

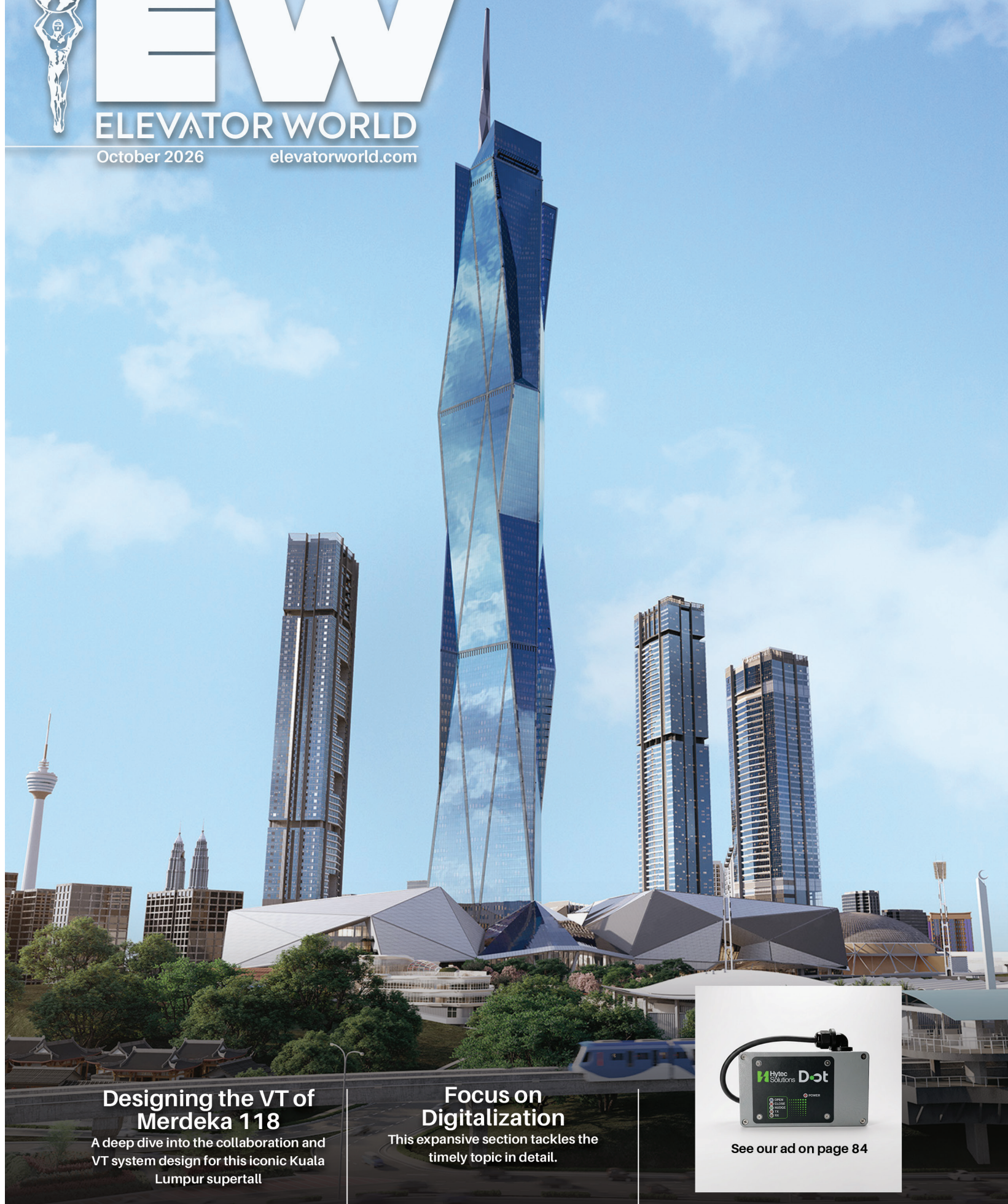


EW

ELEVATOR WORLD

October 2026

elevatorworld.com



Designing the VT of Merdeka 118

A deep dive into the collaboration and VT system design for this iconic Kuala Lumpur supertall

Focus on Digitalization

This expansive section tackles the timely topic in detail.



See our ad on page 84

Project Spotlight

Designing the Vertical Transportation of Merdeka 118

A deep dive into the multidisciplinary collaboration and the VT system design for this iconic Kuala Lumpur supertall

by Rick Barker and Sean Morris, P.E., Barker Mohandas, LLC

The entire precinct with the tower;
image courtesy of PNB Merdeka
Ventures Sdn. Berhad





Nighttime shot of the tower at the hoistway for the scenic lifts to the OB deck; image courtesy of PMV

Note: After this article was submitted to EW, the building name changed to Menara Merdeka Maybank.

Introduction and Basic System

We became involved with Merdeka 118 at the start of concept design in 2010, working with Fender Katsalidis Architects (now FK) and for PNB Merdeka Ventures Sdn. Berhad (called PMV in this article). PMV is the owner/builder of the Merdeka 118 precinct that includes the Merdeka 118 tower and Malaysia's two heritage stadiums. PMV is a wholly owned subsidiary of Permodalan Nasional Berhad (PNB), one of Malaysia's leading fund management companies. According to PNB's website, the "Merdeka 118 precinct development represents PNB's aspiration to uplift the financial lives of Malaysians across generations as well as a symbol of Malaysia's progress and development as a nation."ⁱ The tower's spire is symbolic of Malaysia's first prime minister, Tunku Abdul Rahman, raising his hand in the Stadium Merdeka to proclaim Malaysia's independence ("*Merdeka*") in 1957.

