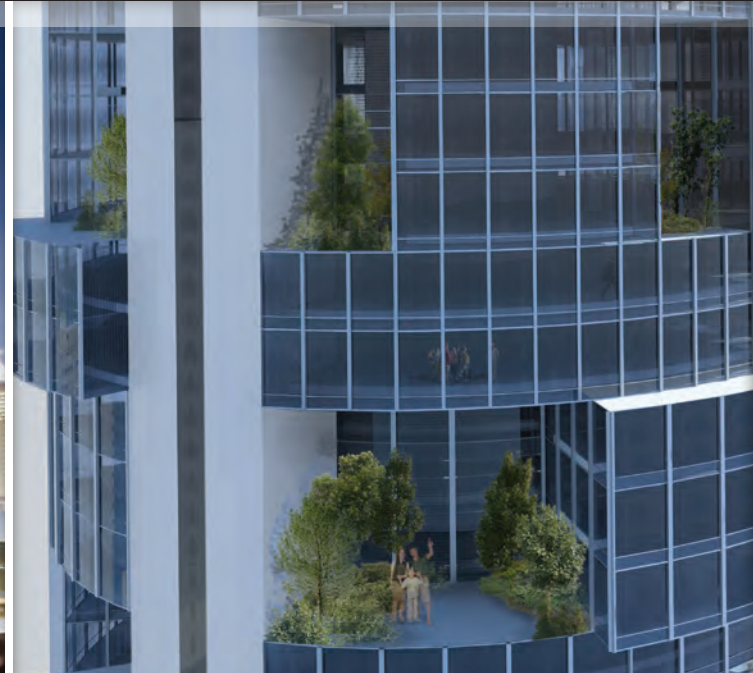
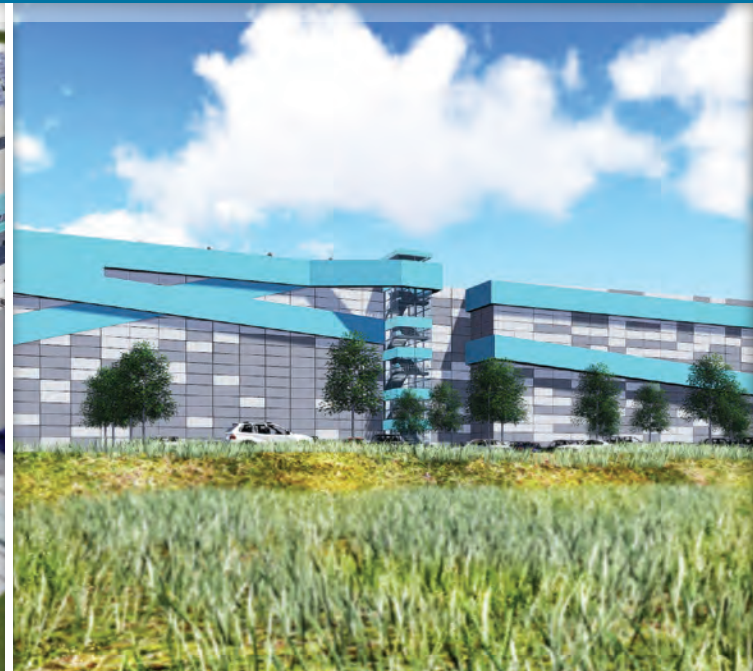


The Distribution/Fulfillment Center of the Future



Riddell Kurczaba



Ware Malcomb

The Distribution/Fulfillment

“Distribution is broken.” That’s the frank assessment of **Brook Melchin**, senior architect at Riddell Kurczaba, one of the winners of NAIOP’s 2013 Distribution/Fulfillment Center of the Future competition. “In an era of liquid digital communication, the traditional structure and roles of physical warehousing and retail distribution exist in a state of flux. New modes of consumption (e-commerce, m-commerce, and s-commerce) have challenged the role of the traditional retail storefront and put strains on the infrastructure and distribution systems which support it.”

With dizzying speed, the distribution game has changed, from getting goods in distribution centers (DCs) to retail stores *on schedule* to getting goods directly to consumers *now*. In the new online shopping paradigm, consumers, already accustomed to instant gratification in other areas of their lives, expect ever-faster delivery of the products they order.

