Historic Civil Engineering Landmarks of Texas

[View Map]

National CE Landmarks in Texas

2001 -	Galveston Seawall and Grade Raising	Galveston
1998 -	Hangar 9, Brooks AFB	San Antonio
1997 -	Texas Commerce Bank, originally the Gulf Building (now Chase Bank)	Houston
1996 -	San Antonio River Walk & Flood Control System	San Antonio
1993 -	Denison Dam	Red River
1992 -	The San Jacinto Monument	East Harris County
1987 -	Houston Ship Channel	Houston
1986 -	El Camino Real, Eastern Branch	San Antonio
1976 -	International Boundary Marker No. 1	El Paso
1968 -	Acequias of San Antonio	San Antonio

Texas Section Historic CE Landmarks

2015 -	Cowtown Coliseum	Fort Worth
2011 -	Faust Street Bridge	New Braunfels
2003 -	Bataan Memorial Trainway	El Paso
2001 -	Hays Street Bridge	San Antonio
2000 -	Highland Lakes	Texas Hill Country
1992 -	Holly Pump Station and North Holly Water Treatment Plant	Fort Worth
1991 -	Medina Dam	Lake Medina
1990 -	Buchanan Dam	Lake Buchanan
1989 -	Houston Street Viaduct	Dallas
1989 -	Original Dallas Floodway	Dallas
1988 -	El Camino Real, Central Branch	El Paso
1988 -	Corpus Christi Seawall	Corpus Christi
1981 -	Mills Building	El Paso
1980 -	International Boundary Marker - Republic of Texas and the United	Logansport, LA
1979 -	Alamo Portland and Roman Cement Works	San Antonio
1976 -	Franklin Canal	El Paso
1976 -	Paddock Viaduct	Fort Worth
1975 -	Galveston Seawall and Grade Raising	Galveston
1971 -	Waco Suspension Bridge	Waco

Markers with Other Sections

2016 - Roma-Cuidad Miguel Aleman International Bridge
with the Mexico Section — Location: Roma, TX & Cuidad Miguel Aleman

1993 - Denison Dam
with the Oklahoma Section — Location: Red River

1980 - International Boundary Marker - Republic of Texas and the United States
with the Louisiana Section — Location: Logansport, LA

1976 - International Boundary Marker No. 1
with the New Mexico and Mexico Sections — Location: El Paso

Acequias of San Antonio, 1968 HCEL

The Acequias of San Antonio date back to 1718 with the founding of Presidio San Antonio de Béxar on the west side of the San Antonio River. As part of initial city planning for the settlement, the Acequias comprised a network of eight irrigation canals, along with small diversion dams that transported water from the River to residents and area farmers. The first of the canals, Concepción, was navigable by boat. One of the smaller connections brought water to the Alamo.

With their expertise in the design and construction of the Acequias, early Spanish colonists brought large-scale irrigation - a welcome addition to Texas' semi-arid climate. However, construction and maintenance took a considerable amount of labor. Landowners were, therefore, required to assist in the initial construction of the Acequias as well as contribute towards the cost of their upkeep. Those who did not comply were fined. In the 1790s, after the secularization of the missions, authorities managed the distribution of water through the Acequias. However, this was discontinued in the late 1800s, leaving those that remained to the management of informal community enterprises or to abandonment. In fact, most of the original network was abandoned with the expansion of San Antonio in the twentieth century. However, traces of the old Acequias can still be seen there today.

Photo: National Park Service

Waco Suspension Bridge, 1971 HCEL

In 1870, the Waco Suspension Bridge, a 475-foot span, was the longest suspension bridge in the world at its opening. This solid, yet elegant structure rising above the Brazos River features two large towers on each bank, medieval-style turrets joined by an arch wide enough to allow two stagecoaches to pass in both directions. With its construction, the bridge removed a critical obstacle from the path of emigrants traveling westward; it also opened the western side to mass cattle migration, replacing the ferries that had previously been the mode of crossing.

The bridge was a private venture taken on by the Waco Bridge Co. The company obtained the steel trusses and wire cables from the John Roebling engineering firm of New Jersey. Distinguished civil engineer Thomas M. Griffith was also commissioned from New York to manage its construction. Griffith arrived in 1868; trusses and cables soon arrived by way of steamer, rail, and oxen, and locally manufactured bricks were assembled to finish the structure. Waco soon became a vital center of manufacturing and transportation as well as one of the critical cattle trails of the era. By charging five cents per head of cattle, the Waco Bridge Co. soon repaid the debts incurred during construction.

