Chubb Construction Risk Engineering

Construction Resource Guide – Emerging Technologies

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Introduction

In recent years, technology innovations introduced into the construction industry have made available new tools and resources which can assist contractors with how their projects are managed, how quality is incorporated into design and process, how safety and security can be enhanced, and how documents can be managed effectively among many others.

Technology firms are creating advanced new tools that can be utilized day-to-day, incorporated into the design and construction of a project as well as to supplement necessary project functions such as Safety and Quality.

Technological innovations available now or becoming available, are tools in the toolbox that can be used alone or in conjunction with others, to enhance the broader overall effectiveness of a given program. These new tools will, over time, most certainly become more common in the construction industry and like the hard hat, Personal Fall Arrest Systems, and reflective vests, will become commonplace, utilized by an ever-growing list of construction firms across the U.S. One day, their use will no longer be the exception but the norm.

To maintain a competitive advantage both in project quality and worker safety performance, contractors must continue to look throughout the industry at these new tools and advances in their efforts to bring to bear the safest and most efficient means to complete the project and do business. Contractors should be always on the lookout for new equipment, software programs, and other tools to enhance their operations both in the office and in the field.

In this guide, we will review diverse types of Artificial Intelligence ("AI"), Internet of Things ("IoT") and other technologies becoming available to the construction industry to provide insight into tools that you may find useful in your efforts to build a better, safer project. This is not a complete listing of all available construction technology in the market today as this industry continues to grow and more products and equipment become available regularly, but it might serve as a good starting point for your research.

Although this guide is focused on the technological advances in the industry, companies specializing in construction tools and equipment as well as personal protective equipment, continue to enhance their existing products, add new product lines, and adapt designs for new applications to meet the ever-changing construction environment and risk; these opportunities should be continuously evaluated to ensure you are utilizing the safest and most effective tools and resources available.

Emerging Technologies

Water Sensors

Water damage prevention technology has come a long way. Today's devices incorporate sensors that not only alert an owner or contractor when moisture is detected or if potential major water damage issues occur, but they can also automatically turn-off a water source valve to stop further water infiltration.

These systems are often battery-powered or hard wired with a battery backup and have the capability to notify you with alerts via email or text. They can be implemented as part of a third-party monitoring program which can be set up to react to specific situations and notify personnel according to a building or projects response plan.[1]

Claims Reporting

Insurance carriers and third-party administrators ("TPAs") continually make advances in most aspects of the claims management system. The ability to access claims data, generate reports and utilize the information have come along way. Today, you can find systems that include data analysis and predictive modeling to assist a client in not only monitoring a claims lifecycle but also using the available data to determine probable risks and exposures based on your real-time claims experiences.

In addition, initial claims reporting, and incident response have become another area where technology has allowed for quick reporting and response.[2]

For example, the Chubb Environmental Incident ALERT[SM] is a program developed to assist Chubb Environmental clients find and dispatch qualified incident response contractors, monitor cleanup costs (in real time) and mitigate potential liabilities associated with environmental releases. Insureds can report an incident through an App, on-line or by phone, making it much easier today than in the past.[3]

Another example is for claims reporting where an App is also utilized for rapid reporting and response due to a loss. ESIS On Call for Construction is an example of such technology that provides ESIS clients with immediate access to resources needed to handle severe workers compensation or complex general and automobile liability claims. This system facilitates immediate engagement with your dedicated ESIS client service consultant; streamlined claim reporting and immediate nurse triage for injured persons.[2]

On-Site Medical Care and Telemedicine

An important aspect of your project's risk management program is the preparation and planning for the medical care provided to your workers should they become injured on the job.

On-site medical care and telemedicine can help ensure injured workers receive the care necessary to treat their injuries and help ensure this care is administered as quickly as possible. These services help ensure care is provided by qualified medical staff, and the patient is given the attention they need to resolve their concerns. Maintaining a positive experience for the injured worker helps to reduce undue stress as they navigate their treatment. Workers who feel they are being taken care of by their employers will be more open to limited duty options to bring them back to work sooner, will be likely to respond to treatment options and may be less likely to seek legal avenues if they are being well taken care of.