Speaking for Ware Malcomb, the other winner of the 2013 Distribution/Fulfillment Center of the Future competition, **Matt Brady**, regional vice president, concurs. “Consumers’ expectations for receipt of goods have increased from several days to ‘next day’ or even to ‘same day.’ Although sophistication of product handling has improved, the instantaneous expectations are straining the current distribution/logistics model.”

Every link along the supply chain is weakened by these demands. “Retail

distribution is hindered by slow lead times, inefficient transport of goods, and poor inventory management,” Melchin elaborates. “It is an archaic distribution model built on a fragmented and inefficient network that cannot meet the increasingly tight time frames for delivery to consumers.”

While Amazon’s “same-day delivery” model may — sometime in the future — be jettisoned as not sustainable from a profit perspective, today’s businesses — and distribution centers — find themselves challenged to follow Amazon’s lead in compressing the time it takes to get goods to consumers.

Three Themes Emerge

These global distribution challenges affect commercial real estate in two ways. As online sales increase, demand for brick-and-mortar retail continues to decline. Meanwhile, the demand for dis-

tribution/fulfillment centers increases, providing an opportunity to re-evaluate the concepts of how DCs can function more efficiently and where they should be located.

Interestingly, the two winning concepts represent opposite ends of the spectrum. The Ware Malcomb concept begins with a structure that has the large footprint typical of DCs; its innovations are focused on materials handling within the building. Brady explains: “We started the design process by asking, ‘what if?’ What if we could make the distribution buildings more efficient? What if our current technology is being underutilized?”

In contrast, Riddell Kurczaba envisioned a vertical DC suitable for an urban setting. Its “Swarm” concept moves the storage and distribution functions into the core of a 25-story mixed-use building, which also houses residential, office, and retail space and integrates goods movement that makes use of existing transit systems such as metro and light rail.

Despite these two very disparate visions, three common themes emerged in both proposals. Tomorrow’s DCs will be:

- Nearby;
- Green; and
- Agile.

During the spring and summer of 2013, NAIOP conducted a design competition in which it sought concepts for the Distribution/Fulfillment Center of the Future. NAIOP invited architects to conceptualize and design the physical “goods exchange” structure that will accommodate distribution, fulfillment, and retail functions in the year 2020. An independent panel of judges evaluated the submissions against an objective set of criteria regarding how well the proposed concepts achieve the highest and best use for target users and meet the space utilization trends of the future.

The winning firms are Ware Malcomb, with offices across North America, and Riddell Kurczaba, based in Calgary and Edmonton, Alberta, Canada. Presentations made by the two winners of the Distribution/Fulfillment Center of the Future competition at Development ‘13 in San Diego will be available at www.naiop.org.

Center of the Future

Nearby

Perhaps the simplest way to decrease the amount of time it takes to deliver goods to consumers is to **move distribution/fulfillment centers closer to population centers**. But today's massive horizontal structures must be adapted if they are going to pencil out with urban development economics. Higher land costs will have to be offset by increasing density. As Ware Malcomb's Brady elaborates, because consumers expect goods to be delivered more quickly, "distribution centers will be closer to consumers and consequently will have smaller footprints. The speed of the flow of goods will need to increase and cannot be accommodated by current material handling practices."

Moving DCs to city centers also will reduce some of the delays in transporting goods currently caused by traffic congestion and weather. Riddell Kurczaba's Melchin notes that "as cities move toward goals of greater density and consumers' demands increasingly blur the lines between digital and physical consumption, we foresee a shift in supply chain management away from peripheral metropolitan distribution via time-consuming and inefficient vehicle travel into city centers, toward a focused model of distribution that moves target product storage closer to consumers."

While this is a novel concept today, warehouses were once a common part of the cityscape. "The vertical urban warehouse represents in many ways a return to the roots of warehousing," Melchin reminds us. "At the turn of the 20th century, warehouses were much taller than they are now, and they were located along existing infrastructure channels [near] the retail providers they would service."

Green

Both winning concepts envision that **the sustainability movement already underway in commercial development will gain momentum in the distribution/fulfillment centers of 2020**.

