# The Unique Medina Dam and Outstanding Texas Civil Engineer: C. Terrell Bartlett

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## ABSTRACT

In mid-1910, C. Terrell Bartlett, Resident Engineer, Medina Valley Irrigation Co., and two others made a report to build Medina Dam, located northwest of San Antonio. By May 1911, Dr. Fredrich Pearson, Pearson Engineering Corporation - N.Y.C. (with Mexico and other dam experience), secured Medina Dam financing by selling $6 M in British bonds. In Oct. 1911, a large wooden crushing/mixing plant was erected on the site bluff. Innovations included a triple system of hoppers for concrete materials, double- track incline delivery chutes, and two cableways between the towers positioned on the bluffs. From Nov. 9, 1911 - Dec. 31, 1912, the Medina Lake Dam was built in record time. When completed on Dec. 31, 1912, Medina Dam was the largest dam in Texas, fourth largest dam in the U.S., and the largest western irrigation system (26 mi. (41.8 km) of irrigation canals for 33,000 acres (13,354.6 hectares)). On Aug. 24, 2012, the Medina Lake Preservation Society hosted Medina Dam centennial activities (1912 - 2012).

In July 1913, Terrell Bartlett, a speaker at the Texas Good Roads Congress, Corpus Christi and six other civil engineers met there to plan/found the Texas Association of Members, ASCE. Bartlett served in many ASCE Texas offices including 1928 President. Terrell Bartlett started an early engineering practice, designing more than 50 bridges, including the second 1938 Galveston causeway, and Bartlett served as engineer for the Hondo Army Airfield/Base plus various city projects. Bartlett wrote many nationally - published technical papers that are still considered classics. Bartlett supported engineering registration and was Texas P.E. Registration No. 9. C.T. Bartlett was named San Antonio Engineer of the Year in 1953 and cited as “Dean of Texas Consulting Engineers.”

## INTRODUCTION

Charles Terrell Bartlett was a San Antonio native born July 26, 1885 and a life-long resident of San Antonio. Terrell attended the Massachusetts Institute of Technology, was editor of the student newspaper: *The Tech,* and graduated in 1906. He returned to San Antonio in 1908 and formed a consulting engineering firm in the area of

hydraulics, irrigation and structures with Willis Ranney (also an MIT graduate who also worked on the student newspaper with Terrell) and Alfred Ranney. Bartlett and the Ranneys were located in the Gibbs Building in San Antonio. To maintain his knowledge of engineering, Bartlett became a 1912 Associate Member of the American Society of Civil Engineers and was a member of the American Water Works Association. (In 1910, Mr. Bartlett married Elizabeth Cassin of San Antonio and they had a daughter: Charlotte, deceased at age 15 in 1926.) Much of this paper was written by Rogers, Steadman, Stewart, Wuensche, Wagner (2013) and Rogers, Wuensche, and Klinzing (2013) and rearranged for this paper.

## MEDINA DAM AND IRRIGATION

Bartlett and Ranney became interested in the proposed Medina Dam and irrigation company, located 40 miles from San Antonio, proposed by Henri Castro, A.Y. Walton, and others. They invited C. H. Kearney, construction supervisor of the Pearson Engineering Corporation of New York, to visit the proposed dam site and project. Pearson Engineering was experienced in major dam construction in Mexico and other countries. C.H. Kearney talked Dr. Frederick Stark Pearson into supporting the proposed Medina Dam and irrigation project. In mid- 1910, Bartlett and Ranney, along with A.Y. Walton, Jr., completed the first surveys, investigations and preliminary report on the Medina Dams and canal irrigation project. Dr. Pearson visited England, finding investors for $6 M bonds, which were sold by mid-summer 1910. Construction soon increased full-time by the Pearson Engineering Corporation, importing as many as 1350 workers from Mexico, 150 U.S. workers and stonerock masons from Poland. C.T. Bartlett became resident engineer for Medina Valley Irrigation Company and Willis Ranney was named resident dam engineer for both Medina Dam and the Diversion Dam downstream. Two notable construction articles on Medina Dam were printed in national engineering publications:

1. The Pearson Engineering Corporation construction supervisor was: C. H. Kearney, “Construction Methods on the Medina Valley Irrigation Project, Texas,” *Engineering Record*, 66, No. 23 (December 7, 1912), pp. 632-634.
2. A classic engineering paper on Medina Dams by resident Medina Valley Irrigation Company engineer: Terrell Bartlett, titled “Rapid Construction on Medina Valley Irrigation Project in Texas,” *Engineering News*, Vol. 70, No. 11, pp. 508-513, Sept. 11, 1913. This was the first of the known Bartlett’s classic papers that appeared in nation-wide engineering journals for which he became noted, assisting his consulting engineering practice.

After obtaining British funding, the Pearson Engineering Corporation built a 19.5 mile railroad spur to connect the Southern Pacific RR to Dunlay, the closest town to the Medina Dam site. Cement, equipment, and materials were shipped by railroad. A gravel road was constructed from Dunlay to the Medina Dam site by an irrigation

company land speculator to haul equipment and materials from the rail headroad. At the dam construction site, three narrow gage rail spurroads were laid to three nearby rock quarries. After preparing the dam site by excavation, a massive crushing and mixing plant was constructed on one bluff. Cableway towers were extended from one bluff to the other. Wooden inclines were constructed from the crushing/mixing plant to the sides of the dam and stiff-leg derricks/cranes were placed to transport the concrete from the incline chutes to the wooden frame dam sections. All of these developments led to record placements of concrete and established new records in dam construction.

Bartlett's 1913 paper stated:

1. "For the principal mass of the dam, delivery was almost entirely by inclined chutes leading from the discharge hoppers down the base of the bluff into a large wooden hopper located over the end of a double track incline, which extended from bluff to bluff, first along the downstream edge of the dam, and later at a high level on the face of the dam."
2. "A car carrying two 2-yd. buckets or a 4-yd. per trip was used on each incline track, so that it was possible to send 8 cu. yd. at once to the various derricks by the incline, as well as 2 yd. simultaneously by each of the cables."
3. "On still a third level below was a narrow- gage track on which flat cars carried the concrete buckets about 75 ft. to the cableways. This method of delivery was used exclusively for the narrow upper portion of the dam."
4. "The two cableways and control were of the Lidgerwood type, cables 2-1/4 in. with spans of 1050 and 1270 ft., mounted on 100-ft. and 70-ft. towers. Their load capacity was ten tons."

A valuable collection of photos documenting the construction of Medina Dam and irrigation were compiled into an album, and is available from the Edwards Aquifer website.

The sequence of construction included: after the $6 M in British bonds were sold by May 1911, the first dormatories and support buildings were constructed by July 24, 1911 for food, medical care, engineering coordination,…... A dam section photograph shows excavation underway to reach solid rock about 12 to 14 ft. below existing grades. Much of the work was accomplished during the next two months, by September. On September 26, 1911 another photo shows the preparations for the construction site with establishment of a crushing/mixing plant built, cableway towers, and boiler smokestacks being utilized, as well as more dormatories completed. (Next built were wooden inclines from the crushing and mixing plant and cranes or derricks.) The first concrete was placed on November 9, 1911. Workers had two 10-hour shifts with Sundays off, and Medina Dam was completed by Dec. 31,

1912, a just record 14 months. This established a record construction schedule, since the engineers feared high floods in the spring/summer of 1913, which fortunately did not occur. By September and to November 1912, photographs showed the dam, more than 60% completed, with empty railroad cars and a locomotive departing the site to return to one of the rock quarries through an opening in the dam center. Cableways delivered concrete to the upper portions of the dam for the closure center section portion after the center rail spurroad was dismantled. The dimensions of the completed dam were: 1580 ft. long, 164 ft. high, 25 ft. wide at the cresttop, at elevation of 1084.0 ft., and a spillway elevation at 1072.0 ft. The dam was constructed with a vertical upstream dam face and curved downstream face. There were outlet pipes, and tunnel for drainage and safety and inspection in the dam. Other engineering structures (listed in Bartlett's 1913 paper) were:

1. "The diversion dam (also of concrete… in a similar manner as the main dam) (four miles downstream) was 50 ft. high, 44 ft. wide at the base, 440 ft. long, and is arched slightly upstream." From Kearney's 1912 paper: Five fixed derricks were set on concrete at 35 ft. (for the 50 ft. high diversion dam) vs. movable derricks on the main dam that rose to 164 ft. The diversion dam was nearly completed by November 1912.
2. "The headworks (have) a double set of metallic gates."
3. "The canal (has) almost 3000 ft. of concrete- lined channel in rock cut, the remainder being almost entirely sidehill work in compact clay: capacity 600 cubic feet per second." From Kearney's paper: canal work began Nov. 1, 1911.
4. (After 1.5 mi. along the west river bank) "the canal is carried under the river in a reinforced- concrete siphon consisting of two bores 8 ft. in diameter. After another mile the canal is returned to the west bank by means of another siphon." Siphons avoided severe bank [erosion] problems on one side. From Kearney's paper: the siphons were 1150 and 1310 ft. long.

There were also eleven flumes along the main canal. "These flumes consist of creosoted timber trestle of long-leaf Texas pine with truss/tower construction, where high, supporting two No. 180 semicircular Hess flumes 9-1/2 ft. in diameter, of galvanized steel. The largest flume was: 95 ft. high and 1520 ft. long." From Kearney's paper: flumes were 122 to 1520 ft. long, totaling 5540 lineal ft. Medina Dam was the largest dam in Texas and fourth largest in the U.S. when completed. The many irrigation canals below Medina Dam delivered water to many customers for 34,000 acres, making the Medina Valley Irrigation Company the largest west of the Mississippi River.

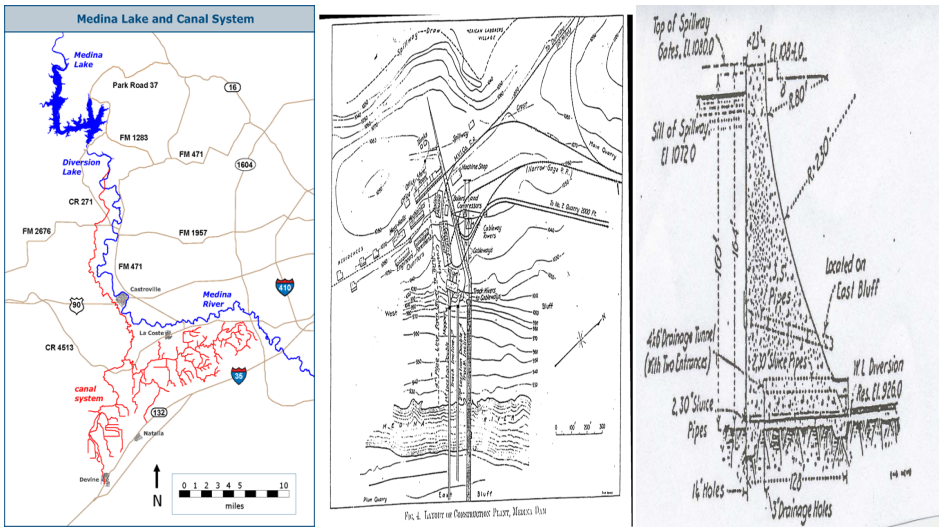


**Figure 1. Map of Medina Dam, Lake, and Irrigation System (with permission from Edwards Aquifer Website). Figure 2 and Figure 3. Site Drawing from Bartlett's 1913 *Engineering News* Article as Well as Medina Dam Cross Section.**