Typically, the employer will identify medical treatment locations near the project and provide this information to the workers in the event of an injury. Many times, the insurance carrier can provide their recommendations for treatment facilities they have had positive experience with and may also have agreed upon treatment cost schedules to help lower overall claims costs.

There are also times when your project is remote, where there are no medical treatment facilities in close proximity to the project or the project determines a need to provide onsite medical care where alternative medical care may be necessary or at least helpful. With the advances in technology today, there are options available where the use of telemedicine and or full-time onsite medical staffing may be the right fit for your project.

With the use of computers or mobile devices, telemedicine offers the convenience of being able to reach qualified medical staff around the clock. This enables medical professionals to speak to onsite first aid providers and to the injured worker directly. They will have the capability through video, to view the injury in real time to make an informed diagnosis for the worker and recommend next steps in the treatment process.

Depending on the need, you may also choose to staff the project with full-time onsite medical personnel who can provide immediate first aid, stabilize worker injuries and facilitate emergency evacuation of a worker should it be necessary. In addition to onsite care, some of these firms can provide other onsite occupational related functions such as administering drug and alcohol screenings if your project requires substance abuse testing, perform respiratory fit testing, EKG screening, provide routine health and wellness information to the workers, assist in identifying potential illnesses such as COVID, the flu, pneumonia, and heat related illnesses. These onsite medical personnel typically work within a designated and customized office location on the site that would be stocked with the supplies and equipment necessary to perform their intended scope of care.

Highway Work Zone Technology

Highway work zones continue to be one of the most dangerous work areas for construction. The combination of a project's traffic control plan, traffic control devices and inherent driver distraction creates what can be a perfect storm for serious injuries and deaths.

A work zone's signs, lighted directional boards, flaggers, channeling devices (cones and barrels), the mobile equipment, lighting (day or night), weather factors, and dust are some examples that create distractions for the public driving through the work zone that can lead to vehicle accidents.

Physical concrete barriers which are used routinely for long term work zones work to prevent a vehicle from entering the work zone once the driver has veered off the road, or an incident has occurred. The ideal situation is to create an environment leading up to and within the work zone that better aid drivers in understanding what to expect and how to proceed through it as well as provide advanced warning to the workers when those vehicles enter the work zone and may pose a danger to them.

Across the U.S., new safety and advance warning devices and smart systems are being tested by state Departments of Transportation, the Federal Highway Administration as well as contractors and municipalities that if proven affective, can be utilized to enhance the safety of a work zones for both contractors and the public. Some of the tools being implemented include the following:

Dynamic Lane Merge Systems (DLMS). These systems use dynamic (ability to change) electronic signs and other special devices to control vehicle merging at the approach to lane closures.[4]

Speed Management Systems. There are a variety of technologies available to help in managing and enforcing speed limits in work zones, including Variable Speed Limit (VSL) systems, automated enforcement, radar, and speed advisory systems.[3] Traffic-information systems for work zone and snowplow operations that combines

dedicated short-range communication (DSRC) technology and portable changeable message signs (PCMS) to communicate with all approaching drivers to improve traffic mobility and driver safety.[4]

Intelligent Traffic Systems (ITS). One example of this technology being evaluated, is in the state of Texas by the Texas Department of Transportation (TxDOT). They are using ITS as part of a construction traveler information system along a major highway construction project. The system provides motorists with travel time information for the 90-mile stretch of roadway that is being converted from four to six lanes. Dynamic message signs have been installed to let motorists know how long it will take to get to specific destinations along the route. This is the first phase in providing advanced traveler information along the route. Future phases will incorporate information about construction delays resulting from lane closures. The travel time information is obtained through sensors placed at locations along the interstate. Information will also be posted to the highway web site and provided through social media channels. The system will eventually connect to other ITS systems across the state to provide statewide traveler information. Once the project completes, TxDOT plans to maintain the sensors to help manage traffic along the highway.[4]

Other ITS in use as part of Smart Work Zones includes installing devices such as variable speed limit (VSL) signs, cameras, variable message signs (VMS) and Roadway Weather Information Systems (RWIS), as well as communication devices to help relay the information back the DOT's Transportation Management Center. This system will be used during construction and remain in place post-construction to help manage traffic.

