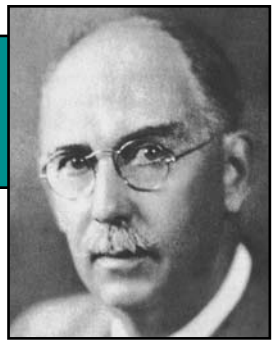
Homer G. Balcom

America's Post-WWI Structural Superstar

By Richard G. Weingardt, P.E.



Homer "H.G." Balcom. Courtesy of Empire State, Inc. by Publicity Associates 1931.

Best known as the structural engineer for the historic Empire State Building (ESB) in New York City (NYC), Homer Gage "H.G." Balcom was the most prominent consulting structural engineer in America after World War One (WWI). When his capstone skyscraper (the ESB) debuted on May 1st, 1931, it was hailed as the Eighth Wonder of the World and the 61-year-old Balcom was considered an engineering superstar. In addition, he had a special way of explaining technology in terms that laypeople could understand.

On February 2nd, three months before the ESB's opening, *Time Magazine* ran a feature article reporting, "Last week in Manhattan, the American Society of Civil Engineers (ASCE) met to ponder the problem of bracing skyscrapers against the winds of heaven. Homer Gage Balcom told assembled engineers that Ohio University was conducting experiments in wind pressure on Manhattan's ESB, world's tallest. Total wind pressure on the 1,250-foot building is more than four million pounds. Seven percent of this total represents pressure on the 200-foot mooring mast from the pull of a dirigible."

The ESB held the record as the world's tallest building for more than four decades (from 1931 to 1972) and became one of the defining symbols of NYC. But the towering structure was not Balcom's only major engineering accomplishment.

As an internationally recognized expert on the use of steel and wrought iron in complex structures and bridges, the daring engineer was a pioneer in developing design concepts that allowed tall buildings to withstand large lateral forces. In addition to being considered a world authority on dealing with wind stress in high-rises, Balcom was known for designing unique foundations that eliminated vibrations in both buildings and bridges. His creative methods advanced and improved engineering techniques and construction procedures worldwide.

Balcom's portfolio of completed projects included numerous leading-edge structures around the country and in Europe. Over his career, he was responsible for a billion dollars' worth of construction (in mid-1910s to 1930s dollars), an astonishing accomplishment considering a significant portion of his practice was during the Great Depression.

During WWI, in addition to keeping his consulting-engineering design practice operational, Balcom voluntarily served as chief structural engineer for fabricating warships for the U.S. government at the Hog Island, Pennsylvania shipyards. His structural engineering contributions there were crucial to its record-shattering production of steel ships. As the largest shipyard in the world at the time, Hog Island built 122 military vessels for the war effort, the most of any shipyard by a wide margin.

Homer was born on February 16, 1870 in Chili, New York, the only child of Mahlon and Francis (Gage) Balcom. He received his grade school education in Morton, New York, and then went on to State Normal School in Brockport. After graduating, young Balcom taught for two years at Stone Church School, Kendall. In 1894, he entered Cornell University, earning a degree in civil engineering in 1897.

H.G. first went to work for the Berlin (Connecticut) Iron Bridge Company as a draftsman and junior engineer. When the Berlin firm was absorbed by the American Bridge Company in 1900, Balcom was promoted to design engineer. Three years later, he was put in charge of all structural engineering for the company's NYC and Pittsburgh, Pennsylvania districts.

On October 24, 1900, the earnest, bespectacled, 30-year-old structural engineer married Gertrude McCrum. They would have one daughter, Gertrude Marie. The precocious Gertrude grew up quickly, often accompanying her father to engineering and social functions in place of her mother when she was unable to attend. Gertrude Marie eventually married John A. Moon, a member of Balcom's firm. When an enormous broadcasting-antenna structure was erected on top of the ESB in 1950, adding 222 feet to the structure's height, Moon was placed in charge of its construction.

