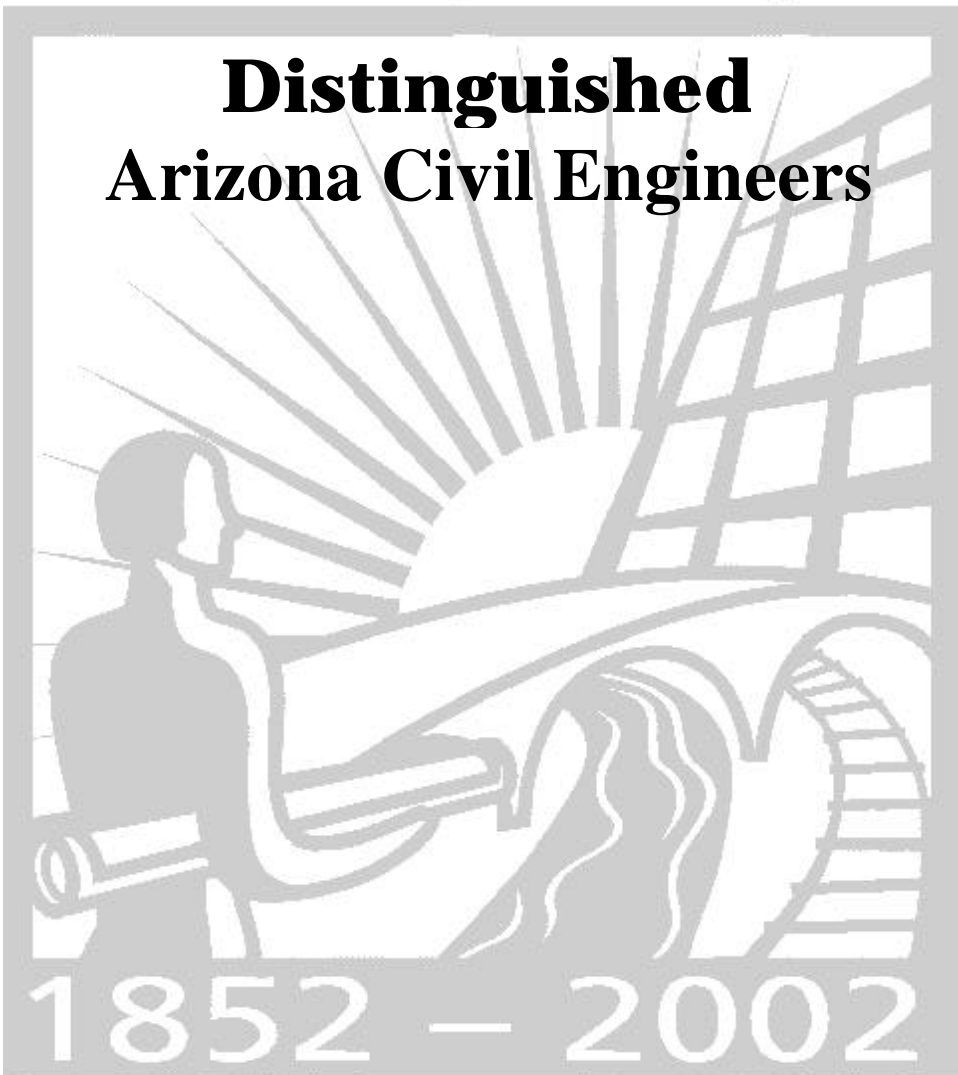


American Society of Civil Engineers

**Distinguished
Arizona Civil Engineers**



1852 — 2002

Building a Better World

Foreword

The Arizona Society of Civil Engineers celebrates the 150-year history of the American Society of Civil Engineers with this publication highlighting the distinguished civil engineers and projects that have established Arizona's prominent role in engineering history.

Visual evidence of engineering history in Arizona first appears to the individual arriving by air in observation of the network of irrigation canals and agricultural fields that were first tilled by native peoples called Hohokam, those who have gone. Other native people, trappers, settlers, soldiers, and farmers followed the Hohokam people.

In 1848, gold was discovered in California, and by 1849, the rush to the gold fields became the greatest migration of people known so far in America. Many emigrants followed the Old Spanish Trail from New Mexico across northern Arizona to the Colorado River. One hundred fifty years ago, US Topographical Engineers, led by Captain Lorenzo Sitgraves and mountain man Antoine Leroux, mapped out a better route to California, crossing the Colorado River near Yuma, Arizona. During the same period, Mexico gave up rights to 500,000 square miles of lands north of the Gila River including areas in future states of California, Nevada, Utah, Colorado and New Mexico and Arizona.

In 1851 the Surveyor General of the General Land Office, Department of Interior, established the Initial Point on a rocky hill near the confluence of the Salt and Gila Rivers to survey the public lands in the New Mexico Territory. The Gadsden Purchase in 1854 added 29,640 square miles south of the

Gila River to the Territory, and in 1863 President Lincoln split the New Mexico Territory and created the Arizona Territory.

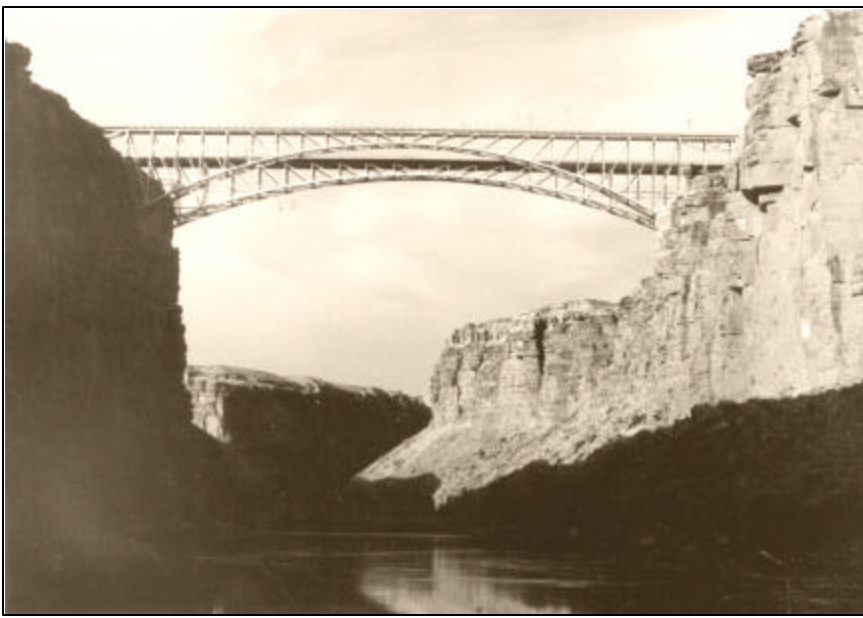
Bringing the lands of the Arizona Territory into the United States brought new settlers. Civil engineers experienced in canals, dams, highways, mining, soils, flood control, water supply and waste disposal, and education also came to serve the new settlers. Many faced extreme hardship in establishing new beginnings and in building the society and projects we enjoy today.

