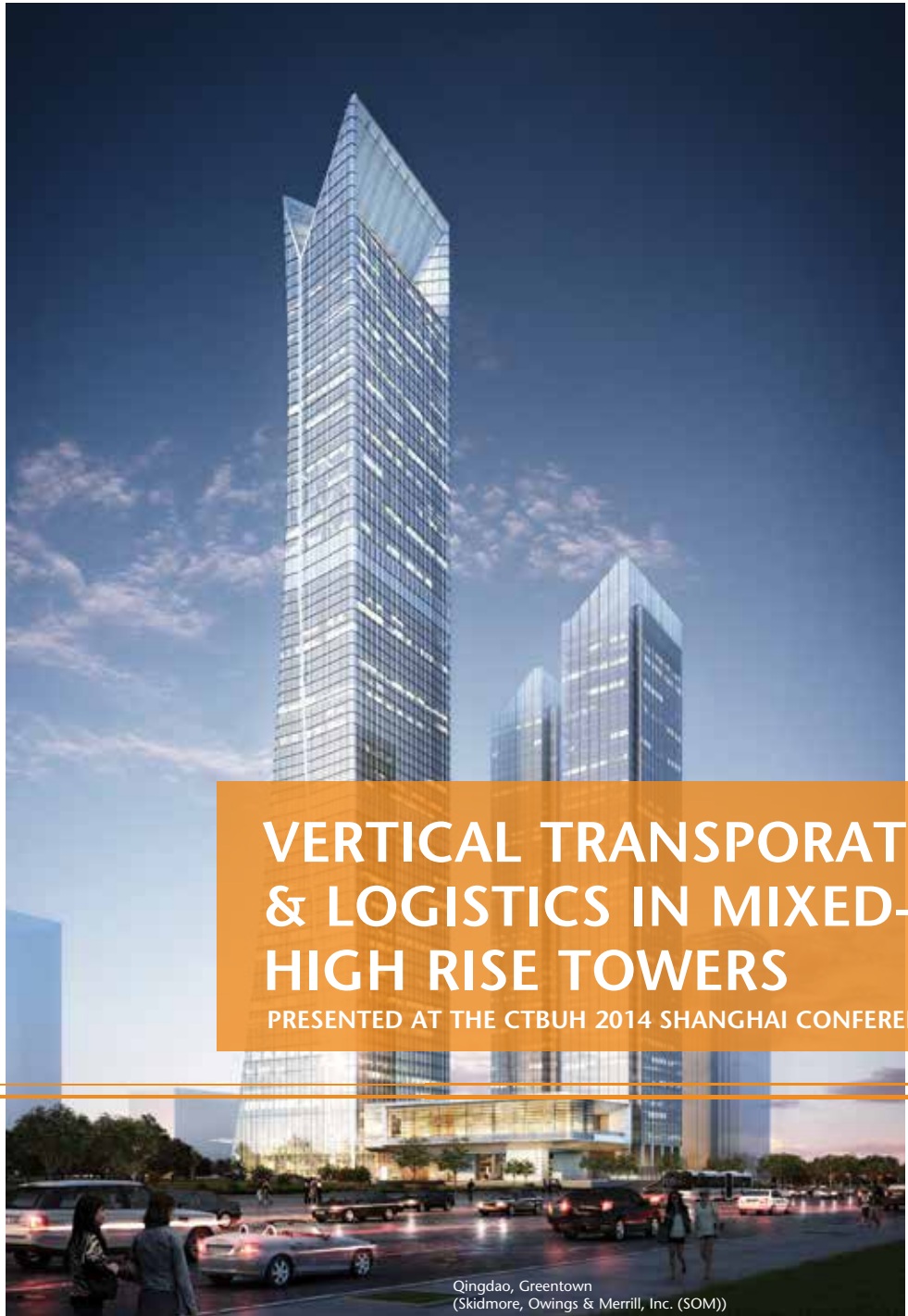




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Building Insight



VERTICAL TRANSPORTATION & LOGISTICS IN MIXED-USE HIGH RISE TOWERS

PRESENTED AT THE CTBUH 2014 SHANGHAI CONFERENCE

Qingdao, Greentown
(Skidmore, Owings & Merrill, Inc. (SOM))

