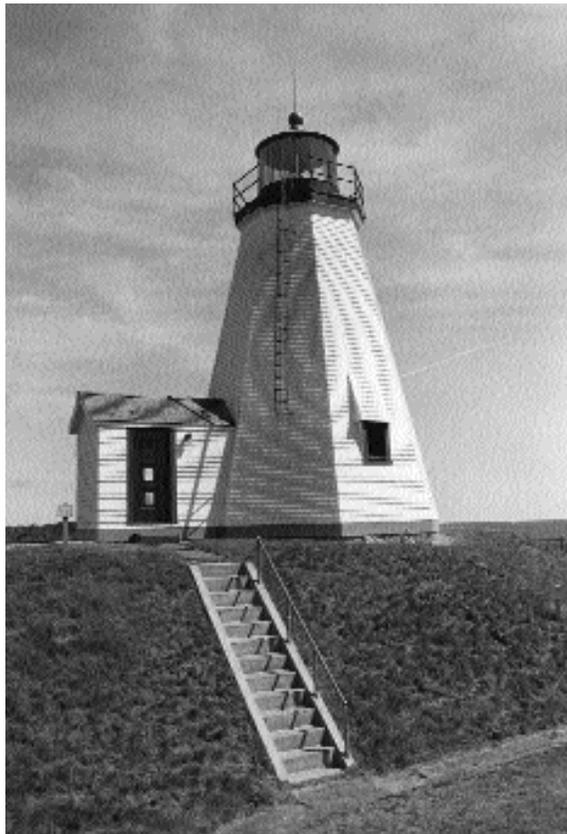


# Lighthouse Construction Types

*Example of an off-shore skeletal tower, Sombrero Key Lighthouse (1858), Florida. Photo of lighthouse in 1959 courtesy U.S. Coast Guard Historian's Office.*

Most lighthouses can be categorized by construction method, shape, building material, or foundation types. A lighthouse can also be classified as terrestrial or aquatic, i.e., onshore or offshore. The majority of today's 634 lighthouses are land based; close to one-fourth of them have foundations built in the water. The major construction types for historic lighthouses described below are wooden, masonry, wave-swept, concrete, cast-iron plate, skeletal, straightpile, screwpile, diskpile, crib, caisson, and Texas tower. Lighthouses were built on land, in the water, on islands, on top of ledges and cliffs, on breakwaters and piers, on caissons, and at least five are on fort walls. Some light towers are stand-alone structures, while others are attached or integral to the keeper's quarters or fog signal building. In addition to a light tower, a land-based light station could consist of a keeper's quarters, oil house, fog signal building, workshop, cisterns, privy, landing wharf, boathouse and ways, barn, roads, walks, and fences.



*Plymouth (Gurnet Point) Lighthouse (1843), Massachusetts, is the earliest surviving wooden tower. Photo by Candace Clifford, 1995, courtesy NPS.*



Politics, need, cost, location, and geography of the site, as well as technology available at the time of construction influenced lighthouse designs. Before the mid-19th century, lighthouse construction technology required solid rock or other stable foundation soils; onshore towers sometimes proved inadequate to warn ships off a shoal located offshore. In some locations, a lighted buoy or a lightship solved this problem. Riverine and estuarine environments, however, often had unstable muddy and/or sandy bottoms which could not support the heavy masonry towers then in vogue. In areas such as the Chesapeake Bay, Delaware Bay, the Gulf of Mexico, the Mississippi River delta, and the coral reefs of the Florida Keys, the development of newer technology using screwpile, diskpile, caisson, and skeletal tower lighthouse construction was essential to adequately lighting the marine hazards.

