ULMA

HIGH-RISE CONSTRUCTION

IMPORTANT:

Any safety provisions as directed by the appropriate governing agencies must be observed when using our products.

The pictures in this brochure are snapshots of situations at different stages of assembly, and therefore are not complete images. For the purpose of safety, they shall not be considered as definite.

All indications regarding safety and operations contained in this document must be strickly observed and fulfilled with all the preventive measures included in the labour legislation and the risk assessment issues, as applicable on the jobsite. ULMA Construction's Technical Department must be consulted on any changes of any type, since new calculations will be required.

Our equipment is designed to work with accessories and items produced by our company only. Combining such equipment with other brands is not only dangerous without having made all corresponding verifications, it also voids any and all our warranties.

The company reserves the right to introduce any modifications whenever consider necessary for the technical development of the product.

// INDEX

High-rise Construction

More references...

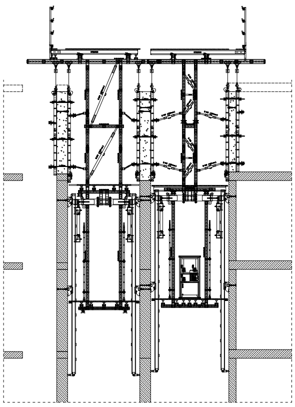
Q22 TOWER, WARSAW, POLAND

Contractor: Modzelewski & Rodek Sp. z o.o.
Architects: Kurylowicz and Associates with Buro Happold

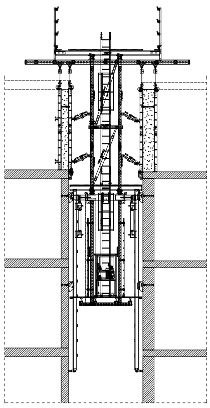
One of the highest skyscrapers in Poland, the Q22 tower is rising in the centre of the Polish capital. At 155 m high, this office building have 47 floors, 5 of which will be underground.

Consisting of 4 cores with different cross-sections, ULMA has provided a solution to each case using the same self-climbing systems: ATR.
ATR-P self-climbing systems were used for the first two cores. This solution includes three working platforms, and a bearing structure for the ORMA modular formwork.

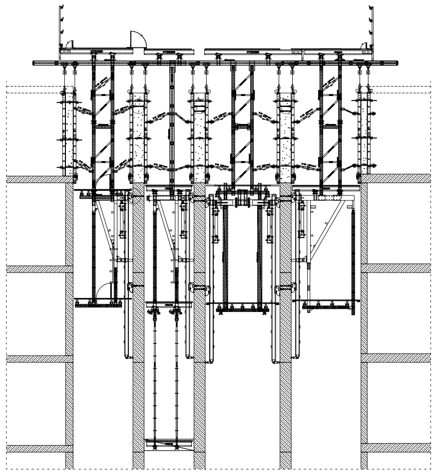
In the third core, the largest, the three different ATR configurations were combined: ATR-N (narrow openings), ATR-B (roll-back in the bracket itself) and ATR-P (wide openings).
For the fourth core, KSP shaft platforms were used in the interior and RKS rail climbing system on the exterior.



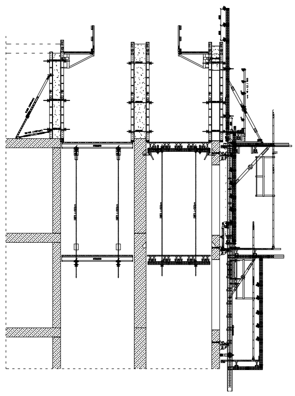
First core section



Second core section



Third core section



Fourth core section

In projects of this type worker protection from both falls and inclement weather is paramount, which is why the building perimeter was covered using 42 protective screens. The HWS system once again proved its ability to adapt easily to the exigencies presented by both the design and the surrounding environment, providing a material storage platform and adjusting to the irregular façade and slab geometries presented.
Other ULMA products used: BMK configurable climbing bracket, ORMA modular formwork, BRIO multi-purpose falsework, configurable MK heavy-duty truss.

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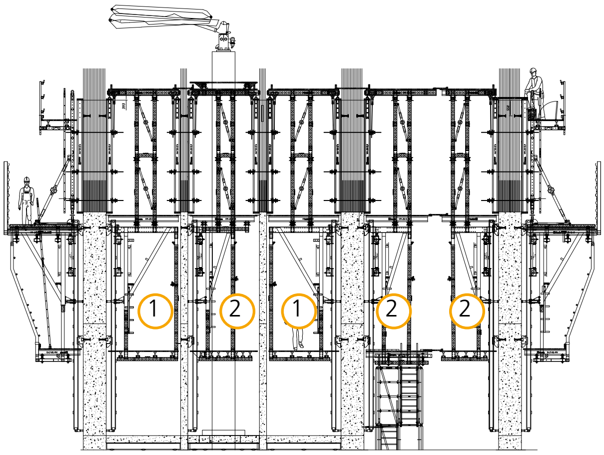
THE SAIL TOWER, JEDDAH, SAUDI ARABIA

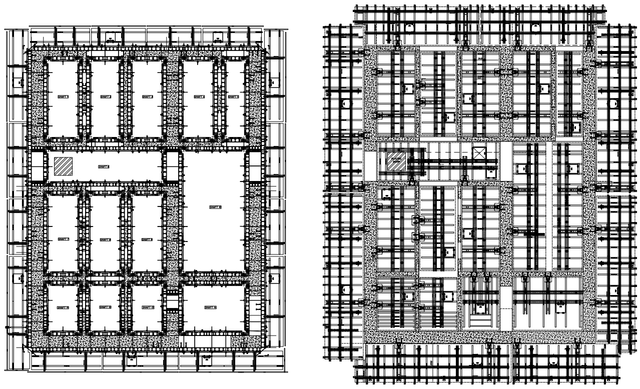
Contractor: BESIX Saudi joint venture with ALSAAD general contracting
Architects: The American architectural firm Perkins & Will

The Sail tower, with 67 storeys and standing at 240 m in height, comprises a 60,000 m² space, 600 car parking spaces, 242 rooms, 122 homes and services such as a luxury spa, a gym, an indoor swimming pool and restaurants. The entire building was designed to create an architectural environment with unique textures and lighting.

Of the different solutions designed, the ATR-B self-climbing brackets (1) used to build the core's outer walls particularly stand out. Both high productivity and comprehensive safety were achieved in all work phases, as the system allowed for formwork units of up to 50 m² to be assembled per bracket pair, whilst the hydraulic system can simultaneously lift up to 300 m² of formwork. Cost was also optimised by reducing the number of brackets to a minimum.

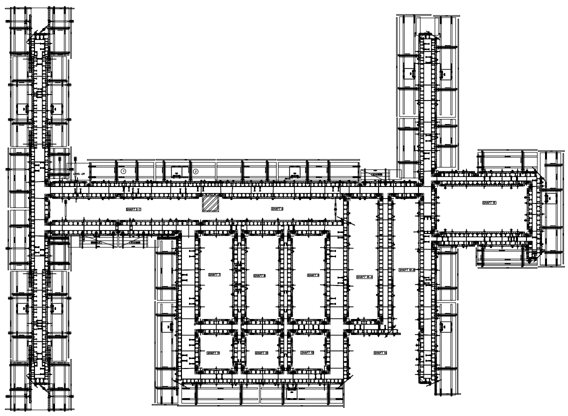
The concrete building core is characterised by multiple stairwells and lift shafts. ATR-N brackets (2), specially designed for use in small spaces with limited access, were employed in conjunction with MK system components to build the core structure.





Basement-level core

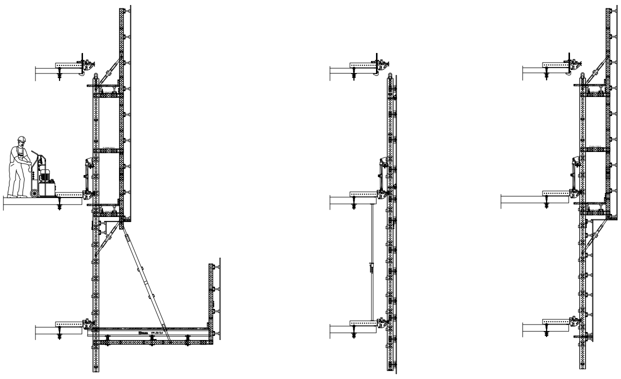
One of the special features of this project was the significant changes to the main core's geometry. The solution provided allowed for construction times to be minimised and optimised for each of these changes.



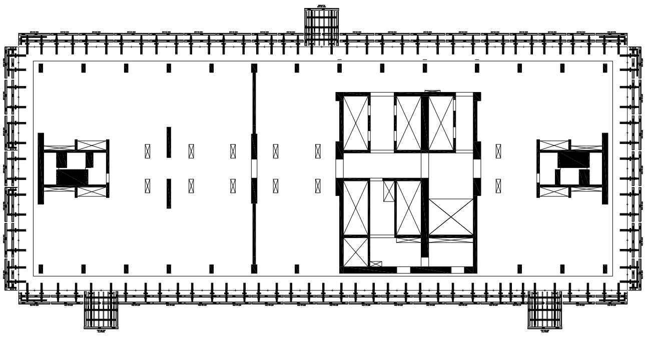
Core from storey 30 upwards

The working platforms were enclosed in order to ensure complete and constant worker safety. HWS perimeter protection was installed as an additional safeguard.

The following were also used in this project: BRIO scaffolding with its multiple configurations, in addition to stairs, walkways or mobile towers, enabling platforms and access to working areas.



Different types of HWS panels



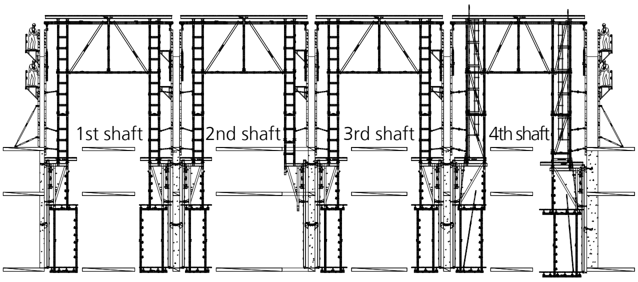
Distribution of HWS panels in the perimeter

TOWER C, HUDSON YARDS, NYC, USA

Contractor: Tutor Perini Building Corp.
Architects: Kohn Pedersen Fox Associates
PCArchitects & Planning Consultants

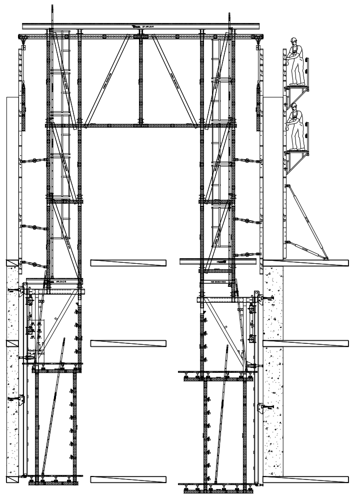
The Tower C, with over 270 m tall and total surface area of 157,935 m^2, is one of the biggest urban development plan New York has undertaken in the past two decades. It comprises 47 floors, with different areas which make the tower seem to tilt over the city.

