

Reflections in Copper

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Inspirations and Details



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**North American
Copper in Architecture Awards™**

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Restoration

Kansas Statehouse Copper Dome & Roof Replacement

Topeka, Kansas

A recipient of a 2014 North American Copper in Architecture Award, the Kansas Statehouse's patented copper dome, contrasted by the building's limestone structure, has captured the attention of citizens and visitors alike for more than 100 years. Built in three distinct phases over a 37-year period, the Kansas Statehouse reflects changes in construction between the 1860s and the turn of the 20th century. The extensive copper roof and dome replacement, completed in late December of 2013, occurred over previously restored, occupied spaces and utilized approximately 127,000 pounds of copper. East and west wing roofs are covered with 24,700 square feet of 20-ounce copper batten seam roofing. Central, north and south wing roofs are finished with a hybrid horizontal and standing seam roof constructed of 20-ounce copper to replicate the historic roof.



Key Partners

Architect

Treanor Architects, P.A.
Topeka, Kansas

Owner

State of Kansas
Topeka, Kansas

Sheet Metal Contractor

Baker Roofing Company
Raleigh, North Carolina

Sheet Metal Contractor – Roof

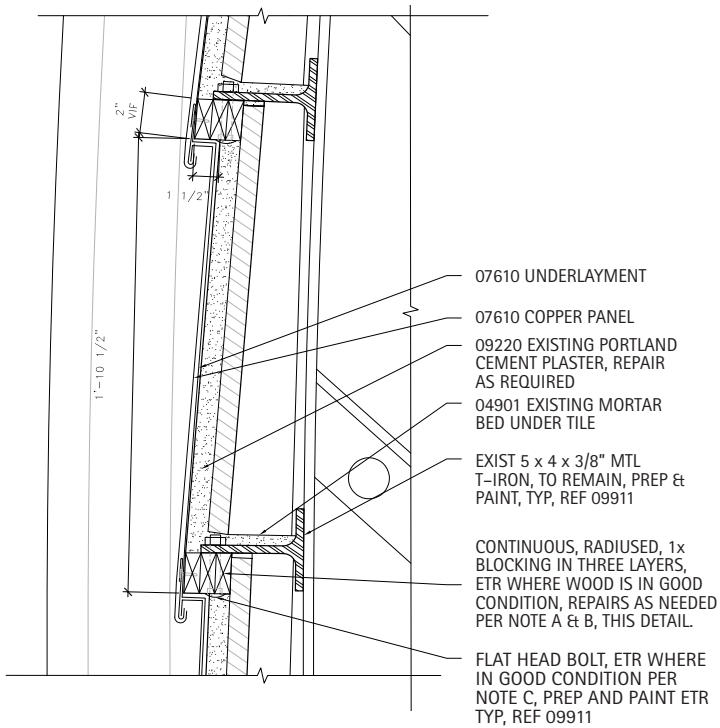
MG McGrath, Inc.
Maplewood, Minnesota

General Contractor

J.E. Dunn Construction Company
Topeka, Kansas

Specialty Fabrication – Dome

Ornamentals, LLC
Cullman, Alabama

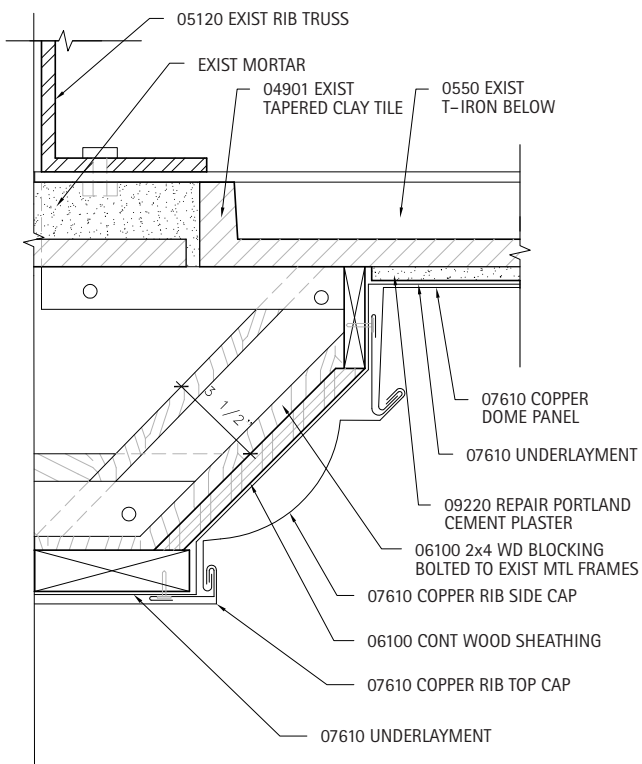


Drawing 1: Kansas Statehouse Dome Horizontal Seam Panel Step Detail

The copper dome on the Kansas Statehouse showcases successful methods for combining different copper systems to cover a monumental and complicated shape.