## NECESSARY SAFETY IMPROVEMENTS TO MEDINA DAM

From Rogers, Wuensche, Klinzing (Sept. 2013): In 1925, the Bexar- Medina-Atascosa Water Control & Improvement District No. 1 was formed. In 1950, the BMA- WCID No. 1 acquired the $6 M Medina dams and irrigation assets for $10.00 and considerations. In 1988, H. Douglas Steadman and W.E. Simpson, Inc. completed a structural analysis report and recommended safety improvements of Medina Dam. On July 5, 2002, floods along the Medina River allowed spillage of up to 12 ft. over the Medina Lake side spillway and close to the cresttop of the dam. As a dam safety failure precaution, some cities downstream of Medina Dam were asked to evacuate. An Oct. 2004 Medina Dam safety study confirmed that safety improvements were needed. In 2009, the Texas legislature approved $4 M for Medina Dam repairs. In Nov. 2012 with a URS Corporation- Austin design, Austin Bridge & Road installed 32 rock anchors to tie the dam to the underlying bedrock (to resist overturning) and poured concrete aprons downstream to retard undercutting of the downstream toe during design flows to keep the dam from slipping/tipping (Edwards Aquifer website). The *Bandera County Courier*, July 26, 2012 article "Medina Dam Renovation Heads to the Finish Line" by Carol L. Smith stated the Medina Dam improvements had the largest post tension cable anchoring system in the U.S. up to that time. Thirty-two 12 to 14 in. diameter holes were drilled to bedrock 75 to 170 ft. below grade and had cables inserted and loaded to a torque test of 2.5 million pounds per square inch. See *Bandera County Courier*, July 26, 2012: "Medina Dam Renovation Heads to the Finish Line" by Carol L. Smith and Bob Owen, *San Antonio Express-News* / © 2012 San Antonio Express-News: Downstream paving and largest U.S. post tensioning anchoring system for Medina Dam safety improvements.

## TERRELL BARTLETT AND THE 1913 FOUNDING OF THE ASCE TEXAS SECTION

In July 1913, Terrell Bartlett, a 1912 ASCE associate member, traveled to Corpus Christi on the San Antonio, Uvalde and Gulf Railway, bumping into John B. Hawley from Fort Worth who wore a blue ASCE pin. Bartlett and Hawley agreed to meet with other civil engineers at the Texas Good Roads Congress in Corpus Christi to discuss the formation of a Texas civil engineering organization. At the Good Roads meeting, Terrell spoke on: "Business Phases of Road Improvement Contracts." Between July 12-13, 1913, Hawley/Bartlett rounded up five Texas civil engineers (J. Milton Howe- Houston, Robert J. Potts and James C. Nagle- College Station, J. F. Witt- Dallas, and Julian C. Feild, Jr.- Denison) and moved to the Beach (Breakers) Hotel to plan the formation of a Texas ASCE section over a tub of beer. With an appointed planning sub-committee of: J. Milton Howe (Chair), John B. Hawley, and Terrell Bartlett, Dallas was selected as the (fall) meeting location during the Texas State Fair with low railroad rates. Before the Dallas fall meeting, National ASCE provided a copy of the 1905 San Francisco ASCE constitution which served as the model for Texas. At the Dallas 1913 fall meeting, the group named themselves: "The Texas Association of Members of the American Society of Civil Engineers," with the Texas constitution approved Dec. 31, 1913 by the ASCE Board in NYC. Terrell Bartlett was elected a Director for two years and became President in 1928.

## TERRELL BARTLETT'S OUTSTANDING TEXAS CIVIL ENGINEERING CAREER

With his Medina Dam experience, Terrell Bartlett became a consultant on the Elephant Butte Concrete Dam (301 ft. high) in New Mexico, authorized on February 25, 1905, but not begun until 1911. The reservoir began filling in 1915, and the project was completed in 1916. Elephant Butte Dam (ASCE National Historic Civil Engineering Landmark) was the largest irrigation dam ever built with the exception of the Aswan Dam (Egypt). Elephant Butte was the state-of-the-art mass concrete dam for the U. S. until construction began on Hoover Dam.

