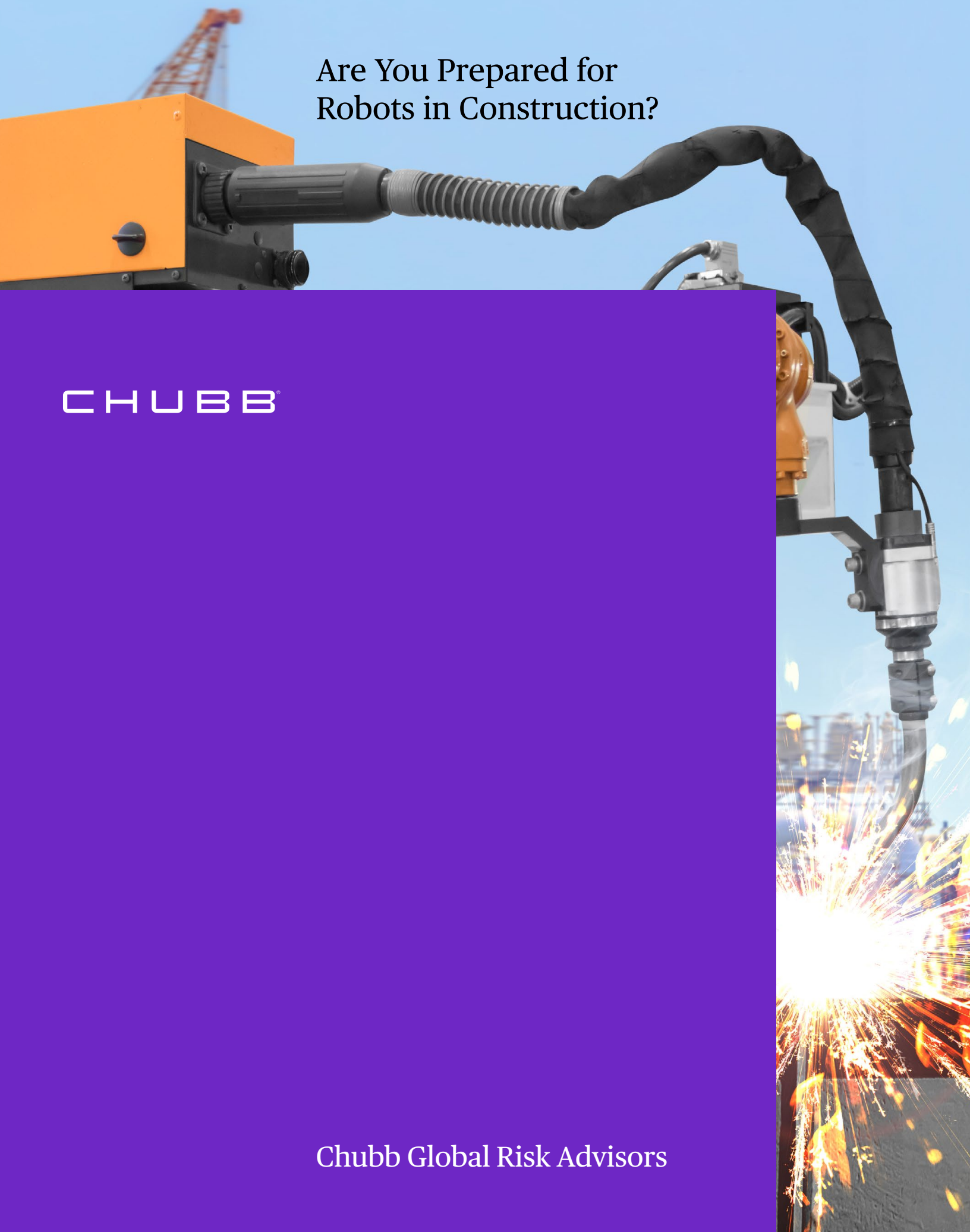
# Are You Prepared for Robots in Construction?



CHUBB

Chubb Global Risk Advisors

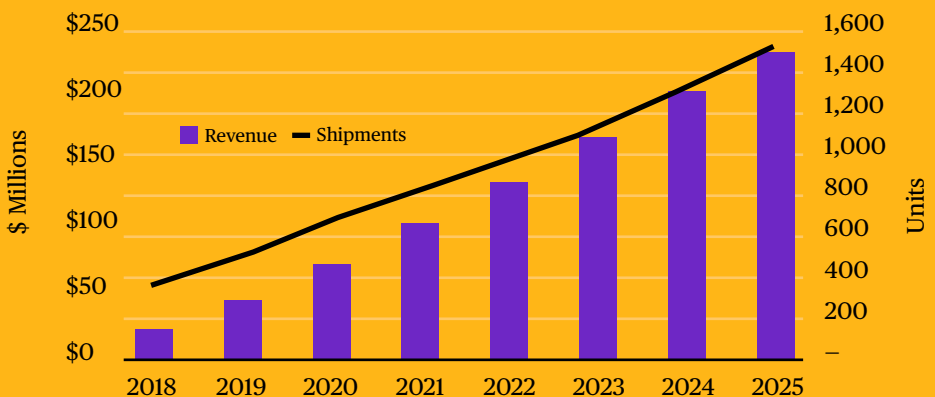
## In 2020, Few Robots Were in Use on Construction Sites, But That is About to Change in a Big Way

