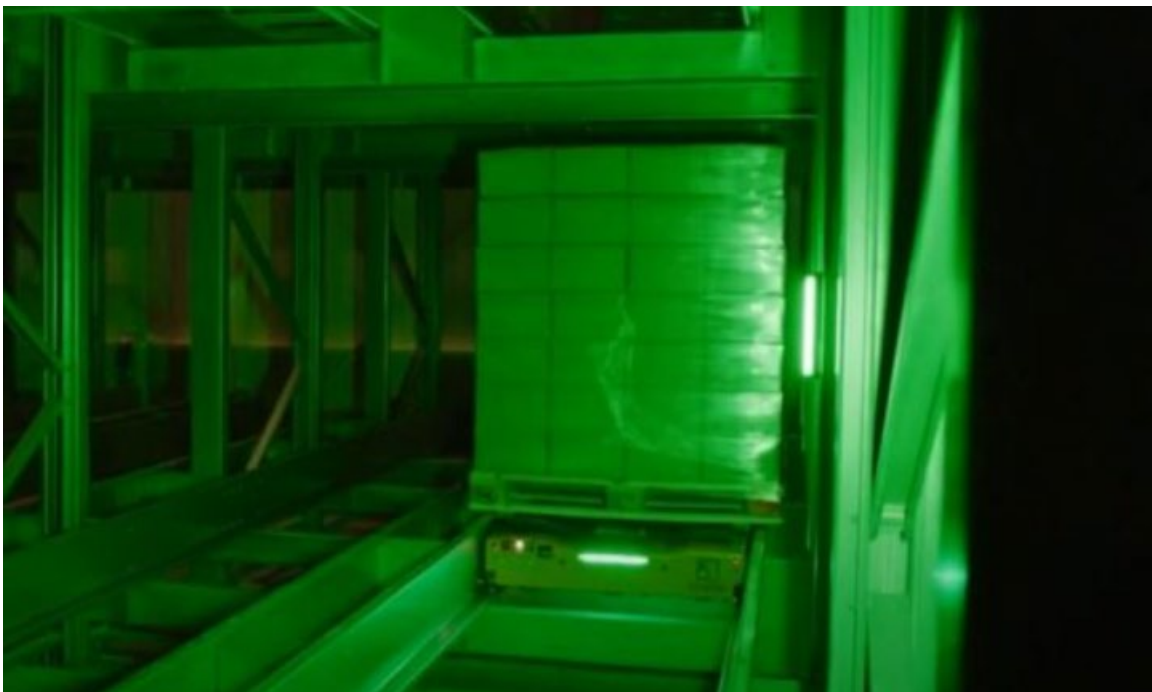


BEYOND PALLET POSITIONS

Choosing between conventional, semi-automated and automated cold storage

How stock profile, movement, labour and operational control shape the right storage route.



THE PRINCIPLE

The decision should begin with the operation and its data, not with a preferred storage system. Stock profile, pallet movements, access requirements, labour and the physical constraints of the cold store determine which options are worth developing.

INTRODUCTION

Pallet capacity is only the beginning

Cold-store storage systems are often compared by the number of pallet positions they create. It is an understandable starting point: refrigerated volume is expensive to build, cool and maintain, so every cubic metre has to work hard. But pallet count alone cannot show how effectively stock will move once the layout is operational.

A cold store also must protect airflow, maintain stock control, provide reliable access, and sustain dispatch when inbound and outbound demand peaks.

A layout can create an impressive capacity figure while leaving lanes partly occupied, concentrating too much activity at the aisle or increasing the handling required to reach stock.

The strongest design is not necessarily the one that stores the most pallets. It is the one that creates the right balance between storage, accessibility and movement for that operation.

Drive-In, Push Back, two-way shuttle storage and AutoCube® use the refrigerated cube differently. They also create different requirements for lift-truck travel, skilled labour, stock control, and technical support.

Comparing them is therefore not about establishing a winner. It is about understanding the conditions in which each solution delivers the most value for your cold store.

THE QUESTION THIS PAPER SHOULD HELP YOU ANSWER

What would our operation look like under each route, and which changes would create genuine operational and commercial value?

The information that can change the answer

Two cold stores can present the same cubic space and still require very different designs. One may feature deep lanes with relatively small number of SKUs but in large volumes. Another may manage smaller stock groups, more batches and intensive retrieval.

The storage solution should reflect how the inventory behaves, how workload arrives and where pressure is created.

