A contractor offers his perspective on floating and fixed docks

By Gil Dissen

A fundamental decision facing any marina owner/operator who is either constructing a new marina or replacing, expanding, or refurbishing an existing one is to determine what type of docks to install—*floating or fixed*.

Although many marina operators are currently choosing to install floating docks, there is still a loyal following for fixed docks in various parts of the country. These are primarily coastal areas characterized by shallow water and small tidal fluctuations, such as those found in the Mid-Atlantic States. In these areas, fixed docks are not only a viable alternative to floating docks, but they are often preferred.

There are two reasons why fixed docks continue to be popular in these areas. One is their long history as the dominant docking system for both recreational and commercial boats–a period spanning hundreds of years. The other is the abundant supply of southern yellow pine.

Because timber is readily available, marinas in these sections of the U.S. routinely use it to construct docks, boardwalks, bulkheads, and other marine structures on both private and public projects. It is woven into the very fabric of the coastal landscape.

But the reluctance to change doesn't fully explain the continued staying power of these structures. For some, it boils down to what they perceive as the real advantages of fixed over floating docks. This article seeks to provide information on the perceived benefits of floating and fixed docks from the viewpoint of a contractor who has had extensive experience installing both types in the Mid-Atlantic States. On this question, marina owners/operators are not neutral. They have a strong preference.

Basic analysis

Floating docks are flexible structures, usually modular in design, that float on the surface of the water. As such, they rise and fall with changes in water level–a key distinction compared to fixed docks. Floating docks can be either permanent or seasonal in nature and various types of mooring systems hold them in place.

In warmer climates, marinas usually leave floating docks in the water year-round. In colder climates, where ice floes and ice build-up can be concerns, marinas often remove the floating docks at the end of each boating season and re-install them in the spring. The other option is to use water agitation systems to prevent ice formation. The degree to which floating docks are permanent or seasonal depends largely on the type of mooring system used and the utilities.

Floating docks typically consist of flotation units to provide buoyancy; a framing system constructed of wood, steel, aluminum, or concrete; and a decking constructed of timber, aluminum, concrete, or composite material.

Fixed docks

Fixed docks are rigid structures that are permanently attached to the water bottom. As with most permanent structures, construction specialists build the docks on-site, and they remain in the water throughout the year. Most marinas construct fixed docks out of timber pilings, framing members, and decking. However, fixed docks can also be constructed out of steel and concrete, especially in areas prone to ice and/or other heavy loads. For purposes of this article, the author is primarily discussing fixed timber docks. A key attribute of fixed docks is that their deck elevation does not change with changes in water level.

Many marinas use both types of docks-fixed docks traverse shallow water areas and provide boater access to floating docks moored farther out in deeper water.

Considerations

The first factor to consider when installing docks is water level.

Floating docks rise and fall with the water level, just like the boats moored to them. As such, the difference in elevation between the boat's deck and that of the dock remains constant, facilitating boarding and disembarking. For this reason, floating docks are ideally suited to coastal areas characterized by tidal variations, typically four-feet or more, and lakes and rivers with seasonal variations in water levels and/or water management practices.

In contrast to floating docks, the elevation of fixed docks does not change with the water level. As a result, there can be a substantial difference between the elevation of the boat and the dock during periods of low water, which makes boarding and disembarking difficult and potentially dangerous. For this reason, marinas have used fixed docks in those areas where the water level has not varied greatly, typically less than four feet. If variations exceed four feet, floating docks may be a better choice. For this reason, fixed docks are very common in the mid-Atlantic and other low-tidal range areas.

Water depth

For structural and cost reasons, the use of fixed docks is limited primarily to shallow water applications. As the water depth increases, fixed docks require longer pilings and more structural support to provide sufficient strength and rigidity. This heavier construction adds considerable cost to the dock installation. Moreover, most fixed docks are constructed of timber, and, practically speaking, timber pilings longer than 60 feet should not be used where the depth of water exceeds 30 feet. If a marina wants to construct a fixed dock in these deeper waters, it should use more costly steel or concrete pilings and framing.

Floating docks are also secured with pilings, although typically much fewer in number. However, floating docks can also be secured with various types of anchoring systems, such as concrete or helical anchors. These anchoring systems enable floating docks to be moored in deeper water not well suited to piles.

Bottom substrate

Marinas need to consider the relative hardness of the bottom substrate when selecting docks. As previously noted, many marinas secure their docks with pilings. The ability of a pile to support a load is a function of the firmness of

Figure 1. Pile-supported floating dock installation.

the soil and/or the presence of bedrock.

Contractors use impact or vibratory pile hammers to drive most pier piles into firm, but penetrable soils, to a minimum bearing and/or penetration – nominally 10 tons and/or 15 to 20 feet. The absence of load-bearing soil can necessitate longer piles, a potential problem if the piles are timber, which have a limited length.

Conversely, if marinas can't penetrate the bottom substrate due to overly firm soils or rock, drilling or auguring may be required. This is a process in which piles are inserted into pre-drilled holes requiring specialty construction equipment. As might be expected, this method of securing docks is more

Figure 2. Fixed timber dock installation.

costly than conventional pile driving.

