

## Site report

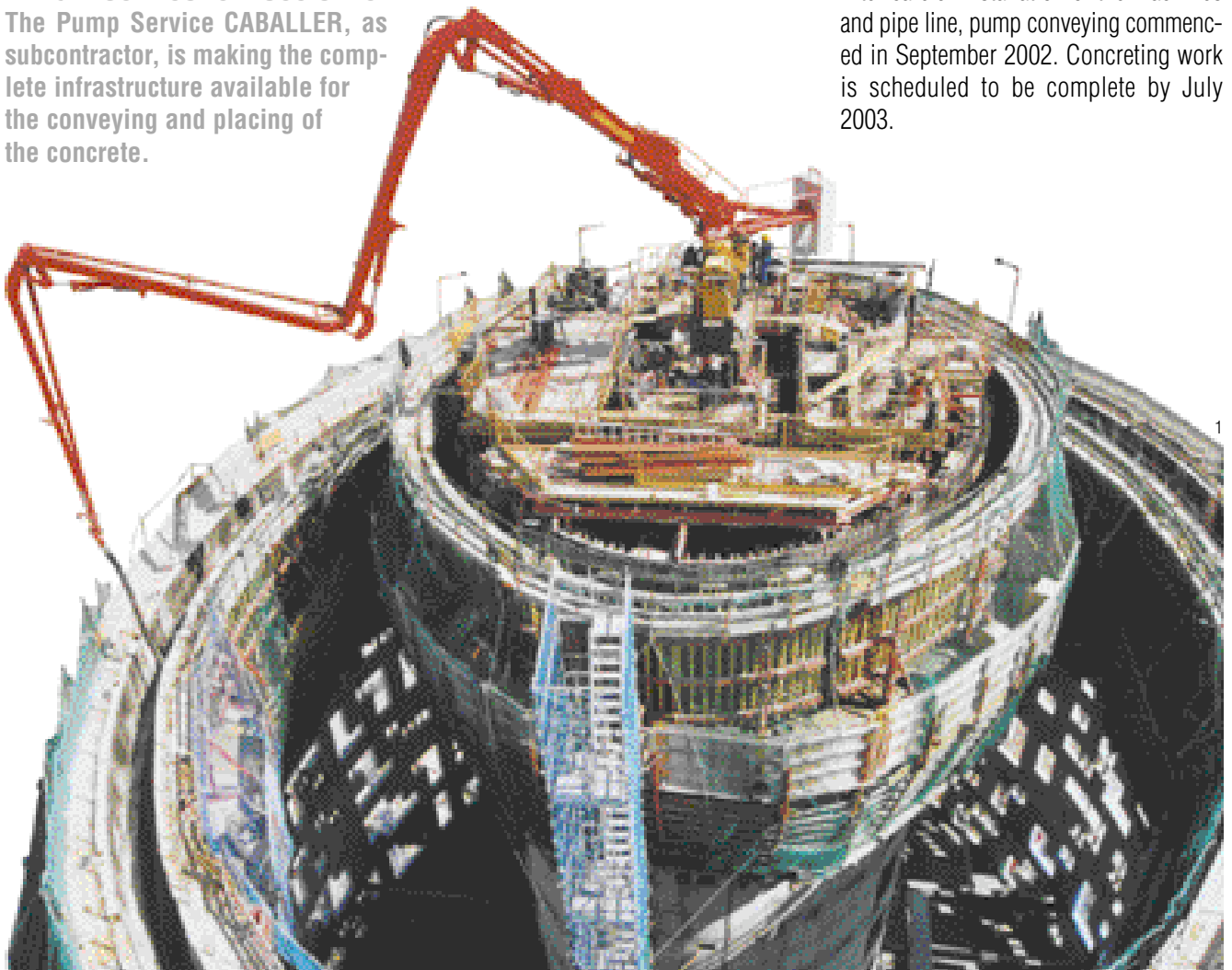
# Professional Concrete Logistics at the Torre Agbar



With an investment volume of approximately 133 million €, the Water Supply Works of Barcelona are having their new Administration Building “Torre Agbar” built. The building of the high-rise tower is at present the most spectacular construction project in the City. It is scheduled to be completed by the end of 2003. With its 35 storeys above ground and four below ground, this sophisticated office construction will then have reached a height of 142 m. The general contractor awarded the contract is DRAGADOS Y CONSTRUCCIONES. The Pump Service CABALLER, as subcontractor, is making the complete infrastructure available for the conveying and placing of the concrete.

On completion, this second highest building in Barcelona with over 4,400 different size windows that seemed to have been simply placed at random, will become the landmark of the city. With an overall area of 50,700 m<sup>2</sup>, 30,000 m<sup>2</sup> will be available for generously cut office rooms. The uneven oval (“egg-shape”) plan of the outer wall and the core of the high-rise building, as well as the wall thickness which decreases as the construction progresses, make high demands on the concreting team.