Owner:	McLennan County
Engineer:	Thomas M. Griffith (Civil)
Contractor:	George Dutton
Photo:	Michael N. Fowler, Creative Commons Attribution 2.0 Generic license

Galveston Seawall and Grade Raising, 1975 HCEL

On September 8, 1900, a disaster struck Galveston which remains the deadliest in North American history. A hurricane struck Galveston Island, killing approximately 15% of the island's population of 44,000 people and causing an estimated $30 million in damage. After the storm, the Galveston City Commission and County Commissioner's Court appointed a three-member board of engineers to devise a plan of protection from future storms. The board, comprising Brigadier General Henry Martyn Robert, U.S. Army Retired; Alfred Noble; and Henry Clay Ripley, which represented some of the finest engineers of the time, presented its formal report to the City in January of 1902.The report recommended construction of a curved-face concrete seawall which would run across the eastern edge of the city from Galveston's south jetty down to the beach, as well as a fill behind the wall with a crest one foot higher than the wall and 2000 feet back from it.

The design called for driving piles 40 feet below sea level to secure the foundation with the outer wall curving inward to direct crashing waves back towards the sea. In preparation for future storms, Galveston was also faced with the task of raising the ground level of the island by up to 12 feet - a feat which involved raising all of the buildings by hand-turned jack screws, and lifting utility systems such as water pipes, streetcar tracks, and telephone lines section by section. Galveston has seen untold benefits from this endeavor; it is left with an aesthetically pleasing shoreline, with the seawall having become a major tourist attraction. Furthermore, the seawall and grade rising have prevented over $250 million in storm damages and have saved countless lives to date.

Photo: Michael N Fowler, FEMA

Franklin Canal, 1976 HCEL

The Franklin Canal, started in 1889, was the first large-scale, complex irrigation project in West Texas. The canal, a private undertaking of the El Paso Irrigation Co., was fed by a dam on the Rio Grande that diverted water into its thirty mile stretch down through the El Paso Valley from the City of El Paso. The project was completed in 1891 with an original width ranging 15-30 ft. In 1912, the Franklin Canal was appropriated by the U.S. Reclamation Service as part of its Rio Grande project and underwent extensive renovations from that time until 1914. The canal's earthen sides and bed were sheathed in concrete and its capacity was increased; the Franklin Canal became one of the projects primary canals.

Although it was originally designed to irrigate an estimated 30,000 acres, because of the erratic flow of the Rio Grande, it would water only 3,000 acres in the few years following. In 1935, considering the water supply in this area was significantly dependent on sharing the waters of the Rio Grande with Mexico, Congress commissioned diversionary projects to measure and allow Mexico's share to pass through to the Acequia Madre, while diverting everything else into the American Canal, a two-mile stretch that now feeds the Franklin Canal - a successful solution to the problem of dividing the waters.

International Boundary Marker No. 1, 1976 HCEL

The Emory-Salazar Commission - a joint U.S.-Mexican team - showed both skill and fortitude in working together to define the 2,000-mile U.S. Southern border across wild, often dangerous territory. Requisitioned after the Mexican War ended in 1848, this was the first survey marking the official international boundary between the United States and Mexico. The survey extended west into the Pacific, ending eastward near El Paso and Juarez on the Rio Grande.

The easternmost point of the land boundary was marked by a four-sided marker in the same year that the team determined its location – 1855. The marker is located on the west bank near El Paso; its southern half lies in Mexico while its northern half rests in the United States. The monument is twelve feet in height with a width of five feet at the base. The monument was enhanced with a concrete base and a white marbleized concrete resurfacing in 1966.

Photo: James Sullivan

Paddock Viaduct, 1976 HCEL

Replacing the ferries and low-water crossings, the Paddock Viaduct connected downtown to the northern sections of the city of Fort Worth. The bridge, started in the 1890s, was designed by Benneke and Fay of St. Louis as the first reinforced concrete arch in the U.S. to use self-supporting reinforcing steel. The bridge also utilized a unique three-hinged arch design, with the highest point on the arch and two end points being hinged - a recent innovation of Swiss engineer Robert Maillart. This was an optimal design considering the soil instability and unpredictable nature of the Trinity River.

Although sometimes referred to as the Main Street Viaduct, the project was officially named in honor of B.B. Paddock, former Ft. Worth newspaper editor, mayor, and state legislator. The bridge, completed in 1914, comprises four arch spans for a total of 1,319 feet long and 54 feet wide. A 225 foot span crosses the Trinity River with 175 foot spans on either side; a fourth arch reaches across the north side into downtown.

Photo: Mark Fisher, Creative Commons Attribution-Share Alike 3.0 Unported license

Alamo Portland and Roman Cement Works, 1979 HCEL

The Alamo Portland and Roman Cement Works - the first Portland cement factory in the American Southwest - was a critical supplier for the many Texas public works projects of the late 19th and early 20th century. Portland cement, a strong, durable, and quick-hardening blend, which is still in wide use today, was essential building material when the first plant opened in 1880 - only eight years behind the first one of its kind in America (Copley, Pa.).