Work Zone Intrusion Alert Technology. Work zone intrusion alert technology are systems/devices installed to provide roadway workers with alerts in a timely fashion, to provide them time to escape the work zone should a vehicle intrude into it. Alarm types can include visual, audio, and haptic (silent, vibrating).[5]

Incorporating additional "smart" technology to enhance a work zone can help a driver better prepare for the work zone ahead and better understand how to proceed through it as well as give the roadway workers advance warning of vehicle intrusions in turn providing them time to escape the danger area.

Autonomous Equipment and Robotics

Autonomous machinery and equipment are slowly creeping into the construction industry from 3D printing concrete components and larger structural elements such as foundations and walls to bricklaying, and site grading.

Robotics in construction is advancing in many ways. It has enhanced the ability to provide increased quality, prevent repetitive motion injuries (e.g., material handling) and perform in dangerous locations and conditions such as in confined and enclosed spaces, tunnels and for demolition operations.[6] For example:

Brick Laying
There are construction robots for brick laying and masonry, and even robots that can lay an entire street or sidewalk at one time. Robots are also being used for the highly repetitive task of tying

reinforcing bar or rebar on bridge decking and other areas. These types of robots can significantly improve the speed and quality of construction work.[6]

Demolition

In demolition, remote controlled machines look like mini excavators, but they do not have the traditional operator's cab. Breakers, loader buckets, crushers, or drills may be attached to hydraulically powered arms. The robots are easy to maneuver and can work in spaces too small to fit an excavator or skid steer and can accomplish their tasks faster than workers. Currently most of these machines are not autonomous but are remotely controlled. This is going to change as more autonomous machines are utilized in construction.[6]

Material Handling

While the major automakers and technology companies are working on self-driving cars, autonomous vehicles are already part of construction robotics. Such equipment can transport supplies and materials on a construction site, reducing employee exposure to injuries from lifting heavy loads, reduce or eliminate exposure to dust and vibrations, and prevent "struck by" or "caught between" injuries. Equipment manufacturers have been working on fully and semi-autonomous electrically powered end dumps and other common construction equipment that can move heavy loads without manual control. They have no driver cab and instead use a digital logistics-driven control technology to detect workers and other obstacles while moving on a project worksite.[6]

Solar Panel Installation

With the increasing push to transition away from fossil fuels to renewables and limited available manpower, there are energy firms who have tested and are now deploying autonomous robots specifically designed to complete large scale "utility level" solar panel installations.

These robotic systems are described by one of the firms as "an automated field factory" that can double installation productivity. The installation system makes use of digital twins, logistics software, an on-site digital command center, a field-deployed automated assembly line, and installation rovers that can operate 24/7.[7]

Rebar Placing and Tying Robots

Another innovation being offered in the bridge and concrete sectors is a robotic system that incorporates both a robotic machine designed to lift, carry and place horizontal and longitudinal rebar as well as its counterpart which is a similar robot that ties the rebar.[8]

The Rebar placing robot is said to be capable of placing up to an average rate of #5000 lbs. per hour and the Rebar Tying robot can tie 1200 + ties per hour and both robotic machines can be run day or night, rain, or shine.[8]

Both machines run along the existing edge form or screed rails and when used together, are said to provide up to a 50% savings on the schedule in addition to the potential reduction of worker injuries due to the elimination of workers having to perform these same repetitive motion tasks.[8]

Robots operate within a cell or work cell, which is an arrangement of equipment and resources, including at least one robot and a controller. Work cells can include safety barriers as well as all the equipment needed to do a particular task. Unauthorized access or entry into a robot work cell can result in a serious "struck-by" injury or death. Additionally, if an operator or controller in the cell is unfamiliar with the safety hardware within the robotic work cell, they can find themselves in a dangerous and potentially fatal situation. Preplanning, barricades, and employee training are essential to prevent these types of injuries.[6]