In 1915, Terrell Bartlett designed the first Corpus Christi causeway across the inlet between Corpus Christi Bay and Nueces Bay at a cost of $166,500. Bartlett's first causeway design was too low, and it was destroyed by the 1919 hurricane, which reached a height of 12.4 ft., wiping out the causeway. Terrell's technical papers often included classic drawings, as had his second national paper of national exposure: Terrell Bartlett, "Corpus Christi Causeway Contains 2300 Feet of Reinforced-Concrete Girder Spans," *Engineering Record, Vol. 73, No. 12,* March 18, 1916. In 18 months during 1914-1915, Bartlett designed and built several concrete bridges in Bexar County with Texas Good Roads bond assets. Terrell used his Good Roads experience and contacts in his work. He also designed 10 low water crossings in

northern Bexar County. From 1915-1930, Bartlett was the engineer for Lands Industries, designing many flour, feed and cotton-seed mills. In 1917, Terrell became a full Member of ASCE, upgrading from his Associate Member start.

Terrell showed hurricane factors impacting design/damages (damaging his 1915 causeway) in his third known national paper that gained national exposure: (Terrell Bartlett, "The Tidal Storm at Corpus Christi and Its Effect on Engineering Structures," Vol. 83, No. 19, pp. 848-852, Nov. 13, 1919, *Engineering News Record,* published only two months after the hurricane). The subtitle stated: "High Water Sweeps Over Barrier Islands, Relied Upon for Protection—Buildings Demolished—Serious Damage Done to Concrete Causeway." There was the usual classic Bartlett drawing with this one showing the direction of the storm at its height, the Causeway Bridge site, rail lines, the Corpus Christi business district at +5 to +7 elevation, and the barrier Mustang Island,…… Terrell's classic papers included messages, such as: p. 852: "The principal lessons….from this storm are the great tidal height possible (12.4 ft. above mean low tide at 1:45pm Sept. 14, 1919 with 80 mph winds against 5.9 ft. in 1916 hurricane with 100 mph winds) and….outer or barrier islands do not afford protection to the inner shore."

His fourth known classic article to gain national exposure (on diverse topics in nine years) was printed in 1922, titled: C. Terrell Bartlett, "The Flood of September, 1921, at San Antonio, Texas," *ASCE Transactions*, Paper 1485, pp. 355- 365, 1922, including four discussion papers by noted engineers, such as Charles W. Sherman and Allen Hazen. Bartlett noted the heaviest rain fell near Taylor, north of Austin (19.5 in. in 12 hours or 23.1 (24 in.) in 24 hr. The San Antonio's Olmos watershed averaged 14 in., flooding much of the business district to depths up to 12 ft., from 2 to 8 ft. above the bridge decks. A great mass of flotsam and debris was caught by and damaged supporting bentspiers and railings. Terrell included an isohyetal rainfall map for 30 hr.: Sept. 8-9, 1921 showing a 20 in. contour and other contours, Olmos Creek, watershed drainage areas, and two Olmos Dam sites.

After the 1921 flooding in central Texas and San Antonio, the Governor of Texas requested an "ENGINEERS- ONLY CONFERENCE with the Governor" to discuss future ways to cope with and to analyze flood hazards as well as droughts. In 1922-1923, the TEXAS ENGINEERS ADVISORY COMMITTEE, Terrell Bartlett - Member, planned much of the original/extended stream gauging in Texas, providing critical data for the design of Texas reservoirs and flood analyses. (Texas is indebted for the foresight of early Texas Civil engineers with leadership and planning!)

