WJE

ENGINEERS
ARCHITECTS
MATERIALS SCIENTISTS

CELEBRATING 50 YEARS

50

1956-2006

WJE 50 Years | 50 Most Significant Projects

This monograph

is dedicated to the memory of

JACK RAYMOND JANNEY

June 17, 1924 - October 9, 2006

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2006

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Table of Contents


CELEBRATING 50 YEARS
WJE
ENGINEERS
ARCHITECTS
MATERIALS SCIENTISTS
50
1956-2006

INTRODUCTION

In 2006, Wiss, Janney, Elstner Associates, Inc. (WJE) celebrated the fiftieth anniversary of its founding. This monograph honors the fifty projects judged to be most significant in the company's first half century. Considering that WJE has completed over 70,000 projects, selection as one of the "Top Fifty" is indeed a unique distinction.

50 Most Significant Projects

What makes a project significant?

Of course, large, high-profile projects are significant by their nature. But, the most significant projects are not necessarily the biggest or most famous—they may be projects that are significant because they change the nature of our practice, involve unique solutions to particularly complex problems, or make an extraordinary contribution to the profession.

How were the projects selected?

WJE employees were asked to nominate projects they felt deserved consideration as one of the fifty most significant. Jack Janney and others familiar with the history of WJE were consulted regarding significant projects from the company's early years. In the end, 102 projects were nominated and background information, photographs, and a statement of significance were developed for each nominated project.

A blue ribbon panel was then asked to rate the significance of each nomination. The nine members of the panel are listed below, along with brief biographical profiles. The fifty projects with the highest collective ratings were selected as the most significant.

The collective ratings were also used to determine the "Top Ten" projects and they are identified as such in this monograph along with comments from the panel. Two projects stood out above all others as most significant: Consulting and Testing Services for the Illinois Tollway Authority (1956), and Load Testing at the New York World's Fair (1966). These two projects are recognized for their special significance to the founding, growth, and reputation of the firm.

Did we get it right?

As we review the monograph, many of us will think of other projects that are at least as significant as some of those selected—and the selection of these most significant projects was of course a subjective exercise. But getting the Top Fifty exactly right, even if that were possible, is not really the point. What matters is what these projects represent: a fifty-year tradition of delivering better solutions to challenging construction-related problems. And that is something to honor and celebrate.

How is this book organized?

The projects are divided chronologically into four chapters of WJE's history. A brief narrative on the contemporaneous events in the firm's development precedes the project descriptions in each chapter. In the fifth and final chapter of the book, we look to the future and recognize a few of the ongoing and recently completed projects that may be candidates for "most significant" status in our next half-century.

On behalf of WJE, thank you for taking time to learn more about the rich history of our firm and the company's most significant projects to date.

Ian Chin, *Vice President and Principal*

Ian, an architect and structural engineer, joined WJE in 1978 and has served as manager of the Chicago office. Ian specializes in the investigation and repair of building facades, including many high-rise structures. His most memorable project is the recladding of the Amoco Building.

Jim Connolly, *Principal*

Jim, a chemist, joined WJE in 1973 and has served as manager of the Materials Science and Engineering group (now the Janney Technical Center). Jim has contributed to materials investigations across the country. His most memorable project is the Willow Island Cooling Tower collapse investigation.

John Hanson, *Affiliated Consultant*

John, a structural engineer, joined WJE in 1972 and became president in 1979. He specializes in the investigation of concrete, steel, and masonry structures, and is currently Distinguished Professor Emeritus of Civil Engineering and Construction at North Carolina State University. His most memorable project is the Fremont Bridge evaluation and repair.

Harry Hunderman, *Principal*

Harry, an architect, joined WJE in 1986 and has served as manager of the Architecture group. He specializes in historic preservation and the application of technology to the conservation of the built environment. His most memorable project is moving the Cape Hatteras Lighthouse.

Jack Janney, *Founder*

Jack, a structural engineer, founded WJE in 1956 and served as president and chief executive officer until 1979. Jack continued to serve the firm until his death in October 2006. In interviews for this publication, he noted that his most memorable project was load testing at the New York World's Fair.

Gary Klein, *Executive Vice President and Principal*

Gary, a structural engineer, joined WJE in 1979 and served as manager of the Structures I group before becoming vice president. He specializes in structural investigations, especially collapses. He has completed over five hundred investigations of concrete, steel, and wood structures. His most memorable project is the collapse investigation of the Koror-Babeldaob Bridge.

Bill Nugent, *President and Principal*

Bill, a structural engineer, joined WJE in 1976 and served as manager of the Structures II group before becoming president. Since joining WJE, Bill has completed over four hundred investigation, testing, and repair projects, including several unique projects involving diagnosis of glass failures. His most memorable project is the TWA Flight 800 reconstruction.

Don Pfeifer, *Affiliated Consultant*

Don, a structural engineer, joined WJE in 1976 and served as manager of the Materials group before becoming vice president. Don specializes in the investigation and repair of corrosion-deteriorated concrete structures. His most memorable project is the FHWA corrosion protection study.

Jerry Stockbridge, *Affiliated Consultant*

Jerry, an architect and structural engineer, joined WJE in 1973 and served as manager of the Architecture group before becoming president in 1993. He specializes in building envelope investigation and repair. His most memorable project is moving the Cape Hatteras Lighthouse.


CELEBRATING 50 YEARS
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ARCHITECTS
MATERIALS SCIENTISTS
1956-2006
50

CHAPTER 1
Getting Off the Ground

1956–1970

Illinois Tollway Authority
Consulting and Testing Services

Upjohn Pharmaceutical Headquarters
Space Frame Testing

Kodak Pavilion
Model Test

Federal Office Building
Investigation of Glass Breakage

New York World's Fair
Full Scale Load Testing

U.S. Bureau of Mines
Blast Monitoring

Lake Point Tower
Wind Tunnel Study

Indian Point Nuclear Power Plant
Structural Integrity Test

Clarkson Hospital Garage
Collapse Investigation

Soldier Field
Long-Term Condition Assessment and Rehabilitation

1956–1970: Getting Off the Ground

The postwar era was a time of tremendous growth and transition for the United States. With the help of the educational and home loan benefits provided through the GI Bill, many returning servicemen settled down and started families. The growth of suburban communities and increasing reliance on automobiles for commuting created a demand for more roads. In 1956, President Dwight D. Eisenhower enacted the Federal-Aid Highway Act, which authorized the construction of over 40,000 miles of roads for the interstate highway system.

In the same year that President Eisenhower signed the Federal-Aid Highway Act, a young engineer named Jack Janney *(upper left)* was working for the Portland Cement Association (PCA), conducting research on prestressed concrete. Through his work at PCA, Janney was one of only a handful of engineers in the country with a good understanding of prestressed concrete. His expertise was recognized by the Illinois State Toll Highway Authority, which had begun a massive construction project using a relatively new product—precast, prestressed concrete girders. The Tollway Authority offered Janney a consulting job that he quickly accepted. He then established his own company, Janney and Associates, working out of his apartment in Glenview, Illinois.

Janney's work for the Tollway Authority included full scale load testing and quality control services. His first major assignment was to instrument and load test the Beverly Road Bridge. To assist in this job, Janney sought help from numerous moonlighters, including his former PCA colleague, Dick Elstner, *(middle left)* and one of his neighbors, an engineer named Jack Wiss. By 1957, Jack Wiss *(lower left)* joined Janney in the business, and the company became Wiss and Janney Associates.

The two engineers focused their attention on instrumentation and testing, with Janney concentrating on structural behavior and Wiss working with measurements of vibrations and noise. To enhance their ability to provide these special engineering services, Janney and Wiss pooled their resources and borrowed $4,000 from Janney's father-in-law to purchase testing equipment, including an oscilloscope and a strain gage meter.

By 1959, Wiss and Janney Associates had outgrown its original workspace in Janney's apartment and the company moved into an office in Des Plaines, Illinois, which was being vacated by the Tollway Authority. After a short time, Dick Elstner joined the company.

In 1961, the three engineers formed a new partnership and officially renamed the company Wiss, Janney, Elstner and Associates (WJE). The firm focused primarily on problem solving for contractors, engineers, and owners. Working in an age before computers and the types of structural analysis programs that are routinely used today, WJE also experimented with the use of scale models to determine the distribution of strains and stresses within a structure. Many years later, the use of three-dimensional scale models as design aids and research tools earned Jack Janney national recognition as one of the modern pioneers of the engineering field.

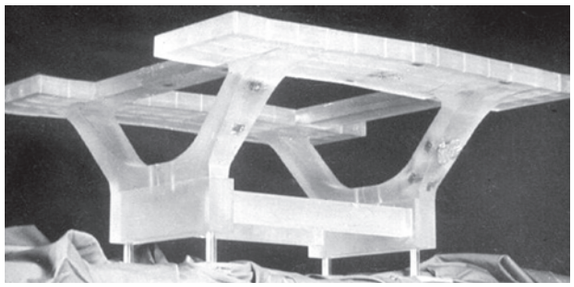
1956	1957	1958	1959	1960	1961	1962
Jack Janney established his own company, Janney and Associates, in Glenview, Illinois.	*Jack Wiss joined Jack Janney, and the company became Wiss and Janney Associates.*		*Wiss and Janney Associates moved to an office in Des Plaines, Illinois. Dick Elstner joined the firm.*		*A new partnership was formed and the company was officially renamed Wiss, Janney, Elstner and Associates (WJE).*	*The company had grown to five employees working on fifty projects a year with annual billings approaching $150,000.*
President Eisenhower enacted the Federal-Aid Highway Act.	The Soviet Union launched Sputnik, the first earth-orbiting satellite.		Alaska and Hawaii became states.	John F. Kennedy was elected the thirty-fifth president of the United States.		Lt. Col. John H. Glenn, Jr., became the first American to orbit the earth.

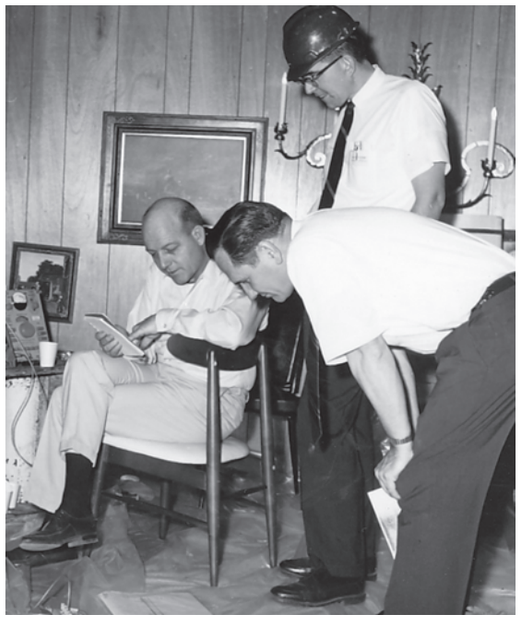
By 1962, the company had grown to five employees working on fifty projects a year with annual billings approaching $150,000. As the staff size increased to meet a growing demand for services, the partners decided to construct their own building. Unable to afford property in Des Plaines, they chose a site in Northbrook, Illinois, where developers were hoping to convert a small, abandoned airport into an industrial park. One of the special features of the 10,000 square foot building was a structural testing laboratory.

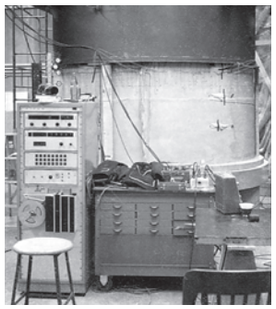
Shortly after moving to the new headquarters, the National Academy of Sciences retained WJE to conduct full-scale load tests on three buildings at the site of the 1964 New York World's Fair. To date, it was the company's largest project with a fee of $280,000. The successful project was heralded as an innovative engineering feat, and established the reputation of Wiss, Janney, Elstner and Associates as a leading investigative and testing firm. Years later, Jack Janney considered it the job that "put WJE on the map."

Throughout the 1960s, WJE continued to build upon its growing national reputation for structural testing and investigation. Notable assignments included the investigation of glass breakage at a federal office building in Pittsburgh; blast monitoring for the U.S. Bureau of Mines nationwide; and a wind tunnel study for Lake Point Tower in Chicago. Among the firm's new high profile clients was the Chicago Park District, which engaged WJE to conduct numerous condition assessments and load tests of Soldier Field. Certification of the structural safety of the stadium prior to the start of Chicago Bears' football season became an annual assignment for WJE.

NEW LABORATORY AND OFFICE BUILDING
OF
WISS, JANNEY, ELSTNER AND ASSOCIATES







A new office and laboratory facility was constructed in Northbrook, Illinois.

Staff size was twenty employees, with annual billings surpassing $500,000.

1963

Martin Luther King, Jr., delivered his "I have a dream" speech at the Lincoln Memorial.

President Kennedy was assassinated in Dallas, Texas. Lyndon B. Johnson became the thirty-sixth president of the United States.

1964

The Beatles performed on *The Ed Sullivan Show*.

The Civil Rights Act was passed.

1965

The U.S. military sent an increasing number of soldiers to fight in Vietnam.

1966

The National Historic Preservation Act was enacted.

1967

1968

Martin Luther King, Jr., and Robert F. Kennedy were assassinated.

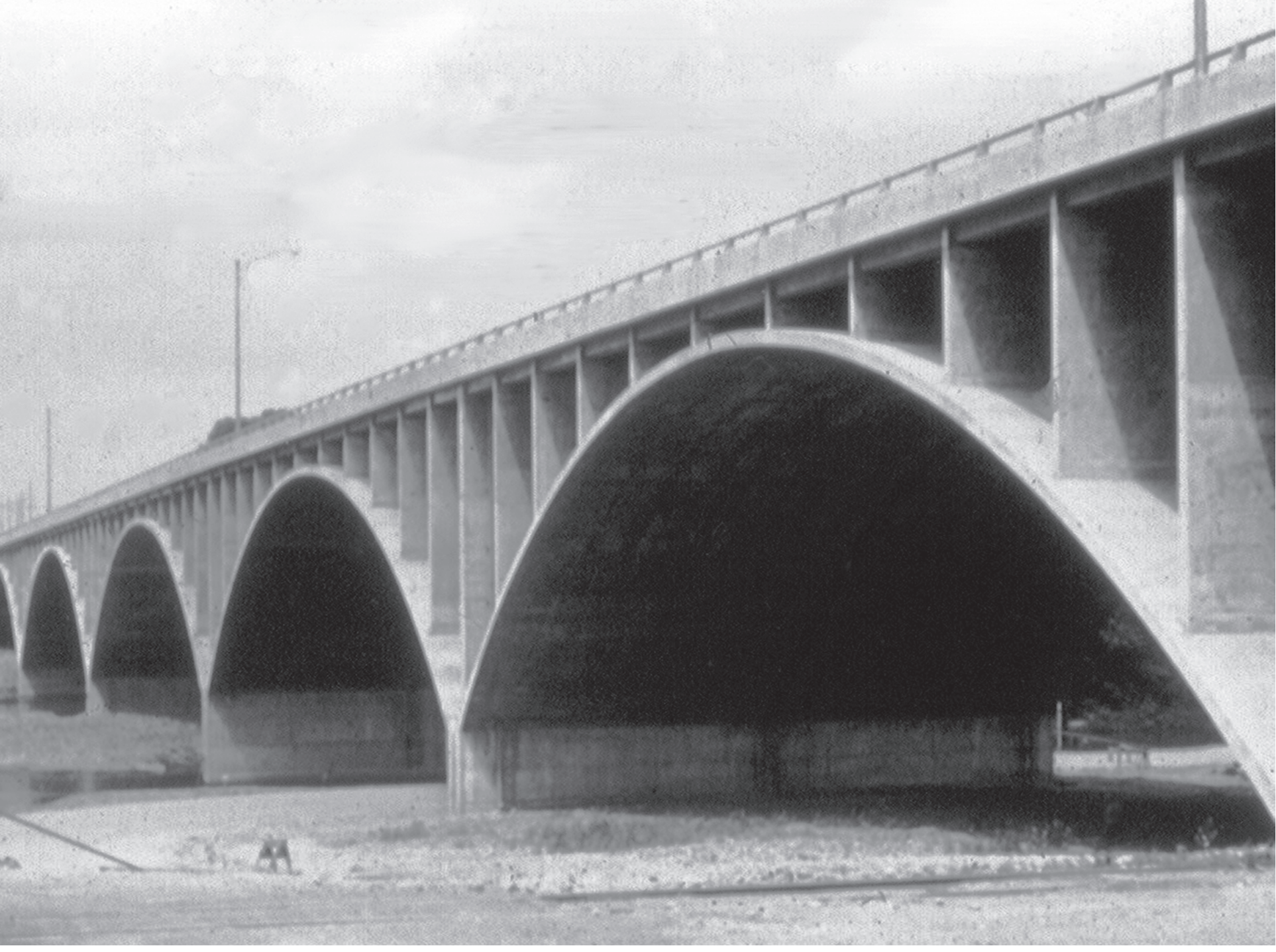
Richard M. Nixon was elected thirty-seventh president of the United States.

1969

Neil Armstrong walked on the moon.

Woodstock music festival was held.

1970



What was the challenge?

To assist in the construction of interstate bridges and grade separation structures using a relatively new product—precast, prestressed concrete girders

Suburban Chicago, Illinois

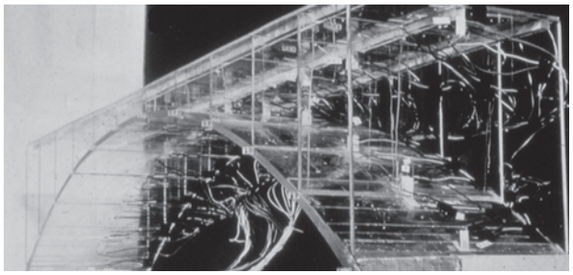
1956

ILLINOIS TOLLWAY AUTHORITY

Consulting and Testing Services

While working as a researcher for the Portland Cement Association, Jack Janney was offered the opportunity to serve as an engineering consultant for the Illinois State Toll Highway Authority. The Tollway Authority urgently needed engineering expertise for construction of the first phase of the Tri-State and Northwest tollways, and Janney was one of only a handful of engineers in the field with research experience in prestressed concrete.

Janney accepted the offer and founded Janney and Associates, a one-man engineering firm initially operating out of his apartment in Glenview, Illinois. His work with the Illinois Tollway Authority involved many of the special services that would become trademarks of the firm: refining state-of-the-art designs and troubleshooting construction and fabrication problems, as well as modeling, instrumentation, and load testing.



TOP 10

The Bureau of Public Roads and the Illinois State Highway Department were demanding that the Tollway engineers prove that their design concepts were sound—that's what we did. – *Jack Janney*

Significant for many reasons, but mostly as the genesis of WJE – *Harry Hunderman*

It is noteworthy that, after fifty years, we are still doing interesting work for the Tollway Authority. – *Gary Klein*

The first, and the most significant, because it represents the essence of WJE – *John Hanson*

Notes of Interest

- Some of the original strain gages and wiring installed on the Beverly Road Bridge for testing and instrumentation are still visible today.
- Much of the field testing was performed at night to minimize the effect of temperature changes upon the strain measurements.
- Jack Janney employed a number of moonlighters from the Portland Cement Association, including Dick Elstner, to help him with the instrumentation and field testing.

What was the assignment?

To determine strains and stresses
in the space frame members for the
purpose of refining the structural design

Kalamazoo, Michigan

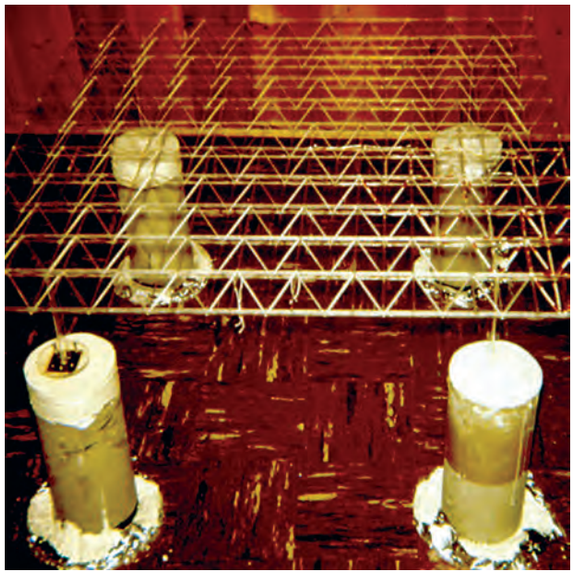
1958

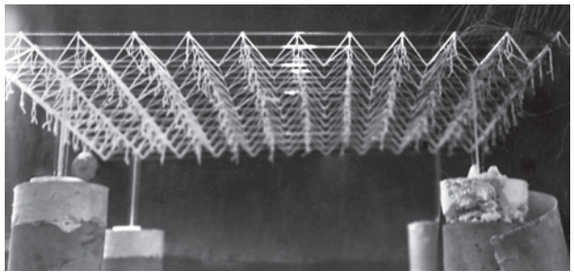
UPJOHN PHARMACEUTICAL HEADQUARTERS

Space Frame Testing

In the late1950s, Upjohn Pharmaceutical unveiled plans to build a new company headquarters complex in Kalamazoo, Michigan. To accommodate Upjohn's request for large, uninterrupted floor space, Skidmore, Owings & Merrill (SOM) developed a modular structural design. SOM hired Wiss and Janney Associates to build, instrument, and test a one-tenth scale model of the space frame roof structure.