Ware Malcomb's horizontally oriented structure takes full advantage of a large roof by outfitting it with a photovoltaic

(PV) farm that will supply the building with clean power. Skylights and the PV panels provide natural light for workers in the office space and materials handling areas below. Horizontal projections along the sides of the building combine a design element with a sustainability feature, capturing rainwater for non-potable uses while also enhancing the aesthetics of the building facade.

Riddell Kurczaba's vertically oriented concept is built around a large central core that encourages passive ventilation. Locating the structure in an urban setting enables the use of rail networks to reduce the volume of truck traffic on roadways. Products would be delivered to consumers within a smaller area, which could even be accomplished by bicycle couriers or — in some cases — on foot.

Both winning concepts also incorporate green roofs and rooftop gardens, and the sun-facing sides of both buildings have integrated PV panels.

Agile

The teams at both Ware Malcomb and Riddell Kurczaba incorporated flexibility into their design concepts. Realizing that population centers can shift over time — and that land uses might evolve from one use to another — the architects envisioned buildings that could change function. Although both begin as clearly industrial structures, **either could be reconfigured to accommodate different uses in the future**.

Ware Malcomb's horizontal design calls for clear heights of 14 feet, floor to floor, to accommodate a "mid-life refresh" for the building. The facility's central spine could be removed to create different floorplates for office space or a shopping mall, for example, or that area could be used to provide green space or parking. The skin on the building facade is comprised of several types of modular panels, which could be replaced with glass panels for more conventional uses like office space.

Riddell Kurczaba's vertical concept takes agility to the next level with the notion of mutability. Its DC concept includes residential and office uses within the building. These are configured as pods, the numbers of which could be in-

creased or decreased as conditions warrant. A company could grow or contract, for example, and would even be able to relocate its offices from one building to another, in the same or a different city, by packing up its pods and moving them. Residents would have the same flexibility when their households grow or shrink. If desired, both office firms and residents could shift their belongings into long-term storage space.

This emphasis on flexibility opens the door to buildings that can stand the test of time.

Meeting 21st Century Demands

A successful distribution facility hums with activity 24 hours a day, as goods are continually received, processed, and shipped out again. Speed and accuracy are a given, at every step of the process. But today's businesses and consumers are demanding even quicker turnaround. Consumer expectations for ever-faster delivery times will require the DCs of the future to be located closer to those consumers and/or to logistics partners within the logistics chain (i.e., FedEx and UPS).

Locating traditional large-footprint DCs closer to consumers and/or established distribution markets, however, will mean contending with higher land values and infrastructure investment costs, both of which could decrease development profitability. Accordingly, higher density and more vertical development must be considered in order to bring DCs closer to consumers. If they are to be accepted by city zoning officials as appropriate in more residential settings, these large industrial buildings also will require more attention to exterior aesthetics and design features. The visions presented in the two winning submissions demonstrate a way forward. ■

**Congratulations
to our winners:**

Ware Malcomb

Riddell Kurczaba

Ware Malcomb

Doubling the Through-Put of a Distribution Center

The Vision

As Ware Malcomb designers grappled with the challenges of land costs, proximity to customers, and aesthetics, they set several goals for their concept. They wanted it to be holistic, creative, modern, and sustainable. In addition to visual appeal and functionality, the building concept had to offer financial advantages. They also aimed to give the building's developer/owner strategic benefits, long-term value, and the flexibility to adapt the building to changing market conditions.

The Elements

In a conventional DC, products enter from truck trailers through dock doors along one side of the building. Once inside, they are stored in like groups and then exit through dock doors at the opposite side of the building, back onto truck trailers.

Flow is limited by forklift speed, interactions with people, and the inefficiency of large blocks of storage. The areas where people and handling equipment can connect to load and unload goods are relegated to the perimeter of the building — potentially the farthest away from the desired stored inventory. Outdoor maneuvering space also affects the velocity of material handling, which is further limited by truck traffic. Sites often are congested with idling trucks waiting to be loaded or unloaded, a condition that wastes fuel and spews carbon emissions.