The Arizona Society presents some of these individuals and projects to celebrate our history and heritage for civil engineering in the winning of the West. Many suggested names and provided descriptions of contributions of distinguished engineers and described significant projects to be included in this honorarium. Many other distinguished engineers and projects were not included because of limitations of space and time. Contributors included Peter Atonna, Dave Deatherage, Pat Eisenberg, Mike Ellegood, Bob Esterbrooks, Enamul Hoque, Ron Joost, Robert Kerns, Tom McGovern, Jason Mikkelsen, Fred Nelson, Ed Nowatzki, Shari Olsen, Rich Perry, George Shirley, Al Smolko, Ken Voyles, Ken Walsh, and Bob Wortman.

The Committee and the Arizona Society Board of Directors thank you, the membership of ASCE, for your assistance in this effort and for Building a Better World.

*Jim Attebery, Marty Rosness, Jon Girand
150th Anniversary Committee
Fred Nelson, President
Arizona Society of Civil Engineers, ASCE*

October 2002



Historic Navajo Bridge



Ashfork Bainbridge Steel Dam

HOHOKAM NATIVE AMERICAN ENGINEERS

PREHISTORIC BUILDERS OF CANALS AND IRRIGATIONS SYSTEMS

Native American builders constructed the largest single body of land irrigated in prehistoric times in North America or South America according to Dr. Omar A. Turney, F.R.G.S. archaeologist in a 1923 report. These were the original engineers, the true pioneers who built, used and abandoned a canal system when London and Paris was a cluster of huts. The largest system was in the Salt River Valley and similar system was built along the Gila River. Researchers have identified irrigation systems at 32 other Arizona streams. This extensive pre-Columbian irrigation system foreshadowed by several centuries the irrigation systems that replaced them in the Salt River Valley and the New World.

Beginning in 300 BC through 650 AD Native Americans were using canals diverting floodwaters and not irrigation to sustain their crops. Remnants of one of these canals have been dated at 50 AD.

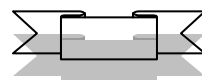
Between 650 AD and 900 AD several major canal systems were constructed, the largest of which included a trapezoidal section 65-feet wide by 12-feet deep. A portion of this canal is on exhibit at the Park of the Four Waters, just northeast of Phoenix Sky Harbor International Airport.

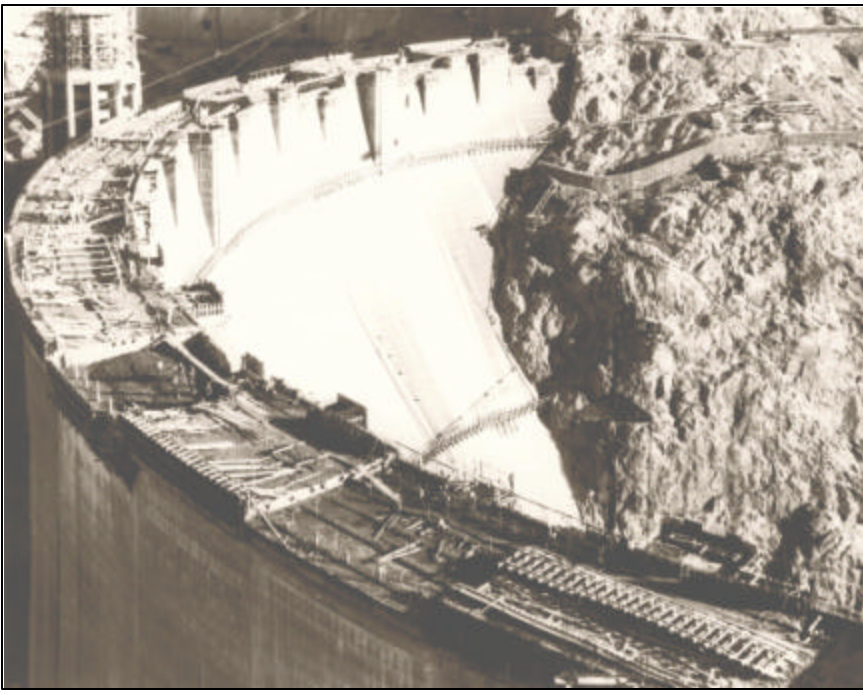
By 1450 AD, the system included major canals that average 8 to 12 miles in length, the longest being 16 miles. The canals were largest at the headwaters and

tapered throughout their length, so that the velocity was maintained between 1.5 and 3 feet per second, the lower limit to prevent excessive silting and the upper limit to minimize erosion.

While archaeologists have yet to discover remnants of ancient survey instruments Mr. Herman Grey, an elder of Salt River Pima-Maricopa Community, spoke of an elongated pottery or ceramic bowl or instrument used for leveling the fields and alignment of the canal systems. The device was approximately 2 1/2 to 3 feet in length, 4 to 5 inches wide and 4 inches in depth. A front and rear sight was notched on the edges and the device rested or was set on a tripod like structure made of willow. A floatation device was placed in the bowl, which was partially filled with water.

The HOHOKAM CANAL SYSTEM Salt River Valley was designated as a Historic Civil Works in 1992 by the American Society of Civil Engineers and three plaques were installed at the historic sites.





Hoover Dam



Willow Creek Dam, Prescott

LOUIS CLARENCE HILL

RECLAMATION ENGINEER

Louis Clarence Hill was the designer and supervisory engineer of the construction of Theodore Roosevelt Dam, Arizona's great water storage facility. This accomplishment alone launched him upon a long, brilliant career in the construction of many more large successful dams in the West, including the great Hoover Dam.

He was placed in charge of the Roosevelt project in the spring of 1904. He remained in this position until March 1911.

Roosevelt Dam was an engineering challenge from the very first. Yet the initial stone of the huge structure was not set down until September 20, 1906, and the last stone was laid on February 6, 1911.

Much of the preliminary work was devoted to the building of access roads, using Indian labor from the White Mountain Apache tribes. Hill lauded the ability of the Apaches as dependable unskilled laborers and often sent them out on the job in unsupervised squads.

It was necessary to erect a cement plant due to the remoteness of the job site. Hill built such a plant. He also built a small lumber mill and provided needed power by constructing a 13-mile power canal for generating electricity.

Critics of Hill and his men were legion. Congress held hearings regarding Hill's use of Indian labor, hearings that eventually placed the U.S. Reclamation

Service on trial. Hill was called an impractical dreamer, a shady engineer who was building an unnecessarily large power plant "for the fun of it, or for purely speculative purposes."

Unwavering, Hill stood behind his belief that revenues from the sale of power would be a major means of financing the project.

In 1911, the 284-foot high structure, from bedrock, was completed with its turbines ready to generate electricity. Roosevelt was the largest dam built to that date in the country, but the cost had reached the frightening amount of \$5.4 million.

Later he was a consultant engineer and, in that capacity, he was retained by the Water Users'.

His outstanding work for the Federal Government on dams, in addition to Roosevelt, was done on Boulder (now Hoover), on the Colorado; Coolidge, on the Gila; Elephant Buttes, in New Mexico; and Bonneville, on the Columbia. He also served in engineering capacities for the Government on the All-American Canal in Yuma, the Fort Peck Dam in Montana, the Los Angeles Flood Control Project, and on 10 flood control dams in southern Ohio.





