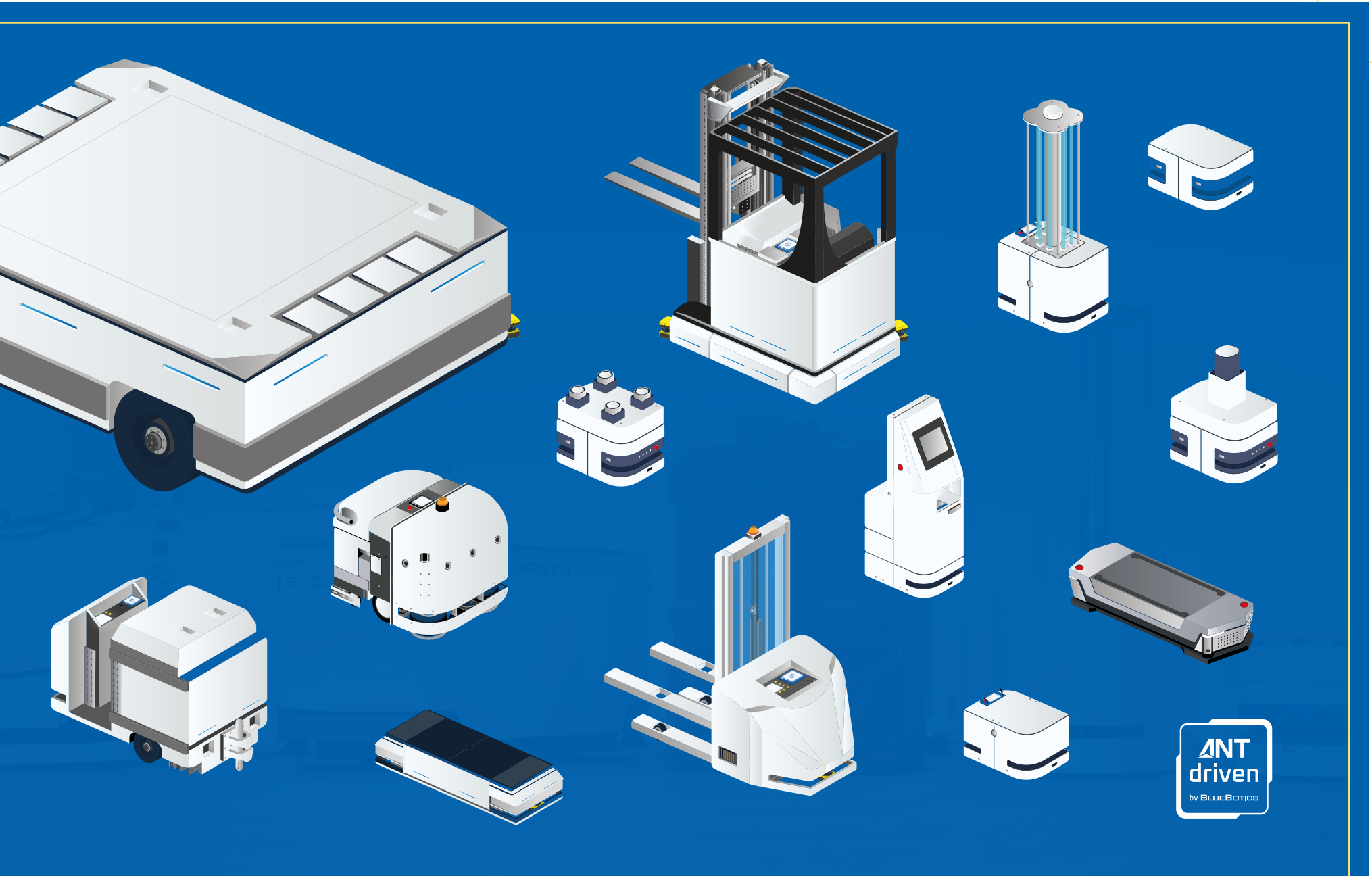
# AGV BUYER'S GUIDE

## Your guide to choosing the right automated guided vehicle for your business




www.ANTdriven.com

The world of automated guided vehicles (AGVs) can be overwhelming. How do these solutions work? Are they safe? What return on investment can they offer? There are numerous questions to explore before embarking on an investment.

This guide aims to answer these queries and more. In it, we provide you with clear, concise information you can use to identify the best-fit automated system for your business.

First, we explore what AGVs are, including looking at the different types of vehicles available and how they work. We dive into how much they cost and how to calculate AGV ROI. And we explore the potential benefits AGVs can bring your organization, while also highlighting some potential drawbacks you should be aware of. Lastly, we explain the five things you should always consider before moving forward with any vehicle investment.