Dome panels are simple adaptations of basic Horizontal Seam Roofing, as presented in the *Copper in Architecture Handbook*. Each row of curved horizontal seam panels has a different radius to accommodate the dome shape. Drawing and Image 1 demonstrate the horizontal seam dome panel step condition. Image 2 shows the "bread-pan" detail at each dome panel end. Copper's inherent malleability frequently makes such joinery possible without sealant or soldering.

Drawing 2 highlights very large decorative "ribs" segmenting the dome. Copper covering for these "ribs" is attached using much the same theory as the batten cap in standard "Batten-Seam" Copper Roofing, as presented in the *Handbook*. Because the Statehouse's dome ribs are much larger and include a complex beveled-batten shape, three copper pieces cover each rib: a simple piece over the top, with more complicated pieces on each beveled-batten side.



Drawing 2: Kansas Statehouse Rib Dome Detail

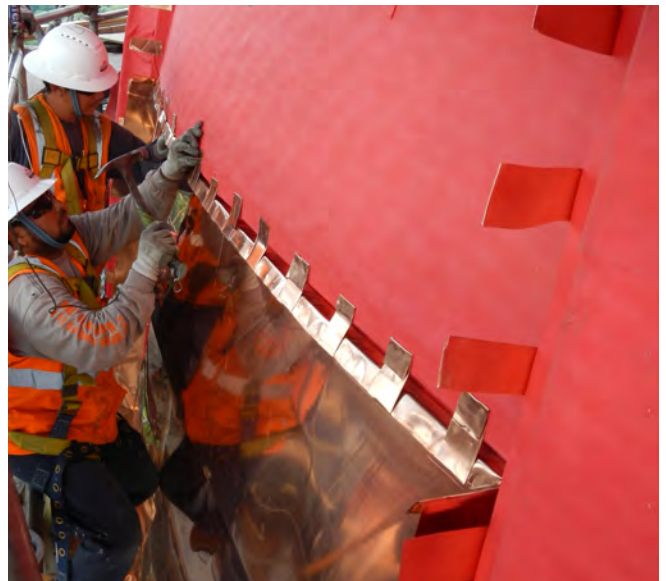


Image 1: Kansas Statehouse Dome Horizontal Seam Panel Step Detail



Image 2: Kansas Statehouse "Bread-Pan" Detail

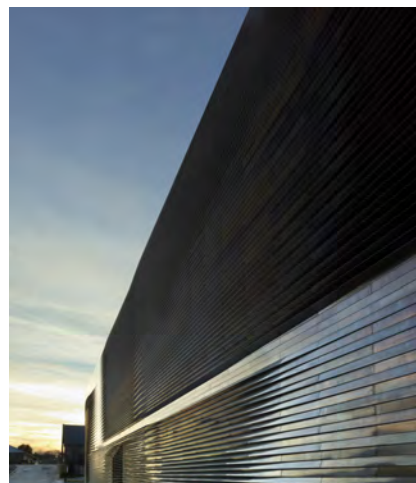


New Construction

Louisiana Sports Hall of Fame and Northwest Louisiana History Museum

Natchitoches, Louisiana

The new Louisiana State Museum and Sports Hall of Fame, located in historic Natchitoches, Louisiana, merges two contrasting collections that were formerly housed in a university coliseum and a 19th century courthouse. The simple copper exterior alludes to shutters and clapboards found on nearby plantations. Copper louvers both contrast and complement the curvaceous interior surfaces. On the upper-level, a hall leads to a veranda, sheltered by copper louvers, that overlooks the city square.