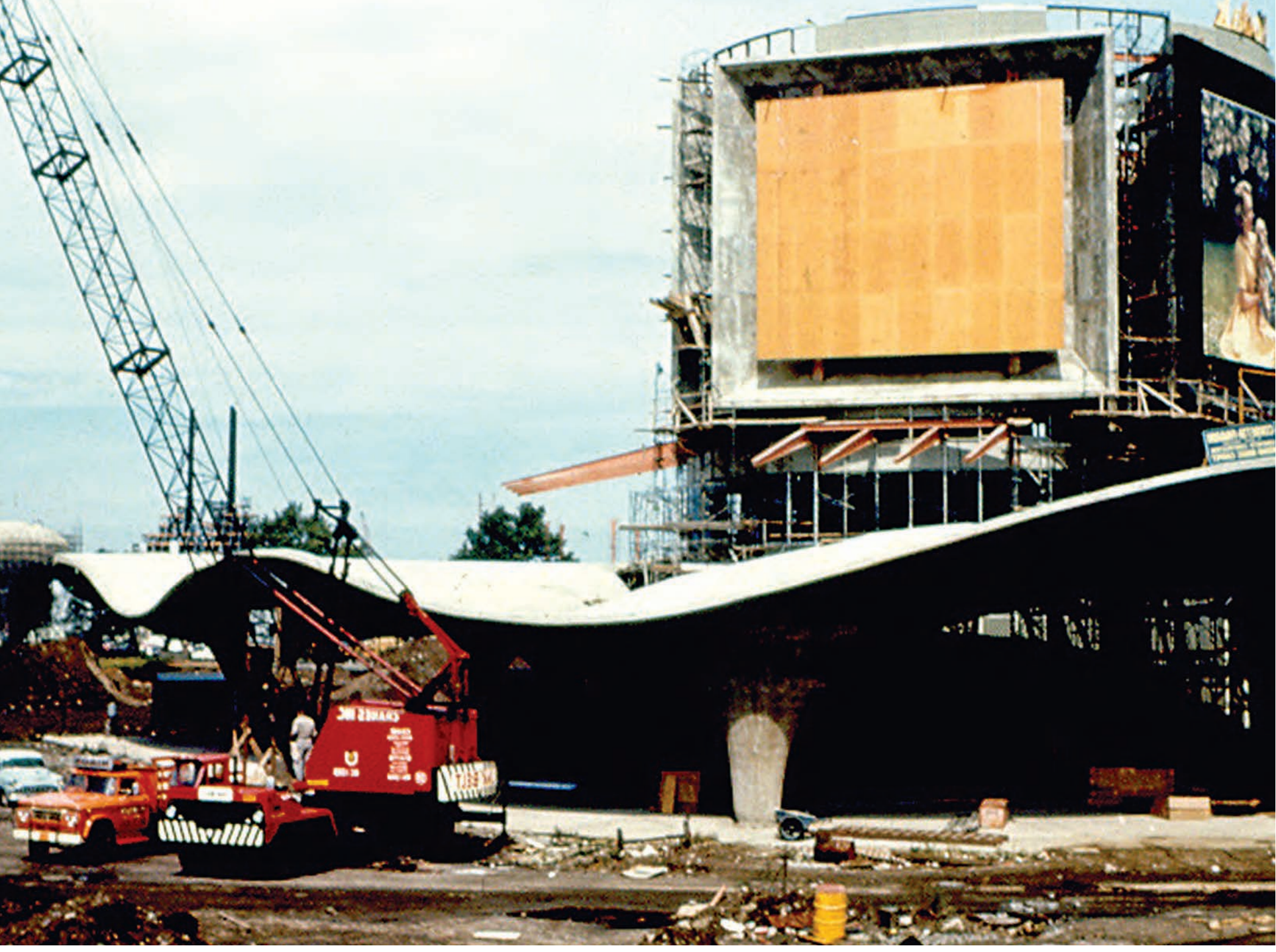
Based upon the results of the model tests, certain diagonal truss members were strengthened in the final design. However, lingering concerns with the design prompted the owners to request a full-scale load test on the first space frame module erected in the field. Wiss and Janney performed this field test, which confirmed the accuracy of the results obtained from the scale model tests. The Upjohn project was especially significant because it enhanced the credibility of model testing—an innovative analytical technique at the time.





Notes of Interest

- The model was constructed using plastic truss members glued together. Strain gages were applied to typical and critical members and wired to a switch box for incremental measurement during the application of loads.
- Loads were applied to the model using washers hung with string attached to the panel points along the top chords of the trusses.
- The scale model testing conducted in Jack Janney's basement was one of many "all-nighters" undertaken by the founders in those early years. An initial miscalculation of the superimposed loads led to an overload by a factor of ten and a premature failure of the model. Working through the night, Jack and Peg Janney and Jack Wiss hastily rebuilt the model, performed the test with the proper loads, typed up the report, and hand-delivered it to the downtown Chicago office of SOM just before the deadline at 10 a.m. the next morning.



What was the challenge?

To analyze a structural shell with a shape that could not be defined by any mathematical formula

New York, New York

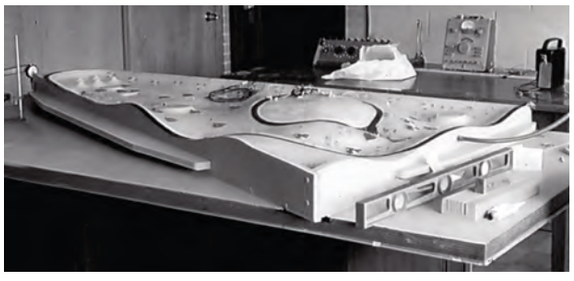
1962

KODAK PAVILION

Model Test

For a signature exhibit at the New York World's Fair, Eastman Kodak hired renowned engineer Lev Zetlin to design an unusual concrete shell structure. The shape of the roof structure, intended to imitate a profile of the moon's surface, defied mathematical description. Zetlin hired WJE to create, instrument, and test a scale model of the roof structure.

Given the unique geometry of the Kodak Pavilion, considerable craftsmanship and creativity were required to build and test the model. The test results furnished to the client were crucial; Zetlin used the data from the model tests to design the reinforcing steel within the thin concrete shell. The project enabled WJE to showcase its expertise and unique capabilities to an international audience at the New York World's Fair.



Notes of Interest

- The pavilion's moon-shaped roof reflected America's growing interest in space exploration during the 1960s. After the successful launch of the satellite Sputnik in 1957, the United States and the Soviet Union were engaged in a "space race" to see which country could be the first to send a man to the moon.
- A wood form for the test model was generated by scaling off the artist's sculpture of the structure. The wood form was meticulously chiseled, shaved, and sanded down until its shape coincided with the shape of the structure.
- A sheet of Plexiglas was then heated and pressed against the wood form with vacuum pressure. In order to eliminate the residual stresses or "memory" created by the deformation of the Plexiglas sheet, it had to be slowly heated again to anneal the material. At that point, the model could be instrumented and tested.

What did WJE develop?

Nationally recognized expertise
in the diagnosis of glass problems
and failures

Pittsburgh, Pennsylvania

1966

FEDERAL OFFICE BUILDING

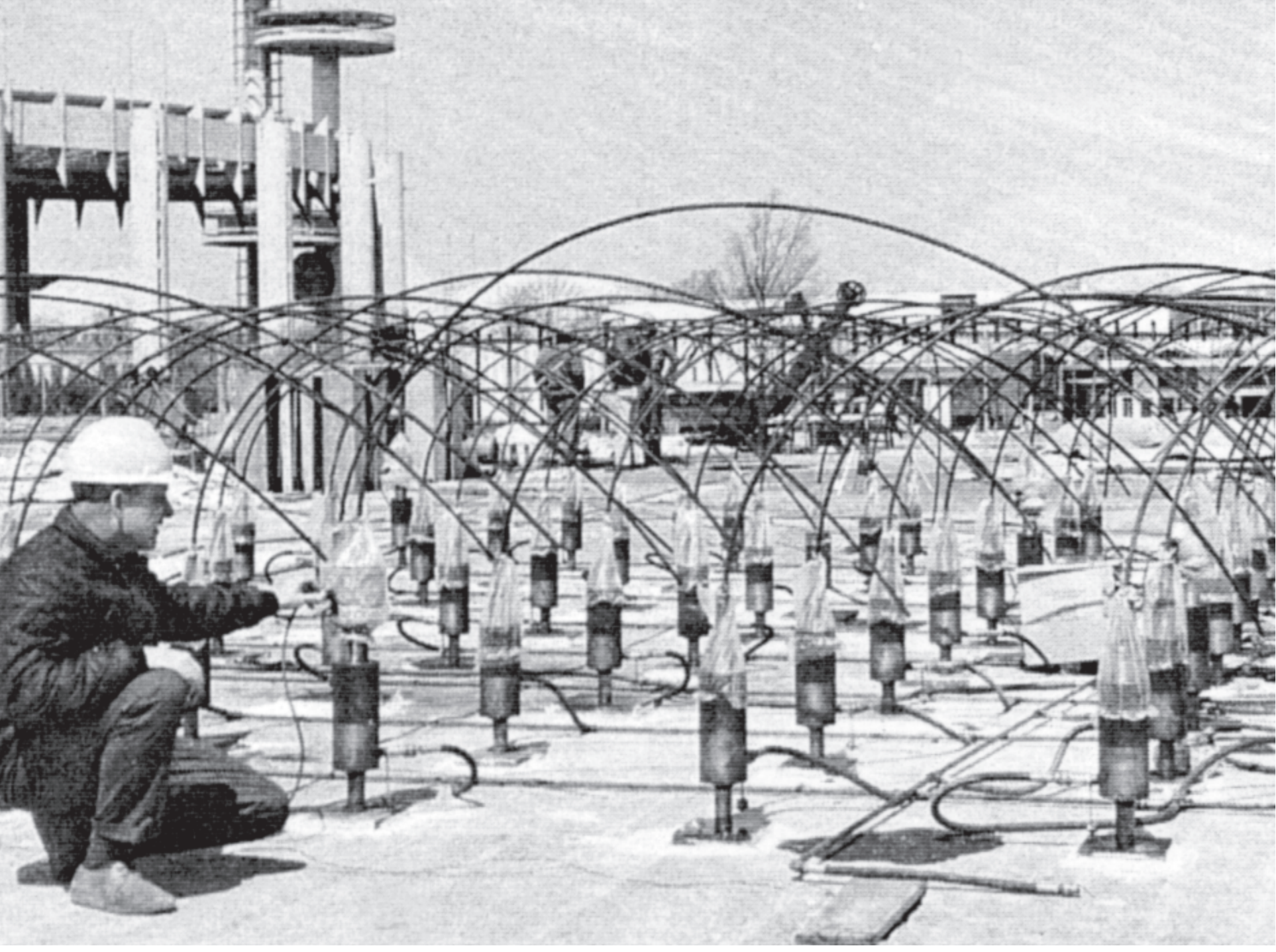
Investigation of Glass Breakage

In response to glass breakage during construction and initial occupancy, the U.S. General Services Administration engaged WJE to inspect the exterior spandrel glass on a twenty-three story high-rise structure, now known as the William S. Moorhead Federal Building, in Pittsburgh. With support from industry experts, WJE successfully diagnosed the cause of the glass failures: inclusions originating during production of the glass rather than flexural or thermal stresses, as originally suspected.

This study, led by Dick Elstner, was the first glass investigation conducted by WJE and added yet another specialty to the firm's growing portfolio of problem-solving capabilities. The project also opened the door to numerous subsequent glass investigations, including the John Hancock Building in Boston, the College Life Buildings in Indianapolis, and the CNA Building in Chicago.

Notes of Interest

- Large glass panels were not extensively used as a building component until the 1960s and there was very little published information on the properties and performance of glass panels. As a number of glass failures began to occur, glass manufacturers were also reluctant to disclose or share technical information. As a result, Dick Elstner turned to a paper by E.R. Ballantyne of the Division of Building Research in Melbourne, Australia, entitled "Cracking of Flat Glass," which indicated that certain failures could be caused by small inclusions that originated during glass production.
- "Cracking of Flat Glass" had been presented by E.R. Ballantyne at the Australian Building Research Congress on August 17, 1961.
- Nickel sulfide inclusions were the most common cause of failures in tempered glass panels like those first investigated at the Federal Office Building in Pittsburgh.



What was learned?

How to instrument and load-test full-scale structures, and how those different structures behaved as they were loaded to failure

New York, New York

1966

NEW YORK WORLD'S FAIR

Full Scale Load Testing

Shortly after moving to new headquarters in Northbrook, Illinois, WJE was retained by the National Academy of Sciences to conduct full-scale load tests on three buildings constructed for the 1964 New York World's Fair. The buildings were only two years old but were scheduled for demolition, making them ideal candidates for a study of building performance by load testing to failure.

The results of the tests led to an improved understanding of how buildings behave and ultimately fail, especially the vulnerability of concrete buildings to failure in punching shear. At the time, the $280,000 project was the company's largest ever. This successful project was heralded as an innovative engineering feat and established WJE's reputation as a leading investigative and testing firm.

TOP 10

The project that put WJE on the map – *Jack Janney*

This project established our reputation as the "engineer's engineer." – *Gary Klein*

Received wide recognition for its contribution to the knowledge of the performance of full-scale structures – *John Hanson*

Notes of Interest

- The Chimes Tower was subjected to dynamic excitation using four vibrators that were the only type in existence at the time. Jack Wiss took measurements of the natural frequency of the tower for comparison with the calculated value. The test had $150,000 worth of instrumentation that recorded fifty channels of data.
- The Bourbon Street building was a steel structure with open web floor joists. The floor system was tested to failure using air pressure. The vacuum technique had been used on model tests before, but this was the first time the technique was used to load test a full-sized building to failure.
- The Rathskeller building featured a reinforced concrete floor slab that was tested to failure using hydraulic rams reacting against soil anchors installed through the basement floor. A total of 208 center-hole hydraulic rams of 30-ton capacity were used for the tests. At the time, the rams had to be specially made for the tests.

What was the challenge?

To determine the vibration levels and resulting cosmetic and structural damage produced by blasting

Nationwide

1967

U.S. BUREAU OF MINES

Blast Monitoring

In the late 1960s and early 1970s, the U.S. Bureau of Mines engaged WJE to monitor and study ground vibrations generated by blasting operations at a number of locations around the country. The work involved the use of state-of-the-art monitoring and data acquisition equipment.

This was the signature project in the long and distinguished professional career of Jack Wiss. The data generated by the ground vibration studies for the Bureau of Mines formed the basis for several landmark publications by Wiss and others at WJE that are still referenced. The work helped to define the threshold vibration levels that could produce cosmetic and structural damage to buildings.

Notes of Interest

- The job sites were typically located in remote areas of the country, and WJE technicians and engineers would often put in sixteen-hour days while out in the field; the assignments typically lasted one to two weeks.
- In the early years, vibration data was recorded on strip charts and had to be manually interpreted and reduced each day.

How did WJE help the client?

WJE provided a more refined and accurate determination of the design wind pressures on this uniquely shaped building.

Chicago, Illinois

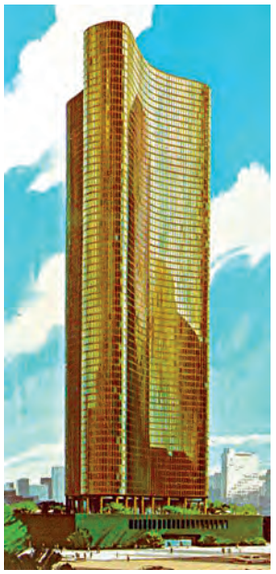
1967

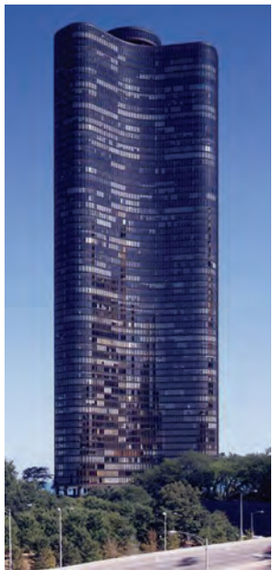
LAKE POINT TOWER

Wind Tunnel Study

WJE was retained to construct a scale model of Lake Point Tower to study the effects of wind on this Chicago lakefront high-rise. The model was built and instrumented in the WJE laboratory and then tested in the wind tunnel at Purdue University. Test results were used to finalize the structural design for the building.

The study of the interaction of wind and tall buildings was an emerging science in the late 1960s. At that time, wind tunnels, which had been originally developed to study aircraft design, were only infrequently used for measuring wind pressures on buildings. The study for Lake Point Tower was one of the earliest and most prominent examples of the many wind tunnel models that WJE produced and tested in the 1960s and 1970s. When completed in 1968, the seventy-story Lake Point Tower was the tallest all-residential building and the tallest reinforced concrete building in the world.





Notes of Interest

- The design for Lake Point Tower was partially derived from a 1921 sketch by Mies van der Rohe.
- The actual design was produced more than forty years later by John Heinrich and George Schipporeit, who were both students of Mies van der Rohe.
- The original design concept consisted of a building with four wings, but it was eventually replaced by a design that included only three wings separated by 120 degree angles. This design allowed for greater unobstructed views of Lake Michigan. The unique geometry also offered less surface area exposed to direct wind loads in comparison with a conventional rectangular design.

What did the project demonstrate?

That nuclear containment vessels had sufficient strength to safely withstand the maximum internal design pressures

Peekskill, New York

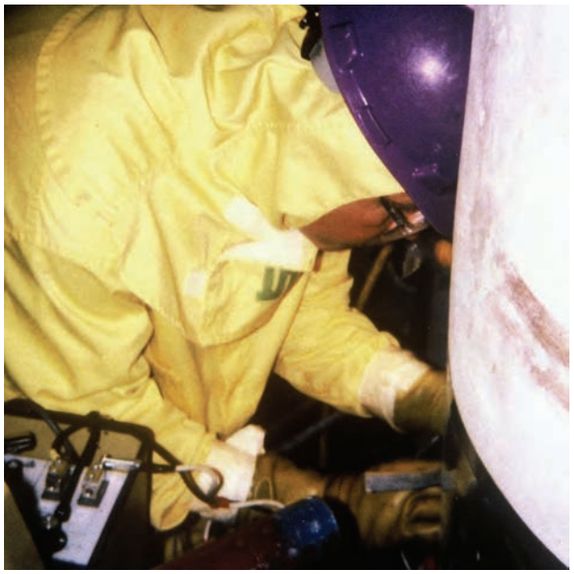
1969

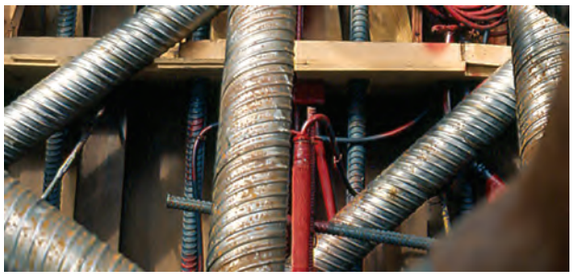
INDIAN POINT NUCLEAR POWER PLANT

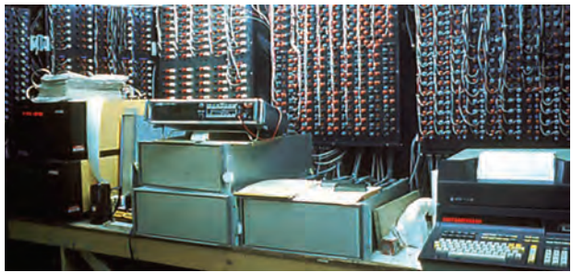
Structural Integrity Test

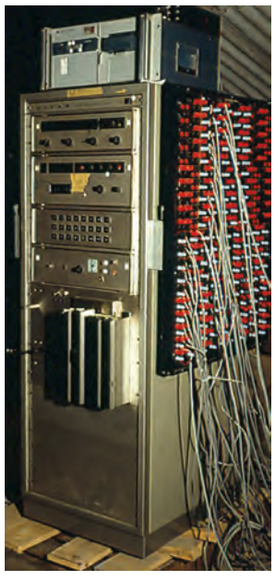
Most of the nuclear power plants currently operating in the United States were constructed during a fifteen-year period beginning in the late 1960s. As part of the process of licensing a plant, the U.S. Atomic Energy Commission, now known as the Nuclear Regulatory Commission, required a structural integrity test (SIT) to demonstrate that the containment vessel could safely withstand the substantial internal design pressures. During this time frame, WJE conducted more than a dozen SITs on containment vessels under construction across the United States. One of the first such tests was performed at the Indian Point Nuclear Power Plant in Peekskill, New York.