We quickly realized the importance of the project to Malaysia. Rick was lead consultant through schematic design, then Sean and Rick co-led our services during design development, tender reviews and project submittals. Paul Bennett also assisted early in design, and Mike Spaner assisted later with project submittals.

In talking about the VT designs, whether the improvements or state-of-the-art techniques, we will talk about some foundational work by others, and by ourselves from our past hats. We strive to take practical next steps to improve elevator safety, reliability and/or performance with tall buildings. After working for a multi-disciplinary engineering firm that was involved with the world's tallest buildings in the 1970s, Rick wrote in a paper for Otis:

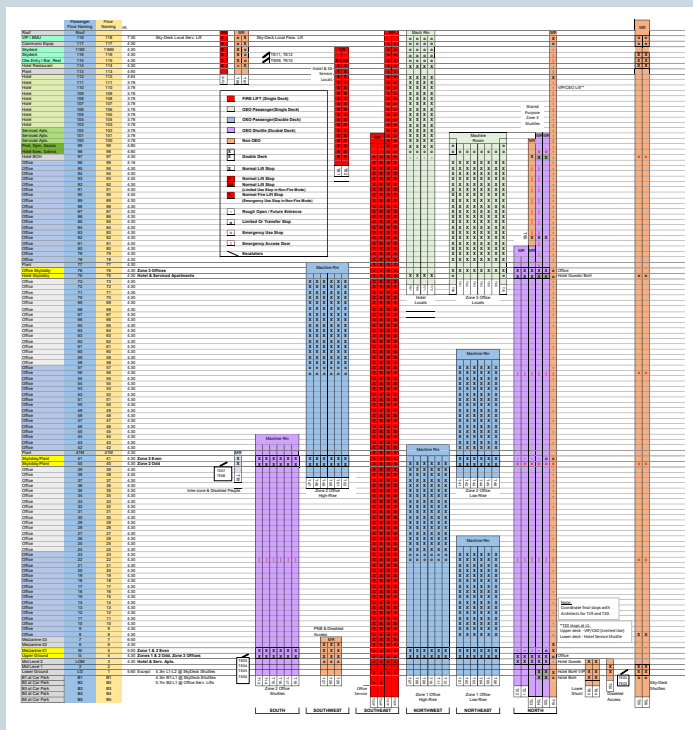
"In such buildings we must listen very carefully to our experience, Mother Nature, the codes, and remember, vertical transportation is still a subsystem of the building."ⁱⁱ

Some of the VT designs in Merdeka 118 also came from our firm's experience with tall buildings.

The first architectural concepts by Karl Fender were for a tall, all-office tower called KL-100. It was immediately clear the basic strategy for the main passenger lifts should be a system of double-deck local and sky-lobby shuttle lifts. This would minimize core space while providing the handling capacity needed for office occupancy and utilize machines available from multiple manufacturers. The first precedent system was also in Kuala Lumpur – the Petronas Twin Towers – which, when completed, were the world's two tallest buildings.

The owner's program and the architectural design evolved and eventually settled at approximately 80 floors of office space,

Continued



Barker Mohandas VT riser diagram as used by Dr. Janne Sorsa in his presentation, “Moving 10,000 People Through Merdeka 118 — the World’s Second-Tallest Building,” CTBUH, Singapore and Kuala Lumpur, October 2023. (Note: Four groups of elevators for the car park outside the footprint of the tower are not shown.)

a luxury hotel above, and restaurant and observation (OB) deck levels, as the tower was built and became the world’s second-tallest building (after the Burj Khalifa in Dubai).

The system of double-deck local and sky-lobby shuttles remained the basic solution for the many office floors, while in the top office zone passengers would transfer from the upper deck of the shuttles to a group of single-deck local lifts. (The lower deck of these shuttles is used to transport guests to the sky-lobby level of the hotel, which houses Park Hyatt Kuala Lumpur.)

Traffic Performance and Improvement

We finalized the quantities, sizes, speeds and floors served by the various passenger elevator groups using conventional yet comprehensive traffic calculations to provide results for comparison to various published standards (including various hotel operators). Our calculations consider variability in floor populations to address floors which vary in size or area, probable stops involving double-deck local elevators, etc. The performance considered that large office tenants could occupy multiple floors, thereby creating inter-floor traffic.

However, we knew that for double-deck local elevators in particular, improvements to our industry’s standard destination dispatching (that uses ‘instant’ car assignments at every floor) should be provided to improve waiting times (while retaining its benefits at the main lobby). We asked the top R&D specialist at two manufacturers to run dispatching simulations for one (1) sample group of high-rise double-deck local lifts, using a published traffic profile for office lunchtime traffic, and for the interim their “hybrid” or similar dispatching.

The results confirmed some of our prior work and our improvements in progress for this project. We wound up calling the solution “harmonized” dispatching and passenger interfaces — which utilized standard destination dispatching at the main lobby (introduced by Dr. Joris Schröder of Schindler, where we simply added some signal improvements for car wayfinding), and delayed car assignments at the office floors (while retaining passengers’ floor destinations). This became the cover article in *ELEVATOR WORLD* in November 2018 and is also well covered in the 2022 book *People Flow in Buildings* by Dr. Marja-Liisa Siikonen who notes, “The idea of ‘Harmonized’ elevator dispatching, also called advanced destination control system [by KONE], was introduced by Barker (2018).” Marja-Liisa was instrumental in getting this built for Merdeka 118 while she was with KONE, and Dr. Janne Sorsa was a key contributor to the EW article in providing updated and expanded traffic performance simulations while he was with KONE.

