

Deciding on the Right AS/RS for Your Distribution Center Needs

We often talk about pallet Automated Storage and Retrieval machines. You could get the impression that this is a monolithic term that only describes one type of system. However, there is more AS/RS. For the purposes of this discussion, we are limiting ourselves to pallet AS/RS.

In fact, AS/RS systems have four main types of storage configurations. Each configuration has advantages and disadvantages that may or may not give you the best fit for your unique situation. It adds to the complexity of deciding which configuration you should use. That's why it is imperative to decide to work with a partner who can help you decide on the best option.

Types of Configuration:

The types of configuration for AS/RS systems are named by their storage density. They are single deep, double deep, and deep lane and aisle changing.

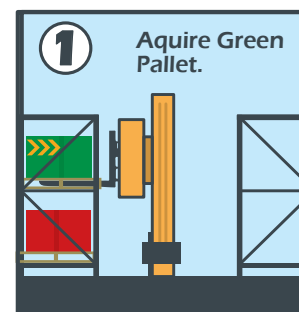
Single Deep: In this configuration, the crane can reach one pallet on its left and another on its right. This is similar to a traditional warehouse where you have a line of racks that can support one pallet of products on each side. The forks can reach any of the products.

Double Deep: With this variation, the crane has two pallets that can be reached by the crane on the left and right, but there is room for two pallets on each side at each location. You can picture this in a traditional warehouse by picturing our original scenario but instead of the racks on either side only holding one pallet, the racks are doubled to hold 2 pallets.

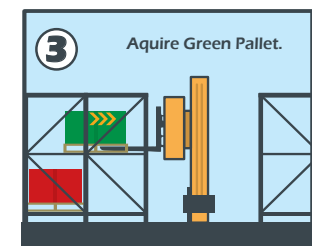
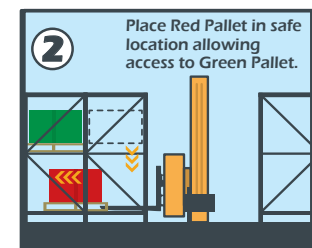
Deep Lane: This type of system basically means that there are three to infinity numbers of storage locations on each side. In regards to a traditional systems picture pallet roller racks, you insert the product on one end and retrieve it on the other.

Aisle-Changing Crane: With this system, you maximize storage with multiple racks. However, you have to have a crane that services more than one aisle. In the other configurations, you have one crane per aisle.

Single Deep Scenario



Double Deep Scenario



Access:

Access is the ability to get to the pallet you need when you need it.

With a **single deep** crane, the crane can reach one pallet on its left and other on its right – all pallets are accessible all times, thereby scoring the highest marks on accessibility.

In contrast, **double deep** has two pallets that can be reached by the crane on the left and right. Accessibility is perfect as long as those two pallets are the “same” or perfect substitutes. That is if each pallet contains the same product, same lot code, same expiration date, etc.

The accessibility score with a **double deep** crane falls when a pallet must be moved in order to get the pallet that is needed. This is referred to as a shuffling move.

Deep-lane has, theoretically, an infinite number of pallets that can be accessed by a crane. The same accessibility challenges come into play as with double deep, but they become exponentially more burdensome with many more pallets to move. Therefore any process that requires any shuffling would immediately discount a deep-lane storage system.

Aisle-Changing reduces costs, since you can have as few as one crane accessing multiple aisles. This has the same accessibility advantages of a single deep system, but does not need one crane in every aisle. This, however, introduces another limitation - speed.