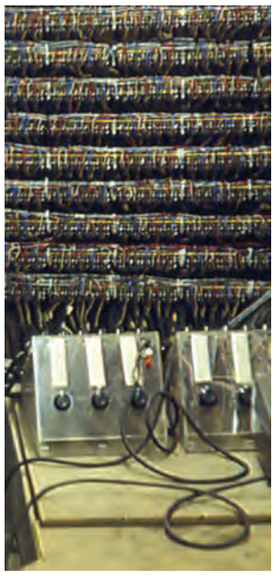
The project is an early example of WJE's testing and instrumentation work for the nuclear power industry, a service that became a mainstay of WJE through the 1980s. This type of testing assignment helped build the firm's instrumentation resources and established its internal quality assurance/quality control program, portions of which remain in place today.











Notes of Interest

- After the crew of WJE engineers and technicians had worked long days for several weeks setting up the instrumentation, the actual testing was scheduled to occur over the Christmas holiday in 1970. Since the actual tests and acquisition of data were fairly routine, Jack Janney volunteered to fly out to New York and relieve some of the engineers and technicians, so that they could spend at least part of their Christmas vacation with their families.
- In addition to structural integrity testing, WJE was typically retained to perform an Integrated Leak Rate Test (ILRT) on many of the containment vessels.
- In 1979, WJE performed an SIT and an ILRT at the Nuclear Power Plant in Almaraz, Spain.

Why did it fail?

Insufficiently spaced and staggered lap splices in the reinforcing steel

Omaha, Nebraska

1970

CLARKSON HOSPITAL GARAGE

Collapse Investigation

On April 14, 1970, part of the two-story Clarkson Hospital garage in Omaha, Nebraska, collapsed. There were no reported injuries, although forty-nine cars were damaged. Dick Elstner investigated the collapse for WJE, and his findings led to fundamental changes in the American Concrete Institute code provisions related to the detailing of reinforced concrete structures.

The Clarkson Hospital project was one of WJE's first major collapse investigations and one of the first parking structure projects undertaken by the firm. The work undertaken for this investigation established a methodology for the study of structural failures leading to collapse. Since the Clarkson Hospital study, WJE has been asked to investigate virtually every major structural collapse in the United States.

Notes of Interest

- The day after the collapse, a local citizen turned himself in to the Omaha police department, confessing he had caused the collapse. The man had been running late for a doctor's appointment at the hospital, and in his rush to park his car at the garage, he hit a concrete column at the end of the stall. When the man returned from his appointment, the section of garage just beyond his parked car had collapsed, and he assumed that the impact from his car had caused it. The police and WJE assured the man that he was not responsible for the failure.
- Clarkson Hospital was founded in 1869, becoming the first hospital in the state of Nebraska.
- The Nebraska Medical Center is a leader in biopreparedness—it is home to a ten-bed biocontainment unit, the largest of its kind in the United States and the only one open to civilians.

What was accomplished?

The monitoring and rehabilitation of a historic stadium to help ensure its continued use

Chicago, Illinois

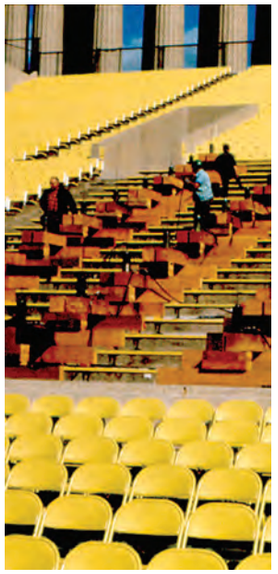
1970–present

SOLDIER FIELD

Long-Term Condition Assessment and Rehabilitation

When the Chicago Bears moved to Soldier Field in 1970, decades of exposure to Chicago's harsh winters had taken a toll on the circa 1925 reinforced concrete stadium, and there were concerns as to its structural integrity. Inspections and load tests conducted by a team of WJE engineers led by Jack Janney confirmed that many of the stands and supporting columns were structurally deficient. Shoring was installed and WJE supervised testing of the supplemental support stands.

WJE has remained involved with the stadium ever since, providing a wide variety of inspections and repairs, including the design of a major structural rehabilitation in 1980 and the development of corrosion mitigation schemes in 2000. Work on the stadium has involved many WJE staff members, beginning with Jack Janney. The innovative repairs developed by WJE over the past four decades have extended the life of the stadium's historic concrete.



Notes of Interest

- Completed in the mid-1920s, Soldier Field served as a memorial to the American casualties of World War I. It officially opened on October 9, 1924 (the fifty-third anniversary of the Great Chicago Fire) as Municipal Grant Park Stadium, changing its name to Soldier Field on Veterans Day, November 11, 1925.
- The Long Count Fight, the second heavyweight championship bout between Jack Dempsey and Gene Tunney, was held at Soldier Field on September 25, 1927. More than 104,000 people were in attendance.
- Soldier Field was formerly the site of the College All-Star Game, an exhibition between the previous year's NFL champion and a team of collegiate all-star players assembled prior to their reporting to the training camps of their new professional teams. This game was eventually discontinued due to the risk of injury to the all-stars and the lack of competitiveness of the game, which in its waning years was almost invariably won by the professional champions.


CELEBRATING 50 YEARS
WJE
ENGINEERS
ARCHITECTS
MATERIALS SCIENTISTS
50
1956-2006

CHAPTER 2
Expanding Expertise

1971–1980

Bailey's Crossroads
Collapse Investigation

LaGuardia Airport
Load Testing of Runway Extension

TWA Maintenance Hangar
Micro-Concrete Model Test

Central National Bank
Investigation of Corrosion Related to Sarabond Mortar

Woolworth Building
Investigation and Repair of Terra Cotta Cladding

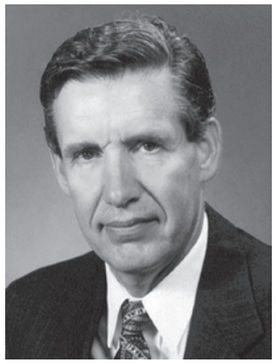
Fremont Bridge
Inspection and Assessment

NCHRP 244
Concrete Sealers Study and Report

Willow Island Cooling Tower
Collapse Investigation

Rosemont Horizon Stadium
Roof Collapse Investigation

TRESTLE
Laboratory Testing, Analysis, Field Testing



1971–1980: Expanding Expertise

The reputation of Wiss, Janney, Elstner and Associates as a leading investigative and testing firm continued to grow throughout the 1970s, as evidenced by high profile projects such as the investigation of the Bailey's Crossroads apartment building collapse. The growth of the new firm did not go unnoticed by the engineering community. In April 1972, the three partners were featured in a cover story for *Engineering News-Record* entitled, "One Consultant's Troubles Pays This One's Fees," which highlighted the problem-solving nature of the work performed by the firm *(top left)*.

With WJE's national reputation for structural investigations well established, the firm focused on expanding its areas of expertise. During the early 1970s, WJE began to perform significant work for the growing nuclear power industry, including structural integrity tests of nuclear containment structures around the country. As part of the work on these projects, WJE pioneered the use of computer-controlled data acquisition systems for the measurement and recording of structural response.

WJE had also become increasingly involved in building envelope investigations. While Dick Elstner had become a nationally recognized expert in solving glass and curtain wall problems, the firm did not yet have an established architectural group. In 1973, architect Jerry Stockbridge *(middle left)* joined WJE, generating a new area of growth for the firm. Under Stockbridge's leadership, the firm's creative approach to troubleshooting was used to diagnose and solve problems relating to the architectural components of buildings.

By 1973, the firm had grown to twenty-five employees, with billings surpassing $1 million for the year. To accommodate the larger staff, a 20,000 square foot addition, including an expanded structural laboratory, was constructed at the Northbrook office site. That same year, the partners decided to sell their company to United States Gypsum Corporation (USG). While the building remained the property of the firm, employees officially worked for the Wiss, Janney, Elstner division of USG.

Jack Janney remained with WJE under its new ownership until 1979, when he retired as president and moved to Denver. That year also brought changes for Dick Elstner, who relocated to Honolulu and opened the second WJE branch office; (the first had been opened in San Francisco in 1977). With Janney's retirement, John Hanson *(lower left)*, a structural engineer and WJE vice president of operations who had joined the firm in 1972, was appointed president of Wiss, Janney, Elstner Associates, Inc.

Supported by the capital improvements funded by USG and the leadership of John Hanson, the company continued to grow. The firm leased Annex I, a building adjacent to the Northbrook headquarters, to provide much-needed office, warehouse, and laboratory space. By the end of the 1970s, WJE employed more than eighty staff members. The number of projects completed over the course of the decade had more than quadrupled and annual billings approached $5 million.

Wiss, Janney, and Elstner were featured in a cover story for Engineering News-Record.

WJE had twenty-five employees and billings surpassed $1 million per year. A 20,000 square foot addition was constructed at the Northbrook offices. The partners decided to sell the company to USG.

The HP9830 computer, with 16k of memory, served engineering and accounting functions until 1982.

1971

The twenty-sixth amendment to the U.S. Constitution lowered the voting age to eighteen years old.

1972

President Richard Nixon visited China.

On June 17, five men were caught breaking into the offices of the Democratic National Committee in Washington, D.C.

U.S. participation in the Vietnam War ended.

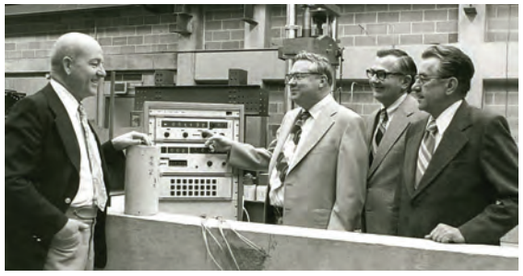
1973

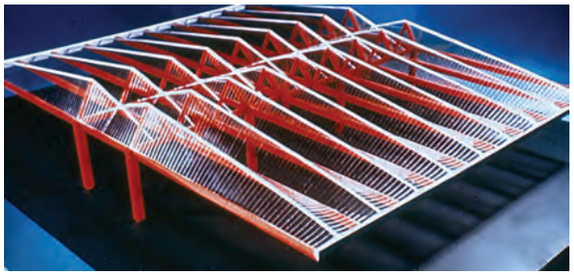
1974

President Nixon resigned from office. Gerald R. Ford was sworn in as the thirty-eighth president of the United States.

1975

Harvard University dropout Bill Gates co-founded a company called Microsoft.





The San Francisco, California, branch office opened.

The Honolulu, Hawaii, branch office opened. The firm had more than eighty staff members and annual billings approached $5 million.

1976

Jimmy Carter was elected thirty-ninth president of the United States.

1977

1978

The U.S. Senate approved the Panama Canal treaty, voting to turn the canal over to Panama by 2000.

At Camp David, President Carter brokered a peace agreement between leaders of Israel and Egypt.

1979

Margaret Thatcher was elected Prime Minister of the United Kingdom.

Iranian students seized the American embassy in Tehran. Fifty-three diplomats were held hostage until January 20, 1981.

1980

Ronald Reagan was elected fortieth president of the United States.

Why did it collapse?

Premature removal of shoring supports for concrete slabs that had not achieved sufficient strength

Fairfax County, Virginia

1973

BAILEY'S CROSSROADS

Collapse Investigation

On March 2, 1973, construction crews were placing concrete on the twenty-fourth floor of the Bailey's Crossroads apartment building while shoring posts were being removed beneath the concrete slabs at the twenty-second floor. The increase in load to the recently constructed twenty-second and twenty-third floor slabs caused shear failures that triggered a sudden progressive collapse to ground level. The contractor retained WJE to investigate the cause of this tragic structural failure.

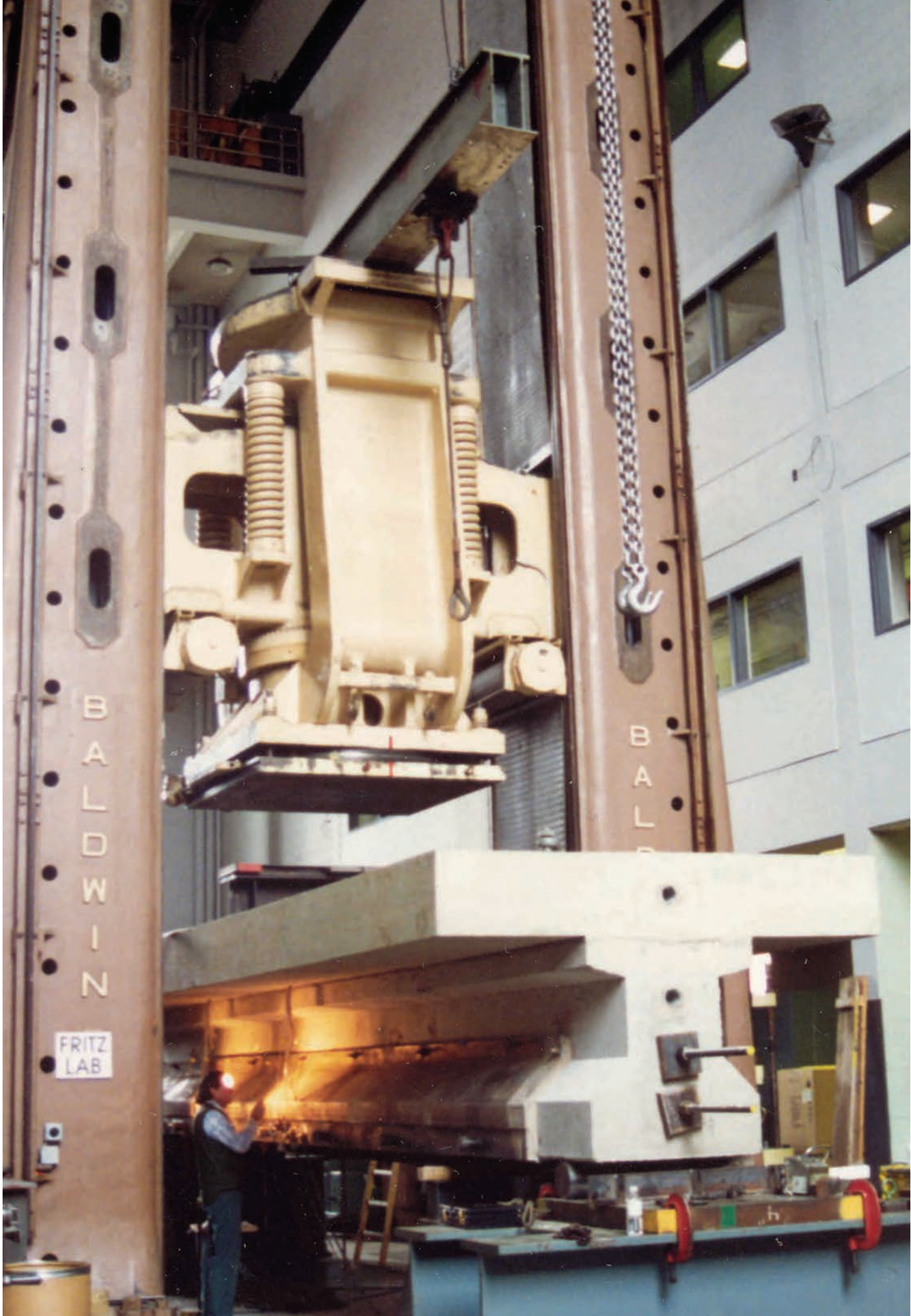
As lead investigator, Dick Elstner concluded that the shoring posts had been removed before the concrete slabs reached sufficient strength to safely support the construction loads imposed from the floors above. The results of the investigation focused greater attention on early strength issues, shoring and reshoring practices, and the profound consequences of progressive collapses.

Notes of Interest

- Progressive collapse is defined in the American Society of Civil Engineers (ASCE) Standard 7-02, Minimum Design Loads for Buildings and Other Structures, as the "spread of an initial local failure from element to element, eventually resulting in the collapse of an entire structure or a disproportionately large part of it."
- Unfortunately, the mistakes made at Bailey's Crossroads were repeated in 1981, leading to the progressive collapse during construction of the Harbour Cay Condominium building in Cocoa Beach, Florida. WJE investigated that failure as well.

What did WJE accomplish?

The in-service repair of a crucial component of a major transportation hub



New York, New York

1973–present

LAGUARDIA AIRPORT

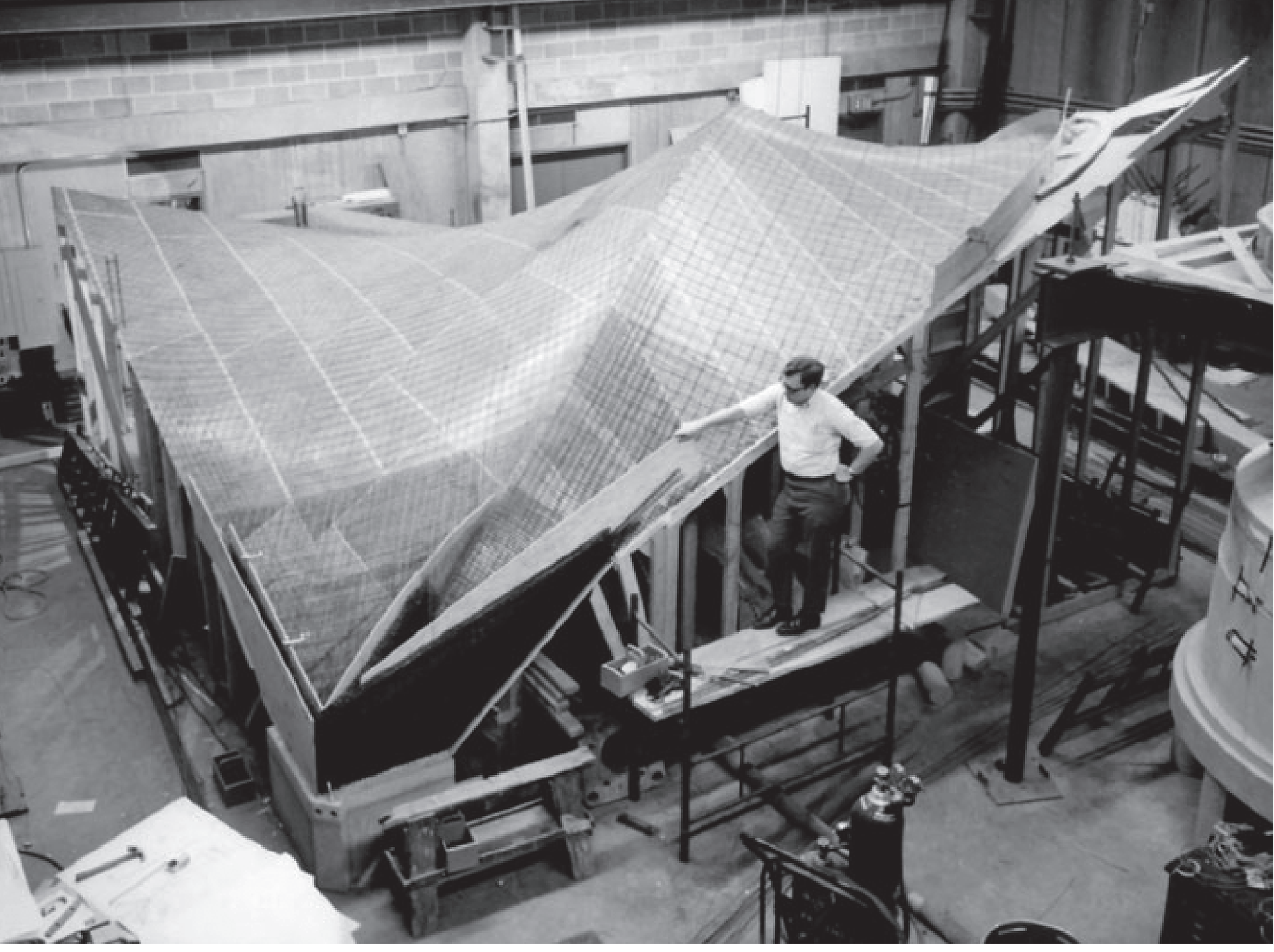
Load Testing of Runway Extension

The runway system at LaGuardia Airport was extended over Long Island Sound in the early 1960s. This over-water runway extension was a historic structural achievement, chosen by the Precast/Prestressed Concrete Institute as one of the fifty most significant projects in its fifty-year history. The precast concrete girders that support the runway extension were exposed to an aggressive chloride environment from partial submersion in seawater twice a day. Consequently, the girders began to deteriorate due to corrosion of the embedded prestressing strands. To restore the girders to their original strength, the Port Authority of New York and New Jersey developed plans to retrofit the girders with a composite steel trough. WJE was retained to perform load tests and determine the feasibility of the retrofit design.

