



How Powered Exoskeletons Can Alleviate 4 Key Construction Pain Points



Custom content for Sarcos Robotics
by **Construction Dive's Brand Studio**

As contractors face new productivity and margin challenges related to labor shortages, injuries, and safety, this new workforce multiplier hardware holds the potential to revolutionize construction

Last week, a major construction firm lost one of its best workers to a back injury that happened while loading heavy material during a last-mile transport where a forklift wouldn't fit. Now the worker is out for an undetermined amount of time, and the job has already slowed. The company lost a key worker, but it will also need to pay thousands of dollars in worker's compensation and spend extra time and effort finding a replacement. With so much market uncertainty and a persisting labor shortage, the result is the industry's worst problem — lost margins and productivity.

Every day, this scenario plays out at countless jobsites nationwide. The federal government estimates the construction industry's total costs of fatal and non-fatal injuries at a whopping \$13 billion each year, according to [figures from CPWR — The Center for Construction Research and Training](#).

That's 15% of the costs for all private industry. The average cost per case of fatal or non-fatal injury is \$27,000. And that's almost double the per-case cost of \$15,000 for all industries.

It gets worse: one in every ten construction workers is injured annually, and construction sees non-fatal injury rates that are 71% higher than any other industry. A company must sell an additional \$1,667,000 in services to offset \$50,000 in losses from injuries, illness, or damage and still make a 3% profit, [according to CPWR data](#). As the industry struggles with an ongoing labor shortage, the COVID-19 pandemic has only heightened labor challenges.



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Source: [The Center for Construction Research and Training](#)

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“In our industry, we see workers being forced to retire because of an injury sustained at work or simply because they just can’t swing a hammer like they used to,” said Kaushal Diwan, national director of innovation at DPR Construction. “Effectively addressing tasks with higher levels of risk, especially heavy lifting tasks, would have the best potential for the construction industry.”

To date, contractors have tried to address safety and injury problems with data-driven software solutions. But these approaches require training workers to use the new systems and rely on them accurately inputting the data. Then there’s the matter of being able to use and make sense of the data effectively.

Other industries have turned to solutions such as robotic arms used in auto manufacturing. And new robots that perform tasks such as bricklaying are entering the construction field. But other than cranes and forklifts that often aren’t workable in crowded jobsite situations, a true worker-level hardware solution has not been available.

Fortunately, innovative hardware in the form of full-body powered exoskeletons is on the horizon, promising to change that — and potentially revolutionize construction. As the name suggests, using the technology means users are wearing a robotic suit powerful enough to augment human strength, thereby reducing fatigue. The technology is agile enough to allow workers to use their own hands for such tasks as screwing on a bolt or fastening sheetrock.





While the approach may sound like science fiction, many industries are already evaluating this technology for future deployment. For example, the [Guardian® XO® exoskeleton from Sarcos Robotics](#) is in a pre-commercial testing phase with organizations like the military and companies from the manufacturing and airline industries. The solution also shows particular promise for construction because their full-body, battery-powered design packs more lifting power, mobility, and flexibility.

“Customers light up when they see the Guardian XO robot and the potential for the industry,” said Kristi Martindale, EVP, product strategy and chief customer officer for Sarcos.

“I believe it's a task-transformational technology that can be a game-changer, not only for employees but also for the construction industry as a whole.”

Forecasters agree: “ABI projects the total market value of the global powered exoskeleton market to exceed \$11.5 billion by 2030 with full-bodied, powered comprising \$4.9 billion in that same time period. Units deployed are expected to exceed 392,000 per year in the same time span,” said Rian Whitton, senior analyst, [ABI Research](#).

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The Twin Problems of Injury and Labor

Safety risks on construction sites can be especially high during the so-called last-mile transport of heavy materials. Forklifts, cranes, and other tools specifically designed for heavy material movement are often unusable in confined spaces. So workers do the heavy lifting themselves, too often leading to injury. But even those who remain injury-free today remain at risk for future physical damage due to the wear and tear that construction work puts on the body. Doctors call these injuries musculoskeletal (MSD) disorders – and their costs are higher than many contractors realize.

The Cost of Occupational Injuries



MSD-related injuries account for as much as **9% of project cost**, according to [the Center for Construction Training and Research](#)



Non-fatal injuries cost millions in lost productivity and OSHA penalties, which can be as much as **\$70,000 per incident**, according to [OSHA figures](#)



Median time away from work after on-the-job injury or illness is ten days, with crane injuries **30 or more days**



Indirect costs for injuries can be as much as **17 times more** than direct expenses, according to [Safety and Health magazine](#)

Labor Shortage in Construction



81% of construction firms report difficulty filling salaried and hourly craft positions



65% of firms say it will be difficult or more difficult to hire over the next 12 months



Many firms are **increasing base pay** rates and overtime hours to keep existing workers



The average hourly earnings of construction workers **increased 3%** from 2019 to more than \$31, making already tight budgets even harder

Source: [AGC 2020 Outlook Survey](#)

Meanwhile, the labor shortage is getting worse, according to the [AGC's 2020 Outlook Survey](#). The industry needs a way to augment its workforce during these challenging times. “Powered exoskeletons will not double your labor force, but they could help reduce injuries and fatigue, which in turn will contribute toward better productivity,” said DPR’s Diwan, noting that his company has experimented with passive exoskeletons.



