



Space Utilization with Block Storage

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Introduction

Block or Floor stacked storage is perhaps the most basic form of warehouse storage consisting of minimal physical infrastructure requirements. It is generally used when dealing with large quantities of palletized products and when available warehouse height is the main concern. For strict First-In-First-Out (FIFO) requirements, block storage is generally not preferred but it is particularly effective when there are multiple pallets per Stock Keeping Unit (SKU) with inventory being turned in large increments.

Depending on several factors like the product and load profile, ability to stack, vehicle lift capacity, building height, the typical block storage, the unit loads may be placed in lanes (blocks) on top of each other. Each lane is generally designed to store only one SKU (or batch); otherwise a 'locked stock' occurs—a situation when access to an SKU is blocked by another SKU. Block storage results in the 'Honeycombing' effect— underutilization of the storage lanes, which has been depicted in the figure (a), as a consequence of the lane depth. That said, a warehouse manager would be happier with lower utilization than deal with the day to day issues of multiple handling and search efforts by keeping multiple SKUs in the same lane.

Common practice today is to also design the block storage layout with a single depth across all SKUs for the entire facility which further lowers the overall capacity utilized in the warehouse especially when SKUs are not mixed within a lane. To achieve high utilizations with the block storage system it is desirable to scientifically determine the optimal depth of the lane or lanes being defined.

Scientific Approach to Block Storage Design

Warehouses today are being designed for block storage with lanes with varying depths (normally between 2 deep to 10 deep) for the various product categories or classes to ensure higher utilization of the floor space available. One way to approach the lane depth decision is via categorization of products / SKUs based on their individual throughputs, say in terms of pallets (or pallet equivalents) per day.

For example, the top 'A' class SKUs (contributing to about 60-70% of the throughput) could be allocated to lanes which are 5 pallets (or pallet equivalents) deep. These would be typically 2-3% of the overall SKU portfolio and likely to be received, as well as dispatched, in larger batches where a depth of 5 pallets (or equivalent) is suitable.

Along the same lines, the bottom 'C' class SKUs (contributing to the last 10-15% of the throughput) could be planned in lanes of 1 or 2 pallets (or equivalent) deep. This is because the 'C' class will not only have a long tail of SKUs but also have only 1 or 2 pallets of stock per SKU. The need to access every SKU or batch would mean that the lane depth optimal for this case would be typically 1 or 2. This would result not only higher utilization of the lane defined but provide flexibility to use the freed up location for any other SKU of the same class.

Establishing the benefits of the lane concept is however useful at this point before dwelling on the subject of optimization of depths. (refer to figure 'b')

Each pallet occupies one square in the grid and the aisle for access of one pallet has been sized as one square of the grid for the purpose of this illustration. Each of the three options accommodates 120 pallet positions, the only difference being that the depths are respectively 1, 2 and 3 in the figure 'b'. Evidently, the same number of pallet positions have been accommodated in the third option with only 2 aisles vis-à-vis 6 aisles in the first. Hence, the area requirement for the single

depth option is 180 squares, 150 squares for the double depth option and 140 squares for the triple depth option.

Lane Depth Optimization

If lane depths are too long, as is the case in figure 'b', the floor space in front of the back pallets is unutilized. If the lane depths are too short, too large a portion of the floor space is devoted to aisles. If the pallets are not easily stackable, too much of the available clear height is lost.

While there are several considerations and methods in arriving at the ideal lane depth, one of the relatively simpler, easily replicable and scalable models to achieve this optimization is through the Penalty Matrix technique.

The Penalty Matrix technique involves estimation of the areas at the desired granularity (illustrated in figure 'c' at the product and throughput category level) for each of the feasible depth options (1 deep to 5 deep in this case). The least area option is highlighted and assigned a 0% penalty. For each of the other depths, the relative increase in area is arrived at as a percentage of the least area depth. For example, in the case of Product 1 of 'A' Class, assigning a 4 deep lane suggests the least area requirement. If one were to place this SKU in a 5 deep lane, it would result in providing for a 16% higher area than the 4 deep lanes (which in this case are optimal).

It is not uncommon to achieve a 15-20% in storage density and a 15% reduction in total warehousing cost owing to reduced handling, travel distances and effort by undertaking the above lane depth optimization exercise and this provides significant incentive to revisit the current block storage practice and evaluate multiple depth options.

Other Critical Factors

To achieve the best storage utilization is perhaps one of the important considerations of a proper block storage planning exercise. There are however several other important questions that need to be answered as well.

For example:

- How should the layout plan accommodate the lane depths most optimally?
- Should the process be system enabled or a manual process?
- What is the degree of system configuration required to manage the operations efficiently or how should the multi depth layout plan be configured in the WMS?
- What should the zoning strategy be? Should there be a fixed bin or a dynamic bin strategy?
- How many types of lanes (1 deep, 2 deep, 5 deep etc.) are to be planned? How many types are too few and how many are too many?
- What are the factors that will determine the stacking height? Is having variable pallet heights and pallet on pallet stacking a feasible option?
- Are the lane width and aisles planned so that product damages are avoided due to constrained movement of material handling equipment?
- What are the best practices in lane marking and bin numbering?
- What is the ideal process for picking multiple or single SKUs in a single pick tour?