For more than thirty years, the Port Authority has continued to call on WJE to test the runway extension because its complex structural behavior has defied their best efforts to analyze it with conventional analytical computer programs. While WJE has tested many structures over the years, few projects match the scope and complexity of the work performed at LaGuardia.

Notes of Interest

- Two full-scale retrofitted girders were tested to failure in the five million pound test machine at Lehigh University.
- The failure mode of the test girders prompted a redesign of the retrofit details to improve the shear strength of the girders.
- LaGuardia Airport was named after Fiorello LaGuardia, the mayor of New York from 1934 to 1945. LaGuardia was instrumental in restoring the economic stability of the city during and after the Great Depression.
- First occupied by Gala Amusement Park, the site was turned into a 105-acre private flying field in 1929. Ground was broken on September 9, 1937, for a new airport.
- LaGuardia Airport has been operated by the Port Authority of New York and New Jersey under a lease with the City of New York since 1947.



What did WJE contribute?

Test data essential for the design of the reinforcing steel within the thin concrete roof shell

Kansas City, Missouri

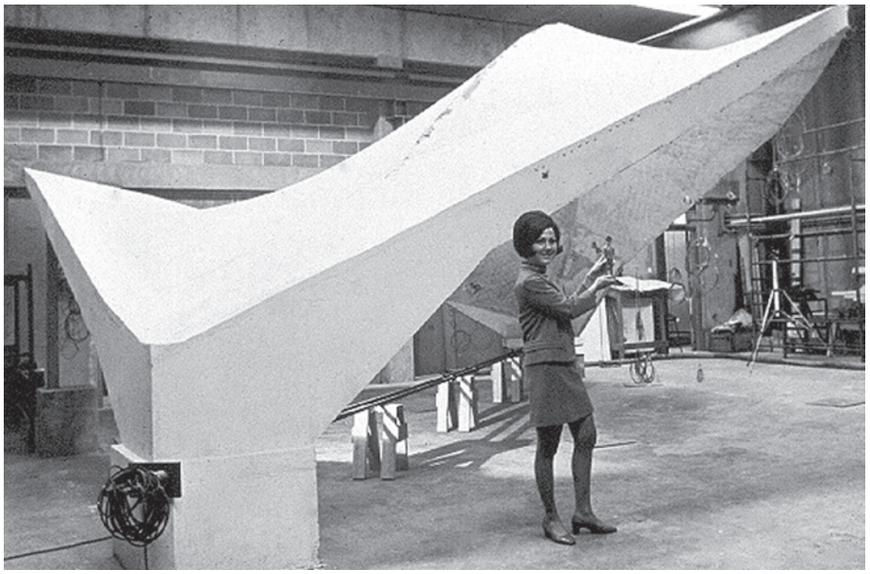
1973

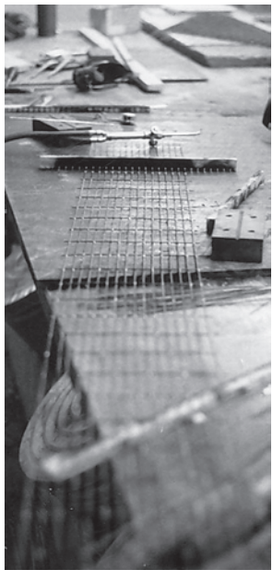
TWA MAINTENANCE HANGAR

Micro-Concrete Model Test

WJE was retained to design, construct, and test a scale model of the thin, folded plate roof structure proposed for the TWA Maintenance Hangar in Kansas City, Missouri. The roof structure design was comprised of intersecting hyperbolic paraboloids of reinforced and post-tensioned concrete. The main shell of the scale model was only 0.3 inches thick. Within it were two layers of reinforcement and post-tensioning tendons. After a series of concentrated load tests, uniform loading was applied to the model using differential air pressures created by producing a partial vacuum in the space beneath the model.

The unusual geometry of the roof structure and the size and complexity of the micro-concrete scale model presented enormous technical challenges that WJE engineers and technicians had to overcome in building and testing a scale model of this unique structure. This project was probably the last great scale model test conducted by WJE—the dawn of the computer age brought with it the ability to analyze most complex structural shapes using finite element programs.





Notes of Interest

- Testing of this model would not have been possible without the 20,000 square foot expansion of WJE's home office and laboratory in the early 1970s.
- The maintenance structures—with their innovative folded plate roofs—are still used today by American Airlines, which acquired TWA in 2000.

Why did Sarabond cause so much masonry distress?

The polymers in the additive contained chloride ions that were gradually released into the mortar, promoting corrosion of embedded steel.

Cleveland, Ohio

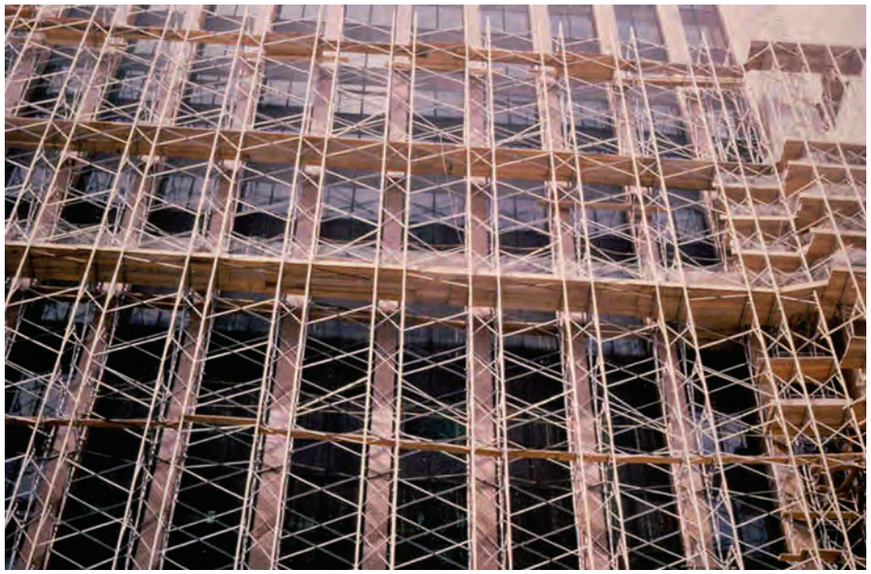
1974

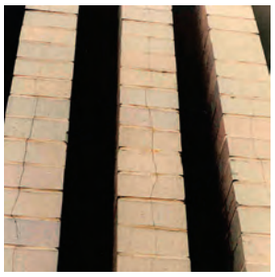
CENTRAL NATIONAL BANK

Investigation of Corrosion Related to Sarabond Mortar

Central National Bank was WJE's first major investigation of problems arising from the use of the Sarabond mortar additive developed by Dow Chemical Company. Following extensive testing and analysis of Sarabond-related distress, WJE provided expert testimony on behalf of Central National Bank in a $28 million lawsuit filed against Dow. This was the first Sarabond lawsuit that went to trial and the jury verdict against Dow provided a clear endorsement of WJE's contention that Sarabond promoted the corrosion of embedded reinforcing steel.

With WJE's reputation firmly established as an expert on the performance of this mortar additive, the Central National Bank project led to hundreds of additional Sarabond investigations over the next twenty years. Many of these assignments eventually required the development of repair plans and specifications, which involved the full range of WJE's materials, architectural, and structural expertise.





TOP 10

. . . the first "Sarabond project"—it helped establish our reputation for being able to provide a full scope of architectural, engineering, and materials expertise. – *Jim Connolly*

The father of the more than 100 buildings constructed with Sarabond mortar additive on which WJE worked. Information from this project was used on all of the other Sarabond projects. – *Ian Chin*

Notes of Interest

- Sarabond was introduced by Dow in 1965 as a mortar additive that would produce great tensile and bond strength and water-tightness, thus allowing factory-built walls, easily delivered to a site and erected as single-wythe exteriors of buildings of more than forty stories.
- Sarabond had one fatal flaw—the additive included a chloride component, which caused corrosion of metals embedded in the mortar and brick panels. Consequently, building facades that used Sarabond in their construction were susceptible to cracking and severe distress.
- Calcium chloride had been added to mortar by some masons in the past, and Dow noted that certain trade groups still sanctioned the practice. The Brick Institute, however, advised against chlorides as early as 1968, noting that the corrosion of metals was intensified by them.
- Sarabond was a laboratory cousin of Saran Wrap.

What was the challenge?

To provide technical preservation solutions for the restoration of the historic terra cotta facades

New York, New York

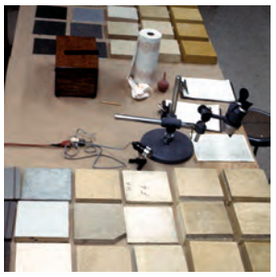
1977

WOOLWORTH BUILDING

Investigation and Repair of Terra Cotta Cladding

Designed by Cass Gilbert and completed in 1913, the Woolworth Building in New York City was the tallest building in the world until 1931. When pieces of the terra cotta facade fell into a courtyard of this historic landmark, WJE was engaged as a technical consultant for the repair and restoration of the building envelope. WJE performed all field and laboratory testing, and provided design and construction phase services during the remedial work.

As technical consultant, WJE developed and utilized several groundbreaking investigative methods, including strain relief testing, to diagnose causes of distress. Repair of the terra cotta at the Woolworth Building remains one of the most noteworthy building envelope rehabilitations ever undertaken—in terms of both the magnitude of the project and the importance of the building.



TOP 10

This was the company's first major architectural project, leading to establishment of the Architecture group and development of a major practice area. – *Jerry Stockbridge*

This project established our reputation in historic building facades, and is one of the earliest examples of providing plans and specifications to implement our recommendations. – *Gary Klein*

An early, outstanding example of the multidisciplinary approach (engineering, architecture, and materials science) that WJE has successfully used on many high profile and important facade restoration and preservation projects. – *Bill Nugent*

Notes of Interest

- The Woolworth Building was commissioned in 1910 by Frank W. Woolworth, the head of a multi-million dollar chain of five-and-ten-cent stores. Woolworth wanted the headquarters building to reflect not only the company's success, but the success of twentieth-century commerce as well.
- Praised for its "success of scale," the fifty-story building featured high ceilings averaging eleven to twenty feet tall, making it the equivalent of an eighty-story high-rise today.
- The building is also highly ornate, with a cruciform lobby and extensive sculpture that graces the yellow marble interior, including medieval caricatures of Woolworth counting his dimes and Cass Gilbert cradling a model of the building.

What problem did WJE solve?

Fatigue cracking and brittle fractures in a major bridge structure

Portland, Oregon

1978

FREMONT BRIDGE

Inspection and Assessment

The Fremont Bridge is a three-span, tied-arch steel bridge crossing the Willamette River in Portland, Oregon. During construction of the bridge in 1973, a severe brittle fracture occurred in one of the box-shaped tie girders at the junction with an arch rib. Subsequent inspections revealed small cracks and other discontinuities in a number of the welds on the bridge. Five years after construction, the Oregon Department of Transportation retained WJE to develop a comprehensive retrofit plan based on inspection and testing of the tie girders.

The work on the Fremont Bridge represents one of the most comprehensive bridge investigations ever conducted by WJE, and established the firm's reputation as a leader in bridge fatigue and fracture assessment. In 1996, WJE returned to the Fremont Bridge to participate in the structure's ongoing maintenance program and to focus on fatigue and fracture cracks in the three-span main arch.

TOP 10

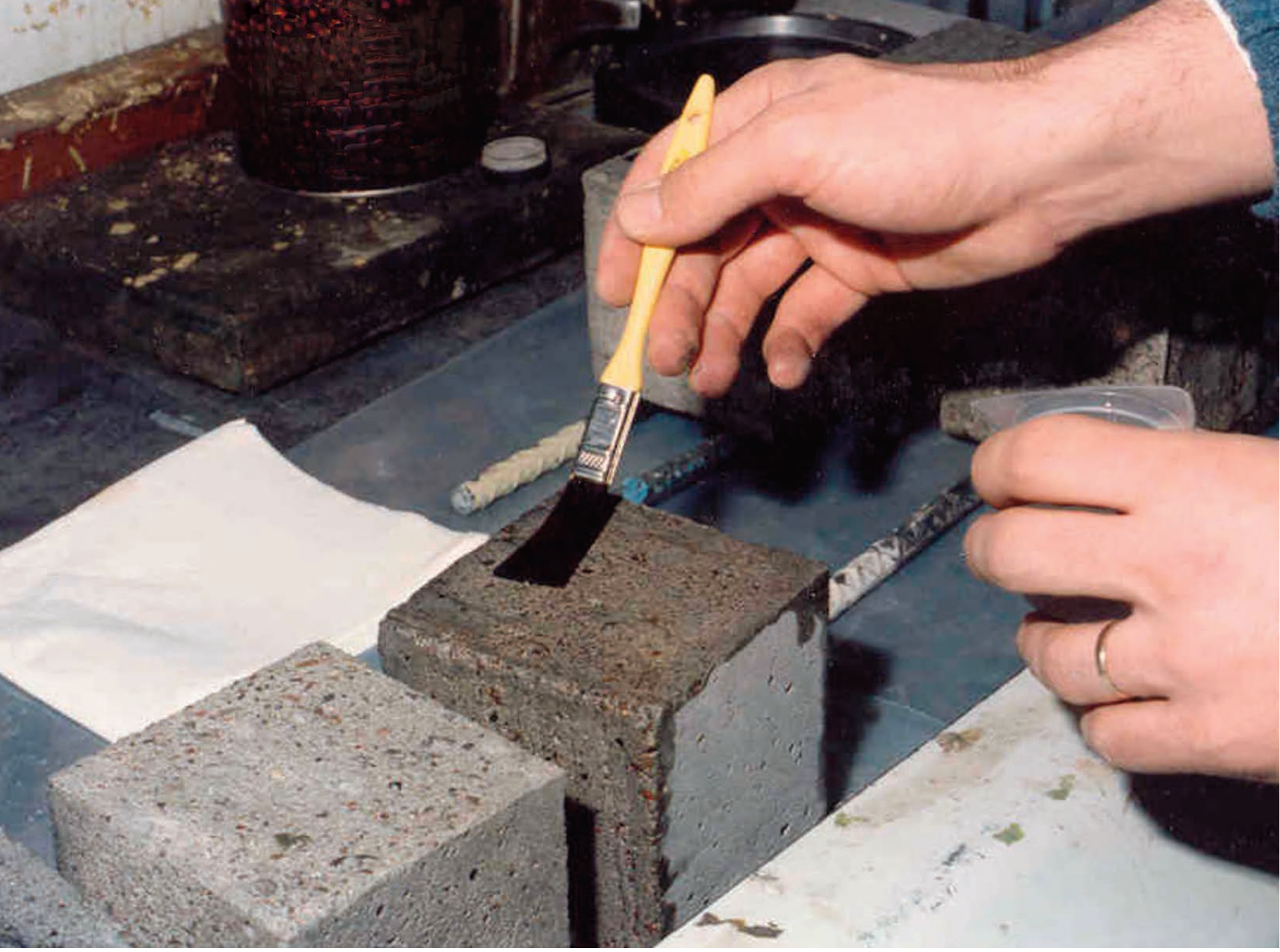
First major investigation of fatigue and fracture of steel bridges. We developed a unique repair to reduce the risk of failure. – *John Hanson*

The most comprehensive bridge investigation ever performed by WJE—this project established WJE as a leader in bridge fatigue and fracture investigations. – *Ian Chin*

Many of the state-of-the-art retrofit concepts that WJE developed and successfully utilized to upgrade fatigue sensitive details on the Fremont Bridge have become standards that are still widely used today. – *Bill Nugent*

Notes of Interest

- Photographs taken by WJE engineers during the initial work on the bridge in 1978 feature Mount St. Helens in the distance, the top of which disappeared after the volcano erupted in 1980.
- The main span of the bridge was built in California and then assembled at Swan Island and floated in place on a barge. On March 16, 1973, the 6,000 ton steel arch span was lifted 170 feet using thirty-two hydraulic jacks. At the time, it was listed in the *Guinness Book of World Records* as the heaviest lift ever completed.
- It has the longest main span of any bridge in Oregon and, until the future completion of the Caiyuanba Bridge in China, is the longest tied-arch bridge in the world.
- The Fremont Bridge was the twenty-sixth peregrine falcon nest site designated in Oregon after the raptor was placed on the U.S. Threatened and Endangered Species list in 1970.



What did WJE contribute?

A research study that resulted in the standard industry reference for testing and comparing sealers

Northbrook, Illinois

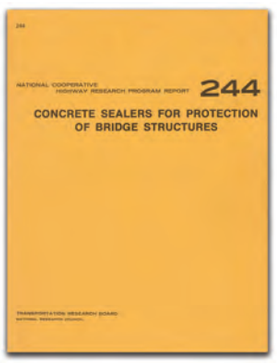
1978

NCHRP 244

Concrete Sealers Study and Report

Prompted by the ever-increasing corrosion problems affecting the nation's bridges, the National Cooperative Highway Research Program (NCHRP) awarded WJE a large research contract to study the performance of concrete sealers. The objective of the study, which resulted in this far-reaching NCRHP publication, was to evaluate the effectiveness of sealers used to protect reinforced concrete bridges exposed to deicing salts and to provide guidance for the successful use of sealers on bridge members. The study evaluated the ability of the most commonly used sealers to prevent migration of moisture and salts into concrete. As part of this study, unique climate chambers were devised and constructed in the WJE laboratories to simulate exposure of the sealers in harsh northern and southern climates.

NCHRP 244, Concrete Sealers for Protection of Bridge Structures, *printed in December 1981, was the first WJE research project for the Federal Highway Administration. The report is still widely used by manufacturers, owners, and engineers as the standard reference for testing and comparing sealers.*



TOP 10

A breakthrough study by WJE that established acceptance criteria for concrete sealers and confirmed WJE as experts on protecting concrete bridges. – *Ian Chin*

Before this landmark research project, DOTs did not know which sealers would perform—now they know. – *Gary Klein*

The second best selling NCHRP report. This report was of great importance to every U.S., Canadian, and European transportation department. – *Don Pfeifer*

Notes of Interest

- The American Association of State Highway and Transportation Officials (AASHTO) has a similar standard test method, but it requires abrading the surface to simulate wear. The NCHRP 244 method does not require abrading.
- This report remains widely used as the standard method for testing and comparing sealer capabilities.

Why did it fail?

The jump forms were lifted onto portions of the concrete shell that had gained insufficient strength due to the cold temperatures the night before

Willow Island, West Virginia

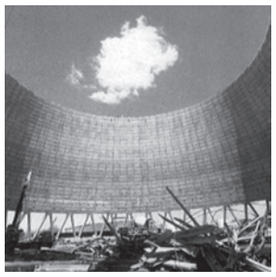
1978

WILLOW ISLAND COOLING TOWER

Collapse Investigation

On the morning of April 27, 1978, the jump form scaffolding collapsed at Cooling Tower No. 2 at the Monongahela Power Company station in Willow Island, West Virginia. WJE was retained to determine the cause of the collapse, which killed fifty-one construction workers. The firm's investigation included an analysis of the jump form system and concrete maturity tests to recreate conditions at the time of the event.

The tragedy focused increased attention on the issue of concrete maturity, and led to heightened awareness and critical improvements in the way early concrete strengths are specified and measured when early loading is anticipated. In the aftermath of the collapse, WJE was retained to redesign the entire jump form scaffolding system used at Willow Island and numerous other cooling towers under construction around the country.



Notes of Interest

- The tragic number of fatalities makes this the worst construction accident in U.S. history.
- Dick Elstner was the principal investigator of the collapse, with Don Pfeifer performing concrete maturity tests to recreate the circumstances at the time of failure.
- A jump form system was used, with the forms secured by bolts in one-day and three-day-old concrete. The framework for the concrete forms also provided the framing and support for the scaffolding platforms for the construction crews. The forms were designed to be progressively moved up the hyperbolic tower as it was built.
- The temperature had dropped to near freezing the night before the collapse, which significantly retarded the rate of strength gain in the recently placed concrete supporting the jump form scaffolding. The cause of the collapse was the imposition of construction loads on the shell before the concrete of Lift 28 had gained adequate strength to support these loads.

