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Standard Guide for Strategic Warehousing[1]

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1. Scope

1.1 This guide provides strategic considerations for effectively managing warehouse facilities and the contents of warehouses (collectively "warehousing assets").

1.2 This guide does not override or increase requirements specific to governmental authorities. To the greatest extent practicable, the guidance in this standard should be considered by these entities where efficiencies may be gained.

1.3 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E2715 Practice for Moveable Property Storage

E2135 Terminology for Property and Asset Management

3. Terminology

3.1 *Definitions:* For additional definitions related to property and asset management, refer to Terminology E2135.

3.1.1 *business case, n*—the sum of an entity's review and analysis of pertinent facts and alternatives regarding a plan of action to be followed. The resources put into the business case depend on the complexity of the situation and the potential impact of the decision. A formal business case may be written out in a structured and logical manner, whereas an informal business case may be developed simply through conversations and deliberations.

3.1.2 *material handling equipment (MHE), n*—equipment that relate to the movement, storage, control and protection of warehousing assets (for example, materials, goods, equipment, and products) throughout the process of manufacturing, distribution, consumption and disposal.

Modified from Wikipedia

3.1.3 *warehouse, n*—buildings or facilities used for storage of personal property assets, including supply distribution centers, material storage facilities, and structures used for storage of vehicles, equipment, and surplus assets. Also included are underground or earth-covered ammunition storage bunkers and magazines. This category excludes water reservoirs and petroleum or gas storage tanks which are storage structures.

3.1.4 *warehousing, v*—the activity of storing, handling, or otherwise utilizing a warehouse to focus on the management of personal property assets contained within.

3.1.5 *warehousing assets, n*—the warehouse facility and the materials or moveable assets housed within the facility.

4. Summary of Guidance

4.1 Effective warehousing activities require a sound business case decision to store moveable assets for short- or long-term storage, operational staging, and other reasons.

4.2 This guide outlines the scope of strategic warehousing activity; the numerous considerations provided here are not developed in detail as there is much to be said on each aspect. This guide is intended to ensure the entity is aware of the scope of warehousing considerations.

4.3 Entities should be able to realize significant cost savings and increases in efficiency when warehouse facilities and warehouse contents (collectively "warehousing assets") are managed strategically and holistically.

4.4 Strategic management of these warehousing assets and activities goes beyond simply providing needed items in an effective manner and at minimum cost; it also entails an overall perspective that asks "do these items need to be warehoused?" or "do these items need to be warehoused in this facility?" Savings and efficiency gains may be realized when the size of the warehouse facility is reduced to the smallest size feasible due to efficient operation of the warehousing activity and most effective use of the space available.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4.5 This guide also provides the operational practices that an entity should consider to make their warehousing activities effective and contribute to the entity's mission, and also suggests metrics to gauge the efficiency of a warehouse or warehousing program.

5. Significance and Use

5.1 This guide provides the considerations for the management of warehouses and warehouse contents.

5.2 The central objective of this guide is to ensure that warehousing activities appropriately contribute to the mission of the entity.

5.3 Measuring and managing the effectiveness of an entities' warehousing activities should result in sustained usefulness of warehoused assets, reduced administrative costs, improved accountability, and enhanced operational performance.

5.4 This guide makes a differentiation between the physical warehouse facility (also called "Real Property") and the contents of the warehouse (also called "Personal Property," "moveable asset," "product," or similar term that differentiates the contents of the warehouse from the physical structure of the warehouse itself). Considerations of both these aspects of the warehousing function must be coordinated to lead to effective warehousing activities.

6. Strategic Considerations

6.1 *Is warehousing needed?*—Are the items being warehoused necessary to contribute to the entity's mission? Often, entities continue a warehouse activity largely because it is easier to not make a hard decision and continue an operational activity than to go through the considerable effort of dismantling a non-essential warehousing activity.

6.2 *Should warehouse functions be consolidated (centralized) or decentralized?*—Depending on the costs and benefits associated with operating warehouses in different locations, effectiveness might be gained if activities can be consolidated at centralized "hubs" (in lieu of numerous locations essentially providing the same function) or decentralized (if less expensive locations may be utilized in lieu of more expensive warehouses). Calculate full cost/benefit factors and use the proper business tools to arrive at an optimum solution.

6.3 *Are there alternatives to warehousing these moveable assets?*—The entity should consider alternatives such as just-in-time purchasing, enhanced supply chain management, or sharing warehouse activities with different organizations within the same entity or with other entities.