The EW article summarized the project specifications for base dispatching operations in conjunction with the various ‘e-fixtures.’ And the specifications summarized what was expected behind-the-scenes with manufacturers’ expert system algorithms, “... to improve the accuracy of predicted response times, weight the importance of the decisions, and recognize,



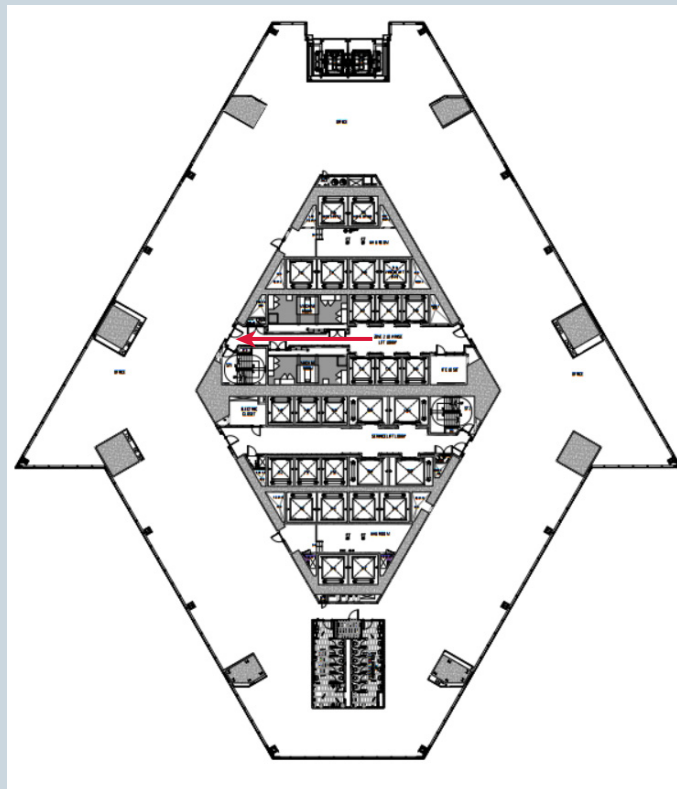
Photo of a lift lobby at a typical office floor in the tower (courtesy of PMV). Note the e-displays functioning as conventional hall lanterns, combined with numeric keypad hall stations.

learn and adapt to distinct changes in the traffic, all to minimize long waits, starts and stops, and passenger waiting queues ...,” based on various inputs which were outlined. Considering Rick once chaired the Otis “Worldwide Dispatching & Elevator Steering Committee,” working with experts such as Dr. Bruce Powell (also known to EW), we understood the state-of-the-art. The functions of the e-fixtures were also planned to improve passenger convenience and information, including for double-deck local lifts.

The e-displays and touchscreens also had a dual purpose for the next improvement.

Building Occupants and Fire Emergencies

Given the importance of the project and knowing about a new U.S. model building code requirement, we introduced the project design team to “Occupant Evacuation Elevators” and,



Floor plan at one office floor (L42) showing elevator spaces at that floor and a backup path to stairs from a lift lobby (via a two-level machine and control room for the adjacent group of lifts).

generally, to the cross-discipline designs involved. For buildings exceeding 128 m (420 ft) with this type of occupancy, the 2009 edition of the International Building Code (IBC) required either elevators for occupant self-evacuation or a third exit stairway. PMV and the project manager, Turner International, supported the effort involved for this large-scale elevator system, and Jensen Hughes was engaged as the fire protection engineer. The benefits included reduced evacuation time and fatigue for occupants. (As an aside, we still find it strange that the IBC does not address such elevators for even a 200-story, all-residential tower.)

Our design team's 'maestro' for the related building spatial and circulation planning was FK's project architect Gerard Van Beek. The importance of planning protected back-up access to an exit stairway from all lift lobbies cannot be understated with such elevators. Working closely with FK, we even planned some two-level machine rooms to allow for this back-up path. Both stairs and elevators were to be used for fire egress.

Given our experience in U.S. code work involving fire and elevators and with international projects, and knowing our model codes were a little new with this step, our specifications referred to TN 09-2041 (the final approved, pre-publication changes that added "Occupant Evacuation Operation" or OEO to ASME A17.1). We also borrowed some elements from British code thought on firefighters' lifts (which became EN 81-72), such as water protection, applied here for the passenger lifts used for occupant evacuation. While other disciplines were planning related building designs to prevent the ingress of water into

hoistways, practicality suggested that lift electrical equipment within 1 m of a wall with an entrance should be protected, per EN 81-72. As an aside, years ago Rick was a member of a joint ASME-NIST-NYC (NYC Fire Department and Department of Buildings) task group on water infiltration for elevators to be used by firefighters, and while we were planning similar elevators for another project (the 1-km Nakheel Tower in Dubai), the owner's engineering manager noted that the benefit for reliability also occurs during the construction of concrete hoistways.

On the other hand, U.S. building code thought was to pressurize the affected elevator lobbies, thereby also defending against smoke entering the hoistways (which then need not be pressurized in addition, as might further be prescribed by British standards for firefighter lifts - and pressurizing hoistways can adversely affect certain types of lift equipment).

