white paper

Determining Your Optimal Storage Density

We Optimize Your Supply Chain

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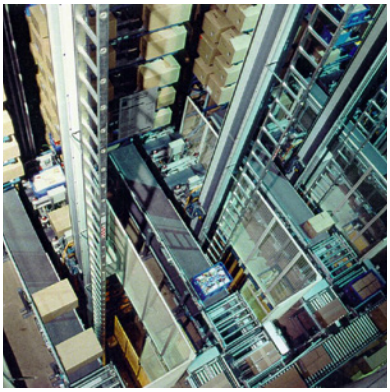


Determining Your Optimal Storage Density

Introduction

Ask any warehouse manager to list his/her top challenges and lack of space will inevitably be one of the top issues. Many organizations resort to utilizing outside storage options or costly expansions to remedy this challenge. There are many solutions to provide dense storage alternatives, but depending on your product mix, some of these alternatives may have significant and costly side effects.

This paper will explore the typical storage technologies and configurations as well as provide general application advice for each. In addition, we will provide the fundamental process to mathematically determine your optimal storage density based on the characteristics of your inventory and order mix.

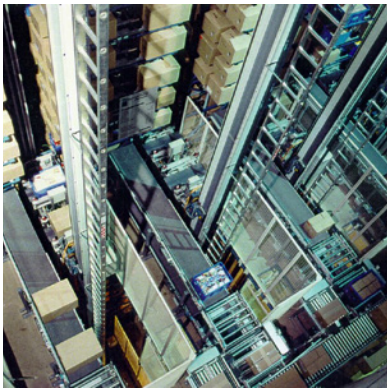
Storage Density vs. Utilization

The most efficient means of utilizing the available warehouse space is to pack it from floor to ceiling with inventory. While this storage strategy provides the most "dense" use of space, it does not provide for product selectivity. In other words, you will have to invest in costly labor to shuffle and dig through the inventory in order to access a specific pallet. For this reason, most operations will not mix different SKUs or lots within the same storage bay. While this approach provides product segregation and selectivity, it can result in poor utilization of space due to the honeycombing effect. At the other extreme, selective pallet racks provide random access to each individual pallet. But, the storage density associated with this storage scheme is rather poor due to the wasted space in access aisles. So what storage strategy should you deploy to make the best use of your warehouse space?

Selecting the Optimum Technology

The quest for identifying the correct storage strategy hinges on finding the technology offering the optimum balance between Storage Density and Storage Utilization. The best storage strategy is the one that provides you with random/selective access to each SKU/lot while providing the highest Storage Density and the highest Storage Utilization.

Begin by calculating the Density and Utilization for each competing technology. By reviewing the results, you will quickly identify the technology best suited for your operation.



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Step 1

Calculate Storage Density – the ratio of available storage area to the total warehouse space (Density=Total storage area in cubic feet/Total warehouse area in cubic feet). Deep lane storage, for example, provides a high storage density solution.

Step 2

Calculate Storage Utilization – the ratio of the number of locations typically used to the total locations committed to a given product/lot (Utilization=Average # of Locations Utilized/Average # of Locations Committed).

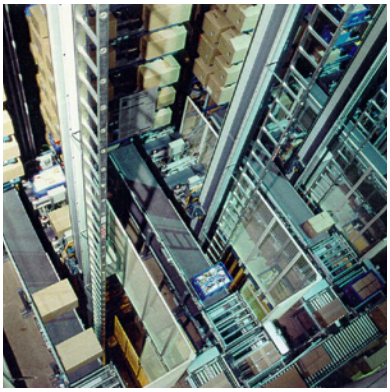
Step 3

Multiply Storage Density by Storage Utilization to obtain Effective Utilization. The technology that offers the highest Effective Utilization will provide the optimal storage solution for your operation.

For example, an operation that has an average lot size of 25 pallets per lot may be evaluated as follows:

Conventional Storage:	Density = 27% Utilization = 70% Effective Utilization = 27% x 70% = 19%
Single Deep AS/RS:	Density = 49% Utilization = 100% Effective Utilization = 49% x 100% = 49%
Double Deep AS/RS:	Density = 59% Utilization = 25/26 slots = 96% Effective Utilization = 59% x 96% = 57%
Triple Deep AS/RS:	Density = 64% Utilization = 4.5/6 slots = 75% Effective Utilization = 64% x 75% = 48%
Deep Lane AS/RS:	Density = 95% Utilization = 5/10 slots = 50% Effective Utilization = 95% x 50% = 48%

As the results suggest, a double deep AS/RS solution will provide the most optimum balance between density & utilization in this particular case.



