



WHITEPAPER

# Tackle Trailer Unloading Woes With Flexible, Mobile Case Handling Robots

*Explore the design and implementation of advanced mobile case handling robots for truck unloading and warehouse applications.*



### Using mobile robots for trailer and container unloading can empower companies to alleviate logistics challenges related to labor shortages, rising costs, and worker injury rates.

Such technologies, which incorporate a pallet-sized base, advanced computer vision and adaptive grippers, can also bring much-needed predictability and efficiency to an inbound process that has until now been anything but.

In recent years, many manufacturers and logistics professionals have struggled with anticipating the flow of goods coming off trucks, as well as the ability to make adjustments quickly if disruptions arise. These challenges have been compounded by several interrelated issues, including labor shortages, inconsistent unloading speeds due to the physically demanding nature of the job, and high injury rates among freight movers. Since truck drivers can't proceed until all their freight is unloaded, any delay during the unloading process — whether due to a single worker calling in sick or multiple workers taking longer than usual to unload the boxes at the height of summer — will have compounding effects on the driver's upcoming scheduled routes.

Alleviating these challenges at the truck level requires advanced case handling robots that are both autonomous and mobile, enabling quick, easy, and scalable deployment in trucks and containers. These robots can reduce the issues related to labor availability, inconsistent unloading speed, and injury rates.



Robots are resistant to extreme trailer temperatures in the summer and winter months. They can also handle many package types and sizes, lifting and lowering boxes for several hours straight without overexerting themselves — tasks that have resulted in over 10,000 injuries among freight movers in 2020 alone.

In addition to addressing these labor-related challenges, mobile case handling robots add a much-needed element of predictability to the case unloading process, improving logistics planning and maximizing throughput off the trucks. Looking ahead, these robots are poised to tackle the traditional challenges associated with warehouse automation, such as object variability and infrastructure costs.

# The Right Robot for the Job

Effectively addressing and overcoming current cost, labor, and supply chain challenges, beginning at the truck level, requires mobile case handling robots with specific design features. Able to work up to two shifts on a single battery charge, robots like Boston Dynamics' Stretch™ can unload floor-loaded trucks or containers, day or night, moving hundreds of cases every hour. They can also quickly identify and place cases on conveyors.

Built on a compact, wheeled base with a footprint the size of a pallet, these robots can easily travel in and out of containers. They are also self-reliant, untethered by power cables or air lines, and incorporate vacuum-based, adaptive grippers that can grasp many box shapes, types, weights, and sizes. Their vision system can detect standard brown and highly graphical boxes alike. Due to their small footprint and embedded controls, these robots don't require any pre-programming of package types and are ready to deploy in just a few days — no overhaul of existing equipment required.

Unlike other industrial robots, which tend to combine a high payload capacity with a heavy arm, mobile case handling robots feature a lightweight arm that can move up to 50 pounds. These four elements work together as one integrated system, creating the foundation for the robot's impressive speed and flexibility.

## The four elements of mobile case handling robots:

- 1 Mobile Base**  
Omni-directional base that can maneuver in any direction, navigate obstacles, and traverse ramps.
- 2 Flexible Arm**  
Robotic arm with seven degrees of freedom, giving the robot a long reach and expansive work envelope.
- 3 Perception Mast**  
Camera mast that incorporates advanced computer vision to deliver fast, precise case detection.
- 4 Adaptive Gripper**  
Vacuum-based gripper that allows the robot to quickly handle a variety of package types.





### Mobile Base

The first element of a mobile case handling robot is an omni-directional base that can maneuver in any direction, navigate obstacles, and even traverse ramps. This base houses high-capacity batteries that power the robot through two shifts.



### Perception Mast

The perception mast incorporates advanced computer vision that delivers fast, precise case detection. Because the vision system and arm are decoupled, both parts perform concurrent — rather than sequential — operations at high speeds.



### Flexible Arm

A robotic arm with seven degrees of freedom gives the mobile robot a long reach and expands its work envelope. To note, this system is not simply an automated guided vehicle (AGV) with a robotic arm attached to it. Rather, the arm and the base of Stretch, for example, were designed from the start as a single fully integrated system, removing the need for a troublesome application programming interface (API) and allowing the robot to move quickly inside trucks, all while dexterously handling 50-pound boxes.



