomatic-workforce mass-testing strategy as part of a rapid-response plan to prevent virus spread in the case of an employee being affected by COVID-19.

EXHIBIT 2 | E&C Health & Safety Protocols and Guidelines



3. Enforcement of Social Distancing:

- Enforce social distancing, particularly between people working statically. If necessary, change shift planning, such as staggering work crews, to reduce the number of people onsite simultaneously.
- Reduce the capacity of onsite project inductions, and consider holding them outdoors whenever possible.
- Consider restricting nonessential physical work that requires close contact between workers, or substituting this work with automated tasks.
- Stagger break times to reduce congestion and contact.
- If possible, allow at least six feet between people waiting to enter the site, and consider installing measured distance lines similar to those seen in retail environments.
- Implement specific measures to work safely and efficiently in particularly challenging

situations, as outlined in the following section.

4. Contact Tracing:

- Extend jurisdictions for contact tracing beyond the worksite to increase effectiveness (linked to public health jurisdiction).
- Identify clinically vulnerable workers and define a specific safety protocol for them.
- Set up prevention mechanisms and dedicated teams (for example, worksite hotspot analysis) to monitor workers' contacts.

5. Communication and Self-Reporting of Symptoms:

- Define a risk assessment framework and triggers based on worksite exposure situations, such as when an individual exhibits symptoms, tests positive, or has close contact with someone who tested positive.

- Set up simple self-reporting processes and tools for challenging situations, including channels to be used, such as mobile surveys, and clearly define the key people to contact, such as the line manager.

6. Compliance Assurance:

- Create a specific H&S risk committee.
- Set up a project taskforce that monitors workers' compliance with H&S protocols.
- Hold training sessions to raise awareness and go through H&S protocols.
- Reinforce communication across sites—for example, posters with protocols and distanced floor markings—as well as with key stakeholders.

The COVID-19 lockdown period has also raised employers' concerns for workers' mental well-being, given that research has shown how lockdown periods can have severe effects on employees, which can manifest months after the end of isolation.

The effects of quarantine and lockdown periods on employees' mental well-being generally appear between three to six months⁴ after isolation. However, employers can sometimes misinterpret this lag to mean that there is no lockdown effect on employees. Surveys performed after two weeks of lockdown show up to 25% of a sample experiencing “high toxic levels of stress” compared with about 15% prelockdown. Additionally, employees suffering from toxic levels of stress who continue to work report a productivity loss of about 35%⁵.

As such, supporting employees' mental health has been identified as a critical success factor for a safe and efficient return to work, even though the issue has not yet been widely tackled. This report

encourages organizations to implement four key initiatives to help avoid burnouts and stress-related absenteeism through the industry rebound period.

1. Mental Well-Being Plan:

Develop and execute a mental well-being plan to provide employees with mental health tips and tools through regular internal communication as well as professional support. Organizations should identify high-risk workers and develop targeted programs for them.

2. Raising Awareness:

Encourage open conversations with workers, and communicate the support available. The relevance of a healthy lifestyle—proper rest, healthy eating habits—inside and outside the worksite should be stressed, as it is a key driver for mental well-being.

3. Monitoring:

Set up monitoring protocols to be supervised by a specific taskforce, or to be assigned to managers as a new responsibility. For example, designees should be trained to focus on supporting the workforce's mental well-being, while also monitoring compliance with H&S regulations.

4. Sustainable Working Conditions:

Organizations should be aware of the relevance of having sustainable working conditions and make adjustments for added operating complexities. For instance, some organizations are setting up relief areas where workers can safely take off PPE for a limited period without putting their colleagues at risk.

Organizations operating in construction sites should take into consideration the whole compendium of H&S recommendations available and then prioritize them according to the specific conditions of each worksite and project phase. Regulations and guidelines differ by country, which can cause confusion among organizations operating in different markets. This working group encourages organizations to adhere to the local regulations and to take the recommendations offered in this report as additional guidelines.

Specific Measures to Work Safely and Efficiently in Particularly Challenging Situations

A framework has been developed to help industry organizations identify risks in particularly challenging situations in construction sites, as well as specific recommendations to manage these risks.