Historic Phoenix



Downtown Phoenix

JAMES BELL GIRAND, P.E.

**TERRITORIAL ENGINEER, FIRST
STATE HIGHWAY ENGINEER,
ARIZONA SECTION PRESIDENT**

James Bell Girand was an engineer whose broad professional abilities were applied to railroads, highways and irrigation water rights. Mr. Girand studied engineering at Texas A&M, entered into professional practice in West Texas until taking a position in 1899 as the assistant chief engineer of the Santa Fe and Grand Canyon Railroad, and was responsible for construction of 45 miles of the railroad between Williams and the Grand Canyon.

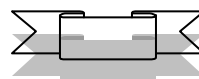
J.B.Girand entered into general engineering practice in Prescott, established the Town site for Williams, Arizona, surveyed portions of lands in the Grand Canyon forest reserve, and located a route for electric railway into the Grand Canyon for a mining company. In 1907 J.B. Girand formed a contracting engineering company that was responsible for the design and construction of the Bisbee and Warren Electric Railway, and the water works and sewer works for the town of Warren. He was appointed City Engineer for the city of Prescott and designed a two million gallon reinforced concrete reservoir for that city.

J.B. Girand was appointed the first and only territorial highway engineer in 1909, served as the first official state highway engineer, and served on the personal staffs of Governors Kibby and Sloan. As state engineer he designed and supervised construction of the 700-foot

long reinforced concrete bridge over the Gila River at Florence and the 1500 foot long and 120-foot high arch rib reinforced concrete bridge over the Salt River at Tempe.

He designed a number of single and multiple arch dams in the state, and in Chile including the Cave Creek Dam, the Gillespie Dam on the Gila River, on the Willow Creek Dam near Prescott and Fry Canyon Dam near Safford. In response to a severe drought emergency in July 1940, Girand prepared a plan to bring water into central Arizona from a pump station at Parker on the Colorado River. The plan was adopted and it became the Central Arizona Project.

Professional activities included serving as President of the Arizona Section, ASCE in 1929 and as a member of the Naval Consulting Board, which was chaired by Thomas A. Edison.



JOHN C. PARK OUTSTANDING CIVIL ENGINEER AWARD

History of the Award

John C. Park was a Professor of Civil Engineering, Dean of Engineering, and a graduate of the University of Arizona. The plaque, which permanently resides in the Civil Engineering Building at the University of Arizona, is dedicated each year to a Registered Professional Engineer in Arizona and a Life Member of ASCE, who is judged to have contributed substantially to the status of the Engineering Profession by:

- Distinguished service in the field of Civil Engineering in Arizona;
- Significant contribution toward improving the professional aspects of civil engineering education or professional development and guidance of young civil engineers;
- Outstanding achievement in the field of professional advancement; or
- Other evidence of merit, which in the judgment of the Awards Committee shall have advanced the Society's professional objective.

The following is a list of past award winners:

1962	George E.P. Smith	1980	R.C. Esterbrooks
1963	Earle V. Miller	1981	R.A. Jimenez
1964	Wayne O'Hara	1982	Wayne W. Linthacum
1965	Eramus S. Borgquist	1983	Jim Anderson
1966	Vic H. Householder	1984	Emmett Laursen
1967	Ralph Hoffman	1985	Charles W. Newlin
1968	George T. Grove	1986	Bill Wiley
1969	Harold C. Schwalen	1987	Ken Renard
1970	David J. Hall	1988	Gene Morris
1971	Harold W. Yost	1989	Ed Mangotich
1972	John Carolla*	1990	Gerald Matlock
	Charles Dryden	1991	Ed Hall
1973	Herman Danforth	1992	James Attebery
	Dario Travaini	1993	John Stufflebean
1974	Fred Glendening	1994	Phil Epstein
1975	Oscar T. Lyon. Jr.	1995	Rudolph Jimenez
1976	Clarence H. Whalin	1996	Margaret Peterson
1977	Quentin M. Mees	1997	Paul Cella
1978	Ben T. Dibble	1998	Fred Nelson
1979	Andrew B. Marum	1999	Ed Nowalski
		2000	Rich Perry
		2001	Tom McGovern

JOHN C. PARK, P.E.

**EDUCATOR;
SECTION PRESIDENT;
CHAIRMAN, TECHNICAL
REGISTRATION BOARD**

John C. Park, served overseas in World War I. After the war, in 1923, he enrolled as a freshman in Civil Engineering at the University of Arizona.

In 1926, after graduation, he was appointed to the faculty of Civil Engineering, at the U.of A., and served continually (except for time to earn his M.S.at Iowa State) until 1958. During this period, he became a full professor, and served as Dean of the College of Engineering from 1951 to 1958.

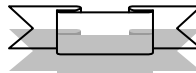
John Park, along with others from the Arizona Highway Department, and the Bureau of Public Roads, initiated the Arizona Roads and Streets annual programs.

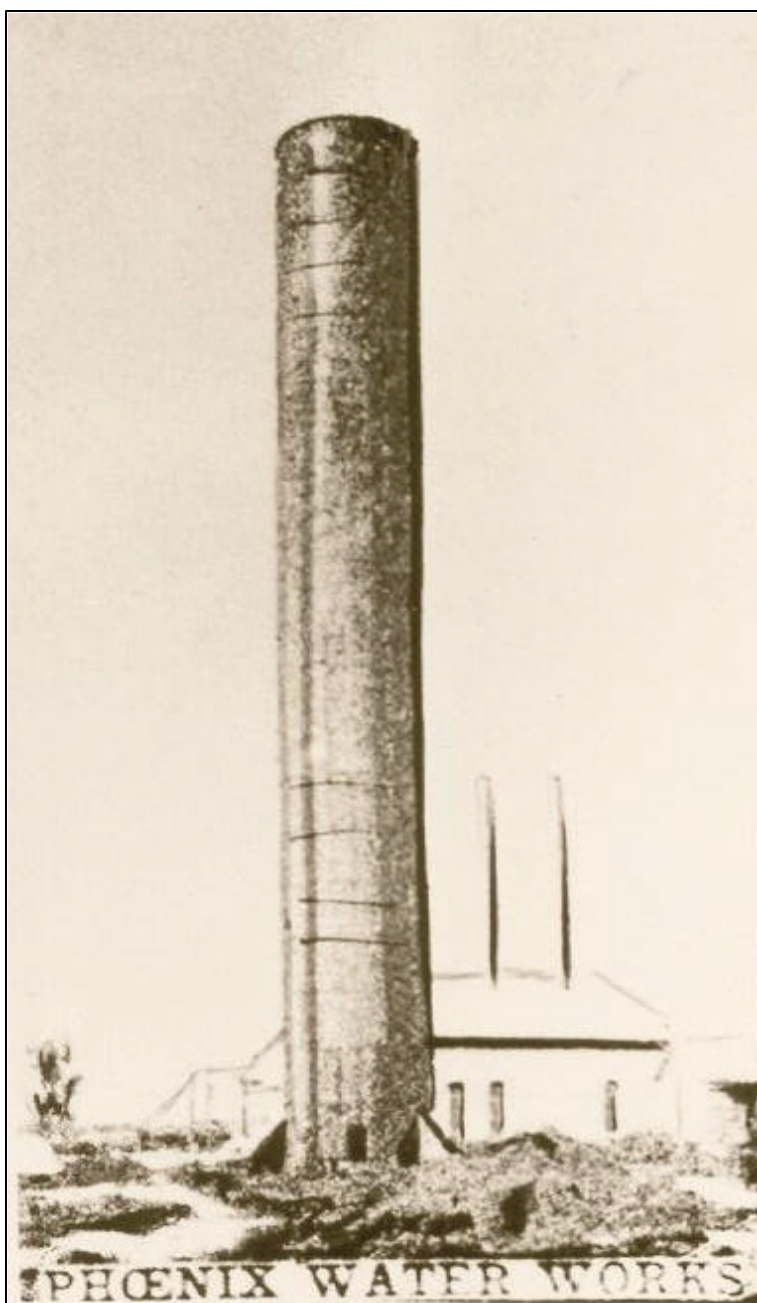
He was very active with the Arizona State Board of Technical registration, and for a long period, starting in 1951, was supervisor of examinations as well as being a member of the board.