ULMA built the core of the skyscraper, composed of 4 elevator shafts. The perimeter of the core measures 38 m by 17 m. The ATR self-climbing system was used for this, with an upper MK structure for hanging MEGAFORM modular formwork.

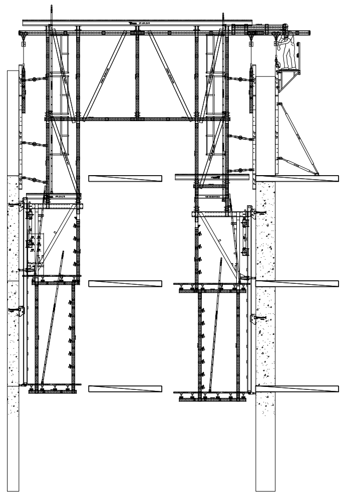


Lift shaft geometry

There is considerable height (up to 8 m) between the slabs of the first 6 storeys of the building. For pouring purposes, a temporary MK supplement was placed on the ATR structure, allowing for climbing in just two movements.
To build typical storeys, the additional MK supplement was very easily removed from the structure.
The high efficiency of our work procedures and the design of the system itself enabled 5-day cycles with 4.12 m pours.



Section of the first 6 storeys

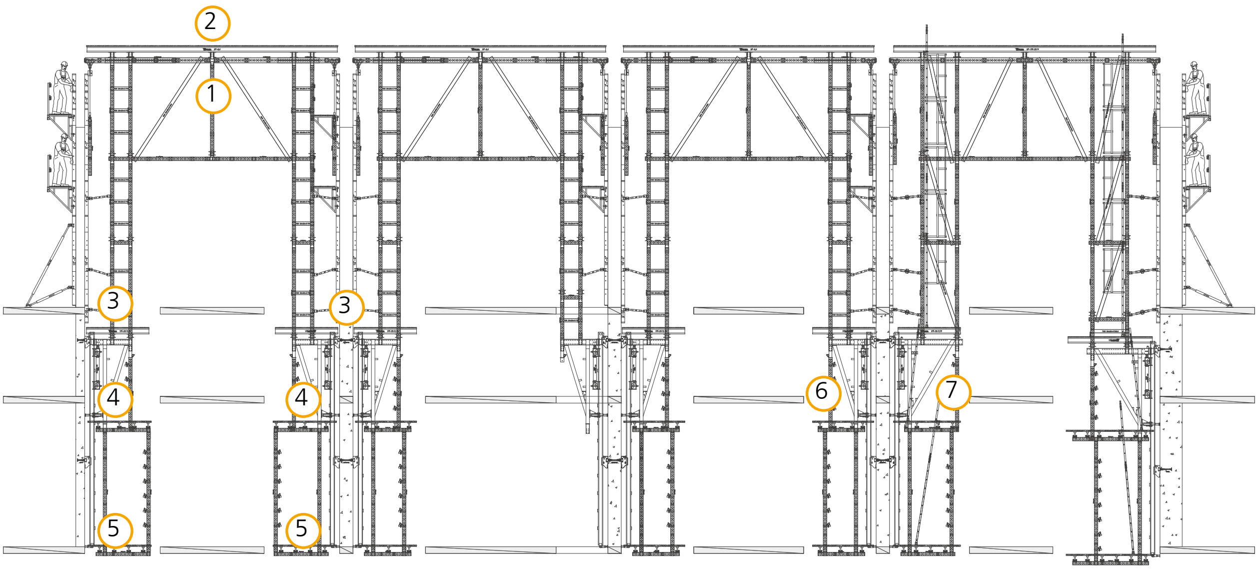


Section from storey 7 upwards

MK hanging structure

// Section of the shaft

. MK hanging structure (1): This structure holds the MEGAFORM formwork. The hoist allows for the panels to be stripped.
. Steel rebar storage platform (2), main platform (3), control platform (4), cone recovery platform (5).
. ATR climbing brackets: The ATR-N (6) and ATR-B (7) brackets are fastened to the core to hold the hanging structure.
. ATR lifting system: All the lifting elements and the hydraulic system allow for the entire unit to be lifted.



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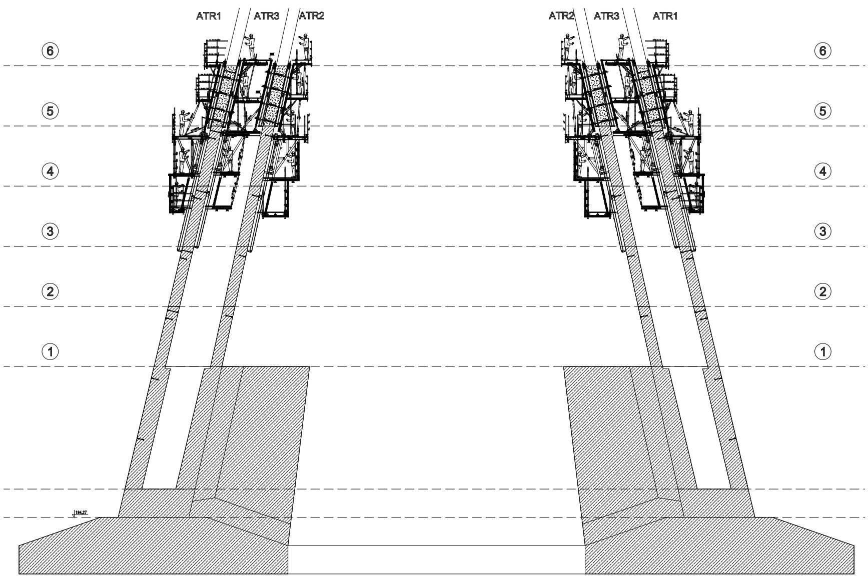
BRIDGE OVER THE WISLOK RIVER, RZESZÓW, POLAND

Contractor: Bilfinger Infrastructure C.o.

This cable-stayed bridge is the largest structure of its kind in the Podkarpacie region, with a length of 480 m and the singular feature of a reinforced concrete pylon 108.5 m tall.



The pylon was constructed in 26 phases: in the first 14, the pylon arms; in the following 3, the pier cap; and in the last 9, the cable-stayed portion was completed.
In the first phase of the project, the tower legs' foundations were poured using ENKOFORM VMK formwork. The structures, measuring 14.5 m in height with a T-shaped cross-section, were later used as a base to install the self-climbing systems. In order to ensure worker safety, the formwork system was equipped with four complete working platform levels.

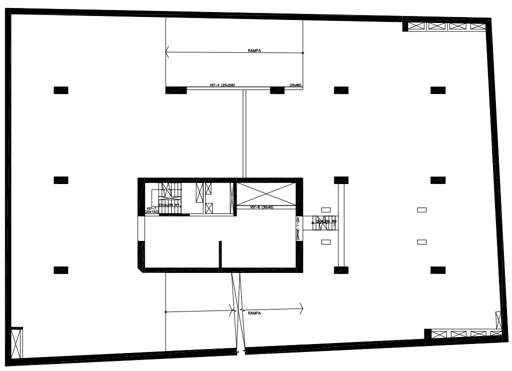
The tower legs are 5.75 m x 4.75 m box girders, with wall thickness varying between 1.30 m and 0.80 m. ULMA supplied two separate sets of formwork designed specifically for the ATR-B self-climbing system. The two sets of ENKOFORM panels, respectively measuring 4.8 m and 4.5 m tall, had a cycle time of only 6 hours.
The exterior formwork, weighing more than 30 tonnes, was supported by only four ATR brackets. The carriages installed on the brackets allowed the formwork structure to roll back up to 80 cm, providing easy access when installing the steel reinforcement and cycling the formwork.
The interior part of the self-climbing system, weighing 4 tonnes, only required two ATR brackets. Cycle times were thus reduced from 7 to 3 days.
Due to the presence of the cable anchors, the cable-stayed section of the pylon was strengthened with a steel core positioned inside the tower and joined to the wall.

ICHMA TOWER, LIMA, PERU

Contractor: GyM C.o.

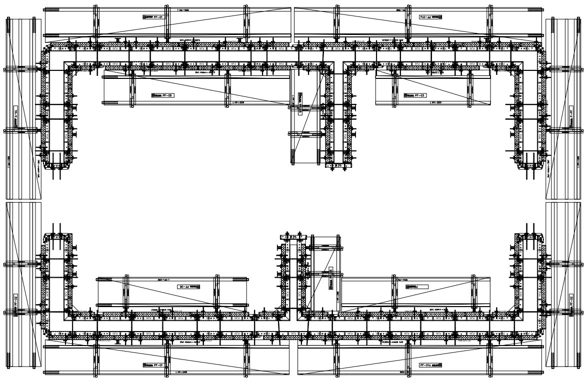
In an area that houses the country's principal business and financial headquarters, this new tower is built to LEED Green Building certification standards for greenhouse gas emissions and efficient resource use.

The building offers 30 m of vertical space below ground with 11 subterranean levels and 317 parking places, and 20 floors extending 69 m above ground.
With a uniform design for the central core all the way from the eleventh floor underground to the last floor aboveground, ULMA proposed ATR self-climbing formwork as a solution for construction "en bloc".

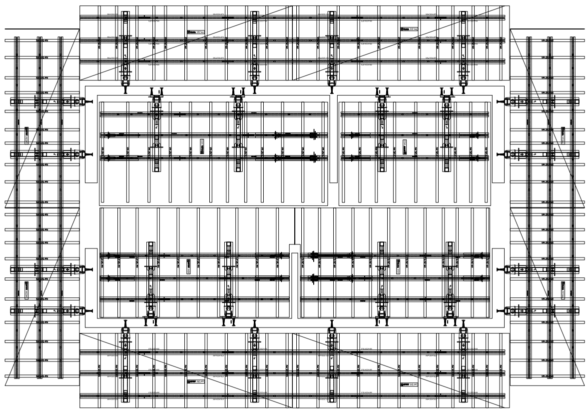


Geometry and building core

The ATR system, combined with NEVI modular formwork, allowed the 14.05 m x 8.20 m building core to be constructed without the need for crane assistance, given that it was integrated into the building structure. The system offers both mechanical and hydraulic means to lift large assemblies as complete units between pours.
The flexibility of the structure eased the various work phases and allowed for pouring cycles of only 4 days.
The entire working area is covered with platforms at all levels, thus guaranteeing safety and "total" isolation of fall hazards in the work area throughout all phases of construction.



