The Lamp-Posts of the Great Lakes of North America

by Frederick A. Talbot

On the North American continent the efficient lighting of the coasts washed by two salt oceans is only one, although the most important, concern of the United States and Canadian Governments. In addition each has a long stretch of rugged, tortuous shore hemming in those capacious depressions draining a vast tract of country, and known generally as the Great Lakes. These unsalted seas are rightly named, seeing that they constitute the largest sheets of fresh water on the inhabited globe.

The responsibility of safeguarding the navigator as he makes his way across these wastes is shared equally by the two countries which they divide, with one exception. This is Lake Michigan, which lies entirely within the United States. The narrow necks of water which link these lakes into one long chain likewise are lighted by the two nations. For some years the Lower Detroit River, connecting Lakes Erie and St. Clair, was maintained for the most part by the United States, but the practice was not satisfactory; so, as the result of a conference between the two Governments, Canada assumed charge of the aids in certain specified portions of the navigable channel lying entirely in Canadian waters. The result of this new arrangement has been the better patrolling of the waterway.

The water-borne commerce on these lakes, although possible for only half the year, is tremendous, while navigation is extremely difficult and beset with innumerable dangers. The different means whereby a ship is handled and maintained on its course upon the salt-water ocean are not completely applicable in this case. The greater number of the boats are freighters and engaged in the transport of ore, which, from its metallic character, is apt to disturb the compass, rendering it somewhat unreliable. Nor is the lead of much avail in thick weather, as the lake-bed varies suddenly from comparative shallowness to great depths. Navigation on these lakes has been likened to coastal traffic, only with land on both sides of the mariner, and the intervals when the ship is out of sight of the shoreline are comparatively brief. Accordingly, the captain picks his way rather by the aid of landmarks, and the vessels are fitted with a bowsprit, to give the master a point whereby to judge his direction. But landmarks, however conspicuous and trustworthy they may be by day and in clear weather, are useless at night and in fog, to which latter visitation, by the way, these waters are extremely susceptible.

Steamship traffic cannot be carried on with financial success by daylight and in fair weather only, so it became necessary to distribute beacons around the indented shores. This procedure was rendered additionally necessary owing to the formidable character of many of the dangers besetting navigation, in the form of shoals, projecting ridges, and submerged reefs, quite as terrifying to the master of a fresh-water ship as similar dangers on an ocean-swept coast.

At the same time, however, one would not expect to find examples of lighthouse engineering comparable with the great sea-rock lights rearing above the ocean, such as the Minot's Ledge, Dhu-Heartach, or Bishop's Rock. On the other hand, the uninitiated might conclude that buoys and small lights, such as indicate the entrance to harbours, would fulfil requirements. So they would but for two or three adverse factors. These lakes are ravaged at times by storms of great violence, which burst with startling suddenness. Fogs also are of frequent occurrence, especially in the spring and autumn, often descending and lifting instantly like a thick blanket of cloud. But the most implacable enemy is the ice. The engineer can design a tower which will withstand the most savage onslaughts of wind and wave with comparative ease, at, relatively speaking, little expense; but the ice introduces another factor which scarcely can be calculated. The whole of these lakes are frozen over during the winter to such a thickness as to defy all efforts to cut a channel, becoming, in fact, as solid as terra firma.

In the spring this armour cracks and breaks up like glass shattered with a hammer. It then becomes the sport of the currents, which in many places sweep and swirl with enormous force round the headlands and spits projecting into the lake. This action sets the ice moving in stately majesty, but crushing everything that rears in its way, or piling and breaking against the obstruction. Ice-shoves, ice-jams, and ice-runs, are the three forces against which the engineer has to contend, and at places his efforts are so puny as to be useless. The ice, if it collects across one of the outlets so as to form a massive dam reaching to the lake-bed, immediately causes the level of the lake to rise; and when at last the barrage breaks, then the water is released in a mad rush.

