



The Legendary Marina & Yacht Club opened a new marina in Alabama that features aluminum floating and fixed dock structures and includes a concierge service capable of delivering boats to the water via forklift.

## New Legendary Marina Highlights the Value of Aluminum Dock Structures

**A**luminum is utilized in a variety of marine applications due to its combination of light weight and high corrosion resistance. This value was demonstrated when the Legendary Marina & Yacht Club launched a new marina in early 2024, with a floating and fixed dock system comprised of aluminum extrusions in Gulf Shores, AL. Utilizing the full design potential of extruded profiles combined with advanced welding techniques, MAADI Group®, headquartered in Mascouche, Quebec, Canada, designed and manufactured the new docking systems for the facility—showcasing the potential of aluminum in marine applications.

### Maritime Structures

Floating structures have been a staple in maritime engineering since ancient times, serving various purposes, such as floating bridges and naval battle platforms. Early constructions were predominantly wooden, relying on basic flotation devices like barrels or tree trunks. The post-WWII boom in nautical recreation spurred the development of more sophisticated marinas and docks, leading to the gradual replacement of wood with more durable materials like concrete and steel.

By the 1960s and 1970s, the advent of plastic materials, particularly polyethylene, revolutionized floating docks, making them more cost-effective and easier to maintain. European innovations, especially in France, further enhanced dock systems with custom-designed aluminum extrusions.

Today, floating docks are widely used for everything from recreational marinas to industrial applications. Floating docks rely on anchoring systems that keep the docks stationary by distributing lateral forces to piles or mooring lines, while the floats handle gravity loads like power pedestals, carts, and foot traffic. The design and engineering of docks and piers are typically undertaken by manufacturers and licensed professional engineers, as improper designs can result in costly damages to high-value yachts.

Modern technologies have enabled the development of modular designs that are easy to install, maintain, and customize according to specific needs. A variety of both traditional and modern materials are used in the design of floating docks, including wood, steel, concrete, and aluminum.

While wood still remains in use for floating structures, it is often used in combination with other materials. Wood requires regular maintenance to prevent decay and insect damage.

Concrete is another popular material, which is frequently paired with foam floats for buoyancy. Despite the popularity of concrete docks, they tend to be less flexible and more challenging to adapt, repair, or modify once installed. While durable and capable of supporting heavy loads, concrete is both expensive and heavy. The material is also prone to cracking, particularly in marine environments where the presence of chlorides in seawater, coupled with high temperatures and humidity, can lead to severe corrosion in concrete structures, thus accelerating deterioration and ultimately reducing their lifespan and durability.



Metal floating docks, such as steel and aluminum, are preferred for industrial applications due to their strength and the ease and affordability with which they can be custom-designed. Steel, however, must be protected from corrosion, whereas aluminum is prized for its lightness and corrosion resistance (Figure 1). These materials can be combined to create tailored solutions for specific environmental conditions and project requirements.

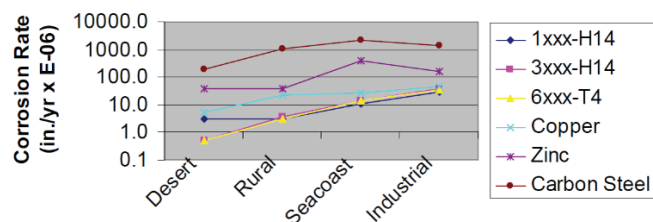


Figure 1. Corrosion rates for aluminum and other materials in various environments.

### Aluminum Dock Design

Aluminum offers significant benefits in dock construction, as it does in other industrial applications. In particular, the use of aluminum extrusions allows for the integration of localized increased wall thicknesses and useful features directly into the structural elements of the profile. For lateral dock profiles, extrusion design enables the inclusion of heavy-duty T-slots, facilitating the secure attachment of pile guides, cleats, mooring bollards, ladders, and other elements required for docks without the need for drilling (Figure 2).



Figure 2. An aluminum extrusion demonstrating the kinds of additional features that can be seamlessly incorporated into a profile.