Key Partners

Architect

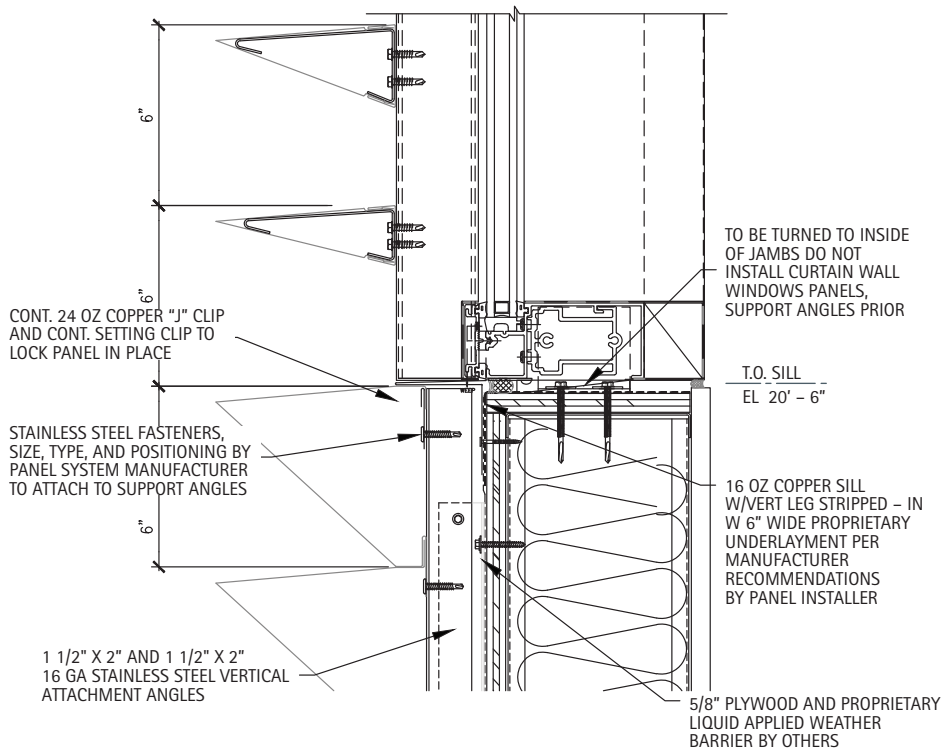
Trahan Architects
New Orleans, Louisiana

Copper Panel Manufacturer

A2MG Architectural Metal & Glass, Inc.
Kansas City, Missouri

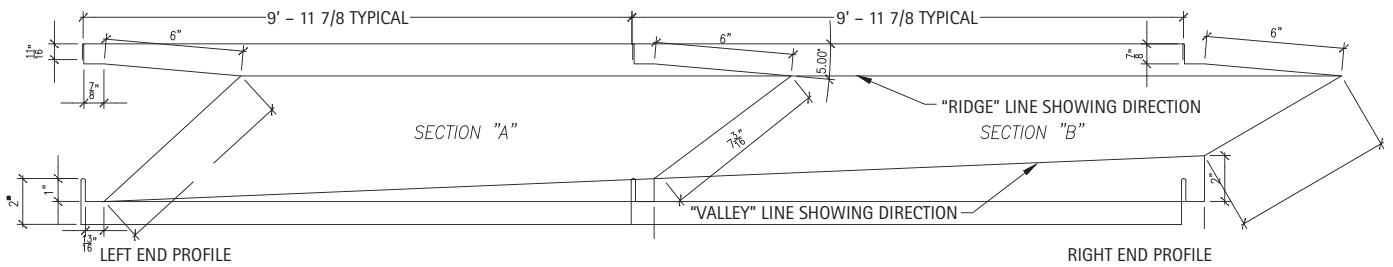
Copper Panel Installer

F.L. Crane & Sons, Inc.
Fulton, Mississippi



Custom-pleated copper panels clad much of the building, creating a louvered skin that controls light and ventilation, animates the façade and employs surface articulation previously achieved by architectural ornamentation. Copper panels, each with custom details as specified in the architect's drawings, comprise a concealed fastener rainscreen system. Close coordination between architectural and wall system manufacturer's engineering staff ensure a quality installation, meeting both aesthetic and performance requirements. Copper lends itself well for creating a complicated curtain wall, as shown in accompanying drawings and images, with a deeply textured surface.