To Ware Malcomb, the solution to this situation seemed clear: "We need to decrease loading/unloading times and decrease distance to goods," explains Matt Brady, proposing a centralized conveyor spine to increase productivity and accuracy. **"Bringing product through the center of the building will double the flow of goods by creating two unloading/loading zones focused in one central area."**



The system is designed to work as follows:

- Trucks will enter the site and drop trailers in the queuing zone. Truck cabs then will continue around the site to pick up departing loads. Arrival of trailers can be synchronized with internal operations or on-site "jockey cabs."
- Jockeys will shuttle goods to an articulated bridge crane that will load the entire trailer or container onto an adjustable-height conveyor comprised of modular scissor lifts to accommodate height variances in trailers and containers. The conveyor will move loads through the facility during the unload/reload sequence at a consistent, optimized pace.
- Employees — and, eventually, robots — will remove and sort loads onto robotic storage and retrieval dollies. Goods will be stored on and retrieved from multiple levels via robotic conveying systems and machines. The placement of each product will be computerized for optimal retrieval time and restocking sequence.

Ware Malcomb's concept **incorporates the container/trailer into the picking process**. This innovation provides many benefits. Initially envisioned as a way to streamline materials handling, it also reduces the amount of exterior space needed. The ability to develop this DC on a smaller parcel with higher floor area ratio (FAR) provides greater site selection flexibility in established markets where land is scarce and costs are high.

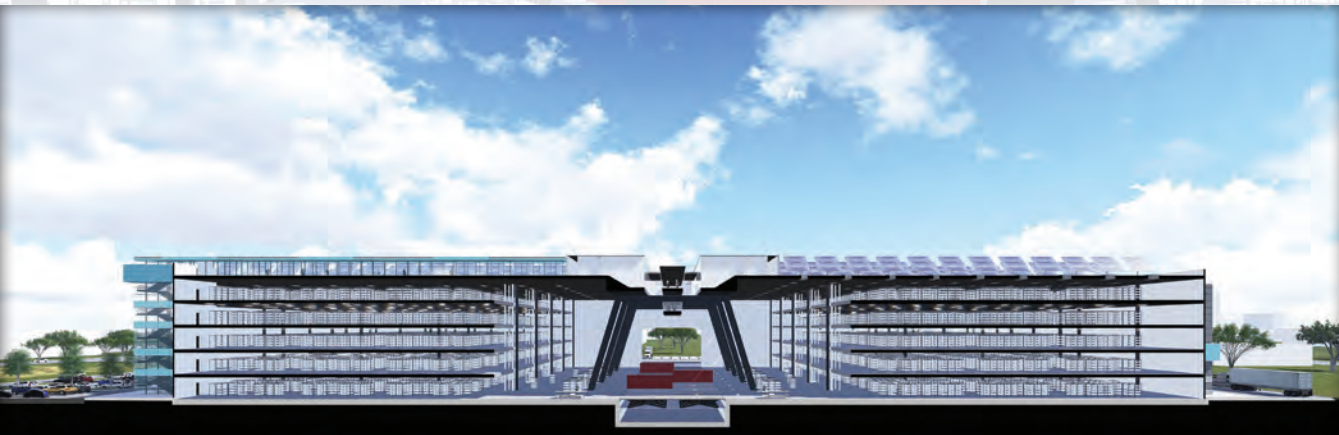
Goods move from end to end through the center of the building. Streamlining the queuing and loading/unloading processes minimizes the need for trailer storage, allowing for a tighter site.

The Office Command Center on High

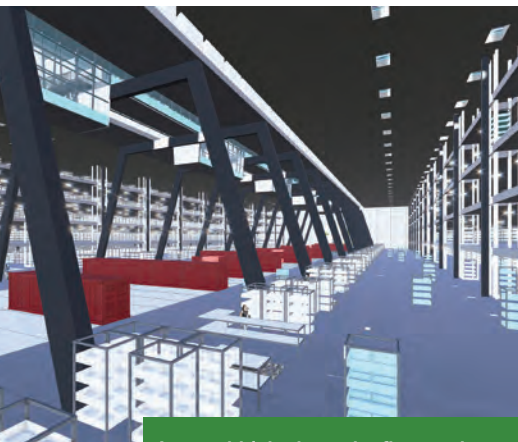
In typical DCs, the office area is at one end of the building, often in a corner. In Ware Malcomb's DC, the main office function is relocated above the floor, directly over the central conveyor line. This provides a "command center" for personnel engaged in daily operations. From these operation areas, or control centers, hanging below the roofline, staff will be able to monitor the entire internal distribution process below. The location of the office function high above the floor also will give office workers views of the exterior roof gardens and provides access to natural light from overhead.