Speed:

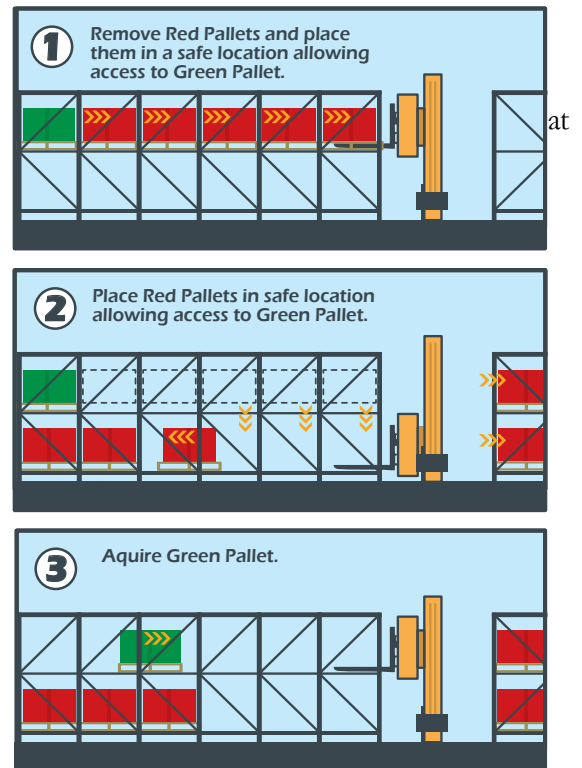
Speed is the number of pallets that the total system can move. The speed of the total system affected most by the number of cranes and the if/how much shuffling that takes place.

The case for the # of cranes impacting speed is fairly straightforward. If one crane can move 25 pallets per hour and there are 5 cranes, then there is the capacity to move 125 pallets per hour for the entire system. ($5 \times 25 = 125$)

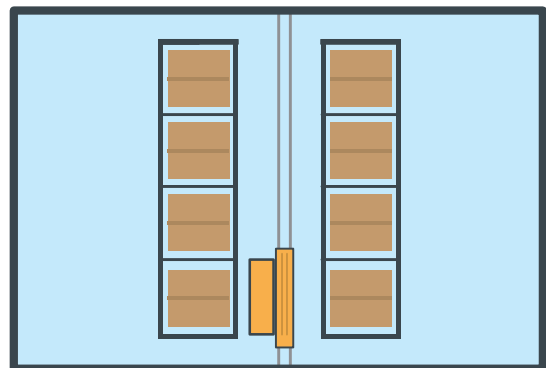
The type of crane (single, double, or deep lane) has a small, though not insignificant, impact on the total speed of the system. This is because front-back (x-direction) and up-down (y-direction) travel time have much more impact on the number of pallets that a crane can move than in-rack (z-direction) travel time. Both cranes need to travel to that pick-up position (A) and then deliver that pallet to a drop off position (B).

These nearly same speeds are only true if there are no “shuffling moves” that must occur. Shuffling is when the

Six Deep Scenario



Single Deep Scenario



is

crane must move a pallet out of the way in order to get to the pallet that is needed. Shuffling significantly adds to the crane's travel time and therefore reduces its effective speed and the number of pallets that it can move in and out of an aisle.

In the above scenario, all of the cranes are nearly the same speed as long as all of the products in that one pallet position "A" are immediately accessible. It takes more time to get a pallet that is 5 positions deep than to get a pallet that is in a single-deep position.

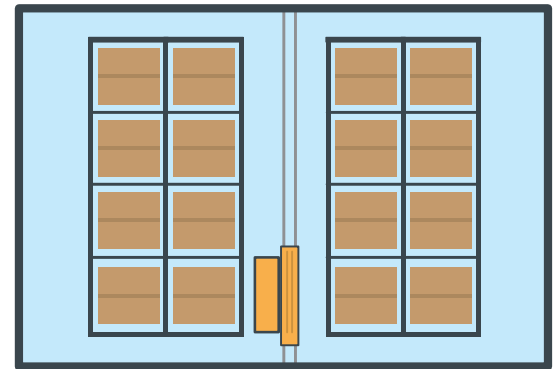
Aisle-changing cranes add another wrinkle. A crane may need to change aisles before it can access the needed storage location. This, of course, takes more time and impacts the overall speed.