The company's history starts in 1879 with William Loyd, a visiting Englishman who discovered the quarry in the course of a hunting trip. The quarry would later be identified as the source of blue argillaceous limestone, a natural cement rock, and the stock and trade of the enterprise. Loyd brought samples from the quarry to George Henry Kalteyer, state chemist of San Antonio at the time, who identified its type and value and later convinced the Texas State Capitol Board to use it in the construction of the Capitol building. The original cement works produced 10 barrels a day powered by a steam engine.

Photo: Sedonaz, Wikimedia. CC License.

International Boundary Marker - Republic of Texas and the United States, 1980 HCEL

The Sabine River, established as the official boundary between the United States and Spanish Mexico by the Adams-Onis Treaty of 1819 - twenty years and a revolution later - became the line of demarcation between Louisiana and the Republic of Texas. A convention of the two governments, held in Washington, D.C., established the official boundary directly at the center of the Sabine River. It now serves as the only marker of international boundary known to exist within the continental U.S.

The original granite marker was placed at its current site in 1841 along what is now the Louisiana/Texas state line on Louisiana Highway 765 and Texas FM-31. It was the first land marker placed by engineers surveying the line northward from the Sabine as it veered westward. The surveyors, John Forsyth of the U.S. and Memuncan Hunt of Texas, embarked on a year-long expedition up the river to mark the line. In addition to achieving ASCE Historic Landmark status in 1980, the international boundary marker between the Republic of Texas and the United States is also recognized on the National Register of Historic Places.

Mills Building, 1981 HCEL

The Mills Building in El Paso, the first and only commercial building recognized as a Texas Historic Civil Engineering landmark, is distinguished as the first large reinforced structure in Texas and a contemporary of the earliest skyscrapers of its type in the United States - first reinforced concrete-framed and second concrete-framed skyscraper in the U.S. Construction began on the structure in 1909; completion to eight stories was accomplished in 1911, and ultimately four additional stories were completed in 1915.

At the time, concrete construction was a new method for buildings, and there was even less guidance on reinforced concrete design. Adolphus Gustavus Trost of Trost & Trost of El Paso was therefore pioneering a new method in his development of this design for the Mills building. The building is named for its commissioner, Anson Mills, a local engineer who surveyed and platted the settlement of Franklin (which he renamed El Paso in 1859). The building faces the street, a gently curved façade with Chicago style moldings and elements adorning its structure. It stands in an area that has been revived, with the intention of preserving its architectural and historical value.

Photo: xnatedawgx Wikipedia

Section Founding Marker, Corpus Christi

1983 HCEL

El Camino Real, Eastern Branch, 1986 HCEL

The Eastern Branch of the El Camino Real, a rugged route running for 2,400 miles between Veracruz, Mexico and St. Augustine, Florida was a trail begun by the conquistador Hernando Cortez in 1519. Although commonly referred to as “The King’s Road,” the road offered a path for settlers, goods, crops, livestock, crafts, and other commerce to travel. Its contribution to the history and culture of Texas, the United States, and Mexico runs deep.

One section of the road, east of the central north-south road, El Camino Real de los Tejas, runs from Guerrerro, Mexico, through Texas and into Natchitoches, La. Many of our roadways today follow the original path of the Eastern Branch of the El Camino Real through cities in Mexico and the southern U.S.The route passes through San Antonio, Natches, Pensacola, and Tallahasse. The Eastern Branch of the El Camino Real is commemorated as an ASCE National Historic Civil Engineering Landmark by a plaque marking its passage through San Antonio.

Links:
http://www.asce.org/People-and-Projects/Projects/Landmarks/El-Camino-Real-(The-Royal-Road)-Eastern-Branch/

Houston Ship Channel, 1987 HCEL

The Houston Ship Channel- 50-miles of waterway stretching from the Gulf of Mexico inland to Houston, Texas - has been an important economic engine and a fixture of the southwestern United States for more than a century. The project was primarily facilitated by investment banker and lobbyist, Jesse H. Jones, whose leverage in Washington garnered federal support for half of the cost of the project. It was also made possible by Harris County which, in 1909, issued bonds to fund the other half of the cost of dredging the channel. The channel was dredged to a depth of 25 feet for its initial opening to deep-water navigation in November of 1914.