Natural Light and Modular Panels

Glass stair towers at the perimeter of the building will provide pedestrian access to the various levels inside. Light will move through the glass, providing additional daylight within the facility. The towers also will create a more aesthetically pleasing perspective for street traffic and pedestrians.



As an adjustable-height conveyor system moves goods through the loading/unloading zone in the center of the building, robotic picking systems transfer them to the vertical lift stations for storage and redistribution.



Located high above the floor at the center of the building, the office zone and command center oversee operations below.

For the exterior skin of the building, Ware Malcomb offers several options. The building will accommodate traditional concrete tilt-up panels. For greater flexibility and aesthetics, however, Ware Malcomb proposes a modular panel system comprised of three types of panels: solid, glass, and building-integrated photovoltaic (PV) panels. The three types of panels can be designed into unique patterns, with varying colors and textures, or remain simple to satisfy stringent budgets. If the building use changes in the future — for example, to accommodate more office space — solid panels can be replaced with glass ones.

Harnessing Solar Power And Rainwater

This futuristic distribution facility will comprise sustainable features that will reduce the building's impact on the environment. These include the following:

- A state-of-the-art building and heating, ventilation, and air conditioning

system to harness the most economical, least environmentally impactful regional power available and use it in the most efficient way.

- A rooftop photovoltaic farm and building-integrated PV panels mounted on the optimal solar faces. Skylights and PV panels will provide natural light and clean power to occupants and operations.
- Horizontal projections along the facade will collect rainwater for non-potable uses. This articulated facade also adds a design element to break up the long, rectangular shape of the facility.

Flexibility to Refresh At Mid-Life

Ware Malcomb designed its building to accommodate a mid-life refresh. Its designers anticipated that this e-commerce

fulfillment facility would be developed near population centers and that, over time, a natural gentrification process could drive its highest and best use from e-commerce to office, residential, or mixed use.

To build flexibility into the design, they proposed the following:

- Floor-to-floor heights of at least 14 feet to allow for efficient robotic picking, as well as a change of use;
- A modular central spine that can be removed to create optimal floor-plate depths, a green space amenity, and/or additional parking fields; and
- Reconfigurable exterior panels that can be replaced with glass panels suitable for conventional commercial uses. ■

Concept Summary

Site Area	29.22 acres (1,272,920 square feet)
Building Area	
Footprint	523,200 square feet
Mezzanine	1,427,200 square feet (four levels)
Total	1,950,400 square feet
FAR	1.53
Parking	326 stalls at 17/1,000 square feet
Estimated Costs	
Green Roof	\$122/SF X 56,000 SF = \$6.83 million
Office Tenant Improvements	\$70/SF X 40,000 SF = \$2.8 million
Storage Levels	\$120/SF X 1,429,200 SF = \$171.26 million
Mechanical/Electrical	\$6/SF X 1,950,040 SF = \$11.7 million
Solar Panels	\$122/SF X 300,000 SF = \$36.6 million
Clear Span Area	\$110/SF X 166,400 SF = \$18.3 million
Site Work	\$75/SF X 1,950,400 SF = \$13.65 million
Total	\$261.14 million

Riddell Kurczaba

The Swarm: Rethinking Distribution

The Vision

Instead of massive disparate warehouses, Riddell Kurczaba's Swarm centers represent a new distribution archetype: densified, agile, mixed-use fulfillment centers located at the confluence of transportation networks and population centers. The Swarm system is designed to streamline how products move through the system, speed to market, and personal delivery of goods. The intelligent systems within the building will integrate seamlessly with the external distribution network, creating a sustainable and efficient transport grid. The centers are designed to be built on smart internal and external transportation networks with light rail transit lines at their core. The system has the potential to transform the organization and delivery of consumer goods from the periphery of the city to urban and suburban fulfillment centers.

The Elements

The Swarm center will operate as a primary agent within this new Swarm system. It will have the ability to operate not only as a local warehouse and distribution center, but also as a mixed-use facility, offering retail fulfillment, entertainment, office, and residential solutions.