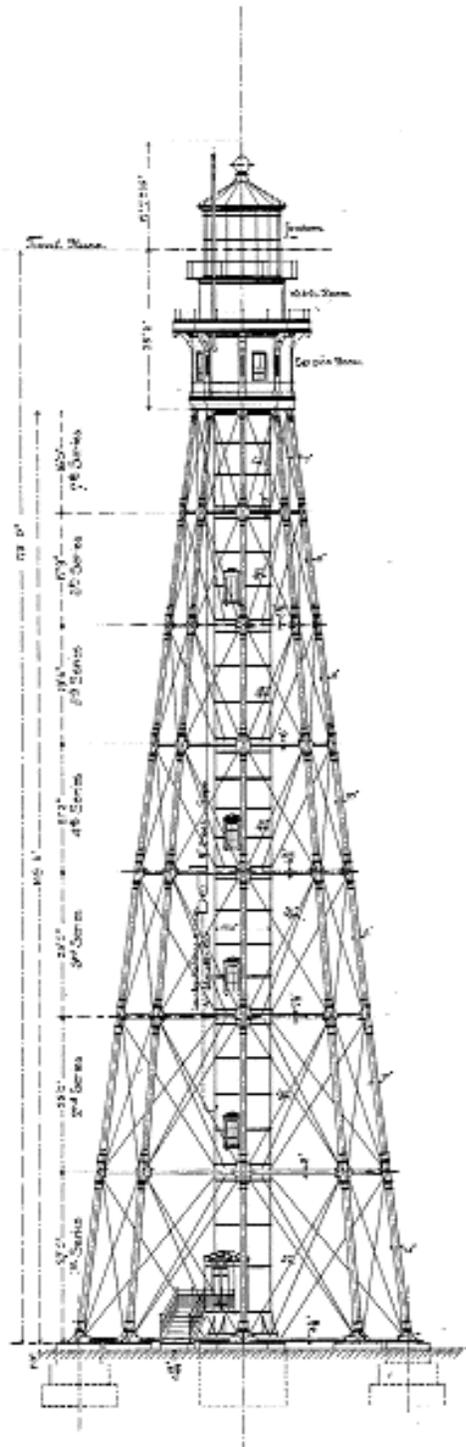
**Wooden tower.** Most early wooden towers have burned and/or been replaced; however, at least 71 wooden towers are still in existence. Prospect Harbor Lighthouse (1891) in Maine is a good example of a stand-alone, conical wooden light tower. Plymouth (Gurnet Point) Lighthouse (1843) in Massachusetts is the earliest surviving wooden tower.

**Masonry tower.** Masonry towers were constructed of rubble stone, cut stone (dressed stone), brick, or concrete. Masonry is the most popular lighthouse construction material with at least 203 surviving towers constructed of brick and another 123 of stone. The oldest standing masonry light tower in the United States is the 85'

The second Cape Henry Lighthouse (1881), Virginia, is the tallest cast-iron-plate tower in the U.S. at 163'. Photo courtesy NPS.

tall Sandy Hook Lighthouse (1764) in New Jersey built of cut stone. Towers over 150' high are referred to as tall towers. The 208' Cape Hatteras Lighthouse (1870) in North Carolina is the tallest lighthouse in the United States.

**Wave-swept tower.** Wave-swept lighthouses were built on low rocks or submarine ledges and constructed of interlocking stones to withstand the fury and power of waves in heavy seas. One of the first wave-swept towers built in the United States was the 114' Minot's Ledge Lighthouse



Construction drawing for the skeletal tower for Cape Charles Light Station (1895), Virginia. Drawing courtesy the National Archives.



(1860) offshore in Massachusetts which replaced a pile-type lighthouse that was destroyed by a storm. It was considered the “most important engineering work” constructed by the Lighthouse Board at the time.

**Concrete tower.** Concrete towers began to replace brick masonry towers at the beginning of the 20th century; a tower of reinforced concrete was first used in the United States at the 115'-tall Point Arena Lighthouse (1908) in California. At least 46 concrete towers exist today.

**Cast-iron-plate tower.** Cast iron was lighter than stone or brick, relatively inexpensive, strong, watertight, and had a slow rate of deterioration. The second Cape Henry Lighthouse (1881) in Virginia is the tallest cast-iron-plate tower in the United States at 163' high. Steel and wrought-iron plate was also sometimes used. This construction type can be dismantled and moved.