Footprint:

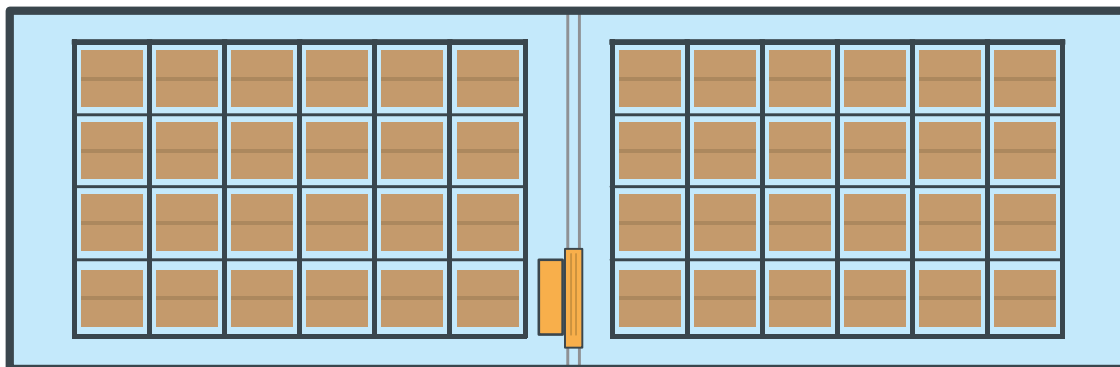
Minimization of the footprint is ideal since there is considerable cost associated with the infrastructure (slab, fire suppression, HVAC, etc.) that will ultimately support an AS/RS. The comparison of the footprint between the four types of cranes is relatively straightforward.

Consider a layout that is 12 pallets wide. In order to accommodate 12 pallets wide, 6 single deep cranes, 3 double deep cranes, or 1 6-pallet deep lane crane would be needed. Each crane has its own costs and requires its own travel

Double Deep Scenario



Six Deep Scenario



aisle. Therefore, more cranes mean more investment, not only for cranes but for the slab footprint. It should be noted, though, that the reduction in crane costs won't be linear since a single deep crane is cheaper than a double-deep crane, and a double is cheaper than a deep-lane crane. A larger footprint also has an impact on operating costs, especially if the stored pallets are in a temperature-controlled environment.

While the individual pieces of the configuration are fairly simple; the analysis of your product mix, time requirements, temperature, all influence your type of crane configuration. In addition, you could have a mix of crane configurations for different parts of your system.

Conclusion/ Graph Explanation

Deep lane ASRS are for organizations with a moderate to low SKU count and moderate to low throughput. For example, a CPG manufacturer has a lot of inventory of their most popular products for a variety of retailers and sales

channels. Since there are fewer SKUs among the flagship products, a deep lane ASRS is a good fit. When a pallet of product is needed, it's probable there will be dozens in inventory.

A grocery retailer, on the other hand, is holding relatively less inventory of these flagship products compared to the manufacturer. Additionally, the grocery retailer is holding SKUs from many CPG manufacturers, driving up the SKU significantly. Here a double deep ASRS may be more suitable. When a pallet is needed there will be more than one pallet inventory, but not dozens like at the manufacturer.

Single deep ASRS are for organizations that have relatively high SKU counts and high throughputs. For example, a sequencing center for an automotive assembly will have a high number of SKUs, given the number of options that are available for a car. Oftentimes an assembly line is calling for a car seat or wire harness assembly that is unique in the inventory. The uniqueness of these sub assemblies and the short time available to satisfy that order make a single deep ASRS a good fit. Other manufacturing operations have similarly high SKU counts, but much less throughput. Batch pharmaceutical manufacturers have multiple SKUs with only one or two pallets of key raw materials. There is more time for an ASRS to pull the needed raw materials in comparison to an automotive sequencing center, making an aisle changing AS/RS a better solution.

Determining the correct AS/RS configuration is certainly a very iterative process. With the right expert at your side, you can be confident that you will find the right solution for your unique situation.