Challenges That Powered Exoskeletons Help Overcome

Here are four key challenges today's contractors face — and why innovation leaders like DPR Construction are so excited about the potential for powered exoskeletons:

1. Ongoing and protracted labor shortages

As noted, many firms can't find enough skilled workers. That's why more than one-third of construction firms are increasing their use of labor-saving equipment, according to the AGC's 2020 Construction Outlook Survey. Powered exoskeletons are labor-saving technology that enables one person to handle heavy construction materials rather than teams or lifting equipment operators, thus optimizing workers while ensuring social distance. Because exoskeletons augment strength, they open more possibilities for employment, allowing workers of smaller stature. At the same time, older but more experienced workers can remain productive longer, and younger workers won't be so put off by manual labor rigors. "Currently, the industry requires a certain body type and strength," Kristi Martindale from Sarcos Robotics said. "It can be difficult for smaller or aging workers to lift and transport things around a construction site. Full-body, powered exoskeletons can change that — making it an equal playing field for anyone who wants to enter the industry. We call this the 'opening the aperture of the workforce's effect.'"

2. Construction safety and injury

Many firms are looking for ways to increase safety and reduce injuries and fatigue. Powered exoskeletons address lift-assist accessibility challenges in tight spaces, where overhead cranes/hoists can't fit. At the same time, they increase an operator's strength and endurance while reducing musculoskeletal injuries. And because the exoskeletons fit where workers do, they enable last mile transport of heavy materials in tight quarters where forklifts and other equipment can't be used. For example, the Guardian XO exoskeleton allows one person to safely handle up to 200 pounds without strain or injury. Meanwhile, its hands-free mode means the exoskeleton can support heavy loads while the human operator completes dexterous tasks that require skill and judgment, such as aligning, bolting, and welding. "Safety and injury prevention is the biggest area where exoskeletons could add value for construction," DPR's Diwan said. "Contractors shouldn't expect that powered exoskeletons will turn their workforce into 'superhumans.' But there is real potential that they will help them feel less fatigue at the end of the day and prevent injuries in the process."





3. Declining and stalled productivity

Construction is a labor-intensive work environment already plagued with labor shortages and productivity issues. Worker fatigue costs \$1.8 million a year in lost production, [according to the National Safety Council](#). While many U.S. sectors, including agriculture and manufacturing, have increased productivity 10 to 15 times since the 1950s, construction remains stuck at the same level as 80 years ago, [according to McKinsey Institute](#). “Productivity is easily the number one problem in construction. That’s the thing that needs iterating,” said Sander Idelson, core robotics team manager for Canvas Construction. Powered exoskeletons directly address productivity issues with a streamlined solution for heavy lifting that beats traditional lifting equipment, which requires a large footprint to load, secure, lift, move, and release materials. In turn, the exoskeletons reduce the cost of transport delays and idle time, especially related to last-mile deliveries and moving materials from storage to site. What’s more, the intuitive design and controls mean little training is necessary. For example, the Guardian XO exoskeleton can be put on and taken off in 30 seconds, and its hot-swappable battery packs prevent unnecessary work stoppages.

4. Tightening margins and financial challenges

Today's contractors deal with rising material and labor costs, increased competition, and stricter enforcement rules and regulations. [According to the National Safety Council](#), a single injury requiring medical attention costs an average of \$32,000 per incident. All these factors make it harder than ever to maintain margins. Robotic exoskeletons allow contractors to do more with fewer labor costs for construction/deconstruction, shipping/handling, and formwork. With their ability to operate in complex, unstructured terrain with robotic strength, stamina, precision, and speed, they also augment workers' strength and endurance. The Guardian XO exoskeleton, for example, has 24 degrees of freedom (like human joints), giving it a wide range of motion. Its embedded sensors enable the exoskeleton to detect operator movement within milliseconds. Its processing power (equivalent to three PC servers) allows the robot to quickly calculate operator movements and control the robot's movements with little latency, providing fluid motion and a feeling of near-weightlessness to the operator. All these capabilities mean that the Guardian XO robot can increase a worker's productivity by four to eight times.

Under a [Robot-as-a-Service \(RaaS\) model](#), the exoskeletons can be "leased" for the equivalent of a fully burdened employee working for \$25 per hour. And when the Guardian XO robot docks to its docking station at the end of a shift, it downloads job usage data for powerful insights that can increase efficiency and profits. "Having the right tool at the right time, and stay on task and schedule, is the key to increasing margins," Martindale of Sarcos Robotics said. "Unlike a crane, which can be time-consuming and costly to move, the Guardian XO exoskeleton goes to the 20th floor and does the job it needs to do. It's not as cost-prohibitive when you consider having access to the tool where it's needed when it's needed."



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A Better Quality of Life

Today's construction firms need ways to address labor shortages, productivity shortfalls, injury costs, and margin-fade. Robotic exoskeletons provide comprehensive solutions to all of those problems in a cost-effective, easy-to-use technology that augments existing labor forces — and improves the quality of life for all workers.

“Manual labor is very hard on our bodies,” DPR's Diwan said.

“With reduced fatigue and potential for injuries, we hope this sort of technology will mature to the point that it allows the workforce to not only be more productive at work but also be able to enjoy the rest of their days when they go home.”





SARCOS®

Sarcos Robotics is the world leader in industrial robotic systems that augment human performance by combining human intelligence, instinct, and judgment with the strength, endurance, and precision of machines to enhance employee safety and productivity. Leveraging more than 25 years of research and development, Sarcos mobile robotic systems, including the Guardian® S, Guardian® GT, and Guardian® XO®, are revolutionizing the future of work wherever physically demanding work is done. Formerly the robotics division of a major defense contractor, Sarcos is based in Salt Lake City, Utah, powered by an innovative team of entrepreneurs and engineers, and backed by Caterpillar, GE Ventures, Microsoft and Schlumberger.

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