Several detailed improvements were then multi-purpose. From Rick's work years ago with a solution to avoid ongoing manual elevator door control adjustments for 'stack effect' - after changes in outside temperature at Sears Tower (now Willis Tower) in Chicago, we specified the addition of torque controls for the door operator motors. We supplemented these with age-old weighted auxiliary closers for the door panels to provide a continual positive closing force, in lieu of most devices using springs. While these improvements reduce maintenance and improve safety and performance normally, we felt these were even more important during elevator fire evacuation operations when building internal air flows can quickly change.

Another improvement was self-recalibrating load weighing for the cabs, considering the time-dependent compression, etc., in any resilient materials used. Normally, we specify these to reduce maintenance involving heavy carts of test weights. While today's machine motor controls may not depend on the accuracy of cab load weighing, dispatching operations still should, and that importance increases during fire evacuation operations.

To complement this, we recall a workshop in Kuala Lumpur when several members of the design team came to the same conclusion: to use CCTV cameras not just for security, but to monitor conditions in lift lobbies and cabs during evacuation operations. Intercommunication was also planned commensurately with sub-stations in the lift lobbies, as well as the cabs.

For the "harmonized" dispatching, we specified electronic displays and touchscreens given the ability to change the information displayed (or just show blank touchscreens to 'hide' floor buttons in the cabs when the cars are at the main lobby, as covered in the EW article in November 2018). Knowing the messaging required for OEO under the new ASME A17.1, we specified that the same fixtures that would already be familiar to passengers be used for the emergency messaging. The following shows the actual KONE electronic display for elevator lobbies when a group of lifts is operating in the OEO mode.

Considering that, during OEO cars are typically traveling 'down' heavier than their counterweights and then traveling



Photo of a lift lobby at a typical office floor during testing of "OEO" (courtesy of PMV).

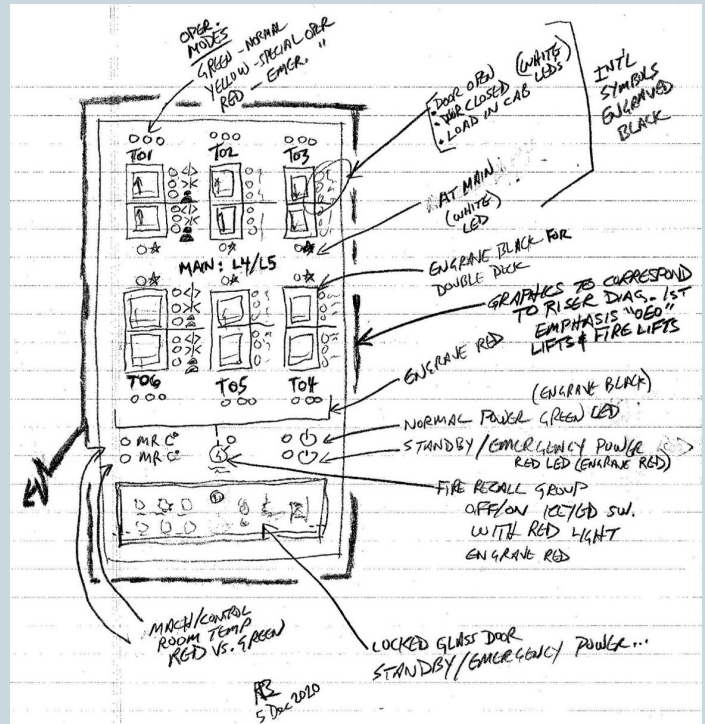
'up' empty when the counterweight is heavier, which are ideal conditions to regenerate power, a further step considered was to use elevator regenerative power during evacuation operation to supplement the building standby/emergency generator system. However, sufficient emergency power was available, and the elevator regenerative power was reused elsewhere in the building.

Backing up a little, in addition to meeting local codes and standards, the underlying lift and escalator equipment was planned and specified based on EN standards, considering both their comprehensiveness and cost practicality with manufacturing sources for projects outside the U.S. However, U.S. model codes were specified for elevator work involving fire safety, seismic designs (which are now also covered by an EN standard), freight load ratings, etc.

'First Responders'

While years back the British led the way with a protected lift for firefighters (we recall it could also be used by a person with a disability 'backing-in' a wheelchair until the fire brigade arrived), its small capacity size [630 kg or 1389 lb minimum] could not accommodate a stretcher and provided little handling capacity for firefighters. Rick later pushed "multi-purpose" service elevators for office buildings which could be used for fire and medical emergencies (paper, ASME Symposium April 1995, reprinted EW, September 1995). It took some time for the U.S. to adopt a protected elevator for firefighters and stretchers, first in the NFPA 5000 Building Construction and Safety Code that is hardly followed here, and then, eventually, in the IBC.

Merdeka 118 is served by a group of four large multi-purpose service/firefighter/stretchers elevators. Two elevators in the group serve almost all floors through L117, where a protected transfer is planned to access a protected medium-rise multi-purpose elevator that serves L118. The other two large elevators then serve most floors – with their top terminal is a hotel 'sky-dock' for transfers to a pair of local service, etc., elevators for the hotel. The sky-dock could also be used as a staging area for firefighters not wishing to use the full-travel lifts. Two of these lifts were also planned to carry a replacement electrical



Rough hand sketch provided during the project submittals stage to suggest 'essential' information and controls for firefighters for one (1) sample group of double-deck lifts within the overall VT Central Command Station.

