SPECIAL REPORT





## Increase Picking Density with Mezzanines, Pick Towers, and Automation

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Going vertical can double or triple the picking density of a warehousing facility. Applying the right robotics solution on top of that can send throughput through the roof.

Fluctuations in consumer spending over the past year are an indication of uncertain economic conditions overall, and warehouse operators are understandably concerned. According to research from Interact Analysis, the number of new warehouses being built in North America and Europe declined by 25% during 2023.

The caution that warehouse operators are exhibiting is also informed by another factor — the healthy jobs growth the industry has experienced in recent years, allowing warehousing workers to demand and receive significant wage increases — amounting to 38% between 2019 and 2023, according to Zippia.com, a jobs website. Zippia's latest estimate shows that there are over 1.2 million general warehouse workers currently employed in the U.S. and that there are over 261,000 active warehouse worker job openings, suggesting that warehouse operators are having a hard time filling available positions.

On top of all that, the massive growth in e-commerce in recent years has meant that online retailers and logistics services providers have required more square footage in and adjacent to population centers — in other words, in urban and suburban locations — to fa-cilitate quick deliveries. In contrast to the expanses of available land in the countryside, where massive warehouses and distribution centers have been built in recent decades, land for new facilities and suitable existing structures for rebuild are not readily available.

Warehouse operators that want to expand their capacity to accommodate future growth but are wary of the risks inherent in greenfield development or don't have greenfield options, have discovered a viable alternative. They can increase the density of their pick operations by installing pick towers and mezzanines within their current facilities, boosting throughput inside their existing building.

These vertical enhancements can double or triple the square footage that can be devoted to warehousing operations inside the same building. Going vertical makes fulfillment operations more complex. This is where automation, including autonomous robotics and their associated information systems, comes in. An automation update also represents at least a partial solution to labor costs and worker shortages. But, for a solution to be efficacious, it must meet the requirements of tiered operations.

"Warehousing operators are always balancing three things — labor, space, and performance," says Mike Johnson, president and chief operating officer of Locus Robotics, a robotic process automation company. "We're in a period of time in which costs and space have become critical. From what we've seen, third-party logistics providers are being particularly cautious about greenfield development."

Besides being circumspect about the risks attendant in the current environment, there are several other factors that play into the increased demand for tiers in existing brownfield warehouses. "One is a real estate shortage, mostly caused by unprecedented spikes in demand," says Kait Peterson, senior director of product marketing at Locus Robotics. "During the COVID-19 pandemic, we saw a lot more product going through the supply chain and warehouses were brimming over.

"Afterward, we saw somewhat of a slowdown," Peterson continues. "So instead of buying and building new facilities, companies are trying to do more with their existing brownfield operations. And for operations that already have pick towers or mezzanines in place, they want to figure out how to automate those facilities without ripping out the multi-level pick structures that are already there. This is something we're seeing in e-commerce and across all industries."

E-commerce operators, especially, have also had to confront the phenomenon of SKU (stock keeping unit) proliferation. "The level of customization that consumers are requiring is just crazy," says Peterson. "They want products in particular colors and unusual sizes, and each one is a separate SKU. Having all those SKUs available at all times is a huge challenge." More SKUs mean more pick locations, which requires more warehousing space and increases the complexity of pick operations — as well as the data associated with them.

Multi-level structures increase storage density — i.e., the volume of product within the same existing warehouse footprint — while the application of automation increases the "pick density" of the operation, and that directly impacts throughput and productivity. "Pick density is the ability to pick and put away as many units as possible without interruption," explains Peterson. "Interruptions come in the form of congestion and accessibility. For example, sometimes, a pick location or storage tote is in transit to or from another pick or replenish activity and is unavailable to be picked from."

Tiered facilities lend themselves to a number of picking schemes — and the automation of warehousing operations can serve to optimize those operations. One is called "multi-level pick and pass," in which specific robots are assigned to each floor in the facility. The robotic solution clusters tasks on each floor for density and efficiency. When all of the picks on one level are complete, the robot travels to a drop-off station where the container is transported by conveyor to the level below.

"Multi-level pick and pass can also support discrete picking where there's no sortation," says Peterson. "That means you're picking the whole order to the box or other outbound container for shipping."

In the case of "multi-level batch picking," all orders on each individual level are picked first, and then transported to a sortation area where the products are allocated to individual orders. According to Peterson, operations that utilize batch picking have already been optimized from the standpoint of product location.

To achieve the desired optimization, automation solutions must incorporate certain software and hardware features that are specific to vertical and high-density locations. High-end warehouse navigational systems that can discern one level from another and understand which products are stored on each level is one such requirement. The solution's orchestration engine needs to be able to figure out, first off, that a given order requires a multi-level pick and then come up with an optimized picking scheme, assigning robots to tasks accordingly.

"The software logic figures out where the picking should start and how to manage tasks as a holistic order," explains Johnson, "To do that, the system has to be space aware, to know where all the picks are coming from in three dimensions. It must assign tasks close to where the robots are located and direct them to a drop-off point that's proximate."

Not surprisingly, all of this requires an advanced automation solution that is data-centric. "Data analytics and predictive and artificial intelligence are necessary to optimize tasking, coordinate activities, and drive performance," says Johnson.

When choosing an automation solution, there are also some physical attributes of the facilities and robots to keep in mind. "Going vertical and increasing storage density usually means having narrow aisles," says Neil Bentley, senior director, product management at Locus Robotics. "You need a robot that has the physical size to fit in those aisles. You also want the robots to be in the right weight profile and able to work on standard flooring. You wouldn't want to have to change the warehouse flooring because your robot was too heavy for the standard installation."

Besides being of the right size and weight, robots "also need to be very nimble to get where they need to get go next," says Bentley. "Mezzanines with four-foot-wide aisles can cause problems for some robots when a box is sticking out of place even a little. The pick-to-pick move time doesn't add any value to the operation."

The storage density of mezzanines and pick towers provides huge throughput increases to warehousing operations by enabling the handling of much more product within the same space. "If you were running at one level, you might be doing 100,000 units a day," says Johnson. "You add that second level or third level and you could potentially double or triple what the building can do."

Adding the right automation solution on top of that enhances the pick density, potentially doubling or tripling the baseline performance of that dense warehouse facility, according to Johnson.

As a side note, implementing automation in greenfield projects that have been designed to accommodate a specific solution can boost picking efficiency by 15% to 20% over and above that of vertical mezzanine adaptations.

The use of robots, notes Peterson, "removes the variability of the speed of human walking and orients operations toward more repeatable processes." The robots also provide "flexible automation," she adds, when compared to the alternatives. "To put in fixed conveyors and shuttle systems, you'd have to rip everything out of the warehouse and close it for six months to a year. The use of robots enables scaling up and scaling down as the business changes," an important attribute in these uncertain times. Robots, says Peterson, are providing integrated solutions to the myriad of issues warehouse operators are facing.

## **Resource Links:**

https://www.supplychainbrain.com/articles/38706-increase-picking-density-with-mezzanines-pick-towers-and-automation www.locusrobotics.com (http://www.locusrobotics.com/)