Drawing 1: Curtain Wall Sill



Drawing 2: Beveled Wall Panel Section

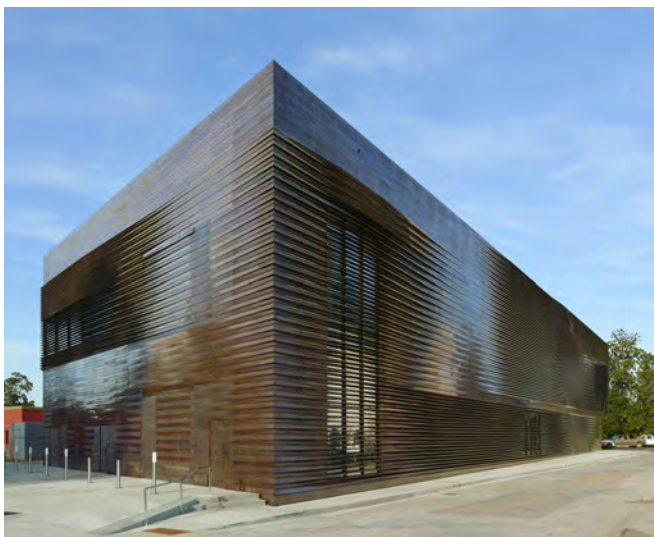


Image 1: Back and Side with Curtain Wall, Copper Louvers Shading Glazing

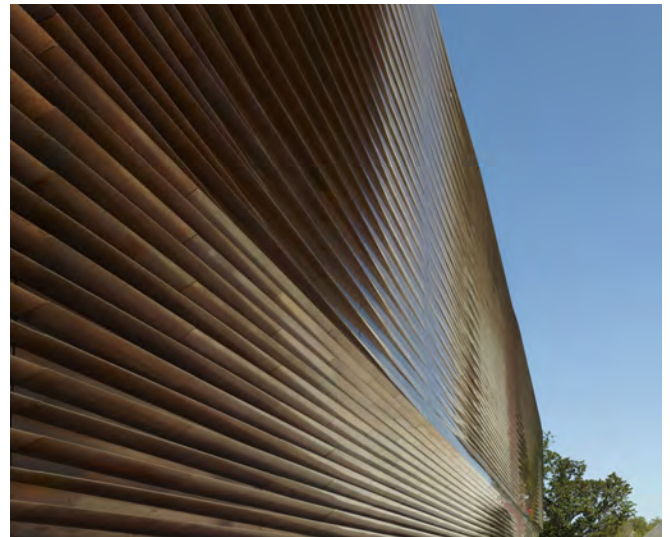
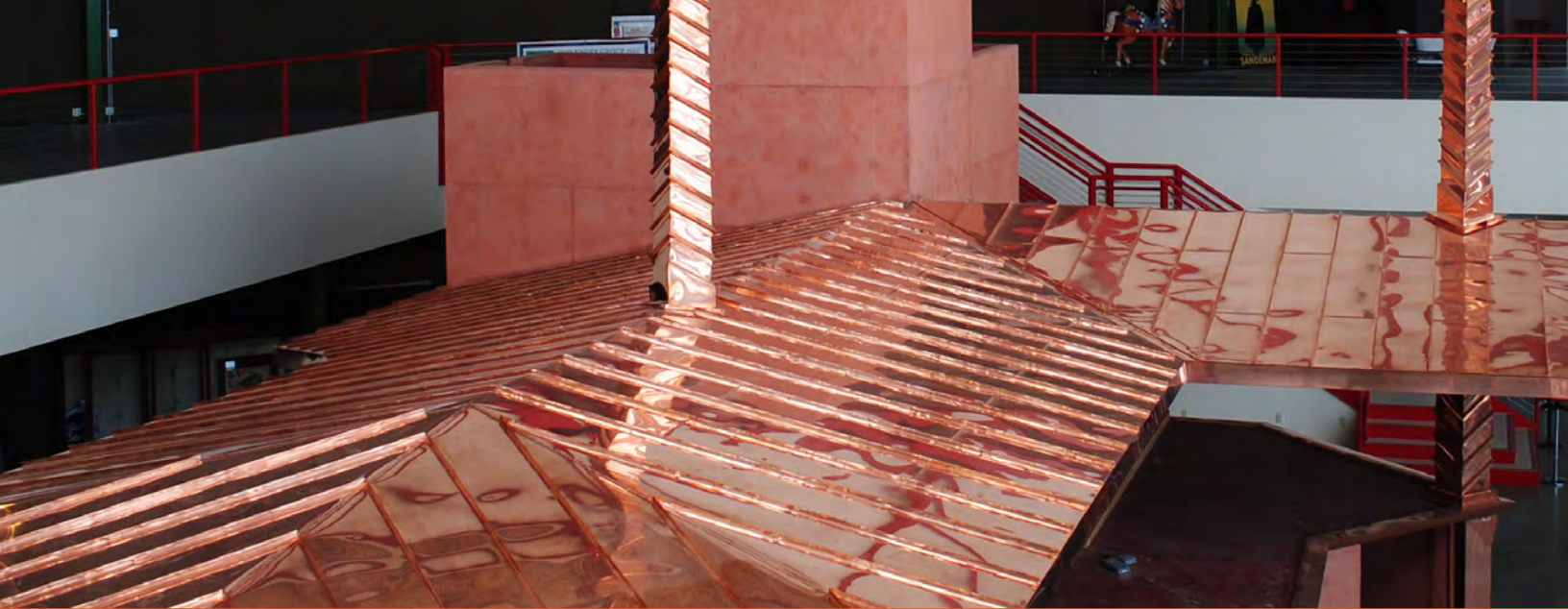