In 1905, H.G. joined Reed and Stem, architects for the Grand Central Railroad Terminal in NYC. While overseeing the design of this leading-edge terminal and many interrelated structures, Balcom developed several innovative framing systems to span railroad lines, deal with track vibration and handle unstable foundation conditions. Included among his methods for insulating building frameworks from vibrations and stresses caused by track and street movements were effective uses of independent foundations, vibration-absorbing footing mats and vertical separations between buildings and traffic-carrying structures.

Three years later, in 1908, Balcom formed a partnership with Wilton J. Darrow – Balcom and Darrow (B&D), a consulting engineering firm based in NYC. Its main offices were located at 314 Madison Avenue. One of B&D's more noteworthy NYC high-rise structures was the Gramercy Park Building, completed in 1913. The B&D endeavor lasted eight years, until Darrow retired in 1916. By

Sixteenth Street Bridge over the Allegheny River, Pittsburgh, PA. Courtesy of Richard Weingardt Consultants, Inc.

then, the firm – and Balcom specifically – had earned an international reputation for designing impressive structures, mostly using structural steel. The company was renamed H.G. Balcom and Associates.

Once the U.S. declared war on Germany on April 6th, 1917, and entered World War I, which by then had already been raging for nearly three years, Balcom became deeply involved with steel-ship building for the war effort. He was chief structural engineer for the American International Shipbuilding Corporation, a wholly owned subsidiary of the American International Company, whose board of directors was a Who's Who of American industry and finance. The initial stages of these emergency fleet building operations were headed by none other than America's most famous civil engineer of the time – General George Goethals (1858-1928), fresh from his successful completion of the Panama Canal.

Although many of Balcom's projects were in the state of New York, his practice spanned the globe. Among his international achievements were the Louvain University Library in Belgium, Devonshire House in London and Young Men's Christian Association (YMCA) building in Jerusalem.

His non-NYC American projects included the National Gallery of Art (Mellon Art Museum), National Archives and Department of Commerce buildings in Washington, DC; the U-shaped Ingraham Building in downtown Miami, Florida; the Cathedral of Learning at the University of Pittsburgh; and the Nebraska State Capitol in Lincoln.

Especially unique with the Nebraska structure – in addition to its 400-foot height, which makes it the second tallest state capitol in the country behind Louisiana's – was

Rockefeller Center Plaza, New York, NY. Courtesy of Sal Galletta.

G.E. Building at Rockefeller Center, New York, NY. Courtesy of Sal Galletta.

its tower, a narrow golden dome with an out-of-the-ordinary statue on top. Created by artist Lee Lawrie, the 19-foot-tall bronze sculpture ("The Sower") is a figure scattering seed, representing the state's agricultural heritage. Because of its tall, narrow silhouette, the Nebraska Capitol building became known as "The Tower of the Plains."

Representative of Balcom's bridge projects was the 16th Street Bridge over the Allegheny River Bridge in Allegheny County, Pennsylvania, opened on October 9, 1923 at a cost of $1.25 million. The 2,000-foot-long, four-lane bridge, with pedestrian walkways on both sides, is a steel trussed arch structure, with three main spans over the river. The center arch spans 437 feet, while the north and south arches span 240 feet. The bridge's approach spans are riveted plate girders and bents. The previous bridge at the location had been the last wooden covered bridge in the city, which was destroyed by fire in 1919.

In addition to the ESB, Balcom's other prominent NYC skyscrapers included the Park-Lexington (20 stories, 1923); 230 Park Avenue (35 stories, 1929); Waldorf-Astoria Hotel (47 stories, 1931); Bank of New York Building (50 stories, 1931); and RCA Building, now called the GE Building at Rockefeller Plaza (69 stories, 1933).

Balcom pioneered many innovative design standards for tall structures still in use today – and he made wind analysis lucid and structural engineering appreciated. In his seminal paper on the construction of the ESB, "New York's Tallest Skyscraper" (Civil Engineering, March 1931), Balcom wrote, "The building exemplifies the fact that good construction and good architecture can go hand in hand, if sympathetic cooperation exists between the architect and the engineer. Such cooperation is, in fact, of the utmost importance in producing satisfactory results; and, as architects are giving this subject more and more attention, it is of first importance that structural engineers render construction assistance in the field."