6.4 *Should the entity apply advanced storage, picking, inventory management, or recordkeeping technology, or combinations thereof?*—Automation can reduce the personnel costs to operate a warehouse activity or increase effectiveness, or both. Options may affect the warehouse structure itself or just the stored assets.

6.5 *Lifecycle costs must be considered*—A business case decision must look at costs and benefits throughout the lifecycle of the warehouse activity. For example, short term savings in leasing an older warehouse facility may be offset in the long term by decreased flexibility to meet entity needs and limitations of the structure itself to employ more efficient operations. Future warehousing needs (increased or decreased activity) should be considered. Also see 7.1.3.

6.6 *Knowing the operational requirements*—Presumed throughout the previous sections of this paragraph is that the entity acquiring, using, or disposing of the warehouse facility is fully aware of the entity's operational requirements. In actuality, this awareness cannot be presumed in planning a warehousing activity. The facility must reflect and address the entity's carefully-considered needs. The warehousing facility is a tool for the effective management of the assets and materials stored and managed within, the ownership, lease, or management of the warehouse facility, or combinations thereof, is not an end in itself.

7. Assets in a Warehousing Activity (Warehousing Assets)

7.1 *Aspects Related to the Warehouse Facility:*

7.1.1 *General Type of Construction*—The type of construction of the structure itself should reflect the need of the entity to store the moveable assets, while at the same time minimizing entity costs.

7.1.2 *Location*—Considerations include:

7.1.2.1 *Proximity to Operational Requirements* to minimize transportation costs and the time to move assets between the warehouse facility and the places where the assets are needed. Also, consider the risk and liability of catastrophic disasters on population centers if storing hazardous materials.

7.1.2.2 *Access to Services* such as needed utilities and most efficient transportation arteries.

7.1.3 *Facility Layout*—Considerations include:

7.1.3.1 *Vertical Dimension*—Higher ceilings increase the volume of the storage capacity without increasing the footprint of the facility. Higher ceilings may also be necessary for storing tall or large assets. Taller facilities might lead to cheaper costs/square foot, which may lead to reduced carrying costs.

7.1.3.2 *Horizontal Dimension*—A basic measurement of warehousing space providing the physical footprint of the facility. In general, large and heavy objects would be stored on the floor, and so the horizontal dimension would directly indicate the storage capacity.

7.1.3.3 *Best Fit of Items to be Housed*—There may be circumstances where the shape of the items to be stored don't dictate a squared storage area, such as when storing bulk materials. Warehousing costs may be reduced if such layouts are utilized.

7.1.3.4 *Aisles versus Storage Space*—In planning the facility layout, the ratio of storage space to aisle space may be a key metric. The higher the ratio, in general, the more property that may be stored. However, there is obviously a need to allow MHE to maneuver and place or pick the product.

7.1.3.5 *Associated Administrative Space*—Areas of the facility where product is not intended to be stored or moved. Examples are offices, open spaces, meeting rooms, cleaning gear closets, and stairwells. This space doesn't add to the storage capacity directly, but facilitates the warehousing operation overall.

7.1.3.6 *Associated Operational Space*—Areas of the facility where product may move through, but are not primarily designed to store the product. Examples are interior and exterior spaces designated as loading docks, assembly, or staging areas.

7.1.3.7 *Flow of Activity*—The Facility should be laid out to facilitate easy entry and exit for people and assets, while at the same time providing necessary safety and security. Shipping and receiving functions should be separated.

7.1.4 *Facility Life Cycle Considerations*—As described in Section 6, costs and benefits must be considered over the life cycle of the facility. Aspects over each life cycle phase include:

7.1.4.1 *Acquisition Phase:*

(1) Long term capital planning methodologies must be used and acquisition alternatives should be quantified and prioritized. The considerations enumerated in this Acquisition Phase, as well as the Use and Disposal Phases, must be included in this business case development.

(2) Lease versus Purchase Considerations—Based upon the facts and circumstances a lease or purchase may be appropriate. When contemplating the acquisition of a warehouse facility, a rigorous business case should include considerations of lease versus purchase, such as a comparison or costs, current and expected market conditions, flexibility to make improvement to the facility over time, and the expected life-cycle costs of the facility.

(3) Build or Use an Existing Structure—Existing structures may be less expensive to acquire, but might not provide cost-saving innovations, enhancements, or flexibilities.