Why did it collapse?

Inadequate lateral bracing for wind and gravity loads

Rosemont, Illinois

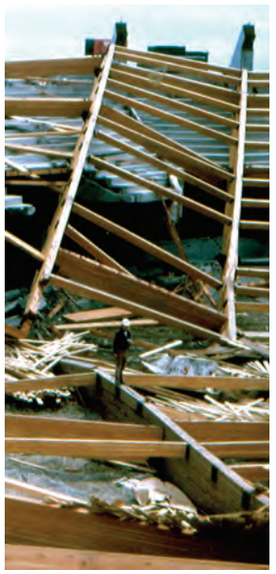
1979

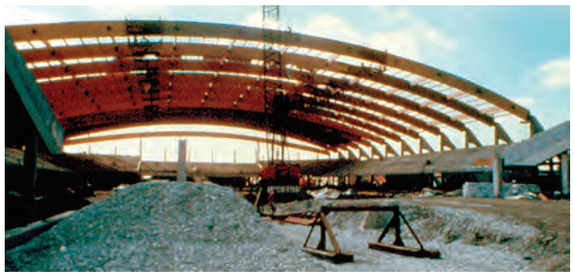
ROSEMONT HORIZON STADIUM

Roof Collapse Investigation

On August 13, 1979, the partially completed glued-laminated timber arch roof of the Rosemont Horizon Stadium collapsed during construction, killing five workers and injuring sixteen others. Laboratory testing and nonlinear computer analyses were performed by WJE to evaluate the stability of the roof structure as influenced by the strength and stiffness of the decking and temporary bracing. WJE determined that the collapse was caused by inadequate lateral bracing for wind and gravity loads.

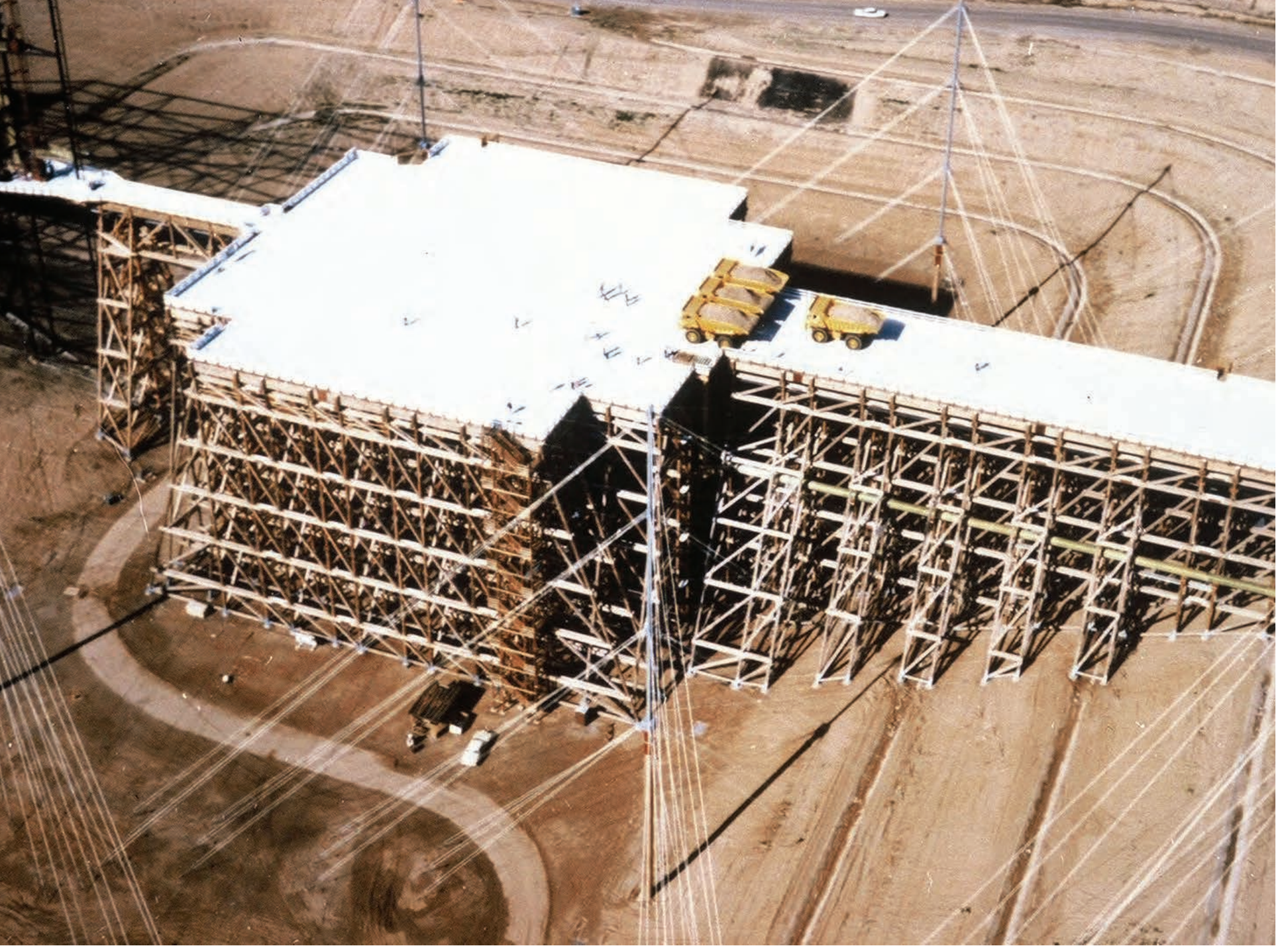
WJE's investigation of this failure was among the first to use nonlinear computer analyses to evaluate structural instability. The findings underscored the importance of temporary bracing during the course of construction. The Rosemont Horizon Stadium collapse and similar failures have led to much more stringent and specific code requirements for bracing of structures during construction.





Notes of Interest

- Four wire rope cables had been installed at the west end of the stadium to resist eastward movement of the roof structure during construction. No cable system was installed to resist westward movement of the roof.
- The stadium was located directly under the flight path for Runway 22R at O'Hare International Airport. One of the early theories of the collapse was that it was triggered by a plane or planes flying too low over the roof structure. Field testing performed by WJE using pressure transducers eventually disproved that theory.
- The City of Rosemont retained WJE to investigate the collapse and oversee the reconstruction of the roof structure. With the help of WJE, the stadium opened in May 1980.



What was the challenge?

Verification of the structural adequacy of the largest glued-laminated structure in the world

Albuquerque, New Mexico

1979

TRESTLE

Laboratory Testing, Analysis, Field Testing

In the late 1970s, the U.S. Department of Defense embarked upon a major research project to investigate the significant electromagnetic fields created by thermonuclear blasts and their disruptive effect on military communication systems. A massive timber structure (TRESTLE) was designed to allow a Boeing 747 aircraft, such as Air Force One, to taxi out and be supported within the middle of man-made magnetic fields. WJE was retained to perform extensive laboratory testing of the glued-laminated beams, columns, wood bolts, and gusset plates. WJE also independently analyzed TRESTLE to verify the adequacy of its design. Despite analysis results indicating that the structure had been properly designed, WJE was eventually hired to perform full-scale load testing of the as-built structure.

TRESTLE remains the largest glued-laminated structure in the world. The project is also significant because of the diverse structural analysis and testing services provided to assess this unique structure. The field load tests confirmed the structural adequacy of TRESTLE and verified the accuracy of WJE's earlier laboratory testing and computer analyses.

Notes of Interest

- TRESTLE, constructed at Kirtland Air Force Base, is twelve stories high and 1,000 feet long, with more than 10,000 structural members equivalent to six million board feet of lumber.
- The structure had to be entirely non-metallic so that it would not disrupt the magnetic fields generated as part of other Air Force studies at the site.
- After WJE had demonstrated by laboratory testing and structural analyses that TRESTLE could safely support a 747 aircraft, the Air Force was still nervous about its structural adequacy. Jack Janney, who had served as a Navy pilot during World War II, volunteered to personally taxi Air Force One onto the TRESTLE platform to show his confidence in WJE's findings and to prove that the structure was safe. His offer was not accepted and, instead, a full scale load test was performed using heavily loaded quarry trucks and aircraft tugs.


CELEBRATING 50 YEARS
WJE
ENGINEERS
ARCHITECTS
MATERIALS SCIENTISTS
50
1956-2006

CHAPTER 3
Branching Out

1981–1990

Kansas City Hyatt Regency
Walkway Collapse Investigation

Wood Truss Investigations
Inspections and Repairs

Railway Exchange Building
Facade Repair/Restoration

Rookery Building
Historic Preservation

Bahá'i House of Worship
Ornamental Concrete Investigation and Repair

Jacob K. Javits Convention Center
Space Frame Roof Analysis and Testing

Tribune Tower
Limestone Facade Investigation and Repair

Schoharie Creek Bridge
Collapse Investigation

Amoco Building
Investigation of Marble Panels and Recladding

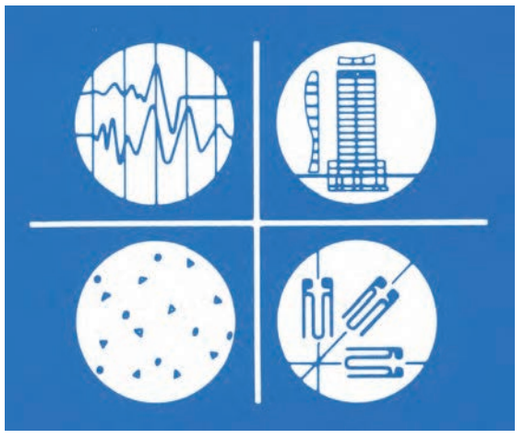
Busch Stadium
Parking Garage Evaluation and Repair

Columbia University
Facade Inspections and Roof Assessments

San Francisco City Hall
Facade and Roof Assessment

San Jacinto Monument
Assessment and Restoration

1981–1990: Branching Out



In 1981, Jack Wiss unexpectedly passed away, leaving WJE to mourn the loss of "Mr. Wiss." A nationally known engineer with expertise in structural vibrations, soil dynamics, and acoustic engineering, Jack Wiss was also noted as being the most formal of the three founding partners. Mr. Wiss showed great respect for his colleagues, and great respect was given in return.

Despite this loss, the company embarked on what would be a period of significant expansion during the 1980s—both in terms of the breadth of WJE's expertise and the number of office locations established around the country. By 1984, Wiss, Janney, Elstner Associates had five branch offices, with new offices established in Princeton Junction, New Jersey, in 1981; Denver, Colorado, in 1982; and Dallas, Texas, in 1983. By the end of the decade, five more branches opened, including offices in Austin, Texas, in 1984; Seattle, Washington, and Chicago, Illinois, in 1986; Washington, D.C., in 1989; and Atlanta, Georgia, in 1990.

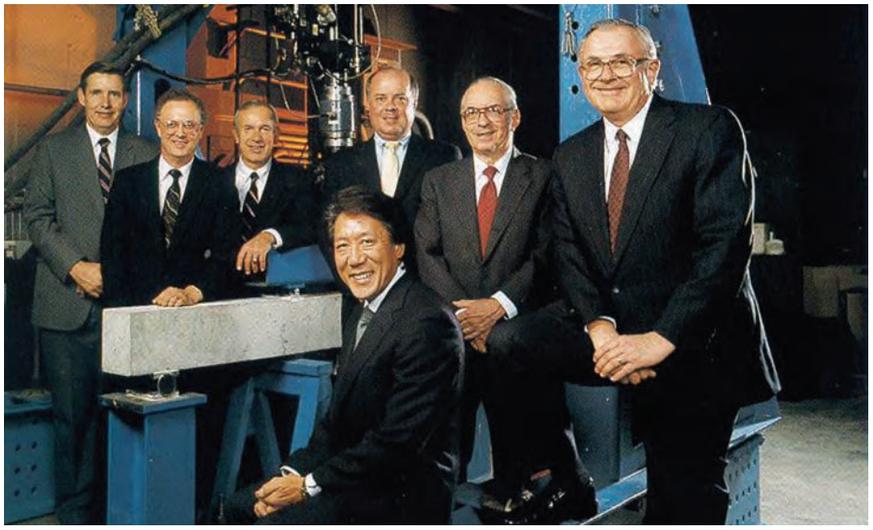
Also in 1984, WJE acquired Erlin, Hime Associates (EHA), a materials science and testing firm located in Northbrook, Illinois, which brought in-house petrographic and chemical analysis capabilities to the firm. *(Bill Hime is pictured at left.)* Shortly thereafter, a building next to the Northbrook headquarters was purchased. "Annex II" became the new home of the EHA division of WJE as well as the firm's original materials engineering group.

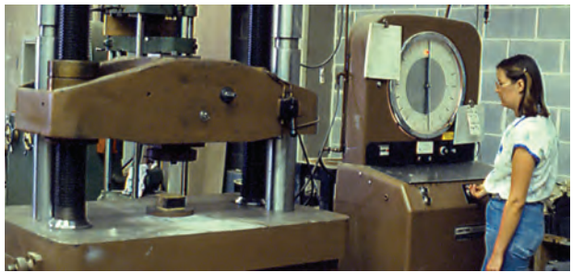
During the 1980s, the company expanded its services in architectural work as well. The investigation of building facades and roofing systems, as well as historic preservation, became strong components of WJE's portfolio during the 1980s. WJE engineers, architects, and materials scientists worked together to investigate problems and provide solutions for the repair and restoration of many different contemporary and historic structures nationwide.

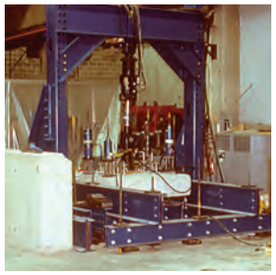
In 1989, United States Gypsum Corporation decided to sell off its WJE division and Wiss, Janney, Elstner Associates, Inc., became an employee owned company. This change was enthusiastically supported by the growing staff. By the time the first company-wide conference was held in 1989, WJE had a total of approximately 200 employees working on approximately 3,000 projects per year, with annual billings surpassing $20 million.

As the decade of the 1990s began, the WJE Difficult Access Team performed its first inspection of a building facade using rappelling techniques.

1981	1982	1983	1984	1985
Jack Wiss passed away. The Princeton Junction, New Jersey, branch office opened.	*The Denver, Colorado, branch office opened.*	*The Dallas, Texas, branch office opened.*	*WJE acquired Erlin, Hime Associates (EHA); the Austin, Texas, branch office opened.*	
Sandra Day O'Connor became the first woman justice on the U.S. Supreme Court. MTV broadcast its first music video.	The Vietnam Veterans Memorial was dedicated in Washington, D.C.		The first MacIntosh Apple computer went on sale.	President Reagan and Soviet leader Mikhail Gorbachev met to improve relations between their countries.







The Seattle, Washington, and Chicago, Illinois, branch offices opened.

WJE became an employee-owned company.

The Washington, D.C., branch office opened.

The firm held its first company-wide conference.

WJE had 200 employees and billings of more than $20 million per year.

The Atlanta, Georgia, branch office opened; the WJE Difficult Access Team performed its first facade inspection using rappelling techniques.

1986

The space shuttle Challenger exploded during launch on January 28, 1986.

1987

On October 19, 1987, "Black Monday," the stock market dropped 22 percent.

1988

The first transatlantic fiber-optic cable was installed.

George H. W. Bush was elected forty-first president of the United States.

1989

Fall of the Berlin Wall.

In May, one million people—many of them Chinese students—protested in Beijing's Tiananmen Square.

General Colin Powell became the first African American to chair the Joint Chiefs of Staff.

1990

The Americans with Disabilities Act was signed into law.

Why did it collapse?

The connection detail was poorly conceived, and a change during construction resulted in the load being doubled at a connection that was not strong enough in the first place.

Kansas City, Missouri

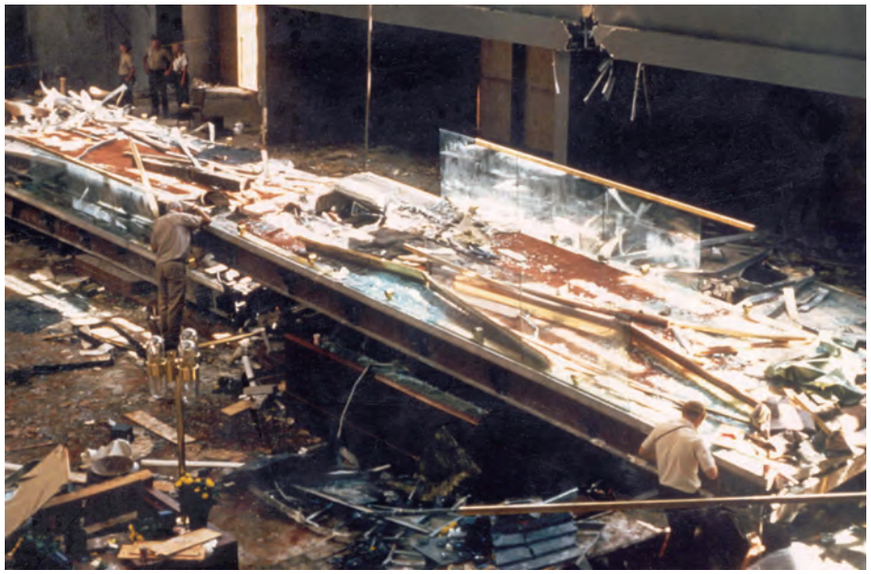
1981

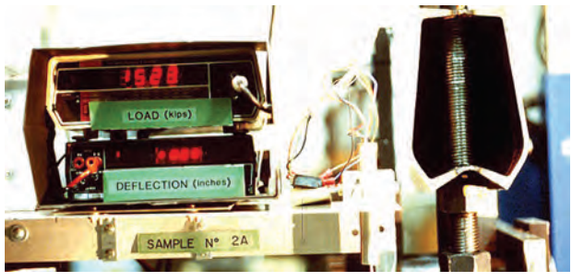
KANSAS CITY HYATT REGENCY

Walkway Collapse Investigation

On July 17, 1981, during a weekly dance held in the atrium lobby of the Kansas City Hyatt Regency, the connection of the steel rods suspending the fourth-floor walkway failed, causing the fourth- and second-floor walkways to collapse onto the crowded atrium floor. WJE led the primary investigation of the collapse, which included vibration testing of the remaining third-floor skywalk to assess possible effects of dynamic excitation, as well as laboratory testing of replicas of the failed connection.

The walkway collapse at the Kansas City Hyatt was one of the worst structural collapses in U.S. history, and led to significant improvements in steel design and construction. The collapse has had a profound impact on construction practices in the United States, especially on the respective responsibilities of structural engineers and steel fabricators.





Notes of Interest

- The design change that resulted in the failure was approved over the phone but never analyzed or tested.
- Even as originally designed, the walkways were barely capable of holding up the expected load and would have failed to meet the requirements of the Kansas City Building Code.
- It was reported that a worker who covered the walkways with drywall during construction noticed a box beam bending. Thinking nothing of it, he finished the job.

What was the challenge?

To develop and implement a methodology for investigation, analysis, and specification of repairs that can be implemented within a few hours at each project location

Nationwide

1981–present

WOOD TRUSS INVESTIGATIONS

Inspections and Repairs

WJE's significant involvement with defective wood trusses began with a $400 investigation of a structural deficiency in a plate-connected joint of a wood truss in a Chicago restaurant. Following that first inspection, WJE literally wrote the book on how to inspect and repair plate-connected wood trusses. Within a few hours at each location, WJE investigators determine as-built conditions, conduct a structural review, inspect the trusses, and specify the needed repairs. Since that initial investigation, WJE has conducted more than 2,500 roof truss investigations.

The investigation and repair procedures developed by WJE have improved the structural integrity of the roof systems at thousands of commercial buildings. The lessons learned have been shared with the industry, resulting in greater attention to quality control in the manufacturing of wood trusses. More than one hundred WJE engineers and architects have worked on these investigations and have crawled through tight attic spaces in search of defective roof trusses.

Notes of Interest

- Since WJE's first assignment for this client in 1981, WJE has billed over $7 million dollars in fees for work on more than 2,500 structures.
- Of all the inspections performed, two current WJE employees have performed more than 150 inspections: Joe Toniolo (250) and Kevin Kalata (175).
- The truss inspection project has been a difficult job because of the extreme access conditions that roof trusses can create. Project Manager Rich Kristie put it all in perspective: "We're in business to solve structural problems—if this is where we have to go to do it, we do it."

What did WJE contribute?