Two main factors affect the risk profile of worksite situations: space limitations and the degree of human interaction required. Organizations can assess these factors in order to come

up with tailored solutions that can overcome health risks and minimize productivity losses.

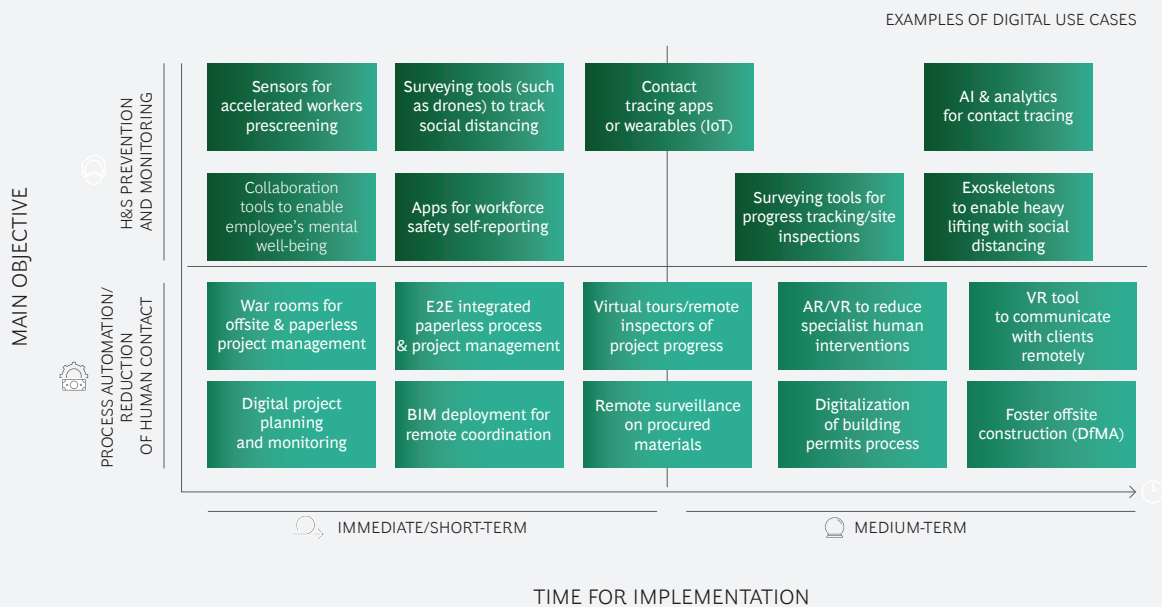
In this regard, three particularly high-risk situations have been analyzed, and recommendations have been proposed to overcome them.

1. Workforce Mobility:

Major H&S challenges are currently being faced by construction workers when traveling in buses or cars to and from construction sites, given the proximity and contact exposure of workers. Various initiatives have been put in place to ensure compliance with new protocols, including:

- Engineered seat isolation, such as plastic films covering the seats
- Decreased capacity per vehicle, even if it means leaving seats empty
- Carrying out sanitization at the end of each journey
- Staggering workforce transport at the start and end of each day

EXHIBIT 3 | Digital Use Cases Accelerated by COVID-19 Outbreak in Engineering and Construction



Sources: World Economic Forum; BCG analysis.

2. Common Areas:

The biggest challenges are often not faced in the construction sites themselves but in canteens and camps, where the level of interactions is higher. Initiatives can be implemented to increase safety in these areas, including:

- Enforced social distancing through signage
- Limited capacity
- Limited time spent per employee
- Cashless and paperless transactions
- Prohibiting food and drink sharing
- Staggering lunchtimes by working groups
- Segmenting the workforce into “small families” to favor contact tracing

3. Buildings’ fit-out and industrial precommissioning:

The fit-out phase of a nearly completed building, or the precommissioning of an industrial development, may also put workers’ safety at risk. It is when congestion is often at its highest, as several subcontractor teams work simultaneously on different tasks in a limited space. Organizations have implemented different measures, such as:

- Isolating and limiting working areas
- Replanning work to limit the subcontractor teams working per time slot
- Increasing sanitization protocols throughout the entire phase to ensure disinfection after the workday

Digital Technologies for a Safe and Efficient Return to Work

COVID-19 represents a unique opportunity to accelerate the digitalization agenda of the E&C industry.