Lighthouse building on the Great Lakes demands the highest skill, incalculable ingenuity, and the soundest of design and workmanship. Consequently, some of the guardian lights distributed around these shores, such as Spectacle Reef, the Rock of Ages, Colchester, and Red Rock lighthouses, are striking evidences of the engineer’s handiwork. Of course, where the land presses in on either hand, transforming the waterway into a kind of canal, or where the shore is free from submerged obstructions, the type of lighthouse on either shore follows the wooden frame dwelling with a low tower, as it is completely adequate for the purpose.

The one erection, however, which commands the greatest attention is the Spectacle Reef light, which has been called the Eddystone, or Minot’s Ledge, of the Lakes. In its way it was quite as bold an undertaking as either of these far-famed works, and in some respects was far more difficult to carry out, although the builder was spared the capriciousness and extreme restlessness of tidal waters. Spectacle Reef lighthouse rears its tapering head from a particularly dangerous reef in an awkward corner of Lake Huron, where commences the Strait of Mackinac, leading to Lake Michigan. The spot is dangerous, because it is covered by about 7 feet of water; awkward, because it occurs about ten and a half miles off the nearest land, which is Bois Blanc Island. The reef in reality comprises two shoals, which lie in such relation to one another as to suggest a pair of spectacles—hence the name. As it is exposed to 170 miles of open sea on one side, when these waters are roused the rollers hammer on the reef with terrible violence, while at times the currents skirl by at a velocity of two or three miles per hour, and the ice in its movement grinds, piles, and grates itself upon the reef in impotent fury. When this ice is forced forward with the push exerted by the currents, the pressure is tremendous and the force wellnigh irresistible.

When the lighthouse was projected, it was realized that it would have to be of massive proportions and provided with adequate measures to protect it from the assault and battering of the ice. The task was undertaken by General O. M. Poe, who was engineer-in-chief to General Sherman on his historic march to the sea. This engineer decided to take the Minot’s Ledge monolithic structure as his model, seeing that the latter had withstood the savage onslaughts of the Atlantic. Fortunately, the foundations were of an excellent character, the reef being formed of hard limestone.

The engineer selected as the site for the tower a point where the ridge is submerged by 11 feet of water. Seeing that the base was to be laid under water, obviously it seemed to be an operation for divers; but General Poe prepared a superior means of getting the subaqueous foundations laid. He built a cofferdam around the site, and, as the work would have to be protected from the winter ice, he built another cofferdam, entirely for protective purposes, outside the former. The nearest point on the mainland where he could establish a depot was Scammon’s Harbour, some sixteen miles away, and here everything in connection with the work was prepared and shipped to the site ready for placing in position.

The protective work comprised a wooden pier, built up of timbers 12 inches square, 24 feet in height. This structure was divided into a series of vertical compartments on all four sides, leaving a clear internal space 48 feet square. The outer compartments or pockets were filled with stone, to secure solidity and stability. Landing facilities were provided on this pier, together with quarters for the men engaged in the construction work.

In the inner space, containing 48 square feet of still water, the cofferdam, in which the subaqueous work was to be carried out, was lowered. This structure was cylindrical in form. It was built up of staves, banded with heavy hoops of iron, so that in reality it resembled a huge barrel 36 feet across. It was fashioned at the site, being built while suspended directly over the spot on which it was to be lowered. When the tub was finished, loosely twisted oakum, 1½ inches thick, was nailed all round the lower edge, while a flap of heavy canvas was secured to the outside bottom rim in such a way as to leave 36 inches dangling free. The exact circular shape of the cofferdam was insured by liberal cross-bracing from a central vertical post, which constituted the axis of the barrel, corresponding to the vertical axis of the tower. While this work was in progress, the face of the rock was cleared of loose boulders, and then the cofferdam was lowered bodily with extreme care, so that it descended with unerring accuracy perpendicularly into the water, to come to rest over the desired spot. As the surface of the reef was very uneven, the cofferdam stopped when it reached the highest projection under its edge. Then each stave of the barrel was driven downwards until it came to rest upon the sea-bed, and, as the oakum rope was forced down likewise, this served to act as caulking. The outer flap of canvas, when the cofferdam was driven right home, spread out on all sides, and lay upon the surface of the reef.