Utilizing robotics in construction is quite new and introducing it into your work environment before fully understanding the risks, exposures and work safety implications can result in injuries to the workers as well as losses to the project. It is important that before you decide on utilizing these types of equipment, you fully consider and evaluate the pros and cons, costs, risks, required controls, and worker safety and training requirements necessary to implement and effectively utilize this technology. [6]

Benefits to utilizing robotic equipment include needing fewer operators on the physical site, it reduces the need for personal protective equipment ("PPE"), keeps operators out of potentially dangerous site conditions and eliminates operators having to climb in and out of the cab; all of which can reduce potentially injuries and costs, including claims costs. Robotic equipment also allows operators to switch control of equipment on one site to another when needed, which can eliminate unnecessary travel between project locations and minimize operator down time through reduced travel.[9]

Robotic Site Layout

Using an autonomous layout robot synced to a Total Station, this technology now allows you to wirelessly link to your CAD drawings with the robot to "print" project layouts onto the floors. This equipment can create precise and accurate complex layouts such as intricate arcs and circumferences.[10]

This technology directs itself along the floor using the CAD drawings and established Total Station Control Points. The markings can be customized by interchanging the color cartridges in the robotic printer. The software allows you to run the program wirelessly using your laptop, tablet, or other mobile device.[10]

Using a robotic system such as this can help with manpower by limiting the number of workers needed to layout a floor or multiple floors, freeing them up to perform other tasks.[10]

3D Printing

3D printing has been around for some time and has been utilized by many industries, but it has more recently started to expand its presence in the construction industry.

Once limited to small scale projects used for models and design prototypes, it has now proven itself as a potentially viable solution in constructing larger and more complex projects. Residential homes have been constructed using this technology as well as the world's first 3D printed office building which was completed in Dubai.

For larger multi-level structures, it requires the use of large, heavy concrete printing machines some weighing over 10 Tons, to extrude the complex layers of concrete. The project team for the Dubai

project stated "The use of 3D-printing fabrication technology, plus the subsequent assembly process, the firm says, cut labor costs by 50 to 80 percent and overall construction waste by 30 to 60 percent."[11]

Drones

Construction is one of the fastest growing industries to utilize commercial drones in addition to industries such as agriculture, law enforcement and public safety. Where adopted, drones can provide a flexible and adaptable means to observe and manage a project through photograph and video technologies as well as complete tasks, for example, in remote locations where worker travel and involvement can be avoided. Drones can provide a contractor with savings in time and cost as drones can be less expensive overall than the typical use of helicopters.

The adaptability of drones along with the evolving sophistication of software, cameras, video quality and applications, along with specialized equipment, can provide a diverse capability to contractors. This can include monitoring project conditions and progress, managing and coordinating sub-contractors, supplementing, and enhancing your Quality Control and Assurance programs.

Drones offer varying levels of capability and contractors continue to use creativity in exploring new and innovative ways to improve their processes through use of drones. Much of their utility will depend on the level at which the company has embraced them.[12]

Proximity Devices

The use of proximity devices either being tested, adopted, or considered by companies is on the rise. Proximity devices are systems that monitor, and sense other objects fitted with sensors, such as persons or equipment, and provide a notification when they enter a pre-determined area or relative proximity. These sensors trigger the system which relays information depending on the purpose of the system.

The following are some uses of a system that utilizes proximity sensors:

- To establish a controlled access zone — the system warns the workers and those monitoring the system when workers or equipment enters an unauthorized area. This is also known as Geofencing.

- Another example would be to establish a system where project equipment is fitted with sensors and when a person comes within the established danger zone (Proximity to the moving equipment or vehicle), a warning is issued to the operator to stop operating the equipment and to the worker warning they are in a location with the potential of being struck by the equipment.

- These sensors can also be used to create and supplement an emergency action plan for a building under construction by monitoring the number of workers on the site and their locations as well as assist the safety and claims department when a worker falls. Some proximity devices have sensors that can monitor acceleration and position and provide notification when a worker wearing one is involved in a slip, trip or fall.

Site Equipment Technology

As noted above, vehicles and equipment can be retrofitted with proximity devices to provide audible and haptic (Vibration) warnings when a worker enters a danger zone around the equipment.