Looking for one-on-one guidance? You can **book a free consultation call** with one of our logistics experts at any time, otherwise feel free to contact me directly.

Enjoy the guide!

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# 1. WHAT IS AN AUTOMATED GUIDED VEHICLE?

An automated guided vehicle or AGV is effectively a type of mobile robot. AGVs are sometimes called automatic guided vehicles or autonomous guided vehicles.

AGVs follow a series of predetermined instructions, cues or signals (depending on the type of autonomous navigation technology they use) to move around and complete actions, such as picking up or dropping off materials.

AGVs are a safe, efficient and cost-effective transportation solution. Therefore, they are well suited to warehousing (intralogistics) and manufacturing operations, or any other application that requires repetitive material handling tasks tasks to be completed in a timely manner.

In other words, AGVs excel at doing what would be boring jobs for humans, very efficiently.

> *"We've been able to meet our target headcount reduction of approximately 73%, and it's also led the way for us to explore other AGV possibilities... It's definitely been a successful project."*
>
> **Steven Lockhart**
> **Head of GECOM's Corporation's Continuous Improvement team**

## AGVs vs AMRs

AGVs are sometimes confused with AMRs (**autonomous mobile robots**). However, there is an important difference between these two types of vehicles.

According to the safety standard For Industrial Mobile Robots – Safety Requirements ANSI/RIA R15.08-1-2020 (R15.08), "The fundamental difference between AGVs and AMRs is characterized by how they traverse the specified operating environment. An AGV traverses the specified operating environment automatically along predefined guide paths (virtual or physical) using collision avoidance" whereas the standard defines AMRs as able to "traverse the specified operating environment by detecting obstacles using sensors and adjusting paths by computing an obstacle-free path through free space rather than using a predefined path."

In other words: when AGVs follow a path around a site - which might be physical (such as magnetic tape) or virtual – if they encounter an obstacle, they simply stop and wait until a human employee removes the blockage. By contrast, AMRs navigate dynamically around obstacles, before finding their way back to their default programmed route).

# 2. TYPES OF AGV

"Vehicle" is a broad term, so let's get more specific. Most AGVs can be categorized into one of four categories:

**underride AGVs**, **tow tractors**, **unit load carriers** and **forked AGVs**. Let's take a closer look at each.

## Underride AGVs

*Also called: automated guided carts (AGCs), self-driving carts, under-cart AGVs, mouse AGVs.*

Underride AGVs drive underneath their payloads, attaching to them in different ways (using retractable pins, lift modules and so on).

Some underride models are also capable of towing.

**Explore: underride AGVs**

An underride AGV by **Kivnon** transporting linen in a hospital.

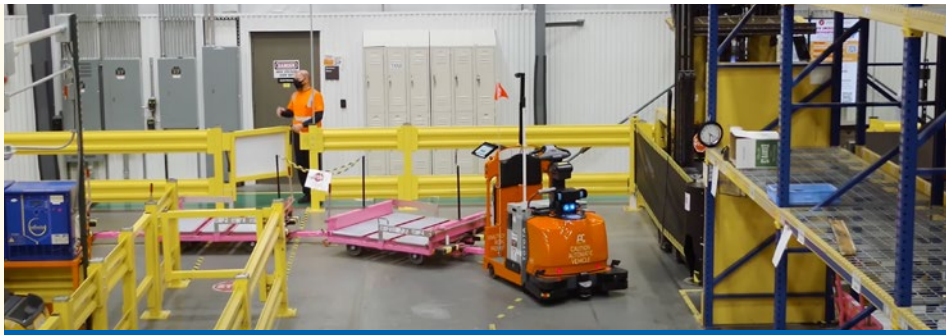
## Tow tractor AGVs

*Also called: tractor AGVs, tugger AGVs, towing AGVs.*

These automated vehicles do one job: pulling heavy loads such as carts or dolly trains.

Tow tractor or 'tugger' AGVs offer towing capacities of up to several tons and offer high throughput since they can move several carts of goods simultaneously.

**Explore: tow tractor AGVs** | **Read: Tugger AGV Guide**



A Toyota Core Tow Tractor by **Toyota Material Handling Inc.**

## Forked AGVs

*Also called: forklift AGVs, pallet truck AGVs.*

A forked AGV is simply an automated guided vehicle with forks. These vehicles perform similar tasks to automated forklifts: lifting and transporting materials and goods.

Unlike **automated forklifts**, which are autonomous versions of existing manual vehicles, forked AGVs are designed exclusively for automated operation. They cannot be driven by humans (so-called hybrid operation).

**Explore: forked AGVs**


Forked AGVs by **Stöcklin Logistik** hard at work in a Swiss manufacturing facility.

