

Site report

RS 850 tubular column system in use for the first time during the construction of Frankfurt's OpernTurm

Putzmeister



From a higher position, the PM stationary boom also distributes the concrete to hard-to-reach parts of the ceiling formwork

Ed. Züblin AG has erected an imposing high-rise project, the OpernTurm, in the centre of Frankfurt am Main at a breathtaking speed. Including its base plate, around 55,000 m³ of concrete had been placed in the 170 m tower. The main players in the speedy construction progress were, among others, Europe's largest truck-mounted concrete pump M 63-5, a stationary high pressure concrete pump BSA 2109 as well as a stationary boom MX 32-4, on newly developed tubular columns with a climbing system.

The new construction of tower building and podium in front is located precisely opposite Frankfurt's Alte Oper, which is steeped in tradition, and blends harmoniously into the surrounding architec-

ture. In the three basement floors, the OpernTurm has 580 car parking spaces, and approximately 67,000 m² office and business space is rented over the 42 upper floors. The project developer was the American estate agency Tishman Speyer, which had already formed a striking image with the construction of the Frankfurt MesseTurm in the metropolis on the River Main. As the main contractor, Ed. Züblin AG was in charge of turnkey-ready construction work. Construction began in summer 2007 and was completed by the end of 2009.

Massive base plate concreted with 5,660 m³ in 72 hours

The order for concrete delivery, both for the base plate and for construction of the building itself, with 46 floors, was given to the concrete pumping service

„Die Pumas“. After extensive foundation work by Ed. Züblin Spezialtiefbau GmbH (in consortium), three truck-mounted concrete pumps from the pumping service situated in Lorsch with 42, 52 and 63 metre booms took on the task of concrete delivery for the base plate with a thickness of 3.0 – 4.5 m in July 2007. Due to the highly restricted space available, setting up the large boom concrete pump was far from easy: while there was space for the M 42-5 and M 63-5 with one-side support on a makeshift ramp or on the very busy Bockenheimer Landstrasse, the third machine had to be set up on a specially-erected heavy-load frame. Three consecutive days and nights were allocated for placing the 5,660 m³ concrete (strength class C 30/35). The Putzmeister M 63-5, the largest truck-mounted concrete pump in Europe, alone delivered 2,000 m³ of the total volume

within 24 hours without any problems. In consideration of performances at the neighbouring Alte Oper, a 20-hour break from concreting operations, which lasted several days, was accepted. It was thanks to finely-balanced concreting logistics that concrete was transported by truck mixers through the heavy inner-city traffic without any obstacles.

The concrete pumping service also has stationary booms and pumps for large projects

In addition to a large fleet of truck-mounted concrete pumps (33 machines), the pumping service „Die Pumas“ also has five stationary concrete pumps and seven stationary booms. This leaves the company in the best possible position to take on concrete delivery tasks for demanding high-rise projects. At Frankfurt's Opern-Turm, „Die Pumas“ were using for the first time the new Putzmeister tubular column system RS 850 with a simplified, automatic climbing system that carries the stationary boom with a reach of 32 metre.

Central constructional elements of the OpernTurm are two building cores, which accommodate the stair wells, lift shafts and supply lines. During the building phase, the two cores were always two to three stories ahead of the floors. Both the two cores and the floors were made of concrete of strength class C50/60 with a maximum grain size of 16 mm. The concrete batches, delivered from three mixing plants, were regularly monitored on the construction site by a laboratory.

Concrete placing boom stands freely 16 m high on the tubular column without lateral guides

During construction of the OpernTurm, the stationary boom climbed upwards, in line with construction progress, not inside one of the building shafts but between the two cores, through holes in the floor. A tubular column and boom were installed after the third floor was completed, i.e. at the height of level „0“ (ground floor). Since then, the concrete



The MX boom stands freely and without ballast on the tubular column, 16 m high

placing boom had stood freely, without ballast, on a tubular column 16 m above the last floor guide. Due to its higher position, the boom not only reached every point of the floors, each of which are 1,800 m², but also the formworks of the building cores, which were three levels higher. The stationary boom was connected to the stationary concrete pump by means of an approximately 80 m long ground line (DN 125). Later on, as the building height increased, the ground line was continued as a riser up to 170 m.