Image 2: Copper Wall Panels: Changing Angles Add Visual Interest



Ornamental Applications

Frank Lloyd Wright Filling Station

Buffalo, New York

The new Frank Lloyd Wright Filling Station demonstrates remarkable copper design details. The Filling Station, inspired by Wright's sketches, is housed in a 38,000-square-foot addition to the Pierce-Arrow Buffalo Transportation Museum in Buffalo, New York. The 1,600-square-foot structure measures approximately 40-feet by 40-feet. Having discovered Wright's sketches from 1927 during the 1970's, the museum's founder and executive director, James T. Sandoro, spent more than 40 years tirelessly researching, prototyping, fundraising and, finally, overseeing its construction.



Key Partners

Architect

Lauer-Manguso Et Associates Architects
Buffalo, New York

Owner

Buffalo Transportation
Pierce-Arrow Museum
Buffalo, New York

Sheet Metal Contractor

Grove Roofing Services
Buffalo, New York

General Contractor

R&P Oak Hill Development
Blasdell, New York

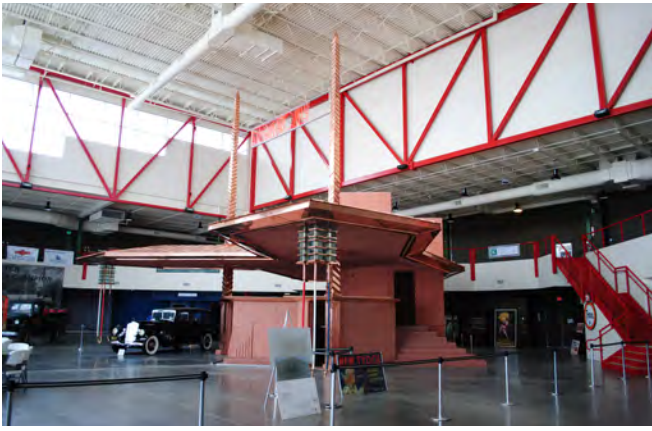
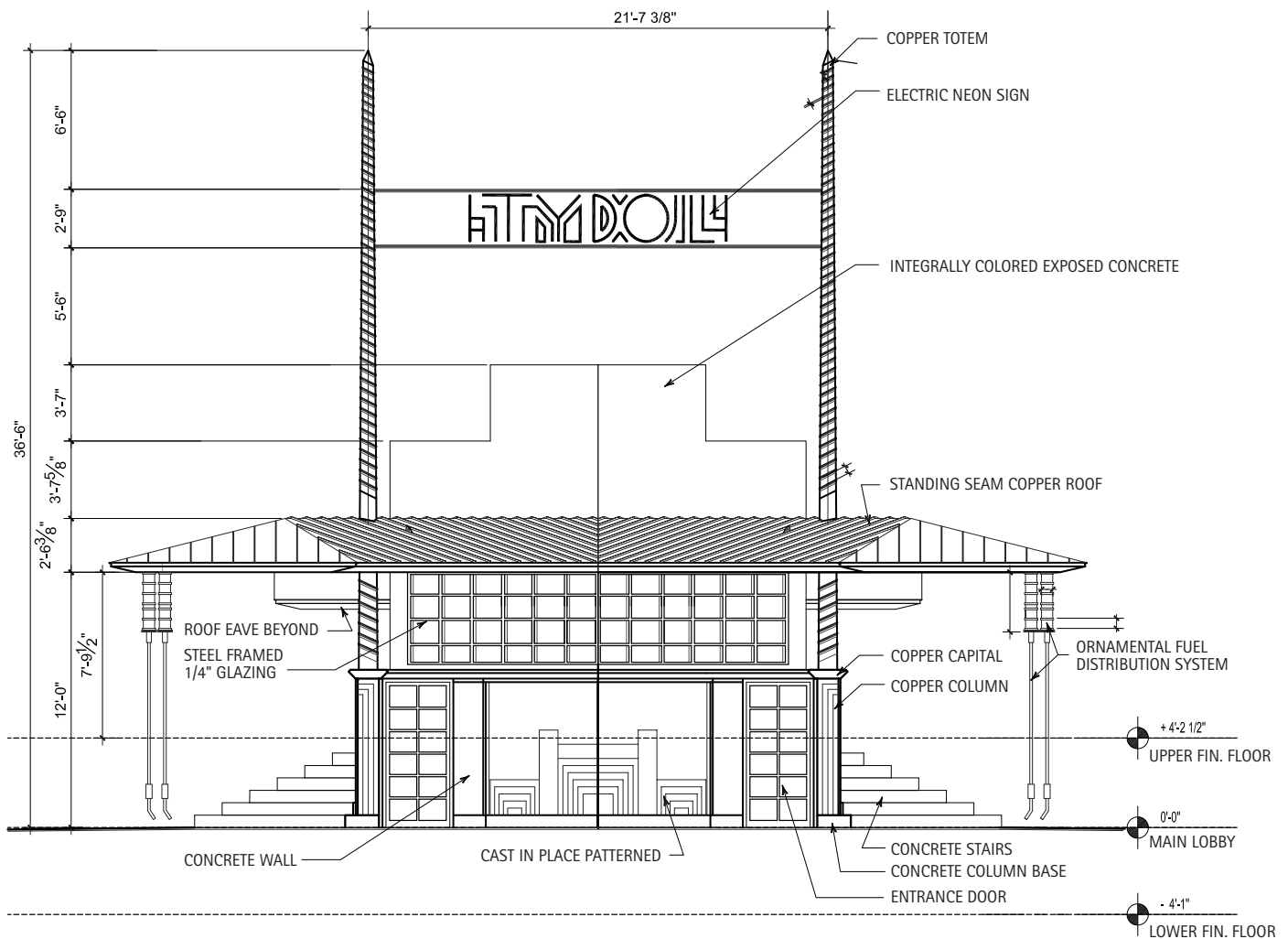