**Skeletal tower.** Onshore skeletal towers were built of metal and were typically constructed on concrete foundations. Offshore skeletal towers were also built of metal and typically constructed with straight or screwpile foundations (discussed below). Manitou Island Lighthouse (1861) and Whitefish Point Lighthouse (1861) in Michigan, both built from the same plan, were the earliest onshore skeletal towers built in the United States. Like the cast-iron-plate tower, skeletal towers could also be dismantled and moved. There are at least 130 existing iron lighthouse towers of both

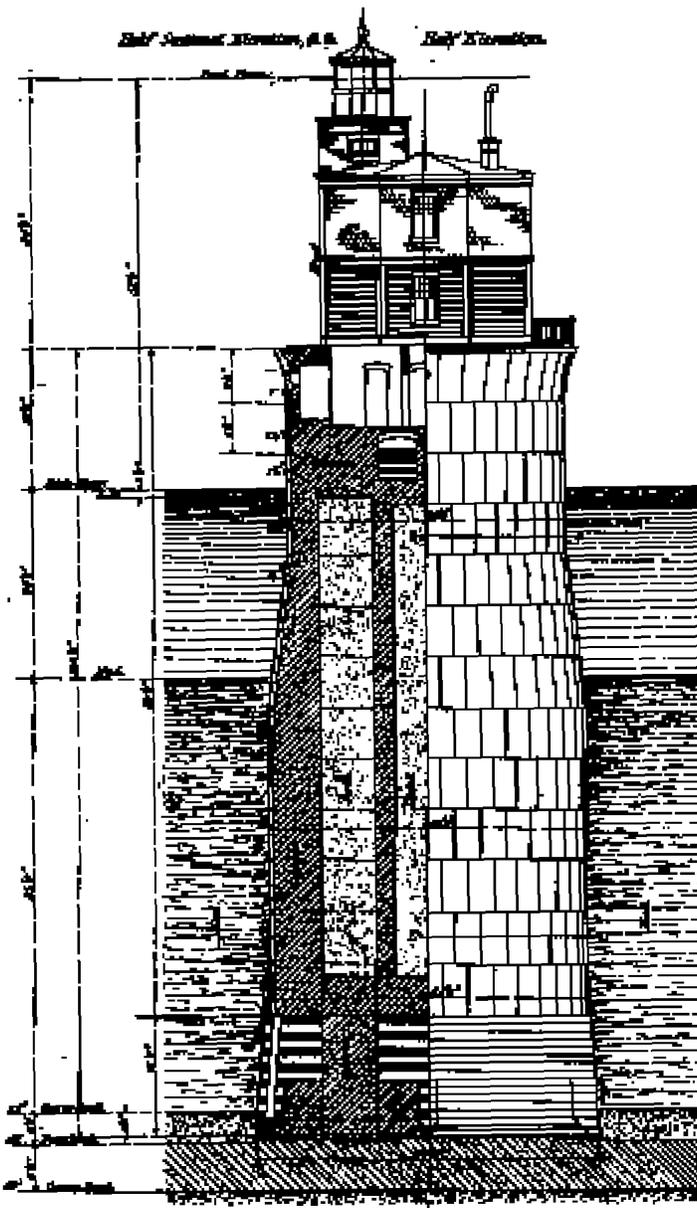
*Thomas Point Shoals Lighthouse (1875), Maryland, the only screwpile lighthouse remaining in situ on the Chesapeake Bay. Photo by R. B. Ressler, 1990, courtesy USCG.*

the cast-iron plate and skeletal variety with another 56 built of steel.

**Straightpile.** The pile foundation lighthouse utilized the principal of least resistance. Waves would pass through rather than crash against the foundation. This design of lighthouse structure was used offshore, even in wave-swept locations. The earliest surviving straightpile tubular skeletal tower lighthouse is Sombrero Key Lighthouse (1858) in Florida.

**Screwpile.** To increase the holding power of the pile, a screw-like flange was fastened to the bottom of the pile and wound like a screw into the substrate. There are two principal screwpile type lighthouses: low spider-like foundations for rivers, bays, and sounds and tall offshore coastal towers. Perhaps as many as 100 spider-like screwpile lighthouses were built throughout the

*Construction drawing detailing the caisson foundation for Baltimore Lighthouse (1908), Maryland. Drawing courtesy National Archives.*



Carolina sounds, the Chesapeake Bay, Delaware Bay, along the Gulf of Mexico, and one even at Maumee Bay (1855) on Lake Erie in Ohio. Thomas Point Shoals Lighthouse (1875) in Maryland is the oldest extant, unmoved, spider-like screwpile lighthouse in the United States. Some offshore screwpile skeletal tower lighthouses built on coral reefs used foot plates or disks to help disperse the weight of the tower. The first of the tall skeletal screwpile coastal towers built in the United States was Carysfort Reef Lighthouse (1852) in Florida, which still stands. At least 24 lighthouse towers with pile foundations are known to survive.