We have identified a set of existing technologies that can enable a safe and productive working environment, especially under current constraints.

We have prioritized these technologies based on their potential impact in the current COVID-19 context and the required timing for implementation. (See Exhibit 3 and Exhibit 4.)

PRESCREENING TECHNOLOGIES

First, medical evaluation gateways, such as Symptom-Sense, provide the ability to prescreen workers for COVID-19 symptoms, such as temperature, blood oxygen levels, heart rate, and respiration rates without physical contact.

Second, thermal-imaging technologies, such as Mitie, can measure human temperatures (within 0.3°C accuracy) and can notify monitoring teams when someone has a fever. Providers offer solutions in several design formats, such as handheld units or mounted on cameras, allowing large areas to be scanned at once.

Finally, other online tools allow the workforce to complete health risk questionnaires required for COVID-19 prescreening protocols at entry sites. This would allow workers who are unwell or show COVID-19 symptoms to stay home in order to prevent the risk of further virus spread.

Example

The government of Alberta has created an online “Fit For Work” tool,⁶ which includes prescreening health check questionnaires, and which organizations can leverage as part of their prescreening protocol.

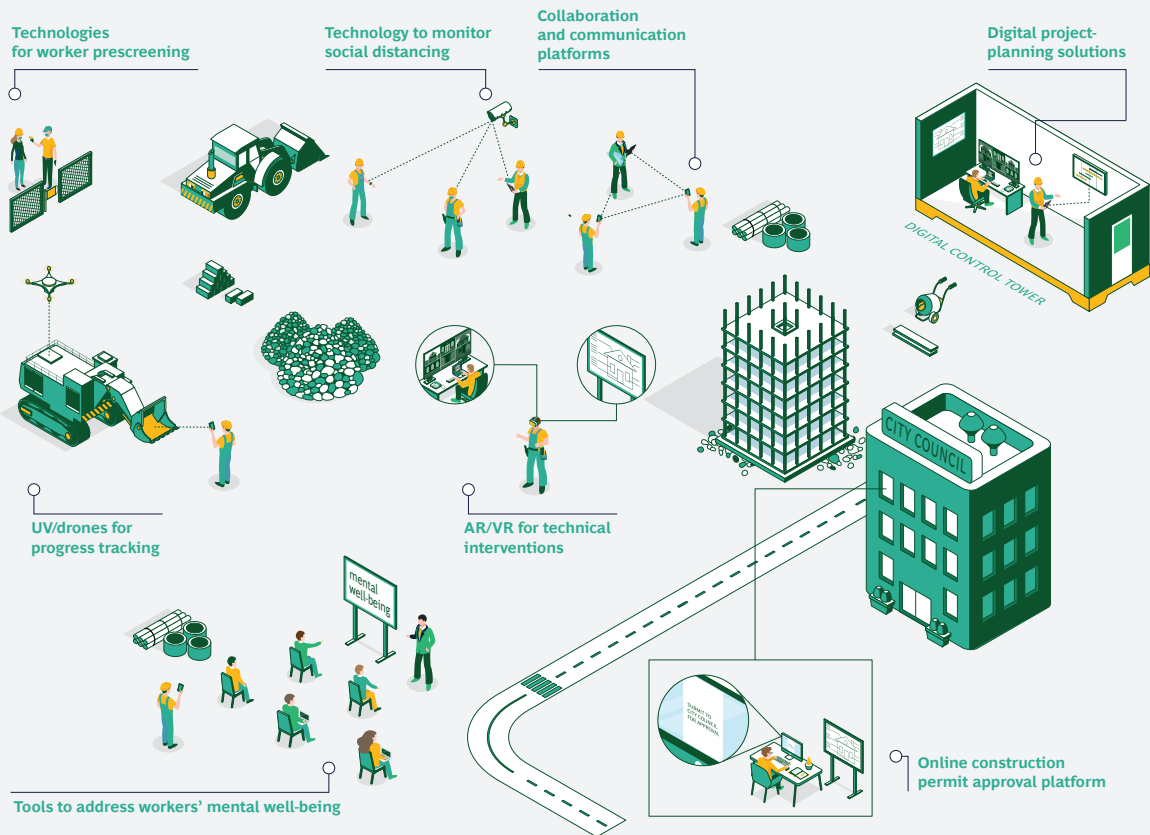
TECHNOLOGIES TO TRACK AND MONITOR SOCIAL DISTANCING

Software-enabled cameras can help control the perimeter across worksites, track social-distancing compliance, and release real-time alerts and daily reports to indicate how often workers were too close together. The software leverages machine learning and analytics to identify key H&S or operations parameters, eventually identifying H&S risks, benchmarking them across projects, and creating a dashboard and risk assessment reports for project managers to act accordingly. For instance, EverCam and SMARTVID.IO offer similar solutions, with SMARTVID.IO offering the optionality of integrating the software plugin into existing conventional worksite security cameras.

Furthermore, construction-specific BLE⁷/RFID⁸ wearable technology, such as iTWO Safe and Prysmex, has been developed to track distance between workers. A wearable can help organizations monitor contacts or exposure to other workers, sending an alert before distance requirements are breached, providing trace-of-contact history in the case of an infection emergency, or providing a comprehensive report for regulators that shows the precautions taken.

Finally, ultra-wideband industrial technology, such as KINEXON, which is about ten times more accurate than BLE/RFID technology, can be used to track real-time worker location and time spent in high-risk areas, as well as trace contacts or exposure to other workers.

EXHIBIT 4 | Digital Use Cases for a Safe and Efficient Return to Work



Sources: World Economic Forum; BCG analysis.

COLLABORATION AND COMMUNICATION PLATFORMS

Several collaboration and task management app providers offer solutions that allow organizations to have a mobile connection among employees, task assignment, automatic quality sheet version control, access to project blueprints, and share of markups and annotations.