The Waldorf-Astoria Hotel, New York, NY. Courtesy of Sal Galletta.

Nebraska State Capitol, Lincoln, NB. Courtesy of David Weingardt.

After delineating many of the building's engineering nuances and details, Balcom closed his paper by stating: "It is, therefore, greatly to be hoped that this building may be noted, not only for its height and its majestic beauty, but also as a means of promoting engineering knowledge."

ASCE's introduction to Balcom's paper read: "Since the dawn of civilization it has ever been the dream of man to build lofty structures. In ancient times, this was exemplified in the building of the Hanging Gardens of Babylon, the Colossus of Rhodes, and the pyramids of Egypt. In medieval times, and until the latter part of the last century, the building of great cathedrals of the old world marked the highest achievement in building construction. All of these structures were limited by the materials then available for use. Within the last thirty years, however, the development of structural steel has opened the field of almost unlimited possibilities and has led to the construction of buildings that surpass in height anything before attained. The most recent of these great structures is the Empire State Building."

Even though the ESB became a quintessential NYC landmark, it began as a purely speculative venture by entrepreneurial industrialists John Jacob Raskob and Pierre du Pont, with former New York governor Alfred E. Smith as their front man. In the planning stages,

Raskob asked the architectural/engineering team, "How high can you make it stand so that it won't fall down?" The project's architect (Shreve, Lamb & Harmon) along with the design-build contractor (Starrett & Eken) relied on Balcom for that answer.

The building's most structurally damaging incident occurred on a foggy Saturday morning in July 1945. A pilot headed for Newark airport lost his way and crashed his B-25 bomber into the structure's 79th floor, killing himself and 13 others. Although the building suffered from fire damage and a gaping 20-foot gash in its side, it was open for business on the following Monday.

Over his career, Balcom found the time and energy to serve the engineering profession on many technical committees. As an expert on several subjects, he was always ready to assist fellow engineers with advice whenever approached, and he was earnestly interested in promoting public recognition of the engineering profession.

Balcom was conscientiously active in both his profession and his community. For instance, he served as a director of the New York State Society of Professional Engineers and president of its NYC chapter, and as a committeeman for the American Institute of Steel Construction. He was also a consistent member of the American Society for Testing Materials, Cornell Society of Engineers and Sigma Xi, and was past master of Fernbrook Lodge of Masons.

On January 3, 1912, Balcom was appointed to the Board of Education of Hasting-on-Hudson, New York, where he served continuously until 1933. From 1921 to 1933, he held the office of president of the board and, as such, exercised great influence in developing a modern suburban school district. He focused on creating a centralized system where children from all sections of the village, both industrial and residential, "received education and training in a democratic way of life."

In 1996, the ASCE Metropolitan Section (ASCE/Metro) established the Homer Gage Balcom Award: "To be presented to an individual who has demonstrated a lifetime of excellence in the structural engineering of buildings, along with advances in the state-of-the-art and a commitment to the advancement of the structural engineering profession." Recipients have included such industry luminaries as Mario Salvadori, Charles Thornton, Leslie Robertson, George Tamaro, Irwin Cantor, Ysrael Seinuk and Mohammed Ettouney.

After ASCE designated Balcom's ESB as a "Monument of the Millennium" in 2001, ASCE/Metro commissioned an artist to produce a poster to highlight the feat. (The poster is available from ASCE/Metro – **www.asce.org/history/monuments_millennium/skyscrapers.cfm**.)

Balcom passed away on Sunday night, July 3, 1938, at age 68. He had checked into the hospital four days earlier for a heart aliment. Masonic funeral services were held at his residence, 65 Calumet Avenue, Hasting-on-Hudson, and afterward he was buried at Sleepy Hollow Cemetery, Tarrytown, New York. The structural engineering great was survived by his wife Gertrude and his daughter Gertrude Marie Moon, and her husband John Moon and three children, Barbara Joan Moon, Lois Gage Moon and John Andrew Moon, Jr.▪

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Empire State Building, New York, NY. Courtesy of Sal Galletta.