Haiger, December 2020.

Probably the last technical giant in Germany

In 2021, the new Niederfinow ship's hoist is to be built directly next to the historical building will be put into operation

As part of the German government's Anti-Congestion Programme launched in 2000, a new ship lift is being constructed at Niederfinow in the Federal German state of Brandenburg. On its expected completion in 2021 it will replace the oldest still working ship lift built in 1934, the capacity of which is insufficient for present and future freight shipping traffic.

Note (reference)

The present text follows the article of the same name by the author Bärbel Rechenbach in BauPortal 4/20 magazine, pp. 50 - 53. The visual material used was provided by:
Alexander and Bärbel Rechenbach / WNA Berlin.
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Two gigantic ship lifts one close beside the other and on one canal are surely internationally unique. Technical and architectural masterworks, they tower above the lovely landscape of the Schorfheide-Chorin biosphere reserve. The view of the surrounding area from either of the visitors' platforms high above is unsurpassed. As is the close-up view of the neighbouring structure.

Old versus new

The two ship lifts operate in the same way: by means of a suspended steel trough ships are lifted or lowered a distance of 36 m between the Oder and the Havel Canal. Like a hoist. The 52 m-high historic lift system has operated since 1934 and is held securely together by over 2 million rivets. The new lift is 54.55 m high and has been constructed as a modern ferro-concrete framework structure. It has been twelve years in the making and is now at the commissioning stage.

There are a number of reasons for building a vertical lift system of the latest generation in Niederfinow Nord. One is that the level of freight shipping traffic was forecast to increase by 4.4 mill. freight tonnes a year. Another is that today's ships, with lengths of up to 110 m, cannot fit into the 85 m long so-called bottleneck of the old lift system and so cannot be used to full load capacity. For this reason push-barge trains are being used before lifting at present. Today's container traffic also requires a headroom of 5.25 m to operate

economically.That is not available either. Service and maintenance of the old lift system are becoming increasingly expensive, because suitable replacement parts for drive and safety equipment have to be fabricated specially to fit the heritage-protected structure.

Planning and preliminary work

The planning order for the new structure was placed with the Berlin Waterways Construction Office as early as 1992. After a ten-year design phase the team headed by structural engineer and architect Udo Beuke of the Federal German Waterways Engineering Authority in Karlsruhe submitted a plan. His biggest challenge was, stresses the architect, “to make the mega-sculpture of the ship lift fit into such a sensitive landscape”.
To do so he drew inspiration from the hall church at nearby Chorin Abbey.


Construction of the building pit next to the historical hoist (© WNA)

The initial excavation work began under the direction of a syndicate made up of Implenia Konstruktion GmbH, Niederlassung Nordost, providing the technical management, DSD Brückenbau GmbH providing the commercial management, Johann Bunte Bauunternehmung GmbH & Co. KG and SIEMAG TECBERG in 2009. At the same time work began on restoring the land to its former condition, beginning with protection of the red ant, the Euro lean otter and the beaver through to restoration of the woodland. During extension of the outer harbour 100,000 m3 of peat soil were dug out and mostly incorporated into the lower harbour of the shut-down lock staircase. In this way the protected peat bog soils are being preserved at an artificially created bog site.


Last exterior works around the new building (© Alexander Rechenbach)

Assembly of reinforced concrete structures


Installation of an element of the rope pulley hall (both © WNA)

Engineering design principle

The complex hybrid design of steel and solid concrete is based on the proven principle of the vertical lift system with counterweight balancing and trough security. Four engines each generating 218 horsepower deliver the power needed to overcome friction, starting resistance, mass moment of inertia and water level differences. All pressure-loaded parts like trough wall base, four pillars and twelve cable pulley support stanchions arranged in pairs are made of concrete. With overhead cable pulley supports of steel they form a rigid structure and ensure the stability of the entire lift system.

The bend-stressed trough is also of steel. The construction pit (6,100 m² with a circumference of 395 m) is lined with a soldier pile wall. A 1.20 m-thick underwater concrete base was fitted into this without reinforcement. Likewise 1,340 ties at 3.20 m intervals.


View into the axis of the ship lift (© WNA)