## Unit load AGVs

*Also called: unit load carrier AGVs, unit load deck AGVs, turtle AGVs.*

Used most often in production and warehouse facilities, unit load AGVs carry their payloads on top and are available with a range of different transfer devices, such as conveyors and lift platforms.

A common use for a small unit load AGV is to move goods between fixed conveyor systems.

**Explore: unit load AGVs**

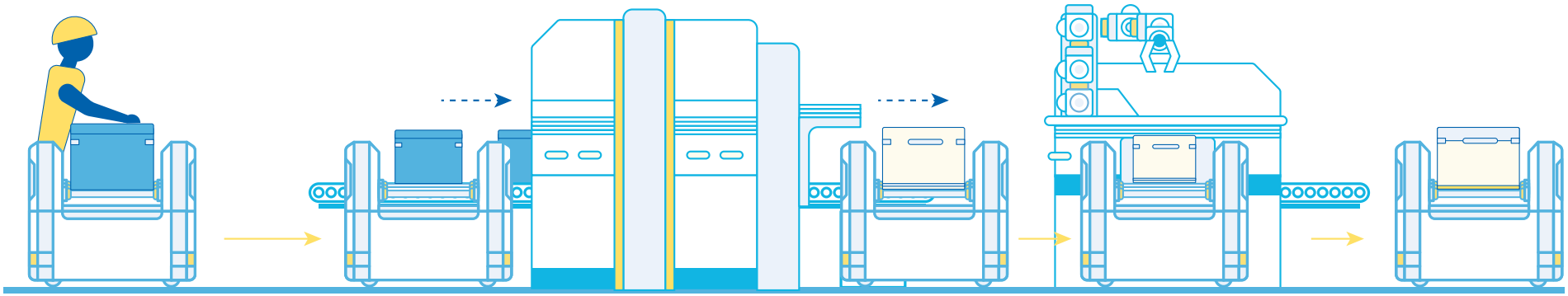

DTA's **Dolphin AGVs** are fully customizable and capable of carrying a wide range of payloads, such as aircraft fuselages.

# 3. APPLICATIONS

Automated guided vehicles are highly flexible: they can benefit any application that requires the repetitive, timely and safe movement of goods or materials.

In a typical manufacturing setting, for example, AGVs might:

- Move raw materials from staging to production lines.
- During assembly, move semi-finished products from one station to the next.
- Transport finished goods back to the warehouse.



## What industries do AGVs suit?

AGVs typically perform jobs that would previously have been carried out manually, for example using forklifts, manual carts, pallet jacks, or conveyor systems. These processes are employed across a huge range of industries, therefore AGV technology suits numerous sectors.

## Manufacturing

Similar to the adoption of fixed automation equipment like robotic arms, AGVs were initially adopted in highly regimented automotive production.

Today however, AGVs are being widely deployed in high-tech manufacturing, such as the production of semiconductors, electronic consumables and more.

Customers in other sectors are increasingly beginning to roll-out AGV programs, ranging from food and beverage production to pharmaceutical, paper and printing, and heavy industries such as steel production and textiles.


AGVs are common in automotive production, such as this **Dürr EcoProFleet vehicle**, a solution designed exclusively to operate in paint shops.

## Intralogistics (warehousing)

AGVs are a key component of supply chain automation. According to a number of market studies,[1] the adoption of AGVs in warehousing is expected to grow hugely in the coming years, even more so than in manufacturing.

[1] https://www.abiresearch.com/press/revenues-robotics-deployed-warehouses-cross-us51-billion-2030/

**Nipper** pallet truck AGVs at work in a U.S. warehouse.

## Hospitals

AGVs such as the EVOcart line of Italian producer OPPENT are increasingly used to optimize on-site logistics, transporting everything from bed linen to meals, medication, PPE and waste materials.


EVOcarts by **OPPENT** transport linen and waste in a hospital in Italy.

## Intra-facility transportation

Some manufacturing plants are spread across large campuses. Although outdoor operation challenging, with the right type of system in place, AGVs can be used to transport materials or partially-completed products between buildings.


AGVs by **DTA** transport materials between buildings at a steelworks in Spain.

# 4. HOW DO AGVS WORK?

Automated guided vehicles travel along a pre-determined route or path, performing pre-programed tasks along the way (such as picking up and dropping off materials).

An AGV's paths can be physical, for example marked on the floor with magnetic tape or tags. Or they might be virtual, programmed using the vehicle's navigation software.

In the case of virtual path following, it is crucial for an AGV system to know a vehicle's exact position in order for this vehicle to navigate effectively. Different navigation technologies approach this challenge in different ways. In the case of ANT driven vehicles, for example, a vehicle's position is calculated using a combination of sensor data (such as data from LiDAR-based laser scanners) and odometry.

