Ten steps for efficient Master Planning and Warehouse Layout Design

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Decision 1: Choose the proper Unit Load

DEFINITION AND STANDARDIZATION OF STORAGE NEEDS

• Standardization, reduce of types and dimensions of unit loads used
• Adoption of ECR (Efficient Consumer Response) principles.
• According to EUL (Efficient Unit Loads):
  • Master Module (600x400mm) (ISO Containers)
  • EUL Pallet Family:
    • 1200x800, 600x800, 800x400, 1200x1000
    • Pallets Heights: 1.050 mm, 1700mm, 1950mm,
    • Pallet Weights: 1000kg, 1500kg and 2000kg respectively
**Decision 2: Fixed or Random Storage System? – Calculation of requisite Storage Capacity**

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Fixed-Location Storage (FLS)</th>
<th>Random-Location Storage (RLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area Utilization</td>
<td>-</td>
<td>+</td>
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<tr>
<td>Time in picking load when processing an order</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Easiness in retaining FIFO</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Need for administration and system support</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Control – Counting Processes</td>
<td>+</td>
<td>-</td>
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<tr>
<td>Better response in contingencies</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

**Examples of Mixed Location Storage Systems:**

Random locations in Stock Area, fixed locations in Picking Area, or even further coupling such as adjacency of promotion and new items, or periodic review and re-arrangement of reserved locations in picking area according to moving-status of an item, in terms of frequency of participation in orders, etc.
## Decision 2: Fixed or Random Storage System? – Calculation of requisite Storage Capacity

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</table>

**STOCK PALLETs PER MONTH (e.g. europallet)**

**REQUIREMENTS IN PALLETs IN RANDOM STORAGE SYSTEM**

**REQUIREMENTS IN PALLETs IN FIXED STORAGE SYSTEM**
## Decision 3: Choice of Storage Systems
(Integration with Handling Systems)

<table>
<thead>
<tr>
<th>100% FIFO STORAGE SYSTEMS</th>
<th>MIXED (FIFO / LIFO) STORAGE SYSTEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional – Back To Back (Single Depth)</td>
<td>Block - Stacking</td>
</tr>
<tr>
<td>Live Storage</td>
<td>Drive In – Push Back</td>
</tr>
<tr>
<td></td>
<td>Mobile</td>
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</tbody>
</table>

### Images:
- **CONVENTIONAL BACK TO BACK**
- **LIVE STORAGE**
- **DRIVE IN**
Decision 3: Choice of Storage Systems  
(Integration with Handling Systems)

Choice of storage systems would be incomplete if its integration with any kind of handling systems is not taken into account.

Indicative questions to be considered:

- Apart from lift trucks are other systems for the handling and transit of materials used, e.g. conveyors, rollers, pushers, sorters, etc?
- Which is the required aisle width? It is directly related to the space utilization.
- In which warehouse activities will the truck be used? For loading or unloading, for preparing the orders, for picking, for replenishment, exclusively inside warehouse, in the yard area?
- Which are the desired either quantitative or qualitative technical specifications? Load capacity in terms of lift height and load centre distance, free lift, lift height, extended mast height, lowered mast height, battery used, axle loading, travel or lift speed, gradient performance? Warehouse should be considered holistically as an entity, where everything is coupled. Answers to above questions are directly connected to the functional height of the warehouse, the size of doors used, floor requirements such as resistance in loads, level of flatness, joints, type of trucks that can be served, load and dimension of ramps, warehouse module, etc.
Decision 4: Storage & Structural Module

Flexibility Vs Storage Density
Decision 4: Storage & Structural Module (Multi-purposed 22,5 module)

- **Split Box** Picking in 3 levels, Picking Stations
  - **Conveyors** move boxes between levels
  - B2B Racks, Reach Truck aisle dedicated

- **Split Box** Picking in 1 level
  - No Conveyors
  - B2B Racks, Reach Truck

- **Full Box** Picking in 1 level
  - No Conveyors
  - B2B Racks, VNA

- **Split Box** Picking in 1 level, Dedicated aisle
  - No Conveyors
  - B2B Racks, VNA aisle dedicated

- **Split Box** Picking in 1 level, Dedicated aisle
  - No Conveyors
  - B2B Racks, VNA aisle dedicated

- **Split Box** Picking in 3 level, Picking Stations
  - **Conveyors** move boxes between levels
  - B2B Racks, VNA aisle dedicated

- **Full box** Picking in 3 level, Picking Stations
  - **Conveyors** move boxes between levels
  - B2B Racks, VNA aisle dedicated
Decision 5: Receipts & Dispatch Areas – Supporting Areas & Facilities

• **Design of supporting areas such as: receipts and dispatch, returns, destroyed, cross-docking, office facilities, is also crucial!**

• Depth of receipts and dispatch area:
  - Minimum: 15 metres,
  - Optimum: 20 metres,
  - Maximum: 25 metres

  - 20-25% of storage area. Which is the speed with which goods are forwarded to storage area? Which is the cross-docking volume? Is a lot of manual handling work involved?

• Position of office facilities:
  - Centrally in the receipt-dispatch area, in the warehouse level?
  - In one side of the receipt-dispatch area?
  - Or extended to more than one floors.
Decision 6: Warehouse External Dimension close to 2:1

- Flexibility is maximum for the internal layout
- Building expansion is easier
- Two options for aisles orientation
Decision 7: Aisles Orientation – Aisles Length – Warehouse Monitoring

- Racks Parallel to length
- Central Aisle Vertical to Length
  - Fishbone Concept

- Racks Vertical to length
- Central Aisle Parallel to Length
  - Hair Comb Concept
Decision 8: Materials Flow, Goods In, Goods Out

- **Material Flow: I**
  - Proposed for warehouses over 30,000 sq.m.

- **Material Flow: L**
  - Only if necessary, Site restrictions

- **Material Flow: U**
  - Proposed, Volume utilization, Dock utilization, Better control
Decision 9: Efficient Loading & Unloading and Maneuvering Area Width

Use 2 different dock types
Forming external landscape
Many type of trucks

Internal Docks
Hypsometric Level: +1,20m from ground
Big Trucks & Containers

Cantilever with external Docks
Hypsometric Level: +1,0 m from ground
Small Trucks & Vans
A typical 17 m truck needs maneuver area of 35 m.
Use of 45 degrees saw tooth type docks decreases this space to 26 m.
## Decision 10: Warehouse Expansion

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
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<tbody>
<tr>
<td>Storage Area expands only</td>
<td>Number of docks remains the same</td>
</tr>
<tr>
<td>Storage Area expands</td>
<td>Number of docks increases</td>
</tr>
</tbody>
</table>