Guide to Classifying Industrial Property

The attached document contains the introduction written by James R. DeLisle, along with reformatted excerpts from drafts of the ULI publication.

<sup>A</sup> his book plays an important role in the evolution of institutional real estate by presenting a more precise classification system for industrial propers, erties than is currently available. This added precision is an important building block as investors and portfolio managers, as well as developers, erties than is currently available. This added precision is an important building block as investors and portfolio managers, as well as developers, search for new, sustainable opportunities in a rapidly changing marketplace and as space users look for optimal real estate solutions. Access to standardized definitions that provide more accurate measures of the risk-return characteristics of various industrial real estate solutions. Access to standardized definitions that provide more accurate measures of the risk-return characteristics of various industrial allocation decisions transfer to other property types. These data can also help investors exploit inefficiencies in the market by allowing them to refine their industrial investors based on the knowledge that different industrial categories react to different market forces. For developers, more precise definitions of industrial property types will help them match physical product to tenant demand, thereby improving the marketability of investments. They can offer better-customized solutions that appeal to tenants with specialized needs without incurring costs for unnecessary features. For users, the ability to select real estate offerings that best fit their specific needs over a specific time horizon offers the produce product proving the market ability of enhanced ductivity and corporate earnings.	<b>INCREASINGLY DYNAMIC MARKETPLACE</b> Some institutional investors and developers view warehouse properties as relatively safe, bond-type investments, generating competitive returns with moderate risk exposures. Indeed, over the long term, the industrial sector has tended to provide more stable risk-adjusted returns than some of the more dynamic property types—such as office, retail, or hotel—for investors with core strategies that are managed relatively passively. Despite such experience, however, there is no reason to think this competitive advantage will hold in the future, because the industrial real estate market has been subject to structural changes in space demand, changes in manufacturing and distribution channels, and growing product diversity in terms of physical and locational elements. The end result is the need to approach industrial real estate development and investment in a much more strategic, proactive manner to ensure continued success. Finally, the opportunity to tap into the sector's potential has been made practical and cost-effective by advances in knowledge management and data mining that make it easier to exploit inefficiencies in the market.	<b>STRUCTURAL CHANGES IN SPATIAL DEMAND</b> Changes in the demand for industrial space that have occurred over the past decade can be attributed to factors such as improved production processes; advances in productivity due to automation and computer-aided design and manufacturing; and improved inventory tracking and forecast- ing techniques. Because many of these changes are more revolutionary than evolutionary, it is impossible to rely on past industry trends and emerging patterns to predict and anticipate future outcomes and effects on real estate. Thus, quantitative, time-series-type trend analysis must be supple- mented with a more qualitative approach that takes structural changes into consideration, especially since those changes have not been distributed equally across various segments of the industrial market and have created market inefficiencies as a result of uninformed, risk-averse strategies. For example, the fear of being stuck with unmarketable space has forced many institutional investors to adopt a risk-management strategies. For example, the fear of being stuck with unmarketable space has forced many institutional investors to adopt a risk-management strategies. For example, the fear of being stuck with unmarketable space has forced many institutional investors to adopt a risk-management strategies. For example, the fear of being stuck with unmarketable space has forced many institutional investors to adopt a risk-management strategies. For example, the fear of being stuck with unmarketable space has forced many institutional investors to adopt a risk-management strategies. For example, the fear of being stuck with unctionally downers, developers and investors may incorrectly opt for investments to modern, the strategy of concentrating on "modern" facilities relative to tenant demand. Since reactions to structural forces vary widely by type of tenant, the strategy of concentrating on "modern" facilities to avoid being stuck with functionally obsolescent investors and investors sense of security. W	
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industrial properties that are theoretically appealing to a wide audience but have limited demand. This possibility is especially likely when investment policies ignore the role that a particular market plays in the broader manufacturing and distribution system. Finally, the bottom-line focus of many companies in the new economy has amplified the demand for more specialized, customized solutions. Knowing how to classify a "unique" property can promote a solution permitting conversion of the property to alternative uses without requiring investment of massive capital for renovation. Thus, the space-time component can be compressed without excessive capital expenses. Added precision in categorizing industrial real estate can allow developers and investors to build, design, and buy better products that have locked-in clients, creating an oligopolistic advantage facing less competition than do those who approach the sector with the attitude that one size should fit all.

In addition to seeking knowledge on changing spatial requirements, investors and developers should develop better techniques for making decisions regarding industrial real estate. Relying on such insight, analysts can better predict real estate needs measured in space-time and money-time terms that recognize the costs and challenges associated with changing real estate options. For example, although analysis of a tenant's spatial needs might argue for moving to a property more compatible with corporate needs, existing lease terms, financial resources, decision-making models, and other factors might prevent or defer such a choice. In another scenario, consolidation of two companies will ultimately result in divestiture of assets, with some decisions more driven by which party is the acquiring interest and which corporate culture dominates rather than by more objective measures of space needs or business process fit. Bankruptcies and forced restructuring also can create a situation in which the occupancy or tenancy of individual investments or groups of investments can be wiped out in an unexpected manner. The failure to understand the underlying business of tenants, both existing and potential, could undercut the creditworthy nature of a portfolio of space, subject it to systemic risk when a particular sector (e.g., technology or telecommunications) or a company (e.g., Enron, Consolidated Freightways) implodes, or both. Although such wipeouts caused by external forces cannot be foreseen, investors and developers can manage their severity through diversification strategies that reduce reliance on demand segments subject to systemic risk. Such strategies should allow developers and investors to avoid being left holding functionally obsolescent space for which there is limited or no effective demand. By understanding the business processes of key tenant groups, real estate managers should be able to develop more strategic relationships with tenants, leading to greater collaboration and vertical integration of servi

## **GROWING PRODUCT DIVERSITY**

The supply function for warehouse facilities has dramatically changed, both in terms of their development and ownership structure and in terms of physical assets. For example, because of the relatively short time needed to construct new facilities and the relatively low cost of carrying "entitled" property on the books, developers typically waited for tenant commitments before building new facilities. Often, these developers were local players, who controlled the relatively limited supply of industrial land. This supply-side elasticity was one of the saving factors over recent business cycles, allowing the industrial sector to respond quickly to increases in supply. Over the past decade, in many markets the profile of industrial developers has changed to large, well-capitalized, regional or national players. These new players, both public and private, have demonstrated a willingness to take on greater development risk and add speculative building products to the market. This strategy has resulted in overbuilding cycles that are more frequent and of higher magnitude than previous long-term averages for the industrial property sector.

More savvy developers and investors who have been able to gain greater insight into tenant demand and industry trends have moved into the development of more-specialized facilities. As a result, the array of industrial products has increased, creating a potpourri of investment and development opportunities. This product diversity is expected to expand even more, as space users seek to improve efficiency and productivity to remain competitive in an increasingly sophisticated and dynamic business environment. These changes make the major industrial categories historically used (e.g., warehouse, manufacturing, and research and development [R&D]) too broad to provide meaningful insight into the composition of the overall industrial market. Although most industrial properties can indeed be rolled into those three major groupings, they are simply too diverse to be treated as conglomerated sectors. Within those major categories a wide array of subtypes are subject to significantly different drivers of value and market functions. Without an understanding of those differences, analysts and investors cannot accurately determine market balance and may falsely interpret signals of the relative balance of supply and demand. For example, although overall warehouse space may be in an oversaturated state in a particular market, critical shortages may exist within specialized subcategories. The product cycles for various industrial strata can differ widely. These cyclical differences are the result of issues on the production side, as in the case of barriers to entry for large facilities and high costs of capital associated with specialized facilities that create prolonged development phases, capital constraints, or both.

## **INCREASED RESEARCH BENEFITS**

Understanding the increasingly segmented demand and supply side of the industrial sector is a daunting task. However, market changes have rendered passive approaches that focus only on certain core industrial assets obsolete in assessing risk/return tradeoffs. A generalized approach to industrial development and investment can still be profitable, but it will be inferior to more strategic approaches that respond to rapidly changing market needs that arise from broad business trends and supply-chain reconfiguration.

The good news for those dealing in the industrial sector is that the real estate market has become more efficient in terms of information access and analytical processes. To some extent, the availability of more-specialized data has been caused by the emergence of the public side of the market, such as real estate investment trusts (REITs) and commercial mortgage—based securities (CMBS). At the same time, the Internet and other technological innovations have created an explosion in the volume and accessibility of data about real estate and markets. The availability of such data, coupled with improvements in the tools by which they can be accessed and analyzed (e.g., relational databases, statistical models, geographic information systems), has made more informed decision making possible. One of the prerequisites to take advantage of such advances is the ability to disaggregate the overall industrial sector into meaningful classes for which such data can be compiled, analyzed, and disseminated through trade associations and thirdparty vendors. Using more specific data, investors are able to develop more refined investment strategies that outperform more general approaches.

In addition to enhancing industrywide performance for developers and investors through improved access to more precise public information on industrial sectors, a more sophisticated classification system can assist larger investors, managers, or associations who utilize proprietary space-time, money-time data as tools to outperform the broader market. When these data are mapped into meaningful industrial classes, data management, data mining, and data analysis tools can be used to develop investment strategies that exploit informational inefficiencies—especially in the industrial sector, in which many passive investors are content to focus on mainstream, core properties, markets, and tenants. Investors and managers gain an understanding of their existing clientele and operational efficiencies, as well as the ability to identify new initiatives and niches that will firm up their competitive advantage and open new frontiers.

In recent years, the need for a more precise, unambiguous classification system for industrial properties has become clear. The necessary level of detail for such a system hinges on several key considerations that can help strike a balance between too few and too many categories.

- First, the categories should comprise comparable assets that share fundamental physical elements differentiating them from other classes in terms of physical and spatial attributes.
- Second, each of the classes must have distinct market processes of supply, demand, and investment that apply to the spatial side of the equation in terms of supply/demand interaction, as well as to the capital side of the equation in terms of price setting and investor appeal.
- Third, the groupings must be meaningful, sharing underlying commonalities that affect investment performance. Ultimately, these effects should distinguish risk/return profiles, be measurable, and be predictable. In addition, the categories should be meaningful in that the market will be rewarded for understanding and incorporating their unique character in terms of performance, either individually or collectively.
- Fourth, the classification system should be comprehensive, embracing the full array of properties that fall under the broad industrial label.
- Fifth, the classes must be substantial, as measured in terms of market size and investment opportunities. That is, each of the classes must comprehend a significant level of wealth. In addition to size, each category must include a number of investment opportunities for which there is a positive cost-benefit tradeoff for the added rigor associated with understanding the nuances of the asset class. Given the capital-intensive nature of real estate, this consideration is particularly important because decision makers must live with their choices over time in the face of an increasingly sophisticated and dynamic business environment.
- Finally, the classification system must be reliable, capable of accurately grouping components over a reasonable forecast period. This criterion is important to avoid a continuously changing system that thwarts the collection of time-series data needed to provide insights into prior performance and serve as a basis for predicted performance.

An exploration of the portfolio management process illustrates the importance of the classification system presented in this book. Most institutional investors view industrial investments as a subset of a larger real estate portfolio—which, in turn, is a component of a broader mixed-asset portfolio. Real estate investments typically constitute a portion of a mixed-asset portfolio that includes other asset classes such as stocks and bonds. For investors, superior performance and diversification are important considerations in portfolio management. Because real estate has a relatively low correlation with other asset classes, it provides diversification benefits that can help stabilize overall portfolio returns. In the case of mixed-asset portfolios, investors develop strategies for each of the relatively broad asset classes that provide the overall framework within which individual sectors are managed, as well as guidelines for the selection of individual companies or investment products.

#### CLASSIFICATION REQUIREMENTS

#### INVESTMENT CONSIDERATIONS

In managing real estate portfolios, many investors follow a process similar to that applied to the mixed-asset portfolio; however, the extent to which strategic overlays guide portfolio construction and management varies among investors. There are two competing approaches to real estate portfolio management. The *bottom-up* approach focuses on individual assets, ensuring that they exhibit solid fundamentals in terms of size, quality, market, and location. The *top-down* perspective focuses on ensuring that a proper mix of assets is maintained among property types and markets. Today, it is increasingly clear that a hybrid approach is necessary to maximize risk-adjusted returns over the long term. A meaningful classification system can help straddle the two approaches, permitting top-down investors to develop more sophisticated asset allocation strategies and allowing bottom-up investors to develop sector-specific policies that draw on experience to guide individual investment decisions.

