

Urban Kayaking Facility - Design Issues

Table of Contents

Introduction	1
Boats, People, and Docks.....	1
Floating Dock Placement	2
Floating Dock Design.....	3
Ramps vs. Beaches	5
Public Boathouse Design.....	6
Public Kayaking Programs.....	9
Long Term Issues	10

Introduction

Below is a list of some of the issues that need to be addressed when designing a public boathouse, dock, or kayak launching facility, in New York City. The assumed objective is to build a facility that easy and safe to use by most people, regardless of their skill level, and their physical capabilities. It is also assumed that the boathouse will be for general community use, which implies that a large number of people will be using it.

This note is a strictly personal document and in no way reflects the policy of any group or club that I belong to. Having said this, most of the observations are based on my experience as a dock worker at the Downtown Boathouse in NYC, where I have helped many thousands of people go kayaking on the Hudson River.

Graeme Birchall

Phone: (201) 963-0071

Email: Graeme_Birchall@verzion.net

Web: http://mysite.verizon.net/Graeme_Birchall/

17-Aug-2009

Boats, People, and Docks

The type of dock and/or boathouse that one designs must reflect the kind of usage that it will get. To this end, various kinds of human-powered boats should be considered:

- Canoes.
- Decked kayaks.
- Sit-on-top kayaks.
- Inflatable and folding boats of various kinds.
- Outrigger canoes of various sizes.
- Rowing sculls of various sizes.
- Dragon boats, and other large boats.

Some of the above boats have almost opposing needs. For example, teams launching large rowing sculls might prefer a wide ramp with few obstructions, but a person wheeling their own kayak

down to the water might need a narrow ramp - so they can reach for the handrail if they start to lose control of their boat.

If one is building a public launch facility that is likely to be around largely unchanged for the next twenty or more years, then the boat that one arguably should design for is the boat that has not been invented yet. I don't know what it will look like, but it will be cheap, and portable, and easy to use by most people. Once it comes to market, it will be bought in the many tens of thousands.

Equally importantly, one must determine what kind of people will use the facility, and make it suitably safe for all of them. In particular, if it is a public facility, the dock should be safe for very small children and less-able people, even if it is not intended that they will use it in the immediate future.

Floating Dock Placement

The best place to put a floating dock is in calm sheltered water with no nearby hazards, and that is deep enough to be usable at all times of the tide.

- Study the local microclimate and currents before deciding where to place the dock. In some embayments distances as small as twenty feet can have a significant impact on conditions.
- Find out from where the predominate waves and winds come from. In NYC the predominate wind direction differs from winter to summer. We care about the summer.
- Know where in the embayment the flotsam and jetsam typically accumulate (in summer). Do not build a dock in that location.
- If there is a major shipping lane nearby, determine how busy it is (in summer) and what size swells are likely to come into the embayment, and from what direction. Determine if the swells break near or where the dock is proposed to go.
- Avoid placing the dock in or near items that are hazardous to inexperienced kayakers. In particular, do not place the dock in, or directly upwind of, a pile field or pier.
- Ensure that the dock is not shaded by nearby structures for most of day, as it may become unduly cold at the beginning and end of the season.

Water Depth

In general, if the conditions are calm and the bottom clean, place the dock in shallow water (to prevent drowning). If the bottom is unsafe, or the water sometimes rough, go for deeper water.

- All measures of water depth should be done at low tide. The dock should be safe and usable at all times of the tide.
- If part of the embayment is shallow, know what is on the bottom. If it is rocks, or nasty sharp stuff, or especially toxic mud, locate the dock elsewhere.
- A dock placed in shallow water (i.e. less than two deep) that is exposed to swells may have waves breaking over it, which can bother some people. Be especially wary of placing a dock in shallow water that is right next to deep water, because persons on the dock will get no warning of an incoming wave.

Public Program Issues

When the dock is to be used to run a public kayaking program, it should ideally be placed so as to maximize the safety of the persons on the water.

- All of the water area under supervision should be visible from the dock.
- Consider placing the dock so that the transit time from dock to the whole of the area (on the water) under supervision is minimized. This enables a lifeguard on the dock to deal with an incident on the water as quickly as possible.
- If the public kayaking program is being run in an embayment that is exposed to open water, consider placing the dock near the entrance to the embayment. This enables a lifeguard on the dock to more quickly get to a person who leaves the embayment.
- The persons working on the dock may also be acting as lifeguards, in which case make sure that all of the area under supervision is viewable from the dock. Also check that glare or light reflecting from buildings will not be a problem at any time of day.

