Lock monitoring and measuring the reference grid on the working site using Leica Viva TS15

ENSURING SMOOTH FLOW THROUGH A BUSY CANAL

RENOVATION OF THE KIEL CANAL REQUIRES THE BUILDING OF AN EXTRA SLUICE CHAMBER TO HANDLE THE CANAL'S TRAFFIC. KATHERINE LEHMULLER LOOKS AT HOW AUTOMATIC POSITION MONITORING IS BEING USED TO ENSURE THAT CONSTRUCTION IS AS SAFE AS POSSIBLE

Germany's busy Kiel Canal has been used as an international shipping lane for more than 100 years. Linking the North Sea to the Baltic, it enables ships not only to save a distance of roughly 280 nautical miles but also to avoid the potentially dangerous storm-ridden conditions of Denmark's northern Jutland Peninsula. One of the most travelled artificial waterways in the world, it is the lifeline and gate that connects German ports to the Baltic, and many countries rely heavily on it for the economy of their industries and businesses.

After a century of heavy traffic on the canal, German's Ministry of Transport, Building and Urban Development decided to modernise and improve safety on the locks of the Waterways and Shipping Authority (WSA Brunsbüttel). Closing the canal during this seven-year construction project would be unthinkable, so a fifth sluice chamber will need to be added to the existing infrastructure. With an expected completion in 2020, this will handle the traffic while renovation of the older locks is being carried out.

The Kiel Canal not only functions as a shipping lane but also neutralises the effects of the North Sea's tidal fluctuations. The water level of the locks continuously fluctuates, rising and sinking roughly 3m over the course of six hours as the tides change. The Brunsbüttel lock system also provides important coastal protection from the Baltic Sea's notorious water level differences that occur due to gales and storm flooding from the sea.

The WSA Brunsbüttel has numerous water sensors that continuously collect water level data to foresee any possible difficulties for the locks' infrastructure and the canal's surrounding area, supplying vast amounts of back-analysis. A geodetic monitoring system is also onsite and continuously collects massive amounts of data. Further review of the data dictated the need for a program that could read and combine sensor information into the data processing software.

Before beginning construction, the stability of this enormous project had to be assessed. The new infrastructure presented demanding technical and logistical challenges that needed to be taken into consideration. The fifth sluice chamber, when completed, will be roughly 350m long, 45m wide, with an underwater extending cill on the lock gate at 14m below sea level. The chamber will be built into the sluice island between the large and small locks, and requires the removal of roughly 1.6m cubic metres of mostly clay soil. Three months of monitoring the existing lock system at Brunsbüttel was necessary to analyse the stability of the structure before starting construction and the construction site will be monitored until its completion.

Monitoring movements during construction

Kirchner Engineering Consultants GmbH was contracted to monitor the movements of the structure during construction. A key requirement for

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