In recognition of the importance of diversification, most institutional real estate portfolios contain asset allocations for the major property classes. In the current market, a typical real estate portfolio would consist of 30 to 40 percent office assets, 20 to 30 percent retail, 10 to 20 percent industrial, 10 to 20 percent apartment, and 10 to 20 percent other assets (e.g., international, hotel, timber, agriculture). After establishing this general framework, investors would then develop sector-specific strategies that addressed subsector allocations (e.g., retail allocated among neighborhood, community, regional, and super-regional malls) based on some understanding or expectation for relative performance on a risk-adjusted basis.

The industrial sector label traditionally has covered three subclasses of properties: warehouse, manufacturing, and R&D. Many private investors limit the scope of core institutional–grade industrial properties that will be considered for inclusion in their portfolio to the warehouse and light manufacturing categories. They focus on core industrial space that is sufficiently generic to suit a variety of users, believing this strategy helps avoid getting caught with unique, specialized facilities that either have a very narrow appeal in terms of tenancy or require additional capital expenditures that cannot be amortized over the life of the initial tenancy. Investors also categorize core industrial investments on the basis of office finish and physical design (e.g., ceiling height, loading dock heights, divisibility). For example, some institutional investors define core industrial as properties with high ceiling heights (i.e., 24 to 30 feet), dock-high loading, low office finish (i.e., less than 10 percent), situated in business parks or industrial zones. This additional layer of criteria is intended to help avoid properties that are functionally obsolescent and cannot meet the needs of future tenants. Similarly, many institutional investors tend to avoid R&D properties, the label attached to a wide range of office showroom and customized high-tech, corporate campus–type facilities. As with other specialized facilities, R&D properties are considered specialized, hybrid investments that combine office and warehouse or office and showroom uses in one structure, which should be approached opportunistically to offset higher acquisition costs, narrower tenant appeal, and limited exit strategies.

The core/noncore allocation embraced by many risk-averse institutional investors can backfire in terms of portfolio-level performance. Assuming industrial portfolios are of sufficient scale in terms of number and value of properties, a proactive approach can be used to shift the classification of industrial investments from the noncore to the core category. For example, by careful research and data mining (i.e., tracking what works and what does not) to identify indirect benefits (e.g., lower turnover, higher marginal rent to reward customized space, conversion costs, leading indicators), owners can reduce the risk of noncore activities. In effect, they can use "insider information"—still legal in the inefficient real estate market—to beat the market. In addition, by approaching industrial investments with greater precision and using scale to its advantage, an investor can experiment

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with various customized portfolio solutions and test what works and what does not work without jeopardizing the whole. For example, investors can strategically allocate a portion of the industrial category to more noncore, opportunistic activities that have a higher risk/higher return profile than bread-and-butter operations. This strategy will allow them to capture potentially higher portfolio-level returns without a commensurate increase in risk. Over time, insights gleaned from actual performance can be used to shift assets from the noncore to the core category. This benefit also applies to market timing, since investors and developers tapping into such proprietary market knowledge can anticipate changes in demand on the margin for various subsectors, allowing them to sell into a softening stage and buy into a recovering one. Those who use generic, unsophisticated approaches that do not recognize the dynamics of demand and supply embedded in the industrial sector will lag behind these more sophisticated, strategic players. Because fiduciary relationships are generally involved in private sector institutional investing, with advisers and consultants providing such a role, it is likely that "best practices" will demand a more precise approach to the industrial sector.

Investors use REITs to fill or supplement their real estate portfolios in an attempt to take more strategic approaches to various property sectors, including the industrial sector. In effect, these investors are using a "risk-management by transfer" mechanism to reduce risk associated with dynamic real estate markets without giving up the potential benefits that can be garnered from a more precise, proactive approach to industrial investments or taking on unmanageable networks of staff or consultants. REITs provide the advantage of centralized management, economies of scale, and a focus on the industrial sector as a means of exploiting potential market inefficiencies created by the broader industry's reliance on generalized approaches. As the market becomes more refined and as investor expectations increase, a more detailed approach to the industrial sector, as supported by the classification system presented in this book, will become increasingly important. Two recent changes have highlighted this need. First, the imposition of greater accountability for corporate executives in other sectors has raised the bar in terms of disclosures for REITs. In order to provide supportable, defensible predictions for performance, managers will have to develop more empirically based outlooks. Second, growing concern over analysts' forecasts and possible conflicts of interest has resulted in new requirements that Wall Street analysts track and report their company ratings against actual performance. Both of these structural changes will force added discipline on those involved in the public real estate market, including the adoption of a more precise classification of industrial properties.

The industrial property sector covers a broad, eclectic array of space users and property subtypes. The combinations and permutations of the demand/ supply equation argue for a new, more precise classification of properties. To help explain the forces that have led to the current array of products, this foreword has examined the key evolutionary forces that have affected space users and producers. The book examines the classification system, presenting a cross-sectional look at the industrial property sector. It describes the primary and secondary classes that satisfy the criteria outlined earlier in terms of uniqueness, distinctiveness, meaningfulness, substantiality, and sustainability.

The industrial property classification system presented in this book is intended to endure over time, but the reality is that the dynamic nature of the market likely will necessitate adjustments. Because major structural shifts or revolutions such as technology and the new economy will occur, it is important to identify the major external and internal trends that will have an impact in the near term. Insight about emerging trends will be particularly

#### market Trends

helpful to the more proactive developers and investors who tend to operate on the edge and approach real estate in general, and industrial properties in particular, as short-term plays. With respect to industrial properties, two key types of trends are noteworthy: external trends that affect the broader business and economic environment, and internal trends that affect industrial space users, space producers, and market facilitators.

#### EXTERNAL TRENDS

*Globalization, Consolidation, and Securitization.* Three major external trends will likely continue to influence the evolution of the industrial market: globalization, consolidation, and securitization. Much has been written about them. For the purposes of this book, they are explored in general terms with an emphasis on how they might affect the future market for industrial space.

The globalization of businesses, economies, and finance affects industrial real estate both directly and indirectly. As a result, business forecasts and strategic plans must consider global economic conditions, and companies must operate on a more global, diverse plane. Similarly, the globalization of finance has tremendous implications on real estate capital flows, affecting the relative demand for investments and ultimately the cost of capital. Likewise, the growth of multinational companies domiciled in the United States and based offshore has created a network of businesses that transcend national boundaries and parochial concerns. As the global market matures, relative economic roles can be expected to emerge, with various countries and locations playing dominant roles in the areas in which they have a competitive advantage, thus changing demand for industrial space.

The consolidation of industry continues to unfold, penetrating deeper into industries and cutting across sectors and global boundaries. Like globalization, consolidation affects industrial needs both indirectly and directly. Although its effects are still being played out, the trend will clearly result in a greater concentration of power and an increased homogenization of services and responses to external conditions that indirectly affect the industrial market. The concentration of industrial activity in the hands of well-capitalized public and private entities, replacing smaller, generally local predecessors, will have a direct impact on both demand and supply.

The securitization of real estate markets also has affected materially the way the domestic real estate market operates. Because many investors will invest in both private and public structures, management philosophies are expected to converge, resulting in advances in best practices and more precise, sophisticated investment strategies and practices. With respect to industrial investments, which are becoming more diverse and complicated, investors will seek out players who are best capable of responding to the opportunities that emerge during this evolutionary process.

Technological Innovation. Unlike globalization, consolidation, and securitization, the technological revolution has led to a seemingly endless series of new paradigms and response paths. This situation reflects a dramatic departure from more gradual evolutionary change, which richly rewarded innovators and early adapters able to capitalize on new opportunities. Unfortunately, logical, disciplined approaches break down in the face of rapid technological changes, leaving businesses and real estate professionals alike to face a difficult dilemma: either adopt emerging technology trends as they unfold, or wait until some clear direction indicates where new trends are headed and what they mean to business processes. In the case of industrial real estate, such a passive, risk-averse approach could, on the one hand, expose developers and investors to a series of wipeouts by leaving

them with functionally obsolescent facilities. On the other hand, by overreacting they could be left holding overimproved facilities for which companies would be unwilling or unable to pay the premium rent required to amortize the added expense. Since technological innovations are likely to continue to emerge, industrial investors and portfolio managers must develop financially feasible and sustainable response systems to such technological trends.

# INTERNAL TRENDS

Supply Chain Management. The term supply chain management refers to the integration of procurement, production, pricing, logistics, and other business functions associated with providing goods and services. During the 1980s, interest in supply chains was focused largely on transportation issues as companies struggled with how to get their products to market in a more timely and cost-effective manner. In the early 1990s, the notion of supply chains was broadened to include the warehousing function, setting the stage for a more comprehensive approach to the field. As manufacturers began to appreciate the added value of more comprehensive supply chain systems, many of them turned to third-party logistics (3PL) providers to capture the benefits promised by applying more-sophisticated management tools. Over time, emphasis shifted from approaching supply chains as a cost-containment model to viewing them as tools that can create competitive advantage.

The contemporary approach to supply chain management is comprehensive, incorporating state-of-the-art advances in such subareas as planning and scheduling, distribution planning and deployment, inventory management, material handling systems, outbound/fulfillment, trading partners, transportation management, and warehouse management. While some firms have developed in-house capabilities for supply chain management, many have turned to outsourcing to capture the benefits without incurring the overhead and costs associated with in-house approaches. This trend has become even more pronounced as best practices have improved dramatically, creating windfalls for those who can stay on the cutting edge of innovation and wipeouts for those who lag behind and fail to remain competitive. In this environment, supply chains are becoming more interconnected, creating greater dependencies in which companies look to their suppliers and facilitators to help improve customer satisfaction and responsiveness and focus their efforts on their core capabilities.

Advances in two subareas of the supply chain—logistics and procurement—are particularly noteworthy to industrial real estate. Logistics—an important subset of the broader area of supply chain management—has undergone dramatic changes triggered by the e-business, Internet, and technological revolution. For example, changing logistical models associated with technological advances and elimination of middlemen in many industries have dramatically affected the level, design, and location of desired facilities. On a related note, the use of technology-enhanced inventory tracking and shipping systems, coupled with more efficient approaches to packaging and logistics management, has set the stage for further disintermediation of middleman. As a result, many companies now bypass the use of traditional storage facilities in favor of direct manufacturer-to-end-user shipping. On another front, changes in production, as companies increasingly look at improving productivity by reengineering manufacturing processes, have also changed manufacturing channels. Going forward, supply chain management will continue to be one of the more dynamic fields for industrial investors to monitor as a wave of new computer-tracking, communication, and distribution systems technologies are expected to emerge.

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Technology Integration. Technological innovation, as well as the successful integration of technology, has been one of the driving forces behind the advances that have been made in supply chain management and improved productivity levels in manufacturing. Although some might view these as new changes directly resulting from the Internet and e-business explosion, many of the technology-induced innovations actually have been on the scene for a number of years. Such innovations include automated warehousing, product tracking, production modeling, direct order processing, and improved fulfillment processes. Thus, for seasoned observers and those actively engaged in the industrial sector, many of the changes are more evolutionary. However, close attention must also be paid to unexpected technological innovations or other advances, such as increased use of automation, which have the potential to improve manufacturing productivity or materially change business processes.

In this increasingly dynamic industrial environment, innovation and successful integration of technology can clearly affect real estate demand, influencing both the site-selection process and design features required by tenants. Changes in business processes and compressed product life cycles will translate to a preference for more flexible leases. To stay on top of these trends and help quantify their effect on the broader industrial sector, attention should be paid to the more innovative space users. Advances in the shipping and logistics sectors—where locational preferences are shifting toward greater airport accessibility, shipments are tracked on a real-time basis, and hub-and-spoke distribution models have been developed to accommodate drop shipping—can also provide insights. Given the durable, capital-intensive nature of real estate, technological advances must be identified that will have a lasting effect on real estate use or market processes.

Changing distribution models for the retailing industry provide another example of evolving business functions and technological integration that are affecting warehouse demand. In the highly competitive retail arena, a number of retailers are developing highly refined and technologically dependent distribution systems. The heightened awareness of retailers to micromarket merchandise (i.e., customizing inventory to local demand) to satisfy an increasingly eclectic and dynamic consumer base also is causing changes in logistics management. These needs affect the physical design of warehouses in order to handle vertical distribution, the size of facilities to achieve necessary economies of scale, and the location of such facilities. In the area of facilitation, growth of the Internet and extranets supports the emergence of extended enterprises that foster greater interaction and collaboration. In addition to improving communication, such efforts can help improve throughput from businesses to consumers. For example, many stores are shifting to manufacturer-added electronic article surveillance (EAS) source tagging that adds surveillance labels on goods before their delivery to the store. Although there is no current industry standard for such tags, the competing technologies most likely will be reconciled, adding even more efficiency. Increasing use of computer-assisted logistics and scanner technology also makes it easier to manage distribution processes and respond to smaller order size to ensure that stores have adequate supplies without requiring large in-store storage spaces.