(4) Availability of public emergency services and flood, fire suppression, and rodent control measures must be carefully considered.

(5) Bonding and insurance requirements (for facility and contents), along with provisions for governmental compliance, recordkeeping and reporting must be considered in this acquisition phase.

(6) A determination must be made whether the acquiring entity will be the only entity using the facility, or if other entities may also share in its use, in either formal or informal arrangements. Additional requirements of the shared space of the non-acquiring entity/entities must be considered.

(7) As determined by the acquiring entity, consistent with the scale of the warehouse acquisition activity, a formal concept of operations should be developed to address the considerations in (7.1.4) to formally consider the lifecycle of the facility and its contents. The ASTM standards referenced in Section 2 should be consulted for guidance.

7.1.4.2 *Use Phase:*

(1) Utility Options—The location may provide alternatives for utilities and related services.

(2) Labor versus Automation Considerations—Business case decisions need to be made to maximize the benefits while minimizing the costs.

(3) Maintenance and Repair—Costs may be largely based on age, type, and style of construction. Maintenance and repair activities should maximize long term warehouse productivity.

(4) Administration and Recordkeeping—Provisions for effective management of the facility and its contents must be provided.

(5) Signage must comply with mandated health and safety requirements (for example, hazard warnings and symbols, alarms, and emergency ingress or egress areas) as well as provide useful guidance to workers and visitors; exterior signage identifying the owning or leasing entity may be used where appropriate.

7.1.4.3 *Disposal Phase:*

(1) Remediation Costs—Costs to bring facility and land to acceptable level for sale, transfer, or return to owner.

(2) Disposal Options—All possibilities must be considered when disposing of owned facilities.

(a) Sale—To obtain proceeds for use elsewhere in the entity.

(b) Transfer to State/City/Local Organization—Required in some governmental policies, or as a donation.

(c) Exchange or Sale—Solely to obtain replacement facility, where allowed.

(d) Lease Out with Option to Buy—May be best way to consummate a sale in a competitive real estate market.

(e) Abandonment—A disposal option where allowed by law, regulation, or ordinance.

(3) Demolition Costs—At the point where the facility is not needed by the entity, or other entities, and is only accumulating repair and maintenance costs, demolition is an option.

7.1.5 *Internal Environmental Concerns*—Including heating, air conditioning, and humidity; both for the stored material and for the assigned personnel. Additionally, some product may require more extreme climates, and dedicated hot or cold storage.

7.1.6 *Specialized Structures and Capabilities*—Including reinforced flooring for heavy MHE or product, increased ventilation, special lighting, high voltage applications, soundproofing, etc.

7.1.7 *Hazardous Material Handling*—Consideration must be made for the types of materials to be stored as product or used in the operation of the facility.

7.1.8 *Worker and Public Safety*—This consideration takes into account all the ways to minimize the safety risks of the warehouse workers or the general public. As an example, U.S. entities would refer to Occupational Safety and Health Administration guidance and standards.

7.1.9 *Security:*

7.1.9.1 *Security of Facility*—Safeguards must be implemented to minimize the risk of damage or destruction of the facility itself. Examples include cameras, physical barriers to entry, fire and water alarms, ready access to local emergency responders, and intrusion detection and alarms.

7.1.9.2 *Security of Assets*—Many of the measures considered under 7.1.9.1 also contribute to the safety of assets. Additional options include sensors to detect variations in environmental factors where the stored assets or materials are sensitive to temperature or humidity. Security cages or vaults may be used for highly valuable or sensitive items.

7.1.9.3 *Security of People*—In addition to the considerations above, distress or panic alarms should be considered, along

with clear emergency entry and exit routes. Training in emergency procedures is essential.

7.1.10 *Sustainability and Environmental Concerns*—Entities should be familiar with the laws, standards, and best practices associated with their warehousing activity. External requirements are designed to ensure benefits to people and the environment that affect individuals in the facility, in the community, and beyond the community. Additional options may be considered to go beyond the punitive requirements in order to reduce the amount of energy used or greenhouse gases released. Examples of this latter direction are the use of skylights, green roof technologies, solar power, rain water capture, and others.

7.1.11 *Warehouses Designated as Historic Sites*—Special concerns apply where warehouse facilities are designated as historic sites or otherwise recognized for their age, historical activities, or special designs. These facilities should be managed in accordance with the authority making such a designation.

