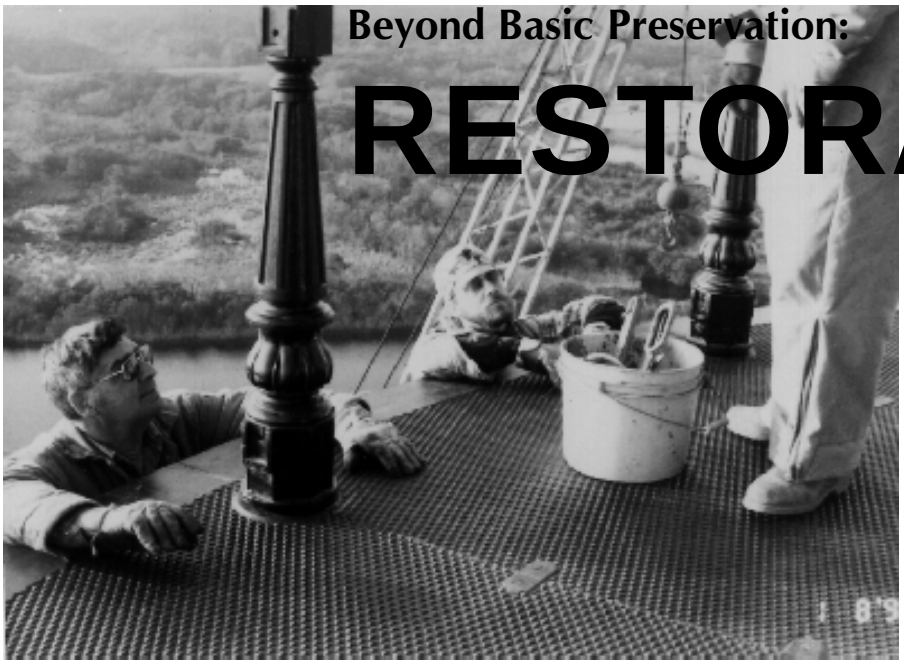
# Beyond Basic Preservation:

# RESTORATION



International Chimney Corporation (ICC) photo

**Figure 1.** New ornate cast-iron handrail posts were recast and installed on the new gallery deck as part of a restoration at Cape Hatteras Lighthouse, Buxton, North Carolina.

***Restoration*** is defined as the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by removing features from other periods in its history and reconstructing missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.

***Restoration as a Treatment:*** When the property's design, architectural, or historical significance during a particular period of time outweighs the potential loss of extant materials, features, spaces, and finishes that characterize other historical periods; when there is substantial physical and documentary evidence for the work; and when contemporary alterations and additions are not planned, *restoration* may be considered as a treatment. Before undertaking work, a particular period of time, i.e., the restoration period, should be selected and justified, and a documentation plan for *restoration* developed.

**Standards for Restoration**

- Use the property as it was historically or find a new use that reflects the property's restoration period.
- Remove features from other periods, but document them first.
- Stabilize, consolidate, and conserve features from the restoration period.
- Replace a severely deteriorated feature from the restoration period with a matching feature (substitute materials may be used).
- Replace missing features from the restoration period based on documentation and physical evidence. Do not make changes that mix periods and falsify history.
- Do not execute a design that was never built.

This is a summary of the central ideals of the *Restoration* treatment standards excerpted from the *CRM* article, "Historic Preservation Treatment: Toward a Common Language" by Kay Weeks (Vol 19, No. 1, 1996, p. 34).

## CASE STUDY: Restoration of the Cape May Lighthouse

by Joseph Jakubik, International Chimney Corporation

The Mid Atlantic Center for the Arts, Inc., a non-profit organization, obtained funding for the restoration of the Cape May Lighthouse, Cape May, New Jersey, through local donations, the state of New Jersey, a grant from the National Trust for Historic Preservation, and the Department of Transportation through the Intermodal Surface Transportation Efficiency Act. The architect selected for the project was Watson & Henry Associates, of Bridgeton, New Jersey, a veteran of other lighthouse projects, including the Barnegat Lighthouse. The restoration required a variety of disciplines including masonry restoration, painting, machining, steel and cast-iron fabrications, copper work, and glazing. Plans were completed and the project sent out to bid to a list of pre-qualified bidders. International Chimney Corporation (ICC) of Buffalo, New York, was selected.