The contract to place the concrete at Torre Agbar was awarded to the local pump service CABALLER. The middle size company has at its disposal the 3 man operating team as well as the complete concreting equipment for the high-rise building project. Part of this is also a stationary BSA concrete pump, an approximately 190 m long and high-pressure resistant delivery line with shut-off valves, as well as a stationary concrete placing boom. Also the cleaning of the concreting equipment and the placing of the pump line was carried out by the pump operators of CABALLER. After careful installation of the machines and pipe line, pump conveying commenced in September 2002. Concreting work is scheduled to be complete by July 2003.



From the PERI platform, the stationary boom MX 28-Z comfortably reaches the form works of the exterior wall and the core of the building

### Stationary boom climbs with the formwork platform

The placing of concrete into the formworks of the outer wall and the core of the building, is taken over by a stationary Putzmeister placing boom MX 28-Z. The boom is mounted on a two-section tubular column (length 6 and 10 m), and stands on a special PERI formwork platform. This is lifted hydraulically along with the placing boom, and climbs smoothly from storey to storey. Due to the eccentric position of the boom to the layout of the building, the boom arms have to be constantly relocated to enable continuous concreting of the inside and outside formworks. In future the stationary pump placing booms will also be available with EBC control.

### BSA with reassuring pressure reserves

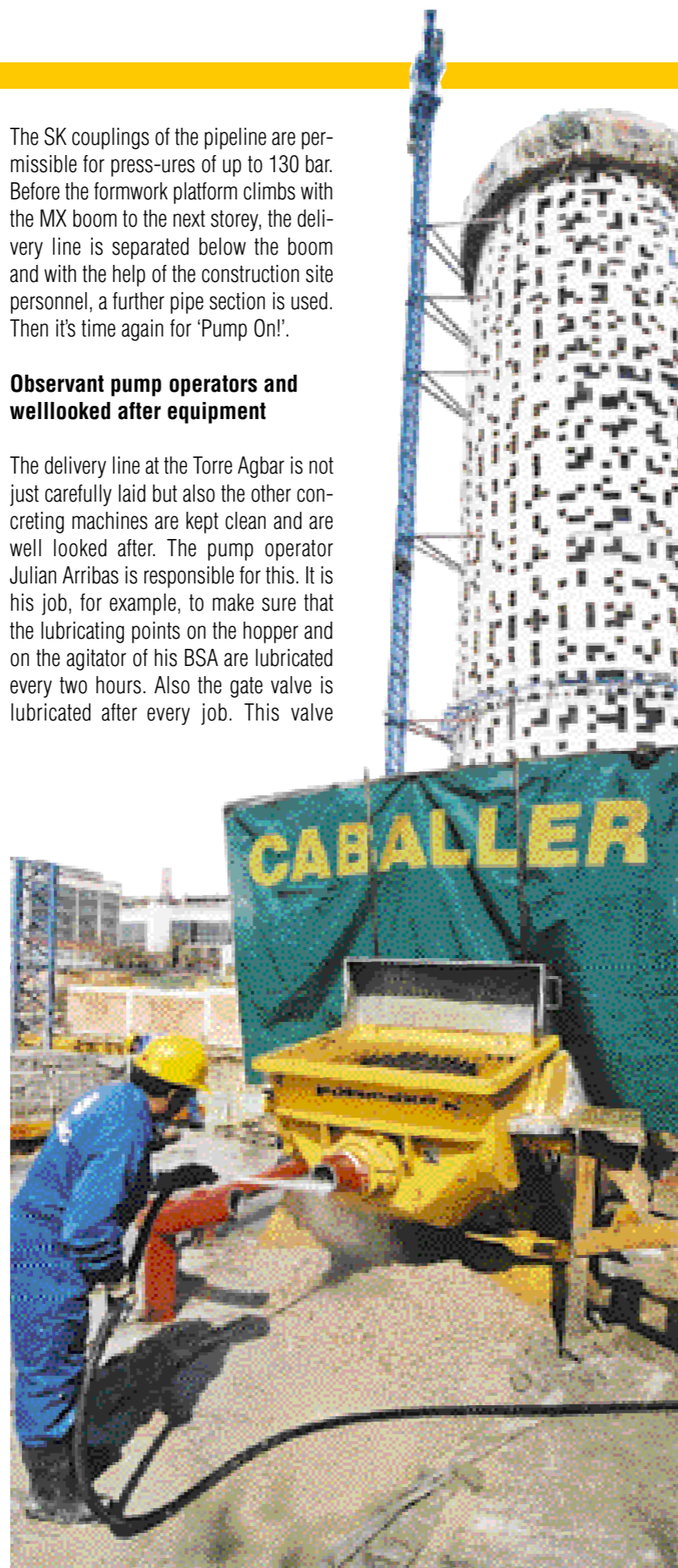
The 'feeding' of the stationary boom is taken over by a BSA 2110 H-D. The employees of CABALLER have set up the machine at the edge of the construction site approximately 50 m away from the building so that it can be easily reached by truck-mixers. A large spray protection between the hopper and the hood stops the stationary pump from being unnecessarily contaminated. With a maximum hydraulic pressure of 350 bar, Putzmeister has designed the BSA 2100 H-D for conveying pressures up to 115 bar (rod-side pressurization), respectively 160 bar in head-side operation. With a building height of approximately 70 m, the pressure-gauge, however, does not even show half the hydraulic pressure possible. This leaves reassuring pressure reserves available for the later construction progress.