The long-term repair, restoration, and maintenance of historic and contemporary department store facilities nationwide

St. Louis, Missouri

1982–present

RAILWAY EXCHANGE BUILDING

Facade Repair/Restoration

The May Company retained WJE to help develop a plan for the restoration of the facade of its corporate headquarters, the Railway Exchange Building, in St. Louis, Missouri. The project included terra cotta restoration and window replacement. The successful restoration of the Railway Exchange has led to at least one additional project for the May Company in each successive year.

The May Company projects illustrate long-term continuing services for a single client; WJE's ability to offer comprehensive technical expertise and practical solutions for a wide range of repair projects; and the firm's active role in the preservation of historic landmarks. Collectively, WJE's work for the May Company has contributed to the revitalization of numerous urban centers across the country.

Notes of Interest

- Other historic May Company buildings for which WJE provided facade repair services include the Hecht Company Warehouse building in Washington, D.C.; Filene's downtown store in Boston; the Gimble's building in Pittsburgh; the Meyer Frank downtown store in Portland, Oregon; and the Lord & Taylor store in New York. Most of these buildings are on the National Register of Historic Places. In many cases, WJE received preservation awards and other recognition for these efforts.
- When completed in 1914, the twenty-story Railway Exchange was the tallest building in St. Louis.
- WJE has also provided many types of services for well over one hundred other May Company mall stores around the country. These services have included marble inspections, exterior wall reclads, and even seismic upgrades. Ongoing May Company (now Federated Department Stores) work includes repairs to the historic Marshall Field's store in downtown Chicago and the Kaufmann's store in Pittsburgh.

What did WJE contribute?

In-depth understanding of the archaic cast iron, wrought iron, and terra cotta structural systems

Chicago, Illinois

1984

ROOKERY BUILDING

Historic Preservation

The Rookery Building was designed by the renowned architectural firm of Burnham & Root in 1888. Frank Lloyd Wright remodeled the interior public spaces in 1905. WJE personnel were initially involved in the preparation of a Historic Structure Report and the restoration of the exterior facades. For the interior building restoration that followed, WJE performed structural and materials analyses of terra cotta, brick and mortar, cast and wrought iron, and clay tile. WJE contributions to the project also involved evaluation of historical load test data, structural analysis, load testing, and design of repairs.

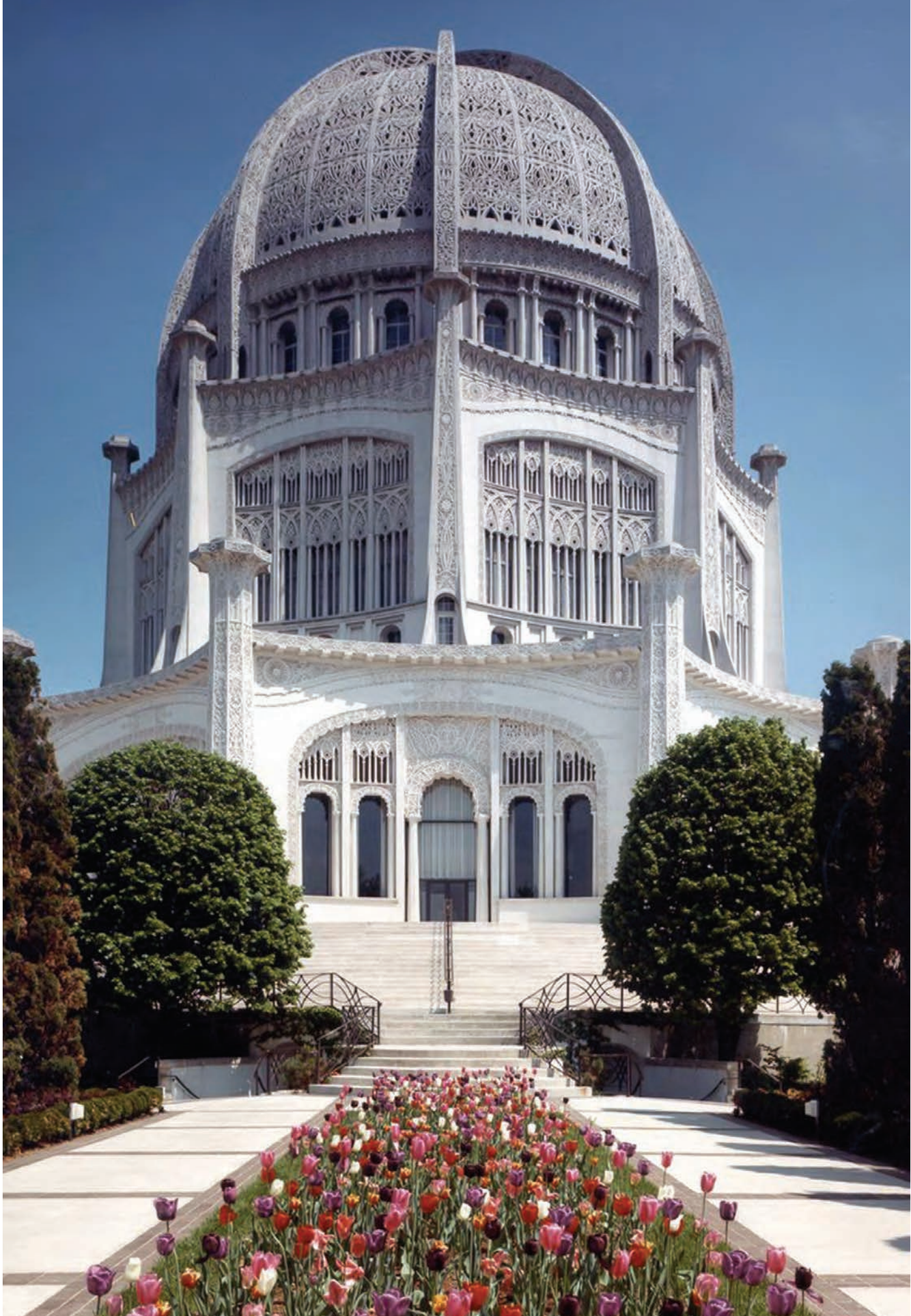
The Rookery Building, a National Historic Landmark, is one of Chicago's most important historic buildings. WJE provided unique structural engineering expertise to understand and evaluate the Rookery's archaic structural systems and to design measures to preserve the building and permit its continued use.

Notes of Interest

- After the Great Chicago Fire of 1871, a dilapidated building that occupied the southeast corner of LaSalle and Adams Streets was used temporarily as City Hall. The legend is that pigeons became such a nuisance at this location that a Chicago citizen, demanding that the city do something about the problem, called the City Hall a "rookery." The press adopted the nickname and it soon became common among the city's residents. After the construction of a new building for City Hall, several names were considered, including the Central Building. Ultimately, "The Rookery" stuck.
- The Rookery Building is a National Historic Landmark. Designed by John Wellborn Root and Daniel H. Burnham in 1888, it is considered one of their masterpieces.
- Root devised the "grillage foundation"—iron rails and structural beams in a crisscross pattern and encased in concrete—to support the building's immense weight without heavy foundation stones.

What was the challenge?

Designing repairs that would match the appearance of the ornamental historic precast concrete facades and terraces while providing enhanced durability



Wilmette, Illinois

1985–present

BAHÁ'I HOUSE OF WORSHIP

Ornamental Concrete Investigation and Repair

Completed in 1953, the Bahá'i House of Worship in Wilmette, Illinois, was designed by architect Louis Bourgeois and engineer John J. Earley for the National Spiritual Assembly of the Bahá'is of the United States. It was placed on the National Register of Historic Places in 1978. Since 1985, the National Spiritual Assembly has retained WJE to design the restoration of the ornamental precast concrete facades, stairs, and terraces, as well as cleaning and waterproofing of the exterior concrete. The project has included hands-on inspection, field and laboratory testing of the concrete, petrographic studies, structural analysis, and development of repair details and construction documents.

WJE provided rigorous coordination during implementation of the repairs to ensure an appropriate concrete mix that matched the building's original highly decorative surfaces. The firm has received numerous awards for its work on the Bahá'i House of Worship, both for preservation of a significant architectural masterwork and for the inventive technical approach WJE has used in the concrete repair.

Notes of Interest

- The Wilmette house of worship is the largest and the oldest surviving Bahá'i House of Worship, second only to the original temple in Russia, which was destroyed in an earthquake.
- The building has nine sides, representing the nine religions subsumed under the Bahá'i faith.
- Bahá'i Houses of Worship are open to all people. Services focus solely on the worship of God, and there are no collections and no sermons. Only the Word of God is uttered within the Temple, with readings from all the holy writings of the earth. The only instrument used is the human voice, and the choir in any Bahá'i House of Worship sings without instrumental accompaniment.

What was the challenge?

Development of a large, complex computer model to evaluate a complex structure

New York, New York

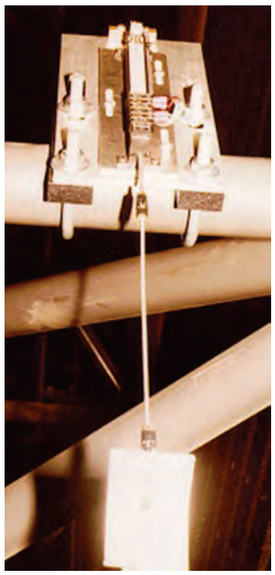
1985

JACOB K. JAVITS CONVENTION CENTER

Space Frame Roof Analysis and Testing

Designed by James Ingo Freed of Pei Cobb Freed & Partners, the 1.6 million square foot Jacob K. Javits Convention Center is covered by a unique space frame roof. Given the unusual nature of the space frame, the owner engaged WJE to conduct peer reviews and independent computer analyses of the roof structure. WJE later designed and installed a sophisticated structural monitoring system to verify that the structure was behaving as predicted. The lessons learned in developing the system were later employed on a variety of structural monitoring projects.

The review of the space truss roof framing incorporated a wide range of expertise and required collaboration between three WJE offices: Princeton, San Francisco, and Northbrook. The project also required the development of a large, complex computer model that predated the use of graphics to view analytical results.



Notes of Interest

- The Javits Convention Center is one of the world's largest, most technically advanced exposition halls. It is easily recognized by its thousands of glass cubes that mirror the New York City skyline. Encompassing more than 575,000 square feet and one hundred meeting rooms, it can accommodate six events simultaneously.
- The center's south end is distinguished by a spectacular 150-foot-high lobby, known as "The Crystal Palace."
- In 2006, construction began on phase one of the Jacob K. Javits Convention Center Expansion and Modernization Plan. The expansion will more than double the size of the convention center, allowing the city to host some of the largest and most lucrative conventions, exhibitions, trade shows, and events in the country.
- The convention center is named after former New York Senator Jacob K. Javits.

What was the challenge?

To provide ongoing technical preservation consulting for the restoration and maintenance of this landmark structure

Chicago, Illinois

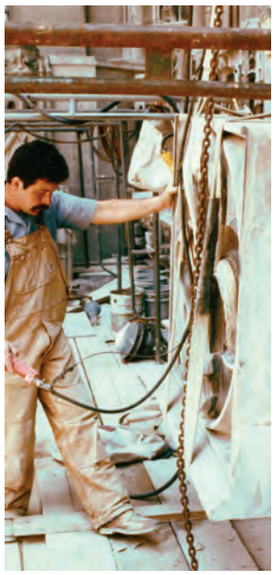
1986–present

TRIBUNE TOWER

Limestone Facade Investigation and Repair

New York architects Raymond Hood and John Mead Howells won the 1922 international design competition for the Chicago Tribune Tower, which has become one of the city's most notable historic landmarks. The Tribune Company has engaged WJE to work on a variety of projects to restore and maintain the building's appearance, beginning with a multi-year exterior restoration of the highly ornamental, buttressed limestone facade that was completed in 1999. In 2001 and 2005, the WJE Difficult Access Team performed inspections of the limestone exterior, using rope-descent techniques to access the many complex profiles of the building facade.

WJE work on the landmark Tribune Tower has returned this Chicago icon to its historic appearance. A revolutionary facade cleaning system, imported from France and used for the first time in the United States on the Tribune Tower, was significant to the successful completion of this restoration.



Notes of Interest

- The Tribune Tower is the home of the *Chicago Tribune* and the Tribune Company. WGN Radio also broadcasts from the building, with ground-level studios overlooking nearby Pioneer Court and Michigan Avenue.
- Prior to the building of the Tribune Tower, correspondents for the *Chicago Tribune* brought back rocks and bricks from a variety of historic sites throughout the world at the request of Colonel Robert McCormick. Many have been incorporated into the exterior of the building and labeled with their location of origin. Stones included in the wall are from such sites as the Taj Mahal, the Parthenon, the Great Pyramid, the Alamo, Notre-Dame Cathedral, Abraham Lincoln's tomb, the Great Wall of China, and the Berlin Wall, among others. In all, there are 136 fragments in the building. More recently, NASA loaned a piece of moon rock to be displayed in a window. A piece of steel recovered from the World Trade Center is another recent addition to the wall.
- The tower's site was chosen for its proximity to the old printing plant, which was built in 1916 and still stands on the east side of the tower.

What did WJE contribute?

Increased understanding of scour around bridge supports, and enhanced awareness and monitoring of this condition nationwide

Amsterdam, New York

1987

SCHOHARIE CREEK BRIDGE

Collapse Investigation

On April 5, 1987, two spans of the five-span Schoharie Creek Bridge on the New York State Thruway plunged into the flood-swollen creek; about ninety minutes later, a third span collapsed into the water. Within hours, the New York State Thruway Authority retained WJE to launch an exhaustive investigation into the cause of failure of this thirty-one-year-old structure.

The investigation of the collapse of the Schoharie Creek Bridge focused attention upon the potentially catastrophic consequences of scouring around bridge supports. It triggered an increased level of awareness and monitoring of scour by state transportation departments across the country. The project also confirmed WJE's reputation as a bridge expert and enhanced its reputation as a firm with the ability to respond quickly to catastrophic failures.

Notes of Interest

- Although the Schoharie Creek Bridge had been inspected annually or biennially since 1968, an underwater inspection of the pier footings had never been performed. The bridge was scheduled for an underwater inspection in 1987, but the bridge collapsed before the inspection took place.
- The WJE report noted that bridges must be designed for hydraulic, geotechnical, and structural effects. Of the three, only the geotechnical design, relying on the support strength of the glacial till, was satisfactory.
- Due to the collapse of the Schoharie Creek Bridge and other bridges failing in a similar manner, bridge inspectors were further trained to recognize scour potential by examining and comparing any changes in the conditions from previous inspections. Scouring failures also sparked much-needed research for detecting scour potential.

What did WJE contribute?

An increased understanding of the way in which thin marble claddings fail, and unique detailing for facade recladding

Chicago, Illinois

1988

AMOCO BUILDING

Investigation of Marble Panels and Recladding

The exterior of the eighty-two-story Amoco Building was clad in white marble panels imported from Carrara, Italy. In 1986, significant cracking and bowing of the building's marble panels led to an extensive investigation by WJE. The study concluded that the panels were continuing to lose strength and the risk of panel failure under high winds was increasing. After extensive research on replacement materials, WJE designed and oversaw the recladding of the building with Mount Airy granite.

The Amoco Building is the tallest building in the world that has ever been reclad, and it is the tallest building in the world clad with granite panels. This project established WJE as an expert in stone investigation and design. The investigative approach and tests developed for the Amoco Building have been applied by WJE engineers and architects on dozens of other projects.

TOP 10

The Amoco Building is the tallest building in the world that has ever been reclad. This project established WJE as the leaders in stone evaluation. – *Ian Chin*

From the initial investigation to the final repair design and implementation, our in-house multidisciplinary expertise was instrumental. – *Jim Connolly*

A monumental project requiring the full range of WJE skills – *Gary Klein*

Investigation of loss of strength of marble panels and then safeguarding one of the tallest buildings in the world – *John Hanson*

Notes of Interest

- The Amoco Building is currently the fourteenth tallest building in the world, and the tallest building in the world without any major antennae, spires, or finials at the top.
- From 1990 to 1992 the building's 43,000 marble cladding panels were replaced by two-inch-thick Mt. Airy granite panels at a cost of about $80 million.
- The marble removed from the cladding of the building was crushed and used as decorative stone to surround Amoco refineries, notably the refinery in Whiting, Indiana. Some intact marble panels were donated by Amoco to teach disabled individuals how to fabricate small stone items like bookends, clocks, and pen holders.

What did WJE contribute?

Design and implementation of the largest post-tensioning repair project in the United States

St. Louis, Missouri

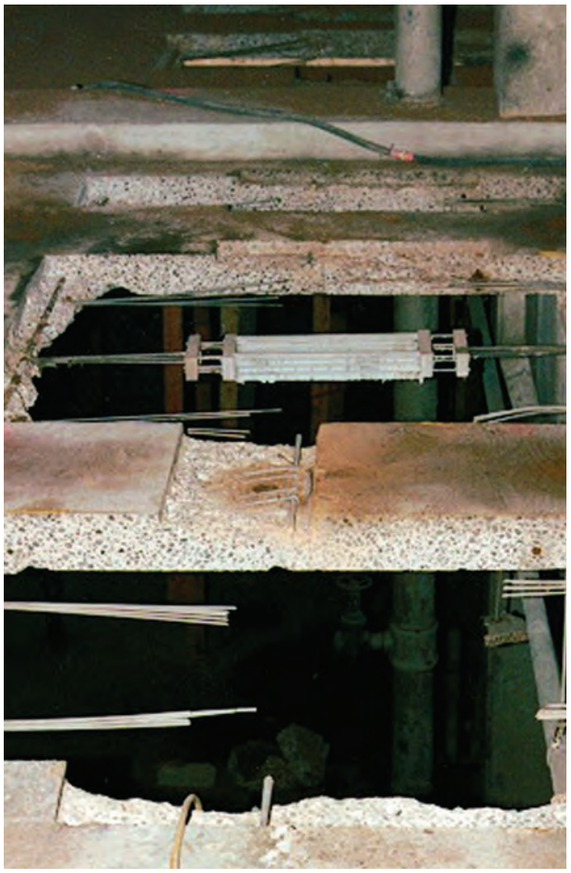
1990

BUSCH STADIUM

Parking Garage Evaluation and Repair

The two nine-story parking garages at the old Busch Stadium occupy an entire city block in downtown St. Louis, Missouri. In 1990, WJE conducted an evaluation of the condition of these two large structures, necessitated by the apparent failure of two post-tensioning tendons in the east garage. Because the initial evaluation revealed extensive corrosion, Anheuser-Busch engaged WJE to design a repair program for both garages.

At completion, the Busch Stadium garage repair was the largest post-tensioning repair project in the United States. Approximately 1,000 tendon repairs were performed in these two facilities. The project helped WJE gain expertise in post-tensioning evaluation and develop repair techniques that are still in use.



Notes of Interest

- Due to the size of the garages and the extent of the work, the repairs took approximately eighteen months to complete.
- The stadium was designed by Edward Durell Stone, who also designed the Kennedy Center for the Performing Arts in Washington, D.C., and the Amoco Building in Chicago, Illinois.
- Busch Stadium hosted World Series games in six different seasons: 1967, 1968, 1982, 1985, 1987, and 2004. The stadium was also the site of Mark McGwire's historic sixty-second home run of the 1998 season that broke Roger Maris' single-season record, as well as McGwire's seventieth of that season (a record that lasted until Barry Bonds surpassed it in 2001).

What was the challenge?

To provide ongoing investigation, repair design, and construction phase services for more than sixty historic and contemporary structures

New York, New York

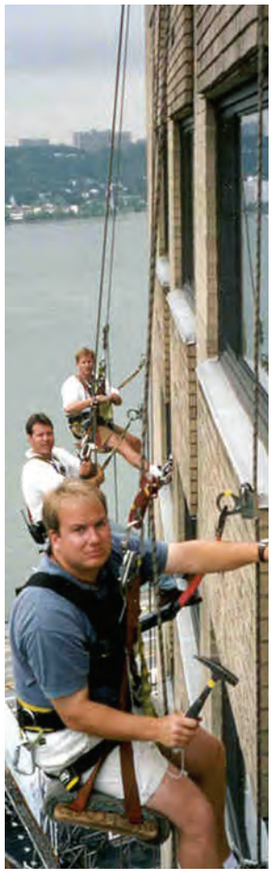
1990–present

COLUMBIA UNIVERSITY

Facade Inspections and Roof Assessments

Columbia University is one of the largest property owners on New York City's Upper West Side. Its extensive portfolio of properties includes a variety of institutional structures on the main campus and more than 170 residential and commercial properties in the surrounding neighborhoods. Following the successful investigation and repair of Bard Haven Towers, Columbia's Office of Institutional Real Estate retained WJE to provide investigation, repair, and preservation services for many other structures. To date, WJE has worked on more than sixty buildings at Columbia.

