

WHITEPAPER



Strengthening the Supply Chain with Automated Case Unloading



BostonDynamics



Using advanced mobile robots for trailer and container unloading can overcome logistics challenges and create a more robust supply chain.

As the past few years have shown us, the global supply chain is anything but stable. From rising shipping container costs to bottlenecked cargo ports, manufacturers and logistics professionals around the world felt the ripples of a fractured supply chain. In response to the increasing challenges, many advanced automation solutions are poised to strengthen the supply chain, creating a more adaptable network for moving goods from point A to point B.

One area in particular that holds exceptional promise for companies reeling from the effects of supply chain disruptions is truck unloading. Automating this inbound process can bring many benefits, allowing companies to alleviate challenges related to labor shortages, rising costs, and worker injury rates, and bringing predictability and efficiency to a process that has until now been unpredictable and inefficient.

Digging even deeper, many of the reasons for automating the case unloading process are more nuanced; by shedding light on what has ultimately been an intralogistics dark spot, autonomous robotic systems can contribute to a flexible, more observable supply chain, providing companies with much-needed operational agility within this unpredictable landscape. In other words, beyond the trucks and warehouses, bringing this key inbound logistics process under control will have positive effects that ripple throughout the rest of the supply chain, enabling manufacturers to tackle broader supply chain issues like shipping bottlenecks.



It All Starts With the Trucks

Until now, manufacturers and logistics professionals have been unable to anticipate the flow of goods coming off the trucks, or pivot quickly if and when disruptions arise. These challenges have been compounded in recent years by the following interrelated issues:



Labor availability

Unreliable labor can have significant downstream effects for manufacturers and logistics professionals as they continue to address warehouse bottlenecks. If you're a logistics operator, for example, you know you have to send a certain number of boxes to warehouses around the country. To effectively plan around these goals, however, you have to calculate how many trailers your workers can unload during their shifts, which in turn will allow you to route where the trucks need to go. An inability to plan around labor can easily lead to misappropriating logistical resources, delaying the trucks, and creating bottlenecks across the warehouse network.

Inconsistent unloading speeds

Without enough workers to unload the inbound trucks, it will be next to impossible to achieve consistent and predictable unloading cadences. Even without a labor shortage, workers unload trucks at varying speeds. They may start the day unloading boxes very quickly, for example, but worker energy ebbs and flows and will oftentimes slow down as the effects of this physically demanding job set in. If you add up these factors, you're left with not just slow unloading speeds, but — more importantly — varying unloading speeds that are hard to predict and schedule around. The supply chain likes predictability.

High injury rates

Exacerbating the labor availability even further is the high rate of worker injury. Trailer and container unloading is a dangerous job. In 2020, the Bureau of Labor Statistics reported [64,930](#) work-related injuries among laborers and freight movers, resulting in days away from the job. That same year, the bureau also reported [79,360](#) overexertion injuries while lifting or lowering at work.

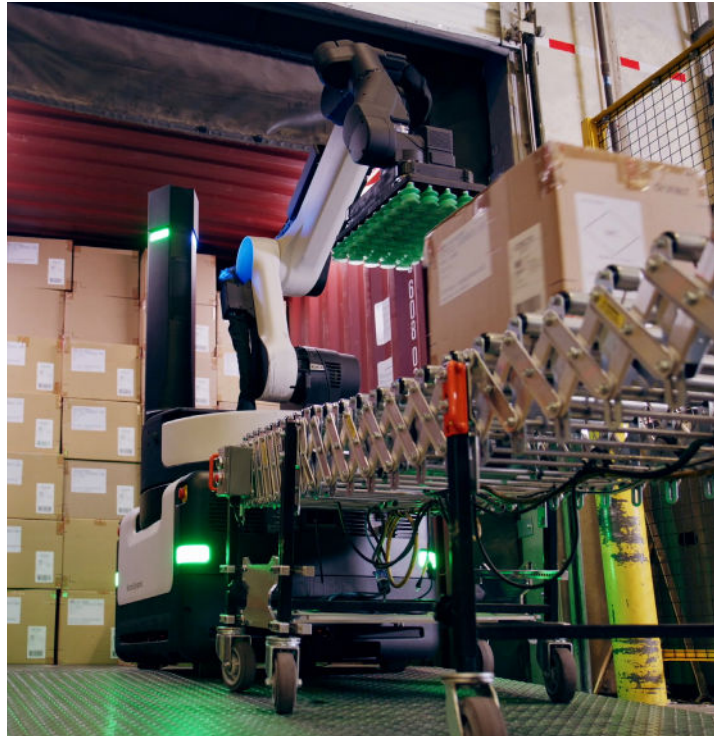
Rising costs

And, finally, there are cost pressures to finding long-term, reliable workers in this tight labor market, especially in a physically demanding profession like case unloading. These labor challenges — coupled with skyrocketing labor prices and high injury rates among workers — are driving up how much it costs to move a case.