Image 1: Ground View of Filling Station.

Copper is strongly incorporated into the building's design, starting with the expansive standing seam roof. Every 1-inch high, double-locked seam panel was individually shop-fabricated, as intended in Wright's original design. The project architect used specific designs with copper detailing to enhance the material's natural qualities. In particular, the unusual ridge detail eliminates a more typical ridge standing seam.

Equally impressive are copper eaves and soffits under deeply cantilevered canopies. Measuring 24-inches wide, the copper fascia transitions to an angled soffit and screen vent. The assembly consists of five pieces and provides a stunning complement to the red-clay stucco ceiling and walls. Much heavier 0.5-by-4-inch copper plate was utilized in the capital columns. Individual pieces were saw-cut and assembled with pop rivets on their concealed backside. The column motif blends eloquently into adjoining patterned, red concrete walls. Hanging gravity gas pumps are also made of copper, with underlying units constructed from wood and glass. Copper bands are carved into the wood to mimic gallons of fluid left in the pumps.

The most noteworthy elements of the station are imposing twin-copper totems. With a nod to Native American design, twin 40-foot high spires clad in copper with a decorative pattern of seams support an abstractly lettered "TYDOL" in red, neon-like LED lighting (Tydol Oil Company was a popular brand at the time and intended benefactor of Wright's blueprints). The totems are actually obelisks—four-sided columns that become incrementally narrower until culminating in a pointed pyramid.



Drawing 1: Filling Station South-East Elevation



New Construction

Coastal Cohousing Community

Coastal Maine

Over 16,000 pounds of 16-ounce copper successfully protects building envelopes of the Maine's Coastal Cohousing Community project while providing visual appeal. The result is a contemporary interpretation of a classic New England building form.

The architects relied on copper's adaptability to clad a variety of elements. Copper not only covers most of the roof, but it is also used for chimneys, parapets, soffits, rakes, window flashings, scuppers and downspouts.

The roofing contractor skillfully formed each copper roof panel, choosing either shop or job site fabrication to best accommodate conditions. Attention to detail from workers, combined with advantageous mechanical properties of copper allow for a symmetrical layout—top to bottom and left to right.



