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A construction of massive proportions: Genoa's new breakwater will span a total of 6 kilometers

The colossus of Liguria

At the Italian port of Genoa, one of the largest port expansion projects in Europe is taking shape. Once the »New Breakwater« is completed, it will allow the world's largest ships to call at the centuries old port, allowing for further economic growth. ***By Jannik Westerkamp***

Few seaports in Europe can look back on a history as eventful as that of Genoa. Located in northwestern Italy, the city owes its wealth primarily to its position at the northernmost tip of the Ligurian Sea – a location that, as early as antiquity, established it as a vital commercial hub for the region and beyond. During the Middle Ages, the port served as the heart of the maritime Republic of Genoa, which maintained trade routes spanning the entire Mediterranean and reaching as far as the North Sea coast.

Today, the port of Genoa remains as significant as ever: covering an area of 1,200 hectares, it is Italy's largest seaport, with an annual cargo throughput of approximately 50 million tons – second only to Trieste. Genoa provides a gateway to the hinterland of northern Italy and, by extension, the rest of Europe. While it lacks inland waterway connections, this geographical disadvantage is offset by extensive motorway and rail networks, as well as an airport built directly within the harbor basin. Genoa is also a major destination for the cruise industry, welcoming more than 3 million passengers each year.

A port at its limit

Despite its vast size, the port is currently reaching its limits. This is largely due to the ever-increasing dimensions of modern container and cruise ships, many of which are too large to enter the port – at least for now. The city is currently the site of one of the most significant port expansion projects in recent history. Once the »Genoa New Breakwater« project is complete, the city is set to join the ranks of Europe's largest seaports. It will be able to accommodate container ships up to 400 meters long and 60 meters wide, as well as »World Class« cruise ships.

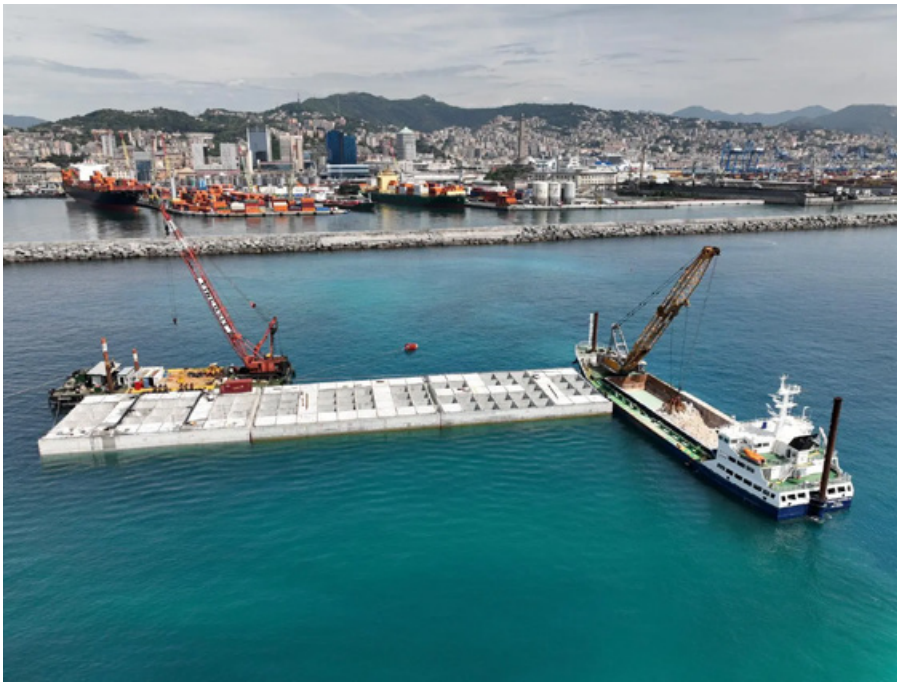
Furthermore, the port's infrastructure is being upgraded to become more resilient against adverse weather and sea conditions. At the same time, the breakwater creates the necessary conditions for further expanding the port, thereby

establishing new trade and logistics capacities.