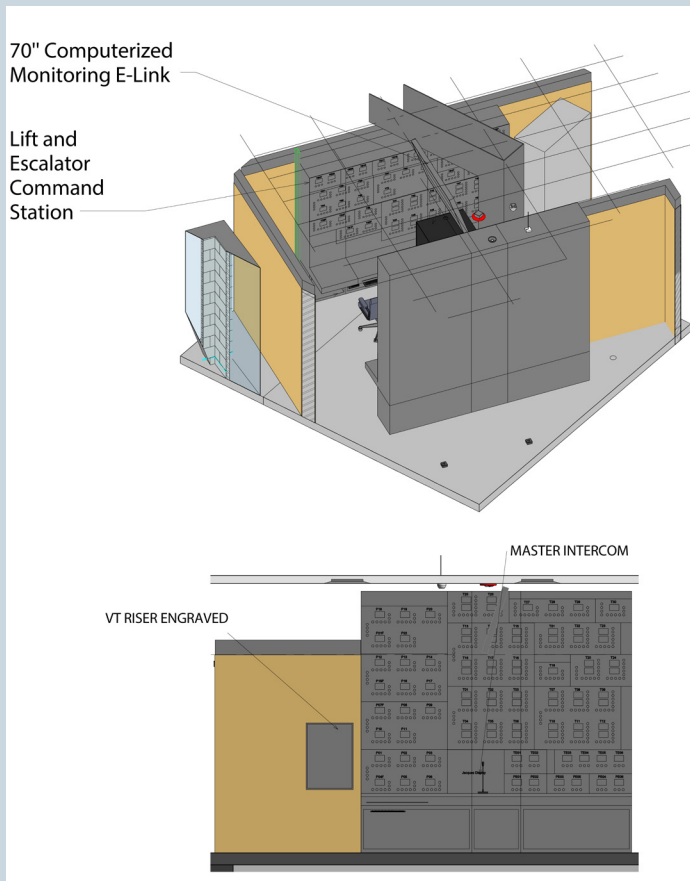
transformer with a special capacity rating at slow speed in a manual operating mode.

During fire and power emergencies, today's elevators go into automatic operation modes – and they should. However, we also feel it is important to provide firefighters with clear and essential information to monitor these operations (and, of course, to have overrides to control the lifts manually if needed). A firefighter should not be required to read a software application manual for an 'elevator monitoring and control system' in a fire or central command station, or to rely totally on building management staff.

Our specifications for the VT central command station covered the work involved. During the submittals review stage, Rick provided a very rough hand sketch to clarify the intent of providing essential information and controls for firefighters, here for one (1) sample group of double-deck local lifts. A large-scale version of the VT riser diagram is also part of the central command station. These would be supplemented by the extensive information and controls available to building staff via KONE's display screens and keyboards.

The following general 3D layout was provided by KONE as part of their initial submittals for the VT central command station.

While three other manufacturers we had surveyed at the time advised that there were a number of buildings in the U.S. with OEO under ASME A17.1, none of the VT systems were as large, and the tallest building was 260 m (853 ft). And all being in the U.S., the fire departments would be familiar with at least prior emergency operations under A17.1. However, with OEO, we felt the importance of fire management information increased



Two general 3D layouts of the VT Central Command Station provided by KONE early in the submittal stage. Some analog functions were later changed to digital.

for elevators — especially for such a large international project. (As an aside, while it was also reported that some other tall buildings worldwide had such elevators, to the best of our knowledge none of these followed a comprehensive group of codes that also covered related building work, including coordinated fire alarm and elevator operations.)

Vertical Movements

Long-accepted solutions for hoistway vertical movements were included, such as ‘sliding clips’ to fasten rails to their support brackets — with the clips designed for the project’s seismic requirements — and adjustable jack bolts in the pits below all rail columns involving safety devices (and all lifts in the tower have a counterweight safety device). We also specify that feedback devices for landing control systems are mounted on the entrances and not the rails, considering their relative vertical movements in high-rise buildings.

It’s worth reviewing some history on elevators and tall buildings in the 40-year-old article on Sears Tower (now Willis Tower), “Design of High-Rise Shuttle Elevators for Tall Buildings — The Second Generation,” by William S. Lewis, Jaros Baum & Bolles, EW, January 1986. Following in Bill’s footsteps at JB&B, Rick knew of one innovation covered — for the elongation of suspension ropes which, at the time, had a ‘sisal core,’ and for the retrofit work involved there was a very limited pit depth.

This was to jack the machine’s secondary sheave downward from the machine sheave, where with the double wrap machine roping also used, a 4:1 advantage was provided to take-up rope ‘stretch.’ However, Rick also followed the availability of ‘steel core’ suspension ropes with Dr. Michael Molkow of DRAKO GmbH, Germany, and then at Otis followed their success as replacement ropes at the World Trade Center in NYC with Otis’ Pete LaGow.

Steel core suspension ropes were specified for their benefits to reduce elongation (and maintenance) in tall buildings. These were also specified for all machine-room-less (MRL) lifts to help maintain tension equalization for the smaller diameter ropes typically used. For all tall travel lifts, ‘deep groove’ compensation sheaves were also specified with unequal rope tension in mind, while we accepted a system of load sensors on the rope shackles to monitor rope tension equalization (given various design precedents including expired U.S. Patent 6,123,176 assigned to Otis Elevator by co-inventors Hugh O’Donnell, Tom Hoffman and Rick).