Floating Dock Design

Below are some issues to consider when designing a floating dock:

- Ideally, one should be able to launch/land on a floating dock from at least two sides - so if the wind or waves make one side too rough, the other can still be used.
- If the end of the dock is often hit by big waves (e.g. it faces the open water) make the dock rectangular in shape (instead of square) so that the (useless) exposed end is shorter, while the more sheltered sides are longer.
- Make the floating dock flat with respect to the water. Young infants pick up speed remarkably quickly on even gently slopping surfaces.
- The dock should be rigid (i.e. not a flexible modular system) and have a non-slip surface that is soft enough to allow boats to be dragged across without damage. Wooden planks are ideal.
- Make sure that any wood chosen for docks does not cause splinters. Unfortunately, much of the hardwood that is used in public spaces in NYC is chosen to prevent vandalism, which means that it is very hard. This is fine as it goes, but this wood species often slowly emits millions of micro-splinters, which are a major hassle.
- Make sure that the sides of the dock go straight down into the water. Do not have a lip or rim on the side - where a person might get their hand crushed if it is underneath and a wave suddenly lifts their boat up.
- Do not make the dock float too high in the water. Six inches is ideal. One foot is too much. The higher the dock is, the fewer people that can launch and land kayaks safely.

Be aware that motorboat docks are typically built at least 18 inches above the water, also for safety reasons (i.e. to prevent waves from splashing on the dock). Don't do this!

- It is generally OK if the dock surface is occasionally swept by waves. People get their feet wet, but that is about it. But if a portion of a dock is constantly being swept by waves it may be so wet that algae will grow, which will cause it to become slippery.

- Geese like to hang out on docks. It is hard to design docks to prevent them from doing this. If they are going to be a problem, make it easy for the dock to be cleaned. Otherwise it is hard run a volunteer program.
- Make the dock floatation shallow and broad, vs. deep and narrow. The former is better at keeping the dock a constant height above the water, regardless of the weight on it.
- The dock must not move suddenly or violently when a wave hits it.
- There should be no sharp edges anywhere on the dock.

Dock Size

- A typical embayment between piers in NYC usually has room for a hundreds of kayaks on the water. All of these kayakers should be able to get off the water in "n" minutes if needed, where "n" is less than ten. If no other exit points exist, size the dock accordingly.
- It is all but impossible to do basic crowd control with large groups of kayakers - because they can come to an embayment by water from many locations, and once arrived they will probably have to land. If such events are likely to occur, size the dock accordingly.
- Kayakers tend to spend an inordinate amount of their time in the water right next to the dock spot, or on the dock itself. In part, this is because it often takes a while to land and/or launch. But it also happens because the dock and/or beach acts as a natural meeting place. Likewise, many kayakers often rest for a minute or two - just as soon as they have got out of their boat. For all of these reasons, one should over-size the dock.
- If the dock will be used to run a public kayaking program, make sure that there is enough space to hold all of the boats in the program (e.g. up to 30 kayaks) without having to constantly move them around, or double-stack them.
- The dock should be at least 24ft wide, so that boats can be stacked in the middle, and persons landing or launching can easily walk around them. The dock should be long enough so that a person coming down the ramp pulling a kayak can maneuver around what is already there. Sixty feet a good minimum length.

Security

- Have a secure lockable gate at the top of the entrance to the floating dock.
- Make the gate lock work like a safety door - that can always be opened from one side. In this case, somebody landing on the dock should be always able to get out.
- Make the whole of the dock visible to persons walking by - so they can see if something is wrong. Provide a police call box next to the entrance.

Ramp

- Make the ramp suitably long, so it is not too steep at low tide. Ramps that are too steep are not good for people in wheelchairs, children in strollers, or persons with very long kayaks. The latter will get stuck at the bottom of the ramp, where there will be a sharp "v" between the ramp and the dock.
- Make the ramp reasonably narrow (i.e. 5ft or less). With wider ramps there is a temptation to wheel a boat down the middle, which means that the person will have nothing to grab on to if they lose control.

- Make the ramp straight from top to bottom. If the ramp gets steeper as one goes down people may not realize it, and start out at the top, only to lose control half way down. People on roller blades are especially worrying in this regard. Also, a convex or concave ramp must be steeper at its steepest point than an equivalent length straight ramp. It is the maximum steepness of a ramp that determines its overall safety, so this should be minimized.
- Two standard-width ramps (e.g. both 5ft wide) placed side-by-side are arguably more useful than a single extra-wide ramp. They enable one to assign different ramps for different purposes, and they mean that everybody on the ramp is within reach of a handrail.
- Do not have not any steps (especially very tiny ones) above or below the ramp. They can cause people wheeling boats to lose control.
- Do not design the ramp to support large crowds of people (e.g. spectators). Doing so requires lots of flotation, which makes the dock float high in the water when all of the extra weight is not there.
- Bevel or cover the (sharp) metal lip at the bottom of the ramp to avoid injury.