The opening ceremony involved an additional bit of engineering in celebration of the achievement, through which President Woodrow Wilson was able to press a button in Washington that launched cannon fire at the Houston Ship Channel. At its opening in 1914, the Houston Ship Channel banks were home to few industries; today, they support the second largest petrochemical complex in the world. Later improvements deepened the channel to 40 feet and widened it to 400 feet for the majority of its length. The Port of Houston is currently ranked the nation’s second largest port in tonnage and largest in foreign trade.
Photo: Blair Pittman; NARA

Corpus Christi Seawall, 1988 HCEL

The Corpus Christi Seawall was first conceived in 1921; it would be the only storm tide protection project on the Texas coast financed with state ad valorem tax remissions. This funding method was part of the Timon Plan, which called for return to Corpus Christi of ad valorem taxes collected from seven surrounding south Texas counties. The plan was thrice approved by the Texas Legislature and provided for both a seawall and a breakwater. In exchange for extending the property from the existing shoreline to the new seawall - a strip of land with dimensions of 11,000 ft long by 200-300ft wide – the City obtained rights along the waterfront for recreational and commercial development.

The design of the seawall called for unique concrete and steel construction, with 3500 psi concrete and steel reinforcements buried at least three inches from the concrete face and creosoted wood piling. A moveable steel form and railroad wheels are utilized to facilitate steps that extend out into the bay. The moveable form, a new idea in the 30s, provided for time savings in the concrete pour. The Corpus Christi Seawall has withstood the test of time, protecting the city from the force of seven hurricanes, including winds up to 161 mph and tides rising to 8.9 feet, with no significant flooding downtown and virtually no maintenance since its initial construction.

Owner:	City of Corpus Christi
Engineers:	J.C. Bisset (City Engineer)
	Meyers and Noyes
Contractor:	Jay DePuy - San Antonio
Photo:	Vernon Wuensche - ASCE Texas Section

El Camino Real - Central Branch, 1988 HCEL

The Central Branch of the old El Camino Real trail starts in Veracruz, Mexico, passes through Chihuahua and El Paso, and finally ends up in Santa Fe, New Mexico - a 1,600 mile stretch. It is no wonder that the El Camino Real is oldest and longest historical trail in the Western Hemisphere. The integration of Spanish and European culture throughout the Southwestern United States owes much to this historic trail.

The Central Branch was actually the first major route of transportation originated by European settlers in the new world. Having begun in Mexico City in 1540, the trail gradually expanded north over half-a-century through Zacatecus and Durango to Chihuahua City. As additional mining opportunities were sought, it crept further north. The first Spanish trailblazer of this branch of the El Camino Real was Father Augustin Rodrigues, who came through “El Paso del Norte” in 1581. The conquistador Don Juan de Onate later completed the route to what is now Santa Fe, taking 400 men, women, and children colonists and 6,000 head of cattle northward, through El Paso. The trail is commemorated by a plaque that marks its passage through El Paso, recognizing it as an ASCE Texas Section Historic Civil Engineering landmark.

Photo: Bil Kirchner; November 3 2010 via hmdb.org
Map:
Matthew High, Flickr
Links:
http://www.asce.org/People-and-Projects/Projects/Landmarks/El-Camino-Real/

Hangar 9, Brooks AFB, 1988 HCEL

With the start of World War I, military preparedness ramped up full-speed ahead and with it, a new flying field, Brooks Field, broke ground in February of 1918. The facility was established to train Army pilots, some of whom included: Charles Lindberg, Nathan Twining, and Thomas D. White. It became home to many early innovations in aviation training, such as the invention of the Ocker Box (to teach instrument-only flying) and early experiments in paratroop jumps.

Hangar 9 is a 2-story, 865 sq ft wooden building - one of 16 hangars constructed in 1918 as temporary buildings for the new airfield. The other buildings were demolished in the late 50s, but Hangar 9 remains standing as a museum, housing artifacts related to aviation history and development, including early space exploration. The building's design distinguishes itself in the use of local materials and human resources, the speed of construction, and the durability with which it has faced the years unscathed.

Owner:	U.S. Air Force
Architect:	Albert Kahn
Contractor:	Harmon & Co.
Photo:	U.S. Air Force

Houston Street Viaduct, 1989 HCEL

The first of five concrete and steel viaducts connecting the north and south sections of Dallas, the Houston Street Viaduct was entirely funded by Dallas County, and is one of the longest (6,562 feet, 56 feet wide) bridges ever built utilizing reinforced-concrete arches. This crossing, from the Dallas Central Business District, was the first reliable transportation to the then City of Oak Cliff, providing a future rail link, as well as clearances which would allow ocean- going vehicles to pass on a proposed Trinity River Canal. The Trinity River Canal would connect Dallas to the Gulf of Mexico and demanded a 90-foot clearance; this project is still under consideration today.