As a further safety measure and to facilitate maintenance, we specify photoelectric sensors in the pit to monitor the counterweight bottom ‘run-by’ distance, with a signal in the VT central command station to indicate an adjustment is needed (which may be simply to add or remove blocking on the bottom of the counterweight). We also specified a counterweight safety device for all lifts in the tower — not just for code minimum reasons where there is occupied space below a pit, but as a measure to stop an over-speeding ascending car (and/or to avoid pit damage from a counterweight falling much faster than the overspeed governor’s tripping speed). The only exception was for the four groups of low-rise, low-speed MRL lifts in the car park areas surrounding the tower.

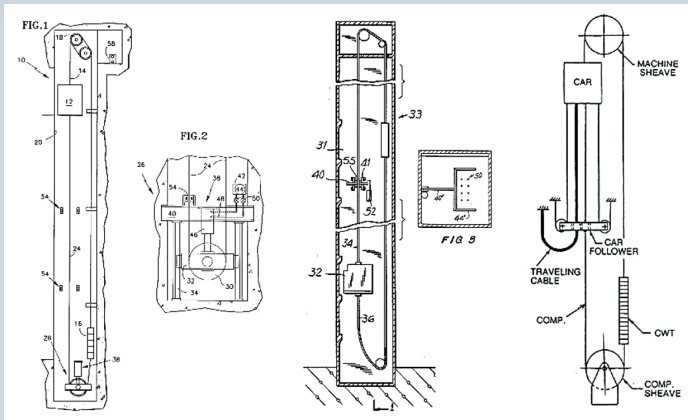
Later, we will mention an improvement for the car safeties for the scenic lifts to the observation deck.

Horizontal Movements

Wind-induced building lateral movements can, of course, cause adverse sway movements in elevator ropes when their frequency is sufficiently close to that of the building. The 1986 EW article cited earlier showed Bill Lewis’ solution for a car ‘follower carriage,’ as it was built by Westinghouse Elevator (a concept Bill said was first used for a tall hydraulic elevator piston to help guard against buckling). The solution works as a traveling damper for the compensation ropes, and to separate those ropes from the traveling cables.

At Otis, co-inventors Rick Barker and Peter Erlandsen obtained a different patent for the company, a graphic from which is shown on the next page (along with a graphic for a car follower carriage). The compensation sheave in the pit is jacked up or down (when the car is parked at a floor) to alter compensation rope tension, and avoid the maintenance/reliability issues and weight associated with a follower carriage (and/or simply adding dead weight to the compensation sheave to increase rope tension). Photoelectric sensors were also incorporated to know when to actuate the jacking of the compensation sheave(s). Still, the solution is not effective for all rope sway movements, as some of our studies have shown.

Continued



(left) from U.S. Patent 5,861,084 by Frederick Barker and Peter Erlandsen, assigned to Otis, to alter compensation sheave rope tension by moving the compensation sheave when the car is parked, actuated by photoelectric sensors in the hoistway to monitor adverse rope sway movements; (center) from U.S. Patent 5,103,936 by Leslie E. Robertson for retractable damper arm(s) for elevator ropes; (right) diagram for 'traveling carriage' for elevator compensation rope and traveling cable sway, innovation by William S. Lewis, P.E., of JB&B Consulting Engineers; source: *The Vertical Transportation Handbook*

Sometimes elevator manufacturers just prefer to park elevators in a 'non-resonant zone' and reduce speed. However, for Merdeka 118, it was clear that degraded elevator performance due to building sway would not be acceptable. We specified rope sway studies to be provided by the manufacturer, then listed multiple potential solutions to meet the performance requirements. Among the solutions were retractable damper arms with interlocks (reminiscent of an expired patent also shown by structural engineer Les Robertson), with photoelectric sensors added in the hoistway from the expired Otis patent (to know when and where to actuate the active sway countermeasure). Based on the VT performance requirements and studies primarily by KONE, but also by us, retractable damper arms and photoelectric sensors were provided. Such arms can also address adverse movements of the suspension ropes if demanded by the sway characteristics of the particular building or tower.

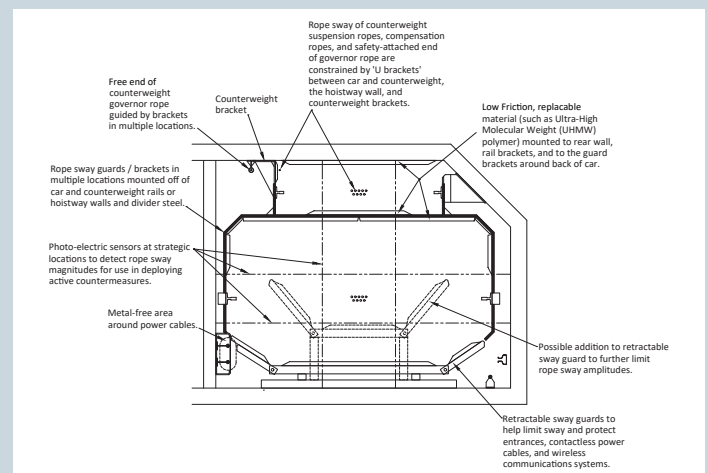
LERA Consulting Structural Engineers, based in NYC and founded by Leslie E. Robertson, had joined with the Robert Bird Group in Melbourne as the structural design engineers for Merdeka 118. At the Council on Tall Buildings and Urban Habitat (CTBUH, now the Council on Vertical Urbanism or CVU) conference in Chicago in late 2019, the last time Rick saw Les, he told him that his idea of retractable damper arms for elevator rope sway had finally been built. Les had intended these for certain shuttle elevators in NYC's World Trade Center back when his firm was the project's structural engineer. Les passed away in early 2021. While we were aware that retractable damper arms for elevator ropes had been installed in Paris at the Eiffel Tower and at La Grande Arche, their purpose was not a countermeasure for building sway, rather for wind forces acting directly on the ropes of these outdoor/exterior elevators.

