Demystifying the Internet of Things for CONSTRUCTION

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Here's how the Internet of Things works, and why construction needs it

Imagine being able to track the exact location of a backhoe on one jobsite, a pallet of drywall on another and an electrical sub on a third—and doing it all in seconds, with just a few simple strokes on your laptop, smartphone or tablet.

It's possible, thanks to the Internet of Things (IoT), the tech term that describes how we connect everyday items and, even, individuals—like that backhoe, pallet and subcontractor—to the Internet (and more importantly, to the computer systems that run our businesses).

BIG
Benefits with IoT

A McKinsey report found that improvements in operations from IoT applications at worksites, including construction and mining jobsites, will be worth more than $470 billion per year in 2025. The same report also found that IoT on worksites, such as construction sites, can have an economic impact of **$160** **billion to $930** **billion per year in 2025.**

Wearables are **improving site safety,** according to Dodge Data & Analytics' Safety Management in Construction report. It found that **13% of contractors use wearable devices.** Of those, **82% say they have a positive impact.**

Carpenters, welders and painters on the jobsite might not talk about the Internet of Things in casual conversation, but a growing number of industry-leading contractors and builders are using IoT-enabled devices to track equipment, machinery and workers to make better decisions in real-time. Tech adoption in construction, particularly the deployment of IoT-enabled devices, has boomed in recent years as companies sign on for the benefits of a smart and connected jobsite.

And, when contractors implement IoT and take advantage of that connected jobsite, they reap big rewards, reducing risks and building a safer and more secure workplace. With the right network and hardware in place, IoT users can:

- Immediately track the location of workers, materials and equipment to understand the minute-by-minute flow through the site.
- Have more insight and control over schedules to allocate resources more effectively.
- Collaborate in real-time with site managers, subs, trades and the home office.
- Benefit from extensive reporting capabilities to uncover bottlenecks and streamline processes for current projects and future ones.
- Alert workers to hazards and evacuations.

But that doesn't mean IoT doesn't come without challenges on busy construction sites where electricity is at a premium, heavy equipment threatens hardware and thousands of workers can come and go daily.

If you're considering IoT for your next project, read on to know what you should consider.

The
LIFT PROBLEM

Construction suffers from bottlenecks on a regular basis, slowing work down dramatically without supervisors knowing it's even happening.

Consider the case of one company, which was building a 50-story high rise. A simple clipboard study discovered why workers were losing hours of productivity each day once construction reached beyond the 30th floor: They were spending too much time waiting for the lift.

The company lost nearly **$4 million** in productivity over the life of the project. Installing a second lift on day one would have cost them just **$1 million**. With an IoT device that provided information in real time about the bottleneck, they could have made other decisions that would not have had such a serious impact on their bottom line.

On the Job Challenges

So, if IoT is the secret ingredient to enable the jobsite of the future, why aren't we there yet?

IoT is all about connectivity—sending information from devices worn by workers or attached to equipment to, usually, a cloud-based server—and that's not easy to do on a jobsite. **Next to deep sea or deep space, it might just be the most challenging place to deploy a network.**

Here are just a few of the conditions that threaten IoT on jobsites:

1. **Electricity is in short supply—if it's even available.** That makes it difficult to power the typical gateway—the hardware that connects the IoT device with the cloud and usually requires a plug-in to an outlet.
2. **The landscape is constantly changing,** making more traditional network deployment impossible.
3. **Big machinery and heavy materials endanger hardware.** It's not uncommon for devices to get stepped on, smashed and run over.
4. **Vibrations, large temperature extremes, exposure to weather and dust cause damage.** Hardware must stand up to all of these conditions.

IoT in Action:
The Case of the Moving Equipment

At a large jobsite, one contractor, who had implemented IoT tracking devices on equipment, noticed that a piece of machinery had started moving around the site on a weekend when no workers were on the job.

The contractor had the IoT system configured to send notifications about activity on the site. Thanks to the alert, the contractor could quickly contact building security, who found one of the building's employees using the contractor's equipment—unauthorized and unsupervised. The unsafe situation was addressed immediately because the IoT device gave the contractor immediate visibility on the site.

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Altogether, the kinds of IoT-enabled devices that we might find in a home, office building or warehouse would barely survive a day outside, in the elements, of a construction site.