The system is designed to work as follows:

- **The central core of the building is organized into a vertical warehouse.** A sophisticated network will maintain, monitor, and replenish inventory levels for retailers located at the base of the building.
- The "trade" or retail area will occupy the levels closest to grade or the street. Such close proximity between retailers and the vertical warehouse will lead to smaller retail footprints and give retailers the ability to offer hybrid sales experiences, like online purchases through in-store kiosks, with near-instantaneous delivery to the shopper.
- The perimeter of the upper-level floors will be reserved as commercial and residential space, for households and companies seeking flexibility and liquidity.

The pod concept is central to Riddell Kurczaba's urban distribution center. Businesses and residents will be able

to expand or contract their space by increasing or decreasing the number of pods (units) they occupy. The pods also may be packed up and moved as necessary, both within the building and to other Swarm centers.

Blended Multichannel Distribution Network

"Swarm distribution networks will become the future of the blended multichannel distribution network as they are integrated with traditional supply channels such as roadways and waterways," Melchin explains. "The real shift in the speed and scale of distribution will occur as these networks take advantage of channels that currently are underutilized: light rail transit and underground metro systems."

Transit ridership in many jurisdictions often is well below capacity outside of peak commuting hours and, in most cities, service is stopped for much of the overnight period. These off-peak and offline conditions create an opportunity for jurisdictions to move smaller volumes of targeted goods to Swarm centers. As goods arrive, retailers can replenish their supplies and display them; consumers can locate and purchase/retrieve them; and contract delivery services (like FedEx, UPS, and even bicycle and foot couriers) can distribute them locally.



The Swarm center is a vertical mixed-use facility designed to include retail, distribution, warehouse, residential, and office facilities on the same site. To bring goods closer to retailers and consumers, Swarm centers will be located at rail and transit hubs. Swarm networks will connect multiple Swarm centers, expanding the system and extending its efficiencies.

The Trade Area

The "trade" or retail area will occupy and enhance the levels closest to grade, and integrate with the urban streetscape. With stores occupying smaller footprints, a larger number and variety of retail enterprises will be able to coexist within the trade area, offering consumers more choice.

The integration of retail spaces and the vertical warehouse could even change the way that products are displayed, purchased, and delivered within the Swarm, enabling the development of several types of hybrid retail environments. Goods purchased via the Internet, for example, could be picked up at any retailer. And showroom floor space for large items like furniture could be minimized; retailers could display one basic model while stocking the most popular combinations in the vertical warehouse for quick delivery.

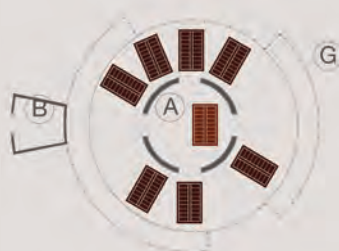


Goods enter the Swarm center from an underground light rail or metro line, located above the parking garage. They are moved by magnetic crane up to the internal storage area in the building core, where they can be delivered to retailers, consumers, and short-range delivery companies. The spaces beyond the central storage core are intended for retail uses on the lower stories, and residential and office uses on the upper floors.

Concept Summary

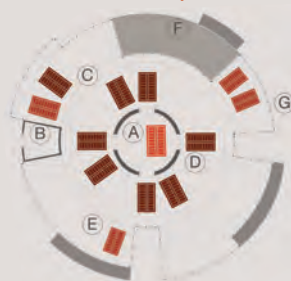
Site Area	180,000 square feet
Building Height	25 floors
Building Area	
Retail Podium	200,000 square feet
Vertical Warehouse (two cores total)	200,000 square feet
Shipping, Receiving, and Horizontal Warehouse	100,000 square feet
Residential	200,000 square feet
Office	100,000 square feet
Total	800,000 square feet
FAR	5
Estimated Costs	
Retail Podium	\$40 million
Vertical Warehouse	\$40 million
Shipping, Receiving, and Horizontal Warehouse	\$20 million
Office and Residential	\$60 million
Total	\$160 million

Typical Retail Floorplate



- A CENTRAL CONTAINER DISTRIBUTION CORE
- B ELEVATOR / STAIR CORE
- C CIRCULATION CORRIDOR
- D INTERNAL STORAGE SPACE
- E RESIDENTIAL / COMMERCIAL
- F OUTDOOR GREEN SPACE
- G GRAY WATER COLLECTION TUBES FOR IRRIGATION WITHIN MULLIONS

Typical Residential/Office Floorplate



The Swarm center's circular floorplates comprise a central container distribution core that extends vertically throughout the entire height of the building. Diverse retail shops will occupy the podium at street level, with residential and office space on the upper floors, all accessible via exterior elevators.