ABSTRACT

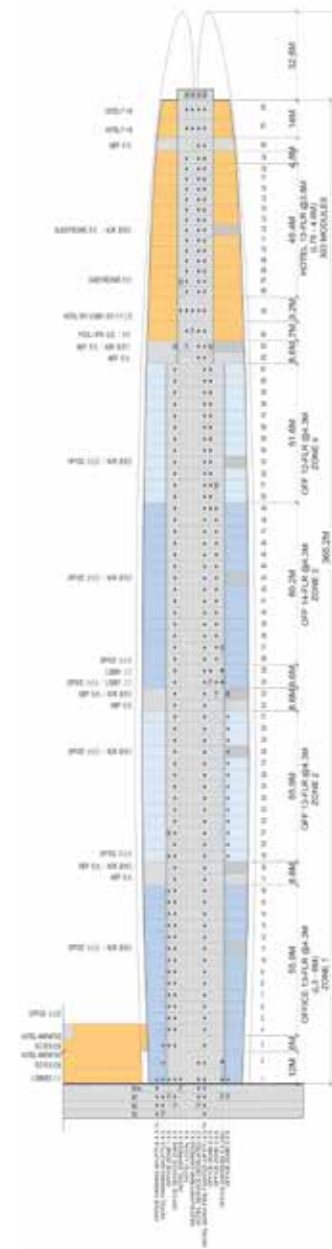
The mixed-use vertical city is a concept as an option created from the necessities of ever increasing urban densities in maturing cities around the world. Unique benefits of multiple building uses within the same area have driven the development of the vertical city concept where people live, work, recreate, and shop in the same complex. The vertical transportation system is of significant importance as these complexes are designed to provide proper vertical transportation without consuming the building core; elevator users' segregation by mixed-use type; front of house vs. back of house or people vs. materials segregation; security concerns; and life safety solutions. Meeting the diverse Logistics requirements of all occupants is also a challenge that must be addressed including segregated truck deliveries, service elevator access, and waste and recycling operations. Proper planning of the vertical transportation systems and Logistics operations is critical in ensuring a successful community atmosphere in the vertical city.

SUSTAINABLE VERTICAL URBANISM

The mixed-use vertical city is a concept created from the necessities of ever increasing urban densities in maturing Asian cities. The unique benefits of multiple building uses within the same area have driven the development of the vertical city concept where people live, work, recreate and shop in the same complex. As real estate has become more scarce and expensive in other mature urban markets, this concept has expanded around the globe including even Los Angeles, California, where sprawl has dominated the urban landscape for more than 50 years. The vertical city becomes an economic response to increasing real estate costs and the increased cost of development. Developers view modern mixed use projects more favorably as they are viewed as less risky and more financially attractive for the following reasons. First risk is mitigated as absorption is dependent on more than one use. For example if housing is flattening from a demand perspective, office and retail demand may be strong. Second the synergy between the uses creates demand for tenants/owners to be included in these complexes thus helping to ensure their financial success. If people want to live near where they work, employers are more likely to lease space in

“When people are able to live, work, recreate and shop in vertical city complexes they have the opportunity to develop a community atmosphere.”

this environment. If there are workers present during the day and night then restaurants and shops want to be there to provide their services. The loop is closed as people want to live where they are close to work, shopping and entertainment. Sustainability is improved as people are able to reduce or eliminate commutes, travel, vehicle usage and other resource intensive activities. This reduction in resource intensive activities includes not only the occupants of these complexes but also the provision of services. Consider refuse pick up and removal as one example. A relatively few trucks can collect the refuse from thousands of office dwellers, restaurants and residents. This would not be possible in traditional urban or suburban arrangements where many more trucks would have to drive countless miles to collect the same refuse. This concentration of services is a key to sustainability.



Ningbo, Eastern New City, Elevations and Sections (Skidmore, Owings & Merrill, Inc. (SOM))



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VERTICAL CITY

When people are able to live, work, recreate and shop in vertical city complexes they have the opportunity to develop a community atmosphere. In order for the community atmosphere to be successful it is important to understand what components are necessary in a mixed-use complex. Vertical cities are often more than just one building and include: work locations/office space; residential units (condominium or rental); retail; entertainment; hospitality; and indoor/outdoor recreation. If these pieces are evident in a mixed-use project, the opportunity exists for the favorable development of community atmospheres which will draw people to these complexes thus creating the sustainable environment.

