



## Technology Information: Automated Truck Loading Systems

How automated truck loading can contribute to optimizing the supply chain



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### SUMMARY

The current economic conditions put efficient truck loading and unloading in the focus of companies. By the use of automated truck loading and unloading systems substantial and quantifiable reductions in time, manpower, space and material can be achieved. The systems also have a positive impact on ergonomics, safety and less damage to goods.

However, this technology is relatively unknown and to date only approximately 1 % of all truck loading and unloading takes place automatically. The main reason for this is that the trailers need to be dedicated and therefore, the systems are mainly used for applications with shuttle transportation. The second reason is that for a long time manufacturers have focused primarily on the automation of production and less on logistics.

Automated truck loading and unloading systems can especially contribute to the optimization of the logistics supply chain with a fast return on investment in applications with high volumes and short driving times.

Types of applications with high potential are:

- shuttle transportation
- high volumes
- standardized pallets and goods

Depending on the application, manual loading or unloading by means of fork lift trucks or the use of AGV's can be more effective. Because all three options have different advantages and disadvantages, in practice a combination of all three will seek to maximize cost efficiencies.

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## 1. INTRODUCTION

The conventional way of loading and unloading by means of fork lift or pallet trucks is used in almost every situation. With increasing volumes, manual loading and unloading becomes very personalized to their own requirements. Therefore, a lot of companies are keen to rationalize and optimize this specific aspect of the logistics supply chain. Next to increased efficiencies, focus on a clean and safe working environment and reduction of damage also play an important role. Especially in temperature-controlled transportation, the minimization of cooling loss during the loading process can decrease energy cost and has positive environmental effects.

The current macroeconomics impacting on automated truck loading and unloading are:

- rising personnel costs
- a shortage of labor
- increasing lack of space in metropolitan areas
- increase of outsourcing of logistics by third parties → shuttle transport
- increasing focus on controllable logistic costs
- increased attention for clean, safe and controlled logistic processes
- more stringent health and safety legislation

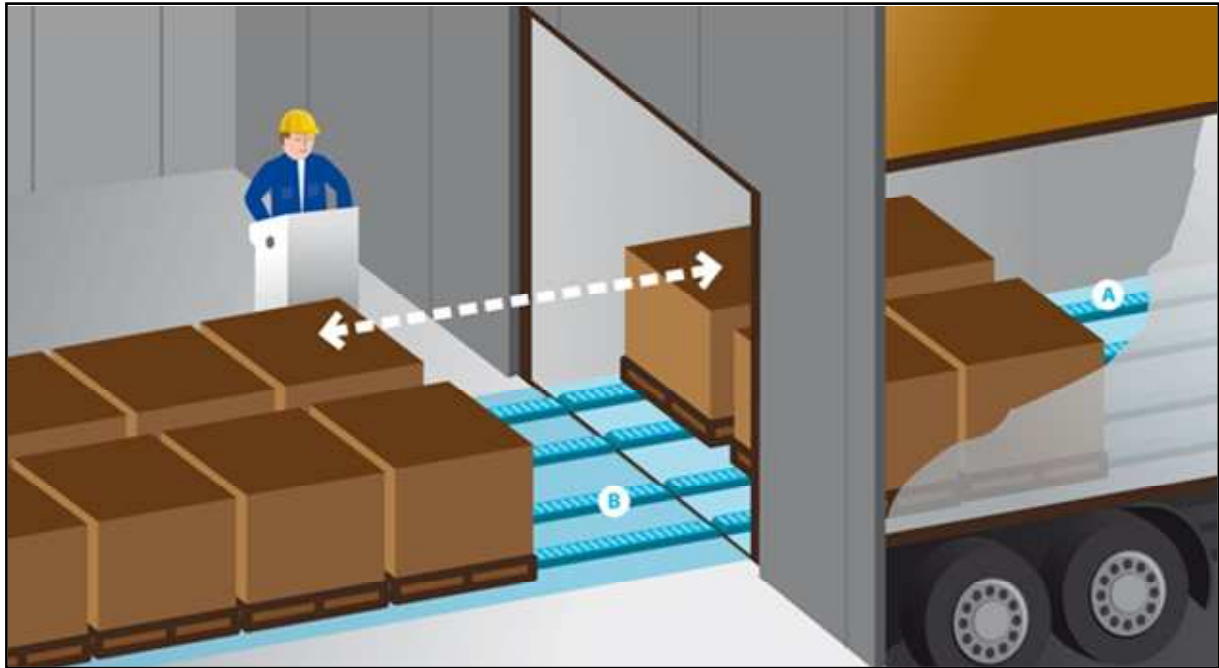
Because of these developments, automation of the loading and unloading of trailers is becoming more and more attractive for a lot of companies. In the right application and using the right technologies, the loading and or unloading time can be shortened to just over 2 minutes. This will result in significant and quantifiable reductions in among others personnel cost, warehouse, external space, and forklift truck running costs.