In addition, systems now available create virtual barriers around the equipment to provide visual identification of the danger zone for the worker when working or walking near equipment. These systems are also available for cranes.

The equipment is fitted with colored laser lights which project warning lines around the equipment. For cranes, this can project a barrier on the ground which is considered a danger zone where overhead lifting is taking place. Since these lights are mounts on the equipment, as the equipment moves throughout the work area, the visual barrier travels with it.

Wearables

Wearable technology is a broadening concept as increasingly smart devices are created and/or adapted to perform additional functions within a system.

Such as with a smart watch that can provide a myriad of biological information from heart rate to O2 saturation, some can monitor and provide visual EKG's and detect many different types of heart arrhythmias, wearables can also provide functionality that can feed into a system to track and monitor worker performance, potential falls, resting time, location and much more.

Workers along with their families, and friends wearing their personalized devices (Smart Watches, Fitness trackers etc.,) are increasingly getting use to them. The idea of employers requiring their use and workers understanding how they can help the organization as well as protect them in the event of an emergency is not that foreign any longer and less of a challenge to incorporate them into your company's requirements and daily use on site.

Another capability and use of wearables is to assist workers and their employer in detecting and controlling heat related exposures among the work force. A system being tested in the western U.S. for example, utilizes an arm band, smart watch and phone application to monitor a worker's heart rate, and body temperature among other biometric indicators. If thresholds are met, an alarm is sent to the worker as well as the worker's supervisor warning of a potential heat related illness. This allows supervisors to monitor and manage the workforce and take steps necessary to control these types of potential injury.

If you are investing in a system or systems designed to enhance the safety and quality performance of your company, you should not discount adding wearables as a functionality if available.

Emergency Response

Emergency response is an important and often underappreciated aspect of a project's operational and safety process. Typically, a project will do a search of nearby emergency services and identify those which can be the closest and have the availability to respond to the site in the event of a fire or other emergency. In additional, there can be other emergencies that occur onsite that would not involve calling emergency services such as abrupt weather conditions (Tornado, Flooding, Thunderstorms and Lightning etc.) where a protocol should be in place to notify those on site and direct them to a specific muster area or to implement specific actions to prevent loss.

Unless a there is a specific required protocol due to owner requirements or location, little is typically done to enhance this effort aside from using passive signaling devices such as air horns, phone/cell phone notifications and word of mouth. All of those have their limitations such as wireless signal strength, distance, structural design, confinement, and the ability of the device (cell phone) to be heard. As a result, it may be necessary to use redundant actions to ensure everyone on the site hears the alarm and can react.

There are also phone applications (Apps) that are available that can be set up to provide messaging alerts but cell service and signal strength can pose challenges. In addition, any sound alerts would be subject to the ability of the phone's speakers and volume decibel capability which may be insufficient in some locations.

Some of the monitoring systems discussed in this guide may have wearable devices that are linked to an emergency response capability which will identify each wearer's specific location within the project as well as alert workers via an audible alarm, from a vibration and visual notification (flashing light). The system's "network" is established on each level and throughout the project so there is little or no signal loss; the alerts are not prevented from activating and functionality is not interrupted.

Automated External Defibrillator or AED

Although not typically thought about when considering the construction technology market, you cannot forget to include lifesaving devices such as the Automated External Defibrillator or AED.

AEDs are used to revive someone from sudden cardiac arrest. This usually occurs when a disruption in the heart's electrical activity causes a dangerously fast heartbeat (ventricular tachycardia) or a fast and irregular heartbeat (ventricular fibrillation). Either of these irregular heart rhythms keeps the heart from pumping effectively and can cause it to stop.[13]

When this happens, the brain and other vital organs don't get the blood and oxygen they need. This requires treatment within minutes to prevent death. The sooner the heart's rhythm is restored, the greater the chance there won't be permanent damage to the brain and other organs.[13]

If an AED is near someone having ventricular fibrillation or ventricular tachycardia, a bystander in a public place, a family member or a co-worker can use it to jolt the heart back to a regular rhythm. Using the AED could possibly save a life.[13]

Cardiopulmonary Resuscitation (CPR) after cardiac arrest can keep blood flowing to the heart and brain for a time. But often only defibrillation can restore the heart's rhythm. Together these treatments can improve the chances of survival.[13]