Because of his desire for professionalism in Engineering, he was named a member of the National Council of State Boards of Engineering Examiners. He was very active in the Arizona Section of A.S.C.E., and served as President along with membership on several other national engineering committees.

Throughout his professional and academic life, John Park was strong supporter on engineering ethical behavior, and the desire to establish engineering as a dominant profession. He wrote many articles in national publications on these subjects.

Because of this professionalism, the Arizona Society John C. Park Outstanding Engineer Award was established in 1966. The award was to exemplify some of John Park's achievements in an engineer's professional and personal life.





Phoenix Water Tower

DARIO TRAVAINI, P.E.

**SECTION PRESIDENT
DIRECTOR, CITY OF PHOENIX
WATER AND SEWERS DEPARTMENT**

Dario Travaini was employed continuously in various capacities by the City of Phoenix from 1931 to 1971 and amassed a wealth of experience in a variety of engineering positions before that.

Born in San Francisco in 1903, Travaini graduated from the University of California at Berkeley in 1924 and took post-graduate work the following year. He was a registered professional engineer in both Arizona and California.

After completing his education, Travaini worked as a civil engineer on design and construction on the Jack Pumping Plant and on geophysical exploration for the Shell Oil Company; was sanitary engineer for the Sanitary District of Indianapolis, Ind. He was sanitary engineer for Grand Canyon National Park and was in charge of construction and operation of the sewerage system and preliminary work on the present Grand Canyon water supply.

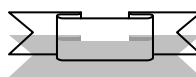
He served as City Engineer of Miami, Arizona, and joined the City of Phoenix in 1931 to manage the completion of the 23rd Avenue Sewage Treatment Plant. Travaini rose to the position of engineer in charge of water and sewers in 1950 for the City of Phoenix. The title later was changed to Director of Water and Sewers.

Travaini understood that the city's growth in size and population required a similar growth in infrastructure. He helped plan and build the first three of the city's water treatment plants, a second wastewater treatment plant, and thousands of miles of water and sewer mains. Beside his wide experience in the engineering field, Travaini also had written for many technical and trade publications on the subject of sanitation.

He received the Samuel A. Greeley Award, for outstanding community service for a period of 30 or more years, at the American Public Works Association Conference in New Orleans, in 1962.

Travaini has received the George Warren Fuller Award for outstanding work in the field of water works; the Kenneth Allen Award for outstanding work in the field of sewerage and in 1957 was Arizona Engineer of the Year. He has received many other awards and was invited to membership in the Select Society of Sanitary Sludge Shovelers, a limited membership organization for people in sanitary and public health work.

Travaini was President of the Arizona Section ASCE in 1954.



THE ARIZONA CIVIL ENGINEER DISTINGUISHED SERVICE AWARD

History:

In 1990, Ben T. Dibble was awarded ASCE National's William H. Wisely American Civil Engineer Award for his contributions to the civil engineering profession and to ASCE. The honorarium received by Ben for this award was donated to the Arizona Society for the purpose of establishing a similar award at the Arizona Society level.

Criteria:

The award is to be presented annually at the Fall Arizona Society Meeting Banquet to an ASCE Arizona Society member who has provided distinguished service to the profession and to ASCE.

The award is rotated among the established branches of the Arizona Society.

The nominee shall be an ASCE member of "Member" grade status.

The nominee shall be a dues paying member of the Arizona Society.

The nominee shall be (or have been) active at any level of ASCE, i.e. National Officers, National Committees, TAC, PAC, Arizona Society or Branch officers, Arizona Society or Branch committees, etc.

The nominee shall be involved in activities outside of the society, i.e. Student Chapter Support, School Booster Clubs, Little League Coaching, Boy Scouts/Girl Scouts, Parent Teacher Organizations, Bond Committees, Religious Activities, Chamber of Commerce, other civic and professional activities.

<u>Year</u>	<u>Branch</u>	<u>Recipient</u>
1991	Phoenix	Martin H. Rosness
1992	Southern Arizona	Stanley E. Turney
1993	Phoenix	Wayne Collins
1994	Northern Arizona	Mark Woodson
1995	Phoenix	Dan Sagramosa
1996	Southern Arizona	Priscilla Sawyer
1997	Phoenix	Jon Girand
1998	Northern Arizona	Dr. Richard Mirth
1999	Phoenix	Tom Sands & Dennis Richards
2000	Southern Arizona	Richard Martinez
2001	Northern Arizona	Karl Rockwell

OSCAR T. LYON, JR., P.E.

STATE HIGHWAY ENGINEER, ASCE NATIONAL DIRECTOR AND HONORARY MEMBER

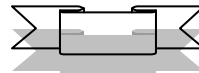
Oscar T. Lyon, Jr. during his long and distinguished career integrated the field of education and applied research with good judgment to achieve practical and effective engineering and construction programs for the public good. One of the best known and highly respected engineers in the Arizona Society and the southwest his contributions to professional organizations such as ASCE, AASHTO and NSPE have brought him national recognition. As Arizona State Highway Engineer he initiated and carried out unique concepts of University-Government cooperative engineering research and education and was also responsible for implementing one of the major engineering projects in the US, the Virgin River Gorge along Interstate Highway I-15 in northwest Arizona.