A lighter dock has a lower mass, which reduces the inertia generated when subjected to lateral dynamic forces, such as waves, currents, or vessel impacts when the boat or craft performs a mooring maneuver. Due to its light weight, aluminum results in lower point loads being transmitted to the anchoring systems of the floating docks. It's important to note that the ability of anchoring piles to absorb or resist lateral forces depends on their design, installation, and the specific characteristics of the site, such as the nature of the seabed. Additionally, aluminum's light weight facilitates handling and installation, and reduces the dock's buoyancy requirements, leading to lower transportation and installation costs.

Aluminum also has a unique ability to dampen forces due to its low modulus of elasticity. An aluminum dock, for example, might flex or deform more easily, storing energy when subjected to dynamic forces like waves or moving boats. This energy storage can offer significant benefits in terms of flexibility, shock absorption, and the reduction of concentrated stresses, contributing to better durability

and enhanced performance under dynamic loads or challenging marine conditions.

MAADI Group has a strong history of working with maritime structures. Founded in 2005 as an engineering firm in downtown Montreal, the company is focused on providing engineering services exclusively for the North American aluminum industry, specializing in structural designs, including floating breakwaters, docks, and pedestrian bridges.

In response to the growing demand for not just design services, but also fabricated structures and driven by the scarcity of quality fabrication shops with gas metal arc welding (GMAW)-certified welders, MAADI Manufacturing Inc. was established in 2014, expanding the company's offerings to include manufacturing capabilities. MAADI Group moved its manufacturing operations to the state-of-the-art facilities of Meta-For (one of its shareholders) in Mirabel, Quebec, following the COVID pandemic. Meta-For has over a decade of experience in constructing aluminum GMAW-welded structures. By situating itself within this specialized fabrication facility, MAADI Group has access to Meta-For's expertise and advanced capabilities, thus ensuring that MAADI's high standards of quality and innovation continue to flourish in this new manufacturing partnership.

More than 50% of MAADI Group's work is focused on the marine industry. The company specializes in the use of aluminum extrusions, which allow them to incorporate unique design features across all of its structural products. The company has designed a number of docks, bridges, and other structures, including the floating breakwater installed at the Old Port Cove marina in Palm Beach, FL, in 2007 (Nancy Klein, "Aluminum Provides a Better Breakwater Design, *LMA*, October 2008). The recently completed Legendary Marina & Yacht Club project (described hereafter) is MAADI's most recent example of an aluminum dock design. In addition, the company is currently involved in engineering aluminum marine projects in Vancouver, BC, Canada; Toledo, OH; and the Virgin Islands.

### New Floating Marina in Alabama

In response to continuous year-on-year increases in recreational boat usage and sales, Legendary decided to construct the Legendary Marina & Yacht Club, which opened in early 2024. The new facility includes floating and fixed docks for 56 wet slips designed and manufactured by MAADI Group (Figure 3), as well as "hurricane-proof" dry storage supplied by Mack David Buildings. Using dry storage, boats (up to 53 ft) are lifted out of the water using two large marina forklifts and stored in a purpose-built



Figure 3. A view of the one of a gangways and floating docks at the Legendary Marina & Yacht Club.

building with vessel racks. Dry storage provides owners with a safe location to store their vessels when not in use, while making it convenient to quickly retrieve the boats and place them in the water. This enables the company to provide a premium concierge service, including the ability to make launch requests via an app, unlimited in-and-out-of-water services, boat preparation (including ice, water, and fuel supply), and complimentary freshwater rinse from the rub rail down.

"We take a lot of the hassle out of boat ownership with our concierge-styled service," said Rodney Chamberlain, professional engineer for Legendary Marina & Yacht Club. "Our members simply request that their boat be launched at a specific day and time and tell us how much fuel they need, and we make sure everything is ready and waiting when they arrive. Upon their return, our dockhands will retrieve the boat and provide a complimentary freshwater rinse and engine flush. We even offer complete factory-trained marine service for any mechanical issues."