Advanced AGVs can work alone or as part of a larger connected fleet. To schedule tasks, distribute these between vehicles, and manage traffic, AGV fleet management software (such as ANT server) is commonly used. This software might be run independently by an AGV operator or its data used inside a site's existing software platform, such as a warehouse management, manufacturing execution or ERP system.

## What software do AGVs use?

It's easy, perhaps even natural, to first focus on hardware when assessing your AGV options. But the software running these autonomous vehicles is equally important.

Two main types of software are used when deploying and operating AGVs:

1. Configuration software
2. Mission & fleet management software

**Configuration software** is used by vehicle makers and third-party integrators — in other words, whoever is installing your AGVs on-site. This software is used to calibrate the vehicle before it starts working, to map the site, and to program the vehicle's routes and actions (such as moving its forks). An example is **ANT lab software** by BlueBotics, which is used to program **ANT driven vehicles**.

By contrast, mission and fleet management software is largely used by AGV operators (potentially you) to manage and optimize their on-site operations. This software typically offers features such as:

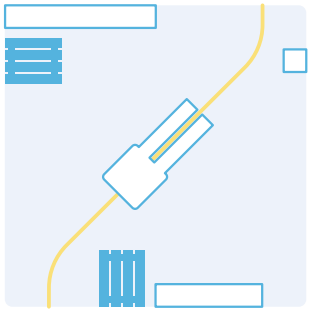
- Mission simulation (for testing before deployment)
- Mission scheduling
- Fleet monitoring
- Charging management
- Traffic control

This type of software, such as **ANT server**, can often also interface via API with on-site equipment such as elevators and automatic doors to ensure AGVs can communicate with such devices and get where they need to go. An API also allows AGV data to be piped into a site's existing WMS/MES/ERP software platform, allowing staff to manage AGV operations from within that program.

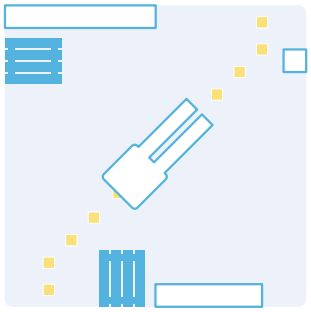
## How do AGVs navigate?

As discussed above, automated guided vehicles typically follow pre-defined guide paths or routes. Different navigation methods accomplish this functionality in different ways, but generally speaking AGVs either follow virtual or digital paths that exist only in the vehicle's software (virtual path following), or follow physical lines (line following) or tags that are on, or in, the ground.

In this section, we'll discuss the differences between these two approaches and their pros and cons.



Line following



Tag following

## Physical path following (line following)

Automated guided vehicles that follow physical lines have been in use for decades. With line following AGV navigation, vehicles are literally guided through the facility by a physical line, such as:

- Magnetic tape (stuck to the floor)
- Inductive wire (installed in or under the floor)
- Painted lines
- Tags (stuck to the floor, spaced intermittently in a line)

For example, a tape-following AGV will be equipped with a sensor that 'looks' at a line on the floor. It then measures the left and right error, and corrects the vehicle's trajectory as needed. Tag following works in a similar way.

### Pros and cons of line & tag following

| | |
|---|---|
| Highly accurate and repeatable | Time consuming and expensive to install |
| Robust to environmental change | Time consuming and expensive to modify routes |
| | Maintenance required (tape for example is subject to wear and tear) |
| | Fleet management difficult |

## Virtual path following

Automated vehicles that follow virtual paths are newer than those that follow physical lines, but they have still been in industrial use for over a decade.

There are several types of virtual path following technology. The key difference between them is how they calculate the vehicle's position.

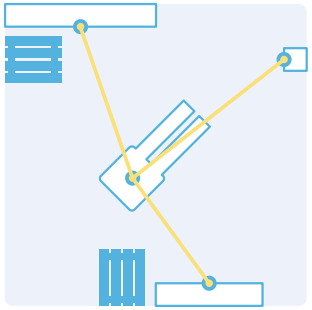
Virtual path following technologies include:

- Laser triangulation (also called laser guidance)
- Vision guidance (also called optical navigation)
- Natural navigation (also called free navigation, SLAM navigation)

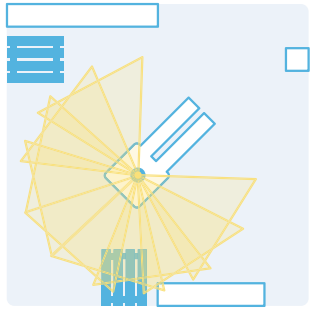
**Laser triangulation** uses references in the form of permanently-installed reflective targets to triangulate the position of the vehicle. It does this by firing beams around the space from a laser scanner installed on the vehicle. As the word triangulation implies, at least three targets must be recognized at any one time.