New tubular column system automates the climbing of concrete placing booms

The boom tubular column was held by four lightweight floor corner brackets. Each weighing approximately 35 kg, these guides can comfortably be carried to the next but one floor after the climbing procedure – heavy floor frames are not an issue with this system. In the Putzmeister RS 850 tubular column system, the climbing cylinders and locating bolts that

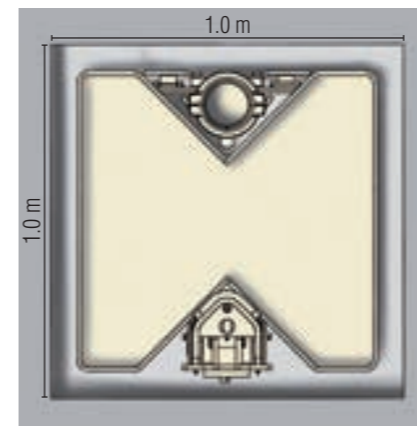


The BSA 2109 H D is connected to the 170 m high riser by means of an 80 m long horizontal delivery line



Easy-to-move floor guides keep the boom tubular column laterally fixed

are otherwise customary are replaced by integrated extending feet and the climbing system that is secured to the tubular column and also rises. With the new tubular column system, the delivery line is also no longer guided sideways along the column but integrated in the tubular column. When the floor is broken through, therefore, only one square opening is required. Let the placing boom climb one storey, set up the formwork, position reinforcement, concrete and strip the formwork after 12 hours – on average, one storey is completed every four days.



Tubular line and climbing system are integrated in the „M“ profile

The RS 850 system – well thought out right down to the last detail

New tubular column

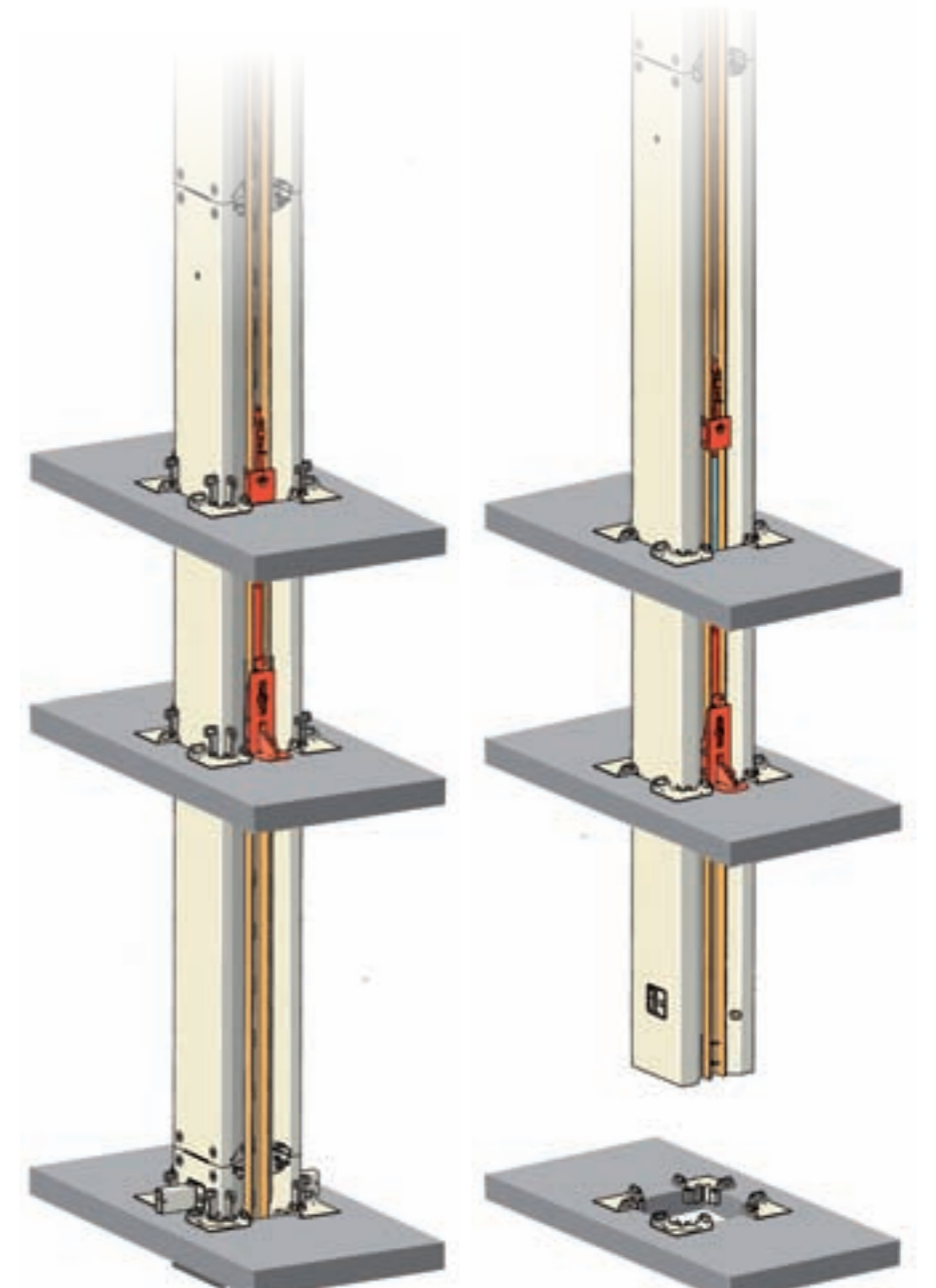
The RS 850 tubular column system comes with 3 m, 6 m or 9 m columns as standard, with standard pipeline lengths. Different tubular columns for setting up the boom pedestal and arm assembly are not required. The double M tubular column profile requires only one simple, square cut-out (1 m x 1 m) in the floors. When an adapter is used, existing booms can continue to be used with the RS 850 tubular column.

