



Why **Autonomous Mobile Picking** is the Most Efficient Way to do Order Fulfillment



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Executive Summary

Ecommerce has fundamentally transformed supply chain operations for retailers and grocers. In brick and mortar stores, customers typically pick and consolidate their own orders. By contrast, to fulfill online orders, a retailer needs to hire and pay laborers to pick and consolidate customer orders. As a result, order picking labor has become one of the largest operating costs for online retailers, accounting for up to 50% of total warehouse costs. In addition, persistent labor shortages, rising wages and labor retention issues have added to this challenge. To mitigate all this, companies are increasingly turning to automation.

It is clear that companies selling online can benefit from automating their order picking. Different robotic solutions require varying amounts of labor and robotic resources. This document describes the efficiency of various types of automated fulfillment systems based on how much labor and robots they require. Among them, autonomous mobile picking requires the least of both. As warehouses look to cut picking costs, increase picking accuracy and reduce labor needs, autonomous mobile picking will offer the highest ROI and lowest cost per pick of any solution.



Existing Robotic Order Picking Solutions

There are three existing types of automated fulfillment systems on the market today: **pick-assist**, **Goods-to-Person** and **Goods-to-Robot**.



Pick-Assist

In pick-assist solutions (also known as Person-to-Goods), humans remove items directly from the shelves and place them onto autonomous mobile robots (AMRs). The AMRs move around the warehouse from one pick location to the next and, once the order is fully consolidated, deliver it to the packing station. As a result, human pickers only need to concentrate on one warehouse zone (e.g. 1-2 aisles), which reduces foot travel and increases productivity.

The biggest drawback of pick-assist solutions is that they are still highly reliant on human labor, requiring humans to walk from one shelf to another to retrieve and pick items. Pick-assist solutions typically require one human per 3-4 robots¹.

¹The ratio of humans-to-robots can vary hugely based on the warehouse layout, size and throughput needs.

Goods-to-Person (G2P)

In Goods-to-Person solutions, robots retrieve totes or racks of merchandise from storage and transport them to centralized picking stations where human operators pick the items to consolidate orders. After all the necessary items are picked from the tote or rack, the robots return the remaining items back into storage.

Such solutions eliminate human walking and increase human productivity by using robots to transport all the items. However, Goods-to-Person solutions still require human operators to pick, typically one human per 8-12 robots¹. Moreover, because robots need to constantly travel back and forth to retrieve and return items, that can negatively affect throughput and cycle times.



Goods-to-Robot (G2R)

Goods-to-Robot solutions work similar to Goods-to-Person, except the human picker is replaced by a robotic picking arm in the centralized picking stations. This reduces human picking needs to zero (assuming all items are robotically pickable). Recent advancements in machine vision and AI have broadened the range of robotically pickable items to include most ecommerce and grocery items.

The issue is that, like in Goods-to-Person, Goods-to-Robot solutions require robots to travel back and forth between each pick, which negatively affects throughput and cycle times.



¹The ratio of humans-to-robots can vary hugely based on the warehouse layout, size and throughput needs.

Efficiency of Existing Order Picking Solutions

To determine the efficiency of each solution, companies need to measure how many human hours (human labor) and robot hours (if robotic automation is used) are needed to fulfill orders. Below are calculations on how efficient each fulfillment solution is in a typical warehouse based on how many human-hours and robot-hours it requires for 10,000 picks.

Labor Needs in Fully Human Operations

In fully-manual operations, human pick rates typically range from 35-75 picks per hour (PPH)², equating to 182 human-hours for 10,000 picks (based on an average of 55 PPH). This equates to 26 full-time employees (FTEs) with 7 hours of productive labor per shift (taking into account lunch/bathroom breaks, lost productivity time etc.).

How Automation Reduces Labor Needs

Pick-assist solutions reduce human foot travel and enable humans to spend more time picking; this increases individual pick rates to 100-180 PPH and reduces the human-hours required to 71 (or 10 FTEs).