Distribution of NEVI formwork H=2.7 m



Distribution of ATR brackets

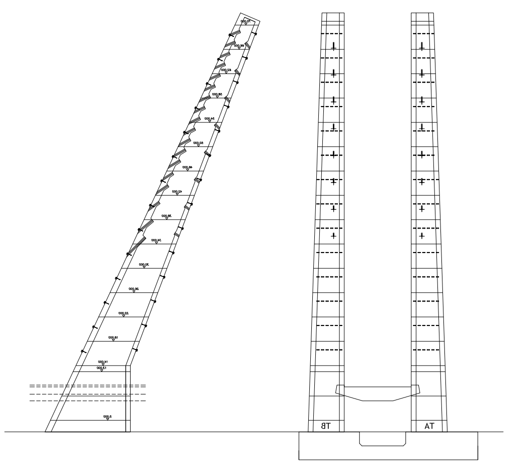
Being a space designed to house Class A+ offices, it was necessary to achieve an exposed slab finish of the highest quality for a surface area of 854 m². For the first time in the country, a modular aluminium formwork was employed, thereby making it possible to meet the architectural requirements for exposed concrete.

ESTAIADA BRIDGE, LINE 4 OF METRO, RJ, BRAZIL

Contractor: CCRB, Odebrecht, Carioca Engenharia, Cowan & Servix

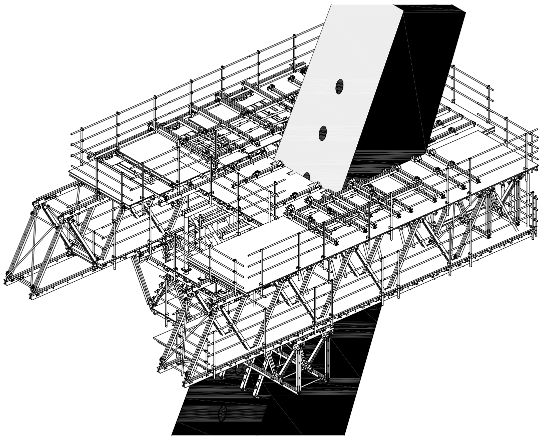
At 72 m high and 320 m wide, building the Estaiada cable-stayed bridge was one of the most spectacular, challenging and large-scale projects of the infrastructure plan for the 2016 Olympic Games. It was also the first time that a self-climbing system was used in Latin America for tilted pylons on a cable-stayed bridge.

The pylons are inclined at 23º from the vertical and are composed of two hollow, symmetrical towers varied on all four faces. To construct these pylons the ATR self-climbing system was chosen for its hydraulic assembly capable of lifting vertical structures without the need for a crane.

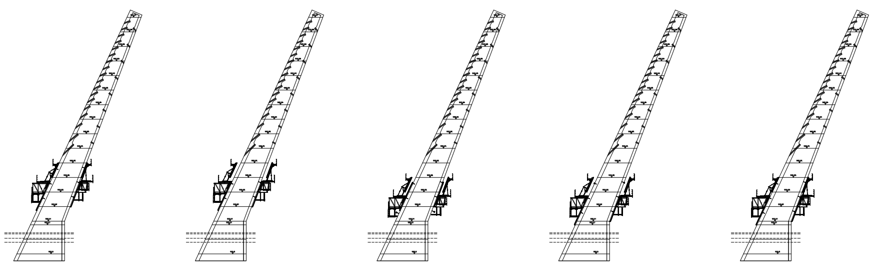


23º pylon tilting

The flexibility and productivity of the ATR system made it ideal for the project, given that the towers are differently inclined – one set at 25º and the other at 21º. The solution proposed by the ULMA engineering team was to incorporate a pair of MK trusses on the self-climbing brackets set in the inclined faces, supporting another pair of MK trusses run across the two lateral faces. The four trusses thus created a ring surrounding the pylon with work platforms elevated by the hydraulic equipment set on the climbing brackets. This design allowed the structure to adapt to the changes in each section without need for disassembly.



The ATR system, combined with the ENKOFORM VMK beam formwork, allowed the assembly to be moved successively in 4 m stages. After 19 pours, executed at a rate of one per week, the project was completed.



Lifting sequence

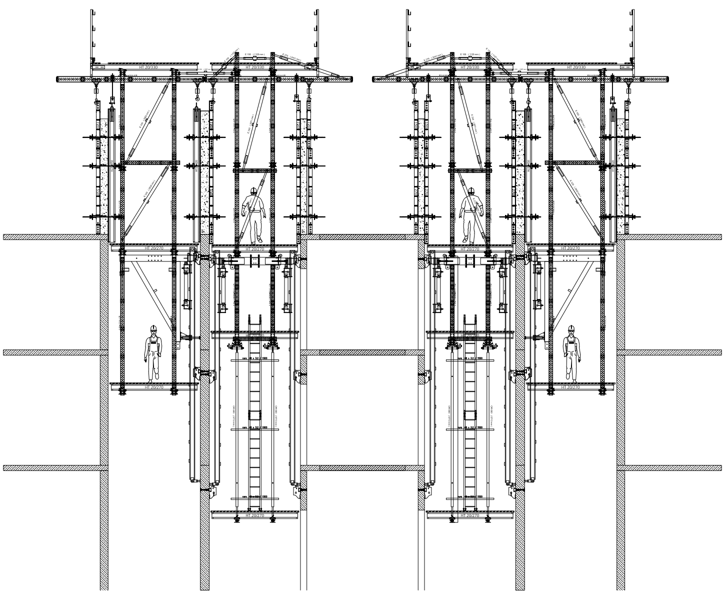
ULMA

EUROCENTRUM COMPLEX, WARSAW, POLAND

Contractor: ERBUD, Co

This modern building, complied with sustainable building standards, is composed of 14 storeys, with a total surface area of 67,000 m^2 dedicated to offices, green atriums, shopping centres, and two subterranean floors with parking for 615 vehicles.

The building core, with two stairways and lift shafts, was built with two selfclimbing systems. ATR-B self-climbing brackets were used for the stairways, and ATR-P platforms were used for the lift shafts. Both assemblies were built with the MK system.
To meet the demanding surface finishing requirements for the stairwells, modular ATR formwork systems were used for the exterior walls. The interior walls were completed using ENKOFORM beam formwork.



In order to build the transverse walls of the lift shafts without the need for a crane, pulley platforms were attached to the walers of the upper structure.
This setup allowed for easy assembly and disassembly of the hanging formwork. Trapdoors installed in the upper platforms facilitated installation of the stairways, which were prefabricated with landings and joining elements included.

Two hydraulic units and 12 cylinders with a 120 t collective lifting capacity were used to climb the complete structure, composed of ATR-B and ATR-P systems. Little more than half an hour was required for lifting.
The columns were constructed with metal circular formwork. The reinforced concrete slabs were built using ENKOFLEX beam formwork shored with EP props. T-60 shoring was used to complete a slab at height in the centre of the building.

JAVIER PRADO TOWER, LIMA, PERU

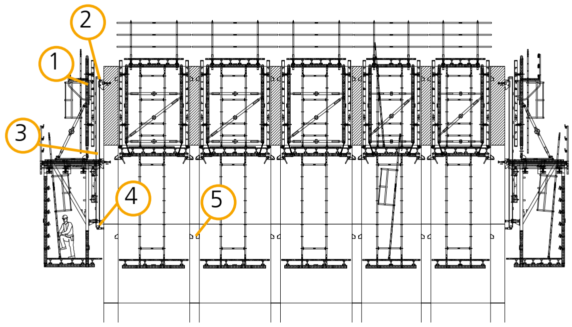
Contractor: HV CONTRATISTAS S.A.

This 27-floor office block is one of the tallest buildings in the city of Lima. With a constructed area of almost 45,000 m^2, it boasts administrative offices, 10 high-speed lifts and two emergency staircases.The tower is designed as a High Performance Building, based on the use of sustainable materials, interior air quality, water conservation, and energy efficiency.

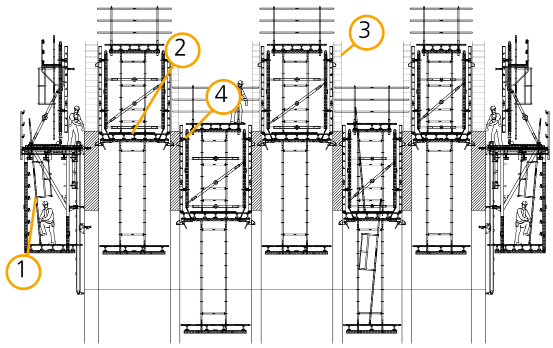
To build the main core, measuring 16.8 m x 8.1 m, ULMA supplied its ATR self-climbing system; because the geometry of the core was non-variable, it required a system which could provide "en bloc" formwork without the need for a crane from the basement (storey -9) to storey 19.

The ATR-B systems with 3 working platforms (main, concrete pouring and cone recovery), combined with NEVI modular formwork, allowed for construction of the outer core. Meanwhile, the inner core was built using the inner platform for KSP openings, with the support of abutment platforms using rocking support.

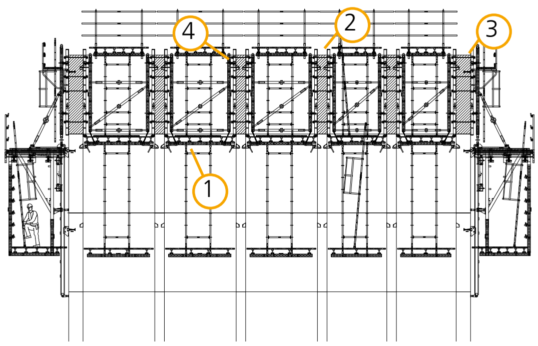
The steps to followed for this type of climbing are:
1. Offset the formwork for the mast lifting position.
2. Position ATR anchor brackets.
3. Lift the mast hydraulically to the next anchor.
4. Support the mast post against the wall.
5. Fold in the recoverable inner abutments of the KSP platforms.
6. Remove the lower ATR anchors.



1. Raise the ATR platforms to the next anchor.
2. Raise the KSP platforms alternately to facilitate the steel rebar process.
3. Position the ATR anchors and the KSP posterior recovery abutments on the formwork.
4. Withdraw the push-pull props on the KSP platforms still to be lifted, to move the formwork closer and position the posterior recovery abutments on the formwork before lifting.