### Pros and cons of laser triangulation

| | |
|---|---|
| Highly accurate and repeatable | Reflective targets are time consuming and expensive to install (requiring a professional surveyor) |
| Robust to environmental change | Modifying routes may require the re-design and reinstallation of reflective targets |



Laser triangulation



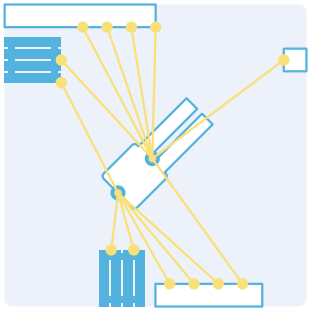
Vision guidance

**Vision guidance** uses cameras to recognize features in the environment. These features are then compared to a 3D map in order for the vehicle to calculate its position and navigate through the space.

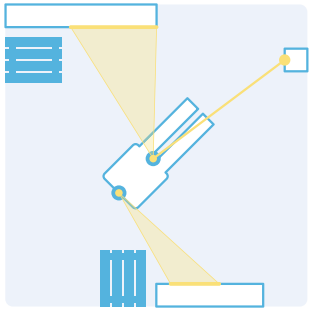
### Pros and cons of vision guidance

| | |
|---|---|
| Quick & cost-effective to install | Sensitive to changes in the environment |
| Quick & cost-effective to modify routes | |
| Efficient fleet management | |

**Natural navigation** uses data from a vehicle's laser scanners (often the AGV's safety laser scanners) to calculate the vehicle's position. It does this by comparing or 'matching' the laser scanner data to either the cells of a grid-based 2D reference map of the environment (scan matching) or permanent map references such as walls (as with **ANT natural 'feature' navigation**).



Natural navigation



ANT natural 'feature' navigation

### Pros and cons of natural navigation

| | |
|---|---|
| Quick & cost-effective to install | |
| Robust to environmental change | |
| Quick & cost-effective to install | |
| Quick & cost-effective to modify routes | |
| Efficient fleet management | |

## How fast do AGVs drive?

An AGV's speed is a fine balance between its achieving optimal efficiency (maximizing the number of missions per shift) and ensuring the vehicle's safety (ensuring optimum stopping distances).

Most AGVs on the market today move at speeds of up to 1.5 m/s (3.3 mph). Vehicles that are driven by ANT navigation by BlueBotics can drive up to 2 m/s (4.5 mph). With some vehicles and applications even faster speeds are possible, but safety must always remain the priority.

## Are AGVs safe?

Yes. Automated guided vehicles are significantly safer than their human-driven counterparts.

Compared to AGVs, manual forklift trucks for example have a much higher level of recorded accidents and incidents. In fact, over the average eight-year lifespan of a manual forklift, about 90% of these vehicles will be involved in some type of accident.[2]

By contrast, with automated guided vehicles the incident level is virtually zero. In rare cases where AGVs have been involved in accidents, this is often due to proper safety procedures not being followed on-site. Therefore, as with manual vehicles, in-depth and ongoing staff training is essential.

With their controlled movements, consistent speed and certified safety sensors, AGVs represent a very safe and reliable solution.

**Tip:** When it comes to AGV safety, the time of highest risk is during the vehicle's installation — when routes are being tested and staff are getting used to having the vehicles around. Advance briefing and careful employee training are therefore essential. This training has the side benefit of improving employees' acceptance of the new technology.

[2] https://www.meilirobots.com/resources-list/operational-safety

## Comparing the stats: manual vs. automated vehicle incidents

- Manual forklifts: estimated 85 deaths linked to forklift accidents every year in the U.S. alone[3]
- 2 recorded deaths linked to AGVs in the US: in 1997 and 2012[4][5]

## The business impact of different AGV navigation technologies

An AGV's navigation technology has a direct impact on how efficient, flexible and scalable that vehicle installation will be over time.

The installation of line following- and laser triangulation-based AGVs, for example, requires fairly significant changes to a site's infrastructure (laying tape or installing reflective targets high on the walls), while technologies such as natural feature navigation do not require any permanent changes - except for sometimes reflective stickers being added if a site has very few walls (features) visible.

These differences affect installation timings too. Line or tag following AGV installations, for instance, might take several weeks to set-up, while AGV projects based on vision guidance or natural navigation are commonly up and running in just a few days.

And installation may not be a one-time event. As your site and business evolves, you may have to modify routes. For some technologies (like line-following) this may mean an entirely new layout design and implementation. Other navigation technologies (like **ANT by BlueBotics**) can be modified, via the vehicle's configuration software, in just a few clicks. Other technologies (such as laser triangulation) fall somewhere in between these two extremes.

