# Willard E. Simpson

## The Daring Texan

*By Richard G. Weingardt*

The first inductees into the Engineering Hall of Honor (Fame) established in 2005 by the Structural Engineers Association of Texas (SEAoT) were two early 20th century structural engineering icons – Willard Simpson of San Antonio and Robert Cummins of Houston, both legitimate claimants to the title of "father of consulting structural engineering in Texas." Both were outstanding engineers and citizens of their communities according to Sam White, chairman of the SEAoT Hall of Honor Committee. "These individuals should be role models for today's youth. By highlighting them to our younger engineers, perhaps we can encourage them to take a greater role as leaders in their communities and industry," said White.

The following is story of one of the icons – Willard Eastman Simpson.

Willard was born in San Antonio, Texas, on May 8, 1883, the son of Willard Lloyd Simpson and Edith Carlton. He attended private schools in his hometown, followed by four years at the West Texas Military Academy (now Texas Military Institute–TMI) where one of his more illustrious classmates was Douglas MacArthur (the flamboyant five-star general of World War II fame).

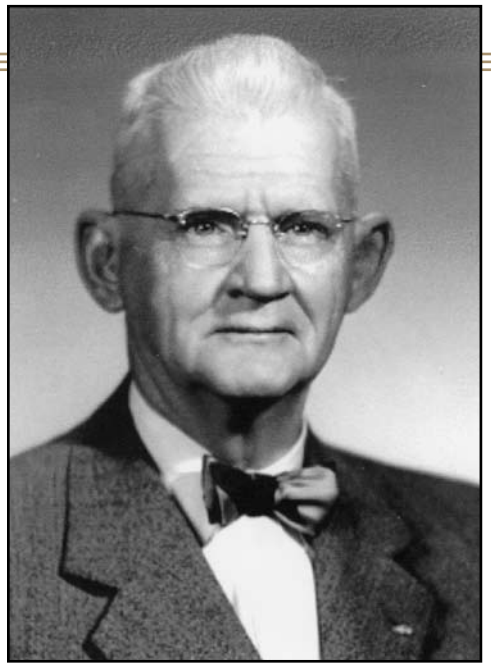
Upon graduating from TMI in 1901, the 18-year-old Simpson entered the Massachusetts Institute of Technology (MIT) as a student of naval architecture. However, influenced by MIT's President Henry Pritchett and Professor Charles Swain, both eminent civil engineers, Simpson changed the emphasis of his studies to civil-structural engineering.

About his training at MIT, Simpson said, "The whole school was devoted to instilling in us the idea that we would become professional engineers and the leaders in our field. We were taught to continually study and improve our minds – and keep abreast of the times. As professional men [and women] of learning, we were to show the way for others." Swain, head of the civil engineering department, constantly pointed out how "successful engineers gave of their time to civic affairs for the benefit of their communities."

Simpson graduated from MIT with a bachelor's degree in civil engineering, with special emphasis in structural design, in June 1905. He immediately took a position at MIT as an engineering instructor working for Swain.

In 1906, Simpson moved back west, joining the Southern Pacific Railroad in Tucson, Arizona. One year later, he returned home to San Antonio to work for architect J. Flood Walker as his structural engineer. Although a structural engineer was unheard of at that time, he convinced Walker that he could do both architectural drafting and structural engineering.

In 1909, Willard and his one-year-younger brother Guy, who also graduated from MIT, established an engineering-construction firm in San Antonio. Among the projects they built were a series of buildings on the TMI campus at Alamo Heights and at Fort Crockett in Galveston, Texas. These structures made history for being the first in the nation built using concrete tilt-up walls and design-build procedures. Even though the brothers were very proficient as specialty subcontractors designing and building tilt-up concrete structures, they lost everything when an unscrupulous general contractor failed to pay them for their work on a major project.



*Willard E. Simpson (Photo courtesy of H. Douglas Steadman)*

The brothers reorganized in 1911, this time concentrating on consulting engineering and design. Many of their early projects included the design of structural frames for schools and commercial buildings.