The Houston Street Viaduct displays a remarkable insight into future infrastructure needs and development. In addition to accommodation for possible future oceangoing vehicles, the viaduct features a roadway for vehicular traffic, sidewalks with provisions for a double-track electric railway, pile footings, and discontinuous rocker bearing girders designed as simple beams. Work began in 1910 and was completed a year later.; Remarkably, the overall structure remains intact with no visible modification and continues to support a major traffic artery. This link to the past continues to serve the public and to further the legacy of the skilled, forward-thinking engineers of the early 1900s.

Owner:	Dallas County
Architect:	Ira G. Hedrick, CE
Engineers:	J.F. Witt (County Engineer)
	Hedrick & Cochrane (field work mgmt)
	M.R. Ash (design)
Contractor:	Corrigan, Lee, & Halpin
Photo:	Joseph E. B. Elliott, National Park Service

Original Dallas Floodway, 1989 HCEL

The need for flood control of the Trinity River came to the forefront of Dallas' public attention after the May 1908 flood – the worst the City had ever recorded, which resulted in the death of eleven people and the loss of more than five million dollars. The Kessler Plan - a result of committee action by the Dallas Chamber of Commerce in January of 1910 - called for the reclamation of the Trinity River Valley, which would involve the leveling of the river and development of a levee system.

In 1919, the Dallas County Levee Improvement District No.5 was established, the lines of which were later broadened, providing for the reclamation of 7217 acres of land in the City and County and 336 acres outside of the original District. The geographical boundaries of this new Joint Plan of Reclamation roughly followed the flood limitation line of the 1908 flood. Bonds issued by the flood control districts funded the levee system and four pump stations, which went online in 1931. The original Dallas Floodway was designed for a 300,000 cfs flow of water.

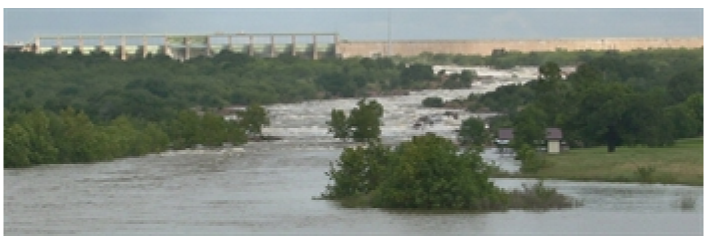
Photo: U.S. Army Corps of Engineers

Buchanan Dam, 1990 HCEL

Completion of Buchanan Dam in 1938 was a tremendous achievement, representing the taming of the Colorado River – the largest river wholly in Texas. Buchanan Dam created Lake Buchanan, which is the largest in the Highland Lakes network. The dam is named after U.S. Congressman James Paul Buchanan, then chair of the House Appropriations Committee who secured the federal funding needed to finish the dam after work had stopped following the bankruptcy of the original contractor during the depression.

The construction and completion of Buchanan Dam became a tremendous economic and agricultural stimulus. Moreover, the provision of hydroelectricity reduced dependency on imported and fossil fuels. The act of achieving the design itself - the longest multiple-arch dam in the nation (and at the time it was built, largest in the world), was a testament to and encouragement of American ingenuity even in the face of hard times (the Great Depression). The 11, 200 foot long, 145 foot high arch-and-gravity structure was designed for hydro-electric power and flood control storage. Buchanan Dam contains three turbines that generate 37,500 kilowatts of electricity and has a reservoir capacity of 922,000 acre-feet.

Photo: Jon Lebkowsky from Austin, USA



Medina Dam, 1991 HCEL

The Medina Dam, completed in 1912 was, at that time, the largest in Texas and the fourth largest in the United States. The entire irrigation project was the largest west of the Mississippi; the entire system was designed without the use of pumps, operating by gravity alone. The concrete gravity dam is an engineering application for which we can find evidence of as far back as the Egyptians of 5,000 years ago. The potential of the site was first recognized by Henri Castro, a French-born settler, upon founding his colony near San Antonio in 1844. However, funding efforts stagnated for decades until another San Antonio native, Clint H. Kearney, contacted Frederick Stark Pearson, an internationally recognized engineer who was able to obtain financing from British investors.

Owing to skillful design and project management, the project was completed in record time despite its remote location. It includes a diversion dam and system of irrigation canals which delivers water to 24,000 acres of farmland, and a lake, Lake Medina, which provides for outdoor recreation. The extraordinarily short time-frame of construction was made possible by the competency of the crushing and mixing process, the triple system of hoppers which kept materials always prepped and waiting, and the steep incline, which provided for rapid delivery.