1. Lift the remaining KSP platforms.
2. Position the formwork.
3. Place the formwork tie rods.
4. Pour concrete.



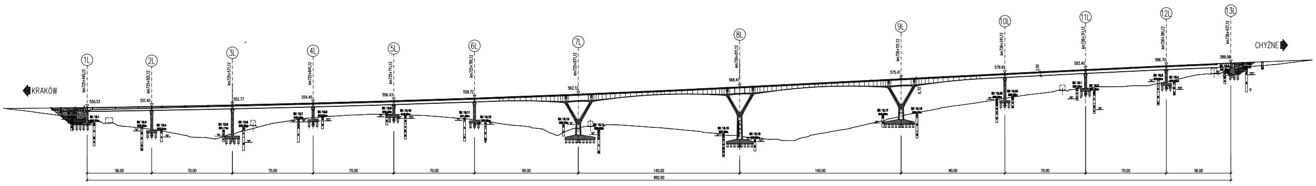
The following were also used: ENKOFLEX wooden beam formwork, COMAIN modular manuportable formwork, BRIO multi-directional scaffolding and the EP certified steel prop.

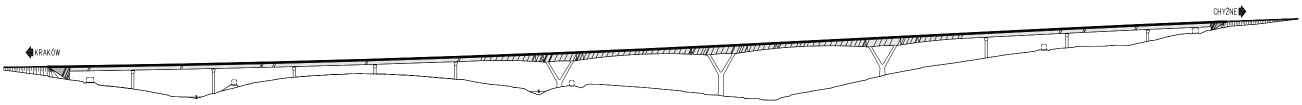
VIADUCT 21, EXPRESSWAY S7, POLAND

Contractor: Porr Polska Infrastructure C.O.

Expressway S7 is one of the principal transportation routes in Poland, and its construction in large part will consist in improving National Road 7. This project forms part of the European plan to relieve traffic congestion on trans-European routes.Stretching 992 m in length, Viaduct 21, which forms a part of Expressway S7, will join the Polish regions of Lubień and Rabka Zdrój.

Two types of piers were designed to support the bridge. The shorter spans, with uniform deck dimensions, received rectangular-section piers with curved sides. Y-shaped piers were designed for the larger spans, which range from 90 m to 120 m in length with deck thickness ranging from 3.5 m to 6.7 m. The tallest pier reaches 43 m in height without counting the deck above.





The Y-shaped piers were built in three distinct phases. The hollow rectangular bodies were built in 4.56 m pours with the VMK timber formwork system set on configurable BMK climbing brackets. At the base of the column head, where the arms of the Y begin, single-sided UCAB-EUC formwork was used with the BMK brackets. This combination made it possible to create a support structure on which the 6.40 m wall formwork panels could be set. The last section of the inclined structures was completed with the ATR self-climbing system and BMK brackets, together capable of matching exactly the predetermined angle of inclination. The self-climbing system was formed with MK trusses and a unique configuration of cylinders placed on the exterior face of the column arms.

The other pier type, with rectangular cross-section, curved sides, and a truncated-cone column head, was built in two phases. An adjustable circular formwork system was set to obtain the proper curvature, while the ULMA universal VMK system, adaptable to any geometry, was employed for the column head.

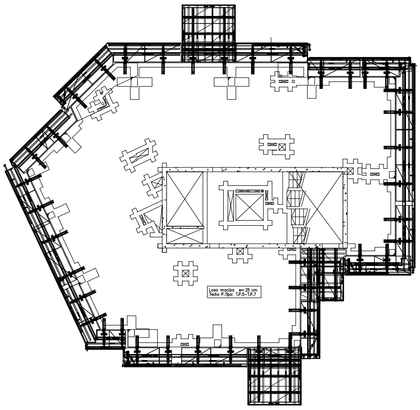
GARELLANO TOWERS, BILBAO, SPAIN

Contractor: EXBASA OBRAS Y SERVICIOS S.L. + AMENABAR
Architects: Richard Rogers + FIARK

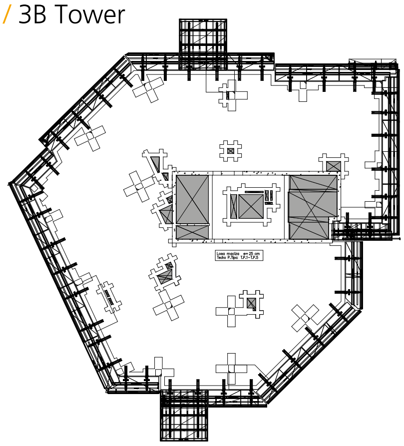
Designed by the famous Italian architect Richard Rogers, the tallest residential buildings in northern Spain now stand at 78, 88, and 98 metres tall, respectively.

Each of the three towers are unique, designed with irregular hexagonal geometries, projections, and continuously changing lines; the surface areas of each of their floors measure 400 m², 510 m², and 550 m², respectively. The complexity of the buildings presented a demanding challenge for ULMA in both the design and the assembly. In the end, three distinct sets of panels were made, customised to match the contours of each tower, protecting a total vertical surface area of more than 3,600 m².

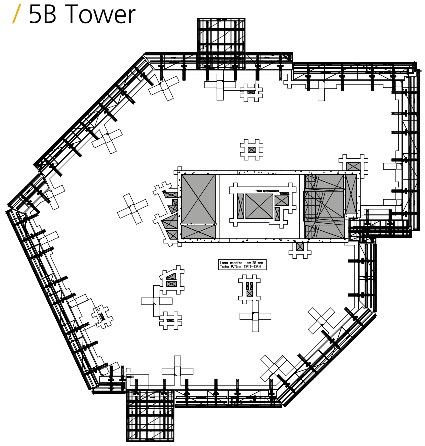
/ 1B Tower



/ 3B Tower



/ 5B Tower



Distribution of HWS panels in each tower

ULMA supplied HWS perimeter protection screens with plywood enclosure and a self-climbing system with hydraulic lifting. By means of this, the project was made safe, crane usage was minimised and, consequently, the expected construction time was reduced. It also prevented both individuals and construction materials from falling from height and served as a parapet wall against the wind and the visual effect of height.

Using the HWS panels measuring 12 m high and between 2.45 m and 5.20 m wide, workers were able to cover four floors of the buildings at a time. The entire panelling necessary for each tower was raised in less than 6 hours. The HWS system allowed three lower floors to be stripped while the formwork was assembled on the floor above. Moreover, a 3.9 m cantilever platform allowed all of the formwork equipment to be moved from floor to floor almost effortlessly.

The solid slabs of the buildings were built with the RAPID recoverable formwork system and SP props. ORMA modular formwork was used for the columns and walls forming the building cores, which are composed of lift shafts, stairwells, and the mechanical systems infrastructure.

HARBORSIDE TOWER, JERSEY CITY, NEW JERSEY, USA

The Harborside Tower, with a total height of 214 m, is now the tallest residential building in New Jersey. It is designed with 763 residences with spectacular views of Manhattan. The project combines contemporary design, a great number of services, magnificent views, and a convenient location with easy access to public transportation, in addition to creating hundreds of jobs in the city of Jersey.

The HWS perimeter protection screen was the system used as a safety element for this tower. Formed of light, straight-section panels without working platforms, it covered the storey under construction plus the three storeys below.

The panels were covered with wooden VM-20 beams and reinforced netting. This gave the protection system an aesthetic finish with minimal weight, and minimal stress on the anchors.

Although the geometry of the building is irregular, with storeys staggered every 8-10 levels, the protection provided by HWS was completely seamless, preventing the fall of even the smallest of debris or other objects. To achieve the tight seal necessary for this project, strips of rubber were used around panel perimeters and between the panels and slabs.

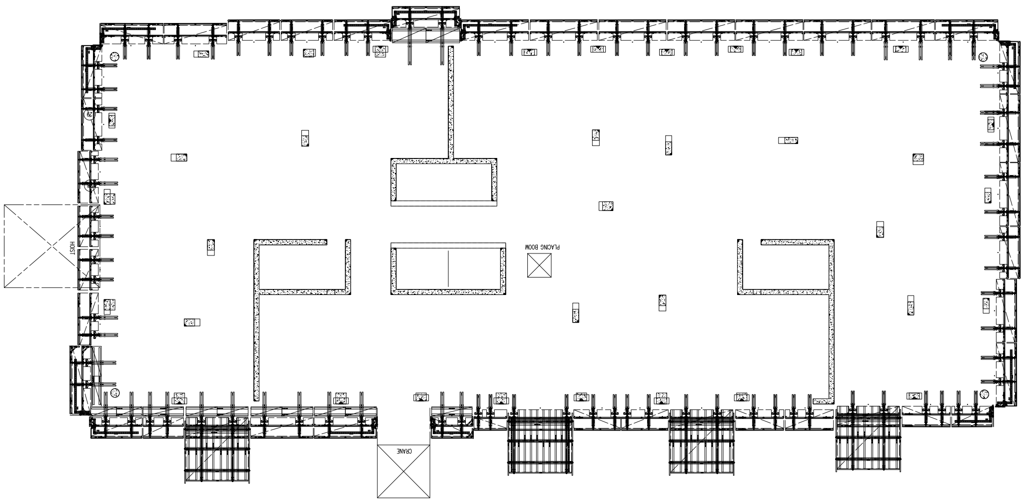
PROVOST SQUARE, JERSEY CITY, NEW JERSEY, USA

Contractor: FORSA CONSTRUCTION
Architects: SLCE Architects

The complex is composed of three buildings. The first, called The Morgan, was designed with 417 flats on 38 storeys, with a ground floor measuring 4,880 m^2 destined for commercial use, along with a car park of 371 spaces.

In order to ensure a safe working area, the building perimeter was covered with self-climbing HWS protection.
The assembly measures 13 m in height and 3.6 m in width, with different configurations possible: as a purely vertical protection system or with an added working platform for material handling.

The panels were covered with reinforced netting to prevent falls of not only people but objects of any size, to protect the slabs under construction from wind and inclement weather, and to allow the entry of natural light.
The vertical structures, such as the core for stairwells and lift shafts, were built with the lightweight formwork MEGALITE, operable without crane assistance.