Emergency Exit

- If the dock is the only exit from the water in the embayment, have a small backup exit (e.g. a ladder down to the water) nearby - just in the case the main dock is inoperable. Put this exit in an area that is sheltered when the dock itself is most exposed to the elements.

Ramps vs. Beaches

In New York City it is very hard to get a beach built. But all other things being equal, a beach, or a concrete ramp going down into the water, is usually better than a floating dock:

- Beaches by definition lead into shallow water. Thus there is no chance of a person falling off and immediately ending up in deep water.
- Beaches don't need fences to keep people out. Docks often do, because of the deep water.
- Beaches are almost always prettier to look at than floating docks. They are also safer to play on. Thus children require less supervision on a beach.
- It takes less skill to land or launch a kayak from a beach. And if things do go wrong, a person is not going to fall out of their boat and end up in deep water.
- People often get wet when launching a kayak from a beach. This may seem like a bad thing, but it is actually good news. People who think that kayaking can be a "dry" sport should be discouraged from going on the water.
- Beaches tend to be rougher on boats than docks. Again, this may seem like a bad thing, but it is arguably a good thing if it discourages fragile boats (or people) from entering the water.

In hiking trail design, there is a concept that is sometimes called a "yuppie barrier". When a wilderness trail is built close to a densely-populated area, the section right next to the road-end is sometimes designed to be the muddiest section of the trail. Thus people hiking the trail get to experience the worst conditions when they are the most prepared, and if they are not prepared, they can always turn around and go right back to their car.

A similar logic should be used when building access points to the harbor in large urban areas. Try to send an unwritten message that kayakers and other small boaters will get wet, and that a certain skill level might be good to have. All other things being equal, a beach does this better than a floating dock.

- Kayakers can exit the water in much less time via a beach. They simply run their kayak up onto the sand and jump out. By contrast, exiting via a dock requires that the kayaker maneuver the boat so that it is parallel to the dock, then get themselves out of their boat.

If the nearby water will occasionally have many hundreds of kayakers, then a beach is a must. The only way to empty an embayment of hundreds of persons in a very short time (e.g. if a thunderstorm comes in) is via a beach.

- Beaches usually have lots of connections to the upland beyond. By contrast, a floating dock often has a fairly narrow ramp, which is an additional bottleneck.
- Beaches almost always have more space than a floating dock. Thus they can be used to store many more kayaks before becoming crowded.
- Beaches are not maintenance-free, but the maintenance required is often much less technologically challenging than for a floating dock.

Having said all this, there are issues with beaches:

- Beaches cannot be imposed upon nature. No amount of sand or pebbles will stay where they are put unless some very sophisticated analysis is done of local waves and currents.
- Beaches have to be usable at all times of the tide. They should not be too muddy at low tide, nor too small at high tide. And seaweed buildup needs to be prevented.
- Beaches need waves – but not too many and not too few. If the beach is too sheltered, it is likely to slowly turn into a swamp. Likewise, exposed beaches may not last long.
- Sand beaches are best, but pebble beaches are also fine in more exposed locations. As long as the pebbles are constantly being turned over by waves, seaweed buildup is unlikely.
- Beaches that immediately drop off into nearby deep water can have breaking waves, and also give a false sense of safety. At low tide, deep water should be at least 20ft out.
- Very heavy human-powered boats may be hard to drag over a beach. A narrow concrete ramp leading down into the water can be provided for these types of boats.
- Building a beach in NYC almost invariably means digging a cove, which means less landside park space. For very small waterfront parks, this is an issue. But for almost all parks, having a beach is worth the space.

There is an excellent new beach at Maxwell House Cove in Hoboken NJ. Check it out.

Public Boathouse Design

A public boathouse is not like a clubhouse, nor a private boathouse, both of which tend to be enclosed spaces with limited public access. It is closer to a public library in that it will have large numbers people constantly coming and going, with a minimum of restrictions, and yet with all of the public spaces always under some degree of supervision.