Now that we have conceptually created a vertical city and community it is important to understand the elements of the physical design necessary to efficiently, and with comfort, move the members of this community and the material necessary to support them vertically and horizontally throughout these spaces.

VERTICAL TRANSPORTATION

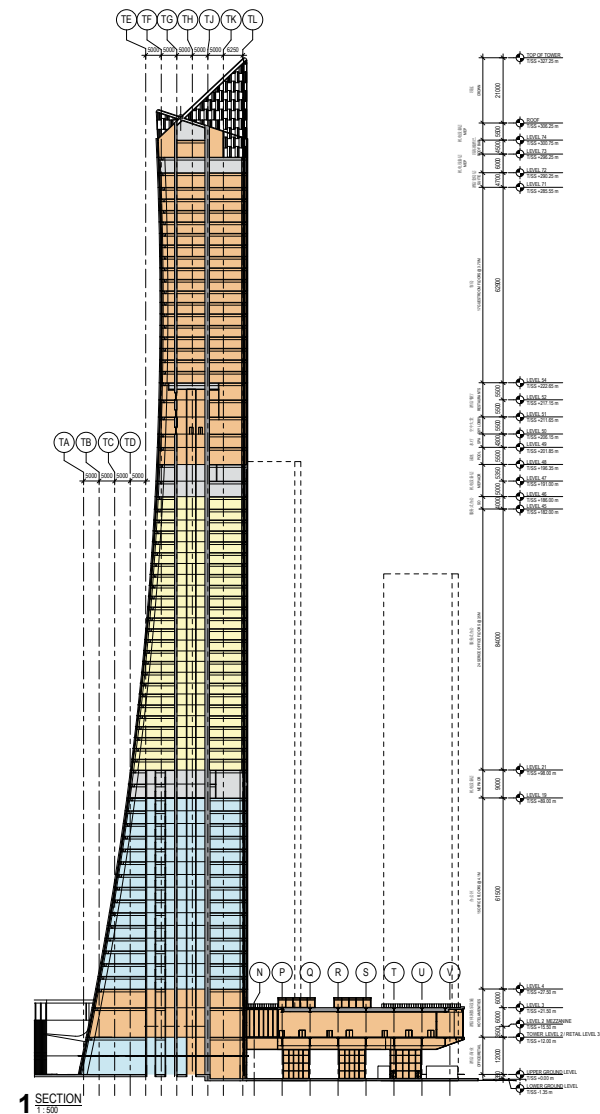
The structure of the vertical transportation system is of critical importance as these complexes are designed for the following reasons:

Providing Proper Vertical Transportation without Consuming the Building Core. Careful elevator analysis must be conducted to provide advice to the design team in order guide the architectural design of these complexes. This helps create a “stacking” which allows for optimal elevator performance while minimizing the total number of elevator shafts in the building core. This may require the use of sky lobby shuttles, double deck or uncoupled double deck elevators, Destination Based Dispatching and sophisticated access control systems. Additionally, by careful consideration of the stacking, the core designs of these mixed-use towers can use stacked elevator hoistways where multiple elevator uses can have hoistways stacked one atop the other.

Just as we strive to segregate rider types, it also is important to keep staff and materials separated from passengers.