Choosing a technology which can be easily modified is essential to the long-term profitability of your automation project.

When choosing AGV technology, it is also important to consider the future scalability of your automated fleet. Virtual path following technologies are much more suited to advanced AGV fleet management, in particular traffic control, than older physical line-following technologies. Many **ANT driven vehicles** are even interoperable, enabling you to build out a diverse multi-brand fleet that is controlled via one software interface.

[3] https://www.safetymanualosha.com/forklift-fatalities/

[4] https://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=200900348

[5] https://www.mhlnews.com/chain-of-thought/article/22049995/death-by-agv-is-a-tragic-surprise

## How accurate are AGVs?

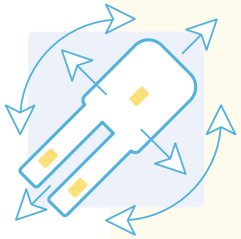
When an AGV is picking, dropping, or docking to recharge, high accuracy is required. The level of AGV precision possible is a direct result of a vehicle's positioning accuracy (determined usually by its navigation system).

This accuracy varies from vehicle to vehicle, but as an example, most AGVs which navigate using ANT by BlueBotics are capable of achieving a positioning accuracy of approximately one centimeter, and one degree – sometimes better. This is more than precise enough for most intralogistics and production applications.

## What types of AGV steering are available?

How an AGV steers (its drive kinematics) has a direct impact on how it performs. Its steering system affects, for example, how well a vehicle can operate in tight spaces (such as when slotting between conveyor systems) and the radius of its turning circle.

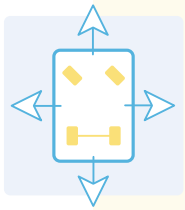
It is useful then to understand the different AGV steering systems available and to consider which set-up might best fit your operation's needs. The most common AGV steering types are explained below.



### TRICYCLE

Features:
- Agile, small turning radius

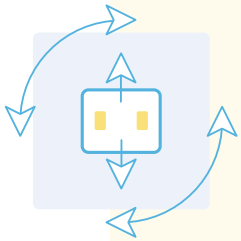
Used by:
- Forked AGVs, automated forklifts, tow tractor AGVs



### CAR-LIKE (ACKERMANN)

Features:
- Stable, suits heavy loads

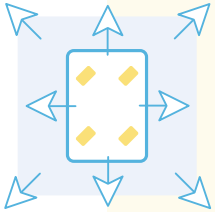
Used by:
- Unit load carrier AGVs, autonomous mobile robots (AMRs)



### DIFFERENTIAL

Features:
- Agile can turn on spot

Used by:
- Smaller AGVs, autonomous mobile robots (AMRs)



### OMNIDIRECTIONAL

Features:
- Highly agile, can move in any direction
- Suits tight environments

Used by:
- Unit load carrier AGVs

# 5. COST OF AGVS

How much an AGV cost depends on the type of vehicle in question.

In the U.S. for example, a forked AGV might cost USD $100,000-120,000 or more, while an automated pallet truck might cost around USD $70,000. Tow tractor AGVs are usually cheaper at around USD $60,000. While underride AGVs can cost as little as USD $20,000.

On the maintenance side, AGV upkeep usually costs around 10% of a vehicle's sticker price per year, compared to approximately 5% for manual vehicles. It is also important to factor in the costs of commissioning (installing) AGVs on-site, which can vary greatly depending on the complexity of your project (e.g., the number of pick and drop locations).

## Long-term efficiency benefits

Although the upfront costs of AGVs are significant, the efficiency benefits they bring usually lead to significant return on investment being achieved, often in as little as one or two years.

## The cost of manual vehicles

Although AGVs have a higher initial cost than manual vehicles, manual vehicles typically cost more over a period of several years. There are two key reasons for this:

- Labor costs: In the U.S., for example, the average annual salary of a forklift driver is over $36,000, or as much as $41,000 with overtime.[6] While AGVs combine labor and hardware costs into a single one-off cost, the labour costs associated with a manual vehicle continue year-on-year. In addition, labor costs can also vary greatly and therefore, unlike AGV running costs, can be difficult to predict.

- Manual vehicles such as forklift trucks are associated with a high level of accidents and on-site damage (to stock, machinery, and facilities themselves). Automated vehicles work only as programmed and therefore do not have the same risk profile.

[6] https://www.indeed.com/career-advice/pay-salary/how-much-does-forklift-driver-make

# 6. HOW TO CALCULATE AGV ROI

To sell the business case for AGVs inside an organization it is important to gather as much credible data as possible. Calculating the potential return on investment of such technology is therefore a valuable exercise.