Photo: Larry D. Moore CC BY-SA 3.0

Holly Pump Station and North Holly Water Treatment Plant, 1992 HCEL

The Holly Pump Station, which opened in 1892, and North Holly Water Treatment plant (opened in 1911) comprise the first waterworks system constructed by the City of Fort Worth. The City was responding to an increased demand for water associated with tremendous population growth. From 1880-1890, the population of Fort Worth quadrupled. The water supply was stretched thin and water-borne illnesses were a major problem. The city invested in the new technology of the time: including 5 million gallon low-lift centrifugal pumps, sedimentation basins, rapid sand filters, a million-gallon clearwell, and a laboratory to facilitate chemical and bacteriological tests. Major purchases were made from the Holly Water Works Co. of New York, which furnished the pumps and designed the plant; its initial system cleaned two million gallons a day.

The total cost of the project – including pump and broiler house, two engine foundations, a brick smokestack, 12 8-inch wells, a suction crib, a standpipe, and pipelines, valves, and other components of the distribution system – was $687,000. The plant continued to grow over the years. Completion of the treatment plant's second expansion in 1923 brought a dramatic decrease in the incidence of disease. The facility finally reached its ultimate size (79 MGD) fifty years after its initial construction. Unlike many of the early waterworks facilities, parts of the system are still functional; the updated plant is still a critical part of Fort Worth's water supply system.

Owner:	City of Fort Worth
Engineers:	John H Gregory
	A.W. Scoble (City Engineer)
Contractor:	John B. Hawley of McArthur Brothers
Photo:	Freese & Nichols

San Jacinto Monument, 1992 HCEL

The San Jacinto Monument, located in the San Jacinto Battleground Historical State Park on the Houston Ship Channel is, according to the Guinness book of world records, “the world’s tallest monumental column - at 567.31 feet in height (15 ft. taller than the Washington Monument). The monument commemorates the Battle of San Jacinto, April 21, 1836, the battle that won Texas’ independence from Spain. Ground-breaking for the monument took place on the same site as that historic battle on April 21, 1936 – exactly one hundred years later.

The San Jacinto Monument was funded by state and Public Works Project funds at a total cost of $1.5 million. The engineering work on this project is remarkable for its contribution to soil mechanics, having been one of the first field tests of the theory of Dr. Karl Terzaghi for computing the magnitude and rate of settlement. The monument, completed in 1939, is also notable for the innovative construction techniques employed, including the use of an engineered system of suspended scaffolds in achieving a continuous pour of 6,000 cubic yards of concrete during a 57-hour interval.

Owner:	The State of Texas, Parks & Wildlife Commission
Architect:	Alfred C. Finn
Engineers:	Robert J. Cummins
	Raymond Fillmore Dawson (geotechnical)
Contractor:	W.S. Bellows Construction Co.
Photo:	Tijuana Brass, Wikipedia

Denison Dam, 1993 HCEL

The Denison Dam, the largest rolled-earth dam in the world when completed in 1944, at 15,000 feet long and 165 feet high, created Lake Texoma - the second largest lake in Texas, with a shoreline of 1, 250 miles. The Red River, which separates Texas from Oklahoma and from Louisiana, has always been a strong and dangerous waterway. The idea of building a dam to tame this important channel, championed by Denison Resident, George Moulton, and advanced by Representative Sam Rayburn of Bonham (who would later become speaker of the House), was authorized by the Flood Control Act and funded by the WPA.

Although the primary function of the dam was flood control, it also generates electrical power. The construction of Denison Dam has been instrumental in the development of dam construction methodology, as it is used as a model by the Army Corps of Engineers in arid environments. Additionally, sampling procedures and equipment developed during this project are now commonly used in soil testing. One piece in particular, a sampling device called the Denison Barrel, is able to obtain undisturbed samples of heavy clay. Denison Dam is currently worth tens of thousands of dollars in water supply contracts, has prevented hundreds of thousands more in flood damages, and is still one of the most productive of its kind in the world.

Owner:	U.S. Army Corps of Engineers
Engineers:	Gen. Lucius D. Clay (District)
	Asa V. Shannon (Principal)
Contractors:	Shutt Construction Co.
	John Kerns Construction Co.
	C.F. Lytle Construction Co.
	Guy F. Atkinson Co.
Photo:	Robert Nunnally

San Antonio River Walk and Flood Control System, 1996 HCEL

The San Antonio River Walk & Flood Control System includes three key components: the River Walk, the "Great Bend Cutoff", and Olmos Dam. Olmos Dam, a flood water detention facility constructed in 1927 - reaching 54 feet high and 1,941 feet long -has become an essential reservoir for the area. The River Walk area is further protected by the "Great Bend Cutoff," comprising isolation gates at the north and south entrances from the "Great Bend Cutoff" – a bend or reservoir to the "River Loop" segment (loop in the river). The cutoff was designed by Freese and Nichols, to prevent flooding in that specific loop section and allow development to occur at the particularly charming lower bank level. The River Walk development included construction of outdoor stairways, walkways, bridges, benches, landscaping, and even an outdoor theatre - taking on the architectural style and meandering charm of an old Spanish city.