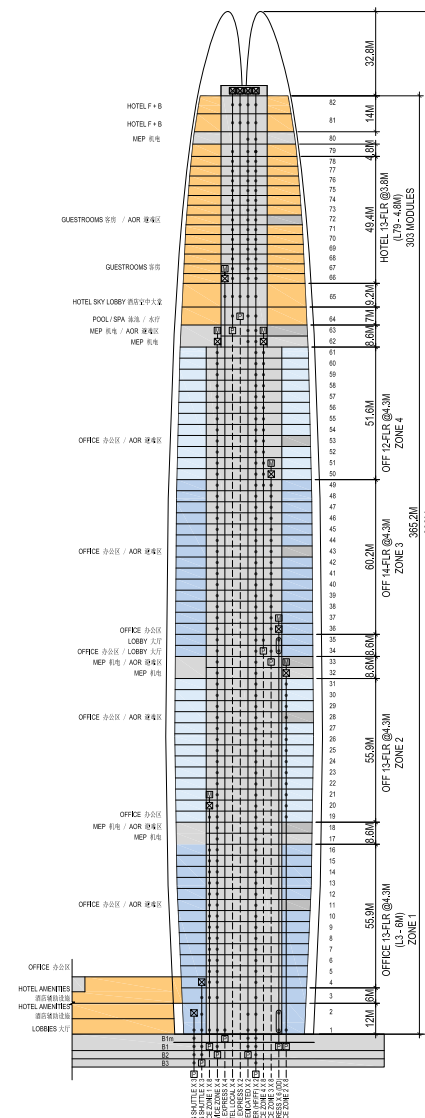
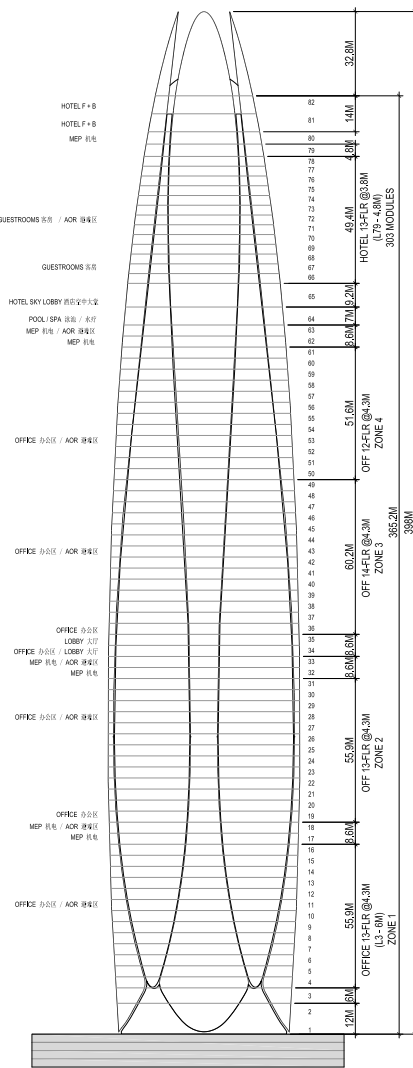
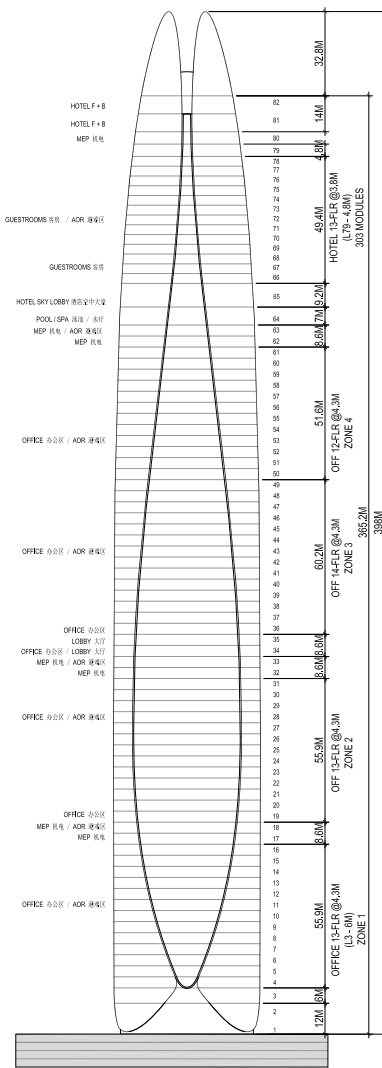
Elevator Users’ Segregation by Mixed-Use Type. As each of these user types are considered, the expected level of elevator performance varies by each group type. Average wait times and elevator handling capacity expectations are markedly different. The most demanding elevator performance is required by the Class A office space contained within these complexes while less aggressive elevator performance is required of the residential components of these towers with other uses falling in between. As noted above, careful stacking design by user group ensures proper segregation without impacting elevator performance. For example, hotel related functions should be kept as close as possible to one another to eliminate the need for elevators to serve more floors than necessary. If the hotel pool is located on the 5th floor but the hotel sky lobby is located on the 35th floor, it may become necessary for the hotel local elevators to serve all the way down to the 5th floor so that guests in wet bathing suits do not have to ride to the hotel sky lobby shuttles with arriving guests. This requires more core space and impacts the project

significantly from an economic perspective. We must give consideration to these types of examples throughout the tower.