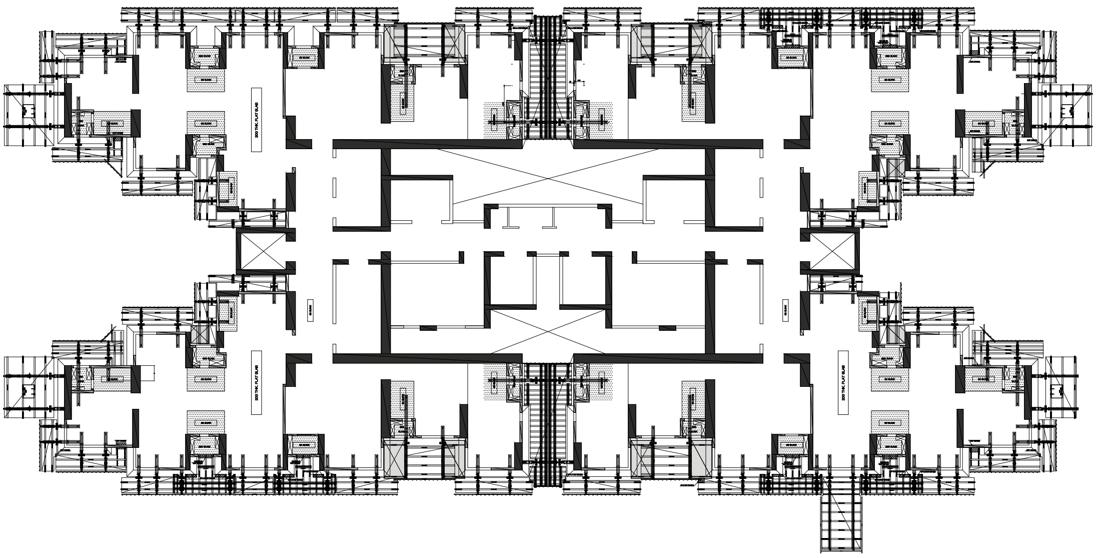
Distribution of HWS panels, floor Nº36

THE PARK TOWER 1, MUMBAI, INDIA

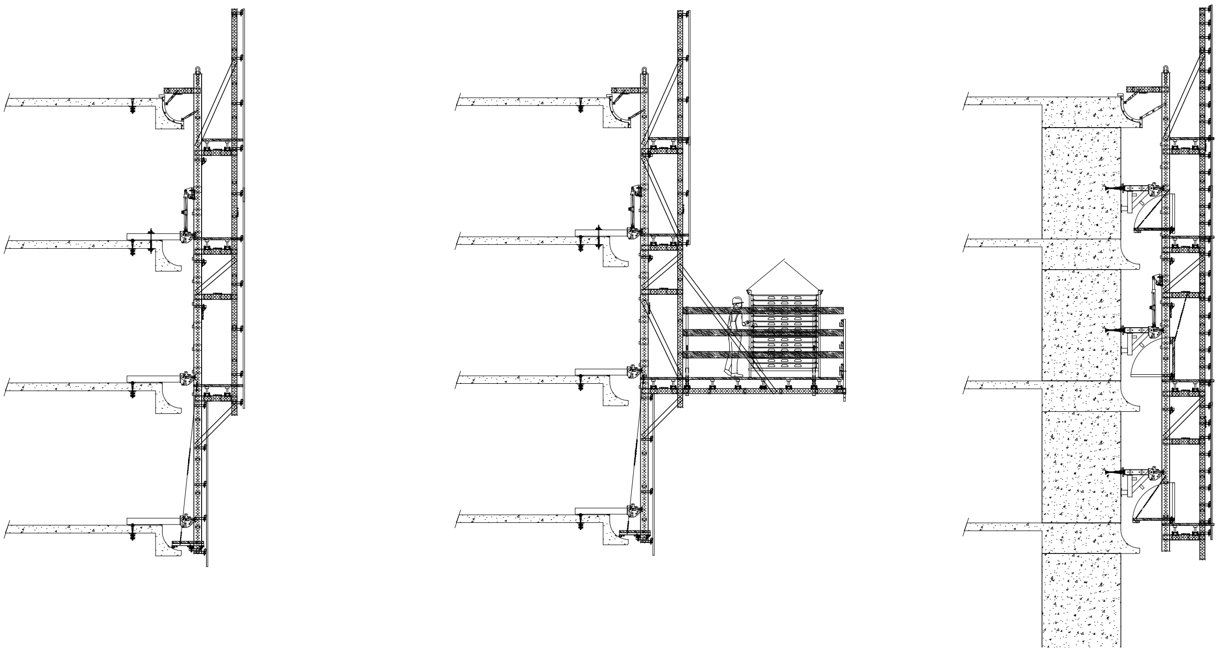
Contractor: BILLIMORIAN

In the Blue Moon housing complex, south of Mumbai, Moon Tower 1 rises up at a height of 268 m distributed across 90 floors. These homes boast spectacular views of the Arabian Sea.

This tower is characterised by its unique geometry, maintained on most of its storeys. To protect the building's perimeter, ULMA employed its HWS perimeter protection, with panels of different widths and anchor cantilevers in areas where a customised design solution was required.



Distribution of HWS and RKS panels



Standard panel, HWS with work platform and panel with cantilever anchors

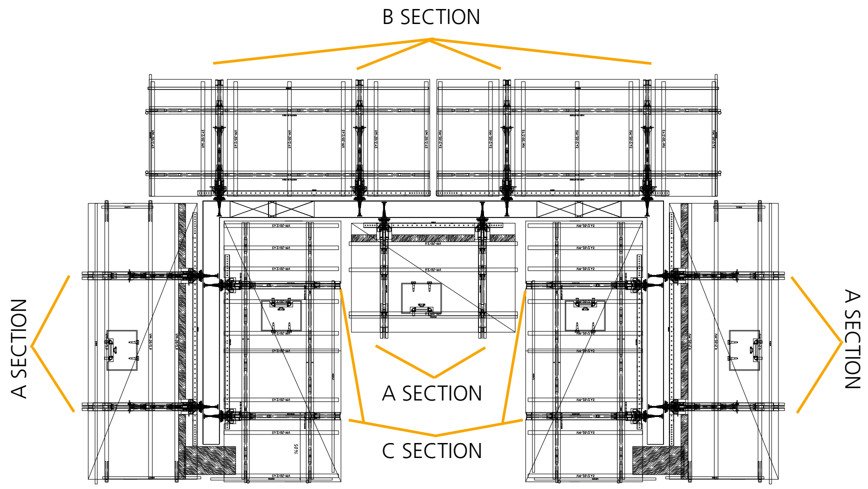
The HWS panels supplied were coated with perforated sheet metal, which both prevents individuals, objects and rubble from falling and allows for the passage of light. Strategically-positioned material extraction platforms were also used.
This project was characterised by its multiple HWS solutions. One of its most special solutions was the integration of formwork for the perimeter beam in the HWS unit.
When constructing the perimeter walls, the RKS guided climbing system combined with wooden beam formwork were used; for the slabs, CC-4 aluminium modular formwork, the SP steel prop and ENKOFLEX wood beam formwork were used, in addition to NEVI light modular formwork for columns.

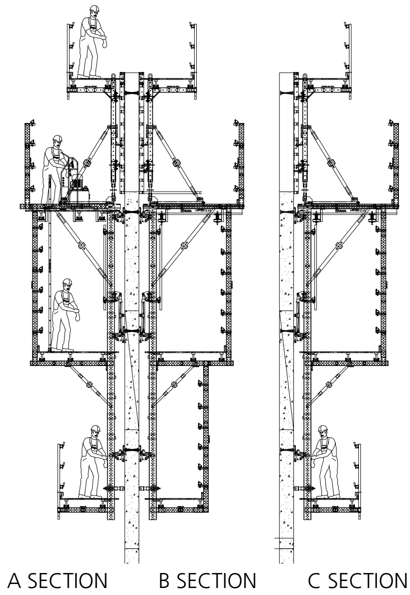
BOLUETA TOWER, BILBAO, SPAIN

Contractor: Construcciones SUKIA + Construcciones Conscesgal
Architect: V arquitectos

Measuring 95 m and with 28 storeys, Bolueta Towers is the world's tallest sustainable skyscraper. Part of a complex of 361 homes spread across two skyscrapers, the following aspects were taken into account for its construction: energy saving, acoustic and thermal comfort, indoor air quality and the use of natural materials.

To construct the central core of lifts, ULMA supplied its RKS guided climbing system, which provides high on-site performance and allows for safe lifting, even in adverse weather conditions. Thanks to the system's versatility, it was also possible to combine lifting the unit (7 RKS elements) using a hydraulic system and lifting using a crane.





The RKS system was provided for both the outer and inner parts of the core which, combined with ORMA modular formwork, allowed for 3 m pourings and a work pace of one storey per week.

The wide platforms and handrails of the four working platform levels (main, drive, concrete pouring and material recovery) also allowed workers to move around completely safely.

AURA TOWER, TORONTO, CANADA

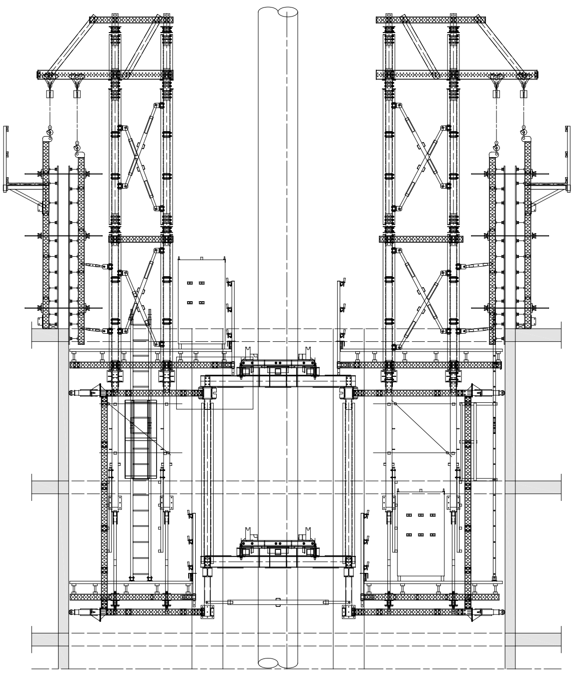
Contractor: Verdi Alliance
Architects: Graziani + Corazza Architects

/ This project has been carried out with ULMA concrete formwork systems

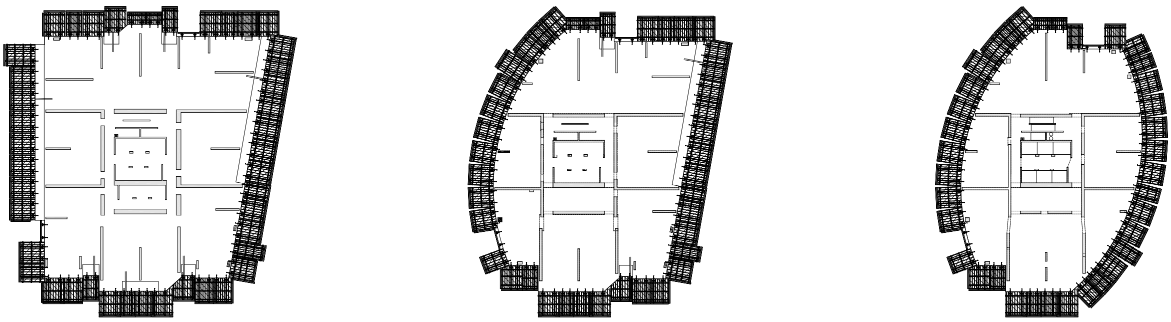
With 272.8 m and 78 floors, the Aura Tower is one of the tallest residential building in Canada. The total area of 124,490 m² is divided into 16,720 m² for commercial premises and 107,770 m² for residential space.