Chamberlain noted that having floating docks was an important element of the new facility, because the process of securing a boat to the dock and fueling is easier than with fixed docks. He also highlighted the fact that floating docks, particularly those comprised of aluminum, are visually appealing. "Aluminum is a superior metal in terms of corrosion resistance and aesthetics," he explained. "Legendary places a high value on the look and feel of the marina space. We want our members to be proud to be at our marina."

The company selected MAADI for the design and construction of the aluminum floating and fixed docks due to its previous work manufacturing upscale marinas. The project involved close collaboration between the MAADI team and various professionals working for Legendary, including architects, planners, and structural engineers.

A number of considerations had to be taken into account regarding the design of this marina project, including space constraints, budgets, wind speeds, and storm surges. "Our primary concerns centered around the environmental conditions of the marina's location," said Alex de la Chevrotiere, CEO of MAADI Group. "Specifically, the marina is situated in a busy channel where both commercial and private vessels frequently pass, creating significant wake. Another challenge was integrating the new marina into an existing basin that had been left incomplete by a previous owner. This required careful planning to ensure the docks fit seamlessly within the existing infrastructure."

The design process began with the development of an optimized layout created using satellite imagery, which proposed a design aimed at maximizing potential revenue for Legendary. All of the stakeholders involved had an opportunity to review the initial layout, resulting in feedback and discussions that led to multiple revisions. "Once the layout is finalized and approved, we proceed with structural detailing and develop a calculation note to account for the environmental loads and conditions the marina will face over the next 30 years," explained de la Chevrotiere. "Throughout this process, our collaboration with Legendary was integral, ensuring that every aspect of the design met both their expectations and the long-term durability standards required for the project."

MAADI implemented two distinct structural systems for the project, which were tailored to the required length of the boats that will be moored at the marina. For the floating dock design, the company implemented its Great Lakes™ and Tri Ocean™ systems (Figure 4),



Figure 4. Tri Ocean is one of the two extruded aluminum systems implemented in the design of the new marina.

which provide 80 ft LOA (overall length of the vessel) and 175-ft LOA, respectively—both of which are designed to withstand hurricane category 1 environmental loads, while at full occupancy. For all of the gangways, the company's MakeABridge® system was utilized. These systems were integrated with pile and H-beam anchoring solutions to ensure stability and durability. Various auxiliary components were also incorporated into the dock design to complete the marina, including service pedestals, mooring cleats, pump-out stations, and gas dock accessories.

The floating and fixed dock frames are constructed from extruded 6061-T6 aluminum (Figure 3), which offers excellent resistance to the harsh, salty marine environment, especially above the waterline. The alloy also has superior strength in the heat-affected zone compared to other alloys that may be more susceptible to weakening in this area. This is important, because all of the fixed and floating docks were fusion welded, ensuring easy assembly, strength, and durability. Each welded aluminum system was supported by MAADI's Welding Procedure Specification and rigorously tested in-house and approved by the company's in-house professional engineer. These tests ensured that the welds met the necessary strength and durability standards for the challenging conditions expected at the marina.

A premium composite material was used for the decking due to its durable and low-maintenance surface. In addition, the floating docks feature reinforced flexible connectors made of EPDM rubber at each end. These connectors are designed to dissipate wave energy and reduce stress on the structure, rather than simply resisting the forces of the waves.

Installation of the marina was expertly managed by Crucible Construction, based in Daphne, AL. MAADI sent a site supervisor during the initial stages of the assembly and installation and was available for support throughout the process. According to Legendary, the entire installation process went smoothly, resulting in the completion of the beautiful new marina.

"Most other marinas use wood or concrete, which can weather over time. Our new aluminum docks are durable and feel great when you walk on them," said Chamberlain. "These docks also look amazing. The quality of the materials, the thoroughness of the plans, craftsmanship in the welds, the on-time deliveries, and the dependable customer support through the installation process were all great. MAADI was able to meet all of the challenges involved in the project with a very technical engineering team, and their experience in the dock fabrication business created efficiencies that ultimately lowered our cost." ■