The project was started in January 1994 with the mobilization of ICC's crew and equipment, including a GCI 5400 tower crane, capable of 325-foot tip height. The first step was to remove the lantern from the tower of the lighthouse. The plane of separation was to have been at the sill connection to the lantern deck, allowing removal of the lantern intact and relocation to ICC's facility in Buffalo, New York. After carefully removing the many layers of paint and corrosion around the connection, it was discovered that the stiles that supported the window wall and roof were embedded into the masonry at least 4 feet below the level of the lantern deck. Shop restoration of the entire lantern room was not possible.

ICC photo

ICC photo

**Figure 2 (left).** Condition of the bronze sill sitting on the lantern deck inside the lantern room. The sill is wedged between two vertical cast-iron stiles, which are anchored into the masonry below.

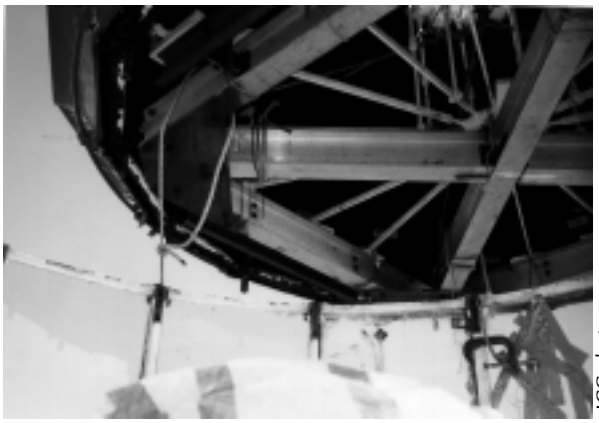
**Figure 3 (above).** Horizontal mullions run in between the stiles and serve to keep the stiles straight and frame the individual pieces of glass. Before restoration, the mullions and sills had been bolted in place over 140 years.

Necessity is truly the mother of invention. The job was replanned to include disassembly of the roof only and rework of the lantern in the field. A large temporary steel enclosure, affectionately referred to as the 'soup can', was fabricated to fit over the window wall system and allow craftsmen to work in relative comfort during the coldest winter in Cape May history. The temporary steel enclosure, designed to accommodate both interior lighting and ventilation, was installed on a system of cantilevered beams that concentrated the load on the brick column of the tower. A lifting jig was designed and installed underneath the roof, and the roof was disconnected from the window wall system.

ICC photo

**Figure 4.** The first step in removing the roof was to take off the vent ball. The vent ball not only serves as a lightning rod but also provides ventilation to the glass in the lantern room, limiting condensation.

Even on a calm day, the winds at 195 feet above sea level blow at a constant 25 to 30 miles per hour. The roof was carefully removed, lowered to grade, and transported to Buffalo, New York, for repair. True restoration work could now begin. The window wall system was carefully dismantled, all components tagged, wrapped, and sent to Buffalo for restoration. Imagine the difficulty of trying to free over 200 bolted connections that have been corroded by a moist salt air environment for over 140 years. Many of the replacement fasteners had to accommodate thread designs used in the 19th century.



ICC photo

**Figure 5.** As the roof is being removed from the lighthouse, the tie rod system, supported by ICC's aluminum roofing frame, is visible. This frame was designed to fully support the roof and alleviate any stress or strain on the roof during the lift. Protruding down from the roof are the ends of the rafters which connect to the top of the stiles.

In Buffalo, extreme care was required to restore the roof without compromising dimensional integrity of the 16 tie rods and 16 roof rafters. The roof would be reinstalled in the same position, mating in 16 individual points, bolting together in 48 individual machined holes. The roof measured over 13 feet in diameter; restoration included replacement of the original cornice brackets that held the roof to the window wall and kept the shape of the copper. A 1/16-inch difference at each location would add up to a one inch deviation, preventing the roof from fitting.


ICC photo

**Figure 6.** During the restoration, this 'Campbell Soup Can' was installed over the lantern room in order to protect restoration efforts from the environment.