Stock depth, not SKU count alone

Pallets per SKU, batch separation and changes in product mix determine whether deep lanes remain productively occupied or become fragmented by part-filled locations which impact space utilisation.

Access and rotation

SKUs need to be accessible to meet throughput demands and therefore, lane-based systems must be compatible with product life, batch control, customer ownership and the sequence in which stock has to leave.

Peak throughput

Daily averages can hide the design requirement. Intake windows, production output, order cut-offs and dispatch peaks determine how many movements must be absorbed when activity is concentrated.

Pallet and load quality

Dimensions, underside condition, deflection, overhang and load stability affect every storage solution. Shuttle and automated solutions require consistent pallet presentation whereas conventional pallet racking can be more forgiving.

Building and refrigeration

Clear height, columns, floors, evaporators, air paths, doors, fire protection and maintenance access define the practical storage envelope and could impact the design/capacity of potential automated solutions.

People, skills and growth

Availability of skilled FLT drivers, time in low-temperature areas, supervision and maintenance capability matter alongside future pallet count and peak movement.

A USEFUL COMPARISON TESTS MORE THAN TODAY

Representative stock and movement data should be tested against seasonal peaks, expected product change and credible growth scenarios.

Where conventional deep-lane storage fits

Conventional does not mean outdated. Where the stock profile supports deep lanes and a forklift-led operation remains proportionate, Drive-In or Push Back can provide high density without unnecessary equipment or integration.

Their value depends on choosing the right lane depths and understanding where the forklift truck works.

Drive-In

Drive-In requires the forklift truck to enter the storage lane. It can use refrigerated volume effectively where enough pallets of the same product or stock group can keep lanes occupied and direct access to each pallet is unnecessary. It relies on disciplined lane allocation, suitable pallets and clear operating procedures.

Its main compromise is access. The front of the lane governs what can be reached behind it, while every put-away and retrieval takes the truck into the racking. If the product range expands or batches must be separated, lanes that looked efficient in the design can become partly filled in practice with utilisation typically 65%.

Push Back

Push Back uses cart systems to store pallets several positions deep while keeping forklift-truck handling in the aisle. Loads move backwards on the carts as the lane fills and return towards the aisle as pallets are retrieved. This removes routine truck entry from the storage lane.

It suits operations holding several pallets per SKU where lane-level access and the applicable rotation method are acceptable. A deeper lane adds value only when the SKU profile can keep it productively occupied.

Why the conventional choice cannot be made from a layout alone

The meaningful difference is not the maximum pallet count. It is how each route manages access and vehicle movement, and whether the livestock profile can support the proposed lane depths.

Decision area	Drive-In	Push Back
Handling method	Forklift truck enters the lane.	Forklift truck remains in the aisle; pallets move on carts or rails.
Best fit	Larger stock groups, lower selectivity and disciplined lane allocation.	Several pallets per SKU where lane access and quicker aisle handling are valued.
Labour and movement	Every pallet movement requires travel inside the racking.	Routine forklift-truck entry into the storage lane is removed.
Data to test	Pallets per SKU, lane utilisation, rotation, pallet condition and retrieval frequency.	Pallets per SKU, lane depth, load quality, access frequency and grouping.
Risk to usable capacity	Part-filled lanes as product mix or batches change.	Lane depth that live pallet quantities cannot consistently use.

CLIENT QUESTION

If our current stock file were mapped against each lane depth, how much of the headline capacity would remain usable?

Where semi-automation changes the labour and movement model

A two-way shuttle takes over horizontal pallet movement within the storage lane. The forklift truck remains responsible for presenting and collecting pallets at the aisle. This dramatically reduces the amount of deep-lane movement dependent on the driver without removing the forklift or operator from the wider process.

That matters where skilled forklift-truck labour is difficult to recruit or retain. Semi-automation does not create a people-free warehouse, but it can reduce the amount of pallet travel that depends on a driver. For some businesses, it is the right long-term operating model rather than a stepping stone to full automation.

What the case must prove

The stock profile still must support deep lanes. The expected gain must also be tested against the number of shuttles required, how often they move between lanes, charging arrangements, forklift-truck availability at peak times and technical support. A physically dense layout can still restrict throughput if work converges on too few shuttles or active lanes.

CLIENT QUESTION

Could we automate the repetitive movement causing the constraint without automating the whole operation?