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The industrial property sector is a property class that meets the diverse needs of a wide range of users who in turn are undergoing dramatic changes in basic business processes and supply chains. The objective of this book is to capture, organize, and explain this diversity to help industrial real estate developers and investors develop more sophisticated approaches to this important component of the broader commercial real estate market. Rather than merely expand on the generally accepted typology, the book introduces a new structure that includes six primary categories and 12 secondary categories. Although the book focuses on the physical characteristics of the various industrial building classes, it also provides insight into the nature of tenants that such facilities can best house in an efficient, cost-effective manner.

To provide additional understanding of the various components of the broader industrial sector, the book explores how the various classes fit in the overall supply chain and highlights some of the spatial and market commonalities within each of the categories. The standardization and precision provided by the proposed classification system should help advance professional practices, creating a more efficient system for balancing the spatial and capital market in terms of industrial property. At the same time, the classification should help developers approach the sector in a more strategic manner. It should also help investors select properties and financial arrangements that help them capture superior risk-adjusted returns from the industrial sector and, at a broader level, for an overall real estate portfolio. This book should help developers and investors develop a greater empathy with various segments of tenants, providing some insight into the driving forces behind the current demand for industrial space. Finally, the trends briefly introduced in this book should help developers and investors gauge future demand, suggesting what issues need to be monitored to manage industrial real estate activities in a more proactive manner to provide sustainable results that exploit market inefficiencies and capitalize on new opportunities.

James R. DeLisle Director, Runstad Center for Real Estate Studies University of Washington Seattle, Washington

#### CONCLUSION

Excerpts from Chapter 1: Guide to Classifying Industrial Property First Industrial, ULI

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# **Section 1: Overview**

#### Introduction

Industrial real estate in the United States encompasses approximately 25 billion square feet of space. Industrial real estate is the largest sector of U.S. real estate, both in terms of square feet and value. It includes manufacturing plants, warehouses, research and development centers, air cargo facilities and a number of other building types. Industrial real estate has a wide variety of sizes, shapes and build-outs. Virtually every American business directly or indirectly relies on some form of industrial real estate to manufacture, warehouse or distribute goods. This <u>Guide</u> provides a unique look at the world of American industrial real estate. In addition to presenting an encompassing structure for the classification of industrial real estate, the use, evolution, location, investment performance and supply chain placement of each category will be analyzed.

#### **Categories of Industrial Real Estate**

All types of industrial real estate have common characteristics, in spite of the varied use and design of specific buildings. These common characteristics can be classified within six primary, and 14 secondary, categories. Certain industrial building types have a recognized history of use, such as Bulk Warehouse facilities. Others are new to the sector, such as Rack Supported buildings. The accompanying table lists the six primary categories and 14 secondary categories of U.S. industrial real estate within this <u>Guide</u>.

Primary Categories	Secondary Categories
Warehouse Distribution –	Regional Warehouse
	Bulk Warehouse
	Heavy Distribution
	Refrigerated Distribution
	Rack Supported
Manufacturing -	Light Manufacturing
	Heavy Manufacturing
	Airport Hangar
Flex -	R&D Flex
	Office Showroom
Multi-Tenant -	Multi-Tenant
Freight -	Truck Terminal
	Air Cargo
Telecommunications -	Data/Switch Center

Historically, only three primary categories of real estate were utilized to classify all industrial buildings. These were: Warehouse, Manufacturing and Flex. Buildings were categorized according to a combination of physical characteristics and use. These three categories encompassed approximately 90 percent of the total industrial stock. However, buildings with great differences in characteristics were included within the same category. Certain types of industrial real estate also were misclassified due to a lack of alternative categories. Finally, these three categories ignored over two billion square feet of existing, unclassified buildings.

The new two-level system of classification introduced in this <u>Guide</u> acknowledges the variations within the original three categories of Warehouse, Manufacturing and Flex. This system also provides the new categories of Freight, Multi-Tenant and Telecommunications. Most importantly, this new system expands the coverage of industrial real estate to almost 100 percent of the national inventory. Certain industrial buildings, however, do not fit within any of these categories due to their hybrid form. These buildings have not been classified.

## **Classification Process**

*Use* and *physical characteristics* are two approaches used to classify industrial real estate. This <u>Guide</u> utilizes physical characteristics to classify building types because this approach recognizes design features that may not be apparent with the use approach.

The process of classifying industrial real estate by physical characteristics utilizes *core* and *ancillary* differentiating features. Core differentiating features are those physical characteristics that are present in all buildings within the same category. For example, all Truck Terminals have docks on parallel walls. This is a core differentiating feature of Truck Terminals. Ancillary features are common, but not always present, within a particular industrial category. Trailer parking is common but not always present in Heavy Distribution buildings. This is an ancillary differentiating characteristic of Heavy Distribution buildings. Several industrial categories can have some of the same core and/or ancillary physical characteristics. The presence of docks along at least two walls is a core differentiating characteristic of both Truck Terminals and Heavy Distribution buildings. However, Truck Terminals and Heavy Distribution buildings have additional core characteristics that are not identical. This results in the creation of two separate secondary categories.

## **Building Physical Characteristics**

The unique physical characteristics of industrial buildings distinguish these facilities from those of other real estate asset classes. The typical physical features of industrial real estate include multiple loading docks, deep truck courts, high ceilings and the presence of cranes. The same attributes that distinguish industrial buildings from those of other real estate sectors also form the six distinct primary categories within this sector.

As reviewed, the historically utilized categories of Warehouse, Manufacturing and Flex do not adequately encompass the diverse world of industrial real estate. Truck Terminals, for example, historically were classified with warehouse buildings, although the terminals generally do not warehouse goods. As well, their ceilings are low and they rarely have racking. As another example, Multi-Tenant buildings do not fit within the historical three-category system either, but historically were included with both manufacturing and warehouse buildings. There also has been a recent surge in the creation of data switch centers from the redevelopment of older buildings and new construction. Data and switch centers are clearly a new category of industrial real estate. In stressing the physical characteristics of buildings this <u>Guide</u> identifies a total of six primary categories of industrial real estate.

The range of physical differences for buildings within each primary category justifies the creation of secondary categories for each. The physical characteristics of Warehouse Distribution facilities, for example, vary significantly from building to building: ceiling heights range from 16 to 80 feet; loading docks vary from 3,000 to 15,000 square feet per dock; office build-out ranges from below five percent to over 25 percent.

Classification of industrial real estate by physical characteristics utilizes the examination of *interior* and *exterior* features. Some building types can be classified by examining

their exterior or interior features only. However, it is important to recognize that all secondary categories of industrial real estate have specific exterior and interior attributes. The principal exterior features are:

- building size
- site coverage
- loading capability
- car and trailer parking

The main interior features are:

- ceiling heights
- space build-out
- power
- floor load and levelness

The six primary and 14 secondary categories of industrial real estate can be classified correctly when examining exterior and interior physical features with the correct ranges of values. This <u>Guide</u> presents the range of values for each industrial building type, as well as additional variables for facilities with unique physical characteristics.

### **Building Use**

Industrial real estate has a diversity of use not found within other sectors of real estate. For example, office buildings can accommodate a variety of businesses classified under various business standard industrial classification codes (SIC). However, the overall use of the space is relatively uniform. Industrial facilities accommodate not only a wide variety of businesses, but a wide range of activities as well. Each activity requires a specific environment and physical structure. The activities of manufacturing, testing, warehousing and distribution directly correspond to four of the primary industrial real estate categories: Manufacturing, Flex, Warehouse Distribution and Freight.

These industrial activities can be further specialized. Manufacturing includes raw materials processing, product assembly and maintenance. These activities correspond to the secondary categories within Manufacturing: Heavy Manufacturing, Light Manufacturing and Airport Hangar.

An industrial real estate classification 'tree' can be constructed by focusing exclusively on a building's physical characteristics. However, building use is also an important classification tool. Building use can confirm classification by physical characteristics and, in some cases, serve as the final determinant. For example, while Truck Terminals are identified by their physical exterior appearance, Light Manufacturing buildings are identified by their activity, or use. Certain physical characteristics also are not visible, such as power, floor load and floor levelness. Additionally, building use varies more than the number of property types. R&D Flex buildings can have a variety of uses within physically identical buildings. Multi-Tenant facilities can have a number of activities within one structure.

Certain industrial real estate categories also have flexible physical characteristics that can accommodate multiple activities. While R&D Flex facilities cannot perform freight forwarding without a total redevelopment of facilities, a manufacturing company can perform light manufacturing within a Bulk Warehouse. This facility, therefore, would be classified by its use (Light Manufacturing) rather than its physical characteristics (Bulk Warehouse). When a building's physical flexibility in design allows for multiple uses, building use is the final classification approach.

In summary, the classification of an industrial building type by use is as important a process as classification by physical characteristics. It is important, however, to thoroughly understand the physical characteristics of all six primary and 14 secondary categories of industrial real estate. Classification by physical characteristics, therefore, is the process utilized within this <u>Guide</u>.

#### **Primary Category: Warehouse Distribution**

The Warehouse Distribution category of industrial real estate comprises over 55 percent of the entire national industrial inventory: approximately 14 billion square feet within the U.S. This is the largest industrial real estate category. Warehouses today have a variety of descriptive names, including Bulk Warehouse, Regional Warehouse, Office Warehouse and Big Box. Each type of warehouse has a specific use. And each name describes a feature that is unique to that building type. Bulk Warehouse and Big Box refer to a building's size. Office Warehouse refers to a high percentage of office build-out. All warehouses have common attributes that classify them within the primary category of Warehouse Distribution. In addition, the unique characteristics of specific warehouses classify them within separate secondary categories.

The Warehouse Distribution category is derived from the functions of warehousing and distribution of goods. These processes are present in all secondary categories of Warehouse Distribution, however may not both be present within an individual building. The proportion of warehousing versus distribution also varies according to building type. This variety of function within a category is an excellent example of the diversity of industrial real estate.

The core differentiating features of warehouses are overall building design, ceiling height and loading capabilities. Most Warehouse Distribution buildings are rectangular in shape, thus use of the term 'box' in some descriptions. In order to be classified a warehouse, buildings that are not perfect 'boxes' must have exterior walls that allow efficient warehousing and distribution by one single tenant. Most buildings that do not meet this requirement are classified as Multi-Tenant facilities. This exterior wall requirement does not signify that all warehouses are occupied by one tenant but, rather, that these buildings potentially could be occupied by a single tenant.

Ceiling height is another core differentiating feature of Warehouse Distribution facilities. A building that is a perfect 'box' in shape must have a ceiling height within a specified range. Ceiling heights in Warehouse Distribution facilities range from a minimum of 16 feet to as high as 80 feet in certain Rack Supported Buildings.

Warehouse Distribution facilities have loading requirements that exceed those of all other primary categories except Freight. The functions of warehousing and distribution involve the movement of goods at a high volume and/or high frequency. This high volume and/or frequency require adequate loading capabilities. Warehouse Distribution facilities have a range of 3,000 to 15,000 square feet to one dock. The average is approximately 10,000 feet per dock.

The Warehouse Distribution category has five secondary categories: Regional Warehouse, Bulk Warehouse, Heavy Distribution, Refrigerated Distribution and Rack Supported. The core differentiating features of the Warehouse Distribution category -- building design, ceiling height and loading capabilities -- also distinguish the buildings within each of the secondary categories. Additional attributes that are unique to each secondary category include dock configuration, trailer parking, power and floor load and levelness. These features are unique, and consistently present and recognizable in each category.

### Warehouse Distribution Secondary Category: Regional Warehouse

The name Regional Warehouse is derived from the market or region it serves. Regional Warehouses are the most numerous facilities within the Warehouse Distribution category. They are also the least distinctive physically. In some regions Regional Warehouses are referred to as Local Warehouses or Office Warehouses.

Regional Warehouses are similar in size to Multi-Tenant buildings and also can accommodate multiple tenants. The shape of the buildings distinguishes these facilities from Multi-Tenant facilities, however. Regional Warehouses are rectangular in shape, allowing more efficient single-tenant use. Multi-Tenant facilities are not typically rectangular.

Regional Warehouses generally do not exceed 100,000 square feet in size. Ceiling heights are at the low end of the Warehouse Distribution range. The primary function of these facilities is to store goods, which require a minimum loading capability. Office build-out varies significantly.

Regional Warehouses typically do not have the features required by manufacturers. The lack of manufacturing attributes in Regional Warehouses is also typical of all Warehouse Distribution secondary categories. When present, manufacturing space in Regional Warehouses rarely exceeds 10 percent of total building size.

# Regional Warehouse: Exterior

Building size often differentiates Regional and Bulk Warehouses. Regional Warehouses are the smallest buildings within the Warehouse Distribution category. The loading requirements of Regional Warehouses typically range from 5,000 to 15,000 square feet per dock. The ratio varies, depending on the facility's use and number of tenants.