The construction industry is getting ready to introduce robots on worksites on a large scale to improve efficiency and safety. The industry has faced challenges in using robots, primarily because tasks in this industry are difficult to automate and the changing nature of the worksite presents challenges since robots are often best suited for repetitive tasks that occur in a consistent, unchanging environment.

Construction businesses, however, believe that introducing robots into the construction workforce will help them improve construction project duration and quality of the work, although manual labor will continue be a significant element of construction. Construction contractors and developers need to understand this new technology, weigh the pros and cons, and train their workforce to avoid the hazards automated machines may create on their worksites.

According to the International Federation of Robotics and the Robotic Industries Association, the construction robotics market will experience a compound annual growth rate (CAGR) of 8.7% between 2018 and 2022. Research firm IDC is more bullish, predicting a CAGR of 20.2%.

**Construction Robots Revenue and Shipments, World Markets: 2018 – 2025**




Source: Tractica

# Benefits of Robots on a Construction Site

Knowing the many hazards that can be encountered on nearly all construction projects, construction managers or owners may be wary of placing robots on any construction jobsite. But giving machines the ability to function autonomously, without the need for human interaction, offers opportunities to improve safety for all workers and augment quality controls.

Source: Advanced Construction Robotics, Inc. Used with permission.

**Robots' contributions fall into three major areas:**

### Repetitive tasks

Musculoskeletal Disorders (MSDs), such as HAVS Hand-Arm Vibration Syndrome (HAVS), tendonitis, tennis elbow, thoracic outlet syndrome, and bursitis, account for 25% of workplace injuries in the construction industry.[1] Many of these injuries are caused by repetitive motion.Using robots to perform repetitive motion tasks can help reduce the likelihood of repetitive stress-related injuries for workers.

### Performing Dangerous Tasks or Operating in Dangerous Environments

Although workers in many industries work in confined spaces, construction has the most fatal workplace injuries related to this exposure.[2] Robots can perform the more hazardous tasks, reducing the need for employees to enter confined spaces, such as ducts, crawl spaces, and tanks, as well as other potentially dangerous work areas. In addition, robots can handle a number of demolition tasks, eliminating the need to have employees perform this potentially hazardous work.

### Quality Control

Errors can occur on any project, but using robots can help ensure quality controls are implemented more consistently on a project, thus reducing the likelihood of construction defect claims. How Robots are Being Used on Construction Sites

1. Bureau of Labor Statistics
2. OSHA

# How Robots are Being Used on Construction Sites

### 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 on bridge decking and other areas. These types of robots can significantly improve the speed and quality of construction work.

### Site Inspections –

Aerial drones and ground-based robots can survey a worksite and gather multiple types of data, including visual data that can be used for inspections, depending on the sensors used. Project managers, safety managers and superintendents must walk the site to conduct final inspections. Construction robotics and drones can help all of these processes.

Robots and artificial intelligence (AI) are also being used to monitor jobsite progress with real-time, actionable data. This technology uses autonomous rovers equipped with high-definition cameras and LiDAR (a surveying method that measures distance to a target by illuminating the target with laser light) to photograph and scan the construction site each day with pinpoint accuracy. AI then uses those scans to compare results against building information models (BIM), 3D drawing, schedules, and estimates to inspect the quality of the work performed and to determine how much progress has been made each day.

### Demolition –

In demolition, remote controlled machines look like mini-excavators, but they do not have the traditional operator's cab. Instead they run on tracks. Breakers, loader buckets, crushers, or drills may be attached to hydraulically powered arms. The robots are easy 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.

### 3D Printing –

The role of 3D printing in the construction industry will continue to grow. The ability to build outside or directly on a project worksite has clear advantages in terms of labor and material costs as compared to more traditional construction methods. 3D concrete printing is emerging rapidly and relies on many technologies and materials, offering its users many advantages.

### Materials 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 equipment, and exposure to dust and vibrations, and being pinned by equipment. Equipment manufacturers, including Volvo, Komatsu and Caterpillar, have been working on fully and semi-autonomous electrically powered end dumps and other common construction equipment that can move heavy loads without additional input. 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.

Want to know more about how robots are being used in construction? Check out this video on robots in action on construction sites from the TechnoBolt channel on YouTube.