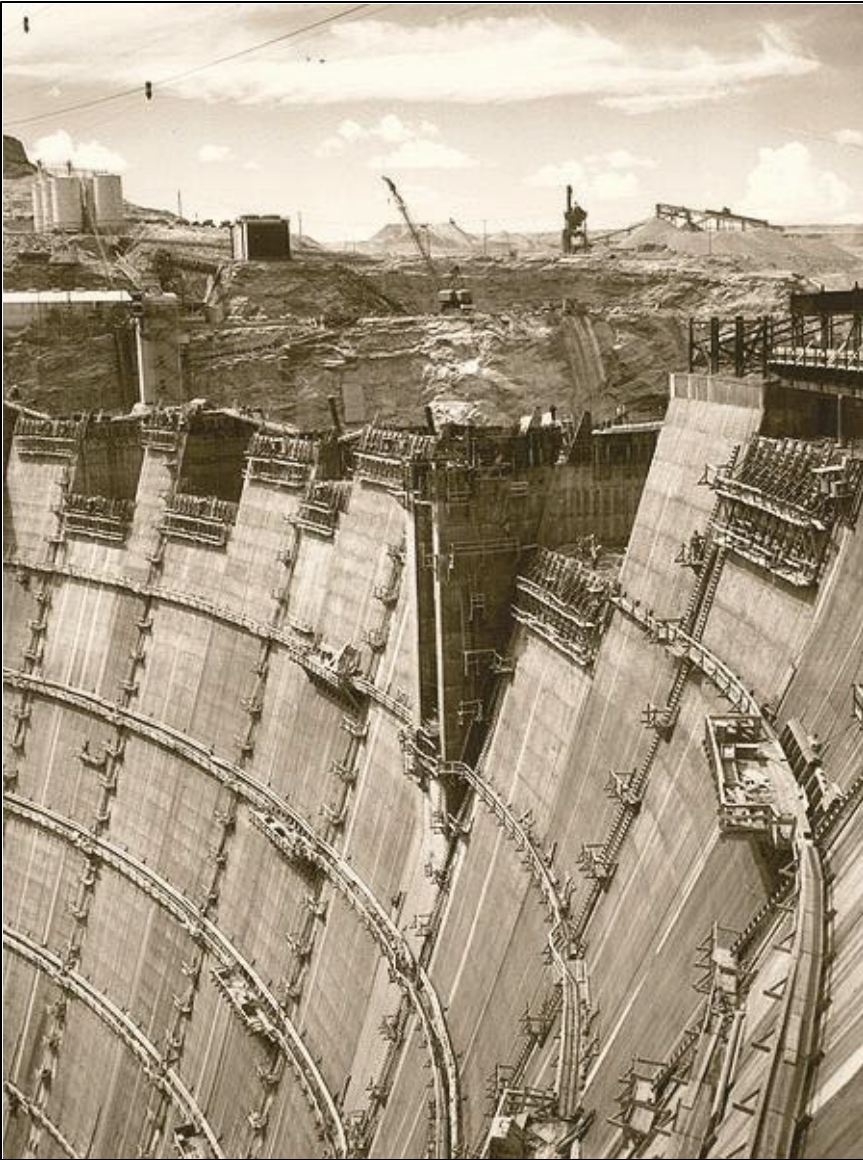
As a leader of the Arizona Department of Transportation, Mr. Lyon was responsible for directing and managing the major part of the state's Interstate Highway design and construction program. He set high standards of excellence in education and performance as manager of the Department, which is one of the largest employers in the state.

Lyon aggressively encouraged ASCE Activity among his peers while actively participating in ASCE at all levels. He was author of several published articles and recipient of ASCE's James Laurie Prize,

The John C. Park Civil Engineering Award and the University of Arizona distinguished Citizen Aware among others.

As a former National Officer and Director, he continued to serve the Arizona Society, installing hundreds of local officers and continuing to carry the issued and concerns of the state to the national stage.





Glen Canyon Dam

**ROBERT C. ESTERBROOKS,
P.E.**

**ZONE IV VICE PRESIDENT – ASCE
CITY ENGINEER; PUBLIC WORKS
DIRECTOR, COUNTY ENGINEER**

Bob Esterbrooks started engineering as a construction superintendent and has served as a design engineer in Los Angeles County, a District Engineer for the City of Los Angeles, a Commander in a Seabees Brigade, a Public Works Officer in a Naval Ammo Depot during the Korean Conflict, eventually retiring as a Rear Admiral, Civil Engineer Corps, USNR, and has served as President of the San Diego Post, the Phoenix Post, and as National Vice President of the Society of American Military Engineers.

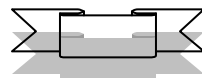
His principal civilian professional engineering responsibilities were as the Public Works Director and County Engineer of Maricopa County. Prior to that assignment, he served as the City Engineer of Phoenix and as an Assistant City Engineer in San Diego. At the time, January 1969, Bob took his job with Maricopa County, the county had a population of 946,000, and the Public Works organization staff totaled 535 with a budget of \$1.9 million. Bob was awarded the honor of Urban Engineer of the Year, 1983, by the National Association of County Engineers.

Bob earned the APWA's "Top Ten" award and was eventually elected the National President of APWA. He also served as a National Director of ASCE (1983-1986) and continued to be active in the National Infrastructure Policy

committee of ASCE. He has served as Section President for the San Diego Section and for the Arizona Section (1975). He served as Chair, ASCE National Water Resources Conference in 1970

Bob Esterbrook has served on the "firing line" of local government in one of the fastest growing and volatile government engineering organizations in the country for nearly two decades, while simultaneously attaining national prominence in a multitude of major professional organizations. He has produced real engineering products for the toughest client possible – the local American taxpayer.

Robert C. Esterbrooks was Zone IV Vice President, 1988-1990.



TONOPAH AWARD

This is an Arizona Society level award, which may be made each year to an Associate Member of the Arizona Society, ASCE who is judged to have given outstanding service to the Arizona Society. Nominations are decided by the Committee on Awards and Prizes. A wall plaque is presented to the recipient at the spring Arizona Society Meeting. The award, which was established by the Arizona Society in 1978 is intended to recognize the contribution of an outstanding young Civil Engineer to Arizona programs. The first recipient was Kent Dibble.

History of the Award

In February 1978, Jim Anderson and Kent Dibble were Arizona Society delegates to the Pacific Southwest Council meeting of ASCE in Reno. Upon flying from Phoenix to Las Vegas, they found their flight to Reno was canceled by bad weather. They rented a car and drove all night to arrive in Reno at 6:00 a.m. for an 8:00 meeting. In Tonopah, Nevada, the roads became so bad that they had to buy a set of chains to proceed. Those chains subsequently became property of the Arizona Society and some of the links are attached to the Plaque we present.

History of Award Recipients

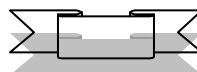
The following is a list of past award winners:

1978	Kent Dibble	1993	Stephanie Yard
1979	Not Given	1994	Michael Barton
1980	Not Given	1995	Michael Kies
1981	Not Given	1996	Ken Walsh
1982	Bill Kantor	1997	Michael Smith
1983	Darrel Wood	1998	Kwame Agyare
1984	Gary Timmerman	1999	Dana Owsiany
1985	Tom Galezewski	2000	Jason Mikkelson
1986	Bob Hughes	2001	Chris Kmetty
1987	Mike Beehler		
1988	Ron Hilgart		
1989	Jim Glock		
1990	Andy Brown		
1991	Jody Kliska		
1992	Eric Garner		

CHARLES W. NEWLIN, P.E.