Pumps capable of discharging 5,000 gallons per minute then were set to work, removing the water from within the cofferdam. The oakum rope seal prevented the water regaining the internal space under the bottom edge of the tub, while the canvas assisted in securing absolute water-tightness, because the outer water-pressure forced it into all the nooks and crevices.

By these means the workmen were given an absolutely dry space in which to carry out their erecting work. The face of the reef was cleaned and levelled off, and the first layer of stones was laid. These were first fitted temporarily upon a false platform on shore, so that when they reached the site they could be set at once without finicking. The bottom layer is 32 feet in diameter, and the tower is solid to a height of 34 feet above the rock. The stones are each 2 feet in thickness, and are secured to one another on all sides with wrought-iron bolts, 24 inches long by 2½ inches in diameter; while the tower is anchored to the rock by cement and bolts 3 feet long, driven through the bottom course into the real rock beneath, entering the latter to a depth of 21 inches. Liquid cement was driven into the holes so as to fill up all the remaining interstices, and this now has become as hard as the stone itself.

The exterior of the tower is the frustum of a cone, and at 80 feet above the base is 18 feet in diameter. The total height of the masonry is 93 feet, and the focal plane is brought 97¼ feet above the rock, or 86¼ feet above the water-level. The tower is provided with five rooms, each 14 feet in diameter, while the entrance is 23 feet above the water. The undertaking was commenced in May, 1870, and the light was shown first in June, 1874. As work had been confined to the summer months, and a fortnight every spring was devoted to preparations, as well as an equal period in the autumn to making all fast to withstand the rigours of winter, the total working period was only some twenty months.

The protection against the ice has proved its value completely. The ice as it moves becomes crushed against the defence, and then has its advance impeded by the shoal upon which it grinds and packs, to form in itself a barrier and ice-breaker against other approaching ice-fields. This structure was soon submitted to a stern test to prove its efficacy. In the spring of 1875, when the keepers returned to the lighthouse—the light, in common with all other beacons guarding the Great Lakes, is shut down during the winter, when navigation is closed—they found the tower unapproachable. The ice-shove had jammed, packed, and been frozen into a solid berg to a height of 30 feet, of which the tower itself formed the core. The doorway was buried to a depth of 7 feet, and the keepers had to carve their way with pickaxes to the entrance.

Owing to the success of the design for the Spectacle Reef lighthouse, which ranks as a striking engineering achievement, it was adopted for the Stannard's Rock tower. This ledge rises from the water 28 feet from shore, and the plant and tackle which were employed in connection with the first-named structure were utilized in this undertaking. The tower is 191 feet in height, and the light can be seen for about twenty miles. During the past two or three years the United States Government has erected two other noble lighthouses in Lakes Superior and Michigan. The first warns all and sundry off a rock having three ugly pinnacles projecting above the water, and known as the "Rock of Ages." This danger stands right in the steamship tracks between Port Arthur and Duluth, off the western end of Isle Royale. The engineers selected one of the pinnacles as the base for the tower, decapitating the projection to 12 inches above mean low-water, so as to secure a sufficiently large and level plinth. On this bed a cylindrical foundation pier, of massive proportions and strength so as to withstand the ice action, was planted, to support a lofty tower in reinforced concrete. The building has seven floors, one being set aside for housing the two twenty-four horse-power oil-engines which are used to drive the air-compressors for the fog-siren. The light is 125 feet above water-level, and gives a double flash at ten-second intervals, which can be picked up twenty-one miles away. This tower was erected in a very short time, the work, commenced in May, 1907, being completed, except for the installation of the permanent lens, thirteen months later. The optical apparatus was fixed and the light shown first on September 15, 1910.