Focus of this white paper is primarily the loading and unloading of palletized goods and other stable cargo movers. Automatic loading and unloading of loose loaded cargo like waste or agricultural goods will only briefly be touched on.

Although the first automated truck loading systems (ATLS) have been around since the mid eighties, the advantages and limitations of this technology are still relatively unknown. To date only an estimated 1 % of all loading and unloading processes take place automatically. For this reason, this white paper has the objective of giving the reader a basic understanding of this technology and demonstrates it by means of a case example.

## 2. FUNCTIONALITY

ATLS are material handling systems which load or unload trucks and trailers automatically by using different kinds of conveyors, rollers or skates. Automated truck loading or unloading usually requires two systems: a system in the trailer (A) and a system inside the dock (B). When the trailer is positioned at the dock, the entire load is loaded or unloaded automatically.



Most types of systems can be fitted into new or existing standard trailers that have to be modified. A whole truck load can be loaded or unloaded in one shot of a block of pallets when the system in the trailer and the dock system are connected. The average conveying speed is 6m/min. Thus, a complete standard trailer can be loaded or unloaded in just over 2 minutes. The driver can operate the system using a simple control unit as shown in the picture on the right.

All types of systems are engineered according to the following possible specifications:

- minimizing system weight and build-height
- complying with strict health and safety legislation requirements relating to vehicle size and weight
- choice of 400V or 24V- power supply
- interfacing with new or existing internal transport systems
- structural requirements of the dock and the trailer(s)
- compact drive to maximize load volume
- type of load and/or type of pallets



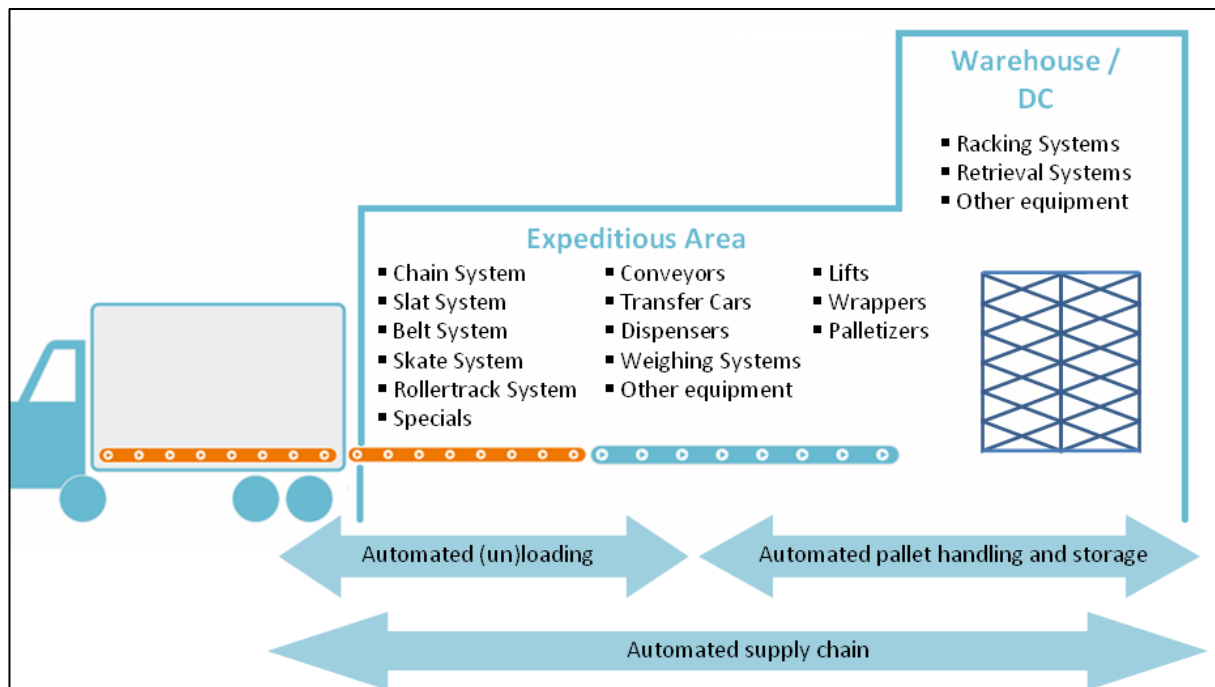
A video animation of an automated truck loading system can be viewed using this [link](#).