In the early part of the 20th century, structural steel fabricators and concrete reinforcement steel suppliers in many parts of the country usually furnished structural design as part of their bid package. Offering structural design for a fee along with architectural services was a new concept in


*Baylor University Stadium, Waco, Texas, 1950. When opened, the 50,000-seat facility was the showpiece sports facility in the Southwest. (Photo courtesy of Baylor University Athletics)*

Texas and, at first, the Simpsons faced stiff competition from fabricators, suppliers and other providers of "free" structural plans. They had to convince architects — and owners — that using structural engineers greatly benefited their projects. Ultimately, they proved that using structural consultants and including structural plans as part of the bid documents resulted in better prices and more cost-effective projects.

With San Antonio growing at a record pace during the early 1900s, one of the city's pressing concerns was the need to widen Commerce Street. A major obstacle was the historic five-story, marble-clad Alamo National Bank Building, which was directly in the road's path. After agreeing to move its building in 1913, the bank called on Simpson for assistance.

To keep the bank operational throughout construction, protect the building's architectural integrity, and complete the move in record time, the enterprising 30-year-old engineer devised a scheme to raise the building (using 1800 simultaneously-controlled screw jacks) onto rollers and slide the building onto its new foundations several yards away. It was a highly visible job that established Simpson's reputation as a structural consultant with a unique creative bent.

Shortly after completing several high-profile schools and a state hospital in San Antonio, and while in the midst of designing the prestigious Laredo National Bank building, Simpson's bachelor days came to an end. In January of 1915, he and Mary Spencer of Galveston were married. From their union, three sons would be born: Willard E., Jr. (who would become a structural engineer), Radcliff (who would graduate from the U. S. Military Academy at West Point and be killed in France during WWII) and Bert (who would die of leukemia at age six).

In the early 1900s, just before the start of WWI, bigger and more complex building structures were being envisioned nationwide and the call for (and value of) consulting structural engineers like the Simpsons increased dramatically. In Texas, this need was further heightened by the realization that unstable upper soils in areas like San Antonio and the Texas Gulf Region were wrecking havoc on buildings and

*International Bridge over the Rio Grande River, Laredo, Texas, 1921. The 1,600-foot long, multi-span, concrete arch structure was the longest and first-of-its-kind in the area. (Photo courtesy of H. Douglas Steadman)*

*Gulf Building (JR Morgan Chase Building), Houston, Texas, 1929. The symbol of the Houston skyline for years and its tallest skyscraper from inception until 1963. Designated a National Civil Engineering Landmark in 1997. (Photo courtesy of H. Douglas Steadman)*

structures. Conventional foundations in southwestern Texas at the start of the 20th century were mostly shallow footings, bearing on just-below-the-surface soils, which expanded and contracted during wet and dry cycles severely damaging buildings.

When one of his own structures became seriously distorted and damaged because of foundation movements, Simpson decided to change the prevailing criteria for the design and analysis of foundations. Since geotechnical engineering was in its infancy in the early years of his practice, Simpson had to develop his own expertise in soils engineering. As a start, he conducted an intensive study of all foundation soils and footing types in the San Antonio.

In 1916, while observing the construction of foundations for a residence, Simpson became enthralled by local well driller, Ed Dudersudt, drilling deep holes with an 18-inch diameter auger powered by a mule walking around in a circle. He enlisted Duderstadt to drill similar holes (down to hardpan) for a foundation system he was experimenting with. Filling the slender cylindrical holes, which bypassed the site's unstable upper soils, with concrete and reinforcing bars, Simpson used the resulting piers as his foundation supports, and the drilled pile (or pier) foundation system so much in use today was born!

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*Fort Crockett in Galveston, Texas, 1909. Among the nation's very first concrete tilt-up construction projects, the first completed using design-build construction techniques. (Photo courtesy of H. Douglas Steadman)*

Simpson also pioneered the concept of reaming out the bottoms of these drilled shafts to enlarge their bearing area to better carry increasingly larger building loads. In the early days, these bottom-belled piers were accomplished by lowering a construction worker down the shaft who then formed the under-ream by hand. Later, in the 1920s, Simpson and Duderstadt collaborated in developing a first-of-its-kind mechanical device to under-ream pier shaft bottoms.

Near the end of the second decade of the century, around the time the Simpsons were branching out into the highway engineering business, Guy died, a victim of the influenza epidemic of 1918-19. Willard was left to continue their consulting practice and to pursue highway work.