The second light has been placed on White Shoal, at the north end of Lake Michigan, and supersedes a lightship which fulfilled all requirements for many years. The shoal is exceptionally dangerous, and the crowded character of the shipping demanded the installation of a more powerful light and fog-signal. The structure is a striking piece of work, comprising a steel cylindrical tower, or shell, lined on the inside with brick and faced externally with terra-cotta—an unusual material for lighthouse construction. The superstructure is built upon a massive concrete pier, about 70 feet square, rising 20 feet above water-level, this being borne in turn upon a heavy stone-filled timber crib laid on a block-stone foundation, the whole being protected thoroughly with riprap. The lantern is of the second flashing order, with the focal plane 125 feet above the lake-level, and the 65,000 candle-power ray is visible twenty-five miles away. The tower is fitted with a duplicate plant of twenty-four horse-power oil-engines and air-compressors, operating an eight-inch whistle; and there is also an electrically-operated submarine bell, the power for which is generated by an independent oil-engine, the bell being operated from the engine-room. This station is equipped also with a compressed air water-supply system and a motor-boat.

Owing to the peculiar prevailing conditions, the provision of adequate beacons upon the Great Lakes is highly expensive. Up to the year 1883 more money had been devoted to the lighting of the shoreline of Lake Michigan than to the illumination of any ocean or gulf in any other State in the country. The total expenditure up to the above year exceeded £470,000, or $2,350,000. The Spectacle Reef light was considered cheap at £75,000, or $375,000; and the Stannard Rock lighthouse, owing to the plant and other facilities being available from the foregoing work, cost £60,000, or $300,000. By the time the "Rock of Ages" tower threw its light, £27,649, or $138,245, had been sunk; and the White

Shoals lighthouse absorbed £50,000, or $250,000.

The Canadian Government, too, has completed some notable works upon the Great Lakes during recent years. In Lake Erie, in the fairway of passing traffic, is a ledge known as Colchester Reef, on the south-east edge of which a lighthouse, one of the most isolated in Canadian waters, has been placed. The circular stone pier is built in 14 feet of water, and the lighthouse, comprising a two-story dwelling and tower, supports the beacon 60 feet above the lake. The light is a fixed white, of the third dioptric order, visible throughout a circle of fourteen miles radius.

At the entrance to Parry Sound, on a convenient site offered by the solid granite mass of Red Rock, a new lighthouse was constructed in 1911. This was the third beacon placed at this point, the two previous lights dating from 1870 and 1881 respectively. It is a particularly bad spot, since the waters of Georgian Bay have a free run, so that the rock experiences the full hammering of the sea. The beacon comprises a reinforced concrete building, nearly elliptical in section, supported upon a heavy stone foundation, which is encased in steel, and which is 12 feet high. The tower has a height of 57 feet, bringing the occulting flash of twelve seconds, with an eclipse of four seconds, 60 feet above the water. This station is also equipped with a powerful diaphone. The keepers of this light experience exciting times, as in a furious gale, such as the lakes only can produce, the waves frequently crash over the building.

Another fine light in the stretch of these waters under Canadian jurisdiction is found about halfway across Lake Superior, where Caribou Island thrusts its scrub-clothed hump above the water, almost directly in the path of the vessels running between Sault Ste. Marie and Sarnia. This magnificent structure, placed on a small islet lying off the main island, is built in ferro-concrete, in accordance with Lieutenant-Colonel Anderson's latest ideas, and was opened for service in 1912. It is of hexagonal shape, with six flying buttresses, and the focal plane is brought 99 feet above the water-level, so that the white flash of half a second may be seen all round from a distance of fifteen miles.

The steamship lanes across the Great Lakes are now well lighted. Canada alone maintains over 460 lights of all descriptions throughout its waters between the eastern extremity of Lake Ontario and the head of Lake Superior at Port Arthur. The United States authorities watch over 694 attended and unattended aids to navigation in the same seas, of which total 152 are scattered around the coastline of Lake Michigan. The mariner in these fresh-water oceans, consequently, has a round thousand lights to guide him on his way, and the number is being steadily increased to keep pace with the growth of the traffic, so that these seas may become regarded as the safest and best protected in the world.

Source:

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