WJE's ability to deliver a broad range of capabilities and adeptness in simultaneously managing multiple short- and long-term projects are critical to meeting the university's diverse needs. This project exemplifies WJE's ability to mobilize staff from several offices to complete complex and challenging projects.



Notes of Interest

- The Office of Institutional Real Estate manages all of the university's off-campus properties. Columbia University owns and directly manages approximately 6,000 residential units in 168 buildings, which are primarily used to house faculty, staff, and students.
- The main campus of Columbia University was designed by McKim, Mead & White in 1894. It occupies an area of thirty-two acres, covering six blocks of Manhattan.
- A number of movies have been filmed at Columbia, including *Ghostbusters*, *The Graduate*, *Malcolm X*, *Eternal Sunshine of the Spotless Mind*, and *Spider-Man*.
- Columbia University's alumni roster includes two U.S. presidents, six Supreme Court justices, and thirty-seven Nobel Prize winners.

What did we accomplish?

Implemented the first large-scale condition assessment of a historic structure using rappelling techniques for access

San Francisco, California

1990

SAN FRANCISCO CITY HALL

Facade and Roof Assessment

The San Francisco City Hall was built in 1915 to replace the previous city hall building, which had collapsed in the 1906 earthquake. After the building was damaged by the Loma Prieta earthquake in 1989, the City of San Francisco sought to upgrade the building's structural system to meet current seismic codes. WJE assessed the condition of the dome and exterior stone facades, and developed recommendations for repair and restoration.

WJE's newly created Difficult Access Team (DAT) used rappelling methods adapted from mountain climbing techniques to inspect areas of the dome that were inaccessible by traditional access methods such as suspended or fixed scaffolding. The project launched company-wide use of this unique inspection technique. More than two hundred projects across the country have since been performed using specialized methods for difficult access.

Notes of Interest

- San Francisco City Hall is a National Historic Landmark and often referred to as "The Crown Jewel" of the finest ensemble of neoclassical architecture in America. City Hall was designed by Arthur Brown, Jr., who also designed the San Francisco War Memorial Opera House and Veterans Building, Temple Emanu-El, Coit Tower, and 50 United Nations Plaza.
- In 1913, San Francisco Mayor James "Sunny Jim" Rolph, Jr., installed a time capsule at the base of City Hall. That box was accidentally discovered in 1997 during the City Hall renovation and seismic retrofit. It contained old coins, newspapers, and public documents related to the original groundbreaking of City Hall.
- The building's dome is the fifth largest in the world, rising fourteen inches higher than the United States Capitol.
- There is approximately $400,000 worth of gold in the dome's design.

What was the problem?

Deterioration related to corrosion of embedded galvanized anchors used in combination with fossiliferous Cordova shell stone

La Porte, Texas

1990

SAN JACINTO MONUMENT

Assessment and Restoration

The San Jacinto Monument was constructed in 1936 to commemorate the centennial of the battle in which Texas won its independence from Mexico. By the 1980s, distress in the Cordova shell stone had resulted in fragments falling from the 570-foot-tall monument. The Texas Parks and Wildlife Department engaged WJE to design the restoration of the monument. WJE performed archival research, a detailed investigation, and site and laboratory testing, as well as design and construction phase services for the restoration.

This project involved significant and innovative engineering assessment of distress conditions, combined with extensive petrographic and laboratory assessments of stone materials. The combination of WJE technical expertise with an innovative trial repair program allowed the team to evaluate and refine each repair technique, providing a basis for quality control as the overall repairs were implemented.

Notes of Interest

- On April 21, 1836, Mexican rule over Texas came to a dramatic close, as General Sam Houston's Texas revolutionaries defeated the "Napoleon of the West," Mexican General Antonio López de Santa Ana, and his army. The climax of the Texas Revolution—the Battle of San Jacinto—eventually moved America's western border to the Pacific Ocean.
- The San Jacinto Monument—fifteen feet taller than the Washington Monument—honors all those who fought for Texas independence.
- The shaft itself is octagonal, forty-eight feet at its base, thirty feet at the observation level, and nineteen square feet at the base of its crowning jewel—a 220-ton star made from stone, steel, and concrete. Despite the scale, danger, and novelty of the project, not a single life was lost during its construction.
- As a result of the Battle of San Jacinto, almost a third of what is now the United States of America changed ownership. In the end, the United States gained not only Texas but also New Mexico, Nevada, Arizona, Utah, and parts of Oklahoma, Kansas, Colorado, and Wyoming.


CELEBRATING 50 YEARS
WJE
ENGINEERS
ARCHITECTS
MATERIALS SCIENTISTS
50
1956-2006

CHAPTER 4
Employee Ownership

1991–2005

Kennedy Center for the Performing Arts
Investigation and Preservation/ Rehabilitation Design

NCHRP 12-37
Transverse Cracking in Newly Constructed Concrete Bridge Decks

Federal Highway Administration
Corrosion Resistant Reinforcing Study

Pacific Park Plaza
Overcladding

Reliance Building
Investigation and Repair of Terra Cotta

Seattle Kingdome
Roof Investigation/Renovation

Nebraska State Capitol
Exterior Facade Investigation and Restoration Design

Federal Highway Administration
Nondestructive Evaluation Center Development

Korea High-Speed Rail System
Quality Audit

Koror-Babeldaob Bridge
Collapse Investigation

TWA Flight 800
Reconstruction

Los Angeles County Buildings
Earthquake Damage Evaluation

Cape Hatteras Lighthouse
Preservation and Instrumentation for Relocation

Lawrence Livermore National Laboratory
Structural Instrumentation of the Contained Firing Facility

Wacker Drive
Structural and Durability Studies for Reconstruction

Alcatraz Cellhouse
Stabilization and Seismic Upgrade

Poplar Street Complex
Seismic and Redundancy Retrofit Project

1991–2005: Employee Ownership

The 1990s were marked by continued change and growth, unique project challenges, and increased national attention on the company and its work. In 1992, a flood in Chicago's downtown Loop area led to twenty new projects for WJE. In 1993, the first terrorist attack on the World Trade Center in New York City required the expertise of WJE staff to perform damage assessment surveys. In 1994, the company inspected hundreds of buildings after a massive earthquake centered near Northridge, California. When a large piece of the ceiling at the Kingdome in Seattle fell just prior to the start of a Mariners' game in July 1994, WJE engineers, architects, scientists, and technicians were asked to investigate the condition of the coliseum roof and develop documents for re-roofing the dome. One of the company's most unusual and challenging assignments was the reconstruction of the ill-fated TWA Flight 800, which exploded shortly after take-off on July 17, 1996. The reconstructed aircraft segment was featured in many television news broadcasts and publications.

The company's architectural expertise was also sought by numerous entities, both public and private, to investigate and repair many high-profile buildings and historical structures, including the Reliance Building, a National Historic Landmark in downtown Chicago, and the Kennedy Center for the Performing Arts, a national memorial in Washington, D.C. Additionally, WJE architects were involved in a variety of projects at historic churches, civic centers, department stores, and state capitols across the country.

As the expertise of WJE continued to grow, additional branch offices were established around the country: Cleveland (1993); Detroit (1994); Houston (1997); New York City and Minneapolis (1998); New Haven and Boston (2000); Los Angeles (2004).

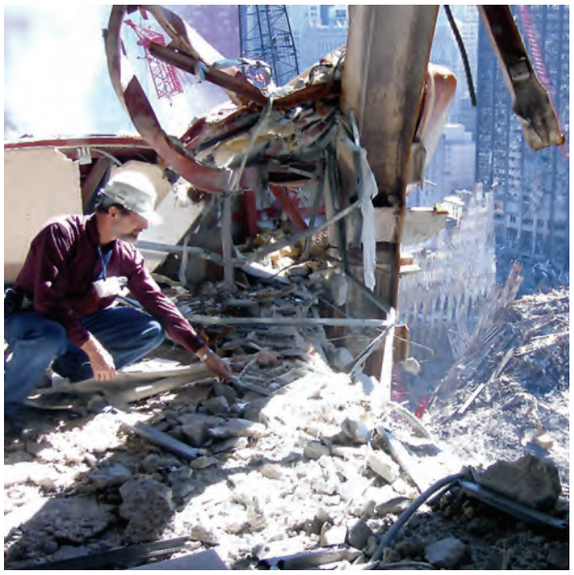
In addition to the undertaking of a number of well-known projects and establishing new offices, the 1990s witnessed further transitions in leadership within the company. In 1992, John Hanson announced his retirement as president of WJE after thirteen years of service to assume a chaired professorship at North Carolina State University. The Board of Directors elected Jerry Stockbridge, vice president of WJE, to succeed him. Stockbridge led the company for five years, until his retirement in 1997. The Board then selected Bill Nugent *(top left)*, as the fourth president of the firm and Gary Klein *(center left)* as chairman of the board. Both Bill and Gary had first joined the firm as young engineers in the late 1970s.

The 1990s era was marked by great loss as well. In 1996, the company mourned the passing of Dick Elstner. A principal and one of the three original partners, Dick Elstner was respected as an insightful investigator of structural failures and one of the country's foremost glass experts. Within the company, he was known for his perpetual optimism and humor, and as a mentor of younger WJE staff.

As the twentieth century came to a close, the company approved a major restructuring of the employee stock ownership plan, adopted ten years earlier with the repurchase from USG. The new plan called for shares of stock to be owned directly by employees. This approach provided for a broader level of ownership, as employee-owners made a monetary investment in the future of WJE for the first time.

With the dawn of a new century, new challenges and opportunities continued to present themselves. In 2001, WJE responded to the Nisqually earthquake in Seattle, and the horrific damage sustained in New York and Washington, D.C., on September 11th. In 2005, more than seventy employees from nineteen offices met the challenge of a large retail chain to perform emergency inspections and retrofits on more than 300 stores across the country. And in the late summer and fall of 2005, WJE responded to the demand for engineers and architects to evaluate the damage in the aftermath of Hurricanes Katrina, Rita, and Wilma.

1991	1992	1993	1994	1995	1996	1997	1998
The United States and its allies defeated Iraq in the Persian Gulf War.	William J. Clinton was elected forty-second president of the United States.	The North American Free Trade Agreement (NAFTA) was ratified by the U.S. Congress.	On January 17, 1994, the Northridge Earthquake struck southern California.	On April 19, 1995, the Alfred P. Murrah Federal Building in Oklahoma City was bombed.	On July 17, 1996, TWA Flight 800 exploded and crashed off Long Island.	On August 31, 1997, Diana, Princess of Wales, was killed in a car crash in Paris.	
	John Hanson retired as president of WJE.	*The Cleveland, Ohio, branch office opened.* *Vice President Jerry Stockbridge became president.*	*The Detroit, Michigan, branch office opened.*		*Dick Elstner passed away.*	*The Houston, Texas, branch office opened.* *Jerry Stockbridge retired as president; Bill Nugent became president and Gary Klein became chairman of the board.*	*The New York, New York, and Minneapolis, Minnesota, branch offices opened.* *WJE senior staff approved a major restructuring of the stock ownership plan.*



Jack Janney was named one of the 125 Most Influential People in the past 125 years by Engineering News Record.

The New Haven, Connecticut, and Boston, Massachusetts, branch offices opened.

The Los Angeles, California, branch office opened.

1999

After nearly 100 years of control by the United States, the Panama Canal was transferred to the Republic of Panama.

2000

George W. Bush was elected forty-third president of the United States.

2001

The September 11th terrorist attacks occurred in New York City and Washington, D.C.

2002

2003

The United States led an invasion of Iraq and removed Saddam Hussein from power.

2004

The Boston Red Sox won the World Series for the first time since 1918.

2005

Hurricane Katrina struck the north-central Gulf Coast in late August.

What was the challenge?

Leading a multidisciplinary project team on a multi-year effort to restore and rehabilitate an occupied performing arts center that is also a national memorial

Washington, District of Columbia

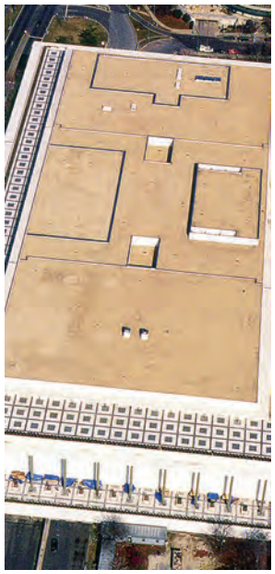
1991–2005

KENNEDY CENTER FOR THE PERFORMING ARTS

Investigation and Preservation/Rehabilitation Design

After several years of intensive public use without major capital improvements, many elements and systems of the Kennedy Center for the Performing Arts had deteriorated or become obsolete. By the mid-1990s, problems had developed with roofing, terrace waterproofing, marble paving and cladding, and outdated building systems. WJE was engaged to investigate and design improvements including repair of the building envelope, expansion of the parking garages, and landscaping of the site. WJE also directed modernization of all building systems and restoration of the theaters, concert halls, and other interior spaces.

For more than fourteen years, WJE led a multidisciplinary team of consulting firms on this project, providing administrative as well as technical services in a wide range of disciplines to achieve the comprehensive preservation and rehabilitation of this national landmark. All services were performed on an occupied and highly active and visible performing arts center.



Notes of Interest

- President John F. Kennedy and his wife, Jacqueline, were strong advocates of the arts, and played an active role laying the groundwork for what would become the National Endowment for the Arts. "I am certain that after the dust of centuries has passed over our cities," President Kennedy once said, "we, too, will be remembered not for our victories or defeats in battle or in politics, but for our contribution to the human spirit."
- The Grand Foyer, at sixty feet high and 630 feet long, is one of the largest rooms in the world. If laid on its side, the Washington Monument would fit in this room with seventy-five feet to spare.
- The Kennedy Center for the Performing Arts is one of the nation's leading performing arts venues, with more than 3,000 performances that play before nearly two million patrons each year.

What did WJE accomplish?

A research study that established primary guidelines for concrete materials and construction practices

Northbrook, Illinois

1992

NCHRP 12-37

Transverse Cracking in Newly Constructed Concrete Bridge Decks

This comprehensive study identified the factors involved in the concrete materials, design details, and construction practices that influence the occurrence of early transverse cracking in bridge decks. The work included a thorough review of research to date, field monitoring of temperatures and stresses during construction, development of laboratory procedures to test the cracking tendency of concrete mixes, and parameter analyses.

The research findings of NCHRP 12-37 were published in NCHRP Report 380, Transverse Cracking in Newly Constructed Bridge Decks*, and included guidelines for materials and construction practices to minimize potential cracking. The report also provided guidelines for selection of concrete materials and construction practices that reduce or eliminate the occurrence of cracking in new concrete. NCHRP Report 380 remains a primary research reference today.*

Notes of Interest

- Instrumentation of the bridge deck included a computer-controlled data acquisition system that monitored strain in the concrete deck with concrete embedment gages; strain gages mounted on the surface; and instruments to monitor wind speed, temperature, humidity, and solar conditions, as well as radiation. The computer was connected to a modem for downloading data to a remote site for data analysis and reduction.
- Administered by the Transportation Research Board and sponsored by the member departments of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration, the National Cooperative Highway Research Program (NCHRP) was created in 1962 as a means to conduct research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide.

What did WJE accomplish?

Defined industry-wide alternatives
for preventing corrosion of reinforcement
in concrete

Northbrook, Illinois

1993–1998

FHWA

Corrosion Resistant Reinforcing Study

In 1993, the Federal Highway Administration (FHWA) began a study to develop new types of organic, inorganic, ceramic, and metallic coatings, as well as metallic alloys that could be used on or as concrete reinforcement. The objective of the study was to identify the most cost-effective corrosion-resistant reinforcing bar types with intended seventy-five to one-hundred-year design expectations.

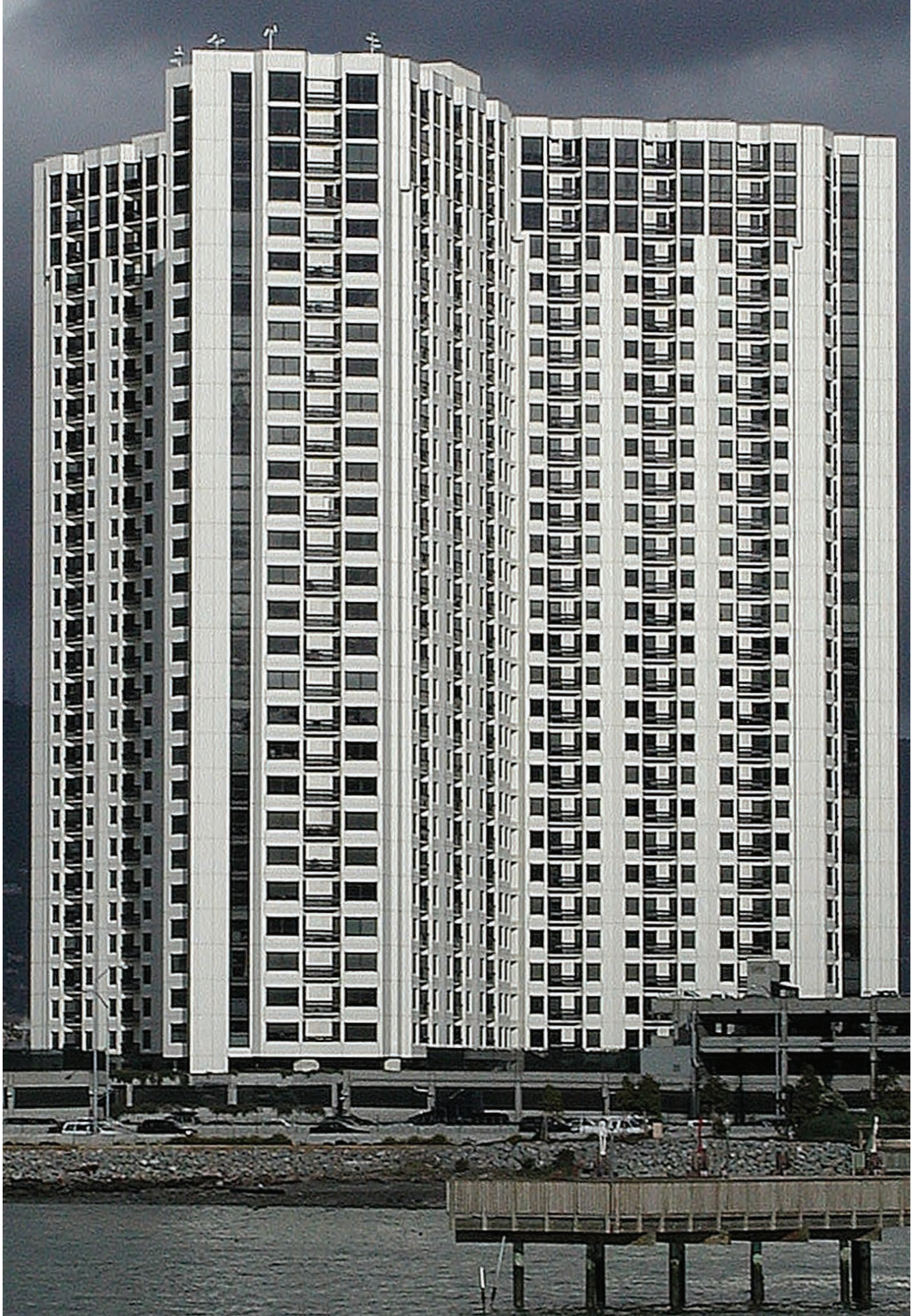
This ambitious and monumental corrosion study established WJE as a leader in the research of corrosion of embedded metals in concrete. The FHWA-published reports, as well as other publications and countless presentations worldwide, helped the industry define alternatives for preventing corrosion of reinforcement in concrete.

Notes of Interest

- The 1993–1998 research program involved testing more than fifty-two different organic, inorganic, and metallic coatings on steel bars, as well as solid metal reinforcing bars (epoxy-coated, other polymer-coated, ceramic-coated, galvanized-clad, epoxy-coated galvanized-clad, stainless steel clad, nickel clad, copper-clad, corrosion-resistance alloy-clad, inorganic silicate-clad, solid corrosion resistance alloy steel, solid aluminum-bronze, solid stainless steels, and solid titanium). Twelve bar types were selected for long-term durability tests in concrete exposed to the very aggressive cyclic testing.
- The FHWA has several predecessors, the first of which being the Office of Road Inquiry. On October 3, 1893, General Roy Stone took charge of the new Office of Road Inquiry, with a budget of $10,000 and a staff consisting of one stenographer. The small agency became a leader in the Good Roads Movement and has grown to include 3,800 employees and division offices in every state.

What was the challenge?