Regional Warehouses with multiple tenants and a high product turnover typically have a lower ratio: approximately 5,000 square feet to one dock. Single-tenant buildings with a low product turnover have a higher ratio of approximately 15,000 square feet to one dock. The average ratio is 10,000 square feet to one dock. The loading requirements of Regional Warehouses exceed those of Manufacturing and Flex facilities, but not Bulk Warehouse, Heavy Distribution and Freight facilities.

Site coverage for Regional Warehouses corresponds to the level of office build-out and resulting parking requirements. Facilities with a higher percentage of office space, referred to as Office Warehouses in some markets, have higher parking requirements and thus lower site coverage. In general, a land-to-building site coverage ratio of two to one is feasible.

#### **Regional Warehouse: Interior**

The interior of Regional Warehouses varies significantly from building to building. Single-tenant use is typical of these facilities. Multi-tenant Regional Warehouse facilities may resemble Multi-Tenant buildings. The size of tenant space, however, distinguishes Regional Warehouses from Multi-Tenant facilities. Average tenant space in Regional Warehouses exceeds 20,000 square feet. This is approximately twice the average tenant space within Multi-Tenant buildings.

Regional Warehouse facilities have one of the most varied tenant use of all Warehouse Distribution facilities. Some Regional Warehouses are designed to warehouse; others are utilized as distribution facilities. Office build-out generally ranges from five to 25 percent of total building size, depending on the number and size of tenants. Multi-tenant warehouses have a higher range of office build-out than single tenant facilities. Dock accessibility varies among the buildings as well: both private and common docks are utilized.

Because Regional Warehouses are small in size, ceiling heights are typically lower than in most other Warehouse Distribution buildings. Ceiling heights generally range from 16 to 24 feet. This lower ceiling height usually precludes the build-out of mezzanine space.

#### Regional Warehouse: Use & Evolution

Because Regional Warehouses are one of the most varied in use among Warehouse Distribution facilities, the types of tenants are equally varied. Tenants range from small, local distributors to large manufacturing corporations. Most space in these buildings is dedicated to storage and distribution. Interior build-out, however, can be allocated to light manufacturing space, which is ideal for small assemblers.

The accompanying map depicts 174 Regional Warehouses in the Atlanta metropolitan market. The evolution pattern of Regional Warehouses follows the population expansion. Older buildings, indicated by purple dots, are located within the center of the metropolitan area. Newer facilities, indicated by green dots, populate areas further out

from the metropolitan center. Some newer facilities are also located closer to the metropolitan center. These replaced older, obsolete buildings. This evolution pattern is indicative of the Warehouse Distribution primary category overall. In spite of some overlap of older and newer buildings, which is a result of local area growth, Regional Warehouses in general follow the population expansion pattern.

#### Warehouse Distribution Secondary Category: Bulk Warehouse

Bulk Warehouse describes a facility that stores large amounts of goods for varying lengths of time, ranging from extensive storage to almost immediate distribution. Bulk Warehouses are easy to identify. These facilities are large in size, exceeding 100,000 square feet. The building's use, combined with its size, determines the interior space build-out that is allocated to manufacturing, office and warehouse. Bulk Warehouses generally are not suited for manufacturing because of their insufficient power, high ceilings and high number of docks. When present, manufacturing space rarely exceeds 10 percent. Office build-out is also minimal.

In addition to building design, the other core differentiating features of Bulk Warehouse facilities are loading capabilities and ceiling heights. These facilities have high loading requirements. The majority of loading and unloading is performed utilizing docks and, to a lesser extent, drive-in doors. Ceiling heights in Bulk Warehouses generally exceed 20 feet, with slightly lower ceilings present in some older buildings. In newer buildings, advances in technologies are pushing ceiling heights above 30 feet.

### Bulk Warehouse: Exterior

Bulk Warehouses are physically distinctive from the exterior due to their large size. The minimum size of these facilities is 100,000 square feet; the maximum size exceeds 1,000,000 square feet. The only other industrial real estate category of this size is Manufacturing. Land coverage differentiates manufacturing and warehouse buildings. Parking, truck maneuvering areas and trailer parking determine a building's site coverage ratio. Bulk Warehouses do not employ as many individuals per square foot as most other Warehouse Distribution facilities, which increases their site coverage. However, they do require deep truck courts and trailer parking, which decreases the overall ratio. On average, the typical land site coverage ratio ranges up to 50 percent.

The mode of transportation and quantity of goods that flow through Bulk Warehouses are additional core differentiating features of these facilities. Modes of transport are truck and rail service. Rail service is not as common as truck docks, and is predominantly utilized by industries that can ship and receive goods competitively by this method of transport. In fact, rail service is now viewed within the industry as an amenity, rather than a necessity. Tenants determine the specific loading requirements and frequency of product turnover. Inventory, production and business delivery cycle ultimately determine the type and frequency of transportation required. The ratio of square feet to docks commonly ranges from 5,000 to 10,000 to one. Most Bulk Warehouse facilities have 10,000 or less square feet per one dock. Certain Bulk Warehouses have both rail doors and truck docks for intermodal, or one type to another type, freight forwarding (e.g.,

truck to train). Intermodal transportation, however, has moved to specialized facilities and is performed externally, without physical structures.

## Bulk Warehouse: Interior

Ninety percent of Bulk Warehouse space is allocated to the storage of large quantities of goods. Office build-out is minimal and occupies a small percentage of the building's overall size, typically below 10 percent of total space and in very large buildings closer to five percent. Certain smaller Bulk Warehouses require office space exceeding 10 percent of the entire building. Manufacturing space also can be present in Bulk Warehouses. However, Bulk Warehouses, like the Warehouse Distribution category as a whole, lack the attributes commonly found in manufacturing facilities and required by most manufacturing operations. Therefore, manufacturing space in Bulk Warehouses rarely exceeds 10 percent of total building size, and does not require a separate build-out of space.

The high ceiling heights in Bulk Warehouses – 20 to 30-plus feet in newer buildings – allow mezzanine build-out, while maintaining a consistent height throughout the entire structure. Bulk Warehouses generally require racking, which creates the floor requirements of levelness and load. Buildings with high ceilings and tall racking systems require leveled floors in order to minimize truck and train vibration. The amount of goods stored determines the specific thickness and load of the floor. Heavier goods, or a large quantity of goods, require a thicker floor. Minimum floor thickness in Bulk Warehouses is six inches, allowing for 4,000 pounds per square inch (PSI). Floor thickness and levelness are not visible physical features, however, are attributes that differentiate Bulk Warehouses from other industrial real estate categories.

# Bulk Warehouse: Use & Evolution

Of all industrial building types, Bulk Warehouses have the widest variety of tenants. Manufacturing companies use Bulk Warehouses to store parts and goods. Logistics companies utilize Bulk Warehouses to distribute goods for other companies and customers. And retailers store goods in Bulk Warehouses before shipping to retail facilities, or directly to consumers.

There are two common perceptions associated with Bulk Warehouses: they are larger and their ceilings are higher now than in the past. The sample displayed in the accompanying map of Dallas/Ft. Worth depicts 129 Bulk Warehouse buildings built in the 1990s, contrasted with 110 constructed in the 1980s. The difference in average building size between these two periods is 20,000 square feet per building, or approximately 10 percent.

Based on the same sample, average ceiling height for Bulk Warehouses has increased over the last 20 years from 23 feet for those buildings constructed before 1980, to 25 feet for buildings built during the 1980s, to 27.5 feet for those built within the 1990s.

Bulk Warehouses follow a clear pattern of geographic expansion that is consistent with the growth pattern of metropolitan areas. The accompanying map of Dallas/Ft. Worth depicts this pattern clearly. Newer buildings -- those constructed within the last 20 years - are located the furthest distance from the city's center. Older buildings are situated closer to the metropolitan center. This pattern is also present in Atlanta, Chicago, Los Angeles and other metropolitan areas.

#### Warehouse Distribution Secondary Category: Heavy Distribution

The design of Heavy Distribution buildings is conducive to the function of distribution, rather than warehousing. Heavy Distribution buildings are capable of warehousing goods for extended periods, however, and therefore are similar to Bulk Warehouses. Because of this, Heavy Distribution buildings share certain characteristics with Bulk Warehouses. They also have requirements unique to distribution. The design of loading capabilities is a core differentiating feature of Heavy Distribution facilities.

Heavy Distribution buildings are large in size, typically ranging from 100,000 to 500,000 square feet. Examples outside this size range exist but are rare. Ceilings in excess of 24 feet in height, and averaging 28 feet, are required for the warehouse function. The number of loading docks and their design are other physical characteristics that differentiate Heavy Distribution from Bulk Warehouse facilities. Bulk Warehouses have a typical ratio of 10,000 square feet for one dock. Heavy Distribution buildings have a ratio of below 5,000 square feet to one dock.

### Heavy Distribution: Exterior

Heavy Distribution buildings can be classified by their dock configurations. Other Warehouse Distribution buildings usually have docks situated along one wall only. Heavy Distribution buildings must have cross docks, or docks along a minimum of two walls. Although by definition a cross-dock facility has docks on two parallel walls, Heavy Distribution facilities can have docks that are either perpendicular or parallel to each other. The model in the accompanying graphic depicts a Heavy Distribution building with perpendicular docks. The ratio of square feet per dock is decreased because of the presence of docks along two walls. In most buildings the ratio is approximately 3,500 square feet per one dock. Within the industrial real estate sector, Heavy Distribution buildings have the third lowest ratio of square feet to docks, following Truck Terminals and Air Cargo buildings.

Building size and site coverage are clear identifying features of Heavy Distribution facilities. The buildings have a minimum square footage of 100,000 square feet, which is identical to that of Bulk Warehouses. There are smaller Heavy Distribution facilities in existence, however, especially in smaller markets. The average site coverage of Heavy Distribution buildings is approximately 30 to 40 percent, the lowest average of all Warehouse Distribution facilities. This low site coverage is a result of the distribution function of Heavy Distribution buildings. The two-wall docking requires a larger perimeter for truck courts around the building, and trailer parking is commonly located

on the site. The presence of truck courts and trailer parking significantly reduce site coverage.

## Heavy Distribution: Interior

The interiors of Heavy Distribution buildings resemble those of Bulk Warehouses. However, Heavy Distribution facilities have certain unique physical characteristics. These facilities rarely require more than five percent office build-out. Manufacturing space is not present. Heavy Distribution buildings have a minimum ceiling height of 24 feet. In most buildings, ceilings reach or exceed heights of 30 feet. And building depth, the maximum distance goods travel between place of storage and the closest dock for distribution, is minimized in this building type. This corresponds with the facility's emphasis on distribution, rather than warehousing. Racking and flooring are attributes that differentiate Heavy Distribution buildings from other industrial real estate categories other than Bulk Warehouses. Heavy Distribution buildings utilize racking. Similar to Bulk Warehouses, the floor thickness and levelness of Heavy Distribution buildings need to correspond to the amount and/or weight of the goods stored, as well as the height of the racking. There is also the potential existence of two-story office build-out, which is independent of the distribution and warehouse functions. The high ceiling height of Heavy Distribution facilities creates this option.

# Heavy Distribution: Use & Evolution

The range of tenants is more restricted in Heavy Distribution facilities than in Bulk Warehouse facilities because of the emphasis on distribution, rather than warehousing. As well, Heavy Distribution facilities do not have manufacturing space. The typical tenants in Heavy Distribution facilities are logistic companies, which distribute goods.

Heavy Distribution facilities are the second newest and the least numerous building type within the Warehouse Distribution category, following Rack Supported buildings.

The accompanying map depicts 74 Heavy Distribution buildings in the Dallas-Fort Worth market. Two patterns are visible. The first is the dominance of Heavy Distribution buildings constructed within the 1990s, specified by green dots. Sixty-nine percent, or 51 of the 74 buildings, were constructed during this time frame. Four percent, or three buildings only, were built prior to 1970. The average year of construction of Heavy Distribution buildings in the Dallas/Ft. Worth market is 1991.

A second pattern is evolution. Newer buildings are located further from the metropolitan center. This is consistent with the evolution pattern of the Warehouse Distribution category overall. Unlike Regional and Bulk Warehouses, however, Heavy Distribution buildings are not located within the metropolitan center.

# Warehouse Distribution Secondary Category: Refrigerated Distribution

Due to their specific function there are a low number of Refrigerated Distribution buildings in existence. The design of this building type resembles warehouse structures.

The word 'distribution' in Refrigerated Distribution refers to the short period of time that goods are stored within the buildings.