Qingdao Greentown Tower/Podium Sections
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Front of House (FOH) Vs. Back of House (BOH) or People vs. Materials Segregation. Just as we strive to segregate rider types as we transport passengers vertically through these complexes it also is important to keep back of house staff and materials transportation separated from passengers. Beyond that segregation it is important to also segregate BOH user types. Hospitality BOH needs are significantly different than those of residential, office or retail users. These challenges also must be considered but are significant design points that cannot be overlooked. Current Life Safety requirements for high rise buildings also place a design requirement on BOH vertical transportation with most local codes requiring at least 2 elevators that serve every level of a tower. This is typically accomplished by using the BOH elevators for the user segment located at the top of a mixed use complex.



Ningbo, Eastern New City, Elevations and Sections (Skidmore, Owings & Merrill, Inc. (SOM))

Security Concerns. These mixed use facilities ask a great deal of the elevator system in order to provide the segregation discussed above. Modern elevator technology and access control systems enable an even finer level of segregation when required. For example, the use of Destination Based Dispatching in an elevator system along with access control systems (proximity cards, swipe cards, proximity fobs or even keypad PIN entry) allows an elevator group to provide security against unauthorized access to certain levels while providing VIP private ride access to others. The design team today has significantly more options available to them than in the past, all of which increase complexity during the design process but which provided a new level of seamless interaction when in use after construction.

Life Safety in Modern Mixed-Use Towers. As mixed-use complexes/towers become ever taller and more divergent in user types, it has become increasingly important to develop life-safety solutions that take advantage of vertical transportation in ways that were previously unheard of. The traditional solution to the evacuation of a high-rise was to not use elevators in the case of a fire and to rely on stairwell egress. This solution is becoming untenable as these structures grow in height. Occupant Evacuation Operation (OEO) has now been recognized by the International Building Code (IBC) as a means of providing egress from a high-rise building. The design team should consult with elevator design and building code professionals if such a design approach is considered as there are significant architectural and code related geographical concerns. The use of OEO and other new strategies provide opportunities to reduce the total number of stairs in a project, which can lead to significant core space savings. This is an emerging trend which must be carefully considered and discussed not only within the design team but also with the developer and the pertinent local code authorities.

LOGISTICS

Retail and commercial tenant types vary widely in modern, mixed-use high-rise towers. Non-residential tenants often include but are not limited to; office suites, hotels, restaurants and bars, grocers, retail shops, fitness centers and small service oriented businesses such as dry cleaners and florists. Special demands of the logistics system are made by many of these tenants in addition to the demands created by residential units. Meeting the diverse requirements of all occupants is the challenge logistics planners must meet.

Street level deliveries are acceptable in limited situations. Depending on the time of day this practice can create traffic congestion. Street level deliveries to new properties may even be prohibited by city codes. Requirements for loading dock provisions may be mandated locally. The best design solutions address the logistics requirements of both residents and commercial tenants in an unobtrusive, back of house manner.

Truck deliveries made at a dedicated loading dock located either within the property boundary or at an adjacent location usually provide the best solution. Often the biggest challenge is to provide access for the larger, articulated trucks typical of businesses such as grocers and restaurants. Some vendors use only these larger truck types as they strive to serve multiple locations from a single trailer. Even

when configured for city maneuvering with reduced wheelbases and shorter overall lengths, articulated trucks require a wide turning radius which translates into considerable building square footage and wide structural spans. Building columns and truck traffic are at odds, so transfer beams that extend column spacing are often employed and should be budgeted for in the construction costs of the project.

Access to and from the loading dock to the street should be dedicated to trucks rather than mixing parking garage access with truck traffic. Congestion and impasses are possible otherwise as automobile drivers often misunderstand the maneuvering space trucks require. A strict system for scheduling deliveries at a mixed-use building is very challenging to implement because it requires the coordination of various building tenants and their vendors. However, a dock master who is assigned to control loading dock activities may be able to manage a delivery schedule that reduces the number of loading bays required. A street level signaling system that alerts truck drivers when no open truck bays are available can mitigate traffic jams at the loading dock. Remember, it is possible to design a loading dock that is much easier for trucks to enter than it is for them to leave.