During the project submittals review stage, we provided information on various past countermeasures for rope and

cable sway, along with our concept design by Sean for a taller tower that was not built. (This is shown below). We provided this to show one concept for such damper arms with photo-electric sensors (not for the details shown for the 'surround' low-friction guards for the taller tower that had a much longer sway return period). KONE's detailed submittals for the retractable arms were somewhat different yet conveyed the same basic functions.

While Merdeka 118 may be the first project with these, like the "harmonized" dispatching, the design improvements are a logical progression from the foundational work of others.

As an aside, based on our past studies by George Wisner for some projects in Dubai involving even longer lift travels, we specified as an option an alternative to elevator traveling cables, specifically inductive power 'rails' (or a rail loop) and



Barker Mohandas detail for a taller tower showing one concept for retractable damper arms with photo-electronic sensors to actuate the arms. (Note: footprints of the elevator car and counterweight are not shown, and the 'surround' low-friction guards were not necessary for Merdeka 118.)

high-bandwidth, guided microwave communications (or radiating coaxial cable), if these became necessary based on the manufacturer's sway studies. While at United Technologies Research Center, George was a co-inventor of U.S. Patent 4,375,057 assigned to Otis on the use of guided microwave signals for elevators. At the same time, we had endeavored to consider the relative layout locations of traveling cables versus compensation ropes below the cars in our basic planning details. For Merdeka 118, KONE was able to provide traveling cables.

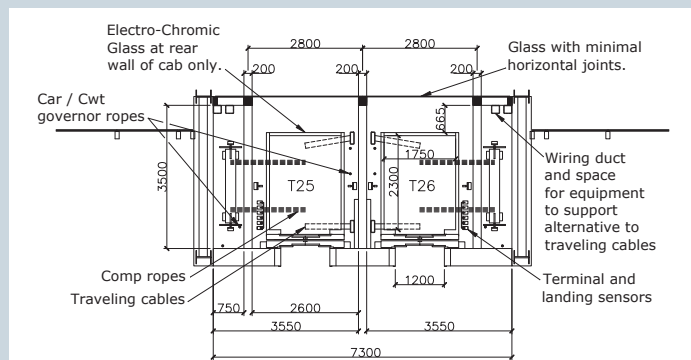
Observation Deck Elevators

When planning a core for a tall building with many elevators, some design adjustments and negotiations can quickly come into play in terms of space requirements — for example, to allow space for mechanical, electrical plumbing (MEP) risers, etc. At a workshop in Melbourne, we were ultimately wrestling with where to locate a pair of elevators for the observation deck when Karl Fender agreed these could be in a 'notch' at an exterior wall and become scenic lifts. At a follow-up workshop in NYC hosted by Val Lehr at the offices of the project MEP design engineers Lehr Consultants

International, structural engineer Les Robertson asked what the layout and framing of these lifts would look like. Rick sketched the layout on a whiteboard, then later took a quick photo of the sketch for our records. (The photo has been omitted due to its poor quality, except to show the project fire protection engineer John Devlin with Jensen Hughes in the foreground.) That sketch established the basic layout.

The following was our final hoistway equipment layout for the OB deck lifts. Like all lifts, a hoistway plan was accompanied by our drawing details of the machine and control rooms and the pits, in plan and section, along with close estimates of the structural forces exerted on the supports, and machine/control room electrical and heat loads, so the project structural and MEP engineers could progress their designs for related work. Our drawing details were closely coordinated with and embedded in the architectural drawings by FK and by the architect of record, RSP Architects Planners & Engineers, to become part of the technical package for “early tendering” by multiple major elevator/lift manufacturers.

There was also a little more to this layout. The deeper-than-wide cabs, with glass at only the rear wall, considered space for passengers who might be uneasy riding in these scenic lifts. We had also specified electrochromic glass, with a change in opaqueness actuated by a button inside the cab (or remotely),



Barker Mohandas hoistway plan for scenic double-deck shuttles T25-T26 for Merdeka 118.

while still meeting the lift codes for the type of glass. However, we were advised that this glass was not yet commercially available for the desired level of clarity when it was not opaque. The goal then was for others to continue to try to minimize horizontal structural members visible during the ride.

Being more interested in providing sufficient handling capacity and passengers enjoying the ride to “Southeast Asia’s highest observation deck” (versus setting lift speed records), we selected double-deck shuttles with a speed of 8 m/s. In the ‘down’ direction for a non-stop descent of 498.5 m (1635.5 ft), the final travel, as we had calculated this should stay within the published threshold of 2000 Pa for ear comfort, with a small decrease in acceleration and deceleration to and from that speed (as covered as of late in our article in EW, June 2017, “Is 4000 fpm Enough?” by Rick Barker, Sean Morris and George Wisner.)

While double-deck lifts naturally increase handling capacity for a given elevator footprint, these were further planned to

have different operating modes to respond to the traffic. During the daytime to maximize visitor throughput capacity, the decks can be loaded sequentially from one boarding level by tourists with families visiting the OB deck. Then, during the evening, the traffic can be separated vertically using two boarding levels, with hotel and restaurant guests boarding one deck and OB deck visitors the other, with both decks being loaded simultaneously. There were also some sub-modes of operation planned by Sean.