### 3. APPLICATION

Types of applications with high potential are:

- shuttle transportation on short distances (< 100 km)
- high volumes (> 6 shuttles per day)
- standardized pallets and goods

The following graphic illustrates the role of ATLS in the logistics supply chain:



The ATLS and the internal conveying systems can be connected and enable a fully automated supply chain.

The main reason that only very few companies make use of ATLS yet is that for a long time manufacturers have focused primarily on automation of production and less on logistics.

## 4. BENEFITS

The benefits of all types of ATLS are:

- fewer logistics personnel
- fewer fork-lift trucks and associated equipment
- fewer docks because each dock can handle higher volumes
- fewer trucks, trailers and drivers due to increased fleet utilization
- reduced warehouse space due to more concentrated flow of goods and less space needed for forklift maneuvering
- reduced outside yard space required due to less dock positions and quicker turnaround times of trailers
- reduced buffer stock due to quicker inbound and outbound transportation of goods
- safer working environment for personnel

However, certain limitations apply:

- Pallets or other cargo movers must be of relatively good quality
- the systems are approx 120 mm high → loss of space inside the trailer
- the weight of the system is approx 1.500 kg → possible loss of volume
- the walls of the trailer must be flush

The conventional way of loading with fork lift or hand pallet trucks, is still used in the vast majority of companies.

The advantages of manual loading are the flexibility of dock use, reduced initial investment and that no modifications to the trailer or the dock are required. On the other hand, the trucks can have long waiting times and there is no steady utilization of the personnel. Furthermore, the staff partially needs to work under physical and climatic unfavourable conditions (e.g. in refrigerated warehouses). In addition, the cost for personnel and the maintenance of the fork lift or hand pallet trucks can be considerably high.

An additional advantage of ATLS over the use of fork lift trucks is the reduction of accidents at the workplace. According to statistics of the HSE (Health and Safety Executive), in the most recent 5 years, 26% of fatal and major workplace transport injuries in the United Kingdom involving forklift trucks took place during loading or unloading processes.

The following table summarizes the advantages and limitations of ATLS compared to conventional, manual loading and unloading of trucks:

Advantages of ATLS	Limitations of ATLS
<ul style="list-style-type: none"> <li>▪ staff savings</li> <li>▪ reduction of loading times</li> <li>▪ less space needed for loading</li> <li>▪ less damage to cargo</li> <li>▪ connection with warehouse management</li> <li>▪ increase in handling capacity/ volume</li> <li>▪ possibility of loading outside the regular working times → no personnel necessary</li> <li>▪ ATLS still allows manual operation</li> <li>▪ savings in building technique (less loading docks)</li> </ul>	<ul style="list-style-type: none"> <li>▪ high initial investment - expensive to implement</li> <li>▪ modifications to the trailer needed → less flexibility</li> <li>▪ modifications to the dock necessary</li> <li>▪ difficult to move, remove or modify</li> </ul>



## 5. TYPES OF SYSTEMS

There are five standardized types of systems for automated truck (un)loading. Basic requirement for the employment of automatic truck (un)loading are dimensionally stable cargo movers like for example CHEP or Euro-pallets.

The following table proves an overview of the types of systems and applications.