For years he served as the county highway engineer for four Texas counties – Kimball, Kerr, Edwards and Real – in the Hill Country, northwest of San Antonio. No contemporary roads existed in the four counties at the time, only rutted dirt wagon trails, and hundreds of miles of highways and countless bridges had to be engineered.

The most spectacular of the Simpson-designed bridges was the International Bridge over the Rio Grande River near Laredo, Texas, a multi-span, reinforced concrete arch structure never before seen in the area. It replaced a steel truss/wooden deck bridge destroyed earlier by a fire, and was the largest bridge in the southwest. A similar record-setting 1,600-foot-long bridge over the Santa Catalina River near Monterrey, Mexico, was also designed by Simpson soon after.

In 1926, Simpson was selected as the structural engineer for the 31-story Smith Young Tower (now the Tower Life Building) in San Antonio. The building's steel superstructure rested on belled drill-piers founded in hard blue marl 50-feet below the street level, the first high-rise to be so supported. For 60 years, from 1928 to 1988, Smith Young Tower was the tallest building in San Antonio.

He was also commissioned to design the structural frame and foundation for the Gulf Building in Houston. To support it, Simpson designed large concrete mat foundation bearing on firm soil, six feet below the building's basement. His use of a mat foundation rather than driven piles for such a tall structure was a breakthrough in the Houston area. In 1997, the Gulf Building was designated a National Civil Engineering Landmark by ASCE. It is also listed on the National Register of Historic Buildings.

Over his career, Simpson was responsible for numerous engineering innovations on many of Texas's most complex structures. His portfolio of history-making projects, in addition to the Gulf and Smith Young buildings, included Austin's Federal Courthouse, El Paso's Natural Gas Company Headquarters, San Antonio's U.S. Post Office, Medical Arts Building, Thomas Jefferson High School, State Highway Department Building, Alamo Stadium, Joe Freeman Coliseum and the 25-story Nix Building, and Waco's Baylor University (now Floyd Casey) Stadium.

In 1955, one of Texas's most legendary architects, the flashy cigar-chomping O'Neil Ford, called on Simpson to help make his circular Villita Assembly Building (in San Antonio) possible. Simpson's solution was one of the country's first cable-supported structures — a concave, 132-foot-diameter

*Tower Life (Smith Young) Building, San Antonio, Texas. The tallest building in San Antonio for 60 years, from 1928 until 1988. Listed on the National Register of Historic Places. (Photo courtesy of Richard Weingardt)*

cable roof having a tension-ring in center and a compression-ring at the outside. Trapezoidal precast concrete panels, attached between the cables, formed the roof deck.

Simpson was a steadfast participant in a number of engineering groups throughout his professional life, and the author of number of landmark technical papers including *Foundation Experiences with Clay in Texas* (1934) and *Problems in Foundation Design: The Soil Laboratory as an Aid in Their Solution* (1936). He served as president of both the Texas Section of ASCE and the Bexar Chapter of the Texas Society of Professional Engineers (TSPE).

In 1955, TSPE honored Simpson with its Bexar Chapter Engineer of the Year Award. TMI honored him with its Distinguished Alumnus Award in 1966.

Simpson took a great interest in San Antonio outside of his engineering practice and volunteered his time freely. He served in leadership roles on a number of civic boards including the State Engineer's Committee on Flood Control, and San Antonio's Public Service Board of Trustees, Symphony Society and Boy Scouts. He was a member the San Antonio Rotary Club for nearly 60 years and YMCA Board of Directors for 25 years.

Simpson lived his final years across the street from the main entrance to his beloved TMI and was a familiar figure to its cadets, often attending major events and football games. He passed away on June 7, 1967, at the age of 84.▪

*Alamo National Bank, San Antonio, Texas. 1913. The procedures developed by Simpson to successfully move the historic five-story structure ascertained his rising reputation as an innovative young engineer of the highest order. (Photo courtesy of H. Douglas Steadman)*

*Richard G. Weingardt, P.E., is CEO of Richard Weingardt Consultants, Inc. in Denver, CO. He is the author of eight books. Weingardt was the 1995-96 national president of ACEC.* ***rweingardt@aol.com***