It has used the ATR self-climbing system as inner shaft shuttering. Consisting of two sub-structures, the concrete placing boom and the formwork, the entire assembly climbed up altogether driven by the same hydraulic power unit.

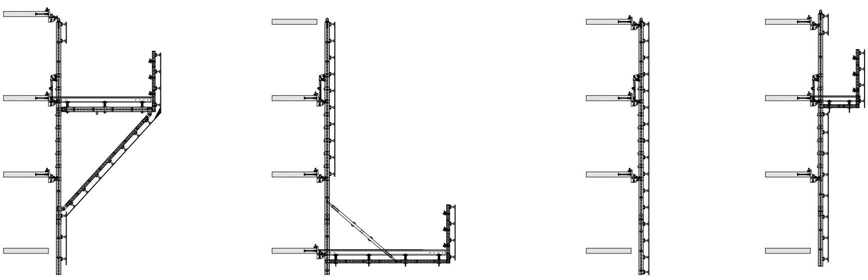
Despite of limited space for both structures, it has been installed on 18 m² a full hydraulic formwork elevation system: MK Structure, climbing brackets, concrete placing boom, hydraulic power unit and anchors.



The HWS Hydraulic Windshield System protects the perimeter against adverse weather conditions and prevents objects from falling from higher levels. Moreover, different HWS structures enable the storage of material around the perimeter of the building, and thus minimise the use of the crane.



The perimeter and shape vary in levels 46 and 56. With 52 HWS screens and 3 different layouts, the entire perimeter was protected.



Different panel types: standard "Debris" with working platform, storage platform type, straight and with narrow platform.

CC-4 aluminium formwork was used for the slabs of the underground parking and ORMA Modular Formwork on single-sided EUC truss structures for wall construction. The upper slabs were built with truss tables shored on ALUPROPs.

UPSITE TOWER, BRUSSELS, BELGIUM

Contractor: BPC – Valens
Architects: Yves Lion, A2RC Architects SA, Ateliers Lion Architectes Urbanistes.

With 142 m height and 42 floors, the Upsite Tower is the tallest residential building in Belgium and the first skyscraper built in Brussels in the last 30 years.

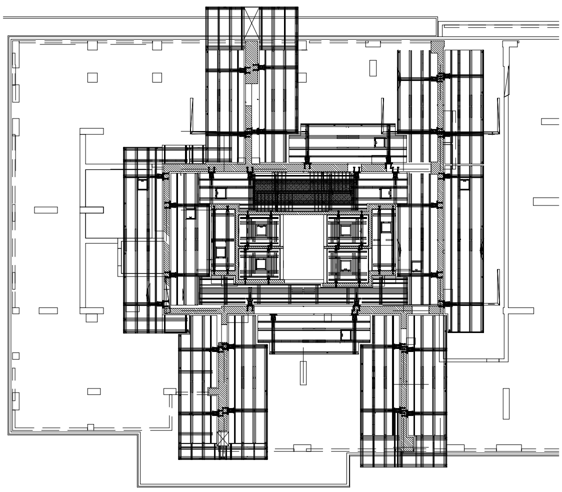
Site requirements were challenging: complex façade, interconnected inside shafts, changing floor geometry, limited use of crane...

ULMA supplied a complete solution including the ATR self-climbing system, the HWS perimeter protection (with assembly service and on-site assistance) and CC-4 aluminium slab formwork.

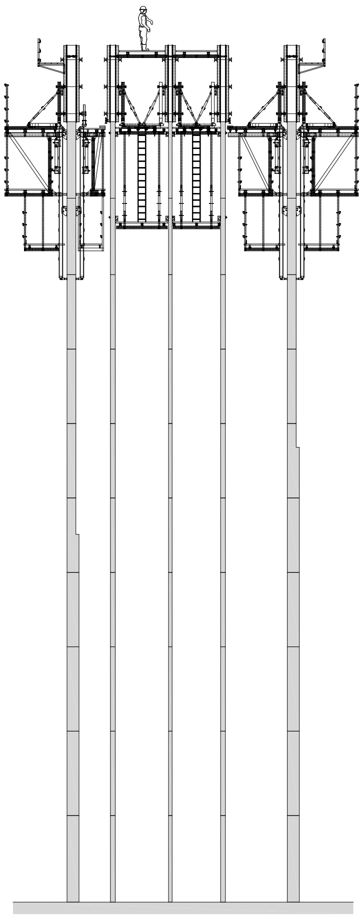
Both the self-climbing structure and the perimeter protection were designed with the MK system, capable of setting up customised structures for any client or project.

The core of the building was built with the ATR self-climbing system and narrow platforms for inside shafts. ULMA's versatile beam-based vertical formwork was used.

The working cycle of the self-climbing system was completed within 7 days.

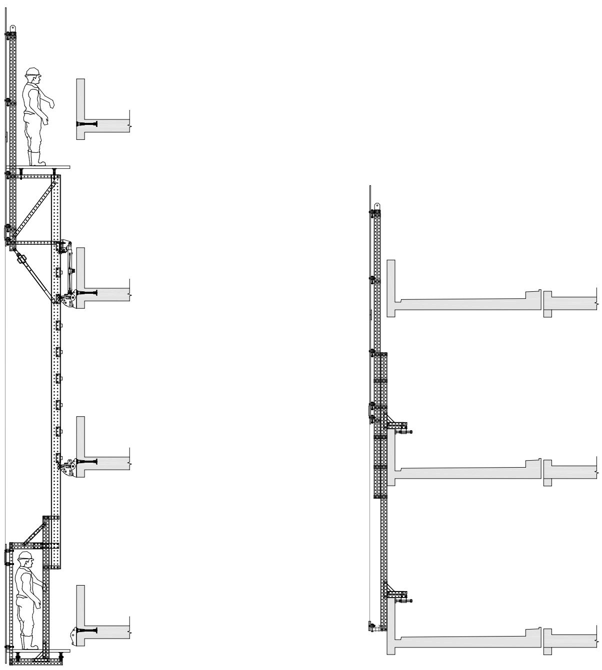


12 m long platforms with narrow platform solutions for inside

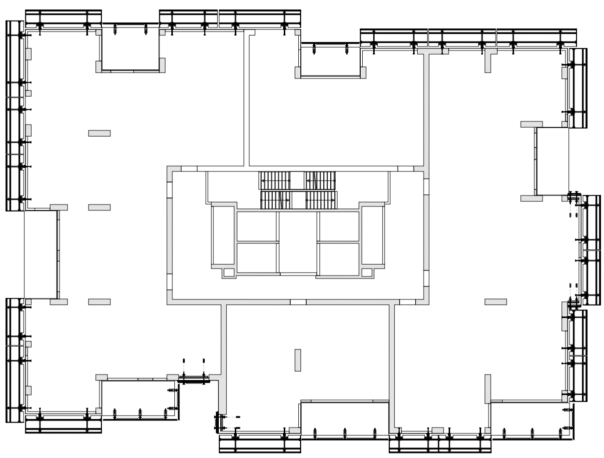


Self-climbing outside brackets and inside platforms

The HWS perimeter protection ensures workers' safety at the slab edge with large hydraulic lifting screens around the perimeter of the building.



Panels anchoring in changing slab perimeter geometry



HWS screen layout

ULMA

THEATRE PARK, TORONTO, CANADA

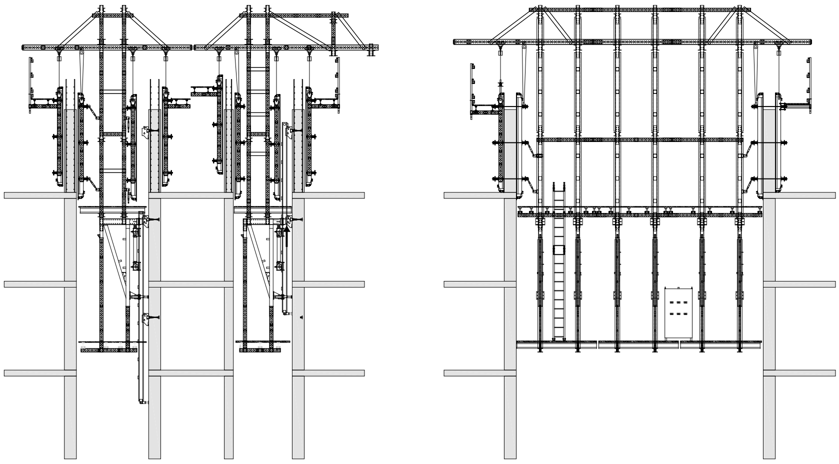
Contractor: Harhay Developments
Architect: Architects Alliance

/ This project has been carried out with ULMA concrete formwork systems

Spectacular 164.3 m tall residential building with 47 floors above ground and 5 underground floors located in the historic district of Toronto. The Theatre Park with 20,116.8 m² residential and 643.6 m² commercial space offers several facilities such as a gym, terrace, event room and outdoor swimming pool.

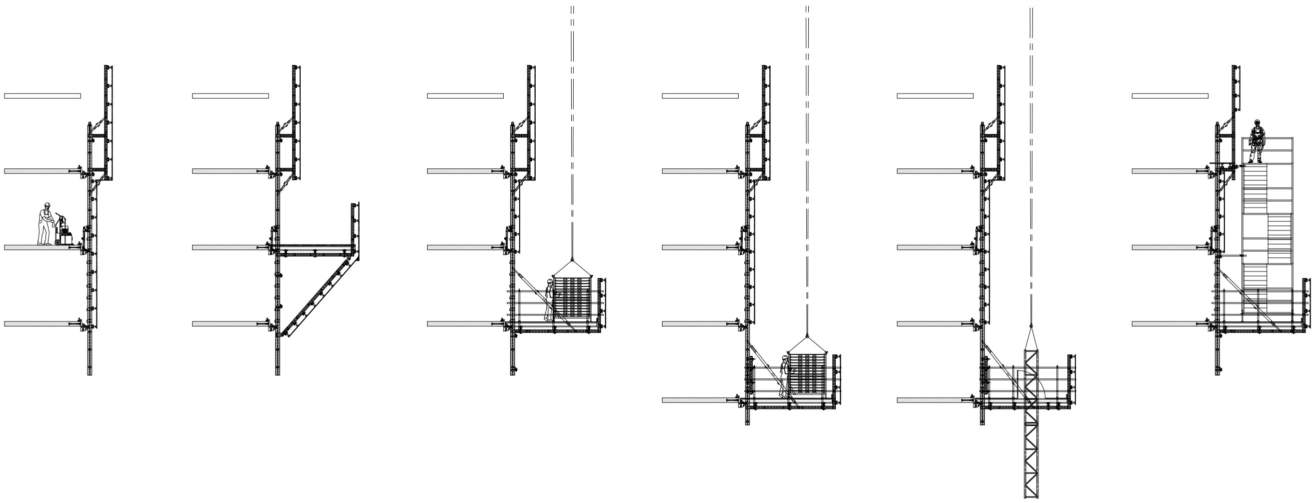
ULMA supplied ATR-N self-climbing equipment for the construction of the inner shaft and HWS perimeter protection with different types of panels. The slabs were built with formwork tables on galvanised steel props.