As with any high-value investment, there are many factors to take into account when calculating how long it will take for an automated guided vehicle to pay for itself.

> *"The investment in service robots for logistics in manufacturing processes is amortized rapidly, if a 24 hours/day operation may be assumed. Therefore, the investment in service robots for logistics may be repaid within 2-3 years, and given a lifetime of 15 years, operating costs are below 5% of the annual investment. Operation availability can be assumed as 98.5%."*
>
> - World Robotics -
> Service Robots 2021

Before starting any calculation, it is useful to identify the following:

- The initial cost of the automated guided vehicle
- The equivalent cost of the manual vehicle(s) an AGV is replacing
- The estimated annual maintenance cost the manual vehicle(s) an AGV is replacing
- The costs and overheads of the labor being replaced (for example, forklift drivers)
- The estimated costs of damage to goods caused by the manual vehicles being replaced
- The cost of installing (commissioning) the AGV(s)

To put these figures to work, view a detailed example calculation at **ANTdriven.com/ROI**. Alternatively, try our **AGV ROI Calculator**.

AGV ROI CALCULATOR

# 7. ADVANTAGES & DISADVANTAGES OF AGVS

When assessing if automated guided vehicles are the right solution for your business, it is important to consider both the advantages they present and any potential limitations.

## Advantages of automated guided vehicles

There are many benefits that organizations can achieve by automating their mobile processes with AGVs. These include:

### Improved safety

Automated guided vehicles are involved in significantly fewer incidents and accidents than their manually-operated counterparts.

Adopting AGVs will almost certainly mean fewer injuries, and may also lead to lower business insurance rates and penalties.

### Cost savings & control

As an 'always on' resource, AGVs offer clear cost savings.

Although the initial capital investment (if not leased or paid via subscription) is larger than that of manual vehicles, ongoing costs are typically much lower. There are several reasons for this:

- AGVs move in a steady, predictable way, accelerating and braking in a controlled manner. Therefore, components need replacing less frequently than those of manual vehicles.
- AGVs always follow programmed safety protocols. They are much less likely than manual vehicles to be damaged or cause damage to goods, materials and infrastructure.
- Automated vehicle costs are more predictable than human labor costs, which can fluctuate greatly.

## Increased capacity

Hiring and retaining material handling staff is a common challenge for many modern organizations. In the U.S., for example, MHI's Annual Report[7] lists workforce challenges as one of the biggest pain points for logistics operations.

Where human resources are in short supply, AGVs can provide the capacity needed. Additional vehicles and routes or missions can be added as required, and AGVs can work a near continuous shift with minimal staffing overheads.

[7] https://www.mhi.org/publications/report

## Greater efficiency

Efficiency, predictability and accuracy are often critical in environments such as warehousing and manufacturing.

As an 'always-on' resource, AGVs can provide predictable, repeatable efficiency (ideal for organizations aiming for 24/7 operation), only stopping to recharge.

This can free up human workers' time to focus on higher value tasks that require more specific skills or consideration.

## Substantial return on investment (ROI)

Robust, efficient and driver-free, AGVs offer the chance of significant return on investment.

Depending on the type of AGV, breakeven can be achieved in as little as a year or two, sometimes even less. Explore AGV ROI in-depth at **ANTdriven.com/ROI**.

*"Key supply chain challenges: Survey respondents report that their organization's greatest challenge continues to be hiring and retaining qualified workers."*

— The 2021 MHI Annual Industry Report: Innovation Driven Resilience

## Disadvantages of automated guided vehicles

While the benefits of deploying AGVs are very real, there are potential drawbacks to be aware of too. As with any investment, it pays to understand both sides before moving ahead.
These possible negatives include:

### High cost

Today, AGVs are expensive compared to manual vehicles. In the U.S. for example, a standard manual forklift truck might cost around $25,000 off the shelf, compared to up to $120,000 for a similar automatic model.

However, as with any technology, AGV prices are predicted to fall over time and leasing schemes are increasingly available, as are Robots as a Service (RaaS) subscription models.

To explore the difference between forklift and AGV costs cost over time, try our **AGV ROI Calculator**.

### Reliance on WiFi

Most AGV systems require some level of WiFi connectivity between vehicles and their mission and fleet management software. Some types of navigation technology even require communication between vehicles themselves.

This reliance on WiFi can be an issue on sites where signal coverage or strength might vary.

However, choosing the right navigation system can help avoid these issues.

Vehicles driven by ANT navigation include embedded mission control, which enables them to run standalone missions without the need for WiFi access. Once the vehicle's map, routes and actions have been received from the server, computation is handled entirely on-board.