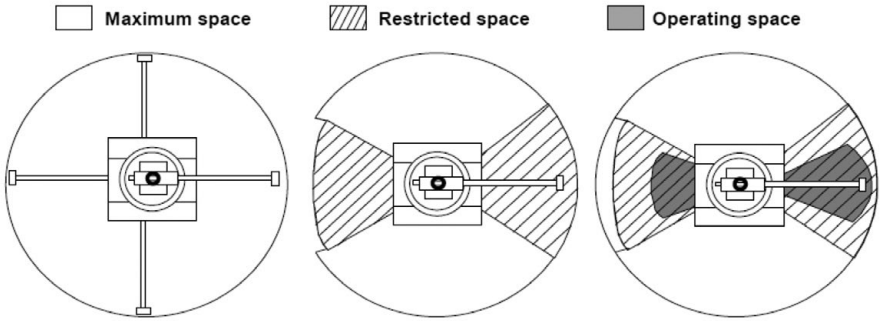
# Robot Safety Issues on Construction Sites

**There are a number of safety issues that can arise if robots are used on construction sites.**

**Unauthorized Access –**

Robots operate with in 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 injuries.

*Illustrations of work cells for robots:*




Source: OSHA

**Human error –**

Whether they are performing preventative maintenance programming or operating the robot work cell, construction workers have the potential to place themselves in hazardous positions if they do not understand the robot's motion path. As with any exposure, over familiarity or over confidence can also contribute to errors.

**Control Errors –**

Errors in the robot's hardware or software controls can result in injuries that occur within a robotic work cell. If the controls system malfunctions, the robot system may respond is ways that create a dangerous working environment, especially if humans also work in or close to that cell.

**Improper Installation –**

The safety of the operators of a robot depends in part on proper installation or set-up of the work cell. The robot should be tested before it is fully operational. If the robotic work cell is inaccurately setup or the original design or specifications are changed, hazards may occur.

**Mechanical Failures –**

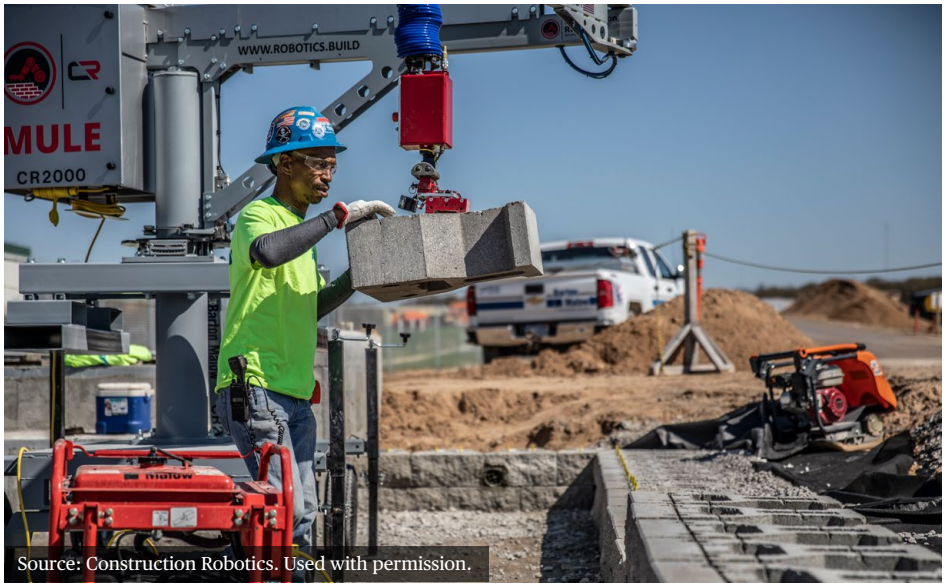
Those involved in designing or programming robots may not always take mechanical failure into account. Unexpected failures can create a potentially dangerous situation for the operator or others in the work cell.

**Power Systems** –

Industrial robots will often utilize significant electrical power loads creating potential electrical hazards. If power sources that connect to or have communication with the robot are disrupted the result can be a release of energy that creates a hazardous environment for an operator or other employees in the area.

**Environmental Sources** –

Outside factors and communication interference can create an undesirable effect on a robotic work cell. A robot's functioning can be affected by changing conditions at the worksite or by adverse weather. Communication interference can also have an undesirable effect on the work cell.



Source: Construction Robotics. Used with permission.

## Managing the Robot Exposures on Construction Sites

As with any introduction of a new technology into an industry unfamiliar with it, training and education should be the primary consideration by any firm that utilizes robots on a construction site. The hazards associated with robots are preventable as long as workers receive training on the robotic procedure and the robotic equipment on site has fulfilled all job requirements, including proper installation, programming, and risk assessment. When the robot /work cell equipment arrives on site the specific hazards associated with it should be taken into account by the safety manager and shared with all employees on site. Education and hazard prevention information should also be incorporated into the site safety and health plan and active job hazards analysis.