System	Picture	Use
Chain Conveyor System		For standardized pallets, with the chains running under the supporting blocks of the pallets. Depending on the quality of the pallets and the weight of the goods, 2 or 3 track systems per pallet can be used.
Slat Conveyor System		For a mix of pallets, non-palletized cargo or slip-sheets. The slats create a full surface. Depending on the type and weight of the goods a 3 or 4 lane system can be used.
Belt Conveyor System		For loose loaded parcels and non-palletized goods. The belt creates a full surface.
Skate System		Euro pallets, short side leading, or when using a subfloor, double deck pallets can be used as well. No system in the trailer is needed, only limited modifications to the trailer floor.
Roller Track System		For air cargo pallets. There are different types for different weights depending on the pitch and width of the rollers and the number of tracks used.



Two other types of systems are the carpet system and the walking floor system. They make use of an integrated conveyor belt technology respectively; the moving floor itself is used to load or unload the materials and there is no other floor beneath the system. Those are predominantly used for loose loaded cargo like waste and agricultural products.

When transporting standard palletized goods the system which is applied the most is the chain conveyor system for the following reasons:

- low weight
- low cost
- low maintenance
- highly standardized
- easily installed in 95% of all new and existing trailers
- limited trailer modifications needed
- full utilization of trailer length due to compact installation of the drive unit at the front of the trailer

In practice, often customized systems and combinations of different types of systems are applied. Efficiency can be increased further by adding elevators, lift platforms and/or turntables and conveyors that interface with the automatic loading and unloading systems.

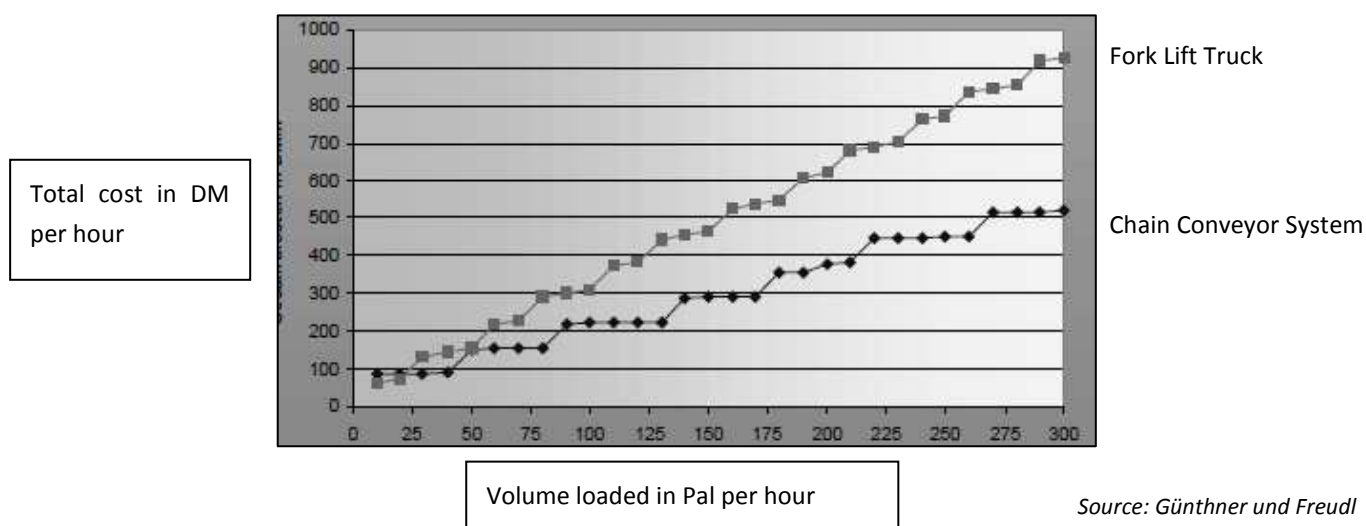
## 6. RETURN ON INVESTMENT OF ATLS

The initial high cost of investment is the most common reason why companies do not automate their loading or unloading process. However, the short loading times that can be obtained with those systems allow significant cost savings in the truck fleet and personnel over time, thus, the total cost of operation can be lower than the cost of manual loading.

The significance of the loading und unloading process on total cost increases with the volume of goods loaded and unloaded or shorter driving times. Therefore, the return on investment times for ATLS depend greatly on those two factors.