- Put the boathouse on the land, not the water. This reduces construction costs, and may improve general safety if it eliminates blind spots, and one does not have to worry about people going under the building.
- Some kayaks need plumbing. Wooden boats especially need to be washed after use. Assume that sometime between the boat is landed and put back in the racks, or taken away, it will be cleaned. Design a suitably large outdoor space to do this.
- Do not make the racks an integral part of the boathouse. The usage will almost certainly change over time, so be flexible. It is often very important that as many boats as possible are stored in the boathouse. Racks that are built for specific boat models can typically store twice as many boats in a given space as general-purpose racks. Thus the boathouse may end up with several kinds of racks, and these may be reconfigured year by year, or even from one season to the next.
- Provide basic unloading and loading access (for persons coming by car) to the boathouse. If they have to walk a distance, ensure that this can be done by pulling the boat on wheels. Kayaks can be up 20ft long, so make sure there are no tight turns.
- One should be able to partition the interior space into areas permitting varying degrees of public access (e.g. unsupervised access, supervised access, no access). Do not put facilities used by the public (e.g. restroom) in the wrong part of the boathouse.
- Design the boathouse, ramp, and dock so that the whole operation can be run by a reasonably fit adult of either sex who weighs no more than 90lbs. This means that there should be no heavy lifting required to open up or close down, to launch or land boats, or to move equipment (including kayaks) from one place to another.

Crowd Control

A busy community boathouse with (say) thirty kayaks for public use may be visited by several thousand people per day, of which over five hundred may go out on the water.

- Design the pier space so that those requesting information, or just looking, can do so without disrupting those persons wanting to go kayaking. Ideally, the first thing that visitors will encounter is an information desk.
- Do a user-flow analysis to ensure that the persons going kayaking do not encounter a bottleneck, other than insufficient boats. Identify each step in the process (e.g. sign forms, use lockers, change clothes, wait for a boat, go kayaking, return, wash off, change clothes again). For each step, determine how long it will take, how many people will probably be doing it at the same time (on a busy day), and where it will happen.
- If there is going to sometimes be insufficient boats, make sure that there is a suitable waiting area (for a line). The ideal place is next to the top of the ramp, but not so close that it disrupts usage of the ramp. There should be space for at least 200 people to wait in line. If the line overlooks the dock, it lets people see what is going on before they go down, which reduces the need to constantly explain everything.
- If space is limited, have changing areas (one for each sex), not changing rooms. Rooms with locked doors that are used by individuals are less efficient than enclosed public single-sex changing areas. Changing areas with no doors, and with screens instead of solid walls (so you can see people's legs) are better at preventing hanky-panky.

- Do not place the lockers in the changing rooms.
- Regardless of whatever interior plumbing there is, provide an outside hose and/shower - so people can wash off. Cold water is fine. Do not place the hose where people passing by are likely to trip over it. Also ensure that it can be used to wash a boat without spraying lots of water or nearby people. Ditto for the outside shower. For similar reasons, the shower and hose should be well away from any information desk - where there is lots of paper.
- Assume that on a busy day upwards of 500 people will be near or at the boathouse. Design the pier space (i.e. next to the dock ramp) to handle at least this size crowd.

Costs and Income

Before beginning to design the boathouse, estimate how much income the intended user will have and design accordingly.

- If the boathouse is only going to be used as a boat storing facility, design it so that it can be closed down in the winter.
- If the boathouse is going to be run by a club or other organization with limited funds, design it so it costs less than \$5,000 per year to run.

Private Kayak Storage

- Do not design a boathouse on public land principally to store private boats. The number of boats that can be stored will inevitably be small, and if the price is cheap enough, there will be far more people wanting to store a boat than there is space.
- The going rate in NYC for kayak storage is about \$70 per square foot per annum (assuming 24 square feet per boat, stored 4 boats high). This may not be enough revenue to maintain an expensive boathouse.
- Assume that every person who stores a boat at the boathouse will have a key to the building.

Restrooms

Restrooms are a very difficult design issue. If they are done wrong, they can greatly complicate usage of the boathouse by a volunteer organization. Kayakers need restrooms, but for various reasons, it is all but impossible for volunteer organizations to run restrooms:

- For security reasons, volunteer organizations should not run public restrooms.
- Volunteer organizations cannot be expected to clean public restrooms.
- Private internal restrooms (i.e. not intended for public use) can cause contention if there are no nearby public restrooms. One does not want to have a situation whereby volunteers constantly have to turn away members of the public looking for restrooms.

Some other design issues:

- Do not place restrooms that the general public can visit in sensitive areas of the boathouse.
- Restrooms imply plumbing, which in this part of the world implies that the building will have to be heated in the winter. This cost of this heating will usually be too high for a volunteer organization to afford.
- Boathouses designed intended for children's programs will need internal restrooms.

Arguably, the best solution is to have some very nearby clean, safe, public restrooms.