Traditional safety measures can be easily adapted to assess and mitigate exposures that may arise from the use of robots on a construction site.

### Job hazard analysis

Work with operators to develop a written job hazard analysis for every type of task involving the robot onsite. The appropriate level of safeguarding should be determined by the risk assessment, and then applied to the specific machine. The hazards will vary depending on the type of machine so the job hazard analysis or risk assessment should be specific to the work cell and the task.

Consider incorporating the following into the job hazard analysis:

- The intended operations at the robot, including teaching, maintenance, setting, and cleaning;
- Unexpected start-up;
- Access by personnel from all directions;
- Reasonably foreseeable misuse of the robot;
- The effect of failure in the control system;
- Where necessary, the hazards associated with the specific robot application.

**Safety Training**

- Incorporate manufacturer's safety instructions into employee and worksite training during safety huddles and site orientation and ensure that workers adhere to them.
- Arrange for each operator to work with a trained spotter, in order to limit the risk operator safety errors or unauthorized employees entering the work cell.
- Train workers to stay outside of the robotic work cell whenever the robot is in use, is turned on, or is not in emergency stop mode.
- Train workers to continually reevaluate hazards around and in the work cell. Training should include on safety hazards specific to the robots on the worksite

**Barriers and warning systems**

- Install a proximity warning system that can automatically alert workers if they come within an unsafe distance of the robot.
- Consider physical barriers or barricades surrounding the robotic work cell.

**Refer to established standards**

In addition, the American National Standards Institute (ANSI) has published ANSI/RIA R15.06-2012, Industrial Robots and Robot Systems – Safety Requirements, that provide guidance on using robots safely.

## Need a hand?

"Business as usual" can make it hard to identify many exposures that often go unnoticed. Risk management specialists can help a firm assess its workplace and identify equipment, fall and other hazards. They can help you address issues such as:

- What types of projects need an onsite safety manager? How many?
- Is the robot or autonomous vehicle set up properly; does it have the necessary barricades and warnings?
- Are spotters utilized during operation of the robot?
- Is there a written job hazard analysis for the robot operation? Can the process be improved to reduce risk?
- What level of awareness and training has been conducted on the project work site regarding the use of robots?

Risk management specialists can also evaluate the effectiveness of management control programs and operational controls in place to reduce or minimize struck by hazards and other risks to employees. They can work with you at evaluating the hazards associated with robots from pre-job planning and hazard assessments to and job safety task analysis (JSTA) in order to eliminate, prevent, protect, and monitor controls and to identify additional controls needed.

## Connect with Us

Chubb Global Risk Advisors can help you assess the hazards created by the use of robots on a construction site – as well as the many other hazards present in the industry.

Globalriskadvisors@chubb.com

866.357.3797 (toll-free)

**www.chubb.com/CGRA**

## References:

www.cdc.gov/niosh/topics/robotics/default.html

https://webstore.ansi.org/standards/ria/ansiriar15062012

www.ishn.com/articles/107815-ansiria-r1506-2012--the-industrial-robot-safety-standard

www.construction-robotics.com/

www.robots.com/articles/innovations-in-construction-robots

https://esub.com/how-robots-are-changing-construction/

www.claimsjournal.com/app/uploads/2019/08/bigstock-builder-worker-in-safety-prote-42740026-580x386.jpg

https://connect.bim360.autodesk.com/robotics-in-construction-history

www.therobotreport.com/construction-robotics-changing-industry/

www.osha.gov/dts/osta/otm/otm_iv/otm_iv_4.html

www.bastiansolutions.com/blog/7-industrial-robotics-hazards-and-how-to-avoid-them

Chubb Global Risk Advisors℠ is a service of ESIS®, Inc., a Chubb company. Chubb Global Risk Advisors℠ provides claim and risk management services to a wide variety of commercial clients. ESIS' innovative best-in-class approach to program design, integration, and achievement of results aligns with the needs and expectations of our clients' unique risk management needs. With more than 60 years of experience, and offerings in both the U.S. and globally, ESIS provides one of the industry's broadest selections of risk management solutions covering both pre and post-loss services. Chubb is the marketing name used to refer to subsidiaries of Chubb Limited providing insurance and related services. For more information, visit us at www.chubb.com.

Chubb Global Risk Advisors' loss control services are not a substitute for, and do not excuse a client from, fulfilling any legal duty they may have to provide a safe workplace, premises, product or operation. Chubb Global Risk Advisors' loss control services are not intended as a substitute for advice from legal counsel, nor are they intended to supplant any duty to provide a safe workplace, operation, product or premises. Any duty to implement Chubb Global Risk Advisors' recommendations rests with the client not with Chubb Global Risk Advisors.