7.1.12 *Warehouse Management Systems*—Systems should be considered that improve or ensure the effectiveness of the warehousing operation. Such system may also manage the stored items.

7.1.13 *Performance Metrics*—To help manage the performance of a warehouse facility, metrics should be designed or utilized to optimize functions such as warehouse activity, use (or lack of use) of stored items, storage space utilization, energy use, and temperature control, See Appendix X1.

7.2 *Aspects Related to the Personal Property/Moveable Property Assets Stored in a Warehouse Facility:*

7.2.1 *Reference to Practice E2715*—This standard addresses the Standard Practice for Moveable Property Storage. Those considerations apply here as well.

8. Keywords

8.1 material handling equipment; moveable property; storage; warehouse; warehousing

APPENDIX

(Nonmandatory Information)

X1. WAREHOUSING METRICS, EXAMPLES

INTRODUCTION

Although clearly not exhaustive, these examples should be useful in themselves, and also lead the entity to consider and develop additional metrics most applicable to its needs.

Warehouse Storage Area

Square feet and cubic feet of warehouse space actually storing product.

This is a basic metric describing how large the entity's storage area is. Useful as a quick indicator of a facility's storage capabilities. This metric would almost always have to be used in conjunction with other metrics.

Warehouse Costs

Total costs of the warehouse facility and operations

Typically viewed as a trend over time, this measure reports the expenditures attributable to the warehouse. The focus could also be any one particular cost element (such as electricity), to bring attention to efforts to reduce these costs over time.

FIG. X1.1 Warehousing Metrics, Examples

Carrying Costs per Square Foot

$$\frac{\text{Total carrying costs of the warehousing operation}}{\text{Square footage of designated storage space}}$$

This metric combines some of the information from the two previous metrics in this Appendix; it indicates the average costs related to your warehousing activity per each square foot of warehousing space. Carrying cost is defined in ASTM E2135, and includes direct, indirect, and financial risk costs. "Square footage" in this metric only measure the space designated for storage.

Customer Fill Rate

$$\frac{\text{Product Delivered to Customer from stock} \times 100}{\text{Product Ordered by Customer}}$$

This is an indication of the health of your warehousing operation in supporting the needs of your customer(s).

Customer Error Rate

$$\frac{\text{Number of stock errors reported by customers} \times 100}{\text{Number of stock issuances}}$$

This in an indication as to how well the warehousing function is operating; errors may include wrong item, wrong description, damaged item or packaging, or incomplete documentation. Metric may look at all these errors in total, or only one type of error to focus more easily on the cause of that type of error, and to highlight improvements over time.

Inventory Quantity Accuracy

$$\frac{\text{Items correct as to quantity} \times 100}{\text{Total number of items in inventory}}$$

An indication of the effectiveness of the processes to receive, store, and retrieve stored items. May be measured on each item, or the warehouse as a whole.

Stock Turn

$$\frac{\text{Number of items distributed} \times 100}{\text{Number of items in inventory}}$$

An indication of the velocity or speed at which product passes through an entity's warehouse, on average. The "number of items in inventory" may be the average number of items during a specified time period, or the number of items at the beginning of the time period. The time period is variable, and defined by the entity. "Value of items" may be substituted for "Number of items."

FIG. X1.1 Warehousing Metrics, Examples *(continued)*

Days of Stock on Hand

$$\frac{\text{Quantity of stock on hand} \times 100}{\text{Average daily demand of stock}}$$

This metric provides insight into how many days your stock will last based on averaged historical use. This metric may provide guidance as to when to initiate restock of the asset so as not to run out of the item. This metric may be modified to look at individual items, commodity categories, or the warehouse as a whole.

Average Days to Process Disposal Actions

$$\frac{\text{Total time for all disposal actions while warehoused}}{\text{Number of items being disposed of}}$$

This metric shows the average time it takes to through-process an entity's assets temporarily stored in a warehouse facility for further processing. This metric may be modified to look at individual items, commodity categories, or the warehouse as a whole.

Days Since Last Use or Pick

A simple measure for each stored asset indicating the days (or weeks or months) elapsed since the last time the asset was picked.

This metric provides the time elapsed since the last pick of that item. In concert with other metrics and observations, this metric could provide an indication that stock in the warehouse is no longer needed.

FIG. X1.1 Warehousing Metrics, Examples *(continued)*