From early flood control reports to design considerations for construction, and of bridges, retaining walls, and floor of the river channel, civil engineering was essential to the development of the River Walk. The River Loop, once considered a safety hazard, is now internationally renowned as a travel destination, bringing in valuable tourist dollars to the local economy (about $2,000,000,000 a year is attracted to the area, with the Alamo and River Walk acting as the primary sights).

Owner:	City of San Antonio
Architect:	Robert H.H. Hugman
Engineers:	W.H. Lilly
	Edwin P. Arneson
Photo:	Loadmaster (David R. Tribble), GNU License

Texas Commerce Bank, originally the Gulf Building (now Chase Bank), 1997 HCEL

The 35 story, art-deco Gulf Building, completed in 1929, had the distinction of being the tallest building west of the Mississippi for 33 years. The project was a landmark in the development of foundation design and has forever changed the way buildings in the region are designed. The use of a mat foundation, rather than piles, was agreed upon after an extensive geotechnical review (with advice from Karl Terzaghi). Settlement records, taken from a set of special bolts which were set to monitor the structure for 19 years, pioneered data collection, the results of which were put to good use in the development of other Gulf Coast buildings and in the use of mat foundations.

The following excerpt from *Engineering a Better Texas: ASCE and 100 Years of Civil Engineering in the Lone Star State* by Betsy Tyson, is a testament to engineering flexibility and ingenuity:

After 14 floors had been completed, building owner Jesse Jones decided he wanted to add four more stories to be sure his building was the tallest west of the Mississippi, and he placed a call to Simpson who responded it would take time to calculate if this would be possible. Jones replied, “That’s all right. I’ll hold the line open for 20 minutes waiting for your reply.” Simpson and his chief engineer, Manfred Gerhardt, determined within the allotted time that they could add the requested stories after strengthening the main columns for the first 14 floors.

Upon completion, the Gulf Building rose 430 feet high. One could see Galveston from the observation deck (with the help of a strong telescope). The deck was also home to an Aeronautical Beacon consisting of two searchlights: one directed vertical, one horizontal, illuminating the night sky.

Owner/Developer:	Jesse H. Jones
Architect:	Alfred C. Finn
Engineers:	J.E.R. Carpenter
	Kenneth Franzheim
	R.J. Cummings (structural)
	W.E. Simpson Co. (chief structural)
	Dr. Charles Terzaghi (foundation)
	Raymond F. Dawson (geotechnical investigations)
Contractor:	Bellows Construction Co.
Photo:	Jerry R. Rogers Ph.D., P.E., Dipl, D.WRE, Dist.M.ASCE, ASCE Texas Section

Highland Lakes, 2000 HCEL

In 1934, the Lower Colorado River Authority (LCRA) was established by the Texas Legislature. The LCRA proceeded to take on the massive engineering project that would become Highland Lakes. The project, a 17-year endeavor, was unique across the nation; it consisted of a network of dams and lakes that would reclaim water, limit flooding, supply two large irrigation systems (distributing water over 640 miles of canals), and supply electricity to more than 800,000 Texans across ten counties.

Upon completion in 1951, the Highland Lakes chain comprised Lake Buchanan and Buchanan Dam; Inks Lake and Inks Dam; Lake Austin and Tom Miller Dam; Lake Travis and Mansfield Dam; Lake LBJ and Wirtz Dam; and Lake Marble Falls and Starcke Dam. The Highland Lakes are also home to a series of seventeen parks which present exceptional natural beauty and recreational opportunities as well as an archaeological center and several natural science laboratories.

Owner: State of Texas, Lower Colorado River Authority

Hays Street Bridge, 2001 HCEL

The Hays Street Bridge is a railroad truss bridge, originally constructed by the Pheonix Bridge Co. of Pennsylvania, connecting Eastside and Downtown San Antonio. Truss bridges were widely used from the 1870s to the 1930s. The Hays Street Bridge utilizes truss spans of two designs, including the Pratt design and the Murphy-Whipple. The Murphy-Whipple is a modification of the Whipple Truss by John Murphy of the Lehigh Valley Railroad. The Pratt design was pioneered in 1844 by Caleb Pratt and his son Thomas, and is considered simple yet efficient (You may have noticed it as part of the wing design for the first successful Wright Brothers airplane). The Pratt truss of the bridge spans 130 feet, and the Murphy-Whipple - 225 feet.