Refrigerated Distribution buildings have clear identifying interior features. While freezers and wheel-in coolers are common in other types of warehouses and some manufacturing and freight buildings, an incorporated freezer floor is an integral design feature in Refrigerated Distribution buildings. Because of this unique floor, it is not economical to convert Refrigerated Distribution buildings to other types of Warehouse Distribution facilities. In certain cases the freezer floor can be utilized as a standard floor.

# Refrigerated Distribution: Exterior

Refrigerated Distribution buildings are the only Warehouse Distribution category with no size restriction. For example, in Chicago these buildings range from 5,000 to nearly 900,000 square feet in size. Identifying Refrigerated Distribution buildings from the exterior can be difficult because of their large variance in square footage.

The ratio of square feet to docks is a distinguishing feature of Refrigerated Distribution facilities. The number of square feet per one dock rarely exceeds 10,000; the average is 7,000 to 8,000 square feet to one dock.

Interior docks distinguish Refrigerated Distribution buildings from other warehouse building types. The type of goods stored in these facilities warrants the use of interior docks, especially in warmer climates. In some facilities the entire interior dock area is temperature controlled. In addition, the exterior docks are usually weather sealed in order to minimize the exposure of products to outdoor temperatures.

Refrigerated Distribution buildings occupy 50 percent of total site size; the remaining 50 percent of space is utilized for parking and truck courts. This ratio is the result of a lower car parking requirement and infrequent need for trailer storage. The ratio is similar to Bulk and Regional Warehouses.

# **Refrigerated Distribution: Interior**

Refrigerated Distribution buildings have a unique interior physical design. A typical facility consists of four sections. The freezer floor section is an integral part of the physical structure. The building also has a cooler, in which the temperature is maintained typically just above freezing. The freezer and cooler sections account for a minimum of 25 percent of the building. Dry storage is a third section and is present in warehouses that store more than one type of goods. Most Refrigerated Distribution buildings have dry storage areas. A fourth section is allocated to office build-out. Large Refrigerated Distribution buildings have minimal office space: about five percent. Smaller facilities allocate as much as 15 percent to office build-out. An additional processing area exists in certain food buildings, and does not exceed 10 percent of the entire structure. This processing area also can be cooled. Buildings with large processing areas and small freezers and coolers are classified within the Manufacturing category.

The freezer capability of Refrigerated Distribution facilities creates additional requirements not present in other Warehouse Distribution categories. These requirements are heavy power, dual sprinkler systems, floor drains and special loading features. Heavy power is necessary for the operation of the cooling and freezing equipment. Different types of sprinkler systems are present in the cold and dry/office areas.

Ceiling height varies according to building size. Refrigerated Distribution buildings that exceed 50,000 square feet in size have ceiling heights ranging from 16 feet to over 30 feet. Facilities smaller than 10,000 square feet have slightly lower ceilings.

#### **Refrigerated Distribution: Use & Evolution**

The features of coolers and freezers drive the use of Refrigerated Distribution facilities. The most common tenants of these facilities are food processing and distribution companies. The accompanying map depicts Refrigerated Distribution buildings in the Chicago market. Only 19 buildings are identified, which is too limited a sample to denote a clear evolution pattern. Similar small samples have been collected in other major industrial markets.

The average age of Refrigerated Distribution buildings is consistent in each evaluated metropolitan market, however. The average age of these facilities more closely approximates buildings within the Manufacturing category, rather than Warehouse Distribution. The average age pattern is confirmed by examining on the accompanying map the number of purple dots (11), versus green dots (4). Although a small sample, this indicates a lack of new demand for this building type. The Refrigerated Distribution category does not include manufacturing buildings, which also have freezers and coolers. It is important, therefore, not to assume the same level of demand for manufacturing food-processing facilities.

#### Warehouse Distribution Secondary Category: Rack Supported

Rack Supported buildings are the least common type of warehouse in the United States. Because of their tradeoff between efficient use of space and lack of flexibility these facilities are more frequently constructed in Europe and Asia, where the cost of land is much higher. However, their existence and uniqueness justify the classification of these buildings as a separate Warehouse Distribution category.

'Rack Supported' aptly describes the physical structure of these facilities. In traditional warehouses the walls and roof have separate support columns. In Rack Supported buildings, racking provides both the structural support and storage space. The resulting advantage of this feature is space efficiency. A disadvantage of Rack Supported buildings is their build-to-suit attribute. Once erected, racking is designed for a specific size and load. If either the size or load changes, the building loses its specific usefulness. Rack Supported buildings, therefore, are built for a specific tenant and an estimated period of use.

Rack Supported buildings have a unique building configuration. A typical facility has separate storage and shipping areas. The storage area is also the supporting structure, with racking encompassing the entire space. The buildings also have very high ceilings. The shipping area resembles a standard warehouse with a number of docks and lower ceiling heights. The storage and shipping areas are typically connected by an automated conveyor system.

#### Rack Supported: Exterior

The configuration of separate storage and shipping areas in Rack Supported Buildings creates the appearance of two adjacent buildings. The storage area is significantly higher than the loading section, and has racking but no docks or drive-in doors. The loading area has a number of docks, lower ceilings and no racking. Within the loading area, the square feet to dock ratio can be as low as 5,000 to one.

The build-to-suit development of Rack Supported buildings is a unique nonphysical characteristic. This feature affects building size. Rack Supported buildings do not have a specific site requirement. There are no docks or truck courts present over a large percentage of the building. Due to their design, the facilities require a smaller square footage to store goods, in fact the smallest of any category within Warehouse Distribution. The entire warehouse operation is also automated, requiring fewer workers. The number of employees per square foot in Rack Supported buildings is the lowest of all warehouse types. The low number of employees results in lower parking requirements, and a resulting higher site coverage. The site coverage for Rack Supported buildings is the highest among Warehouse Distribution buildings.

#### **Rack Supported: Interior**

The storage and loading sections in Rack Supported buildings have entirely different physical characteristics. The storage area consists of racking with wall and roof cladding attached. Space is utilized to a maximum since there are no support columns. This type of construction also permits very high ceilings. Rack Supported buildings that store small objects have ceilings as high as 78 feet. High ceilings create special demands on stability and floor levelness. A Rack Supported structure also must factor in external forces, such as wind and snow load.

As reviewed, the warehousing operation in Rack Supported buildings is usually completely automated. Tall, computer operated stacker cranes lift, pull or grab stored units. Employees within this section perform mostly routine maintenance functions. Automated conveyer belts also connect the storage and loading areas. The loading area has traditional wall and roof support. This area is designed for the sorting, labeling, grouping and dispatching of goods taken from the storage area. A section of this area is usually designated for office build-out.

## Rack Supported: Use & Evolution

There are a limited number of Rack Supported facilities within the U.S. Therefore, there is no existing expansion pattern. The construction of Rack Supported buildings typically follows advances in the field of logistics. Because these buildings have fully automated transport and retrieval systems, their existence depends on modern logistics companies. Without modern logistics systems, Rack Supported buildings would not exist.

## **Primary Category: Manufacturing**

Manufacturing is the second largest category of industrial real estate. There is approximately 30 percent, or 7.0 billion square feet, of manufacturing space in the U.S. Manufacturing is a process, rather than a physical feature. Manufacturing buildings can be identified by physical characteristics, however. The methodology of identification by physical characteristics in this <u>Guide</u>, therefore, applies to Manufacturing buildings as well.

All Manufacturing facilities have physical characteristics that involve the manufacturing process. Two core variables are present in all Manufacturing facilities: a high percentage of manufacturing space build-out, and a high power requirement.

A Manufacturing facility's interior space configuration is its most important core differentiating characteristic. There are three types of space in a Manufacturing facility: manufacturing, warehouse and office. Manufacturing space accounts for a minimum of 50 percent of space; the average is close to 70 percent. Certain Multi-Tenant and R&D Flex buildings have build-outs with a comparable amount of manufacturing space. However, because the high proportion of manufacturing space is a core requirement of manufacturing facilities, this feature differentiates these facilities from all other industrial real estate, including Multi-Tenant and R&D Flex.

The high proportion of manufacturing space creates additional requirements. The manufacturing process requires heavy machinery. Heavy machinery, in turn, requires heavy power. Heavy power is present in all Manufacturing buildings. Heavy machinery and heavy power are core differentiating features of Manufacturing facilities. Telecommunications buildings have an equal power requirement, but a greater level of power on a per-square-foot basis

Manufacturing buildings have a number of additional core and ancillary differentiating features. The exterior features are minimal loading and a high ratio of car parking per square foot. Heavy floor load and cranes are interior features. These features create significant variance among manufacturing facilities. The Manufacturing primary category, therefore, has three distinct secondary categories: Light Manufacturing, Heavy Manufacturing and Airport Hangar. Each of these categories has unique differentiating characteristics. Each category, however, facilitates manufacturing or manufacturing-related functions, such as assembly and maintenance. Manufacturing space and heavy power exist in all secondary categories.

## Manufacturing Secondary Category: Light Manufacturing

Light Manufacturing is the most diverse building type within the Manufacturing category and, therefore, the hardest to classify. Tenant use is also varied. Classification of Light Manufacturing buildings should include an examination of both exterior and interior features. Light Manufacturing buildings have more car parking and lower site coverage than Warehouse Distribution buildings. These facilities also have a higher average ratio of square feet to one dock. The higher average ratio can be misleading in identifying Light Manufacturing buildings because of an overlap in ratios between Light Manufacturing and Warehouse Distribution.

Average Light Manufacturing buildings have ceiling heights similar to those of Regional Warehouses (16 to 24 feet) and a building size similar to that of Bulk Warehouses (over 100,000 square feet). Size, loading, ceiling heights, power and build-out are clear identifying features of Light Manufacturing buildings.

## Light Manufacturing: Exterior

Light Manufacturing buildings are smaller in size than Heavy Manufacturing facilities. In general, they do not exceed 300,000 square feet, which is the average size of Heavy Manufacturing buildings. A manufacturing building smaller in size than 100,000 square feet is more likely to be classified as Light, rather than Heavy.

The loading requirements of Light Manufacturing buildings have both similarities and differences with other Manufacturing facility types. The dual mode of truck and rail transport is a feature shared with other manufacturing facilities. The ratio of square feet to docks differs from other manufacturing building types. Light Manufacturing buildings utilize trucks for product flow. These facilities have a higher frequency of product flow than any other Manufacturing category. As a result, the average square feet to docks ratio ranges from 10,000 to 15,000 to one dock. This ratio is similar to some Warehouse Distribution buildings. Light Manufacturing buildings rely significantly less on rail transport than Heavy Manufacturing buildings.

Light Manufacturing buildings have an average site coverage of 40 percent or slightly below. This lower site coverage is due to the high car parking requirement of the facilities, which corresponds to the light manufacturing and assembly-type activities performed by tenants. This site coverage is lower than Heavy Manufacturing and most Warehouse Distribution buildings, but not as low as R&D Flex.

# Light Manufacturing: Interior

Light Manufacturing buildings have lower ceiling heights, typically ranging from 14 to 24 feet. These lower ceiling heights distinguish Light Manufacturing from both Heavy Manufacturing facilities and Warehouse Distribution buildings. Ceilings outside this range account for less than 15 percent of all Light Manufacturing facilities.

Light Manufacturing facilities have three types of space build-out: manufacturing, warehouse and office. Manufacturing covers the most amount of space. On average, 50 to 75 percent of a Light Manufacturing facility is dedicated to manufacturing space. The remaining 25 to 50 percent is allocated to warehouse and office space. Office build-out rarely exceeds 20 percent of an entire building. Light Manufacturing buildings also are commonly divided into multiple units.

Light Manufacturing facilities can utilize rail service, similar to Heavy Manufacturing buildings. Since rail does not enter the building, there is less of a need for cranes. Crane capacity does not exceed 25 tons, well below the weight in Heavy Manufacturing buildings.

As reviewed, all manufacturing buildings have high power requirements, including Light Manufacturing facilities. The average power requirement in these facilities is 2,000 ampere, which is mid-range between the requirements of Warehouse Distribution and Heavy Manufacturing buildings.

### Light Manufacturing: Use & Evolution

Due to their functional flexibility -- the ability to manufacture, warehouse and distribute -- Light Manufacturing buildings are constructed more often than any other Manufacturing facility types. Light Manufacturing buildings also have a variety of design, unlike the specialized construction of Heavy Manufacturing and Airport Hangar facilities.

The accompanying map depicts 392 Light Manufacturing buildings in the Los Angeles market. In contrast to other Manufacturing building types, the older buildings are not the most prevalent: 32 percent of the buildings were built before 1970; 31 percent were built in the 1980s. The average year of construction for these facilities is 1975, more recent than Heavy Manufacturing buildings.