The location of the loading dock is critical unless commercial anchors such as grocery stores and large restaurants have their own docks. A central location is not as important as is a location nearest the highest volume tenants. Providing dedicated, back of house corridors to serve commercial anchors means that palletized traffic and the highest volumes of waste may be transported outside public view. The aesthetic benefits of dedicated corridors are obvious but physical benefits to the infrastructure are significant. Damage to flooring materials and walls may be mitigated, and better control of trash is possible if dedicated service corridors are provided.

Given the wide variety of truck types and trailer heights, dock equipment such as levelers are strongly recommended to provide a safe and efficient operation. Efficiency is important to the building owner because it may translate into fewer truck bays and less overall space. Adequate working space on the dock behind the truck is important so vendors may pass one another. Adequate vertical clearances for truck access and for waste removal operations are required. The impact of ramps to trucks is an important consideration. Inclines over eight percent grade should be avoided if possible.

Often retail tenants are located on lower floor levels but exceptions exist and access to service elevators is very important. Overnight couriers require access to all building levels including residential spaces. Routing to appropriate check points must be considered during planning. The size of service elevators is an important consideration especially for certain retail tenant types. Sports equipment stores may have oversized items to transport such as canoes. Planning sessions

As mixed-use towers become ever taller, it has become increasingly important to develop life-safety solutions that take advantage of vertical transportation.

should include “what-if” scenarios to account all possibilities.

Residents require access to the loading dock or similar provision for move-in/out activities. Access to elevators suitable for this function and that provide access to all residential units is required. Large facilities require multiple parking positions for moving trucks as move-in/out times are often limited.

Waste and recycling operations require careful planning to ensure optimal, non-obtrusive solutions. Waste chutes for residential units are common. They require adequately sized termination points located on the same level as the loading dock where waste compaction equipment normally resides. Waste transports from those terminal rooms to the loading dock may be reduced by incorporating waste compaction as part of the chute termination point. Waste is dropped into special carts that interface with a small compactor in the termination room so that carts are fully packed before transport to the loading dock. All the equipment in this scenario must be coordinated to work as a system. The trash

chute must interface with the carts; the cart must interface with the transport vehicle and interface with the dockside waste container.

Municipal waste collection scenarios should be considered when planning the property’s waste management plan. Some locales provide waste collection services under local taxes so tenants may already pay for trash collection services. They may balk at paying an additional fee to the property owner for waste collection. In those cases, a waste management plan that provides residential waste in a manner suitable for municipal pickup may be financially beneficial to both parties.

Recycling requires planning to ensure a system which residents and commercial and retail tenants will embrace. Otherwise, recycling will only capture a portion of the potential recycling stream and the rest will end up as general waste. Chutes may be used for recycling bagged cans, bottles and paper but they are not suitable for cardboard. Cardboard often expands and can block a chute. A growing element in the recycling

stream is organic materials such as food scraps. This can be the most challenging component of the waste stream as foul odor is often associated. It’s beyond the scope of this paper to cover all potential solutions. Suffice to say planning sessions including a consultant experienced with options and property staff familiar with acceptable procedures for tenants to follow are warranted. Coordination with waste hauling operations is important as well. Pickup frequency, times of day, and overhead clearances required for dock based equipment, cart dumpers and container hoists provided by waste hauling contractors, must be coordinated with the building design.

The planning team must fully understand the various demands the building will experience, driven by the wide range of uses of a mixed use property. Proper planning can make logistics operations more transparent to the public, tenants and residents. The best logistics operations are those that run smoothly and without being noticed.



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Eric Rupe, Vice President, Central & Northeast Area, has more than 20 years of experience in the vertical transportation industry, providing consulting services on major high-rise building projects, most recently the Samsung Headquarters and Qingdao Greentown projects in China. Mr. Rupe previously worked for KONE Elevator and Escalator where he was the Product Manager for Traction Elevators, Director of Marketing in North America, and held New Equipment Sales and Management positions. Eric holds a Marketing Degree from the University of Iowa and received a Management Certificate from London Business School.



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Robert Baker, Lerch Bates Inc. Business Line Manager, Logistics Group, has more than 30 years of experience in design consulting and engineering documentation. Mr. Baker’s experience includes consulting on materials management, waste management and materials handling projects, as well as extensive involvement with complex systems including automated transport systems, distribution centers and waste processing departments in healthcare, mixed-use and transportation projects. He most recently provided consulting services for Google Headquarters, New York, and City Creek Center, Utah. Bob earned a Bachelor of Science degree from the University of Maryland University College.



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