Automation Means Predictability

Addressing these supply chain challenges at the truck level requires advanced case handling robots that are both autonomous and mobile, enabling scalable deployment in trucks. These robots incorporate a base with a pallet-sized footprint, lightweight arm, adaptive gripper, and sophisticated computer vision system, all of which work together as an intelligent, self-reliant system. These robots are also ready to implement in days — no pre-programming required.

Not only do case handling robots alleviate issues related to labor availability, speed, and injury rates, they also add a much-needed element of predictability to the case unloading process, improving logistics planning and maximizing throughput off the trucks. At the same time, they can tackle grueling, dangerous, and repetitive tasks. Equipped with state-of-the-art vision systems, for example, they can handle a variety of package types, sizes, and disorganized stacking configurations, and can even work autonomously through complex situations like recovering fallen boxes. Using robots for such physically demanding tasks instead of people drastically reduces injuries, creating a safer work environment and allowing workers to focus their attention on more complex tasks.



It's important to note that autonomous case handling robots don't have to be faster than their human counterparts. Rather, the robots are more consistent and predictable, which brings significant value to your supply chain. The work capacity of these robots is not as variable as that of people. Robots don't require sick days or breaks, and they don't grow tired after hours of lifting and lowering heavy boxes. Beyond the day-to-day operations, this consistency is also important for busy times of the year, such as the weeks leading up to the holidays when many companies add round-the-clock shifts. It also allows managers to reallocate workers from physically strenuous labor to work that requires greater cognitive ability or manual dexterity than a robot can provide.

Beyond Trailers: Improving Operational Agility

Getting the boxes out of trailers in a consistent, predictable way will have two major effects on a company's supply chain operations: the first is greater visibility into an intralogistics dark spot; and the second is the idea that greater efficiency at the inbound truck level will have positive effects on the rest of the supply chain — including shipping.

Better intralogistics visibility

Due to its variability in terms of cost, labor, and speed, the case unloading process is currently a dark spot for most manufacturing and logistics professionals. Autonomous case handling robots bring predictability to this step, enabling a more observable and therefore actionable supply chain.

Visibility into the unloading process at the system level therefore unlocks greater operational agility at the enterprise level, allowing companies to better adapt to logistical changes or disruptions. A warehouse in Phoenix, Arizona, for example, might reach capacity, requiring the company to shift its inbound inventory to warehouses in the Pacific Northwest. In this scenario, the operators can deploy autonomous case handling robots to where they're needed most, creating a truly flexible solution for managing the flow of goods

Easing shipping bottlenecks

Greater predictability and efficiency at the truck level has far-reaching effects on the rest of the supply chain — including shipping — enabling logistics professionals to better meet and plan around their daily goals even as demand for order fulfillment continues to climb. For example, say you have to unload 1,200 cases in Los Angeles. If you have an automated system with a fixed unloading pace in place, you know how many cases will be unloaded and how long that process will take, transforming your planning into forecasting. Equipped with the knowledge of the volume that your supply chain can handle, you can take actions to optimize your operations like changing truck routes.



An Eye Ahead

Inbound case unloading is just one area of the supply chain that can benefit from automation in the form of mobile case handling robots. The advantages of these scalable robotic systems aren't limited to the truck and warehouse level. Rather, these robots promise to send rippling effects throughout the rest of the supply chain. Looking ahead to the future, these robots will evolve to autonomously handle even more complex logistics operations, from loading trucks to stacking pallets within warehouses. The result of such innovation will be a revolutionized — and truly predictable — supply chain.

To learn more, please visit: www.bostondynamics.com.



An Integrated Approach to Stretch®

Stretch is an example of an autonomous case handling robot that can change the way ports and warehouses operate. Able to work more than a full shift on a single battery charge, Stretch can unload floor-loaded trucks or containers — day or night. It can also quickly identify and place cases on conveyors, moving hundreds of cases every hour.

Built on a compact, wheeled base with a footprint the size of a pallet, Stretch can travel easily in and out of containers. It is also self-reliant, untethered by power cables or air lines, and its vacuum-based gripper can grasp various box types and sizes.

With its small footprint and embedded controls, Stretch needs no pre-programming or overhaul of existing equipment and is ready to deploy in just a few days.

Unlike fast-moving industrial robots, which tend to have a high payload capacity and very heavy arms, Stretch features a lightweight arm that can move up to 50 pounds. It comprises of four additional parts:

- A **mobile, omni-directional base** that can maneuver in any direction, as well as navigate obstacles and ramps. The base houses high-capacity batteries that power Stretch through two shifts.
- A **robotic arm** with seven degrees of freedom, giving Stretch a long reach.
- A **perception mast** incorporating advanced computer vision. Because the vision system and arm are decoupled, both parts can perform concurrent, rather than sequential, operations at high speeds.
- An adaptive **gripper** that allows Stretch to handle a variety of package types, and is able to accommodate some irregularities and damage as well as openings and seams.

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