As individual retail sites shrink, additional options for agility within the trade center begin to emerge. A retailer that is busier during certain times of the year will have the option to adapt quickly within the Swarm to grow and shrink its storefront. Conversely, a seasonal retailer will be able to easily pack up its shop and store its goods until the next year. Some retailers might decide to aggregate and operate within a market or design center structure, maximizing collective brand power and diversity of goods to stimulate greater consumer traffic.

Office and Residential Mutability

The prime real estate in the Swarm — the perimeter of the upper-level

floorplates — is reserved for office and residential uses. Some floors may be designated for business centers and touchdown space for wireless nomadic employees. Established companies also could find the building attractive because of its flexibility. Large firms that occupy Swarm centers in multiple cities would have the option to move office equipment easily from center to center and region to region, enabling them to efficiently manage office requirements during periods of volatility. Residential space could offer similar flexibility, giving residents the ability to increase or decrease the size of their space as households grow and shrink.

For both residential and office applications, the ability to customize space

is based on the shipping and storage modules contained in the overall distribution network. Thus, a household that is moving to another city could either move to another Swarm center and have its entire apartment moved with it, or could shift its belongings from prime space into long-term storage space.

Sustainability of Locating In the Center City

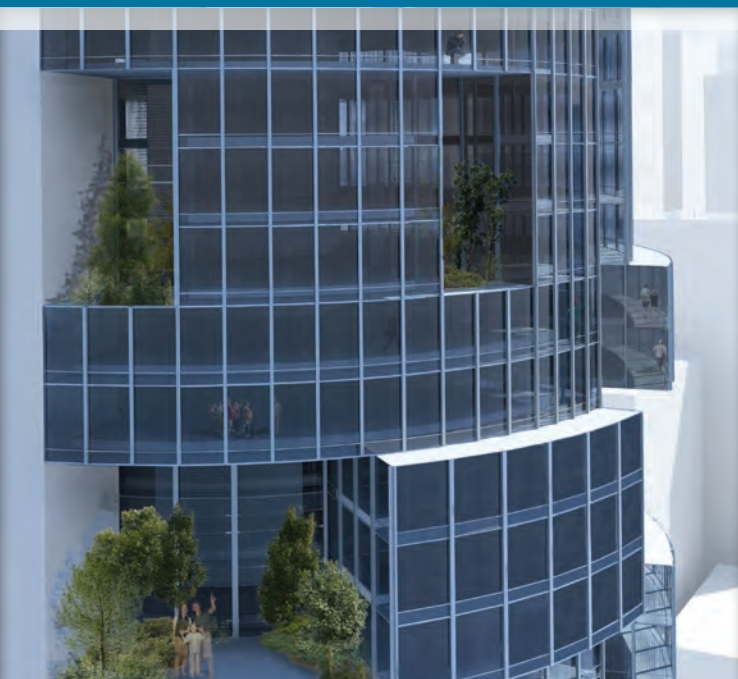
The synergies promoted by the co-location and consolidation of supply channel infrastructure, warehousing, retail, office, and residential functions into a single location result in a number of sustainability benefits:

- Using rail networks instead of trucks to redistribute materials will reduce the volume of transport truck traffic on roadways, increasing capacity for other vehicles and reducing commute times.
- Smaller products can be distributed from each center into the surrounding communities by bicycle or on foot, reducing demand on vehicle transport and resolving hours-of-service issues.
- Swarm center architecture has the capacity to capture the sun's energy via the building envelope.
- The larger central core of the building encourages passive ventilation.
- Terraces and urban roof gardens can help improve air quality. ■

By **Sheila Vertino**, former editor-in-chief of Development magazine and a freelance writer based in the Washington, D.C., area.



Ware Malcomb



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