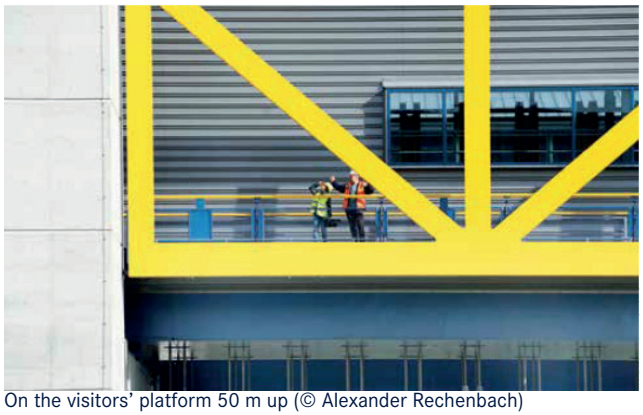
The base of the white trough basin mounted on it measures 2.40 m. Its side walls are between 1.50 m (top) and 3.00 m (bottom) thick. Suspended in the centre point of the structure is a water-filled trough, fastened to 224 six-centimetre-thick steel ropes.
The project further includes a 65.5 m-long canal bridge with abutment, a lift gate acting as a security gate and a rotary segment gate acting as a closure for the upper lock pound. Also an upper, 440 m-long outer harbour that branches out from the summit pound of the Havel-Oder waterway, and a lower outer harbour with a northern, 440 m-long embankment and a 360 m-long south bank. The trough itself is 125.50 m long and 27.90 m wide in the area of the drives, roughly as wide and more than twice as long as an Olympic swimming pool. The usable width of the trough for shipping is 12.50 m. The pillars, at 6.40 m above sea level, stand on the trough basin and so form part of the basin in the lower outer wall area. They extend up to 11 m below the site and 52.30 m above it. The cross-section of a pillar is determined by the trough drive room in its interior and by the dimensions of the stairways, the throughways and the crane for maintenance work on the 14th level.

A special technical feature is the trough security equipment. Four 10 t turn-bar locks move contactlessly inside inside-threaded split columns (threaded jaws) extending the entire height in each of the four pillars. These ensure that the trough is held in position, even in the event of uncontrolled water loss.

Thanks to programmable logic controllers (PLCs) and sensors from now on the new ship lift can be operated in automatic mode.

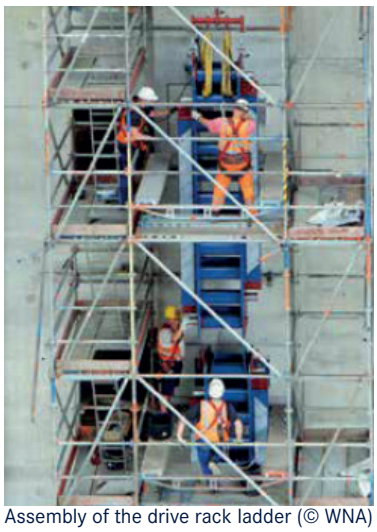
Visitors can take a tour of the entire structure at a height of about 50 m after the project is handed over.

Not like the old one at the height of the trough, but at the height of the large rope sheaves. „There you have to be suitable for heights“, like Klaus Winter white. The civil engineer of the waterway - Neubauamt Berlin has been on board almost since the start of construction and leads the construction supervision. He knows all the pitfalls of this major project that „none is off the peg“, as he says, „and over a decade of construction time is enough. Many things turned out to be more complicated than once-and brought delays with it. Actually, the building should be finished as early as 2014.


On the visitors' platform 50 m up (© Alexander Rechenbach)

Accuracy down to the millimeter

”Realising the architectural concept and at the same time combining the robustness of waterway engineering with delicate mechanical engineering was quite a job,” says structural engineer. All the work phases have to be scheduled to function as a complete system so as to ensure compliance with the machinery directive 2006/42/EG (CE conformity). Thus it was important to, for example, take into account deformation of the pillars caused by loads placed on them later and by temperature fluctuations and to ensure adherence to extreme accuracies. The pillars, which were erected by the climb method, allowed only a maximum positional difference at the top of ± 20 mm at 10 °C outside temperature. The concreting had to be extremely precisely adjusted for all day temperatures so as to determine the suitable point in time, because the precise formwork depended on this. Sometimes up to 300 people were working on the construction site at any one time. So it was important to time construction procedures accurately and establish an understanding between steel erectors and concrete casters. Says Klaus Winter, ”From time to time the steel market changed and prices rose. Constructional adjustments were unavoidable. For example, the inside-threaded-jaw column (security system) was originally intended to be fastened in the frame niche with a tie system for individual elements. What we have now is a structure that has to be fastened pointwise to concreted-in parts every 4 metres. For this the threaded halves of the threaded-jaw elements had to be precisely aligned in the base for a height difference of 0.2 mm. This call for accuracy applied right through the entire construction process right down to production of the 220 43.5 t counterweights. These were produced with a deviation of less than 1 % from the planned required mass.