Additionally, virtual reality tools can be used to communicate with clients located offsite, supporting video, information panels, maps and plans, audio tracks, links to outside websites, and feedback. Furthermore, VR tools offer a chat function so that experts can remotely answer questions as visitors look around the materials, effectively substituting for an in-person event. For example, AECOM offers construction-specific software, and technology providers such as Zoom and Webex offer general online communication tools.

COVID-19 COMMUNICATION PLATFORMS

Selected communication and collaboration technology providers offer mobile app solutions that facilitate the organization-wide communication of COVID-19 related notifications. For instance, the solutions enable organizations to release or update COVID-19 protocols, share alerts if positive cases are identified, or allow workers to self-report symptoms. For example, Atlassian, Alertmedia, or BCG's Safe@Work app.

DIGITAL OFFSITE PROJECT PLANNING SOLUTIONS

Selected project planning technology providers offer planning and collaboration tools prepared for desktop and mobile devices that can improve project productivity and connect three key stakeholders (project managers, worksite employees, and clients) through paperless and offsite reporting.

Such a tool enables project managers to conduct offsite granular planning of activities, resource planning (labor, material, and machinery), and dynamic replanning and scenario analysis. Workers on the ground can update activity progress in real time through a mobile app, where they can fill in the required quality and activity checklists. Additionally, clients can be given access to quality and progress checklists, which are required for the processing of project payment. Similar solutions are provided by Procure, Fieldlens, Fieldwire, PlanGrid, TouchPlan.IO, LeanPlando, vPlanner, and BuilderTrend, among other technology providers.

DIGITAL CONTROL TOWER TO MANAGE PROJECTS

Selected project planning and collaboration tools offer integrated project dashboards that allow for data-driven review and decision making around project activities. These digital war rooms also include action item trackers to ensure the timely resolution of identified issues.

For instance, MTWO (from RIB Group) offers a BIM-enabled platform for the integral management of projects throughout the investment, planning, design, bidding, construction, and operations and maintenance phases. MTWO offers a control tower dashboard that provides a holistic project overview, enabling users to have a single point of communication with all stakeholders; integrating BIM models (synchronizable with Revit), including time planning and cost management information; creating project planning and workflows; scheduling and integrating ERP; and providing real-time progress management.

MENTAL WELL-BEING SUPPORT TOOLS

Several software providers, such as SAP⁹, offer different solutions to address workers' well-being. These solutions combine online support tools with tailored trainings to address key mental well-being pillars, including stress management, psychological safety, positive thinking, asking for help, emotional regulation, and mindfulness.