Automatic climbing procedure

The climbing system integrated in the tubular column profile allows automatic climbing in the building. Once the climbing procedure is complete, the climbing cylinder is drawn upwards along the climbing bar, using a cable winch.

Simple column connection

Instead of the procedure common up until now, in which the tubular columns had to be laboriously screwed together, re-usable pins are now used in the RS 850 system. They can be simply inserted by hand and secured.



Simple climbing thanks to the climbing device secured on tubular column



When the floors were concreted, approximately 100 – 120 m³ concrete was placed within three hours, high above Frankfurt

The shut-off valve attached at the end hose prevents concrete from dropping out

In order to place the average of 100 – 120 m³ concrete in the ceiling formworks, the concrete workers needed around three hours. To concrete a core (30 – 50 m³), one and a half hours. The stationary concrete pump at the base of the OpernTurm was operated by an experienced machine operators. On top of the formwork, a construction site employee controlled the MX stationary boom by radio remote control. The two machine operators stayed in contact by walkie-talkies so that the output could be adjusted immediately. The boom and tubular column climbing

process, which was largely automated, was also controlled by site workers. The climbing procedure from one storey to another, including placing the corner brackets, took approximately 1.5 hours. Concrete was delivered right up to the top level by a ZX pipeline that was around 250 m long in total. This version is permitted for use with pressures up to 130 bar. In fact, the Putzmeister BSA 2109 H D in rod side operation at the Frankfurt OpernTurm „only“ required around 90 bar concrete pressure at delivery rates of 35 – 40 m³/h.

Technical data BSA 2109 HD

Engine:	6-cylinder Deutz
Drive performance:	200 kW
Stroke:	2.,100 mm
Delivery cylinder Ø:	200 mm
Max. delivery pressure (piston side):	91 bar
Max. delivery output (piston side):	95 m ³ /h
Transmission ratio (piston side):	i = 2.3
Max. delivery pressure (rod side):	152 bar
Max. delivery output (rod side):	57 m ³ /h
Transmission ratio (rod side):	i=3.8

Technical data MX 32-4

Number of arms / folding type	4 / Z-folding
Reach	31.7 m
Weight in total	approx. 8,500 kg

Die Putzmeister Gruppe

Betontechnik PCT · Mörteltechnik PMT
Rohrtechnik PPT · Wassertechnik PWT
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