ICC photo

**Figure 7.** Inside the lantern room, the mullions have been reworked and reattached to the stiles. New stainless steel bolts have been used to prevent corrosion and teflon tape has the used as a gasket between the bronze and the cast iron. Teflon washers also separate the bronze from the stainless steel bolt.

Back at the lighthouse, attention was turned to stripping all existing paint from the lighthouse, exposing the original color; meticulously repairing all damaged or eroded mortar joints; and repainting the structure with a special coating that matched the original color of the lighthouse.

In June 1994, all preparations were complete for reassembly of the lantern room and roof system. The matched, marked pieces were carefully refitted with new stainless-steel hardware and teflon tape which acts as an isolator between the dissimilar bronze and cast-iron metals. In the 19th century, little was known about the chemical reaction between dissimilar metals. When a copper-based metal is placed in contact with a ferrous-based metal, an anode-cathode reaction occurs, similar to a battery. This changes the molecular structure of the ferrous metal, causing corrosion.

ICC photo

**Figure 8.** New hand holds were replicated to replace missing pieces. These exactly match the originals.

ICC photo

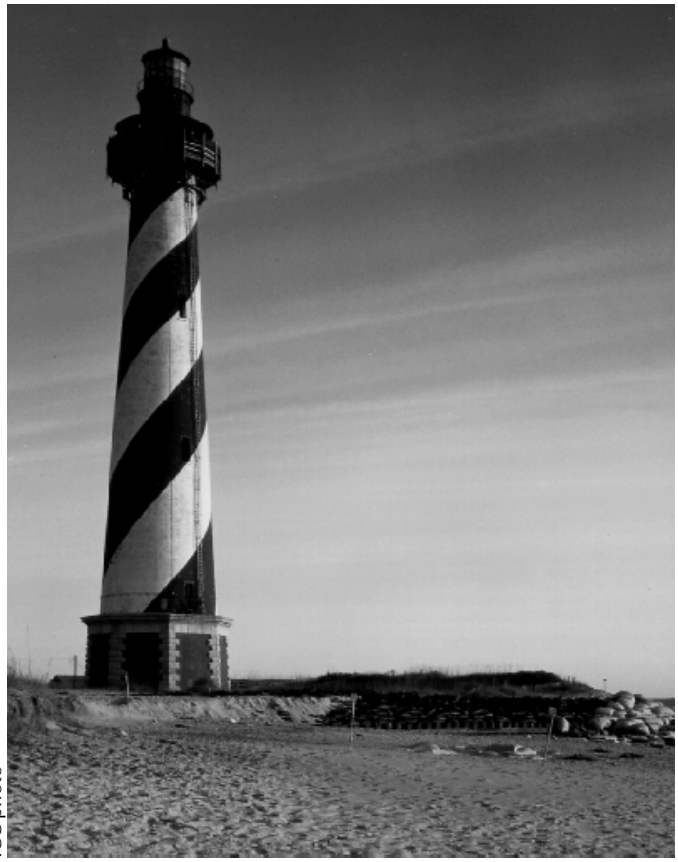
**Figure 9.** The refurbished roof is replaced on the lantern room. The fit is almost exact.

New safety glass was installed on the window wall system, and the 'soup can' was no longer needed. A relatively calm wind would be required to remove the enclosure and set down the newly refurbished roof. On the June 4, 1994, conditions appeared favorable. The enclosure was lifted and, for the first time in five months, the efforts of the craftsmen were revealed. The newly lacquered bronze mullions, glazing bars, and sills gleamed in the bright early summer sun.

Meticulous preparations were made on the ground and in the air for the lift. The refurbished roof was centered as close as possible to the center line of the lighthouse and turned to allow for the proper fit in its original position. ICC's craftsmen were perched on ladders waiting for the roof to be hoisted. When all was ready, the signal was given and the lift began. The roof was centered above the window wall and began its descent. The result was anticlimactic. The roof came down exactly into position as if sucked in by a giant magnet. The major portion of the restoration was complete.