EMPLOYMENT OF UNMANNED VEHICLES AND DRONES

The use of drones in construction for progress tracking and site inspection was successful before COVID-19 restrictions, but these solutions could now be even more relevant as they could help alleviate the labor resource needs onsite for these activities. Selected organizations have shown the different applications of this technology, as outlined below.

Examples

Autostrade and RED use HD imaging and infrared drone-mounted cameras for asset inspection, which in the COVID-19 context can include the supervision of H&S protocol compliance.

The UK's Crossrail project has leveraged unmanned aerial vehicles to monitor rail track progress.

Technology company SigmaRail has used drones to survey a high-speed corridor line in south-eastern Spain, in order to validate the performance of the rail track and examine engineering priorities.

Komatsu has used fully autonomous bulldozers, which are led by drones mapping the activity area and guiding the equipment without the need for additional on-site labor.

AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

AR and VR technology can help to reduce specialist human interventions across design and engineering, enhance safety during construction, and foster efficient operations and maintenance.

Examples of how organizations are using these technologies are outlined below.

Examples

Skanska uses AR and VR to assess construction design options and conceptual estimates to help accelerate decision making and approvals throughout the project stages.

The UK's Crossrail uses AR interfaces to detect pipes and electricity lines during rail track construction to avoid accidents and improve safety.

McCarthy uses AR inspections to compare construction progress with original blueprints, helping workers and project managers to identify deviations rapidly.

At ENEL, operators receive remote AR and VR support from technical advisors. Workers wear headsets with cameras and portable viewers that then replicate the image's content to technical advisors off-site, ultimately getting advice in real time to perform complex repairs.

COLLABORATIVE CONSTRUCTION PERMIT APPROVAL PLATFORM

The opportunities to accelerate technology adoption extend beyond the private side. Governments and public authorities also have the chance to embrace new ways of working to be a part of the industry's transformational change. For instance, selected software providers offer online solutions to governments and city councils to conduct integrated construction project approval processes online.

Example

SoftTech's BIMDCR software is an integrated building plan approval system that enables public authorities to perform online scrutiny of building proposals submitted by applicants. In particular, the software facilitates a single point of submission for applicants, the analysis of BIM models submitted, the interaction and approval across all government de-

partments in the same online application model, and the release of Green Building Code compliance approval documents online (if BIM model includes the required information).

Organizations that have embraced the current situation and accelerated the adoption of multiple technologies throughout their project footprint are leaders in the industry's transformation and can act as a use case for others going forward.

Example

A US construction organization has deployed several technologies to ensure an efficient return to work in the COVID-19 context. The organization created live videos to monitor site conditions and activity, and avoid in-person inspections by using portable cameras (GoPro) or mobile phone apps. Additionally, aerial drone images, overlapped with project blueprints, are helping the organization track progress in large projects without the need for in-person inspections. They are also using collaboration platforms and virtual inspection tools to enable the project management office to connect with offsite technical experts, suppliers, and customers, to show project progress and difficulties. Finally, the corporation developed a scenario modeling tool that leverages AI and data analytics to simulate construction sequences, schedules, and cost options, allowing the project office to identify the optimal case.

Coordination Among Key Stakeholders to Ensure Effective Implementation of the Measures

A successful implementation will require the engagement and cooperation of all key stakeholders:

- Public and private clients
- Regulators and policy makers

- Subcontractors
- Labor unions
- Suppliers

Frequent, integrated, and positive communication among members of the stakeholder group should be implemented, particularly at the early stages of work reopening.

It is important to **align clients** on the COVID-19 context and new ways of working. Organizations should open a dialogue with clients to raise awareness and recognition of the COVID-19 context and its derived cost implications, and to make sure that the risk and cost burdens do not fall exclusively on one side. Furthermore, technology brings an opportunity to accelerate a safer and more efficient return to work, and thus clients should be involved in its adoption—for example, clients can empower technology use by asking for it as part of bids.

Organizations must find ways to **engage subcontractors** to comply with new H&S protocols and ways of working. For instance, a key member of the subcontractor's project leadership could be included in the H&S monitoring taskforce to ensure mandatory involvement.