For IoT in construction to work, solutions must include:

- Hardware that can resist extreme conditions and stand up to the rough-and-tumble activity of a jobsite.
- Battery-powered infrastructure with easily replaceable batteries and little need for a power outlet.
- Networks that can be easily moved from one location to another as work progresses.
- A wireless frequency and protocol capable of operating efficiently even in proximity to steel, concrete and other jobsite complexities.

IoT in Action:
Swing Stage Situation

A contractor was doing exterior work on a tall building, using swing stages to get the job done. All of the subs needed to access the stations, and the foreman was fielding complaints that there weren't enough stations or they weren't available at the right times. Work was slowing down.

With the help of IoT sensors attached to each of the stations, the foreman, on his smartphone, could immediately find out where the lifts were and if one was available. When a sub pushed back that a station wasn't free, he could simply look up on his phone and point him in the direction of one that was.

With the bottleneck resolved, productivity shot up by 50%.

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Network Matters

As IoT offerings grow within construction technology, providers are using a variety of network options to transfer information from the physical jobsite to virtual dashboards and databases. But not all network solutions are created equal.

Here's a look at the network technologies on the market:

Ultra-Wide Band

These high-bandwidth and short-range applications are capable of very accurately pinpointing the location of various items, but, generally, they are best used on permanent sites for the following reasons.

- Because of robust hardware requirements and related high price points, **the system does not scale well on large sites.**
- Current solutions are limited to about 100 devices per gateway, which can make them useless on large construction sites that can require thousands of devices.
- UWB infrastructure is typically not battery powered and requires a constant source of electricity, which often is hard to find on construction sites.

What about Global Positioning Systems ?

We use GPS on our smartphones daily, but the technology's use is limited on the jobsite.

- Tall buildings can block the signal, which means it's not very accurate tracking workers on vertical projects and frequently doesn't work indoors.
- Power consumption is relatively high, which presents a challenge for long-term battery-powered solutions.
- Workers may be less likely to adopt the technology because they're worried about being tracked when they're off-the-job.

Long Range (LoRa)

This low-power communications technology, also called LoRa, works at an extremely long range, but, on jobsites, it has some big drawbacks.

- The solution is limited to just a few hundred devices per gateway, **making it an expensive, and hardware-heavy, proposition on large project sites.**
- It's designed for low bandwidth and offers a low update rate, so continuous real-time notifications aren't possible.
- Because LoRa isn't effective as a real-time location technology, users must pair it with another solution to receive up-to-the-minute information.

Bluetooth Low Energy

BLE must be paired with other devices and, in most instances, those typically are smartphones, which are proving to be a distraction on jobsites.

- All workers, equipment and other site-wide, intel-gathering devices, such as environmental sensors, must have a smartphone or other Bluetooth gateway device attached to them, making BLE an expensive proposition.
- Some BLE solutions are not as low energy as they may imply. Devices that don't stay constantly paired with each other are constantly searching for a signal. Because of this high power consumption, **BLE drains the device's batteries quickly and requires frequent recharges.**

- It's not the right fit for large jobsites as it has difficulty hosting dense collections of devices. BLE, after all, was initially designed to connect accessories to your phone. It was never intended to penetrate a wall.

Proposed new features, such as Angle of Arrival estimation systems, may lead to better location capabilities in the future for BLE, but today's contractors and builders can't rely on it yet. Real-world applications are years away from being field ready.

To make IoT work in construction, the network must:

- Rely primarily on long battery life and easily rechargeable battery power.
- Be capable of supporting thousands of workers and equipment and materials on a single site.
- Route real-time information to the people who need it so they can make better informed decisions more quickly.

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How Spot-r Can Help

When it comes to an IoT solution that works on construction sites, Spot-r by Triax ticks all the boxes.

- **Our hardware stands up to rough elements** on the jobsite and can be quickly repositioned as construction progresses.

- Our proprietary network solution requires **minimal hardware installation and power requirements.** Rechargeable batteries last months between charges.

- **Our solution can support tens of thousands of devices** at the very same time on a single site.

- Our technology **can provide real-time location information by floor and zone**. The solution sends out the status and whereabouts of all users every 12 seconds.

With our wearable IoT-enabled sensors, users can quickly identify the location of injured workers and find new ways to bolster productivity, efficiency, risk management and security with an easy-to-use system that doesn't drain jobsite resources.

When they partner with us, industry-leading contractors are building a connected jobsite that provides full visibility into how their current projects are running—and plenty of insights into how to plan the next ones.