Goods-to-Person solutions eliminate human foot travel entirely and increase individual pick rates to 150-400 PPH per person³ (including idle time in between robot arrival to the centralized pick station). This reduces the labor needs to 38 human-hours (or 5 FTEs) for 10,000 picks (based on an average pick rate of 275).

Goods-to-Robot solutions use robots to automate both travel and picking, thereby not requiring any labor⁴.

Pick rates and human-hours by solution

	Picks per Hour (PPH) per Person	Human-hours to do 10,000 picks ⁵	FTEs ⁶
Manual	35 - 75	182	26
Pick-Assist	100 - 180	71	10
Goods-to-Person AMRs	150 - 400	36	5
Goods-to-Robot AMRs	Not applicable	0 ⁴	0

²Human picking can be enhanced through methods such as RF (radio frequency) scanning or batch picking.

³Assumes 1.5 picks per presentation. ⁴Assumes all items are robotically pickable; human pickers may still be required for items that are not robotically pickable. ⁵Based on average pick rate. ⁶Based on 7 hours of productive labor per shift.

How Many Robots Each Solution Uses

The amount of robots used in any automated fulfillment system depends on the cycle time per robot, which is the average time it takes a robot to complete one pick. The longer the cycle time per robot, the less productive each robot is and the more robots are needed. The main driver of cycle time is travel distance; the farther a robot needs to travel for each pick, the longer its cycle time.

Pick-Assist

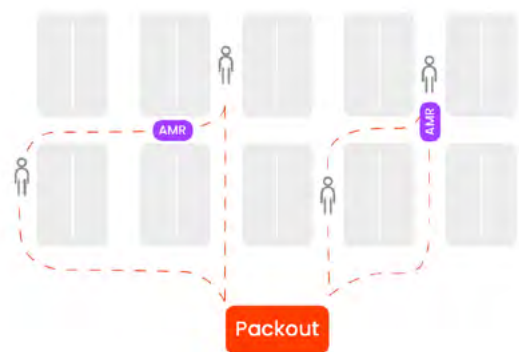
Pick-assist robots move from one pick zone to the typically in the shortest possible path. On average, pick-assist solutions require 3.5 robots per human⁷. With an average pick rate of 140 PPH per person, that equates to 40 PPH per AMR. This means pick-assist requires 250 robot-hours for 10,000 picks.

G2P and G2R

Robots in Goods-to-Person and Goods-to-Robot solutions are less productive than in pick-assist because they need to go back-and-forth to a centralized picking station for each pick. This significantly increases travel distances, lengthens cycle times and reduces throughput per robot.

Typically there are 8-12 robots assigned per picking station⁸. Assuming 10 robots per picking station and a pick rate of 275 PPH per person / robotic picker, this equates to a throughput of 28 PPH per robot and 364 robot-hours for 10,000 picks. In addition, Goods-to-Robot solutions require robotic arms to pick, which further increases robotic needs.