Light Manufacturing buildings are built in clusters. This clustering pattern is driven by zoning restrictions and access to labor. Most Light Manufacturing buildings are built in close proximity to other buildings of the same type, resulting in few isolated facilities. This geographic pattern is similar in other markets, such as Chicago and Denver.

Light Manufacturing buildings most likely will remain the most numerous Manufacturing building type. A variable that may become more pronounced in the future is the building's increased physical flexibility to fulfill both manufacturing and distribution. This would align Light Manufacturing facilities with Warehouse Distribution facilities. One example is Dell Computer Corporation's Parmer Lane North manufacturing plant in Austin, Texas. This 300,000 square foot facility was initially intended to warehouse, but now assembles and distributes its products directly to consumers.

# Manufacturing Secondary Category: Heavy Manufacturing

Because of their large physical size and the heavy-duty manufacturing process, Heavy Manufacturing facilities are the best representatives of the Manufacturing category. The facilities accommodate tenants that manufacture parts and finished products. A heavyduty manufacturing process requires specific exterior and interior characteristics.

While Heavy and Light Manufacturing buildings are closely related, size, loading capability and interior space build-out differentiate the building types. Heavy Manufacturing buildings vary greatly in size, which corresponds to the building's use. The facilities also have high ceilings. The heavy manufacturing processes requires multiple modes of transportation and the use of heavy-duty machinery. Rail service and trucks provide the exterior transportation. Cranes typically move materials on the inside. High power requirements and floor loads are also needed in these facilities because of the heavy-duty machinery present. The power and floor load ranges exceed that of Light Manufacturing facilities.

## Heavy Manufacturing: Exterior

Heavy Manufacturing buildings can be identified easily from the exterior. Because the buildings are designed primarily for heavy manufacturing, they are large and distinctive structures. Because heavy manufacturing is not part of storage and distribution, the loading capacity of these facilities is significantly less than Warehouse Distribution buildings. There is no specified range of square feet to docks for these buildings. Some Heavy Manufacturing facilities do not have docks, just drive-in-doors. Other facilities have 100,000 square feet per one dock, while others have 10,000 square feet per dock. Truck and rail transport affect the number of docks present in Heavy Manufacturing facilities, as well. Most Heavy Manufacturing buildings have rail service. In some facilities rail is situated along side the building, and the building is fitted with rail doors. In other facilities rail enters the building.

Heavy Manufacturing buildings are very large: the average size is more than 300,000 square feet. While there are facilities as small as 60,000 square feet, buildings larger than 1,000,000 square feet are not uncommon, especially in larger metropolitan markets such as Chicago, Los Angeles and Northern New Jersey.

Heavy Manufacturing facilities function with a higher site coverage ratio than Light Manufacturing buildings. The average ratio ranges from 40 to 50 percent. This higher site coverage ratio is due to fewer employees per square foot, resulting in smaller parking requirements.

### Heavy Manufacturing: Interior

The interior of Heavy Manufacturing buildings is designed principally for function. Up to 90 percent of space is dedicated to manufacturing. The remaining 10 percent is allocated to office build-out. Rail service plays an important role in layout, especially for buildings with interior rail. Heavy Manufacturing buildings have one to two tenants typically.

With the exception of Rack Supported buildings and Airport Hangars, Heavy Manufacturing facilities have the highest ceiling heights of industrial real estate. The minimum ceiling height is 16 feet; the maximum height is around 60 feet. These high ceilings permit two-story office configuration.

The presence and capacity of cranes is another differentiating feature. While cranes are present in other Manufacturing secondary categories, as well as in Warehouse Distribution facilities, the high crane capacity of Heavy Manufacturing buildings is an identifying feature. Cranes with a capacity of over 100 tons are common.

Power and floor thickness are two additional characteristics of Heavy Manufacturing facilities. The equipment involved in manufacturing requires heavy power and high floor loads. For example, a typical building of 300,000 square feet with one crane can have up to 4,000 amperes and 480 volts. The largest buildings can have up to 9,000 amperes of power. Minimum floor thickness is six inches; eight inches is more common.

## Heavy Manufacturing: Use & Evolution

Heavy Manufacturing building are used for a variety of functions, from raw materials processing to standard manufacturing of parts or even finished goods. The tenant type varies because of their vast range of use. Examples of Heavy Manufacturing tenants are U.S. Steel (steel production), General Motors Corporation (automobile production) and Motorola (wireless technology manufacture).

The accompanying map depicts the evolution pattern of Heavy Manufacturing facilities in the Chicago market. In general, Heavy Manufacturing buildings are the oldest industrial building type. The number of buildings built before 1970 is significant. Of 109 buildings in this sample, 64 were constructed before 1970. Only 19 buildings were built since 1980. Based on this sample, the average year of construction of Heavy Manufacturing facilities is 1961. Certain newer markets, such as Denver, have a slightly newer average age of construction (1967). This signifies that construction of this facility type has been declining. This finding is consistent with the national manufacturing employment trend. Manufacturing employment peaked in 1979, declined during the early 1980s, and has remained relatively flat since.

There is no significant geographic expansion pattern associated with Heavy Manufacturing buildings. The location of these facilities depends heavily upon zoning and the availability of rail service. Clusters of buildings of all ages are common, therefore.

### Manufacturing Secondary Category: Airport Hangar

Like Warehouse Distribution facilities, Airport Hangars store a product (airplane). Unlike Warehouse Distribution facilities, which warehouse and distribute goods, Airport Hangars perform repair and maintenance. For this reason Airport Hangars are classified within the Manufacturing primary category.

Airport Hangars are clearly identifiable because the facilities need to be large enough to accommodate an airplane. Their size corresponds to the type of aircraft they are designed to service. Hangars that service commercial aircraft are larger and higher than most other industrial building types. Airport Hangars are similar in size to Heavy Manufacturing buildings. Their ceiling heights meet and, in certain cases, exceed those of Rack Supported buildings.

The interior build-out of Airport Hangars is complex. In addition to the aircraft section, a commercial Hangar has multiple shops, storage areas and a separate office build-out. The facility also has a shipping and receiving area with several docks.

#### Airport Hangar: Exterior

Airport Hangars exist as individual buildings, as well as complexes of several hangars with office, shop and storage space. Their overall size depends on their configuration, in addition to the size of the aircraft they maintain. Because airport Hangars are located on airport grounds there is no site coverage ratio associated with this building type. Due to their unique location, car parking is also not a meaningful differentiating feature.

Airport Hangars have loading docks, especially in a complex configuration. These docks are used for the delivery of airplane parts and materials. Because the number of docks is minimal, there is no square footage per dock ratio.

Airport Hangars have a unique front door through which the aircraft enters the building. The size of this door must exceed the height and width of the airplane. Since Airport Hangars are built to size and do not significantly exceed the size of a commercial aircraft, the drive-in door can be the entire front wall of the building.

### Airport Hangar: Interior

In a single Airport Hangar configuration most space is allocated to airplane storage and repair. In a multi-building complex configuration, airplane storage and repair comprise about 50 percent of the entire area (see accompanying floor plan). The remaining space, approximately 50 percent, is comprised of shops, storage areas and an office section. Airport Hangars serve as repair facilities, therefore the range of specialty shops is diverse. Sheet metal, machine, cowl, galley, composite and carpet shops are common. There also can be special build-out for paint booths.

Similar to building size, ceiling height corresponds to the type and size of the airplane for which the Hangar is designed. Facilities designed for the largest airplanes, BA 747, have the highest ceilings, reaching almost 100 feet. Smaller commercial Hangars have ceiling heights of 57 feet, still higher than almost all other industrial building types. Ceilings in the shop and office areas range from 12 to 32 feet.

## Airport Hangar: Use & Evolution

Because Airport Hangars are located at airports, these facilities do not have an independent geographic expansion pattern. Tenants are companies that operate airlines. One notable evolution pattern is the change in appearance of Airport Hangars. Facilities that have been constructed more recently tend to be more upscale in appearance. The trend of more upscale building appearance also applies to most industrial real estate now. Facilities are cheaper to build, and there is a growing sophistication among tenants, which creates increased demand for more attractive facilities.

## **Primary Category: Flex**

Flex is the third largest primary category of industrial real estate, representing approximately 9 percent, or 2.0 billion square feet, of U.S. industrial real estate. The diversity of Flex facilities is subtle and difficult to categorize. The number of different names that refer to Flex facilities reflects this diversity and include Flex, R&D/Flex, R&D/Flex/Showroom, Flex Tech and Service Center/R&D Flex. All these names refer to flexible buildings that can accommodate technology and service tenants. Flexibility of space configuration is a core differentiating feature of Flex facilities. The upscale appearance of the buildings is a second core differentiating feature. High office build-out also categorizes these buildings as Flex, and differentiates them from other industrial facilities.

An attractive external physical appearance, or 'high curb appeal,' is an integral feature of Flex facilities. Use of better materials, more abundant glass and attractive landscaping creates a more upscale appearance. Certain other industrial building types, especially ones constructed more recently, have added style to exterior design. And industrial parks with professional landscaping are now common. The attractive physical appearance of Flex buildings, however, is distinctive. Within industrial real estate, Flex buildings are aligned the closest to the office sector of real estate.

With regard to the Flex interior, the variables of flexibility and office build-out are related. Flexibility refers to the variety of space configurations possible. Two buildings that are identical from the exterior can have entirely different interior space build-outs. One facility can accommodate lab, high tech manufacturing space and office. Another facility can be configured with 90 percent office and 10 percent warehouse build-out. A variety of build-out examples can be found in every large metropolitan market.

A high percentage of office build-out is consistent within all Flex buildings. In most, office space ranges from 25 to 80 percent. Flex facilities with 100 percent office build-out do exist, however, these are rare and stretch the boundaries of industrial real estate. A higher percentage of office build-out is common in those metropolitan markets with low office vacancies and high office rents.

The Flex primary category has two secondary categories: R&D Flex and Office Showroom. These two categories vary significantly. Both, however, have the three core differentiating features associated with Flex facilities: high curb appeal, flexible design and a high percentage of office build-out.

## Flex Secondary Category: R&D Flex

R&D Flex facilities create a natural bridge between the industrial and office sectors of real estate. High quality R&D Flex buildings can be mistaken for single-story office buildings. As well, the typical tenants of R&D Flex facilities require a cleaner environment than those of manufacturing and warehousing facilities. Finally, the volume of traffic is lower on these premises, as is the type of traffic. The result is less heavy truck presence, better roads, nicer landscaping and an overall office-like atmosphere.

R&D Flex buildings have size requirements similar to Multi-Tenant buildings and Regional Warehouses, generally not exceeding 100,000 square feet in size. An additional similarity with these facilities is their single-story configuration. However, there are differences as well, resulting in the classification of R&D Flex within the Flex primary category. R&D Flex has a certain kind of space build-out that is not present in other industrial categories. Laboratory is one example. Most of the space in R&D Flex is utilized as either high-tech manufacturing/laboratory, or office. This build-out can assume as much as 75 percent of an entire building. Warehouse space is the least utilized build-out, which corresponds with the R&D Flex low loading requirements and high ratio of 20,000 square feet to one dock.

# **R&D** Flex: Exterior

R&D Flex buildings are clearly distinguishable from the other industrial building types because of their loading requirements and high curb appeal. While most industrial real estate is commonly associated with the presence of heavy trucks, lower quality roads and less attractive building facades, these characteristics are not present in Flex building environments. Loading requirements and high curb appeal are the best identifying features of R&D Flex facilities.

Most R&D Flex buildings have a loading capability, either docks or drive-in doors. The ratio of square feet to docks is very high. The average ratio for the R&D Flex category is 20,000-plus square feet per dock. Larger facilities have a few docks only for an entire building: a ratio of 20,000 to 30,000 square feet per dock. Smaller buildings have one drive-in door only, resulting in similar ratios.

The facade of R&D Flex buildings is appealing because of the usage of higher quality materials, better glass and windows, and an upgraded building entrance. The site has professional landscaping, including more use of trees and ponds. Instead of truck courts and trailer parking, emphasis is placed on car parking. R&D Flex buildings employ more individuals per square foot than Light Manufacturing buildings, thus require more car parking. Some R&D Flex buildings match the car parking requirements of office buildings: four automobile spaces per 1,000 square feet. This high parking requirement reduces the building's site coverage ratio to 25 to 40 percent.

The size of the facility and number of stories are additional attributes of R&D Flex facilities. These buildings rarely exceed 100,000 square feet. And they usually are

configured as single-story structures. Two-story facilities exist but, in general, are classified within the office sector.

# **R&D** Flex: Interior

The interior space configuration of R&D Flex varies according to a tenant's business. The level of office build-out distinguishes R&D Flex buildings from other industrial facilities. The minimum office build-out is 25 percent; the maximum build-out can exceed 70 percent. The remainder of R&D Flex space is usually allocated among light manufacturing, lab/clean and warehouse. This space combined can account for up to 75 percent of the entire building. Not all R&D Flex buildings have all three types of space, however.