Like other long-travel express shuttles on this project, we also planned some ‘limited’ or ‘emergency’ use stops along the travel — which can be useful when rescuing passengers entrapped in a stalled cab — versus just planning a stop top and bottom for such shuttles. Considering certain other emergencies, years ago another architect referred to our planning in this regard as ‘lifeboat’ stops (while we have heard that term applied differently in our industry).

Another improvement was added. Years back when Rick was at JB&B planning the VT system for a 100-story office tower proposed for Paris (Tour Sans Fins) where all the main shuttle and local passenger elevators were located at an exterior glass

Continued



(l-r) Gerard Van Beek, project architect, Fender Katsalidis (now FK), and Rick Barker at the ground center marker for the Merdeka 118 tower

wall, a ropeless overspeed governor was specified to be mounted on the cars to actuate the car safety device, in addition to the conventional roped governor. We later became aware of various designs by manufacturers — not necessarily for future ‘rope-less’ elevators. Such designs obviously included KONE, that responded positively in providing these for the OB deck lifts.

Energy Efficiency

Knowing the owner’s goals for the project, we specified most known and proven measures for VT energy efficiency, which most manufacturers should also be able to provide.

Fortunately, machines with permanent magnet synchronous motors, and fully-regenerative alternating current variable frequency (ACVF) drives to return power to the building grid (and with a total power factor near unity in doing so), were already state-of-the-art in our industry and widely available.

Those powertrains were also specified for all low-rise/ low-speed and MRL elevators where elevator manufacturers’ standards are sometimes ‘non-regenerative’ ACVF drives, where via control resistors, excess power is dissipated as heat, requiring the addition of air-conditioning to maintain operating temperature for the elevator machine and controller. A regenerative drive was also available and specified for all escalators on the project.

In total, we identified approximately 20 items to be provided or studied (in a few cases), some quite detailed, and some just via the basic system design. For example, double-deck elevators and sky lobbies work to reduce elevator stops (and reduce hoistway construction or ‘embodied energy’). The delayed car assignments at the office floors for the harmonized dispatching also worked to further reduce stops, while improving passenger waiting times.

Most of these were second nature from our past hats, and VT was a small contributor to PMV’s broader goals. Terrapin Bright Green was engaged as sustainability consultant, and Merdeka 118 became the first tower in Malaysia to target triple green platinum ratings, including the Green Building Index (GBI) and Green RE system in Malaysia. And as of March 2024, the tower became Platinum certified under the U.S. LEED BD+C (Energy and Environmental Design: Building Design and Construction), Core and Shell, 2009.

Conclusion

Those in our industry who have been involved in progressively planning a large-scale VT system for a tall building can appreciate the multidiscipline collaboration and coordination required, and the importance of the design architect in orchestrating the tasks of all design team members involved. Then of course, the need for collaboration and coordination increases when the elevators will also be used for occupant evacuation to supplement stairs. And for a tall building as important as Merdeka 118, we felt it important to plan practical next-step improvements for safety, maintenance and performance — and to help see these through during the ‘shop drawings’ stage. 🌐

i: <https://www.pnb.com.my/en/merdeka-118-en>

ii: “Is 2,000 Feet Per Minute Enough”, by Rick Barker, Otis Elevator, CTBUH Conference on High Technology Buildings, São Paulo, Brazil, October 25-26, 1995 (also EW, March 1997).

Rick Barker is a Principal of Barker Mohandas, LLC, which he co-founded in 2000. Previously in our industry, he was Director, Technical Services at Otis World Headquarters, led VT at JB&B Consulting Engineers in NYC, worked for Delta Elevator in Boston (acquired by Otis) and for Westinghouse Elevator (acquired by Schindler).

Sean Morris, P.E., is a Principal of Barker Mohandas, LLC, joining the firm in 2010. Previously in our industry and similar industries, he was Design Department Manager at Lerch Bates Headquarters, Product Engineer for truck-mounted aerial lifts, Mechanical Engineer for Montgomery KONE in Texas, and Mechanical Engineer for material handling equipment.

The following information on the building and project team is from, “The World’s 118 Tallest Buildings”, Edited by Antony Wood, Council on Tall Buildings and Urban Habitat (now Council on Vertical Urbanism), 2022, p. 32.

About Merdeka 118

Location: Kuala Lumpur, Malaysia

Completion Date: 2022

World Ranking at Completion: 2

Architectural Height: 679 m/2,227 ft

Height to Tip: 681 m/2,233 ft

Highest Occupied Floor: 503 m/1,650 ft

Floors Above Ground: 118

Floors Below Ground: 5

Structural Material: Composite

Primary Function: Hotel/Serviced Apartments/Office

Credits

Owner/Developer: PNB Merdeka Ventures Sdn. Berhad

Architects: Fender Katsalidis Architects (design); RSP Architects Planners & Engineers (architect of record)

Structural Engineers: LERA Consulting Structural Engineers (design); Robert Bird Group (design); Arup (engineer of record)

MEP Engineers: Lehr Consultants International (design); KTA Tenaga Sdn Bhd (engineer of record)

Project Manager: Turner International LLC

Contractors: UEM Builders Berhad; Samsung C&T Corp.

Other CTBUH Consultants: Arup (civil); Permasteelisa Group (façade); Fisher Marantz Stone (lighting); Barker Mohandas, LLC (VT); RWDI (wind)

Other CTBUH Member Suppliers: KONE (elevators); Doka GmbH (formwork); Jotun (paint/coating); Dow (sealants); AcelorMittal (steel)

Source: CTBUH (now CVU)