Illustrative pick paths of pick-assist AMRs



Illustrative pick paths of G2P/G2R AMRs



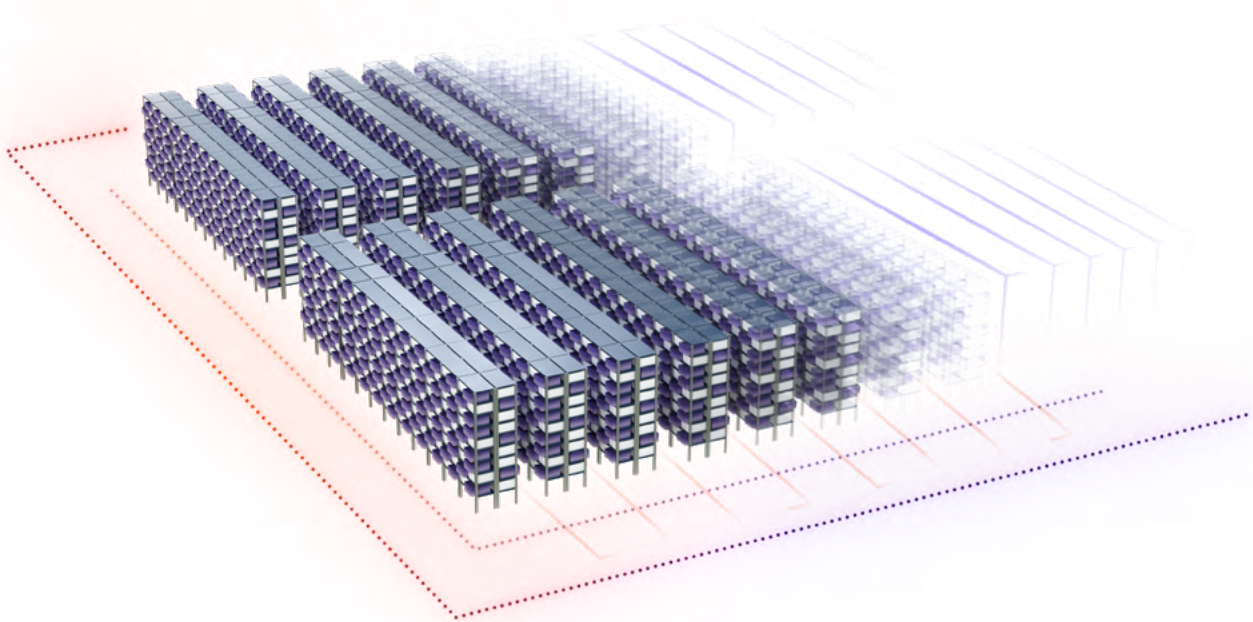
⁷The ratio of humans-to-robots can vary based on the warehouse layout, size and throughput needs.

⁸Based on average pick rate

Average Robot Hours for 10,000 Picks

	Picks per Hour (PPH) per AMR	Robot-Hours to do 10,000 picks
Pick-assist solution	29 – 51	250
Goods-to-Person solution	15 – 40	364
Goods-to-Robot solution	15 – 40	400

Solutions that use fewer humans typically require more robot-hours, and vice versa. Which of these solutions is more efficient and cost-effective comes down to the relative cost of human labor versus robots. For example, greater labor savings may justify more expensive automation solutions in high-wage countries; on the other hand, it may be difficult to achieve positive ROI from any type of robotic automation in low-wage countries⁹.



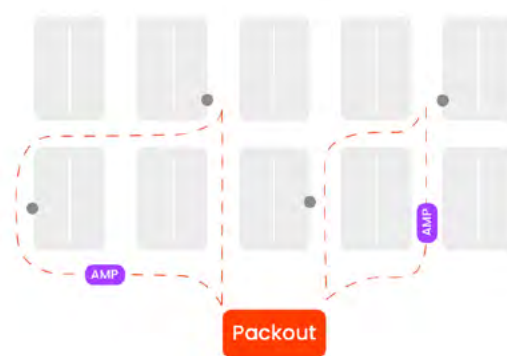
⁹There are many other benefits to automation outside of cost savings and labor reduction, including higher picking accuracy, improved work conditions and lower staff turnover