ICC photo

**Figure 10**. All glass is now in place and final preparations are made for the reopening.



ICC photo

**Figure 11.** The Cape Hatteras Lighthouse during restoration.

## CASE STUDY: Restoration of Cape Hatteras Lighthouse

by Joseph Jakubik, International Chimney Corporation

Late in 1990, International Chimney Corporation (ICC) was chosen by the National Park Service to perform the preservation work on the Cape Hatteras Lighthouse in the Cape Hatteras National Seashore in North Carolina. The Cape Hatteras Lighthouse has served a section of the Atlantic ocean known as the "Grave Yard of the Atlantic" since the 1870s, but the elements and corrosive seawater had taken their toll. The first-order Cape Hatteras Lighthouse is the tallest brick lighthouse in the U.S. The ornate, victorian-gothic, cast-iron construction of the interior and exterior iron work was produced after the Civil War, when foundries, no longer producing cannons for the war, focused their efforts on producing ornate cast-iron architecture and hardware.

The time for replacement of these ornate castings was at hand. The large gallery deck, with its ornate tread patterns and hand rail had deteriorated to the point where it was no longer feasible to repair. On the interior of the lighthouse, many of the steps of

ICC photo

**Figure 12.** Some brackets were so deteriorated that they were totally exposed to the elements.

ICC photo

**Figure 13.** After the most severely deteriorated portion of the brackets were removed, new cast-iron pieces were made and installed; and new deck plates installed.

ICC photo

**Figure 14.** The handrail assembly has been removed and the ornate cast-iron post is ready for removal.

ICC photo

**Figure 15.** A replica handrail is installed.

the long spiral staircase were cracked, weathered, or deteriorated. The ornate cast-iron sections at the landings, complete with handrails would no longer protect climbers on their way up or down the tower.

The restoration was scheduled to begin early in 1991 with the mobilization of International Chimney's GCI crane, capable of 325-foot tip height. At the last moment, however, a barge ran into the Bonner Bridge over the Oregon Inlet. While ferries were immediately put into service to accommodate traffic, the crane was too large to move to the site. The schedule was adjusted to accommodate the change in plans, and the interior lighthouse work started first.

The first step was to remove the deteriorated castings of the spiral staircase and return them to Buffalo to be used as a guide for the new castings. The spiral staircase is built so that each step supports the remainder of the staircase to the next landing. To remove the deteriorated pieces, the stairways were supported, both above and below the removal area, by steel cables from the landings above.

The ornate cast-iron pieces of handrail were carefully removed, examined, and shipped back to Buffalo. The service room windows were severely deteriorated, with only portions of the existing cast pieces available for a guide to new work. These were removed, new pieces cast, and custom-fit to the window openings. New 1-inch safety glass was installed in the service room.

The lantern room in the lighthouse was severely corroded as a result of interaction between dissimilar metals. All components were removed, reworked, and replaced, and new 5/16-inch laminated safety glass installed.

ICC photo

**Figure 16.** At the base of the brackets, the cast-iron belt course is removed, exposing deteriorated masonry below.

ICC photo

**Figure 17.** The cast-iron belt courses are repinned to new masonry beneath.

When repairs were completed to the Bonner Bridge, exterior work could begin. A 7-foot-wide, circular work deck was placed below the large gallery deck. This afforded access to the complete hand rail system and deck plates. The hand rail components were carefully removed, as were the deck plates. The surviving pieces of deck plate were so deteriorated that accurate measurements could not be made. The deck was recalculated and a template made of the theoretical size and shape of the new deck plates. This was custom-fitted to each individual bracket, revealing that the lighthouse was slightly out of round. Measurements were taken for each individual section, which required custom casting, machining, and fitting of each individual section of plate. The brackets supporting the plate were reworked, and individual components recast. The belt course holding the brackets together below was removed, the masonry underneath repinned, and the cast belt course reinstalled. Deteriorated masonry was carefully cut out and repainted, as was the granite pedestal at the base.

All doors were refurbished and the seven landing windows replaced. The project took approximately a year and a half, and was completed before a hurricane hit in the fall of 1993. The hurricane damaged (by impact) three of the windows in the lantern room and tore off a portion of the hand rail of the lantern deck. (This hand rail was not replaced under the original contract). ICC performed the needed repairs in the spring of 1994, and once again the lighthouse opened to the general public.