Additionally, build relationships and **cooperate closely with labor unions** to monitor workforce mental wellness and working conditions. Unions can provide support to ensure that employee concerns about working conditions are addressed and, above all, that workers are adequately protected in all situations. Unions can also play a relevant role in helping to control any potential rise in absenteeism, which could cause severe disruptions if not anticipated.

Coordinate with regulators on measure implementation. It is important to initiate a dialogue with regulators and public authorities to discuss potential measures that could help the industry recover.

Example

A consortium of construction industry organizations in Russia is working to develop an “industry standard” to define and systematize key measures to return to work and prevent the spread of new infections, which will then be presented to the government of the Russian Federation for its review. The new industry standard aims to level the existing differences in the regulatory base of territorial subjects of the Russian Federation. It takes into account the specifics of the epidemiological situation per region and the key identified epidemiological risks. It also aims to allow organizations to considerably lower the costs of the introduction of such measures in comparison with actions of the existing regulations. Organizations should proactively be part of the solution, providing rapid feedback on the effectiveness of the measures released by the governments and giving regulators visibility on their implications.

Finally, creating **crisis management committees**, composed of the different stakeholder groups involved across the entire project decision-making process, could help monitor newly implemented measures as well as project productivity throughout the different re-opening phases.

NOTES

- 1 Percentage of employees in engineering and construction across OECD countries in 2019 (Source: OECD).
- 2 BCG estimate of expected decrease in performance standard, mainly due to impossibility of carrying out parts of work in parallel, decrease in number of workers to guarantee social distancing, delays at delivery or delivery of materials and tools in warehouses, testing, hygienic breaks.
- 3 Introduction of standards is expected to cost €300 to €350 euros in a month of mandatory direct costs (including disinfection of facilities, daily material and equipment, general testing, lease on additional transport...) on one worker, according to BCG estimates.
- 4 For further information, please refer to Eurofund.
- 5 For further information, refer to “Lockdown is the world’s biggest psychological experiment—and we will pay the price” (WEF, 2020).
- 6 For further reference, please refer to Gov. of Alberta Health Services’ “Fit for Work” tool (<https://www.albertahealthservices.ca/topics/Page17076.aspx>).
- 7 BLE: Bluetooth Low Energy.
- 8 RFID: Radio-frequency identification.
- 9 For further information, please refer to Mayer (2018): *Mastering Digital Transformation with Mindfulness*.

APPENDIX

CHECKLISTS TO ENSURE COMPLIANCE WITH PROPOSED BEST PRACTICES

These recommendations are intended to complement, not substitute for, local regulations in place

1. INCREASED SANITATION

A Before reopening, make sure that any worksite is disinfected

- Conduct a health risk assessment at all worksite areas that had been either totally or partially closed before restarting work.
- Carry out cleaning procedures and provide hand sanitizer before restarting work.

B Introduce enhanced cleaning and ventilation procedures across the site and points of worker contact

- Clean work areas and equipment after each shift or use with the usual cleaning and disinfection materials.
- Disable fingerprint scanners and other security systems that require touching, or clean them thoroughly after every use.
- Clear workspaces and remove waste and belongings from work areas at the end of shifts.
- Open windows and doors frequently to encourage ventilation, where possible.
- Reinforce daily cleaning of clothing.
- Frequently clean objects and surfaces that are touched regularly (such as buckets, control panels), and make sure there are adequate disposal arrangements for cleaning materials.

C Maintain good hygiene throughout the working day in common areas

- Provide additional hand washing facilities, such as pop-ups, particularly on a large site or where there are significant numbers of personnel on site.
- Use signs and posters to build awareness of good hand washing techniques, the need to increase hand washing frequency, and importance of avoiding touching the face, and coughing or sneezing into a tissue (which is disposed of safely) or into your arm if a tissue is not available.
- Set clear use and cleaning guidance for toilets to ensure that they are kept clean and that social distancing is maintained as much as possible.

D Stress the use of PPE in all worksite areas and under all conditions

- Thoroughly clean reusable PPE after use and ensure that it is not shared between workers.
- Dispose of single-use PPE so that it cannot be reused.