The trusses that support the Hays Street Bridge, which had originally spanned the Nueces River, were moved by the GH&SA railroad to the bridge’s current location in 1910. This was an unusual action to take considering the type of bridge (length of the Whipple truss), but in so doing, the railroad provided a necessary viaduct for the City of San Antonio. The bridge accommodated many a carriage, and later car, as it clacked across the wooden floorboards (later covered with asphalt). Over time though, officials realized the bridge had seen finer days, and in 1982 it was closed without any plans for maintenance. Luckily, the bridge caught the attention of Douglas Steadman, PE who championed the campaign for its restoration. Concluding its Cinderella story, the necessary funding was acquired and the Hays Street Bridge was restored to its former glory in 2010.

Photo: Juan A Garcia East Light Photography

Bataan Memorial Trainway, 2003 HCEL

The Bataan Memorial Trainway, a massive, three-year engineering project costing $5.5 million and requiring the services of eight major contractors and twenty-two subcontractors, was completed in 1950. Upon completion, the Bataan Memorial Trainway created a six-block-long corridor through downtown El Paso, allowing trains to pass belowground, and making the City safer and more accessible to pedestrians and drivers.This was the first application of depressed trackage for the relocation of a mainline transcontinental railroad through a downtown urban area. Beyond its design and construction phases, the project actually represents fifty years of varied efforts on the part of government and private employees and concerned citizens alike from conception to realization. As far back as 1901, the City of El Paso passed an Ordinance requiring railroads to separate their grade crossings through the downtown area (which went unheeded, requiring further efforts) in anticipation of this issue.

In addition to excavation and construction of the below grade through-way, the Bataan Memorial Trainway required the relocation of multiple railroad tracks into a single route as well as construction of eight bridges to carry the city streets over the depressed corridor. A 1,700 foot-high arch structural bridge was also included in the project to span the railroad yards at Cotton Street outside the Trainway area. The project was named in honor of the POW victims and survivors of the Bataan Death March in the Phillippines during WWII and dedicated during a national convention of ex-POWs in 1950.

Owners:	City of El Paso
	Union Pacific Railroad Co
	Texas Department of Transportation
Engineer:	De Leuw Cather and Co.
Contractor:	R.E. McKee Co. (Principal)
Photo:	Bill Kirchner; October 21; 2012; hmdb.org

Faust Street Bridge, 2011 HCEL

The Faust Street Bridge, which opened in 1887, crosses the Guadalupe River in New Braunfels. This crossing was vital for all traffic between Dallas/Austin to San Antonio from 1887 to 1934. At the time, it was one of very few toll-free bridges, which speaks to Comal County's relative wealth and civic mindedness, at a time when bridges were usually private, toll-funded endeavors.

The bridge is made up of two Whipple trusses forming a 640-foot span; a pin-and-hanger joint system brings them together in the middle. The pin-and-hanger system was a favorite of the 1880s, but very few bridges with two or more Whipple trusses remain. In fact, the Faust Street bridge is the only multi-span bridge in Texas that still maintains its original crossing.

Photo: Craig Hanchey

Cowtown Coliseum, 2015 HCEL

Completed in 88 working days in February 1908, the rectangular Coliseum has a steel and girder infrastructure and concrete sections with a capacity near 10,000. Kennerly Robey, chief engineer, Fort Worth Stock Yards Company, was project supervisor. The Cowtown Coliseum was the third largest in the U.S., following Madison Square Garden and Chicago arenas and held the first indoor rodeo in 1918. The building was completely restored in 1986 by the City of Fort Worth and hosts a weekend rodeo.

Roma - Ciudad Miguel Alemán Bridge, 2016 HCEL

The Roma (Texas) – Cuidad Miguel Alemán (Tamaulipas, México) International Suspension Bridge recognized as a Texas Historic Civil Engineering Landmrk in 2016. The bridge, which is the only remaining international suspension bridge, opened to the public in March of 1928. It has since closed to traffic after the construction of a new concrete bridge in 1978. The bridge features an average width of 22.ft. and a suspended span length of 630 ft.

The bridge was constructed as a private venture by Joseph Pate and was sold to both Starr County, Texas and Mexico’s Caminos y Puentes Federales de Ingresos y Servicios Conexos in 1950. The Project Engineer/Bridge Designer for this project was George E. Cole; who also designed and built the Royal Gorge Suspension Bridge in Canyon City, Colorado in 1929.

In 1984, the bridge (U.S. section only) was designated as a Historical Place and added to the U.S. Department of Interior’s National Register of Historic Places. In 2004, the bridge was designated as a “Sitio Artístico Nacional” by the Instituto Nacional de Ballas Artes of México.