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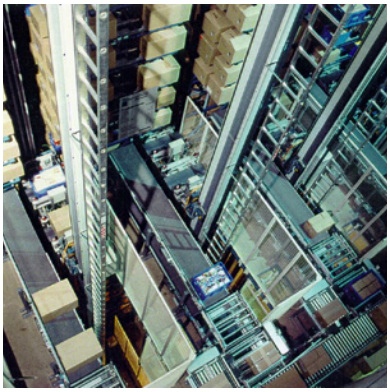
Storage Technology Options

To understanding the importance of selecting the best technology at the best price, we recommend a disciplined evaluation of various storage options and to also consider:

- An increase in density usually coincides with a decrease in selectivity
- Automation allows for an increase in cube per square foot density
- Loading and zoning practices can have a huge impact on improved utilization
- Other business issues such as product damage, product aging, fire protection, labor, etc. should also be considered

TYPICAL CONFIGURATION	RELATIVE FLOOR DENSITY	RELATIVE SPATIAL DENSITY	TYPICAL SPACE UTILIZATION	AVERAGE MOVES TO ACCESS ANY PALLET	STOCK ROTATION	CAPITAL INVESTMENT	OPERATING EXPENSE	SELECTIVITY	CONSIDER WHEN . . . ○ Low ◐ Medium ● High
Floor Storage [2 High x 6 Deep]	84%	27%	○	6.5	FILO	¢	$	○	Low capital investment is critical; large lot sizes; Space not an issue
Pallet Flow Rack [5 High x 6 Deep]	80%	66%	◐	3.5	FIFO	$$	$	◐	FIFO rotation critical; Inbound/Outbound need to work independently
Drive-in Rack [5 High x 6 Deep]	80%	66%	○	15.5	FILO	$	$	○	Very large lot sizes
Conventional Selective Rack (Fork Truck) [5 High x 1 Deep]	41%	34%	●	1	FIFO	$	$	●	Space availability is not an issue; Selectivity is critical
2-Deep Conventional Pushback (Fork Truck) [5 High x 2 Deep]	58%	48%	●	1.5	FILO	$$	$	◐	Space availability is an issue; Lower throughput acceptable
3-Deep Conventional Pushback (Fork Truck) [5 High x 3 Deep]	67%	56%	◐	2	FILO	$$	$	◐	Space availability is an issue; Lower throughput acceptable
Conventional Selective Rack (VNA) (5 High x 1 Deep)	58%	49%	●	1	FIFO	$$	$	●	Space availability is an issue; Selectivity is critical; Lower throughput acceptable
2-Deep Conventional Pushback (VNA) (5 High x 2 Deep)	73%	61%	●	1.5	FILO	$$	$	◐	Space availability is an issue; Lower throughput acceptable
3-Deep Conventional Pushback (VNA) (5 High x 3 Deep)	80%	63%	◐	2	FILO	$$	$	◐	Space availability is an issue; Lower throughput acceptable
1-Deep AS/RS (15 High x 1 Deep)	65%	49%	●	1	FIFO	$$$	¢	●	Small footprint, low operating expense, selectivity, high throughput critical; small to large lot sizes
2-Deep AS/RS (15 High x 2 Deep)	79%	59%	●	1.5	FILO	$$$	¢	◐	Small footprint, low operating expense, high throughput critical; small to large lot sizes
3-Deep AS/RS (15 High x 3 Deep)	85%	64%	◐	2	FILO	$$$	¢	◐	Small footprint, low operating expense, high throughput critical; small to large lot sizes
Deep Lane AS/RS Mole Single Ended [10 High x 10 Deep]	95%	59%	○	5.5	FILO	$$$	¢	○	Small footprint, low operating expense, high throughput critical; very large lot sizes
Deep Lane AS/RS Mole Double Ended [10 High x 10 Deep]	90%	56%	○	5.5	FIFO	$$$	¢	○	Small footprint, low operating expense, high throughput, FIFO rotation is critical; very large lot sizes



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About Dematic

Dematic is a leading supplier of integrated automated technology, software and services to optimize the supply chain. Dematic employs over 5,000 skilled logistics professionals to serve its customers globally, with engineering centers and manufacturing facilities located across the globe. Dematic has implemented more than 4,500 integrated systems for a customer base that includes small, medium and large companies doing business in a variety of market sectors.

If you are interested in learning more about this topic and how we can help, please contact Dematic at (877) 725-7500 or visit: dematic.com.

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