

Linden Comansa tower cranes at the Cadiz bay bridge

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Two Linden Comansa tower cranes model 21LC400 have been working for 8 years in the construction of the Bridge of the 1812 Constitution, which connects since September 2015 the city of Cadiz with the town of Puerto Real, in Spain. Popularly known as "Bridge of la Pepa", the project has been an important social and economic benefit for Cadiz, which until now had only two narrow and outdated routes out of the city and for crossing to the other side of the bay. In addition, the bridge is one of the major infrastructures built in Spain in recent years and has been a challenge of engineering.

With its imposing dimensions, this cable-stayed bridge dominates the views from anywhere in the bay. It has a total length of 3,092 metres, and its two main pylons reach 185 metre high, leaving a main span of 540 metres between them, and holding the deck to a height of 69 metres above sea level.

Belonging to the machinery fleet of construction company Dragados, the two Linden Comansa 21LC400 tower cranes worked from the two huge pylons, one of them located on the edge of the bay at Puerto Real, and the other in the middle of the sea. The team of Eleva Grúas Torre, based in Seville, has been in charge of the complicated assembly and dismantling of the cranes, as well as of all the maintenance works. "The two cranes have reached a maximum height of 195.6 metres. Strong wind gusts are very common in the Bay of Cadiz, with much greater strength at such height, which hampered a lot all the tasks carried out by our team", said Tomás Criado, Manager of Eleva Grúas Torre.

Erecting the two cranes was quite a challenge, especially the one situated in the middle of the bay. A mobile crane on a pontoon (barge) helped to assemble the crane with the minimum height to install a hydraulic climbing cage: 14.2 metres under hook. With this configuration, the Eleva Grúas Torre team could start with the climbing works and add the remaining ten sections to reach a freestanding height 69.2 m. From this initial height, the crane began work on the construction of the pylon. As the pylon was gaining in height, the crane was also climbed until it reached a final height of 195.6 metres. As well as the land-based crane, this 21LC400 needed four ties to the pylon to ensure that it could work without a problem at such impressive height.

The work of the 21LC400 cranes, both with maximum load capacity of 18 tonnes, consisted in the lifting of all the pylons' steel structures and concrete, and afterwards, the lifting of the cables that support the deck of the

bridge. The 110 kW hoisting engines allowed the cranes to work at a great speed and efficiency during these 8 years.

During the works, a change in the design of the metal anchors that attach the cables to the pylons forced Linden Comansa's engineering team to quickly find a solution to an important unexpected situation. The anchors, which initially had to weigh less than 18 tonnes to be elevated and fit into place by the cranes, became pieces of more than 23 tonnes. The construction management used a mobile crane of enormous dimensions for placing the anchors on the pylon located ashore, something that was impossible for the pylon located in the sea. In this case, so that crane could load these anchors, Linden Comansa's R & D department had to review and reinforce the crane's kinematics (pulleys, trolley/hook set, hoisting cable, etc.) and counterweights to enable the 21LC400 to lift this "extra" load in a timely manner and under the supervision of technicians from Eleva Grúas Torre.

Disassembly, the greatest challenge

Once the Linden Comansa tower cranes ended their tasks in the summer of 2015, the Eleva Grúas Torre team had to face the removal. While both cranes had been erected with the same configuration, different setbacks appeared in their takedowns.

The crane in the middle of the bay was the first to be removed once the most important works on the bridge were completed. The crane had four ties to the pylon, having the highest one a weight of 10 tonnes and a length of 23 metres. Removing it with a mobile crane was impossible due the height and the presence of the bridge cables, so the tower crane itself had to take care of this manoeuvre.

The 21LC400 had already been jacked down some tower section and when it was time to slew, an interference arose between the boom of the crane and pylon, so it was necessary to remove several jib sections. An articulating crane, located at the top of the pylon for future bridge maintenance tasks, was used for such duties. This crane removed jib sections and counterweights in a sequential way and placed them at the top of the pylon so that the tower crane could lower them down to the deck of the bridge. Thus, it was possible to reduce the jib of the 21LC400 from 50 to 20 metres, and with this reach the tower crane was able to rotate freely and remove the bracing by itself.

The 21LC400 installed inland was erected closer to the pylon in comparison to the one in the middle of the water. When it came to remove the jib sections of the tower crane, the articulating crane located at the top of

the pylon was not able to reach the jib-end of the 21LC400. It was necessary to use a jib section dismantling device, designed by Linden Comansa's engineering team, to reduce the jib length of the 21LC400 from 50 to 30 metres (two sections). With this new configuration, the articulating crane was able to dismantle the last jib section and leave the 21LC400 with a reach of 20 metres. In addition, to achieve this jib-length reduction, it was necessary to study a new disassembly sequence, move the trolley winch 20 metres through the boom, and change the jib end. Finally, the 21LC400 was able to remove the ties 4 and 3, leaving the lowest two to a mobile crane, which had to remove them by placing its boom between the cables of the bridge.

According to Rodrigo García, head of Eleva Gruas Torre's erection team, the removal of both cranes was complicated, but was done very efficiently: "We jacked down and dismantled the crane installed in the middle of the bay in just 21 working days of work, when we had raised possibilities of more than 30 days. In the case of the 21LC400 located inland, it took just 17 days, even though we had several days in which the weather hindered our work".

Source: Comansa

TOWER CRANES