The automated external defibrillator gives you step-by-step voice instructions. It will tell you how to check for breathing and a pulse and how to position electrode pads on the person's bare chest. When the pads are in place, the AED automatically measures the person's heart rhythm and determines if a shock is needed. If it is, the machine tells the user to stand back and push a button to deliver the shock. The AED is programmed not to deliver a shock if a shock isn't needed. If CPR is still needed, the AED will also guide users through CPR. The process can be repeated as needed until emergency crews take over.[13]

Aerial Work Platform

Over the years, workers have sustained injury or death in crushing accidents where the worker is caught between the platform basket and an overhead obstruction such as a beam, catwalk, or other elevated structure.

To prevent these types of injuries, AWP manufacturers have designed prevention devices that can be installed which will sound an alarm and shut down the lift's ability to elevate if the worker causes the bar to depress to a specific threshold.

These devices give the operator the ability to lower the lift before it reaches a point where the operator can become injured. In addition, it notifies those around the lift that the device has been triggered allowing them to investigate and assist if necessary.

Site Safety Monitoring

Another AI technology is the use of cameras/video strategically located around the project that capture job site activities throughout the day then using algorithms and human analysis to review and detect unsafe actions and conditions.

Reports can be generated and sent to project management to supplement onsite safety audits and resulting observations. This information can be tracked overtime to determine if past observations have resulted in corrective action and a change in the safety culture as well as to provide a sort of checks and balance to the site teams actions.

For example, the software may review a video feed in which a trench is being excavated. During this operation, a worker is seen in the video crossing directly behind the moving excavator in what would be a potential "struck by" incident. This may have happened when the foreman was facing another direction and was not able to intervene to correct the worker. In this case, the AI and personnel who reviewed the video feed would identify this issue and include it in the report provided to the site.

The information provided from the above example can be utilized by project management to train or retrain that crew's workers about those types of hazards as well as implement corrective actions to prevent reoccurrence. Ideally over time, these types of exposures would not be as frequent or not occur at all.

Quick Response (QR) Codes

QR codes can also be utilized for worker safety, quality control, vehicle fleet management, owner facility equipment training, and maintenance tasks as well to name a few.

These codes are being used to provide links to specific equipment and material training for building facilities maintenance workers as well as being placed on the equipment and building fixtures so when repair parts need to be ordered, the worker scans the code, and the parts information is immediately accessed on their smart device. If facilities workers are required to perform a scheduled maintenance activity, the QR Code when scanned can provide the required procedure to follow. This can be a value add for an owner when choosing a contractor; it can streamline operations once construction is completed, and the building is turned over.

QR codes are found virtually everywhere these days from shopping malls to magazines to TV commercials, but they are also becoming popular and utilized in many aspects of the construction industry.

QR code use is a way for a contractor to simplify how their workers receive necessary information. For example, creating project orientations, specific equipment training videos, inspection checklists, equipment data plate/inventories and much more; then link them to a QR code where project workers can scan the code and receive the information directly on their smart device. The specific QR Codes are affixed to identified locations around the project where they can be accessed when required.

QR Codes can also be used for quality management, owner maintenance and training as well as vehicle fleet management. Tasks that are particularly suited for implementation with QR Codes can include inspections, training, reporting of safety issues as well as mobile equipment inventory control to name a few.

In the same fashion as worker training or building facility maintenance, a contractor can create QR codes for each piece of equipment, the driver can use the codes to pull up vehicle specific inspection checklist, driver training, or other required task information. The same can be used for mobile equipment such as earth movers, cranes, generators, air compressors etc.

A QR code created by your firm's marketing department and placed on the vehicle can provide a way for potential clients to find out pertinent contact information for your company by simply scanning the code.

Material Handling

Many advances in exoskeleton technology allow for the use of worker augmented "suits" and devices which can provide the support and additional capabilities to the worker when lifting, pushing, and pulling objects that would normally require the use of multiple workers in tandem. These exoskeletons can help prevent worker injuries, prevent fatigue and minimize worker downtime. In addition, these devices have software that can monitor the user's motions and position in the work area to identify potential risks, and process enhancement opportunities.