### 6.1. Volume

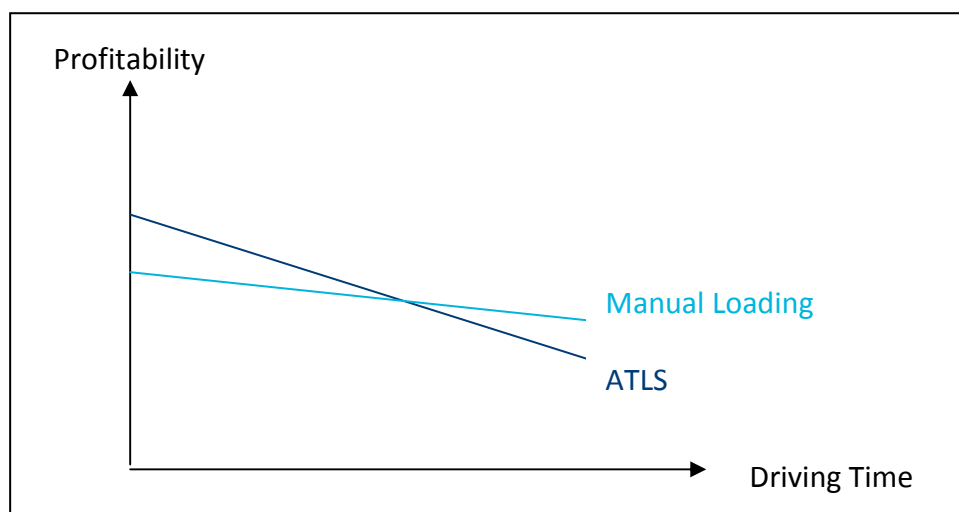
For an optimal profitability of an ATLS, shuttle transport on short distances with a high frequency and high quantities of cargo is required. As the following graph shows, the profitability of ATLS increases with the volume transported:



This graph shows that the higher the volume loaded, the more cost savings can be achieved with an ATLS. This example illustrates the cost advantages of a chain conveyor system over manual loading with fork lift trucks.

## 6.2. Driving Time

As the following graph shows, the profitability of ATLS increases with a decreasing driving time:



Source: Günthner und Freudl

The reason for this increase in profitability is that the shorter the driving time, the higher the impact of the loading times on total cost (Günther, n.d.). This also explains why ATLS are especially useful in shuttle transportation using dedicated trailers.

In conclusion, ATLS have significant cost advantages over manual loading and unloading as volumes and driving times increase.

The ROI for your specific application can be calculated using this [link](#).



## 7. THE AGV ALTERNATIVE

Automatic guided vehicles (AGV's) can also be used for automated loading and unloading of trucks. Yet, there are significant differences between the two technologies.

An AGV is a driverless and computer-controlled vehicle which is equipped with guidance and collision-avoidance systems. It follows markers or wires on the floor or use vision and/or lasers for guidance.

AGV's automatically load and unload common trailers with pallets or other unit loads. They perform the same actions as forklift trucks or ATLS without adjustments to facilities, trailers or docks. AGV's have systems that detect personnel or obstructions. Upon detection, the vehicle slows down or comes to a stop, depending on the obstruction. They handle multiple operations and can perform line take-aways, warehouse storage and retrieval as well as carry out high-reach picks and placements with or without racks. They are also capable of unloading trailers and moving products between work-in-process (WIP) and other manufacturing operations.

The following table compares the two systems:

	ATLS	AGV's
Picture		
Strengths	<ul style="list-style-type: none"> <li>▪ quick loading times (2 min.)</li> <li>▪ relatively cheap</li> <li>▪ wide range of goods</li> <li>▪ proven concept, robust</li> </ul>	<ul style="list-style-type: none"> <li>▪ limited trailer modifications needed</li> <li>▪ limited dock modifications needed</li> </ul>
Weaknesses	<ul style="list-style-type: none"> <li>▪ dedicated trailer needed</li> <li>▪ dedicated docks needed</li> </ul>	<ul style="list-style-type: none"> <li>▪ long loading times (45 min.)</li> <li>▪ expensive solution</li> <li>▪ in pilot stage</li> <li>▪ 1 operator on 3 AGV's</li> </ul>
Best suited for	<ul style="list-style-type: none"> <li>▪ high volume shuttle transportation</li> </ul>	<ul style="list-style-type: none"> <li>▪ overnight loading for 1-way transport</li> </ul>

AGV's do not require any special modifications to existing equipment, dock areas or trailers, which is the main advantage over ATLS. They do not require installations of additional hardware, conveyors or other modifications. But AGV's still need operators and also make the loading and unloading process longer instead of shorter. Therefore, they do not provide the main advantage for the customer which is a reduction of the loading and unloading times. ATLS can be operated by the truck driver.