Assembly of the drive rack ladder (© WNA)

Accident-free construction site

Precise as the stepwise construction work was, everyone was very careful to make sure that the work went off safely and accident-freely. Says

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CONSTRUCTION PROJECT:
New-construction of Niederfinow Nord ship lift

CLIENT:
General Directorate of Waterways and Shipping
(Wasserstraßen und Schifffahrt)
of the Federal Republic of Germany,
Wasserstraßen-Neubauamt Berlin

CONTRACTOR:
ARGE “Neues Schiffshebewerk Niederfinow Nord” with
Implenia Construction GmbH
DSD Brückenbau GmbH
Johann Bunte Bauunternehmung GmbH & Co. KG
SIEMAG TECBERG

STRUCTURAL INSPECTION:
KREBS+KIEFER

View of the counterweights
(© Alexander Rechenbach)

Klaus Winter, ”To be able to work effectively, various trades often had to work one above the other. Communication was everything. I am just thinking here of the fitting of the ropes, that drop from a height of close on 40 m and develop their own dynamic. The fitters worked simultaneously up on the cable pulley, at the two points where the cable is attached, and at the point where the cable is wound on. In coordination with the crane and winch operators. It worked because everybody kept to the agreed rules of the game.” For every task there was a security schedule, in which every week it was specified who would work at what place, at what time and at the same time, and who might stay where and who might not. For this, once a month client, contractor, health and safety coordinator (SiGeKo), trade association and State Office for Occupational Health and Safety met to update safety concepts relevant to the hazard potential of individual construction works.

So, amongst other things, additional boardups under bridge structures were undertaken, likewise protective metal fenders fitted. The footway close beside the structure was closed. Scaffolding, however small, was secured with stairways. The result speaks for itself: throughout the whole of the construction operation there were no injuries worth the mention.

Outlook

Construction of the ship lift is now close to completion. Without doubt it is a masterly achievement by all those involved and, alongside the existing historic one, a further regional attraction for visitors. The first trough liftings have passed the test. The system will go into operation in the next year. It will likely be the last one of this size in Germany. For this reason it is not only the client that is hoping for greater use of the waterways to full capacity and busy shipping traffic between Berlin and Szczecin. Because unfortunately, despite

all the prognoses and the anti-congestion programme, despite the lorry crisis on roads and motorways the road lobby in 2020, too, is further intensifying its efforts. For Klaus Winter, too, that is ludicrous. He wants to see the new ship lift in action.

Comparison of the new and historic ship lift	**New ship lift** **Construction start: 2009** **Commissioned: 2021**	**Historic ship lift** **Construction start:1927** **Commissioned: 1934**
Height (above site) Length Width Depth (trough basin) Rope	54,55 m 133,00 m 46,40 m 11,00 m 224	52,00 m 94,00 m 27,00 m 8,00 m 256
Building material (including canal bridge): steel (new: reinforced steel) concrete and ferro-concrete	8.900 t 65.000 m^3	18.000 t 72.000 m^3
Usable dimensions of trough Length Width Permissible ship width Headroom Water depth Max. load draught of ships	 115,00 m 12,50 m 11,45 m 5,25 m 4,00 m 2,80 m	 83,50 m 11,50 m 9,50 m 4,40 m 2,50 m 2,00 m
Weight of trough/with water	2.785 t / 9.800 t	1,600 t / 4.290 t
Lifting distance Lifting time Speed Lock operation time ø	36 m 3 min 25 cm/s 16,50 min	36 m 5 min 12 cm/s 20 min
Canal bridge Length Width Depth	 65,50 m 21,70 m 4,00 m	 157,00 m 28,00 m 3,90 m

Old structure side by side with the new structure in September 2020. Both will operate together for about five years.
(© Bärbel Rechenbach)

The company

The SIEMAG TECBERG group is the world‘s leading supplier of shaft hoisting technology.
The group provides knowledge-based services for the supply of individual machines and systems for a total of six industrial applications: Shaft hoisting technology for raw material hoisting as well as storage of contaminated raw materials, hoisting and transport of heavy materials loads, ventilation and cooling of underground mines, technologies for the horizontal conveying of bulk materials including handling technology for raw materials, as well as technologies for the efficient use of energy in hoisting technology, ventilation and cooling.

The SIEMAG TECBERG group focuses its technical activities on the development, design, manufacture, commissioning and technical service of shaft hoisting systems for vertical and inclined hoisting of raw materials. The SIEMAG TECBERG group has distinctive engineering competences for mechanics, hydraulics, drive and automation technology. Worldwide unique reference projects prove the overall plant competence and leading position of the SIEMAG TECBERG group.

The technology of the niche specialist emerged from a blacksmith‘s shop founded in 1871 in Siegerland, which produced equipment for local ore mining and the iron and steel industry.
Following a management buy-out in 2007, SIEMAG TECBERG was founded by Jürgen Peschke, who is still CEO and managing partner today.

The SIEMAG TECBERG group is represented on all continents by at least one subsidiary and cooperates with partners worldwide. In addition to the headquarters with assembly plant in Haiger, north of Frankfurt am Main, there are locations in Rugby/UK, Katowice/Poland and Moscow/Russia, supplemented by further locations with their own assembly plants in Tianjin/China, Sydney and Mayfield East/Australia, Johannesburg/South Africa and Milwaukee and Denver/USA. The group employs around 400 people worldwide. The business volume amounts to approx. EUR 120 million per annum. (as of 12/2019).

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