Key Partners

Architect

Richard Renner | Architects
Portland, Maine

Sheet Metal Contractor

The Heritage Company, LLC
Waterboro, Maine

General Contractor

Wright-Ryan Homes
Portland, Maine



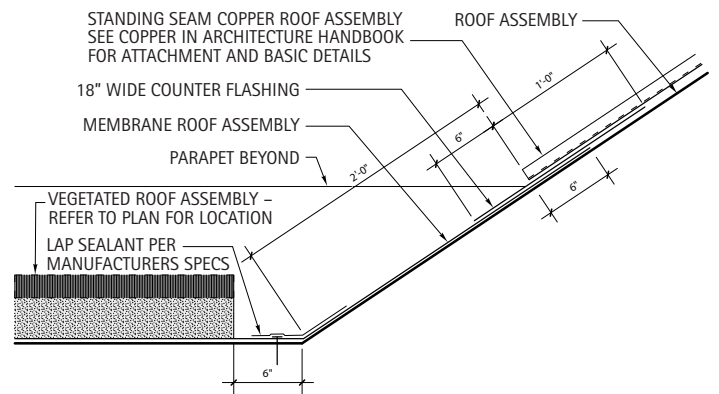
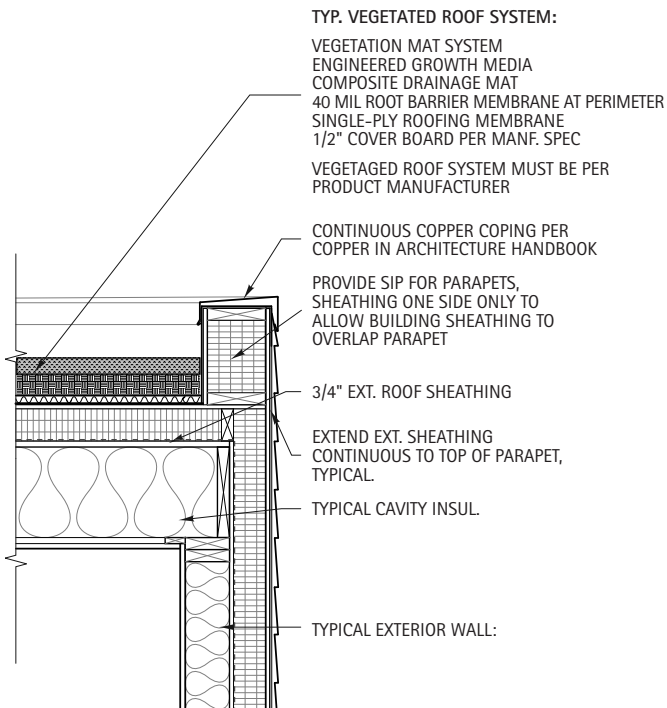
Image 1: Vegetative Roof System

Traditional double-lock standing seam copper roofs support 25-kilowatts of photovoltaic panels on south faces, with provision for additional panels to meet future demand. Special attachment points secure photovoltaic panels while allowing for natural thermal movement inherent in metal systems.

Vegetative roofing covers significant portions of low-slope roof areas, providing additional green benefits. Copper

roofing and flashing border these areas. Natural-weathering tones of copper fit well with vegetation, and copper's malleability will facilitate replacement of key vegetative roof system components when necessary.

Approximately 90-95 percent of sheet copper used for this project was produced using recycled materials. Should the owners ever decide to demolish the building, proven economic drivers ensure copper will be recycled.



Drawing 2: Copper Flashing Roof Detail
Copper Standing Seam Roofing to Vegetated Roof Assembly

Drawing 1: Typical North Wall Section at Low Roof



Ornamental Applications

Basilica of the National Shrine of Mary, Help of Christians, Bronze Entry Doors

Hubertus, Wisconsin

Built on a hilltop and facing southwest, the Basilica of the National Shrine of Mary, Help of Christians at Holy Hill is exposed to relentless sun, wind, rain and snow. Bronze doors, with their heavy cast panels, offer a more durable solution to the original wooden doors and should last for hundreds of years. The new doors are aging nicely, turning a warm brown within the first year of exposure.