In addition, engineering studies were made: 1911, 1920, 1921 by a committee of W.B. Tuttle, E.P. Arneson, Terrell Bartlett, and W.E. Simpson, recommending

solutions for flood problems. (E.P. Arneson, Terrell Bartlett and W.E. Simpson served as Presidents of the Texas Section ASCE in 1933, 1928 and 1949.) Bartlett's 1962 obituary stated: "The master plan used by San Antonio for city storm drainage was drawn up by Bartlett." (San Antonio projects constructed during the 1920s to 1940s".…….included….. Olmos Dam as a detention reservoir…..and construction of the "Great Bend Cutoff and flood gates" in 1927.) Terrell also served on the San Antonio Chamber of Commerce Water Resources Committee and the chamber's advisory committee in 1924-25 for the Olmos Dam and the San Antonio River Channel. The 54 ft. high concrete Olmos Dam spillway was 1,152 ft. long with six flood gates. The River Walk was subsequently constructed between 1939 and 1941.
The "Galveston Daily News" and "San Antonio Express- News": Aug 23, 1929, noted Terrell Bartlett designed the Longhorn Portland Cement Company, up for sale for $1 M. Terrell Bartlett was on the Texas Planning Board from May 1934- March 1935, but resigned from the Board and was then appointed as a consultant. As the Texas Planning Board's consultant on the National Resources Committee, Bartlett donated significant files, now in the Texas State Archives (1914-1935). Terrell designed municipal projects for Beaumont, Waco, Sweetwater, San Angelo and other cities. One 2013 co- author (Dr. Fred P. Wagner, Jr.) notes Frank Benjamin Ogle, Terrell Bartlett Engineers, was the field engineer on the arch bridges over the river in San Angelo. He told the story that one of the bridges was cast one day and a rise on the river during the night washed out the false work. The concrete had set sufficiently enough to hold up and the bridge is still standing.

A fifth known national classic paper by Terrell Bartlett, "The New Galveston Causeway: Basic Features in Developing Two Million Dollar Texas Structure, Now Under Way," appeared in the July 1937 issue of *Civil Engineering*, Vol. 7, No. 7, pp. 497-500. The paper was summarizing a presentation Bartlett made at the ASCE National Meeting: Structural- Construction Division, April 21-24, 1937 in San Antonio on design/construction of a new causeway: 8194.5 ft. long, 48.5 ft. wide for four lanes. "Of the 39 sections, 16 are between the Intracoastal Canal and the island and 23 are between the drawspan and the mainland." Terrell learned from the 1919 Corpus Christi hurricane surge of 12.4 ft.: "The records of the more severe Texas storms indicate a still- water height of 12 to 13 ft. above ordinary gulf level." He designed the 1935 Galveston Causeway to be above these levels. In each of Bartlett's papers, he included several key points or messages. Terrell stated on pile loads on p. 500: "It is believed that a redrive index could be developed in engineering practice, which would be a much better indication of ultimate load capacity than the customary use of the Engineering News Formula with an assumed ultimate capacity of, say, six times the value found."

In 1937, the Texas Registration Law for Professional Engineers was passed. Charles Terrell Bartlett was granted Texas P.E. Number 9, showing his support for professional engineering registration. (In 2013, there are about 58,000 registered P.E.s in Texas.) In 1942, Terrell Bartlett was Chief Engineer for Hondo Army Airfield and Base with Zachry Construction Co. ($8.5M). In 1945, Bartlett completed a survey/report of San Antonio sewers and flood protection work. His new partner in the firm (1945-1962) was Alexander Erskine. On October 16, 1947, Terrell Bartlett Engineers was awarded the contract for the spillway design for the Upper Nueces Reservoir (Upper Dam) near Crystal City.