IoT Safety and Contractor Management Systems

Utilizing a third-party vendor to manage, document, and process contractor pre-qualification documents has been around the construction industry for many years. However, in recent years with the increasing expansion of the internet, related technology (IoT), and the use of algorithms, there are a growing number of third-party vendors who can, with the purchase of their system, create customized contractor management, safety inspection and database systems.

Contractor management systems can assist a contractor in inputting, reviewing, and analyzing pre-qualification documents. These systems, through the use of algorithms, can review text, verify completeness of forms, categorize documents, as well as create scoring mechanisms based on a contractor's requirements of the input data. This allows the system to complete much of the laborious work required to enter and analyze this data allowing more time for the contractor staff to perform other needed tasks.

Safety inspection management is another useful aspect of these same systems in that a contractor can utilize "canned" forms and system requirements or customize their own. Inspection reports can be created specific to a contractor's operations, capture the data input from those forms, store and use that data to analyze observations and recommendations, create reports etc. Being able to store and create reports based on the continuously growing amount of inspection data can be a valuable tool when tracking compliance, determining if a new control recently implemented is influencing observations and potential claims, and managing project subcontractor's safety performance to name a few.

These systems still however require a level of human interaction to review and quality check what outputs are being created and for decision making once the data has been provided and reviewed. These systems may be great in creating consistency, thoroughness,

and timeliness in reviewing documents and creating consistency in inspection processes and data collection for example, but they still only perform what they are created to within specific parameters. Project staff should review the outputs and ensure they understand what is being provided, how it affects the organization, validate the system is correctly analyzing the data etc.

Digital Project Drawings and Document Management

The days of unrolling or carrying around large print drawings on the project and into planning meetings is becoming a thing of the past. While these 2D drawings are still being utilized, the age of digital drawings is here. When combined with a construction documentation and storage platform, mobile devices, and monitors, the project management team can more efficiently and accurately manage the project.

The use of digital drawings and software has made it far easier to markup a set of plans in real time and instantly create updated versions, so the entire project is working from the same up to date set. Coordinating, commenting on, taking off quantities, and measurements can all be done quickly with the built-in tools and functionality that the digital reader software provides.

Project supervision can walk the site with a tablet, pull up a drawing, comment, mark it up and save it, send it to another contractor or party to review quickly and easily all while being tracked and all previous versions archived for future reference.

Depending on your company's needs, the platform you purchase, or use can be customized to ensure you are proving the project management team what they need to perform most efficiently.

3D Augmented Reality (AR)

One of the most advanced technologies being utilized today is 3D Augmented Reality (AR).

This engineering tool is typically utilized with head gear fitted with a visual display device that projects the augmented reality displays for the wearer to see. Augmented Reality brings together both the use of physical plans and drawings with a digital process bringing the user into the combined environment.

As the wearer walks throughout the project site, the system uses GPS, cameras and installed geographic markers that tell the system what drawings to project for that specific area. As the drawings are viewed, the user can access details, verify installation progress, take measurements, look for potential discrepancies or conflicts. Changes can be made to the drawings in real time, documented, coordinated and decision making can be achieved while touring the site.

Other smart AR devices can be utilized for maintenance activities where the worker can view for example, an automatic control valve within a refinery; the schematics, maintenance activities and specific instructions on how to perform the activities can be viewed for the worker performing the activity.

Mobile Devices

Gone are the days when you had to carry around a log or journal to document your daily activities and project observations. There are now countless software options developed that can be purchased, subscribed to, or downloaded for free that allow you to perform virtually all your documentation functions using your mobile phone or tablet.

The software available can be as simple as pre-designed safety or job site inspection forms to sophisticated database systems that allow for custom reports, inspection forms, photos, and video as well as view and mark-up construction drawings. Documents can be distributed to other contractors and comments and versions of drawings can be tracked. The advantages of utilizing a system such as this can greatly enhance your field capabilities and save time and resources in the process by enhancing safety audit and corrective actions processes, communicate and coordinate with other contractors and ensure everyone on the job is up to date with the latest drawings to name a few.