**EDUCATOR, GEOTECHNICAL
ENGINEER, SECTION PRESIDENT,
BOARD OF TECHNICAL
REGISTRATION CHAIRMAN**

Institute and married Susanne Carter in 1947. In 1949 he earned a master's degree in Geotechnical Engineering under Carl Terzaghi at Harvard.



Charles W. Newlin (Charlie) taught at Swarthmore College from 1941-1961 and Arizona State University from 1961-1974, advancing to professor and civil engineering department chairman. During this time, Charlie received his Doctorate from Northwestern University. He relocated to Los Angeles and worked as a senior engineer for Dames and Moore until 1979 when he returned to Phoenix, and became director of the Central Arizona Water Control Study until late 1982.

Dr. Newlin was a private consultant, specializing in forensic civil engineering from 1983 until 2001. His professional affiliations and honors include: American Society of Civil Engineers, Fellow, President of Phoenix branch, 1985-1986; Arizona Society of Professional Engineers, member, founding president, Papago Chapter; Arizona State Board of Technical Registration, member 1967-1974, Chairman 1969; Arizona Consulting Engineers Association, member; Structural Engineers of Arizona, associate member; Robin park award as Outstanding Arizona Civil Engineer 1983; Arizona Society of Civil Engineers member and chairman on accreditation board for engineering and technology.

He served in the Philippines during WWII in the Army Corp of Engineers. He received his bachelor's degree in civil engineering from Rose Poly Technical

THEODORE ROOSEVELT DAM & SALT RIVER PROJECT

NATIONAL HISTORIC CIVIL ENGINEERING LANDMARK

Theodore Roosevelt Dam was the first project of the Bureau of Reclamation and the first multipurpose (irrigation, river regulation, power generation and recreation) project in the United States. It marked the beginning of federal reclamation projects throughout the West. It was the highest masonry dam in the world. It nominated by the Arizona Section and was designated as a NHCEL in 1970, when Phoenix hosted the ASCE National Water Resources Conference.

When the nineteenth century pioneers came to the Salt River they had more sophisticated tools than their predecessors, the Hohokam people to build canals to divert the flows for irrigation from the Salt River. By 1892 the pioneers were irrigating 120,000 acres of land, a significant beginning but very much less than their Hohokam predecessors. However they had the same problems as the Hohokam people, the large floods would washout the small structures used to divert the waters.

After a flash flood in 1900 washed out all the small diversion dams local farmers decided a large dam was needed but the \$5,000,000 project was too much to afford. With Congress in the mood and Theodore Roosevelt as president the National Reclamation Act of 1902 was passed, and the Salt River Valley Water Users was organized and the landowners pledged their lands for the construction of the big dam.

Louis C. Hill was the designer and supervisory engineer for the construction of the dam. It required some 350,000 cubic yards of stone that were cut from the mountainside. Each stone was individually shaped, washed and then cemented into place. The dam was 184 feet thick at the base, 16 feet wide at the crest and 284 feet high from bedrock.

The dam collects water from a 5830 square mile drainage area and had a water storage capacity of 1,382,000 acre feet. President Theodore Roosevelt dedicated the dam.

JOHN ANDREW CAROLLO, P.E.

CONSULTING ENGINEER, BUSINESS LEADER

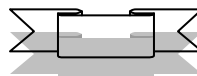
John Carollo was the founder of the engineering consulting firm now known as *Carollo Engineers*. His work in the fields of water treatment and distribution and wastewater collection and treatment have dramatically changed the State of Arizona and laid the groundwork for the rapid growth of the last several decades.

Carollo received his B.S. degree in civil engineering from Notre Dame and went on to earn a Master's Degree from MIT in the newly formed field of sanitary engineering. John held several jobs early in his career including one with the firm of *Pearse, Greeley and Hansen* in Chicago. Ill health resulted in a move to Prescott in 1932. Finding the Arizona climate to his liking, he moved to Phoenix in 1933 with his wife, Louise, their two children, no money and no work. He was fortunate to meet up with Sam Headman and Ben Ferguson and they quickly formed the consulting firm of *Headman, Ferguson and Carollo*. Despite the depression, the firm began thriving when federal money began to come to Arizona as part of the New Deal. Many of the early projects involved water supply and distribution systems for cities across Arizona.

The firm grew rapidly after World War II, capitalizing on their early experience in water-related projects. During the 1950's Carollo bought out his partners and the firm eventually became *John Carollo Engineers*. In this post-war period, Carollo worked closely with Dario Travaini of the

City of Phoenix to master plan the city's water supply and sewerage systems. In an effort to reduce the city's reliance on groundwater, the Verde River Water Treatment Plant was designed in 1949. This was the first of four Phoenix plants on the Salt/Verde system designed by Carollo. Most of the City of Phoenix water and wastewater treatment infrastructure in place today was the result of Travaini and Carollo's forethought.

John Carollo died in 1971 while on the job. He undoubtedly would be proud of the firm that *Carollo Engineers* has become today. Still headquartered in Phoenix, the firm now has over 600 employees in 22 offices from coast to coast, specializing in water and wastewater treatment.



HISTORIC NAVAJO BRIDGE

NATIONAL HISTORIC CIVIL ENGINEERING LANDMARK

Arizona's historic Navajo Bridge spans Marble Canyon in a graceful silvery arch approximately 470 feet above the Colorado River in Grand Canyon National Park. The bridge is located about 125 miles north of Flagstaff in a uniquely beautiful region that is characterized by high plateaus and steep, red-walled canyons. Although the area is remote and sparsely populated, the bridge was a vital transportation link between northern Arizona and southern Utah, providing access to the North Rim of the Grand Canyon National Park, Kaibab National Forest, Zion National Park and Bryce Canyon National Park. Historic Navajo Bridge replaced Lee's Ferry, as the only crossing of the Colorado River for a stretch of 600 miles and was still the only crossing between Glen Canyon Dam and Hoover Dam when it was taken out of vehicular service in 1995.

Originally planned to be a suspension bridge with a wooden deck by the Bureau of Public Roads under an agreement with the U.S. Indian Service, Arizona Highway Department State Bridge Engineer Ralph A. Hoffman, selected his own design for a hinged arch with a concrete deck, because the erection materials could be incorporated into the final construction and recent loss of timber decks in adjacent states because of fire. L.C. Lashmet was the Designing Engineer.

The 750-ft. long steel bridge with its 616-ft. three-hinged braced- spandrel arch main span was constructed in 1929 and has been judged to be the most historically significant bridge in Arizona. In 1981, the bridge was listed in the National Register of Historic Places. Its historic significance is defined within the context of three major themes - engineering, transportation and commerce. The bridge is important because it was the first permanent, dependable north/south route between Arizona and Utah, it is a prominent example of an uncommon structure type, and at the time of its construction it was the highest steel arch bridge in the United States. In addition, it is the only in-state link between the "Arizona Strip" north of the Kaibab Forest and central Arizona, as well as the connecting link for the citizens of the Navajo Nation living on both sides of the Colorado River.

