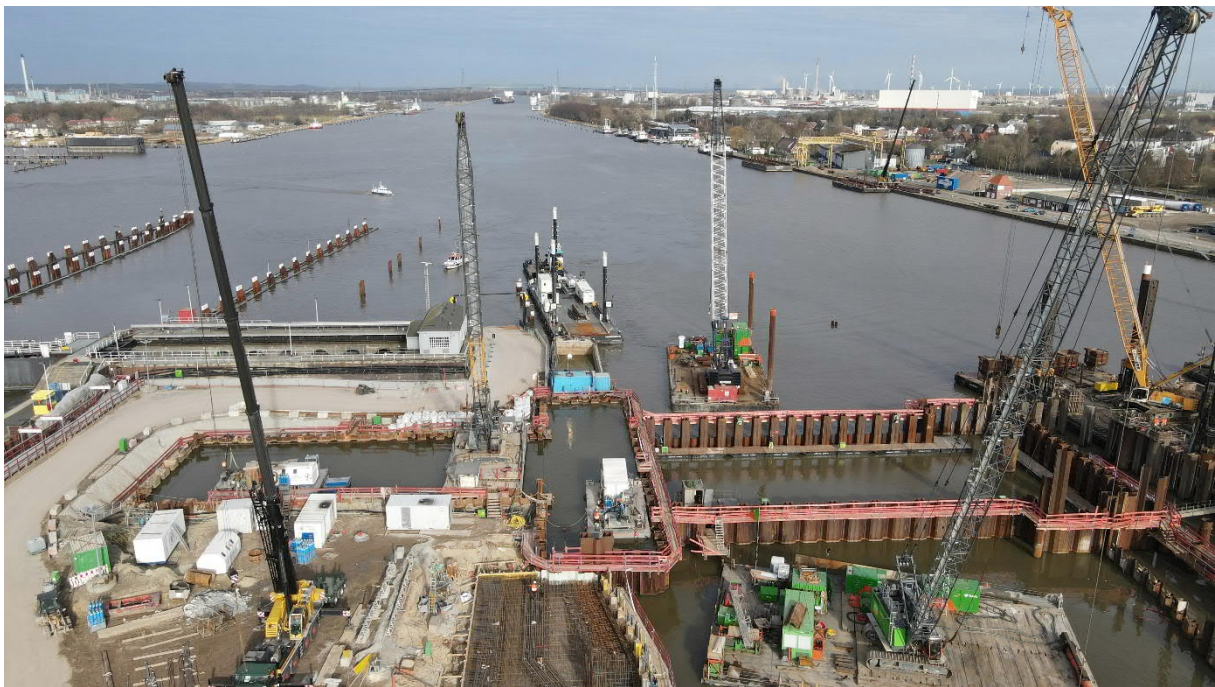


Brunsbüttel Lock: pouring concrete like the ancient Romans

36 hours of non-stop concreting at the Kiel Canal

When we see concrete being poured on our many construction sites today, we don't necessarily think of ancient Rome. Though perhaps we should. After all, it was the Romans who, over 2,000 years ago, invented concrete – still the most important building material for almost all of our projects today. While working on a waterway lock project on the Kiel Canal in Germany, our engineers were literally following in the footsteps of the Roman concrete pioneers. In an impressive concreting operation, 3,654 m³ of *opus caementicium* were continuously laid, non-stop and underwater, with the help of divers – not an everyday undertaking, even for our specialists.



For most people, laying concrete under water sounds like an impossible undertaking – and *opus caementicium* like a piece of classical music. But already the Romans knew how it was done, as you can see for yourself in the Roman port of Cosa, where 2,000-year-old underwater concrete structures have withstood the test of time – and you can take a moment to reflect on this achievement with reverence and awe.

No wonder, then, that the tried-and-tested construction material for underwater concrete works has not changed much since Roman times. *Opus caementicium*, also known as Roman concrete, was used by the Romans to build parts of walls, and later entire structures and port facilities, at least since the third century before our era.

Roman concrete is a highly free-flowing mixture capable of developing high adhesive strength. The fact that (any) concrete hardens under water is nothing unusual. Because concrete doesn't "dry" – it hydrates. In other words, concrete hardens precisely because water is present, not because water is removed.

But enough of the ancient Romans. Let us leap forward in time to the young and dynamic team of MOBIL BAUSTOFFE, who are applying the concrete knowledge discovered and perfected two thousand years ago in the year 2021 where the JV W&F Ingenieurbau/BAM Infra/W&F Spezialtiefbau is currently working on the fourth, and to date largest, concreting operation at the 330 m long Brunsbüttel Lock. The construction of a new fifth lock chamber in late March required 36 hours of continuous underwater concreting – an unusual task, especially in these dimensions.

“It all starts with the fact that the tides need to be kept out,” explains managing director Rudolf Kauper. “The sections of the lock to be concreted are separated from the surrounding water using sheet pile walls, creating a pool unaffected by tides in which to work.” Divers enter this “pool” to pour the concrete at a depth of about 30 metres using concrete pumps – and to observe and control the process themselves.



Underwater concrete was used for the project with a strength class of C30/37, a very fluid consistency (F6 flow class) and having the special property of remaining workable for up to twelve hours in some cases. The MOBIL BAUSTOFFE team, under the leadership of group leader Jens Kosak, produced a specific modern variant of *opus caementicium* for the project.

The average flow rate was 102 m³/hour, with a peak rate of 144 m³/hour. The concrete was produced with a double mixing plant installed on the lock island. The location meant that all raw materials had to be delivered by ship or ferry. “This could only be achieved with a well-coordinated team, good work preparation and a smooth workflow,” says Rudolf Kauper with pride, adding a few more figures to illustrate the dimension of the project.

“We’re talking about 49 truckloads of cement, more than 100 articulated lorries with 3,000 tonnes of sand and 19 tonnes of concrete admixtures, all of which had to be delivered with pinpoint accuracy.” Some of the material even came by water: “We had three ships with coarse aggregates of 1,500 tonnes each in use.”



In conclusion, you don't have to be an ancient Roman to experience the adventure of underwater concreting first-hand. It is enough to work for MOBIL BAUSTOFFE that is constantly involved in exciting construction projects. But the ongoing adventure on the Kiel Canal is not over quite yet. Another 20 large concreting jobs are scheduled (some of them underwater) before the lock is completed.

To finish, here's some more interesting information to take us back to the origins of our industry. While concrete and mortar differ only in that concrete uses coarser aggregates in the mix, mortar is an incredible 8,000 years older. Investigations of ancient buildings have shown that mortar mixtures consisting of fine aggregates, lime as a binding agent and water were already being used 10,000 years ago in the region of today's Turkey. By definition, mortar has a grain size of 4 mm or less. Above that, we speak of concrete.