Types of Warehouses

A **traditional warehouse** is used for storing products/goods for longer periods, while distribution and fulfillment centers store products for relatively lesser periods. The latter see much greater product loading and unloading flow velocity, especially at fulfillment centers, which deliver goods direct to customers.

Following recent updates to its **Trip Generation Manual, 10th Edition Supplement**, the Institute of Traffic Engineers (ITE) now lists six different categories of warehousing designations. For simplicity, these can be aggregated into **three main types of warehouses** that are associated with today's e-commerce landscape and logistical infrastructure. Each is situated in a strategic location and carries out a somewhat distinct activity. They include 1) Distribution or break-bulk facilities, 2) Fulfilment centers, and 3) Last-mile fulfillment facilities or stations. Some of the main differences between these include:

Distribution centers (also known as break-bulk facilities) tend to ship from retail to business, and to fulfillment centers, and typically do not deliver to end-users (i.e., external customers). Distribution centers are typically larger than fulfillment centers, are located away from major consumer markets (population centers), and are a complex transit hub for large quantities of bulk goods that generally do not require finishing or individual packing as they are temporarily stored on palettes before being shipped.

- When items arrive at a port, they go to a break-bulk facility where massive quantities are broken down into smaller clusters for transport to regional locations at fulfillment centers.
- Generally located in or near the largest industrial markets and seaports across the U.S., such as Newark, NJ.
- Often aggregated at massive industrial sites with hundreds of warehouses close to major multi-modal transportation hubs that can include shipping lines, rail lines, and extensive highway networks.
- Can be located an hour to 90 minutes away from the port (e.g., Lehigh Valley along Rt. 78) and still be completely functional for the tenants.
- Access to regional rail and highway networks is key for these larger facilities, since their customers are usually other, smaller fulfillment centers.
- Structures from 500,000 to more than 1.5 million square feet.

Fulfillment centers are a type of distribution center that pick and pack items from shelves **for individual delivery in order to "fulfill" online orders**. They are typically smaller than distribution centers and focus on quickly delivering goods to individual customers and offer an array of services to help with this goal. They typically receive, pick, pack, kit, label, and deliver products to people's doorstep in delivery vans. They are situated closer to consumer markets so individual items can be delivered quickly to people's doorsteps.

- Typically located on the outskirts of major metro areas in regional locations, items can either be stored or sent directly to consumers.
- In major metropolitan areas, items stored in regional warehouses are typically sent to last-mile facilities, which are located close to consumer homes, enabling fast delivery to customers.
- There is a diverse user base for mid-size buildings, ranging from middle-mile support for national users to regional or local businesses serving local customers.
- Structures between 150,000 and 500,000 sq. ft.

Last-mile fulfillment facilities (or stations) are smaller fulfillment facilities serving the final leg of delivery rather than a literal measurement of distance. They serve consumers, either individual households (for online shopping) or the retail stores they shop at (for traditional retail).

- Typically located in urban and suburban infill areas.
- Locational impetus is to be near those customers, which can result in delivery vans/trucks traveling over local streets.
- Higher sprinter van and truck trips warrant more direct access to the interstates and truck networks.
- High parking requirements may need to accommodate hundreds of delivery vans/trucks.
- Structures between 50,000-to-150,000 square feet.

High Cube and automated warehousing: An emerging trend warranting attention

As available and ideally situated land in strategic locations becomes scarcer and more expensive to meet demand, fulfillment companies are increasingly embracing emerging technologies to move and store goods more efficiently. Warehouse facilities are changing to adapt to automation and reduction in available space by reducing footprints and modifying layouts and designs. High cube and automated warehousing are emerging trends to which decision-makers and planners need to pay close attention.

In contrast with the scale of more traditionally designed warehouses and distribution centers seen in both Pennsylvania and New Jersey over the past decade, high cube and automated warehouse construction is literally taking the industry to new heights, with some built as high as 180 feet tall nationwide. Instead of the standard model of storing goods on one ground floor, nearly all the space within a high cube warehouse (HCW) is dedicated to the rapid storage and removal of goods.

A high-cube warehouse (HCW) is a building that typically has at least 200,000 gross square feet of floor area, has a ceiling height of 24 feet or more, and is used primarily for the storage and/or consolidation of manufactured goods (and to a lesser extent, raw materials) prior to their distribution to retail locations or other warehouses.

A typical 1-million-square-foot warehouse has an average daily traffic rate of 1,740 trips, whereas a HCW of the same floor area has 8,180 vehicle trips per day — an estimated 370% increase.
Source: **Institute of Transportation Engineers): HCW Vehicle Trip Generation Analysis.** Whereas a typical large warehouse may have a building footprint between 150,000-to-500,000-square feet with a 40-feet ceiling height (shorter than an average 3-story home), a high cube warehouse can be 10-to-14 stories – potentially four times the height of a typical warehouse. Therefore, square footage may not be the best predictor of traffic generation. Source: **Lehigh Valley Planning Commission: Community Guide: High Cube & Automated Warehousing**

High cube warehousing is highly automated, with sophisticated racking and forklift retrieval systems designed to reduce human labor while dramatically increasing vertical storage capacity (i.e., project density), loading, and unloading speeds. The resultant efficiencies translate to more trucks moving a much greater number of products onto roadways. While HCW building design has the potential to reduce unwanted land consumption (if only at the site-specific level) and provide greater opportunities for a

reduced carbon footprint and the retention of existing green infrastructure and habitat, the success of any strategy using density to reduce a specific uses' overall footprint, ultimately depends on the broader land-use policies in place. While HCW design offers a compelling opportunity to consume less land, municipal officials and planners must be careful to weigh the project-specific benefits against the potential for significant adverse impacts on community character, viewsheds, air quality, health, safety, and the transportation network.