Outside formwork hanging from the upper MK structure of the ATR system



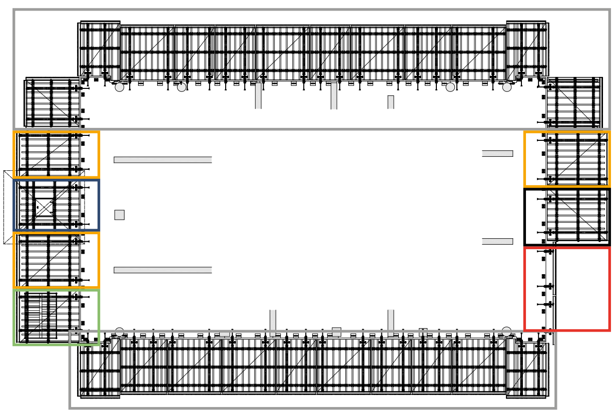
The vertical formwork fitted with a system of trolley hoists and normal hoists hangs from the ATR-N structure

Each panel consists of two vertical MK-180 walers (masts) to which all components are assembled and which guide the structure.



Different HWS screens:

- Straight: for protection.
- Debris: enables the safe movement of workers around the building perimeter and working from the platforms as well as providing protection against falling objects from higher levels.
- Storage: protects 3 or 4 levels and serves for the storage of material.
- With trapdoor: moreover to the protection of 4 levels, it enables the installation of service lift masts.
- With ladder: enables access to the different levels and provides protection.



- Straight panel
- Debris panel
- Storage panel 1
- Storage panel 2
- Trapdoor panel
- Ladder panel

Layout of 30 panels by types

POŁANIEC POWER PLANT, POLAND

Contractor: ABM Solid

The biomass power plant was built in just one year and is an example of the state-of-the-art of Polish energy industry.

Apart from a biomass tank, standard and trapezoidal walls, as well as roofs for the warehouses were built.

ULMA used for the first time in Poland the ATR-B self-climbing system for the construction of 70 m high lift shafts. This system was capable of solving problems of limited site space and complex crane operations for the formwork movement.

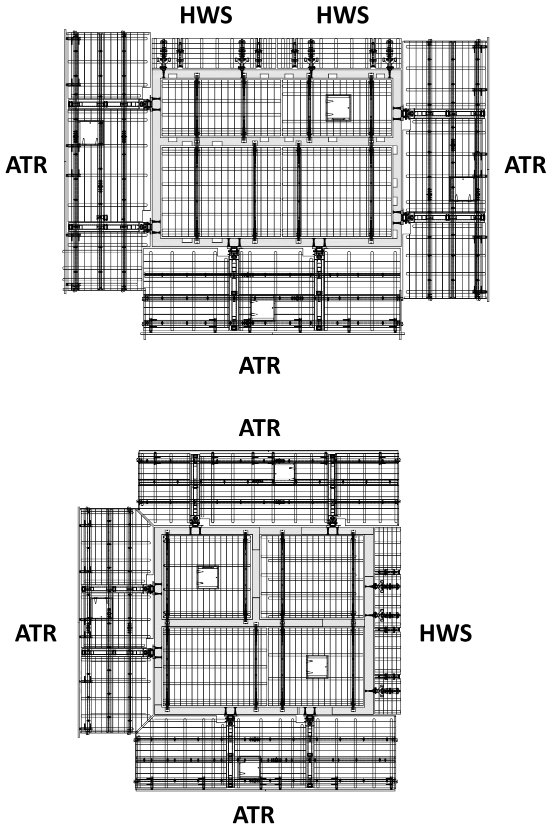
Each lift shaft has three sides, needing a total of 6 hydraulic cylinders.

The formwork was moved 19 times per lift shaft in a cycle of 5 days.

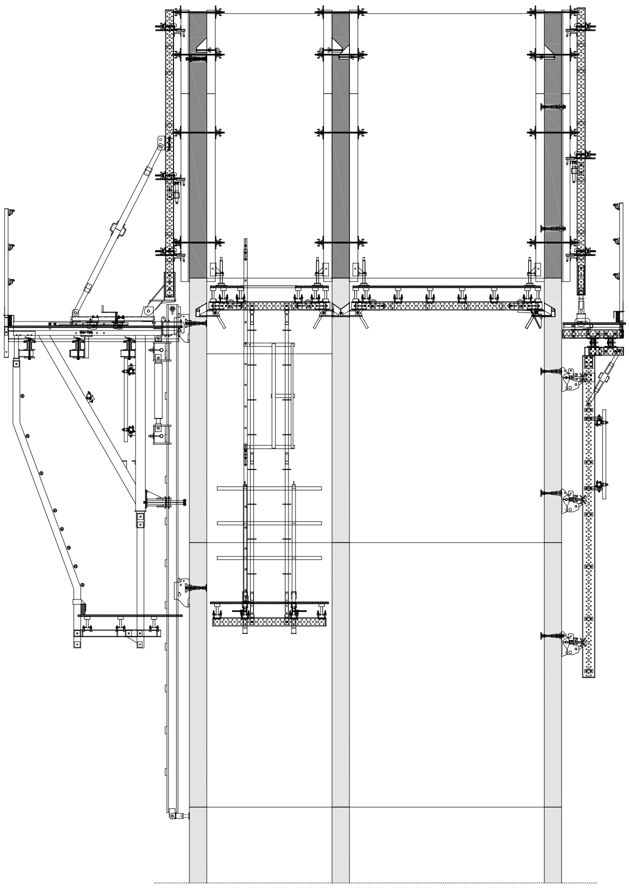
The vertical communication of the building was solved with the construction of two lift shafts.

The ATR system works without crane and under adverse weather conditions. Moreover, its large platforms and handrails ensure workers' safety.

Control platform of the ATR system



Main platform layout for the ATR and HWS systems in the two lift shafts



The solution for the limited space between the lift shaft and the steel structure of the building with ATR self-climbing system, two KSP shaft platforms and HWS system with formwork.

ONE BRYANT PARK, NYC, USA

Constructor: Century Maxim

366 m height and 200,000 m² make up the glass tower of the new Bank of America headquarters. With marked vertical lines, the moving of sun and moon change the perception of the building. This 55 storey office skyscraper is considered one of the most environmentally friendly buildings, as it was mainly built with recycled and recyclable materials.

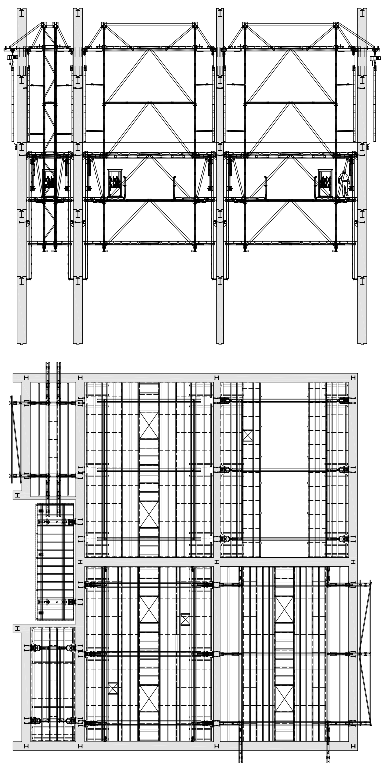
For this project, the ATR self-climbing system was used from the underground levels of the structure on up to the top floor.

The core was built 6 to 8 levels below the structure of the building (steel structure, slabs, etc.). Therefore, ATR self-supporting structure was assembled at the beginning of the construction, and the first 8 levels were built around that structure before starting to build the core with the ATR system.

ATR-P self-climbing system, self-supporting

The ATR system increased productivity by carrying out different tasks simultaneously. The ATR, unlike conventional climbing systems, reduces the requirement for crane time considerably, moreover to quick and easy methods of operation.

With this system, and MEGAFORM modular formwork, the walls of this building were built in work cycles of 8 days.



Core with self-climbing structure and formwork

The self-climbing technique consists in a hydraulic system that enables automatic lifting by successive movements of structure and masts.

ULMA

DO MARAO MOTORWAY, NORTHERN REGION, PORTUGAL

Contractor: UTE Infratunel (Somague and MSF) and Construgomes as subcontractor

The new 15 km long stretch of the A4 motorway is located in the north of Portugal. It consists of 12 bridges and 6 tunnels to ensure traffic safety in the mountainous area between the cities of Amarante and Vila Real. The 911 m long and 29 m wide V3 is with 8 spans and 7 piers the largest viaduct. The bridge deck sits at its highest point of 150 m on 126.6 m high pier.

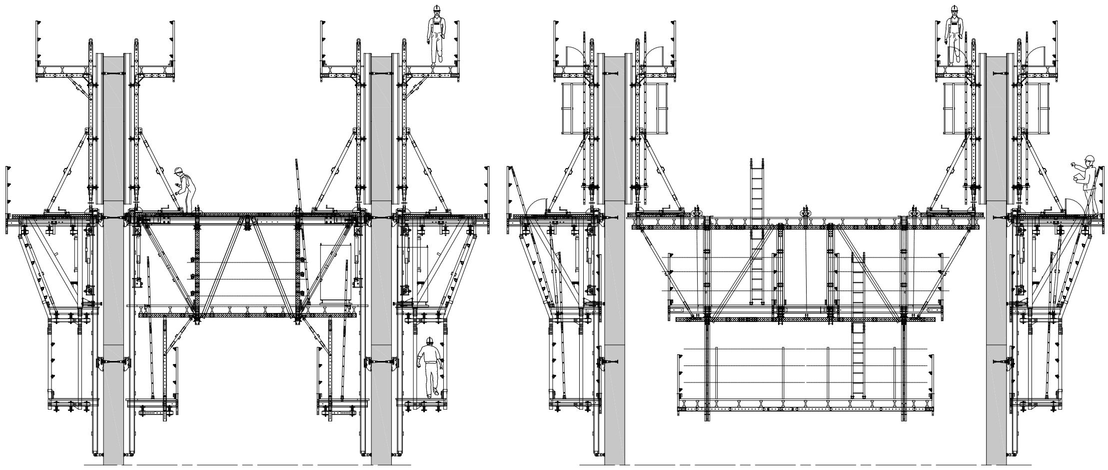
ATR self-climbing system and BRIO scaffolding access stair in pier construction

The hollow piers with a maximum height of 126.6 m and a constant section of 12 x 10 m up to 30 m changed at that point and continued as two I-cross section piers.