Given its location, Genoa is poised to become a serious competitor to major northern ports such as Rotterdam, Antwerp, and Hamburg. The Mediterranean is significantly closer to Asia, allowing shipping lines to offer shorter – and therefore faster – voyages, even when using »mega-ships«. Naturally, this assumes that the Suez Canal remains reliably and securely navigable in the long term.

Let's make some room

In terms of construction, the »Genoa New Breakwater« exceeds the scale of comparable projects. To prepare the port for a new generation of vessels, the »Per-Genova Breakwater« consortium – led by the infrastructure company Webuild – is reconstructing the outer harbor wall. Large sections of the existing wall are being removed, with only the historic wall of »Porto Antico« (the Historic Port) remaining, which will also be reinforced. Simultaneously, an entirely new wall is being built further out in the water; it will not only continue to protect the port infrastructure but also significantly expand the Sampierdarena Channel. Once completed, the port entrance will be over 300 meters wide, and the channel itself will reach a width of up to 500 meters, providing ships with a turning circle of up to 800 meters within the harbor area. At the same time, the competitiveness and operability of all terminals within the port will be increased.



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The caissons are being built on-site and positioned with tugboats

Spanning a total length of 6 kilometers, the new breakwater is a colossal construction project. Its foundation is being installed in a depth of up to 50 meters on the seabed, making it the deepest breakwater project in European ports. The base alone required 9 million tons of rock to build.

Block by block

The breakwater itself is made up of individual cellular caissons, which are being installed in stages. Each segment stands up to 33 meters high, 30 meters



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Rendering of the new breakwater, which is scheduled for completion in 2030



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Upon completion, the breakwater will expand the Sampierdarena Canal (seen in the back) to accommodate larger ships while also protecting the port from rough waters

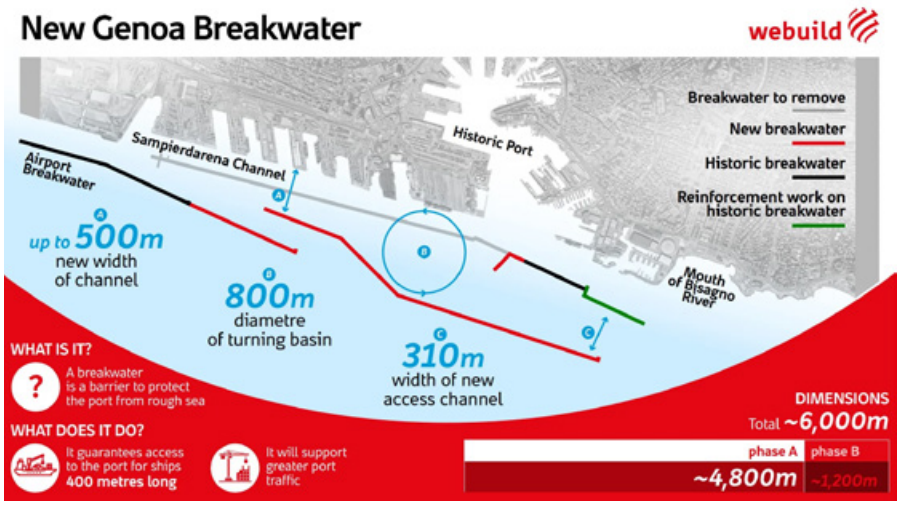
wide, and 67 meters long at a weight of approximately 15,000 tons, making them larger than many office buildings. They are being built directly at sea, with a metal framework being placed on a floating platform and then filled in steps with a new concrete mix that heightens its waterproof qualities. Once completed, the caissons are moved to their destined location and positioned with tug boats. As soon as they're set into place, the cells are being filled with sea water and finally with rock material, partly taken from the demolition of the old breakwater. Once all is done, Genoa will rest safely behind a seawall that sits on top of the caissons, designed to reduce the impact of waves on the harbor.

Phase A of the construction, scheduled for completion by 2027 and intended to expand access to the harbor, involves the installation of 70 caissons spanning a length of 4.8 kilometers. Webuild estimates the preliminary cost at €928 million. Phase B is slated for completion by 2030.