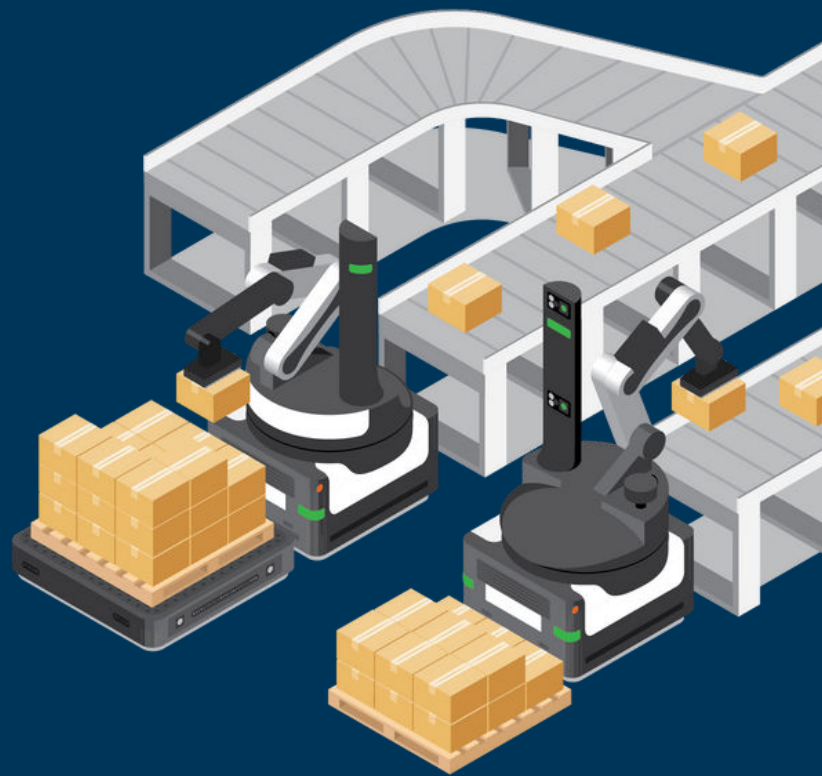
### Adaptive Gripper

Finally, the adaptive, vacuum-based gripper allows the robot to handle a variety of package types while operating quickly. The gripper can accommodate irregularities, such as damage, as well as openings and seams. Unlike other grippers on the market, which can only signal to the controls if they are or aren't gripping an object, Stretch's advanced gripper informs the controller on how well it is gripping an object. Based on that input, the case handling robot will adjust its speed, moving quickly if the grip registers as strong.

# Combining Mobility, Dexterity, and Intelligence

Stretch is one of the most prominent autonomous case handling robots, currently transforming the way logistics professionals address supply chain issues at the truck and warehouse levels. Its mobile base, lightweight arm, computer vision, and adaptive gripper work together as one intelligent, self-reliant system, maximizing the robot's productivity for truck and container unloading.

Stretch is also poised to deliver greater predictability to warehouse operations, ensuring daily goals are met even as demand soars for order fulfillment.



## Stretch Specifications

- Maximum Payload: Cases up to 50 pounds
- Pick Rate: Hundreds of cases per hour at a consistent rate dependent on the configuration of the container and cases
- Maximum Vertical Reach: 10.5 feet
- Footprint: 40 x 48 inches
- Weight: 2,866 pounds
- Battery Runtime: 2 shifts
- Safety: ANSI/RIA R15.08

## Looking Ahead to the Future

Truck unloading is just one area of the supply chain that can benefit from automation in the form of mobile case handling robots. In the future, these robots will be able to autonomously handle even more complex logistics operations. Flexible, mobile automation systems will be critical to addressing warehouse variability and saving infrastructure costs as online sales and ecommerce rates continue to rise.

### Operational Agility

Automated systems in warehouses and distribution centers face far more object variation compared to their industrial counterparts in static manufacturing environments. This is especially true whenever manufacturers want to expand their operation, whether by adding more stock-keeping units (SKUs), employees, or square footage to their facilities. Warehouse tasks also vary throughout the day, precluding the use of a single, static automation system that can only work on a single task in one designated area.

From disorganized boxes to low-light conditions, warehouses have a lot of environmental factors that make automated perception and robotic manipulation challenging. Robotic systems built for this kind of environment must be able to offer more intelligent vision and gripping technologies, all while tackling more versatile applications.

Flexible, mobile case handling robots are an ideal solution to these challenges. They can spend the morning unloading inbound trucks and then in the afternoon shift to fulfilling warehouse orders. By evening, these robots can transition to stacking pallets or loading outbound trucks, easily switching between tasks and moving to wherever the work is most needed.



## Infrastructure Savings

Another barrier to more widespread warehouse automation is cost, owing to the nature of existing infrastructure in warehouses. Although industrial robotic arms have the power to lift the boxes passing through the warehouse, these strong yet slow-moving robots require a fixed installation to operate safely. Current mobile solutions also unfortunately require special accommodations, such as lighting or other add-ons.

Again, flexibility is key to overcoming these challenges. Mobile case handling robots, with their speed and lightweight robotic arms, offer the right combination of strength, size, and perception to autonomously operate in typical warehouse settings. And, they can do so effectively without the need to invest in fixed infrastructure or special accommodations. Implementing mobile case handling robots designed for these variable environments is much more cost-effective than redesigning the entire warehouse around the robot.

## Interested in Mobile Case Handling?

To learn more about Stretch, please visit [www.bostondynamics.com](http://www.bostondynamics.com)

To contact sales, visit [www.bostondynamics.com/stretch-sales](http://www.bostondynamics.com/stretch-sales)

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