With larger fleets of **ANT driven vehicles**, vehicle navigation and actions are again managed on-board, with WiFi connectivity only required for traffic management.

## Lack of interoperability

Most AGV manufacturers' product lines are closed systems. A producer might offer fleet functionality, but the software provided is usually only capable of managing that producer's vehicles.

If another brand of AGV needs to be deployed on-site then, these vehicles will require totally separate installations, involving the use of different software programs and most likely different physical routes throughout the site.

In short, lots of hassle.

This is not the case with '**ANT fleet ready**' vehicles based on BlueBotics navigation. These can be operated in one connected fleet, managed with BlueBotics ANT server software - no matter what the vehicle type or brand.

## Lack of flexibility

If your operational requirements change, your AGVs will need to be reprogrammed. This is quickly done in a vehicle's configuration software, but AGVs are still less 'on the fly' flexible than a human forklift driver simply driving down a different aisle.

## Environmental limitations

Human-driven forklifts are highly adaptable, especially with a skilled driver at the wheel.

By contrast, most AGVs require specific conditions to work at their best. They can struggle to work effectively on uneven floors, slopes, and wet, slippery surfaces. AGVs that use vision guidance might also experience navigation challenges in low-light conditions.

Be sure to understand an AGV's environmental preferences before you invest.

*"67% of supply chain leaders believe robotics and automation have the potential to disrupt or create competitive advantage."*

— MHI Annual Industry Report 2019

# 8. 5 THINGS TO CONSIDER WHEN CHOOSING AN AGV

There are many factors to consider when deciding which automated guided vehicle technology to invest in. The questions below should help you steer clear of any obvious AGV investment mistakes.

## 1. How is the vehicle installed?

You may have explored a vehicle's functionality, but have you considered how it is installed? Will it take a matter of hours, just a few days, or weeks of integration with third-party personnel on-site disrupting your normal operations?

The main factor determining commissioning times is the type of navigation technology used to run the vehicle. AGVs based on natural navigation, such as ANT natural feature navigation by BlueBotics, are typically quick to install since they do not require permanent infrastructure changes.

> *"The global automated guided vehicle market size was valued at USD 3.0 billion in 2019 and is expected to witness a CAGR of 14.1% from 2020 to 2027."*
>
> — Grand View Research

## 2. How easy is it to adapt and change vehicle routes?

Businesses change and sites evolve. So, at some point you are likely to want to change the routes that your AGVs travel. Will this be as simple as you or your integrator reprogramming digital (virtual) paths in the vehicle's configuration software? Or will updates require more substantial and time-consuming physical changes? Check into this question carefully to ensure your AGV investment will not create big new expenses and delays every time your needs change.

## 3. How easily can you scale up your AGV fleet?

You may not require multiple AGVs today, but if your installation is a success then you might decide to expand your program in future.

Ideally, adding a new vehicle to your operation should not require a whole new installation project, so look closely at what fleet management options are offered with the AGV you are considering. Make sure you understand how easy it is, and how long it takes, to add in new vehicles as you go.

It is also worth checking whether your fleet management software ties you to one type of vehicle. Or alternatively, can the system accommodate other brands of AGV (as with ANT)? This is ideal, as it gives you the widest possible vehicle choice and allows you to avoid being locked into one vehicle supplier.

## 4. What kind of maintenance plan is offered?

Automated guided vehicles are only useful if they are doing what they are programmed to do, so be sure you plan how to keep them working.

Ensure you have access to an AGV maintenance plan that suits your business' needs and budget. Budget around 10% of an AGV's sticker price for maintenance per year.

## 5. How proven is the system in real-world applications?

You need to understand the risks associated with your choice. Will you be an AGV startup's first commercial customer or does the company have thousands of vehicles installed and proven in industrial applications around the globe? Ideally, try to speak to several other users of your preferred AGV system before you sign that purchase order.

## PLAN NOW FOR AN AUTOMATED FUTURE

Transitioning to AGVs can be a practical way of future-proofing your business, enabling you to boost effciency, increase capacity, and improve safety.

Automating processes with AGVs can also help your organization improve its resilience in these challenging times. So, with the automated guided vehicle market set to boom in the coming years (and more of your competitors likely considering putting automated vehicles to work), perhaps now is the perfect time to consider your AGV strategy?

To get started...

- Explore ANT driven vehicles at ANTdriven.com/vehicle-finder.
- Book a free consultation call with our logistics experts at ANTdriven.com/free-consultation.

ANTdriven.com by BlueBotics helps you identify and source the right automated vehicle technology for your business.

Start by learning about AGVs. Then, browse our database of ANT driven vehicles. Any questions? Book a free consultation with one of our experienced logistics experts.

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