Flagpoles

A flagpole can be very useful, as long as it is designed properly, and its usage is under the control of the boathouse. For example, if it is visible from all of the controlled boating area, it can be used as a signaling device. If the flag comes down, it is no longer safe to be out on the water (e.g. because a storm is coming in). The flagpole should not act as a lighting rod.

Public Kayaking Programs

A public boating program is defined as one where the general public can rent or borrow boats, and go for a short paddle or row in a confined and supervised space.

- Ensure that it is difficult for boaters to leave the area under supervision undetected. In other words, all exit points should be easily viewable from the boathouse.
- Ensure that the boathouse has plenty of signage. People passing by when the boathouse is closed should be able to learn all they need to know about opening times, rules, regulations, the organization in charge, basic contact information, and special events.
- Ideally, there should be one location from where all of the dock and all of the embayment being used by the public program can be seen. Blind corners, where kayakers cannot be seen from the boathouse and/or dock, should be avoided.
- Make sure that there is plenty of shade for both dock workers and lifeguards. Ensure that this shade neither hinders boat movement, nor blocks sight lines. Going even further, when making a volunteer-run facility make those locations where you want the volunteers to hangout the most pleasant (e.g. with shade). Conversely, do not build a nearby spot that tempts the volunteers to wander away from where they are useful.
- Try to design the boathouse so that when it is in use, it takes a minimum number of people to do the boring stuff, like looking after gear, or keeping an eye on the crowds. This enables as many people as possible to do fun things, like kayaking.
- Do not let kayakers wander into areas that are going to challenge their skills - like amongst piles, or out in the middle of the harbor. Never let them go under piers. Having said this, there is no need to actually fence of such areas. Simple unobtrusive signage works wonders.
- If the proposed boathouse is likely to be volunteer run, design it assuming that most of the space is going to be either open to all, or locked off - as in a public library. For example, at some boathouses the public lockers are on the outside of the building, so they are visible to all. This discourages theft, and is much easier to supervise than inside lockers. Outside lockers should be sealed away when not in use.
- Design the boathouse and dock so as to minimize the time it takes to open up and close down a public kayaking program. Keep the distance from the boat storage to the dock short, and make it easy to use wheels to move things around.
- If the boathouse is some distance from the dock, assume that the people running the public kayaking program will move everything (on wheels) down to the dock in the morning, and then set up shop there for the day. Make the dock a little larger than it would otherwise be in order to accommodate their gear.

- Make sure that there is a restroom within a reasonable distance of the dock.
- Don't mix fishermen and kayakers in the same physical space. Likewise, no motorboats.
- Do not place sources of loud noise (e.g. outdoor music) next to the public kayaking program. Many accidents can be prevented if the person on the dock can simply yell at the person on the water - and thus tell them what to do. To this end, create a "sound footprint" map of the area to determine what sounds will dominate in which spaces.
- Have a webcam overlooking the dock and embayment, so people can tell if the place is open and what the conditions are, without having to come for themselves.

Long Term Issues

No park exists in a technological or social vacuum. Thus one cannot build an urban park today without factoring in rollerblade users. Yet this technology did not exist 50 years ago. But contrast, one can confidently ignore users on horseback. Similar adjustments have to be made, based on the local crime rate, and the child-to-adult ratio.

An urban park that ignores current needs is not going to be used. Likewise, a park that is too tightly focused on current needs is likely to be obsolete in the very near future. With this in mind, I'll make some predictions about NYC harbor (and other urban harbors) usage in the next ten to twenty years:

- The water in the harbor will continue to get cleaner.
- The demand for personal kayaking on the harbor will continue to increase, and will continue to be largely frustrated because individuals won't have anywhere to store a boat.
- Commercial operators will continue to operate and prosper, but they will be unable satisfy the pent up demand, because they will, by necessity, be too expensive.
- Designers building urban waterfront parks will continue to find that it is all but impossible to make money renting waterfront space to human-powered water-based users. Thus we will continue to get waterfront parks that consist of a promenade and a coffee shop.
- On-the-water sponsored events will become increasingly common. These may consist of the types of people and boats that ordinary kayakers disdain (e.g. young kids in big rubber rafts). But they will be important because they will get many hundreds of otherwise land-bound people out on the harbor all at once.
- Some smart inventor will finally make the ultimate safe, fast, fun, portable human-powered boat for harbor waters. When this happens, tens of thousands will hit the surf.
- The urban population will continue to get larger, older, and increasingly female. Thus it will be even more important that all water access points work well for those who are less able than your typical kayaker today.

Graeme Birchall
17-Aug-2009