Originally called the Grand Canyon Bridge, its construction was co- sponsored and funded by the State of Arizona and the Navajo Nation. It was designed by the Arizona Highway Department and constructed by Kansas City Structural Steel Company for a low bid of \$310,000. The bridge today serves as a pedestrian facility for the recently completed Interpretative Area that was constructed as part of the new Navajo Bridge project.

The Historic Navajo Bridge was dedicated as a National Historic Civil Engineering Landmark in May 1998.

RUDOLPH A. JIMENEZ, P.E.

EDUCATOR, RESEARCH ENGINEER: CHAIR, ROADS AND STREETS CONFERENCE

Rudy Jimenez served the engineering community since 1950. These activities have been in the areas of education, research and public service for the Profession.

He was born in 1926, in Illinois, was married with two sons and two daughters, and resided in Tucson, Arizona.

Rudy served in the military in the U.S. Naval Reserve from 1944 to 1946. He attended the University of Arizona with a BSCE, the University of Arizona, with an MS and a PH.D from Texas A&M University.

He was Research Engineer for the Texas Transportation Institute and for the University of Arizona in the Civil Engineering Department. His researches in the areas of pavement materials and structural design have lead to more than 50 publications. Consulted in the highway areas of material and pavement design from 1960 to the present (2002).

In the area of Public Service, he was member and chairman of the Arizona State Board of Technical Registration; member of the national Council of Engineering Examiners (NCEE), Editor to Newsletter of Southern Chapter of ASPE; Governor of Professional Engineers in Education, NSPE; member of Board of Directors, Pima County Traffic Survival School;

member of National Defense Executive Reserve, USDOT; member of the Arizona Governor's Committee on Asphalt Concrete Specifications; member of the Pima County Maintenance Committee, Arizona Bicycle and Foot Path Committee, ADOT, of the National Highway Div. Publications Committee, ASCE, member and committee Chairman, Transportation Research Board, NRC, Panal member to NCHRP and SHRP projects; Chairman to the Annual Arizona Roads and streets Conference, more than 25 years.

His honors were as follows: President, Brazos Cty. Branch, ASCE; President, Arizona Section, ASCE; President, Assoc. of Asphalt Paving Technologists; Honorary Member, Assoc. of Asphalt Paving Technologists; John C. Park Award, 2 years, Arizona Section ASCE; Engineer of the Year in Education, ASPE; 1st Engineer of the Year Award, ASPE; Certificate of Distinguished Service, NCEE.

Emeritus Professor Jimenez's efforts were for developing and disseminating information related to civil engineering works. He was active in consulting and sharing of his knowledge to research panels and the state board of technical registration until the present.



ASHFORK-BAINBRIDGE STEEL DAM

HISTORIC CIVIL ENGINEERING LANDMARK

The first large steel dam in the world was constructed in Johnson Canyon three miles east of Ashfork, Arizona and fifteen miles west of Williams to supply water to the Atchison, Topeka & Santa Fe Railroad (AT &SF).

The 184 feet wide and 46 feet high dam provided 36 million gallons of water storage for the railroad's steam engine as they crossed the arid southwest as well as supplied the town of Ashfork. Francis H. Bainbridge, A.M. ASCE, a civil engineer working for the railroad, invented the steel dam and obtained a patent No. 537,520 Filed September 11, 1894.

The Ashfork-Bainbridge Steel Dam marked a significant departure from gravity masonry construction at the turn of the century. Already familiar with the construction of its many steel bridges, the railroad engineers chose to determine whether steel construction could replace masonry in dams as well. Its light weight and prefabricated components must *have been easily assembled relative* to the laborious job of quarrying and setting stone.

The dam was fabricated by the Wisconsin Bridge and Iron Company and shipped to the site for erection. Twenty-four curved 3/8-inch steel plates, with alternate loose and rigid panels to compensate for a temperature range from 104°F to minus 4°F, give the dam a scalloped look. No spillway was provided, the dam instead was designed with a strength to withstand 6-feet of water pouring directly over its crest.

Construction of the dam began in 1897 and was completed March 5, 1898 at a total cost of \$63, 519. Fifty years after its completion, George Lamb of the American Institute of Steel Construction described the condition of the dam as excellent with no evidence of corrosion or deterioration. He stated that the dam "appears to be in as good condition as if it was just built."

Today, this innovative structure stands with negligible deterioration, providing water for wildlife, livestock and recreation. The Kaibab National Forest, USFS is now the owner of the dam.

Development of this new water supply for the railroad was a key to opening the door to the arid west over 100 years ago.

MARGARET S. PETERSEN

HONORARY MEMBER ASCE
HYDRAULIC ENGINEER, AUTHOR,
EDUCATOR

University of Iowa, where she earned her B.S.C.E and M.S. Mechanics and Hydraulics. Her active involvement in ASCE includes serving as Editor of the Hydraulics Division Newsletter, Chairman of the Hydraulics.



Margaret S. Petersen, a professional civil engineer, teacher, author and active ASCE member made outstanding contributions in the area of hydraulics, water resource planning and environmental issues. She was employed as a hydraulic engineer by the Corps of Engineers for 30 years, starting in Jackson, MS working on hydraulic modeling and laboratory research and for the Missouri River division in Omaha, the Channel Hydraulic Investigations Section in Little Rock, and the Waterways Experiment Station in Vicksburg. As chief of various planning sections of the Sacramento District from 1964 to 1977 she was responsible for \$1 billion Marysville Lake Reservoir, urban flood control, delta levees, bank protection and navigation channels.

Ms. Petersen was Associate Professor, CEEM, University of Arizona where she conducted research for the Corps of Engineers on stabilization and rectification of alluvial rivers and developed new graduate courses in River Engineering and Project Planning among others. She is also author of two text books on "Water Resource Planning" and "River Engineering."

She was an invited lecturer in China, Morocco and South Africa and is the recipient of many awards by the Corps of Engineers. In 1987, she received a Distinguished Alumni Award from the

GRAND CANYON RAILWAY

HISTORIC CIVIL ENGINEERING LANDMARK

The Grand Canyon Railway has never been simply 65 miles of track. This railway opened an area of northern Arizona to mining, supported communities, cattle and sheep ranching and logging. It is legendary for its service to the Grand Canyon. The Santa Fe and Grand Canyon Railroad was planned and constructed to extract what was believed to be the richest lode of copper ore in the country from Anita Camp, 8 miles south of the Grand Canyon. James Bell Girard, assistant engineer under chief engineer P.F. Randall, was responsible for completing the railway to Anita.

Operations began in 1900 principally hauling ore from Anita, but also passengers, who then boarded a stagecoach for the rest of the trip to the rim of the canyon. In 1901 the mining company failed because the rich veins of ore located in breccia pipes ran out. The railway was sold to the AT&SF Railway who completed the remaining miles to the Grand Canyon to take advantage of the tourist trade to the Historic District

Engineering of the railroad required the development of grades up to 3.7%, layout of 112 standard gauge curves up to 11 degrees with super-elevation of the track, layout of the Grand Canyon yards and wyes at both ends of the railroad, and the location and construction of 56 wooden pile and frame open deck bridges or ballasted deck on concrete pile bridges.