Changes to existing traffic patterns, especially truck traffic, are a major concern for most residents and municipal reviewing boards. In addition to concerns for heavy truck traffic that higher product volume capacities can generate, height will also present challenges for emergency services personnel who will need special training and expensive equipment—particularly in instances where high cube towers are proposed in suburban and rural areas where police, fire, ambulance, and emergency medical services may be limited, underfunded or volunteer-based agencies not equipped to respond to a multi-story emergency. At the same time, accommodating such facilities in appropriate industrial locations with similarly sized building heights, or where offsetting elevation changes exist in the immediate landscape, in tandem with direct highway access, can mitigate impacts and conflicts, while providing an appropriate fit for a locally desired project or land use that might not otherwise work in other locations.

When reviewing projects that may be 4-to-10 or more stories in height, the consideration for these services becomes especially critical. Larger, taller, and high-powered (potential electrical, hazardous materials risks) automated facilities can pose serious risks to the community and emergency personnel and should not be permitted unless it can be demonstrated that there are adequately trained and equipped personnel and services to respond to emergency situations. Emergency services impact statements should be required in the form of a questionnaire for applicants to submit as part of the site plan review process. Likewise, establishing a municipal public safety or emergency services committee, including review by the local OEM, fire, and police departments, should be considered to facilitate enhanced communication and coordination between emergency response organizations affected by a development proposal. As it can be expected that highly automated facilities will have substantial impacts on the local and regional workforce as robotics technology and trends towards its application in new and retrofitted facilities continue to expand, municipalities should carefully assess potential employment impacts from HCW proposals.

Land Use Considerations for types of warehousing development

Warehouse development comes in many shapes and sizes, and zoning should evolve to keep up with the changing variety of uses and trends as the differences could mean dramatically different impacts and outcomes, and whether a project is compatible for a site and beneficial to a community. Land use regulations should not simply lump "general industrial" or "warehouse" together, as they can be profoundly different, entailing different impacts, which warrant greater specificity as to appropriate siting and design standards where permitted.

As such, it has never been more important that municipalities update and refine their planning and zoning regulations to **differentiate among warehouse use types** to ensure that local reviewing boards are equipped to adequately assess the extent to which a community's transportation network and land uses can handle the proposed traffic and resultant impacts, or whether other infrastructure such as water, sewer, and municipal services, have the capacity to meet demand. Finally, in reviewing existing zoning districts, an appropriate mix of uses should be considered. For example, in rethinking their industrial

zones, municipalities should consider zoning to support manufacturing or a mix of compatible activities, as this type of space may create better-paying jobs than warehousing spaces.

Area and site-specific considerations

Given the serious impacts on health from mobile sources of air pollution associated with the transportation sector, and particularly from diesel truck emissions, largescale warehouse facilities (e.g., above 200,000 sq. ft. of impervious surface), particularly those served by a larger proportion of heavy tractor-trailers, should not be sited where resultant freight movement will have a significant negative impact on residential or downtown areas, retail corridors, scenic byways, or other sensitive receptors, especially locations where people are already overburdened by excessive heavy truck traffic and high air pollution levels.

Local zoning should exclude large-scale warehouse development in areas located outside of State-approved sewer service areas, or other areas lacking the appropriately scaled infrastructure, transportation systems, emergency, or other municipal services necessary to sustain the costs, and maintenance, or improvements that such projects will entail over their lifetime. Unless appropriate highway or freight rail infrastructure and access are in immediate proximity, such uses and supporting zoning districts should generally not be located outside of State Smart Growth Areas, particularly not in Rural (PA-4) or Environmentally Sensitive (PA 5) State Planning Areas. Warehouse-related zoning should likewise exclude areas and/or avoid sites comprising State-regulated areas, including, flood hazard areas, freshwater wetlands, riparian zones, transition areas, steep slopes, and threatened and endangered species habitat as identified under NJDEP's Landscape Project. In addition, areas and sites targeted for preservation under local, county, regional, or state programs and plans (including Agricultural Development Areas), should also be avoided.

In all cases, zoning should only permit major facilities (above 500,000 square feet of impervious surface), where there is direct and immediate access to interstate and major highways (of adequate capacity) and/or freight rail lines, preferably from industrial zoning districts. At the same time, accommodation should be made for customers in more rural and less suburban areas, where smaller last-mile distribution facilities (structures between 50,000-to-100,000 sq. ft.) may be needed to address the final leg of the delivery system, and generally involve less noxious equipment, comprising a greater proportion of delivery vans than tractor-trailers.

It should be noted that last-mile facilities, can, however, still generate high levels of traffic, and should be located in State-designated Centers, Cores, Nodes, Redevelopment Areas, and other formerly developed and underutilized sites, proximate to highway interchanges, appropriately scaled highways, and other transportation infrastructure. In addition, some rural communities may contain abandoned manufacturing, and resource extraction sites (e.g., quarries) where warehouse uses may be a realistic and appropriate choice for local economic development.