Warehouse space can be as low as five percent of total build-out, the smallest space allocation in R&D Flex buildings. The light manufacturing space present is different from its use in Light Manufacturing facilities. While the manufacturing process involves heavy power, in R&D Flex facilities it is oriented toward high-tech assembly. As such, the manufacturing process is cleaner and equipped with different types of instruments. Lab/clean space is often present, but it requires a special build-out

Most R&D Flex buildings have multiple tenants, which requires additional space buildout. Low ceiling heights distinguish R&D Flex buildings from other industrial facility types. Heights range from a minimum of 10 feet to a maximum of 18 feet. The average ceiling height range is 12 to 16 feet.

# **R&D** Flex: Use & Evolution

A number of technology companies utilize R&D Flex facilities for the development, testing and manufacture of their products. For this reason R&D Flex is the most technologically oriented of the industrial real estate categories. R&D Flex buildings also can function with a 100 percent office build-out, especially during periods of tight office markets and high rents.

R&D Flex is a newer category of industrial real estate than Manufacturing and Warehouse Distribution. The oldest R&D Flex buildings, depicted on the accompanying map of the Denver market, were developed in the 1950s. The average year of construction for this sample is 1984, which is consistent with other major industrial markets. Of note is that almost 60 percent of the Denver sample was completed during the construction boom that occurred during the 1980s.

R&D Flex buildings exist in clusters of both newer and older specimens. For this reason, R&D Flex buildings have a growth pattern that is similar to Manufacturing buildings. And most major industrial markets have a submarket with more R&D Flex buildings than other areas. The driving forces for this are zoning and access to skilled labor.

### Flex Subcategory: Office Showroom

Office Showroom facilities and R&D Flex buildings share certain common attributes. Office Showrooms also resemble warehouses. However, the three core differentiating characteristics of the Flex primary category -- building flexibility, upscale appearance and high office build-out -- are present in all Office Showroom buildings.

High curb appeal, attractive landscaping, lower site coverage and higher office build-out classify Office Showrooms within the Flex primary category. The high ceilings and low ratio of square feet to docks, however, align these facilities closer to the Warehouse Distribution category.

Due to Office Showroom's shared attributes with both Flex and Warehouse Distribution facilities, additional core variables need to be identified. Beginning with building facade, the Office Showroom has an upscale finish to its exterior front side; the back of the building has multiple loading docks and deep truck courts. The interior build-out is comprised of office, warehouse and sometimes retail space. Forty percent of the facility is allocated to office space; up to 60 percent is allocated to warehouse space; up to 20 percent is dedicated to retail space. This retail space component differentiates Office Showroom' connotes a retail space build-out. The average ceiling height of Office Showrooms is 20 feet. This height distinguishes these buildings from R&D Flex buildings, and aligns them with Warehouse Distribution buildings.

### **Office Showroom: Exterior**

R&D Flex buildings have two distinct exterior physical characteristics: façade and loading. Of these, it is only the façade feature that Office Showroom shares with R&D Flex facilities. An upscale appearance differentiates this industrial building type from Regional Warehouses. However, the loading capacity of Office Showrooms has entirely different specifications than R&D Flex buildings. This feature aligns Office Showrooms with the Warehouse Distribution category.

Office Showroom buildings have an upgraded exterior finish and attractive landscaping. An appealing exterior is necessary when there is a retail component, which encourages visitor and customer traffic. In fact, Office Showrooms have more visitor traffic than any other industrial building type. The back of the building, however, resembles a warehouse. This is where loading occurs. The average ratio of square feet to docks is approximately 10,000 to one, about one-half the ratio commonly found in R&D Flex buildings, and in line with that of Regional Warehouses.

Office Showroom building size ranges from 20,000 to 150,000 square feet. Buildings outside this size range exist, especially larger facilities. In comparison with R&D Flex buildings, Office Showrooms have a slightly lower parking requirement: 2.5 spaces per 1,000 square feet. They do, however, require more land dedicated to loading: an average range of 30 to 40 percent site coverage, with 50 percent maximum. This ratio corresponds with the Flex primary category.

## **Office Showroom: Interior**

Office Showroom buildings have a simpler interior space configuration than R&D Flex buildings. Combined office and warehouse space account for 80 percent in Showrooms with a retail component, and 100 percent in buildings with no retail component. Manufacturing and laboratory space are not present in Office Showrooms. Office build-out ranges from 30 to 40 percent, which is approximately 15 percent higher than in standard Regional Warehouses. Build-out quality is also higher, which is consistent with the overall appearance of Office Showrooms.

The building height of Office Showrooms is directly related to the facility's partial warehouse function. The minimum ceiling height is 16 feet; the maximum height can reach 28 feet. The high ceiling height is visible in the warehouse section of the building only. The office build-out section has dropped ceilings that approximate office levels.

Office Showrooms are frequently subdivided for multiple tenant use. This frequency differentiates this building from Warehouses. More than 50 percent of Regional Warehouses have a single occupant. In comparison, 80 percent of Office Showrooms have multiple tenants.

# Office Showroom: Use & Evolution

The Office Showroom is a new Flex secondary category. Its physical characteristics attract warehouse tenants that require attractive facilities, a higher percentage of office build-out and, in certain cases, retail space.

The accompanying map depicts 127 Office Showrooms in the Dallas-Fort Worth market. The majority of these buildings, or 81 percent, were constructed since the 1980s. The average year of construction for Office Showrooms in the Dallas-Fort Worth area is 1985. The high number of buildings constructed within this recent time frame is consistent with other U.S. markets as well. Office Showroom, as a result, is the third youngest industrial building type, following Rack Supported and Heavy Distribution facilities.

Office Showrooms and Regional Warehouses share a similar evolution pattern. Office Showrooms follow population expansion patterns: newer buildings are located further from the metropolitan center; older ones are situated closer to the city center.

In comparison to R&D Flex buildings, Office Showrooms are more restricted by zoning due to their warehouse function and resulting heavy truck presence.

### **Primary Category: Multi-Tenant**

Multi-Tenant facilities historically were not classified as an independent category. Rather, they were categorized as either warehouses or manufacturing facilities. However, the physical characteristics of Multi-Tenant facilities differ from both warehouses and

manufacturing facilities, which justifies the creation of the Multi-Tenant primary category. Multi-Tenant facilities are the most varied in use and tenant base of industrial real estate. The ability to house multiple tenants is a core differentiating attribute of this category. Multi-Tenant buildings are a unique combination of R&D Flex, Light Manufacturing and Regional Warehouse buildings.

Multi-Tenant buildings are smaller industrial facilities with a multiple number of tenants. The facilities provide small businesses the opportunity to lease varying amounts of space. Typical new tenants absorb single small units. As these tenants grow in size and accompanying space needs, they absorb adjacent units until they need to relocate to a larger facility type. For this reason, Multi-Tenant buildings efficiently accommodate new, emerging and small businesses. As well, these facilities also can accommodate established and older businesses, which may not experience significant growth. No other building type can as effectively accommodate the varying size of tenants as Multi-Tenant facilities.

Since Multi-Tenant buildings are occupied by a number of smaller sized tenants, these facilities need to also accommodate various activities. As a result, building use tends to differ from building to building, and tenant unit to tenant unit. A typical Multi-Tenant building accommodates a mix of light manufacturing and warehouse tenants.

Warehouse Distribution, Manufacturing, Flex, Freight and even Telecommunications buildings also have single and multi-tenant configurations. The core differentiating features of Multi-Tenant buildings, however, are the average size of tenants, and the frequency of their presence.

There is one secondary category within the Multi-Tenant primary category, also entitled Multi-Tenant. The creation of a secondary category for each primary category is consistent with the real estate classification of this <u>Guide</u>.

### Multi-Tenant Secondary Category: Multi-Tenant

Multi-Tenant is one of the most flexible industrial real estate building types. The building's flexibility is a function of its design. A typical Multi-Tenant building is small in structure and designed in a nonrectangular shape. Typical Multi-Tenant buildings are configured in 'L' and 'U' shapes, although there are examples of numerous other shapes in every market. This flexible building type is ideal for multiple occupants.

Additional features that differentiate Multi-Tenant buildings from other facilities are also related to the building's flexibility. A high percentage of office space build-out, the presence of retail space and significant variance in the use of space distinguish Multi-Tenant from Regional Warehouse facilities. The higher ceilings and lower curb appeal of the building differentiate these facilities from R&D Flex buildings. And lower power requirements, better loading capabilities and lower floor load distinguish these facilities from Light Manufacturing buildings.

Most tenant space in Multi-Tenant facilities ranges from 5,000 to 15,000 square feet. Office build-out varies widely, in some cases exceeding 50 percent. The presence of space other than office and warehouse is dependent upon individual tenant needs. Loading capabilities include docks and drive-in doors, and range from shared to private, with a minimum range of 4,000 square feet per one dock or drive-in door.

#### Multi-Tenant: Exterior

The process of classifying Multi-Tenant buildings is similar to that of Regional Warehouses. Multi-Tenant facilities are smaller in size, averaging about 80,000 square feet, with a maximum size of 120,000 square feet. Buildings smaller than 20,000 square feet also exist. Building shape varies building to building. The multiple tenant occupancy impacts building design. Unlike Regional Warehouses, Multi-Tenant buildings generally are not rectangular in shape.

Due to the variance in Multi-Tenant building design, there are no standards or averages for loading capabilities. In some facilities, the square feet to dock ratio approximates that of Heavy Distribution buildings. Other buildings have a few common docks that all tenants share. In both examples the number of docks per tenant ratio is very low because of the high number of tenants per building. Some buildings have drive-in doors instead of, or in combination with, docks.

Facade and landscaping are exterior features that distinguish Multi-Tenant buildings from R&D Flex and Office Showroom facilities. Multi-Tenant buildings commonly have loading in the back as well as in the front. The external physical image of the building is less appealing than that of Flex buildings. The site tends to be maximized, which results in higher coverage ratios. Although a typical Multi-Tenant building has loading capabilities, there is a low frequency and volume of goods moved. The number of employees per square foot is also relatively low, although higher than in distribution oriented buildings. As a result, Multi-Tenant buildings do not require truck courts as deep as Warehouse Distribution buildings, nor the amount of parking space as Manufacturing and R&D Flex buildings. This results in site coverage ratios as high as 50-plus percent.

#### Multi-Tenant: Interior

The measurement of average square foot per tenant unit is directly proportional to the size of a particular Multi-Tenant building. In general, a single tenant unit rarely exceeds 20,000 square feet, or 25 percent of the entire structure. A tenant unit also can be smaller than 3,000 square feet.

Space build-out in Multi-Tenant facilities varies from building to building and unit to unit. Office space is relatively high: 50 percent office build-out is not unusual. The high office build-out is due to the number of tenants in each facility: every business has a minimum office requirement. Use of the remainder of the unit is dependent upon on a

tenant's business, and the building's capabilities. The use of space can be any combination of warehouse, showroom, manufacturing and even telecommunications.

The ceiling height of Multi-Tenant buildings ranges from 16 to 24 feet, midpoint between that of R&D Flex and Heavy Distribution, and identical to that of Regional Warehouses.

## Multi-Tenant: Use & Evolution

There is no typical tenant profile for Multi-Tenant facilities, due to the versatility of the individual buildings. Multi-Tenant buildings can accommodate any type of business requiring a small amount of industrial space. Logistics companies do not lease Multi-Tenant facilities, however, because the buildings are not designed for distribution.

Multi-Tenant buildings historically were not tracked as a separate industrial category, although they have existed as long as any other industrial real estate type. The accompanying map identifies 73 Multi-Tenant facilities in the Denver market. The presence of dots of all colors confirms the historical existence of this property type.

A second characteristic present in the Denver market is the lack of evolution pattern. While Warehouse Distribution buildings follow the population expansion, and Flex and Manufacturing buildings concentrate in clusters, Multi-Tenant buildings of all ages are located both close in and further out from the metropolitan center. Clustering is also minimal. This pattern is a result of the small size of the facilities, and their versatility. Because Multi-Tenant buildings do not require any special conditions, such as access to major highways, this dispersed distribution pattern should continue.

### **Primary Category: Freight**

Freight facilities have existed for decades, but historically were not classified as an independent category of industrial real estate. Their physical characteristics are unique, however, justifying creation of the Freight primary category.

Freight forwarding is an integral function in the supply chain management of industrial real estate. There are four major modes of freight transport: airplane, truck, train and boat. Of these, only truck transport connects industrial buildings with other real estate sectors, such as retail. There is an ongoing need for intermodal freight forwarding, or the movement of goods from one transport type to another. The most common intermodal freight forwarding occurs between airplanes and trucks, trains and trucks, boats and trains, and boats and trucks. Intramodal transport, or the movement of goods within the same type of transport, also exists.