According to Webuild, each caisson takes 20 days to construct, with up to 50 of the company's employees working on a single unit. Unlike the construction of a traditional embankment, this breakwater is being built using a modular, »building-block« approach. As of mid-October, Webuild has already completed 1.67 kilometers of the new breakwater using this method.

Stable foundations

Despite its vast size and the difficult conditions, the construction appears to be going along smoothly. To make sure the caissons behave as intended (meaning they move as little as possible), Webuild



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Webuild's visualisation of the project

has been keeping a close eye on the installations.

»This first kilometer allows us to assess the monitoring we're conducting using around seventy instruments, both underwater and on the surface, on the response of the caissons, which, over time, have subsided by several centimeters, not millimeters,« said Nicola Meistro, Senior Vice President at Webuild, on completing a major milestone earlier this year. »This is a natural settling, but these movements are within the ranges predicted during the design phase, and this confirms our confidence in the work we're carrying out.«

The engineer explains that the tests conducted in recent months on the structures already positioned above the 770 kilometers of gravel columns built to consolidate the seabed were positive – the breakwater thus has a solid footing. Each pile is 7 to 12 meters in length and placed in the ground by a new technique named »Wet Top Feed – Blanked Method«. With this approach, a large, needle-like vibrating probe (called »vibroflot«) is taken down to the seabed by connecting it to cranes positioned on floating platforms. There it is directed to a strata of gravel which has been positioned in advance in order to host the columns. Using vibration and combined water-air jets, the probe then penetrates the seabed, thus creating a tube-like space into which the surrounding gravel flows. According to Webuild, the future columns thus take shape and are progressively made more compact.

An unprecedented project

»The initial phase was the most complicated because we had to develop all the technologies necessary for an unprecedented project«, Meistro added. »Now, with the warmer weather, we will proceed quickly towards completion: this is an infrastructure project that has been awaited for decades. I believe dwelling on a week or two diminishes the importance of the hundreds of companies involved and the thousand people who work on it, but we are on schedule.«

Marco Bucci, Comissioner and President of the Liguria Region, confirmed the completion of the work in 2027. He expects the first passage of »mega container ships« over 400 meters in the following year. Once completed, this major project is intended to serve as a »key element« in the development of the Port of Genoa and form part of the city's comprehensive infrastructure modernization program.



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The old breakwater's rock is being used as building material for the new wall, minimizing cost and fuel consumption

Minimal impact

In terms of the footprint left on the environment, Webuild promises to make the breakwater as sustainable as possible. Furthermore, the wall is designed to protect docks and port facilities from the effects of climate change – »a true sea wall«, the company states.

During construction, large parts of the old breakwater are being used to fill up the new one's foundation, therefore reducing material transport and disposal as well as fuel consumption. The concrete mix which is being used in the cassions is said to have a significantly increased impermeability, ensuring the wall remains stable for decades to come.

To further reduce the environmental impact, Webuild has partnered with the Acquario di Genova (Genoa Aquarium) to safeguard the sea's ecosystem around the underwater construction site. »This partnership sees transferring temporarily the sea-life found on the seabed where works are been carried out to the Acquario di Genova, where they will stay until they are then once again put back in the sea when works have been completed,« Webuild explained.

Further initiatives

In addition to the new breakwater, Webuild is involved in the integrated »Terzo Valico dei Giovi – Genoa Hub« project – a new high-performance railway line connecting the port to major European logistics corridors – and is also constructing the Genoa Undersea Road Tunnel. The official construction contract for Lot B was awarded to Webuild by the Italian Ministry of Transport in October, with costs amounting to approximately €800 million. The project will be 4.2 kilometers long, with 3 kilometers made up of two parallel tunnels (one for each direction). Upon completion, the tunnel will connect the Western and Eastern parts of the city. Lot B is said to run beneath the port and the urban area of Genoa.

»Together, these projects will help strengthen the connectivity between the port system, the rail network, and urban mobility, while consolidating Genoa's strategic role within the Rhine-Alpine Corridor,« the company stated. ■