

PUSHING THE BOUNDARIES IN THE APPLICATION OF FLOATING BREAKWATERS AT PORT GÖCEK IN TURKEY

Ingemar's new precast reinforced concrete elements have the largest weight, height and freeboard available on the International market

Milan, 8 July 2013. Versatile project design, own production facilities and considerable investment in research and development, have ensured Ingemar's prestigious position among the top international players in the floating pontoons and marina equipment sectors.

The diversification of their product range and the consistent dedication to the construction of specialist and complex projects are the hallmarks of this Milan-based marine engineering company as well as the reason for their success both in Italy and internationally.

A major role in the approach to the market of the company has always been played by the development of new floating breakwaters: large reinforced concrete elements which can be employed to create new moorings in areas with either natural or artificial protection from the open seas.

Research is aimed specifically at broadening the range of application of these elements and at improving their safety, durability and performance.

Because of this experience with innovative structures, D-Marin of the Do_u_ Group appointed Ingemar to build a turnkey floating breakwater barrier of over 280 linear mts, 6mts in width, as part of the works for the restoration and modernisation of the prestigious tourist port D-Marin Port Göcek. Through sustainable design and pro-active environmental management, D-Marin Göcek has created a relaxed and enjoyable marina village that encourages boat owners and the community to enjoy the marina's peaceful, unique location in Gogek and Fethiye Bay. Positioned deep into the environmentally protected forest, the marina is surrounded by virgin natural bushland that tumbles into the tranquil coves and inlets creating memorable experiences in every visit. The main facilities are: 380 yachts up to 75m berth capacity, 150 yachts dry docking capacity, 75 T shiplift capacity , 250m of private beach and a unique hobby gardens. D-Marine Gogek is BlueFlag rated and is a member of the Yacht Harbour Association and has the internationally renowned Five Gold Anchor award.

The new floating breakwater, which has been in operation since 2012 protecting a marina with 380 berths for yachts up to 40 mts, is made

of newly developed FCA-20x6 modules. These prefabricated floating elements have the greatest weight, height and freeboard of any in series products currently available on the international market: 130 tonnes, 6mts width and 20mts length, 2.40mts total height and a 75cms freeboard over water.

The design took into consideration waves with a height of 1.5mt and a period of 4 seconds. To cut transport and handling costs the modules were made in two elements 3mts wide which were rigidly connected by means of stainless steel girders after the launching.

The modules are anchored to deadweights installed on the seabed at depths of up to 35mts. Anchoring is by an innovative system where mooring lines are made of Dyneema® ropes, instead of steel chains, which have substantial resistance and minimum extension under load. The system was designed to guarantee generous safety factor and maximum layout stability.

The breakwaters and their anchorage systems were designed for continuous moorings of 43 yachts up to 20mts on the inner protected side, and for the seasonal berthing of mega yachts up to 70mts on the outer side.

The modules are made of special reinforced concrete, with the addition of synthetic fibres to prevent cracking, and a brushed surface finish in cement and resins to ensure a pleasing aesthetic look and a non-slip surface. The elements have a core of expanded polystyrene which assures positive floatation and prevents sinking even in case of accidental wreckage. Modules are jointed together to achieve the design length. The joints are made of robust steel cables with inserted rubber elements to allow vertical movement between the modules and minimum deformation of the longitudinal axis of the pier.

The significant size of the yachts and their specific requirements with regard to the service equipment meant individually designing each module and inserting a number of different pipeline arrangements within (each module having different numbers and positions), as well arranging the reinforcing structures to fix the mooring bollards (up to 20 T).

The new breakwater modules, substituting the existing ones in the marina, were tested using physical models in the wave flume of the Civil, Construction and Environmental Engineering Department (ICEA) of the University of Padua: they are unique for their dimensions and capacity to attenuate waves. The tests simulated waves with significant heights of between 0.8mts and 1.5mts and periods of between 3.3 and 4.0 second intervals and demonstrated a substantial ability by these new elements to lessen wave motion ($K_t \leq 0.6$ even with waves of $H_s = 1.5m$ e $T_p = 4.0s$).

Results in the field have been extremely positive: in the first months of 2013 the floating barrier was put to the test during a violent storm and high seas, demonstrating characteristics of stability and reduction of wave motion superior to expectations.

Ingemar's President, *Lorenzo Isalberti* commented on the new project: *"We are extremely pleased with the performance of these new floating breakwaters and proud to have completely satisfied our client: D-Marin is the international leader in the tourist ports' sector and D-Marin Port Göcek is a feather in the cap for Mediterranean marinas. This is further confirmation that R&D methods and diversification in the sector of floating structures can definitely be the key to success in the international sector. Our specialist projects, from these gigantic breakwaters to the piers for mega yachts, to special structures (such as the floating Bridge of the Redeemer at Venice or the pontoons for the Kuwaiti coastguard.....), are recognised everywhere as a sign of excellence and Made in Italy quality."*

"D-Marin has the largest international chain of marinas in the Eastern Mediterranean Basin and Adriatic Sea". D-Marin Marinas Group started its operations in 2003 in Turkey with its first marina, D-Marin Turgutreis . In 2009 D-Marin Didim commenced operations and in 2010 D-Marin Gogek joined to the D-Marin Marinas Group. In the last few years numerous tourist ports in Greece and Croatia have followed in the steps of the Turkish marinas.

D-Marin Marinas is part of the Do_u_ Group founded in 1951 and is today one of the major Turkish entrepreneurial groups with an important history of successes and the objective of becoming the sector's leader.

The Group operates in 7 sectors: finance, automotive industry, construction, media, tourism, real estate and energy. With 124 companies and roughly 20,000 employees, the Do_u_ Group is an established organisation both in Turkey, in the region and worldwide.

For over 30 years Ingemar has been designing and building pontoons and floating breakwaters worldwide and today is one of the few companies in the sector having its own independent production facilities which allows it to carry out Research and Development in order to anticipate market demands. The ISO 9001 certification for design, construction and installation testifies to its constant dedication and commitment to quality and is complemented by the SOA certification by the port sector for commissions of up to Euro 15.5 million. The company's Head Offices are in Milan and production and customer services are at Casale sul Sile in the province of Treviso.

INGEMAR - PRESS OFFICE