Telematics

Telematics is the term used to describe a vehicle technology that can monitor a number of different performance and mechanical diagnostic data points for a single vehicle and driver or your entire fleet.

As the vehicle is being operated, telematics systems monitor and store driving metrics. This data allows the fleet manager to view in real time a specific vehicle's location through GPS, keep track of vehicle assets, engine diagnostics, braking and acceleration, run time, idle time, a driver's operating behavior, and more.

In addition, a fleet manager can run reports based on this information to manage their fleet. A telematics system can help a company to manage not only the vehicle mechanical aspects, but also driver and safety of the public due to operator fatigue, mechanical failure, and at-risk driver behaviors.

Many insurance companies also provide a version of this type of system for personal vehicles as well that are a plug and play device using the vehicle's communication port. A driver who installs these in

their personal vehicles, agrees to allowing the device to send these diagnostics to the insurance company and may receive a credit on their premium costs if they display acceptable driving behaviors.

As with any technology, if you choose to have this installed and utilized in your fleet, it is important to know what data the system can capture, want information you want to capture, how to understand what this data is telling you and most importantly what to do with the data when you have it.

You do not want to have a system providing information that shows poor mechanical performance of a vehicle or at-risk driving behaviors for example and not use it to affect positive change and enhancements to correct these issues. Should an accident occur, and you have and should have known these at-risk conditions exist but did nothing about them, that omission could increase your organization's legal liability.

Integrated Vehicle Safety Systems

It wasn't long ago when vehicle air conditioning, premium sound system, alloy wheels, leather seating and power windows and locks were all options and expensive ones at that. Today, most vehicles, even those in the lowest trims come with many of these as standard features.

The same now holds true for driver safety technology. Many new features such as active cruise control; where the vehicle maintains a set distance from the vehicle in front of you and will accelerate and slow based on the other vehicles speed, cross traffic alerts and blind spot indicators are also standard features on many cars.

In addition to those, there are a number of other technologies available that can be purchased as options or in technology packages that are designed to protect your driver and vehicle from driver

inattentiveness, sudden braking in front of you, alert you when your hands are off the wheel, and provide multi-point and 3D full 360 camera views to name a few.

Having these vehicle options included as part of your fleet purchasing agreements can provide an additional level of safety you may not currently have.

Vehicle and Equipment Camera Systems

Another form of technology that has become widely utilized in a vehicle fleet are front and rear vehicle cameras as well as driver facing (In-cab) cameras.

Many vehicles today are being sold with front and rear cameras as standard equipment whereas early on they had to be either added as an option or retrofitted by a third party. These are great options to aid the driver in backing up and pulling fully forward in parking or other traffic areas.

Other types of cameras are those that are continuously recording from a forward facing, rear facing or driver facing camera. These recordings, depending on the capability of the system and possibly a subscription, can be maintain in the event of an auto accident. The cameras are a great tool to review post-accident to aid in the investigation to see what took place, what other vehicles may have been involved, validate claims information and potentially court testimony. Used as a defense, the video and/or still camera footage may be able to aid in closing claims quickly.

In addition to being used as a post-accident investigation tool, driver facing cameras can provide live video as well as capture video and store it to be used to monitor a driver's habits and to determine potential training or retraining requirements for a specific driver.

Closing

As with other tools and resources put into use over the years, the types of available technology discussed above should not be relied on alone or purchased with the intent of replacing prudent project management or safety functions and oversight. Rather they should be used to supplement and enhance existing processes and provide supporting capabilities to the construction team.

In the end, project management and safety should use these tools to assist them in their efforts and to help guide them toward safer behaviors, processes, and policies.

It is important to remember, that everything has its limitations and will not be effective or practical in every scenario; they must be evaluated, determine implementation and usage costs, and tested before being purchased to understand where they can fit into the process and how or if they can help in your efforts.

Understanding the benefit of emerging technology, the data that can be obtained from it, and how that data can be used is necessary to ensure your time and money are well spent. You want to ensure what you choose to implement will aid you in achieving your goals whether it is for worker safety, building quality, or other goals you are working to achieve.

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