2. PRESCREENING AT ENTRY POINTS

A Stress use of appropriate PPE for testing staff

- Set up weekly training sessions for testing staff to stress the relevance of H&S protocols, given their exposure, and review the week's operational guidelines and restrictions.
- Provide hand sanitizer and required daily PPE equipment to testing staff before opening the gates.

B Define testing protocol and classify people tested

- Define the testing protocol for identifying and recording personnel entering the job site by stakeholder group (for example, subcontractors, suppliers, government officials).
- Set up weekly training sessions for prescreening staff to go through test recording procedure.
- Testing protocol should include workers completing a standard questionnaire to assess health risks (such as exposure to positive cases, self-reporting any symptoms).
- Ensure that the testing staff closely monitors workers with high-risk profiles (for example, over age 55) and reports H&S team.

C Set up testing points (for example, a person required to travel to or from an operational site or entry point)

- Set up testing points throughout the work site, ensuring that all personnel arriving or departing flow through them (such as staff, physicians, and contractors working on the site, regardless of role or patient contact).
- Communicate testing protocols and PPE requirements to all expected job site visitors and workforce.
- Carry out recurrent disinfection procedures at entry gates (such as prescreening walk-off gates).
- Use markings and introduce one-way flow at entry and exit points.
- Define process alternatives for entry and exit points where appropriate (such as by deactivating pass readers at turnstiles in favor of showing passes to security personnel at a distance).
- Have all staff exiting and re-entering the work site on the same day go through prescreening again at re-entry.

D Introduce clear response protocols if a test is positive

- Advise the employee to self-quarantine for 14 days.
- Ask the employee to identify all coworkers that they came into contact with during at least the previous 14 days, or trace contact if technology in place.
- Contact employees identified by the infected employee.
- Consider closing the area of activity where the positive-case employee worked for an OSHA approved cleaning process.
- Inform the workforce that an employee has been diagnosed with COVID-19.

3. ENFORCEMENT OF SOCIAL DISTANCING

A Enforce social distancing between people working statically

- Change layouts to allow people to work farther apart from each other.
- Consider restricting nonessential physical work that requires close contact between workers, or substituting this work with automated tasks.
- If it's not possible to move workstations farther apart, allow people to work side by side, or facing away from each other, rather than face to face.
- Adjust cycle times and work content to allow for production with incomplete shifts, reducing the number of people on site simultaneously.
- Reduce the capacity of onsite project inductions, and consider holding them outdoors whenever possible.
- Separate sites into working zones to keep different groups of workers physically separated as far as practical.

B Ensure social distancing when going to and leaving from work

- Stagger arrival and departure times to reduce congestion in and out of the work site.
- Reduce congestion at entry and exit by having more entry points.
- Allow plenty of space (at least 2 meters) between people waiting to enter the site, and consider installing distance lines (for example, similar to those seen in retail shops).

C Provide for social distancing in workforce mobility across sites

- Limit passengers in corporate vehicles, such as work minibuses, including leaving seats empty if necessary.
- Reduce job rotation and equipment rotation within the work site, for instance through single tasks in single areas for the day.
- Encourage workers to use their own transportation and travel alone.
- Regulate use of high-traffic areas, including corridors, elevators, turnstiles, and walkways to maintain distance.
- Provide additional parking or other transportation facilities, such as bike racks, to allow people to use individual modes of transportation.

D Restrict the use of common spaces, such as canteens and relief areas

- Limit capacity in common areas and workers' time spent there.
- Stagger break times to reduce congestion and contacts.
- Encourage workers to bring their own prepared lunch to site and to eat while respecting social distancing; stress the importance of not sharing food.

4. CONTACT TRACING

A Extend contact tracing beyond the work site to increase prevention reliability and efficiency

- Communicate and raise awareness within the workforce on H&S compliance beyond the job site.
- Ask the workforce to self-report any potential exposure to positive cases offsite.

B Identify vulnerable workers

- Train the H&S monitoring taskforce to understand the current guidelines on the criteria for clinically extremely vulnerable and clinically vulnerable groups.
- Define monitoring protocol and record book, including daily prescreening data from entry and exit points.
- Ask workers who live with extremely clinically vulnerable individuals to self-report, to be taken into account in task planning, in order to ensure that they are able to follow stricter H&S protocols.