Frequency and steepness of grades and curves on this line made it unique and difficult to run. So much so that the Santa Fe trained its engineers and firemen on this piece of track, reasoning that if a crew could handle this line they could run anywhere on the system.

This unique railroad opened travel to the heart of the national park system. Until the late 1920's the railroad was the only way travelers could travel to and see the Grand Canyon in comfort.

Although the mine played out just about the time the railroad reached Anita, it provided the spring board for the Santa Fe Railroad to acquire a new railroad for a song for access to the new resort site. Building a short extension of track to the rim of the canyon and the opening of the historic El Tovar Hotel established the Grand Canyon as a national destination for visitors. It was not until 1927 that the automobile overtook the railroad in the percentage of visitors coming to the Grand Canyon. The railroad continues to serve the traveling public.

JOHN M. BERNAL, P.E.

COMMISSIONER, INTERNATIONAL
BOUNDARY AND WATER
COMMISSION;
DEPUTY COUNTY ADMINISTRATOR
FOR PUBLIC WORKS

John M. Bernal serves as the Deputy County Administrator for Public Works for Pima County Government in Tucson, Arizona.

He returned to Pima County Government after having been a Presidential Appointee from June 1994 through March 2001, serving as the U.S. Commissioner for the U.S. Section of the International Boundary and Water Commission (USIBWC), an international agency responsible for the application of boundary and water treaties between the United States and Mexico and for the amicable resolution of any differences arising in relation to those agreements.

During his tenure as Commissioner he achieved numerous noteworthy accomplishments. Among them, the conclusion of 16 major international agreements with Mexico relating to various sanitation projects in the border region; a binational feasibility study for an aqueduct to bring water to San Diego and Tijuana; improvements to the conveyance capacity of the Colorado River; conceptual framework for development of binational studies and recommendations related to the ecology of the Colorado River delta; and enhances demarcation and monumentation of the boundary at the international bridges and ports of entry.

As Commissioner Bernal, he also provided critical leadership for the start-up of the Border Environment Cooperation Commission (BECC), a binational organization established as a side agreement to the North American Free Trade Agreement for the purpose of helping border communities develop environmentally-sound potable water, wastewater and solid waste projects.

Prior to his Presidential appointment to the USIBWC, Mr. Bernal worked for 14 years with Dept. of Transportation and Flood Control District in Tucson, Arizona. He was involved with infrastructure planning and development in the real estate development industry for several years. He also worked for the Federal Highway Administration in Pueblo, Colorado and other U.S. locations.

He was an active member of the following organizations: Wellness Council of Arizona, Member, Board of Directors; Sustainability of Semi-Arid Hydrology and Riparian Areas, Member, Advisory Council University of Arizona Planning Member, Advisory Board.

He holds a Bachelor of Science Degree in Civil Engineering and a Master in Business Administration from the University of Arizona, Tucson.



Distinguished Engineers

George E.P. Smith	First Arizona Section President, 1925; University of Arizona Educator; Proponent of Colorado River water importation from Diamond Creek Dam site.
David Hall	University of Arizona Educator, Highway Engineering; Section President, 1966; Chair, State Board of Technical Registration; Organizer of Arizona Roads and Streets Conferences.
Ralph A. Hoffman	Arizona State Highway Bridge Engineer. Responsible for design of Historic Navajo Bridge, Burro Creek Bridge and numerous smaller bridges on State Highway System.
P. Fred Glendening	Phoenix Deputy City Manager. Public Works Director; County Engineer, Maricopa County Area Engineer, Civil Aeronautics Administration; President Arizona Section.
Dwight Busby	Civil Engineer, Structural Engineer, Architect; Chair, State Board of Technical Registration; Chair, City of Phoenix Planning Commission
William C. Ordway	First Director, Arizona Department of Transportation; President, American Association of State Highway Officials; President, WASHTO.
Ben T. Dibble	Arizona Section President 1969; selected for ASCE National William H. Wisely American Civil Engineer Award, 1990; Professional Engineer in private practice after Naval career.
Edward M. Hall	Phoenix Streets Improvement Administrator; City of San Diego Regional Transportation Manager, Traffic Engineer; APWA Top Ten Public Works Leader.
Herman Bouwer	Chief Engineer, US Water Conservation Laboratory; Groundwater hydrologist; ASCE Walter Huber Research Prize, 1966; ASCE R.J.Tipton Award, 1984.
James H. Deatherage	Section President, 1965; Civil, Structural, and Forensic Engineer; Able teacher to explain complex ideas in simple terms.

Charles O'Bannon	Arizona State University Educator, Geotechnical Engineering; Chair, State Board of Technical Registration; awarded Outstanding Engineering Educator's Award by Governor, 1986.
Robert H. Wortman	University of Arizona Educator, Transportation Engineering; Director, District 11 ASCE; Chairman, ASCE Highway Division Executive Committee.
James E. Attebery	Professional Engineer; City Engineer, City of Phoenix; President, Public Works Historical Society, History Chairman, Arizona Chapter, APWA
Charles Huckelberry	Pima County Administrator, Assistant County Manager for Public Works, Director/County Engineer and Chief Engineer for the Flood Control District
Sandra L. Houston	Chair, ASU Civil and Environmental Department, Chair, ASCE Soils Properties Committee, ASSCE Geo-Institute Board of Governors; Secretary, ASCE Journal of Geotechnical and Geoenvironmental Engineering.
Edward A. Nowatzki	University of Arizona Educator, Geotechnical Engineering; President Arizona Section, 1987, Chair, ASCE Committee on Curricula and Accreditation.
Thomas P. McGovern	Section President 1989, Manager of Engineering, Pima County Department of Transportation and Flood Control, Engineer in Private Practice with expertise in roadway and hydraulic engineering.
Pricilla Sawyer Cornelio	Transportation Engineer in Private Practice, Served on Governor's Transportation Vision 21 Task Force; Deputy Director of Transportation, City of Tucson.
Kathleen M. Chavez	Director of Pima County Wastewater Management Department, Chair, Pima Association of Governments' Environmental Planning Advisory Committee.



PAST PRESIDENTS

1925 - G.E.P. Smith (D)	1963 - R.G. Welman (D)	1964 - Oscar J. Lyon, Jr.
1926 - W.W. Lane (D)	1965 - J.H. Deatherage	
1927 - J.W.B. Backman (D)	1966 - David J. Hall	
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1930 - W.W. Lane (D)	1969 - Ben T. Dibble	
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1933 - R.A. Hoffman (D)	1972 - Emmett Laursen	
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1955 - Hanen Williams (D)	1994 - Jon Girand	
1956 - W.L. Heckler (D)	1995 - Jim Glock	
1957 - L.O. Gardner (D)	1996 - Peter Vesecky	
1958 - Clarence H. Whalin (D)	1997 - James Davey	
1959 - R.M. Cushing (D)	1998 - Tom Galeziewski	
1960 - A.B. Marum	1999 - Michael Barton	
1961 - E.C. Fraedricks (D)	2000 - Bob Bambauer	
1962 - Quentin Mees (D)	2001 - Martin Rosness	
	2002 - Fred Nelson	