Why Autonomous Mobile Picking Delivers the Highest Efficiency

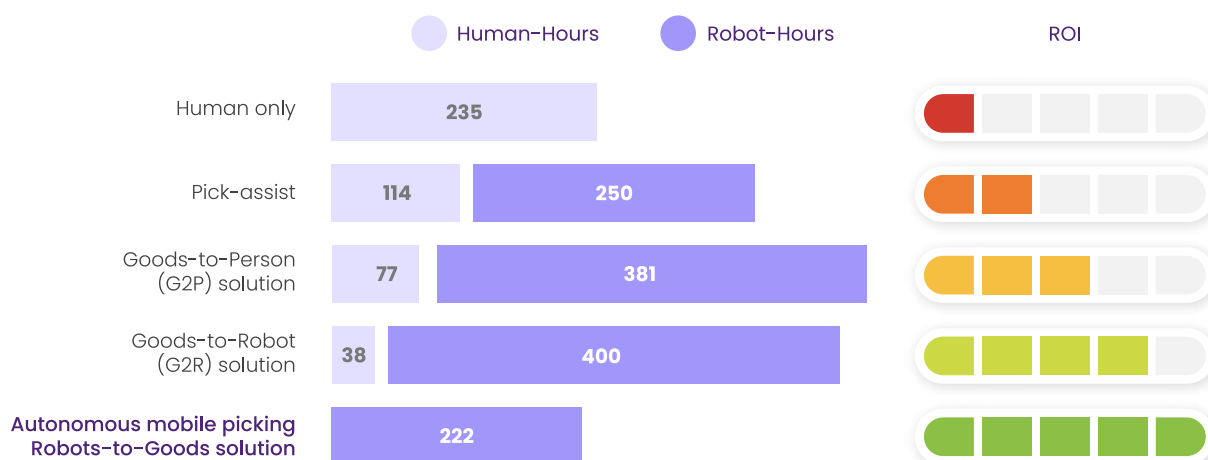
Autonomous mobile picking robots are robots that autonomously move around the warehouse and robotically pick and consolidate items within the aisles. They can best be described as a “Robot-to-Goods” (R2G) solution. Much like a human with a cart, they move around the warehouse and consolidate orders by picking items directly.

Autonomous mobile picking offers the greatest throughput with the least labor and fewest robots. In contrast to Goods-to-Person systems, autonomous mobile picking robots pick inside the aisles and do not need to travel back and forth to centralized picking stations. They also do not need to wait for human pickers inside the aisles to do the pick, like pick-assist solutions. As such, autonomous mobile picking robots can achieve higher throughput per robot, typically 30-60 PPH per robot, equating to 222 robot-hours for 10,000 picks (based on average throughput of 45 PPH per robot). Moreover, because the robots both transport and pick the items, such a solution requires zero human labor.