Because AGV's and ATLS have very different advantages, there is a tendency on the market to use them in a combination. A very interesting combination for an optimization of the supply chain is staging and/or unstaging by AGV's and loading and/or unloading by ATLS.

## 8. CASE EXAMPLE: PARTNER LOGISTICS

Project number:	724
Year of completion:	2002
Location:	Bergen op Zoom, Netherlands
Industry:	FMCG
End user:	Lamb Weston/Meijer
Logistics Service Provider:	Partner Logistics
Type of system:	Chain conveyor system
# Dock systems:	6
# Trailer systems:	4
Products transported:	Deep-frozen potato products



*Lamb Weston Meijer is a high quality producer of deep-frozen potato products and appetizers. They operate several facilities in Europe and serve customers in food services, retail and industry. Partner Logistics Europe carries out the storage and logistics of Lamb Weston / Meijer's products using the trailer loading and unloading solution of Ancra Systems BV.*

The shuttle transport between the production facility in Kruiningen and the highly automated cold store (65,000 pallets and -21 degrees Celsius) in Bergen op Zoom is streamlined using six stationary chain conveyor systems. Three loading systems are integrated into the automated material handling system to take in the end products from the production line. Prior to loading, the complete truckload is verified by an outline checking device to prevent cargo and truck damage.

Inflatable cushions installed at the dock shelter prevent penetration of open air when the trailer connects to the stationary un/loading system. In addition, an automatic bridge comes down to tide over between the mobile and stationary unit. These bridges are also installed for isolation purposes. Polyurethane (PU) wiring is used to maintain flexibility in low temperatures.

A separation space including a control unit enables the truck driver to control the un/loading process without being exposed to the extreme atmosphere. Outdoor traffic lights indicate which stationary units are occupied or free.

Ancra Systems BV engineered the system in a perfect way according to standards and regulations for deep-frozen products. Trailer systems were in accordance with ATP certification and only food grade lubricants are used.

This successful project has enabled Ancra Systems to standardize a tested and proven solution for cold store loading and unloading applications.



## 9. CONCLUSION

Automated truck loading systems are especially useful in shuttle transport or special conditions, e.g. the transport of deep-frozen products. They also provide advantages for the transport of high-value products, e.g. electronic components, because there is a significant reduction in damage to the product caused by manual handling and fork lift trucks.

Due to the high number of major and fatal workplace transport injuries caused by loading and unloading with fork lift trucks, ATLS can also play a role in improving corporate social responsibility by providing a safer working environment to the warehouse staff.

In the right application (high volume, short distances, standardized cargo movers), ATLS can bring major cost reductions and efficiency increases to companies. In particular, the decrease of loading and unloading times contributes to an optimization of the supply chain. However, there are situations in which loading and unloading by means of AGV's is preferable. Often, a combination taking advantages of the strengths of both technologies can be the most beneficial.

Companies need to evaluate carefully their specific logistic situation to find the best loading and unloading solution and take into account the possibilities and limitations of automated truck loading and unloading discussed in this white paper.



## 10. ABOUT ANCRA SYSTEMS

Ancra Systems supplies material handling systems for automatic truck loading and unloading and the connection to new or existing internal transport conveyors. Ancra Systems, located in Boxtel the Netherlands, is the largest supplier of automatic truck loading and unloading systems in Europe. The mission of Ancra Systems is to develop automatic loading and unloading concepts that deliver the greatest added value to the customers. This process always begins by gaining a long-term understanding of a customer's logistic processes so that all of the technical expertise can be employed.

Some leading clients are DHL, Toyota, Bavaria, Federal Express, Procter & Gamble, and Friesland Foods. Case examples of reference projects are available [here](#).

## 11. CONTACT

If you have questions or suggestions about our products or this white paper or require further information, please do not hesitate to contact us:

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