Most freight forwarding does not involve the use of buildings. For example, rail yards are an increasingly utilized method of transport in major hubs. At these facilities large magnets attach and transfer individual containers onto trucks. This process takes place outside, without buildings. Freight forwarding at harbors, which involves boats and rail or trucks, does not require buildings either. This does not eliminate the existence of physical structures at freight forwarding facilities. Office, Warehouse Distribution and Manufacturing buildings are commonly present.

Two freight forwarding processes require buildings. These are trucks to trucks, an intramodal process, and airplanes to trucks, an intermodal process. Loading capabilities, building configuration and space build-out are the physical attributes that classify these buildings within the Freight category.

Similar to Heavy Distribution buildings, Freight buildings have docks on two walls. This cross-dock configuration is necessary for the efficient flow-through of freight. The ratio of square feet to docks is very low. Sufficient trailer parking is also a core requirement.

Building configuration is important in the freight forwarding process. The distance that freight travels from one building side to another is minimized. Therefore, freight buildings are rectangular in shape: always longer than deeper.

The internal space configuration of Freight buildings differs significantly from other industrial real estate. Office and warehouse space is minimal; manufacturing space is not present. Because the sole function of Freight facilities is to move freight through -- not to warehouse -- these facilities do not have a warehouse component. The majority of space in Freight buildings is dedicated to sorting.

Transport by truck and transport by air utilize two unique building configurations. These buildings are classified as Truck Terminal and Air Cargo. Both have the core differentiating features associated with the Freight primary category: loading capabilities, building configuration and space build-out.

### Freight Secondary Category: Truck Terminal

Truck Terminals differ significantly from all other industrial building types. The facilities do have certain exterior features in common with Warehouse Distribution facilities, specifically the distribution function, but are not warehouses.

The variables that classify a Truck Terminal building are few, with an emphasis on exterior characteristics. One variable is the building's loading capability. All Truck Terminals are cross-docked with a very low square feet to dock ratio: 500-1,000 square feet per one dock for most buildings. Building dimensions are another classification variable. Truck Terminals are rectangular in shape, with an ideal width of approximately 60 feet.

In addition to loading and dimensions the other differentiating features of Truck Terminals are: low car parking ratio, short ceilings, minimal racking, trailer parking, low site coverage, simple build-out, lack of manufacturing space and minimal office space.

## Truck Terminal: Exterior

Truck Terminals are small in size: the facilities generally do not exceed 100,000 square feet. The loading capability of the buildings is an integral characteristic. In addition to their cross-dock configuration, the required number of docks is unprecedented among other facility types. A ratio of 500 square feet to dock is common. The typical building depth of 60 feet warrants this ratio. This requirement is more specific than that imposed on Heavy Distribution buildings. Truck Terminals also require trailer parking. The number of trailer slots ideally should match the number of docks per building.

Automobile parking is not an important feature of Truck Terminals. One parking space for every 1,500 square feet is sufficient. Truck courts on both sides of the building, and heavy trailer parking, are additional variables that result in a very low site coverage ratio. The average Truck Terminal site coverage is around 20 percent.

## Truck Terminal: Interior

'Terminal' refers to the facility's interior features. Unlike Heavy Distribution buildings, Truck Terminals do not warehouse goods. Their sole function is to transfer goods from one truck to another. Because of this function Truck Terminals are long and narrow in design.

Because Truck Terminals transfer rather than store cargo, the facilities also have low ceiling heights. Most ceiling heights range from 12 to 16 feet, which is below the height of any facilities within the Warehouse Distribution category. Space build-out is very simple, as well. Ninety-five percent of the building is dedicated to cargo transfer. The remaining five percent is allocated to office space. In some Truck Terminals, the office, which is situated at the end of the building, can be two stories. In a two-story configuration, the total percentage of office is approximately 10 percent. There is no manufacturing or production space in Truck Terminals.

Truck Terminals have minimal power and floor requirements, unlike most industrial building types. Light power is sufficient because no heavy machinery is required to transfer cargo. Smaller buildings operate with a minimum of 200 amperes; larger facilities require no more than 800 amperes. Because of the low ceilings, minimal racking and lack of heavy machinery, floor thickness does not need to exceed four inches.

# Truck Terminal: Use & Evolution

Because Truck Terminals forward freight, their most common tenants are logistics companies. The accompanying map identifies 16 Truck Terminals in the Chicago market. Similar small sample sizes were identified in other metropolitan markets. Because of the small sample size it is not feasible to determine the average age and evolution pattern for Truck Terminals. However, since both older and newer buildings are equally likely contained in the sample, Truck Terminals can be classified an older industrial building type. With regard to an evolution pattern, Truck Terminals have the same difficult zoning restrictions as Manufacturing facilities. Many municipalities limit, or do not permit, Truck Terminal use. Any expansion pattern is affected principally by zoning restrictions, followed by such variables as access to highways.

## Freight Secondary Category: Air Cargo

The Air Cargo classification is commonly associated with a particular type of tenant, rather than physical characteristics. Most Bulk Warehouse or Heavy Distribution facilities that are utilized by an airline are commonly referred to as Air Cargo. However, because the classification process in this <u>Guide</u> utilizes physical characteristics, most of those buildings are reclassified as Warehouse Distribution facilities.

Air Cargo buildings can be identified by their location: the facilities are located on airport grounds. The function of these facilities is to transfer freight from an airplane onto a truck, or from a truck onto an airplane. In order to be classified as Air Cargo the transfer must involve an aircraft.

The location and freight handling requirements of these facilities create additional unique characteristics. A typical Air Cargo facility is cross-docked, which allows easier flow-through of cargo. Because this building type is not a warehouse, it has a unique interior build-out, similar to Truck Terminals. Most space is dedicated to sorting and packaging, rather than storage. And because the buildings are located on airport grounds, there is no site coverage range.

# Air Cargo: Exterior

The exterior of Air Cargo facilities is influenced by their airport grounds location. An entire building can be located behind an airport fence. Or the fence can straddle a building, with a portion of the building located off airport grounds. Air Freight buildings are cross-docked, with standard heavy trucks on the outside and smaller airport-type vehicles that utilize drive-in doors on the inside. Airplanes pull close to these buildings, but do not connect as they would at passenger terminals.

Air Cargo buildings cover an insignificant portion of space on airport grounds. Car parking is not present because of airport security. Parked trailers surround Air Cargo buildings but do not affect the size of the site. These combined location requirements make site coverage calculation meaningless.

The size of an Air Cargo building depends upon the volume of freight that an airline transports. Therefore, Air Cargo buildings are constructed specifically for a tenant's size. In general, the facilities are large in size, similar to Heavy Distribution buildings.

# Air Cargo: Interior

A contemporary Air Cargo facility consists of four sections: office, sorting and weighing, storage and cargo flow-through. The office section does not exceed 10 percent of total

space and is separated from the cargo area. Mezzanine office and separate office buildouts, which can be two stories, are common. A sorting and weighing section is located along the wall with docks. This is the largest area, where transferred cargo is sorted, weighed and packed. The cargo is then placed in a storage area before being loaded onto an airplane. Because Air Cargo buildings are not warehouses the storage section accounts for only about 30 percent of the entire building. Cargo that arrives packed in containers moves through a fourth area, where it is immediately transferred between trucks and planes without delay.

The freight process is primarily automated, especially in more contemporary facilities, resulting in the need for few workers. Freight equipment includes multiple powered decks, scales, elevating workstations and transfer vehicles, and multiple friction powered storage decks.

Air Cargo buildings have varying ceiling heights. A building can have a different ceiling height in each of its four sections. In general, Air Cargo buildings have ceiling heights of about 24 feet, which is comparable to Warehouse Distribution buildings.

### Air Cargo: Use & Evolution

Air Cargo buildings have the same evolution pattern as Airport Hangars. Both are entirely dependent upon the presence of airports. Advances in the field of logistics are affecting the physical evolution pattern of this facility type. The increased automation in contemporary Air Cargo buildings is resulting in fewer employees per square foot. This trend is likely to continue.

### **Primary Category: Telecommunications**

Telecommunications is the newest category of industrial real estate. Telecommunications facilities historically were classified within the office sector, or not classified at all. These facilities also were not considered investment properties and, in most cases, were owner-occupied. Although a number of the facilities remain owner-occupied, Telecommunications Data/Switch centers have become investment opportunities.

Telecommunications buildings are created either through the conversion of existing properties, or through new construction. There is no specific type of building that is converted into Telecommunications use. Office, loft and industrial buildings are all likely to be converted, if a particular facility meets a specified set of requirements. One of the most important requirements is access to fiber optic cable.

The physical characteristics of all Telecommunications facilities, whether converted from other buildings or newly constructed, are most consistent with the industrial sector of real estate. Core differentiating features are power and floor requirements. Telecommunications buildings have the highest power requirement of all industrial

building types. The minimum power requirement is 60 watts per square foot. Most Telecommunications tenants anticipate needing up to 200 watts per square foot in the future. Another core characteristic of Telecommunications buildings is floor load. The equipment that is commonly stored and operated in Telecommunications buildings is both heavy and compact. Therefore, a high floor load per square foot is required.

An additional important and unique variable is system redundancy, or back-up. A Telecommunications facility needs to remain in operation without interruption. All heating, ventilation and air conditioning (HVAC), electrical and fire suppression systems, therefore, have supporting back-up systems.

The Telecommunications primary category has one secondary category only: Data/Switch Center.

### **Telecommunications Secondary Category: Data/Switch Center**

Data/Switch Centers can be redeveloped from older properties, or constructed as new high-tech buildings. Redeveloped properties have a wide variety of sizes and configurations and are, therefore, difficult to identify from the exterior. New high-tech buildings are more uniform and, as such, can be identified more readily.

Data/Switch Centers have unique exterior and interior characteristics. The interior characteristics are the most prominent. These facilities are clearly identified from the interior because of the equipment used and the level of security present. Additional core interior variables are high floor load and heavy power. Redundancy of all power, security and fire detection and suppression systems are required. The high level of system redundancy is not found within any other industrial category. Unique exterior features include site coverage, site security and loading. Building size and number of stories vary too much to be factored.

# Data/Switch Center: Exterior

Data/Switch Centers have diverse exteriors. The buildings do not have a specific size range. They are equally likely to be single and multi-storied. There are certain exterior characteristics, however, that differentiate Data/Switch Centers from other industrial categories. Data/Switch Centers do not have loading requirements, meaning either a lack of existing dock doors, or the dock doors have been sealed. The facilities also require minimal wall and roof penetration. Building dryness and security are the driving force behind these variables.

Security is a site requirement and a unique core variable of Data/Switch Centers. The facility is usually fenced with monitored campus gates. The grounds are under video surveillance. Only a few R&D Flex buildings have a similar high security requirement.

Average coverage ratio is another core differentiating feature of Data/Switch Centers. The facilities employ very few individuals and have infrequent visitors. The car parking ratio, therefore, is low: on average, one space for every 2,000 square feet. The parking ratio, coupled with the absence of truck courts, results in a site coverage ratio as high as 60-plus percent.

A final exterior feature is a utility area that houses power generators and other support systems for HVAC, fire suppression and security.

## Data/Switch Center: Interior

The interior features of Data/Switch Centers differ significantly from other industrial real estate. However, the attributes of power and floor load align this category with the rest of the industrial sector. Extremely high power is required to operate Data/Switch Centers. Watts per square foot range from 60 to 200. A 50,000 square foot Data/Switch Center would need 6,250 amperage at 480 volts in order to meet this requirement. Heavy Manufacturing buildings have amperage that reach these levels, but not at the per square foot basis. Data/Switch Centers also need back-up generators, preferably fed from dual power sources from two separate grids.

Data/Switch Centers have raised floors. Due to the weight of the equipment, high floor load is also essential. The minimum floor load is 150 pounds per square foot.

Security is even more pronounced inside these facilities. Security features include surveillance cameras in aisles and at building entrances, motion detectors, biometric access sensors and specially trained guards.

Fire suppression is the final core attribute of Data/Switch Centers. Equipment housed in Data/Switch Centers is sensitive to water. Therefore, the facilities have gas-based fire suppression systems with early detection, back-up and dry pipes.

# Data/Switch Center: Use & Evolution

Data/Switch Centers are similar to Airport Hangars and Air Cargo buildings in that their location is dependent upon an outside variable. The variable for Data/Switch Centers is access to fiber optic cable. The geographic expansion pattern of these facilities is directly tied to the expansion of fiber optic cable. The need for security also affects geographic pattern, as the specific location of these facilities is typically not advertised.