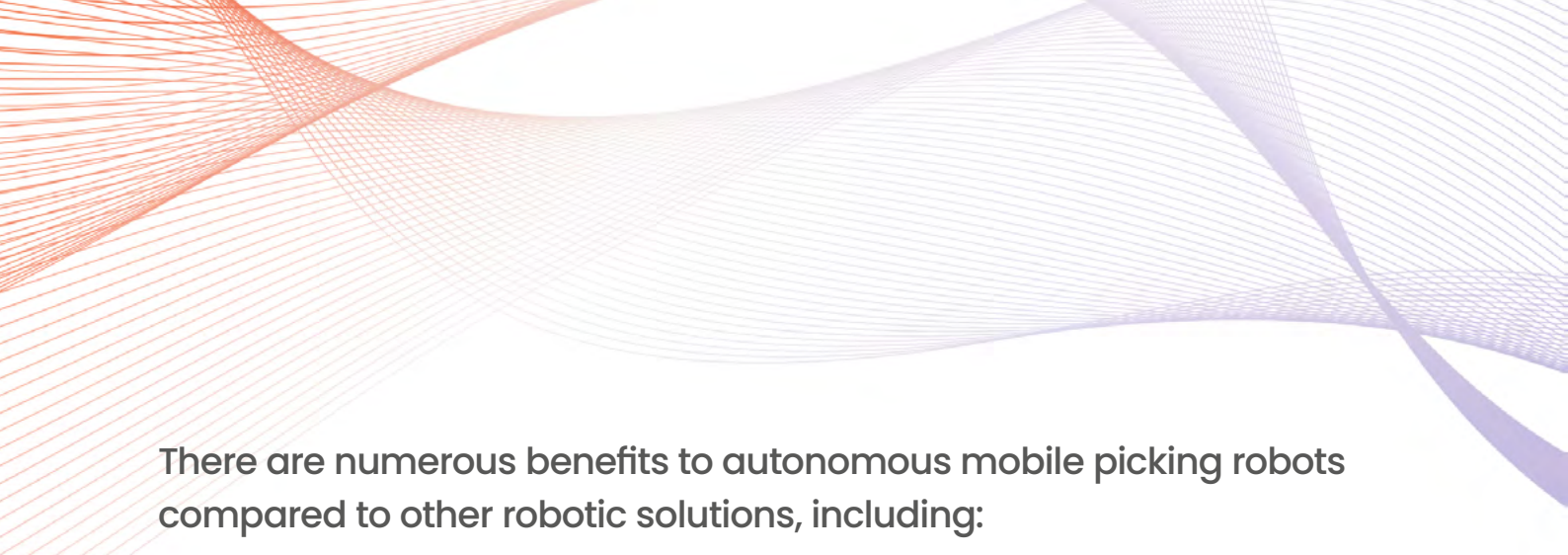
Illustrative pick paths of AMPs



Human-hours and robot-hours for 10,000 picks



¹⁰Assumes all items are robotically pickable; human pickers may still be required for items that are not robotically pickable.



There are numerous benefits to autonomous mobile picking robots compared to other robotic solutions, including:

- » Lower costs and higher ROI as fewer robots need to be deployed
- » Higher throughput as robots do not need to constantly travel back and forth between each pick
- » Less congestion as there are fewer robots traveling around the warehouse
- » Higher savings on labor as both travel and picking are automated
- » Higher picking accuracy as robotic picking eliminates human picking errors

Inadequate Autonomous Mobile Picking Solutions of the Past

If autonomous mobile picking robots are so efficient, why haven't they become more widespread?

A few companies attempted to develop early prototypes, yet none succeeded in delivering one to market. They proved to be too inaccurate, bulky, expensive, and drastically slowed down replenishment. The issue was they tried to pick directly from shelves, meaning items had to be perfectly organized on the shelf to be robotically pickable. Any misalignment would lead to items tumbling off the shelf, resulting in high error rates and poor reliability. Meanwhile, the need to meticulously place each item on the shelf resulted in low storage density and a highly manual and slow replenishment process. These limitations meant that, until now, autonomous mobile picking has not been a viable solution for warehouses.

Autonomous Mobile Picking Robots That Work

Brightpick Autopicker is the world's first commercially-available autonomous mobile picking robot for ecommerce and grocery order fulfillment. It is the only warehouse robot capable of both picking and consolidating orders in the aisles. Like a human with a cart, Brightpick Autopicker moves around the warehouse, retrieves product storage totes (bins) from shelving, and robotically picks items from those totes to consolidate an order in the aisles.

Brightpick Autopicker can reliably pick groceries, cosmetics, personal care products, electronics, pharmaceuticals, apparel and more with 99.9% accuracy. It is fully patented and powered by proprietary machine vision and AI technology. Its advanced AI algorithms have been trained on more than 250 million picks to date and use machine learning to improve with each pick.



Conclusion

It is clear that companies selling online can benefit from automating their order picking. Different robotic solutions require varying amounts of labor and robotic resources; among them, autonomous mobile picking requires the least of both. As warehouses look to cut picking costs, increase picking accuracy and reduce labor needs, autonomous mobile picking will offer the highest ROI and lowest cost per pick of any solution.

About Brightpick

Brightpick offers the world's most efficient warehouse automation solution for ecommerce and grocery order fulfillment. The company's end-to-end robotic solution autonomously picks, consolidates and dispatches orders in large, small and micro fulfillment centers. The Brightpick solution takes less than a month to deploy, enables warehouses to reduce their picking labor by 95%, and cuts costs for order fulfillment by half. Brightpick is part of Photoneo Brightpick Group, headquartered near Cincinnati, OH, which has more than 300 employees and 5000 technology installations across the US, Europe and Asia. Its customers include leading companies such as General Motors, Volkswagen and KUKA. For more information, visit www.brightpick.ai