The delivery line anchored in the ground first runs in a great radius horizontally to the building before it is laid vertically in the stairway for high-rise pumping. On approximately every second floor the pipeline is additionally supported on horizontally anchored transition sections.

The SK couplings of the pipeline are permissible for pressures of up to 130 bar. Before the formwork platform climbs with the MX boom to the next storey, the delivery line is separated below the boom and with the help of the construction site personnel, a further pipe section is used. Then it's time again for 'Pump On!'.

### Observant pump operators and welllooked after equipment

The delivery line at the Torre Agbar is not just carefully laid but also the other concreting machines are kept clean and are well looked after. The pump operator Julian Arribas is responsible for this. It is his job, for example, to make sure that the lubricating points on the hopper and on the agitator of his BSA are lubricated every two hours. Also the gate valve is lubricated after every job. This valve



The delivery line and concrete pump are thoroughly cleaned after every operation

separates the concrete pump and delivery line whilst carrying out cleaning work.

Julian Arribas has been working as a pump operator since 1988. At that point in time, Barcelona was experiencing a real construction boom during the course of the preparations for the Olympic Games. Here at the Torre Agbar, he is at present training a new employee in the theory and practice of concrete conveying. 'After roughly four weeks of practical training, our young colleague is then responsible for his own machine.'

A neighbouring container is used as a recreation room, a shed for machines and a store for tools – everything is there to ensure that the concrete pump and boom easily work well and can then be cleaned.

### Thinner storey thicknesses are sufficient

Due to the design of the building, only relatively little concrete was required for the individual floors. The storeys were assembled both quickly and economically – first by having steel supports bridging the distance between the core of the high-rise building and the external wall



The gate-valve is also regularly lubricated



of the building. The steel supports are covered with galvanised plates ('U'-profile) and bolted down. A simple reinforcement is placed over the plates with short outer stops. This reinforcement is placed with concrete. Due to the thin, but completely sufficient for office purposes, floor thicknesses (11 cm concrete layer with reinforcement plus 'U' profile) a load can be placed on the storey floors of up to 500 kg/m<sup>3</sup>. In addition, approximately 42 m<sup>3</sup> concrete is required per storey for the core of the building. The bottom of the floors is covered with refractory mortar. The material with 2 mm grain is sprayed by a specialized sub-contractor. The work is carried out by just three employees and a Putzmeister mortar pump of type MP 25.

The family enterprise CABALLER has two independent business sectors – a hiring crane company and the concrete pump service. The pump service that was only just founded in 1992, is now equipped with a total of eight PM truck-mounted concrete pumps with booms up to 52 m vertical height, and a stationary machine consisting of BSA pump and mixer boom.

In addition, they also have a TELE-BELT® which Messrs. CABBALLER also use to convey broken stones and other ground materials. The construction sites especially lie in and around Barcelona, as well as around Tarragona, where the pump service set up its new M 46-5 just a few months ago. Orders have been waiting for months already for the Duo made up of stationary pump and stationary boom – for further concreting work for high-rise projects. Juan Caballer, the Company Director, told us, "And then we will be pumping over 110 m vertically again on both construction sites!".



To place concrete on small surfaces, the pipeline to the boom is interrupted and flexible conveying hoses connected

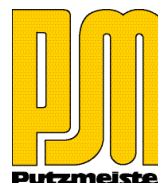
The erecting of the formwork and the concreting is carried out staggered in time. The supportive core of the building thereby has a lead of a height of a storey on the external wall. Compared to the next/most upper storey, the difference in height is even six storeys. To erect and remove the formwork and to concrete one storey, the Management of Works reckons with five working days on average.

Due to the building enclosure tapering off towards the top, the amount of concrete for the wall formwork reduces as the construction progress increases – from approximately 100 m<sup>3</sup> per storey to approximately 60 m<sup>3</sup>. The concrete used is a C 30/40 with crushed aggregate. A total of approximately 30,000 m<sup>3</sup> is conveyed by the BSA 2110 H-D at the Torre Agbar. Pumping is carried out up to a height of 135 m.



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Putzmeister AG  
Max-Eyth-Str. 10 · D-72631 Aichtal  
P.O.Box 2152 · D-72629 Aichtal  
Tel. +49 (7127) 599-0  
Fax +49 (7127) 599-520  
www.putzmeister.com  
E-mail: pmw@pmw.de