Under these circumstances, it may be more cost-effective to secure floating docks with gravity-type anchors. These anchors rest on the bottom and are connected to the dock with cables or chains. Like piles, contract engineers will determine the size, number, and location of the anchors for a given location and dock application.

Performance

A fundamental requirement of dock systems is to dissipate horizontal and vertical loads imposed by natural forces such as wind, waves, and currents; impacts from boats and floating debris; and boaters themselves.

Floating docks have a designed-in flexibility to transfer horizontal loads from one component to another, from one dock section to another, and ultimately to the mooring piles or anchoring system. They directly transfer vertical loads to the water. The load capacity is a function of the dock's strength, surface area, and buoyancy. As such, they often move, which can be pronounced in rough water. In addition, because their deck elevations are typically one- to two-feet above the water, floating docks are vulnerable to wave topping.

Fixed docks, because they typically rise five feet or more above the water, are not subjected to the same loading from wind, waves, and currents. Fixed docks dissipate horizontal and vertical loads directly into the ground through the pilings. For this reason, fixed docks can typically carry more weight than floating docks, which depend on buoyancy to support vertical loads.

Because wood is a very resilient material, it is well suited for typical loads encountered in marine environments. In addition, because construction contractors have built wooden docks for a long time, the design and construction of wooden docks has become standardized and their performance characteristics are predictable.

Aesthetics

In some instances, aesthetic concerns can make one type of dock a better choice than the other. On more than one occasion, a contractor has installed timber docks because the owner wanted to maintain the aesthetic continuity with other landside timber structures, such as bridges, boardwalks, and observation decks. In one marina development project in Maryland, the owner's architect selected fixed timber docks because, in his opinion, they best captured that "Chesapeake feel" that the owner was looking for. In other cases, marinas chose timber docks because they could be more easily integrated into existing docking systems or shoreline facilities.

On the other hand, some customers prefer floating docks because they better reinforced the "state-of-the-art" image the marinas were trying to create. One advantage of floating docks that resonates with marinas is that they require fewer piles to secure, and consequently, have an overall cleaner look, especially if moored with anchors.

Expandability

It is generally acknowledged that floating docks can be easily lengthened or shortened, added on to, or otherwise modified due to their modular design. This is true to a point.

Marinas can modify their floating docks, but the ease with which this is done is largely a function of the dock's utility configuration and mooring

Figure 3. Crane-mounted augur for auguring in mooring piles.

system. It is usually easier and less costly to reset most types of anchors than it is to pull and redrive piles.

It is more difficult and costly to reconfigure fixed docks because of their reliance on piling. However, it is relatively easy to fit timber docks with various amenities such as pumpouts, power pedestals, etc.

Life cycle costs

Over the years, there have been many cost comparisons between floating and fixed docks. When conducting such an exercise, marinas should take great care to make the most accurate comparison.

Floating docks vary greatly with respect to features, performance, and price, depending on whether they are made from lightweight timber and aluminum components or massive pre-cast concrete ones. In addition to the initial

purchase price, marinas must also consider the cost of installation and maintenance. The installation cost will vary considerably depending on the bottom characteristics and mooring system. Similarly, the cost of a fixed dock is greatly influenced by the size, length, and number of piles used to build it, and, to a lesser extent, the amount of structural framing.

Wooden fixed docks have been able to maintain a cost advantage over floating docks because of the availability and relatively low cost of wood, along with the standardization of design and construction techniques. In years past, this price gap has been as much as 20% to 30%, but this gap now appears to be narrowing.

Both types of structures require periodic maintenance to ensure optimal performance. In the case of floating docks, marinas should inspect the mechanical connections that transmit the lateral loads for fatigue. In addition, marinas need to routinely inspect the plastic floats used on many types of floating docks to insure that proper buoyancy is being maintained.

When marinas need to repair timber docks, they can do so quickly with readily available tools and equipment. The key to a timber dock's longevity is the extent to which it is treated with various types of wood preservatives that help it resist attacks made by marine borers. Most marine timber carries a 20 year guarantee against marine borers.

Although the life span of docks depends on a host of variables, this contractor's experience suggests that on average, fixed docks last 25 to 35 years (longer in fresh water locations), and start requiring periodic repairs after 15 years. Today's floating docks routinely last 20 to 30 years with proper maintenance.

Figure 4. Typical finger arrangement on floating dock.

Figure 5. Typical finger arrangement on fixed timber dock.

Figure 6. Typical framing configuration for fixed dock with utility runs.

Other factors that may influence a comparison of floating and fixed docks include tax implications, environmental and permit differences.

Conclusion

In recent years, floating docks have made tremendous gains in the marina marketplace, often at the expense of fixed docks. As floating dock manufacturers continue to design stronger, longer-lasting, and more cost-effective products, their share of the marina dockage market can only increase.

Fixed docks, on the other hand, won't disappear. They will continue to remain a viable alternative in their traditional geographic markets. Their large installed base, broad market acceptance, and low price will keep local dock builders busy for years to come.

Although there are many different reasons why marinas prefer one type of dock to the other, inevitably, it's the boating customer who has a major influence on the decision. In markets where boaters have choices, marinas will provide those types of docks that will best retain their existing customers and attract new ones. ⚓

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