**Crib.** The wooden crib, constructed onshore, towed to the site, and then filled with stone to sink it in place was a lighthouse foundation type used extensively in the Great Lakes, usually to replace lightships. Once settled and leveled, the cribs were capped with concrete or some other masonry upon which the lighthouse structure was constructed. Perhaps the two most significant crib foundation lighthouses are the 93' Spectacle Reef Lighthouse (1874) on Lake Huron in Michigan, located 10 miles from the closest land; and the 110' Stannard Rock Lighthouse (1882) on Lake Superior in Michigan, located 23 miles from the nearest land. Crib foundations were best suited for hard rock bottoms typically found in the Great Lakes. Thirty-eight lighthouses with crib foundations are known to survive.

**Caisson.** Caisson foundations were best suited for unconsolidated bottoms composed of sand or mud. The caisson lighthouse type used a large cast-iron cylinder, which was sunk on the

Chesapeake Lighthouse, a Texas tower at the entrance to the Chesapeake Bay in Virginia. Courtesy U.S. Coast Guard Historian's Office.



bottom and filled with rock and concrete to form a foundation. The caisson foundation was sturdier and better able to withstand heavy stress than the pile foundation lighthouses, so it is not surprising that caisson lighthouses were built in areas where moving ice was a hazard. The Craighill Channel Lower Front Range Lighthouse (1873) in

Maryland, is an early surviving example. Where bottoms were harder, contained rocks, and/or needed greater depth of penetration into the substrate, the pneumatic process was used. The substrate within the caisson was removed and the caisson allowed to sink further into the bottom. Eleven pneumatic caisson lighthouses were built in the United States. The Sabine Bank Lighthouse (1905) in Texas is the most exposed, located 15 miles offshore in the Gulf of Mexico—the only successful caisson south of the Chesapeake Bay. Fifty-nine lighthouses exist today with caisson foundations.

**Texas Tower Type.** A relatively recent technological development in lighthouse construction was the Texas tower lighthouse type which replaced exposed lightships offshore. These so-called Texas towers were adaptations modeled on the offshore oil drilling platforms first employed off the Texas coast. The first Texas tower lighthouse type in the United States was the Buzzards Bay Light, located in Buzzards Bay, Massachusetts, and commissioned on November 1, 1961. It has been extinguished and may be dismantled. A total of six Texas tower lighthouses have been constructed.

Adapted from *Historic Lighthouse Preservation Handbook* section written by Ralph Eshelman

## National Lighthouse Organizations

**U.S. Lighthouse Society**  
244 Kearny Street - 5th Floor  
San Francisco, CA 94108  
(415) 362-7255

USLHS provides its members with *Keepers Log*, an illustrated quarterly journal, lighthouse tours, and a general information service on lighthouse and lightship preservation

**Great Lakes Lighthouse Keepers Association**  
Henry Ford Estate  
4901 Evergreen Road  
Dearborn, MI 48128  
(313) 436-9150

GLLKA provides its members with a quarterly journal and hosts annual meetings

**Lighthouse Preservation Society**  
4 Middle Street  
Newburyport, MA 01950  
(800) 727-2326  
(508) 499-0011

LPS is largely an advocacy and fundraising group for lighthouse preservation issues and projects; membership includes the monthly magazine *Lighthouse Digest*

### World Wide Web

For more information on publicly accessible lighthouses, visit the National Maritime Initiative's site on the World Wide Web, <<http://www.cr.nps.gov/history/maritime/ltaccess.html>>. For a listing of lighthouse-related internet sites around the world visit <[http://www.maine.com/lights/www\\_vl.htm](http://www.maine.com/lights/www_vl.htm)>.