Key Partners

Architect

Duncan G. Stroik Architect, LLC
South Bend, Indiana

Architectural/Ornamental Metal Fabricator

Louis Hoffmann Company
Menomonee Falls, Wisconsin

Sculptor

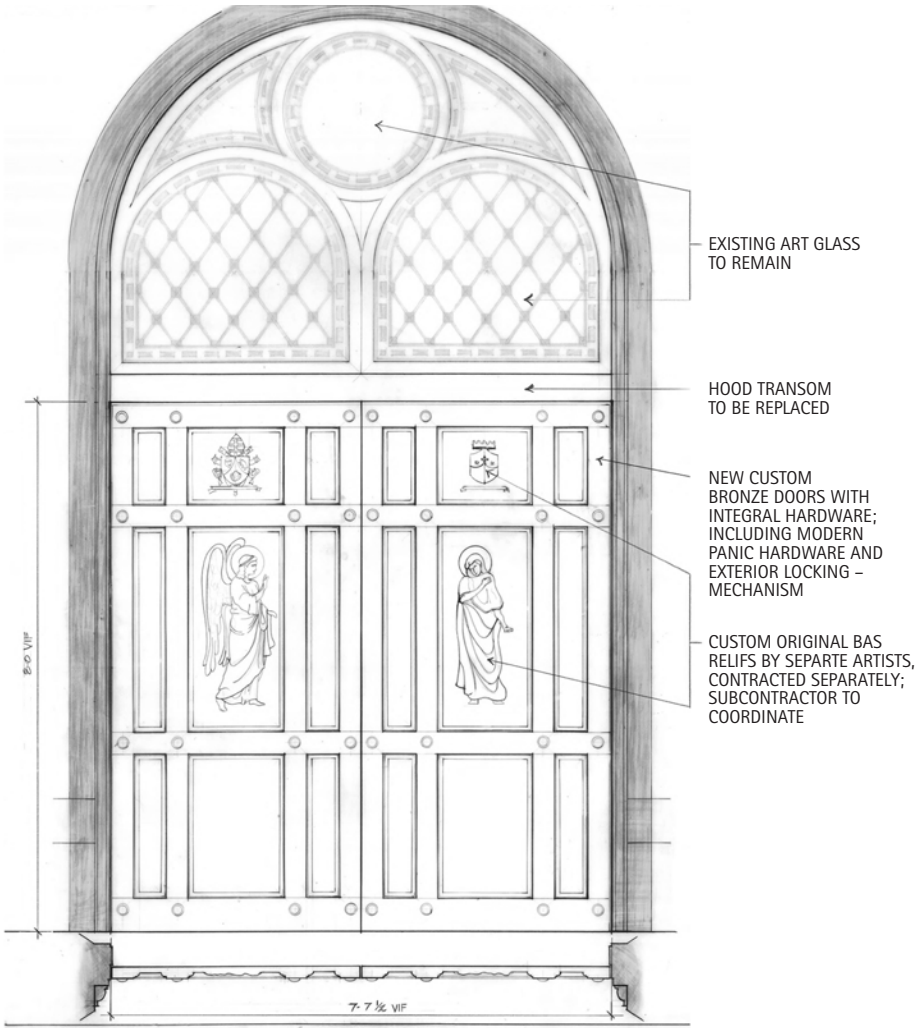
Cody Swanson Sculpture
Florence, Italy



Image 1: Clay Relief Panels of Iconography

Full-size clay mock-ups of the iconography, as seen in Image 1, were used to create silicone shells for the reliefs. Shells, or negative casts, were sent to the fabricator, who also created stiles and rails of the bronze doors for casting. Relief panels were cast using the lost wax method to achieve a clean and smooth finish.

Sand-cast door stile and rail panels are attached to stainless steel tube sub-frames, which provide support and stability. Carefully machined edges on each cast panel create an overlap from top to bottom ensuring a precise fit and a lapped weatherproof joint. Bronze components are attached to the sub frame using concealed stainless steel fasteners, so as not to detract from the beauty of the doors. The central doors weigh about 1,500-pounds and the side doors weigh approximately 900-pounds each.



Drawing 1: Bronze Central Doors and Reliefs Panels



Image 2: Bronze Central Doors



North American Copper in Architecture Awards™

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Development Association
Copper Alliance

About CDA

The Copper Development Association is the market development, engineering and information services arm of the copper industry. Copper, brass and bronze have long been used because of their great natural beauty and finish, and offer building designers and owners unmatched versatility for use in and on buildings. With widely practiced applications in architecture, plumbing, piping and HVAC, copper shines as one of the few metals that display adaptability through all aspects of building and construction. Copper offers the highest durability among competing materials, translating into the lowest maintenance cost, and longest useful lifecycle over a lifetime of installed service. Also, copper's superior electrical and thermal conductivity are critical to improving the energy efficiency of the systems and equipment in today's buildings.

About NACIA

The North American Copper in Architecture Awards program recognizes and promotes North American building projects for their outstanding use of architectural copper and copper alloys. The annual awards program showcases a wide range of projects, all of which highlight craftsmanship, attention to detail and architectural vision. Projects are selected across three different categories: New Construction, Renovation/Restoration and Ornamental Applications. For more information, visit www.copper.org.

For questions about copper or to inquire about technical information, contact CDA at 800-232-3282.