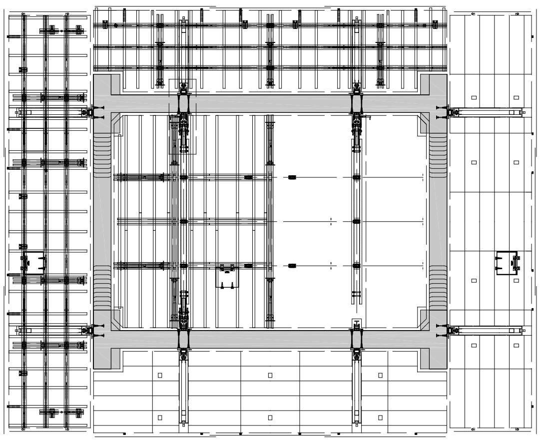
Only the ATR-B and ATR-N self-climbing systems were capable of offering a solution for the enormous cross section and height of the piers.

The ATR system meets highest safety requirements with its large platforms and steel railings at all levels.

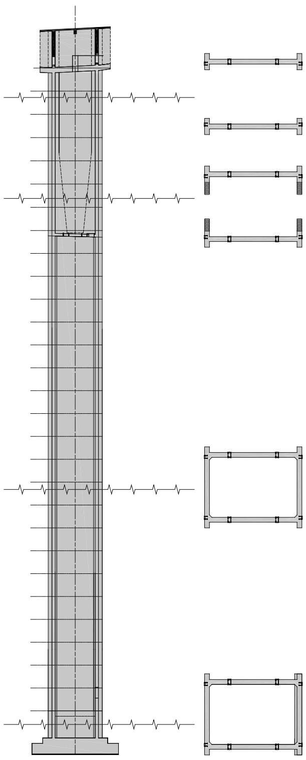
It moreover provided a fast pace of work with 4.5 m high tiers and cycles of 2 and occasionally 3 pours per week.



Piers P3, P4, P5 and P6



Plan view of the main platform of piers P1, P2, P3, P4, P5 and P6



Formwork adjustment and plumbing system with stripping system of up to 70 cm

SyV TOWER, MADRID, SPAIN

Contractor: Sacyr
Architects: Carlos Rubio Carvajal and Enrique Alvarez-Sala Walter

The 236 m high SyV Tower has 59 floors with 1,600 m² each to which must be added further 6 underground basements of 7,500 m². This project is located in northern Madrid and completes one of the most unique urban development plans of the city.

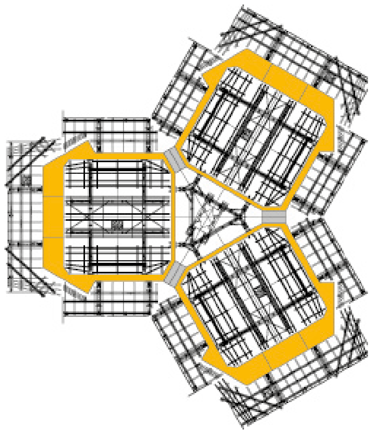
A five star luxury hotel with 500 rooms occupies the first 33 floors while the rest are offices.

The lift shaft was built with ULMA's most advanced technology for the construction of skyscrapers - the self-climbing ATR system - in this case supporting the structure from the 6th floor onwards.

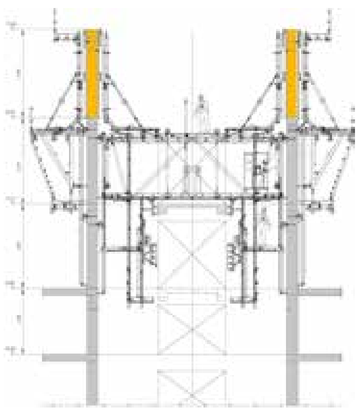
The ATR-B system outside and ATR-P system inside, combined with wall formwork ENKOFORM V-100, enabled the construction of large vertical walls with changing and complex geometry.

The execution cycle of works was less than a week per floor.

The concrete placing boom attached to the inner structure was lifted along with the self-climbing platform.

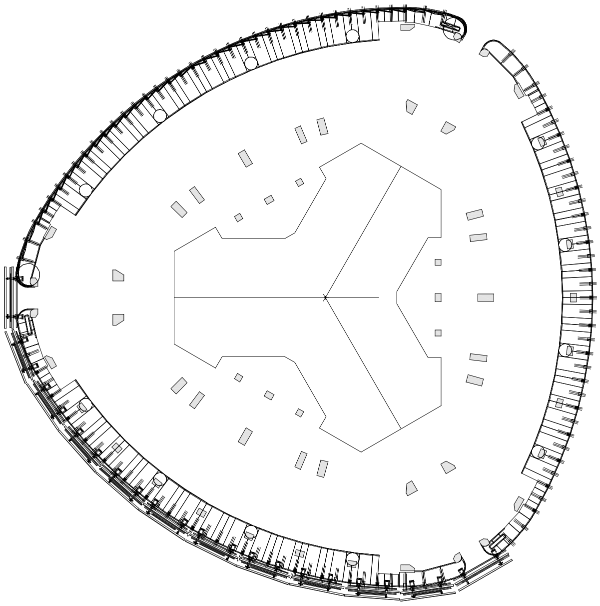


ULMA engineers adapted the formwork to the 4 different shaft sections.



Shaft of complex geometry

The HWS system was used as perimeter protection of the building during the work process. The use of this system enabled full protection of the slab under construction and those immediately above and below it.

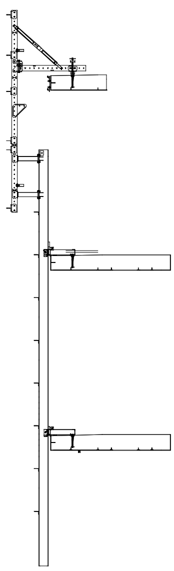


Top view layout of HWS screens

The 6 underground floors and the first 6 above ground were built with CC-4 aluminium slab formwork on ALUPROPs ensuring highest efficiency.

Other ULMA products used:

. ORMA modular formwork for walls and rectangular columns.
. COMAIN for parapets and footings.
. CLR - circular column formwork.



HWS screen

FOUR SEASONS BUILDING, TORONTO, CANADA

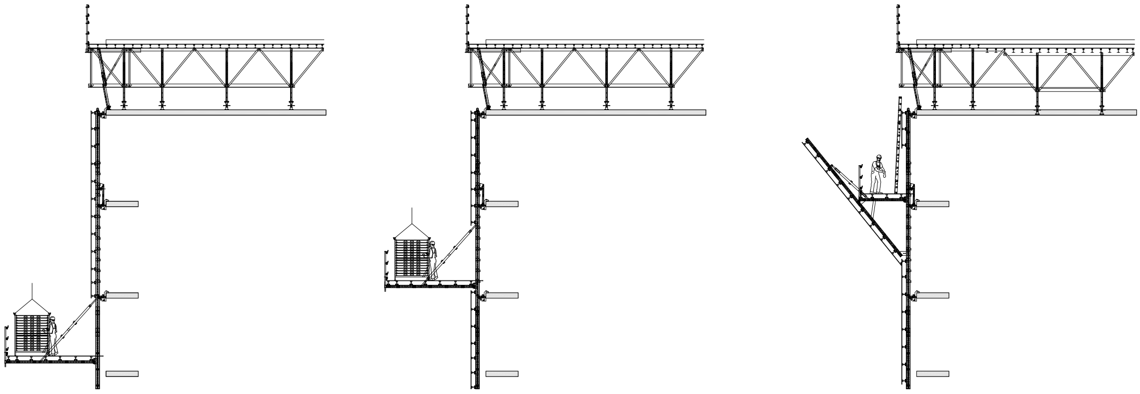
Contractor: Verdi Alliance

/ This project has been carried out with ULMA concrete formwork systems

This 204 m tall building with 57 floors records to have the most wanted and expensive square metres in town. Its location in the city centre required additional safety measures. This is the first construction project where the self-climbing HWS hydraulic windshield system has been employed.

The protective screens around the building perimeter serve the dual purpose of providing safety for the slab under construction and the next two, and platforms for access and storage.

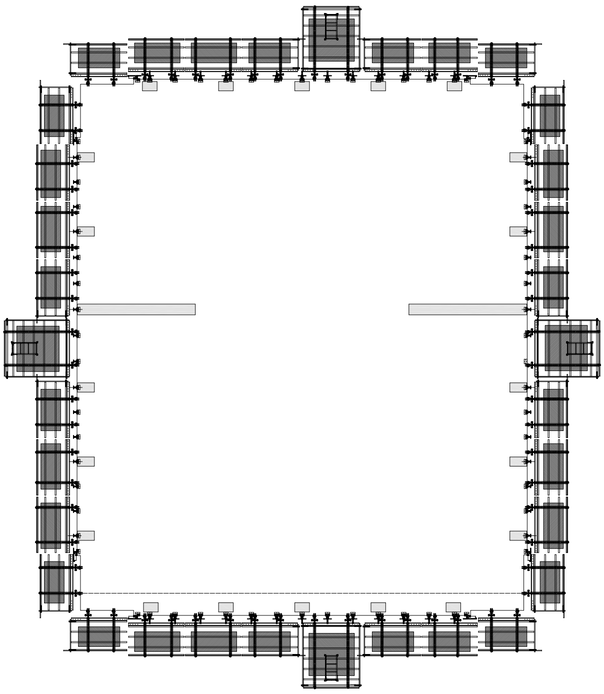
Moreover, the health and safety of passers-by is ensured on the busy streets surrounding the building, since its geometry is specifically designed to prevent objects originating from the use of large slab formwork tables from falling over the edge.



Different HWS screens

In this project, inclined panels with built-in storage platforms were used to enable the moving of already used material to other floors. A mobile hydraulic power unit avoided the use of cranes for the climbing of the screens and other materials resulting in significant time and cost savings.

Mobile hydraulic power unit and HWS cylinders for the movement of the panels. The windshield system is designed to work with the highly flexible MK system which allows using standard walers and simple joints to accurately adapt to the building geometry and to generally fulfil all requirements of the project.



Layout of the different panel types around the building perimeter

HWS screen climbing process

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