## RECOGNITION OF TERRELL BARTLETT'S OUTSTANDING CAREER

In an article from Men of Affairs of San Antonio, San Antonio Newspaper Artists Assoc., circa 1912 references his work: Prominent Men of Southwest Texas. Bartlett was a member of the San Antonio Country Club, Travis Club, International Club, and Boston Technology Club. In Leonard's *Who's Who in Engineering 1922-1923*, Terrell was also a member of the University Club (Dallas) and Elks. Robert J. Potts wrote Bartlett's ASCE Life Membership career summary in the *Texas Civil Engineer* in 1947, noting Terrell had also designed other bridges in: Austin, north of Lake Charles over the Calcasieu River, and over the Rio Grande, as well as working on the Eagle's Nest Dam in northern New Mexico. Charles Terrell Bartlett received the 1953 Bexar Chapter San Antonio Engineer of the Year! He was also honored at a Menger Hotel banquet with charter members of the TSPE Bexar Chapter. On February 22, 1953, the San Antonio Express Engineers Week newspaper headline was: ***"Bartlett Ranks as Dean of State's Engineers.***" (Terrell Bartlett had the longest continuous consulting engineering practice from 1908-1953, up to 1962 upon his death.) *He worked in "90 counties in Texas, New Mexico and Louisiana*." In addition to ASCE and AWWA, Bartlett was a member of the Texas Society of Professional Engineers and American Institute of Consulting Engineers. (As all of us do, Terrell benefited from memberships in these professional societies.) Terrell became a Fellow Member of ASCE in 1959.

At the age of 77, Charles Terrell Bartlett died on August 25, 1962 and was buried in St. Mary's Cemetery in San Antonio, off Palmetto Street and East Commerce.
His gravestone has:
"CHARLES TERRELL BARTLETT
JULY 26, 1885 AUG. 25, 1962"
and his wife and daughter have burial plots and gravestones next to his. Bartlett's newspaper obituary told of his memberships in the Order of the Alamo, Torch Club, Kiwanis Club, ASCE, TSPE,……
Elizabeth Greenwood, ASCE Texas – Austin, found the following *Texas Civil Engineer* announcement on p.6, Vol. 32, No. 9:

"CHARTER MEMBER PASSES: CHARLES TERRELL BARLETT, (A.M. '12, M. '17, L.M. '47, F. '59) and a charter member of the Texas Section, died in San Antonio on Aug 25. His partner in the firm, Major A.M. Erskine, is listed as author of: "Memoir Charles Terrell Bartlett," Texas Section ASCE Archives, 1963, now stored at Texas A & M University.

## TEXAS ASCE HISTORICAL CIVIL ENGINEERING LANDMARK AND 2012 MEDINA DAM CENTENNIAL

In 1991, the San Antonio Branch ASCE and the Texas Section ASCE coordinated a plaque ceremony designating "MEDINA DAMS & IRRIGATION SYSTEM" as a TEXAS HISTORICAL CIVIL ENGINEERING LANDMARK. The Texas ASCE plaque, located on the roadway over the dam, will be relocated to a nearby location.

On August 25, 2012, there was a large Medina Dam Centennial Anniversary (about 300) near the dam with program, speakers, and a Medina Dam construction history presentation, hosted by the Medina Lake Historical Preservation Society. H. Douglas Steadman of San Antonio was the ASCE Texas speaker with Jerry Rogers, Vernon Wuensche, Don Klinzing, and Cres Guzman attending. A wreath of roses was floated above Medina Dam in memory of the seventy lives, mostly Mexican workers, who died during the dam construction. Of the 1500 dam and irrigation workers, 1350 were Mexican laborers. Merry Langlinais made an excellent historic slide presentation: "Building the Medina Dam: 1910-1913." Highlights of the Medina Dam Centennial and photos of Medina Dam construction were printed in a paper by Rogers, Wuensche, and Klinzing (Sept. 2013). Water Data for Texas shows: Medina Lake is 3.2% full as of 2015-01-05, due to an extended regional drought.

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Rogers, Wuensche, Klinzing (Sept. 2013). "Terrell Bartlett and Medina Dams Construction: Medina Dam Centennial (1912-2012)" ASCE Texas, Dallas.

**Figure 4. Photo of Youthful Terrell Bartlett (source unknown). Figure 5. Photo by Vernon Wuensche (with permission) of Aug. 25, 2012 Medina Dam Centennial (1912-2012) with ASCE Texas Attendees on the Front Left and Delegation from Poland in White Hats in the Back on the Right.**