Where full automation changes more than storage density

Full automation becomes a credible route when density, pallet movement, labour dependency and operational control need to be addressed together. At that point, the question is no longer how to improve travel within a lane. It is how pallets should move through the cold store as a complete, controlled process.

AutoCube® is Thistle Systems' high-density automated pallet storage and retrieval solution. Pallets enter through controlled induction points before lifts, shuttles and conveyors complete the internal movements required for storage and retrieval. Loads return to defined outfeed points rather than requiring a forklift-truck driver to travel through the storage environment for every movement.

Cold stores will still need people for supervision, maintenance, intervention and recovery. The opportunity is to transfer routine pallet movement within the storage structure from forklift-truck operators to the automated system, while retaining trained people at defined interfaces and for safe intervention. Where labour availability is constraining resilience or growth, that change can be as important as the capacity created.

What the business case must prove

Value may come from better use of height and cube, fewer routine truck journeys, controlled sequencing, fewer touches or growth without increasing forklift-truck dependency at the same rate. These benefits must be measured against the current operation and tested for overlap. Feasibility must then address the building, refrigeration, fire strategy, pallet variability, peak movement, induction and outfeed, interfaces, maintenance and recovery.

CLIENT QUESTION

At what point would automation improve not only capacity, but throughput, labour resilience and operational control in our facility?

The automated warehouse also needs an operational view

AutoCube® provides physical storage, movement, retrieval and automated flow. MAXIQ® provides the orchestration, inventory visibility, system coordination and operational oversight required to manage that environment as one connected operation.

MAXIQ® enables requests and inventory information to pass between the customer's ERP or WMS and the AutoCube® controls, while the Warehouse Control System manages the automated equipment. This allows inbound, storage and outbound activity to be coordinated around operational priorities.

The value is not the dashboard alone. MAXIQ® provides a trusted view of inventory location, pallet movement and system activity. Teams can understand what the automated warehouse is doing, investigate events and make better-informed decisions without relying on physical observation inside the cold store.

MAXIQ® is not a generic WMS or a replacement for every customer system. Its role is to provide the orchestration, traceability, visibility and control that allow AutoCube® to operate as an integrated warehouse solution.

CLIENT QUESTION

Do we currently have enough visibility to understand where stock is, how it is moving and what is restricting performance?

Compare the operating models, not just the equipment

Decision area	Drive-In / Push Back	Two-way shuttle	AutoCube®
Storage model	Conventional medium density	Deep-lane density with shuttles moving pallets.	Fully automated, ultra-high-density storage and retrieval.
People and movement	Routine movements depend on skilled lift-truck operators in the cold store.	Reduces internal lane travel but retains operators and trucks at the aisle in the cold store.	Removes routine internal pallet movements from drivers; trained oversight and intervention remain – operators do not need to enter cold store.
Access and control	Lane-level access governed by process and stock discipline.	Lane-level access with controlled shuttle movement.	System-directed storage and retrieval through defined interfaces and client specified guardrails.
Digital layer	WMS, scanning and operator execution.	Inventory discipline plus shuttle controls.	MAXIQ® provides orchestration, digital twin visibility, full traceability and minimal oversight.
Investment and change	Familiar, lower-complexity model.	Targeted automation and added maintenance requirement.	Integrated physical and digital change requiring a whole-life case.

WHAT THE COMPARISON SHOULD REVEAL

Not which route has the longest list of benefits, but which trade-offs the operation can accept and which outcomes are commercially important.

THE DECISION THE PAPER CANNOT MAKE FOR YOU

What would your operation point towards?

The right route cannot be determined from pallet capacity alone. Two cold stores with similar footprints and stockholding can require different solutions once product mix, lane occupation, peak movement, labour availability, building constraints and future growth are applied.

The useful question is therefore not simply, “Which system gives us the most capacity?” It is, “What would our operation look like under each option?”

How much of the headline Drive-In or Push Back capacity would remain usable when real SKUs, batches and peaks are applied?

Where could a shuttle remove repetitive travel without introducing unnecessary complexity?

At what point would AutoCube® change not only density, but labour dependency, throughput and control?

Which route would continue to support the business if volumes or product mix changed?

Those questions can only be answered properly against the operation itself.

PUT YOUR OPERATION BEHIND THE COMPARISON

Thistle can assess the stock profile, movement data, building constraints, workforce requirements and growth plans behind the project. The purpose is to identify which routes deserve further development and, just as importantly, which do not.

The best outcome is not the most automated solution. It is a storage strategy that can be justified by the operational evidence and the whole-life commercial case.