C Define safety protocols for vulnerable workers

- Strongly advise extremely clinically vulnerable individuals not to work outside the home (if possible), supporting them to work from home in either their current role or an alternative one.
- Offer clinically vulnerable (but not extremely clinically vulnerable) individuals who cannot work from home the option of the safest available onsite roles, enabling them to stay 2 meters away from others.
- If they have to spend time within 2 meters of others, assess whether this involves an acceptable level of risk.
- Advise any worker who has been exposed to positive cases at home or on the work site to self-quarantine for 14 days.

D Restrict the use of common spaces, such as canteens and relief areas

- Implement a dedicated taskforce for H&S compliance, reporting to HSE team and project management, which can identify potential work site hotspots at every project work stage.
- Especially in campsites, consider segmenting workforce into “small families” to favor contact tracing (for example, living in a camp: same camp lodge and transportation; eat and work together).
- Set up weekly survey on 14-day symptom self-reporting, allowing H&S team to monitor health conditions.
- Consider closing the area of activity of potential positive-case workers for an approved disinfection process.
- Set up weekly survey asking employees to identify all coworkers they came into contact with that week.

5. SYMPTOM COMMUNICATION AND SELF-REPORTING

A Define a risk assessment framework and triggers based on job site exposure situations (for example, symptoms, positive test, close contact with an individual who tested positive)

- Define risk assessment and reaction protocol for different situations:
 - If worker exhibits symptoms, or has been in close contact with a colleague who has tested positive, advise immediate 7-day quarantine, mandatory testing, and self-reporting of daily health conditions.
 - Advise workers who were exposed to the area of activity of a positive case, but who never worked more closely than 2 meters, to monitor health conditions and self-report symptoms daily.
 - Recurrent exposure to job site hotspot.
- Initiate contact tracing protocol for any worker who tested positive or was exposed to positive cases.
- Consider closing the area of activity of potential positive-case workers for an approved disinfection process.
- Consider retiring equipment, such as tools used by positive-case workers, for an approved disinfection process.

B Set up simple self-reporting processes and tools for challenging situations

- Assign a go-to person responsibility within H&S taskforce, providing a single point of contact for workers to self-report symptoms.
- Set up specific online platforms, such as a website, to facilitate access to new operational guidelines and communication protocols.
- Establish a mobile weekly survey, asking employees to identify all coworkers they came into contact with during that work week (if no contact tracing tools have been implemented).
- Communicate and publish throughout the work site the channels for communication in the case of identified symptoms or exposure to positive cases (such as the contact person, telephone hotline, email, surveys).
- Introduce mobile daily or weekly surveys on symptom self-reporting to monitor health conditions.

6. COMPLIANCE ASSURANCE

A Create a project-specific H&S risk committee to monitor H&S initiatives

- Set up a monthly risk committee meeting, involving global H&S business unit members, project committee members, and work site managers.
- Set up a weekly risk committee meeting, involving project committee members and work site managers.
- Set up daily review and alignment between managers and crews.

B Set up a project taskforce that monitors workers' compliance with H&S protocols

- Define governance (roles and responsibilities) of H&S compliance between HSE representative and dedicated team.
- Appoint workers to join H&S compliance team.
- Report to project committee on identified risks or non-compliant activities.
- Daily reporting through H&S protocol checklist.

C Hold training sessions to raise awareness and go through H&S protocols

- Set up dedicated weekly training sessions for project managers and workforce in order to raise awareness and stress the relevance of the H&S protocols.
- Go through the still applicable operational guidelines and restrictions every week, making sure to update deployed signage and communication.
- Highlight lessons learned with regard to relaxed behaviors to ensure workforce compliance with new protocols.

D Reinforce communication across sites and key stakeholders

- Reinforce physical communication across the site such as signs and labeling, especially in areas with highest traffic (such as canteens, rest areas, elevators).
- Distribute an online handbook (for example, App) with new guidelines to all staff (including subcontractors and suppliers of building materials/equipment).
- Report established protocols to public health officials and unions.
- Reinforce communication of work site entry and exit protocols.

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