To design the first major overcladding of an existing high-rise facade



Emeryville, California

1994

PACIFIC PARK PLAZA

Overcladding

Pacific Park Plaza in Emeryville, California, is an irregularly shaped thirty-story condominium building originally clad with an exterior insulation finish system (EIFS). When the EIFS cladding developed extensive leakage problems, the Pacific Park Plaza Homeowners Association retained WJE to investigate the building envelope failure and design a new cladding system to be constructed over the existing facades.

This project, an early example of overcladding for existing facades, established WJE as a premier facade and waterproofing consultant in California. The project also enhanced WJE's reputation as a leader in large-scale architectural consulting services, and was instrumental in the growth and technical development of the San Francisco branch office.

Notes of Interest

- This project used an innovative solution that combined solid aluminum rain screen panels with the existing EIFS to solve a massive waterproofing problem. It was the first known use of Riv-Nuts to support cladding and is still one of the largest rain screen applications in the United States.
- Before colonization by Spain in 1776, this area was the site of extensive Native American settlements. Mudflats rich with clams and rocky areas filled with oysters provided a reliable food source for the area's early inhabitants, who disposed of their clam and oyster shells in a single place over time, creating what is known as the Emeryville Shellmound, a massive archaeological site.

What did WJE contribute?

Technical solutions for the restoration of the exterior terra cotta facades of this unique historic landmark

Chicago, Illinois

1994

RELIANCE BUILDING

Investigation and Repair of Terra Cotta

Designed by D.H. Burnham & Co. and completed in 1895, the Reliance Building is a unique expression of a skeleton frame in terra cotta cladding. As part of the process of restoring the exterior of this historic landmark, WJE was retained to investigate and develop the restoration design for the terra cotta facades, and to design a new cast aluminum cornice to replicate the missing original terra cotta. The restoration of the exterior facades was the first phase in the conversion of this historic office building to a luxury hotel.

WJE's award-winning work on the Reliance Building contributed to the restoration of one of Chicago's most notable historic skyscrapers. This project enhanced national recognition of WJE's expertise and capabilities in historic preservation, especially in the restoration of terra cotta facades.

Notes of Interest

- With its open, glass facade and large window area, the Reliance Building is often cited as a forerunner of modern glass skyscrapers. The light and airy facade is comprised almost entirely of "Chicago windows," which feature a wide fixed pane with narrow movable sash windows.
- In 1999 the building reopened as the Hotel Burnham after a meticulous interior restoration. The Atwood Café in the hotel lobby is named after the building's principal architect, Charles B. Atwood. Atwood also designed Chicago's Museum of Science & Industry and the Fisher Building.
- The original retail tenant in 1891 was Carson Pirie Scott & Company, which later took over a new building one block south. Before construction of the Reliance Building, the site was occupied by the five-story headquarters of the First National Bank of Chicago.

What was the challenge?

To provide immediate on-site investigation, as well as design and construction period services to address the failure

Seattle, Washington

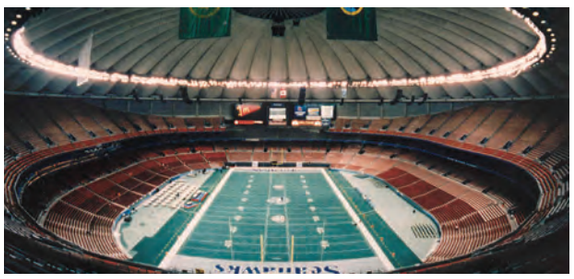
1994

SEATTLE KINGDOME

Roof Investigation/Renovation

On July 19, 1994, just prior to a Seattle Mariners baseball game, several acoustical ceiling panels fell to empty seats below, prompting the closing of the Kingdome. WJE was immediately engaged to investigate the causes of the failure. The investigative findings led to round-the-clock restoration of the domed roof structure, including structural repairs, installation of a new roofing system, and replacement of the interior acoustical ceiling. WJE was on site from just hours after the failure through completion of the repair work.

This high profile assignment showcased coordination among multiple WJE offices and technical disciplines to complete a complex project in just 108 days. The new roofing and ceiling acoustical system provided greater durability and increased the energy conservation properties of the stadium. The American League Division Series was played there during the next baseball season, but after only five more years, the Kingdome was demolished to make way for a new stadium.

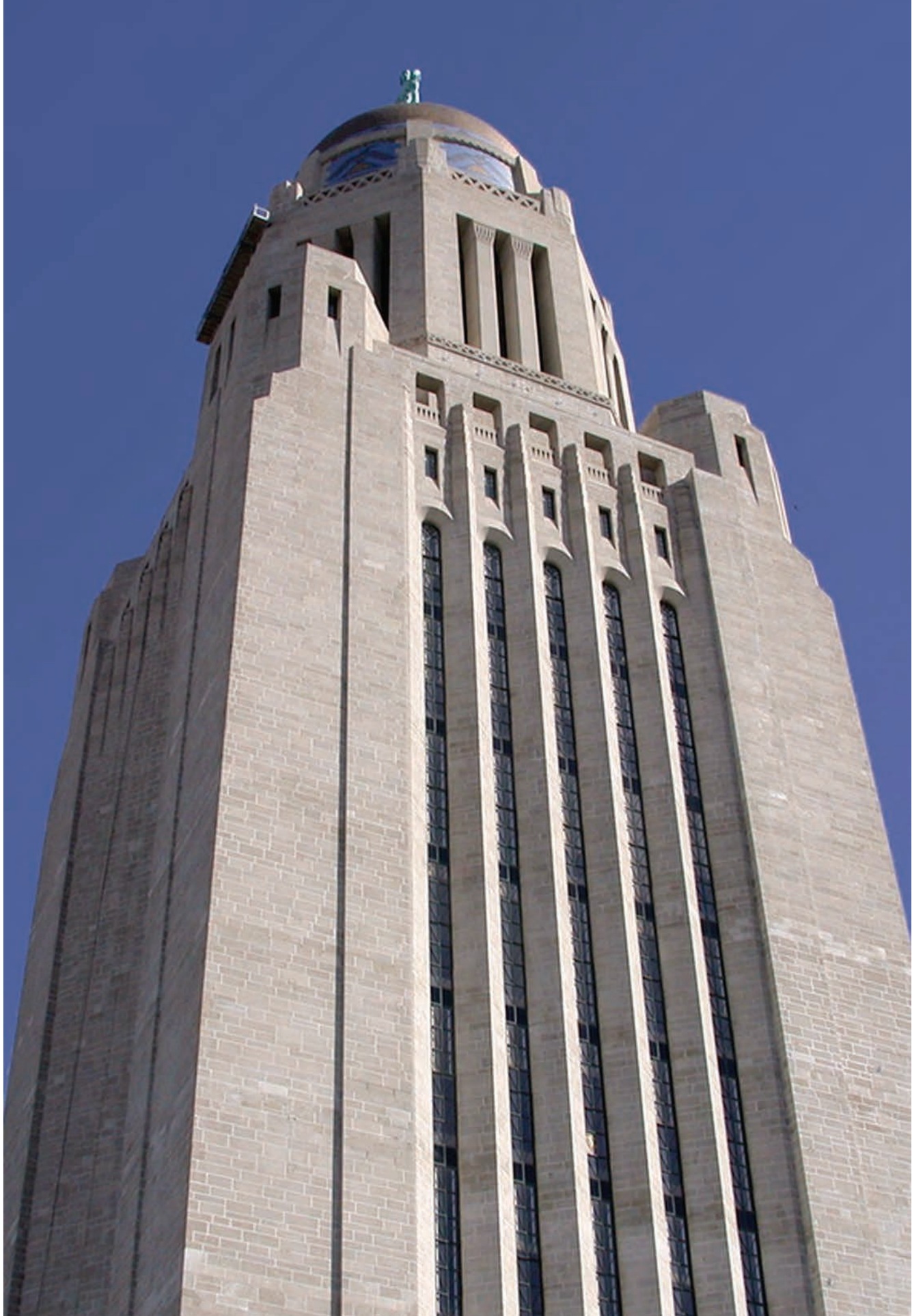


Notes of Interest

- On May 2, 1996, in an event completely unrelated to the falling tiles, the Mariners became only the second baseball team in the history of the league to suspend a game because of an earthquake.
- The Seahawks played their final game in the Kingdome in January 2000.
- The stadium was demolished by implosion on March 26, 2000, in the first live event ever covered by ESPN Classic, setting a world record for the largest implosion of a concrete building.

What was the challenge?

To provide ongoing consulting services for the restoration and maintenance of this landmark state capitol



Lincoln, Nebraska

1995–present

NEBRASKA STATE CAPITOL

Exterior Facade Investigation and Restoration Design

The architect Bertram Grosvenor Goodhue received the commission for the Nebraska State Capitol through a national design competition held in 1920. The capitol building was constructed in four phases between 1922 and 1934. As part of a comprehensive restoration program, the State of Nebraska retained WJE to provide architectural services for the exterior envelope including masonry, windows, and roofing.

This was the first large state capitol restoration project completed by WJE, followed by commissions for the capitols of Kentucky, Georgia, Idaho, Washington, Wisconsin, and others. The client has relied on WJE's expertise in all key decisions pertaining to the Nebraska restoration. WJE continues to provide observation and laboratory services during the multi-phase restoration, which is scheduled for completion in 2010.

Notes of Interest

- The Nebraska State Capitol is known as the nation's first truly vernacular state capitol. The structure is nicknamed, majestically and appropriately, "the Tower on the Plain." It is one of the most distinctive state houses in the United States, as well as one of the tallest.
- The tower is crowned by a golden dome with a nineteen-foot sculpture, *The Sower*, which faces northwest. The dome is symbolic of the sun, and its reflective surface changes color with the weather. The frieze around the drum depicts thunderbirds, the Native American symbol for rain and life. Together, these symbolic elements give homage to the pioneers who created productive farmland and propagated civilization.
- The Nebraska State Capitol was the tallest building in the state of Nebraska until the Woodmen Tower in Omaha was completed in 1969.

Why is this project unique?

The NDE Center is the only facility in the world dedicated entirely to the evaluation and validation of NDE technologies for highway infrastructure.

McLean, Virginia

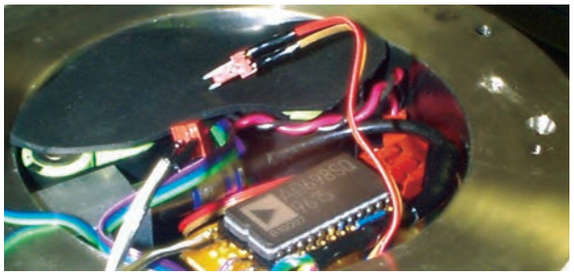
1996–present

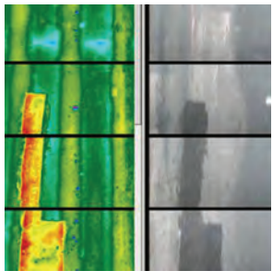
FHWA

Nondestructive Evaluation Center Development

WJE was engaged to oversee the design, construction, and operation of a new national resource center to support evaluation of the nation's highway bridges: the Federal Highway Administration (FHWA) Nondestructive Evaluation (NDE) Center. The NDE Center is the only facility in the world dedicated entirely to the evaluation and validation of NDE technologies for highway infrastructure.

Since the NDE Center was completed in June 1998, WJE has provided full-time professional staffing to conduct ongoing research related to evaluation and validation of NDE technologies. Following the original contract, WJE has been awarded three additional contracts to continue staffing and operation of the center.





Notes of Interest

- In the initial phase of the project, WJE conducted a design study and developed detailed plans for the construction of the NDE Center.
- Regular inspection of the nation's bridges is a massive undertaking. There are approximately 600,000 bridges in the current inventory. In 1997, the FHWA reported that more than 30 percent of these bridges are either structurally deficient or functionally obsolete.
- The NDE Center supports five test bridges, all located within 100 miles of the center, for the field validation of emerging NDE technologies.
- Since 1996, WJE has completed more than twenty-five task orders to validate NDE technology for the evaluation of our nation's bridges.

What was the goal?

To provide quality assurance for the high-speed rail system and to help enhance and update South Korea's construction practices

South Korea

1996

KOREA HIGH-SPEED RAIL SYSTEM

Quality Audit

The Korea High-Speed Rail Construction Authority (KHRC) engaged WJE to audit the quality of completed structures in the Seoul-Taejon section of the rail system. The chairman of KHRC sought a premier U.S. engineering firm to provide quality assurance for the high-speed rail system and to help enhance and update South Korea's construction practices.

The KHRC project was one of the largest in WJE history, with fees and expenses totaling almost $3 million. It also brought together more than thirty engineers and technicians from various WJE offices to collaborate on a long-term project located outside the U.S.

Notes of Interest

- The $16 billion Korea High-Speed Rail System project was the largest single project underway in South Korea at the time and was modeled after France's *Train à grande vitesse* (TGV).
- The line runs between Seoul, in the northwest part of the country, and Pusan, a major port city in the southeastern part of the Korean peninsula. By 2010, it is estimated that more than 500,000 passengers will travel between Seoul and Pusan per day.
- The trains are approximately 1,312 feet long and weigh 700 tons, making them the longest and heaviest TGV-type trains in use, with the exception of the Eurostar trains, which run between London, Paris, and Brussels. The trains travel at a blistering 186 miles per hour, cutting the travel time between Seoul and Pusan in half, to two hours.
- The trains are fitted with an automatic train control system. Allowable and actual train speeds are continually compared, and can be adjusted automatically if necessary.

What was the challenge?

To perform field instrumentation, strain-relief testing, and an underwater investigation at a site halfway around the world

Republic of Palau

1996

KOROR-BABELDAOB BRIDGE

Collapse Investigation

When built in 1976, the Koror-Babeldaob Bridge in Palau was the longest single-span concrete box girder bridge in the world. On September 26, 1996, the 790-foot main span crashed into the sea, separating Koror from its sources of water and power, and from the Palau International Airport. The Republic of Palau retained WJE to determine why the bridge collapsed.

The cause of the failure was anything but obvious, and it took the combined efforts of structural engineers, materials scientists, and testing and instrumentation specialists to understand why the collapse occurred. The Koror-Babeldaob Bridge investigation was one of the most fascinating and challenging projects ever undertaken by the firm. WJE's investigation and guidance were instrumental in helping the republic obtain funds to replace the bridge.

TOP 10

The collapse was one of the most spectacular structural failures of the twentieth century—and the setting was like no other. This investigation was a once-in-a-lifetime opportunity. – *Gary Klein*

A technically challenging investigation made even more so by the fact that WJE engineers had to examine key elements of the failed structure 100 feet beneath the ocean's surface. – *Bill Nugent*

Notes of Interest

- The Koror-Babeldaob Bridge connects the two main islands of the Palau archipelago.
- The two-lane single cell box girder superstructure of the original Koror-Babeldaob Bridge was built using cast-in-place segments and a permanent mid-span hinge.
- The new bridge was funded by a Japanese Grant Aid from the official development assistance program. Construction of the new bridge began in 1997 and was completed in December 2001. It was named the "Japan-Palau Friendship Bridge" at its opening ceremony on January 11, 2002.

What was the challenge?

To design and erect a support system and accomplish the reconstruction within eight weeks of notice to proceed

Long Island, New York

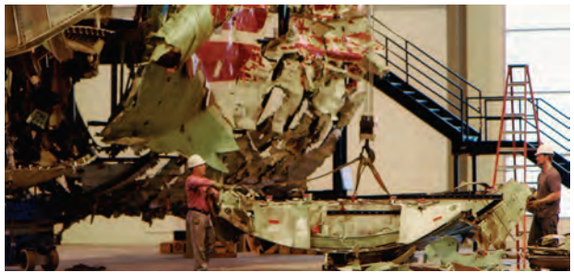
1996

TWA FLIGHT 800

Reconstruction

The National Transportation Safety Board retained WJE to reconstruct a ninety-four-foot long segment of the TWA Flight 800 Boeing 747 aircraft, which crashed off Long Island, New York, on July 17, 1996. The objective was to reassemble the recovered pieces of the plane in a manner that permitted unobstructed viewing of the aircraft, to assist in the diagnosis of the cause of the crash.

The reconstruction of TWA Flight 800 posed a unique challenge. The project remains the world's largest aircraft reconstruction and set the standard for future reconstructions. The use of twin trusses extending along the aircraft's aisles to support the reconstruction was a particularly innovative engineering solution.



TOP 10

The "gold standard" of accident reconstructions – *John Hanson*

This project significantly raised WJE above all of our competitors. Our work on this project set the standards for future post-accident reconstruction of aircrafts. – *Ian Chin*

The importance of this project is readily recognized not only by those responsible for this type of investigation, but by the average person who is concerned about the safety of airplanes. The NTSB demonstrated great trust in WJE by selecting us for this assignment. – *Jim Connolly*

Notes of Interest

- The flight number was retired and replaced with TWA Flight 924 after the crash, although TWA continued to operate flights between New York and Paris.
- The FBI contended from the start of the investigation that there were three possible causes for the explosion: a bomb, a missile, or mechanical failure. In the end, mechanical failure was determined to be the cause of the explosion.
- "When the NTSB initially received our proposal in September, they sent it out to other firms to evaluate if we could do it for that cost and in that timeframe. The comments came back saying that there was no way WJE could do it that fast, and there's no way they could do it for that price. They said it would cost between $1.1 and $1.3 million. After seven weeks of work, we had spent about $480,000. So, we did it under budget and we beat the timeframe by a week." *Mike Koob, Project Manager*

What was the challenge?

To provide professional consulting involving a wide range of disciplines and to coordinate a complex project team evaluating myriad conditions and issues

Los Angeles, California

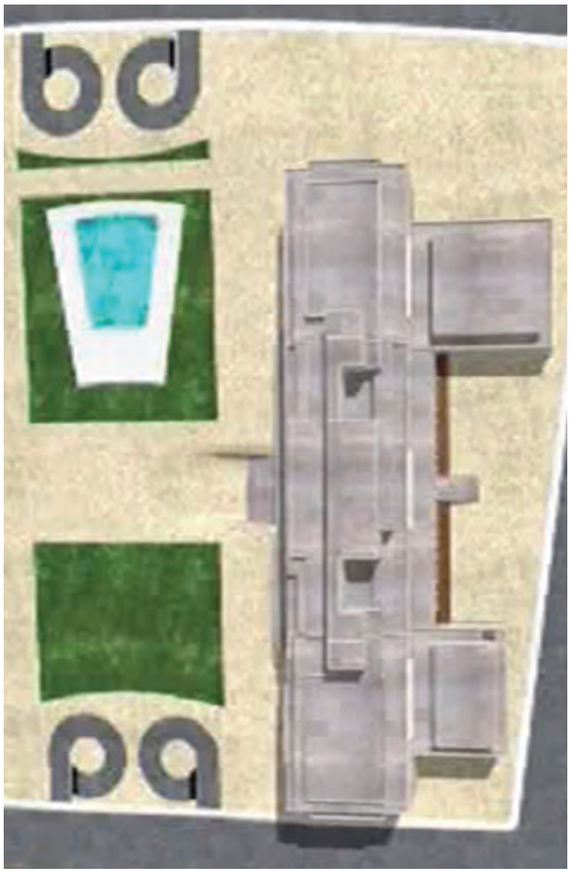
1997

LOS ANGELES COUNTY BUILDINGS

Earthquake Damage Evaluation

When the County of Los Angeles claimed that damage to its buildings was caused by the 1994 Northridge earthquake, the county's insurance companies engaged WJE to evaluate the technical merits of the claim. As the lead technical consultant during the adjustment phase of the project, WJE provided consulting services over a three-year period. The work involved more than thirty WJE engineers, architects, and materials scientists from offices around the country.

The project illustrates WJE's ability to assemble high-quality technical expertise across a broad range of disciplines, as well as to provide and coordinate a large project team to address hundreds of issues. Computer-generated animations were created and used by WJE to complement the expert testimony given by three of the firm's principals.



Notes of Interest

- The Northridge earthquake occurred on January 17, 1994, at approximately 4:30 a.m. Pacific Standard Time. The earthquake had a "moderate" magnitude of 6.7, but the ground acceleration was the highest ever instrumentally recorded in an urban area in North America. It proved to be the most costly earthquake in United States history.
- The earthquake struck in the San Fernando Valley about twenty miles northwest of downtown Los Angeles. Its epicenter was first reported as being in the community of Northridge, thus giving the earthquake its moniker, but was later calculated to be in Reseda.
- Despite the area's proximity to the San Andreas Fault, the Northridge quake did not occur along this fault, but rather on a previously undiscovered blind thrust fault.
- The Great Hanshin earthquake in Japan occurred exactly one year later, on January 17, 1995.

What did WJE contribute?

Specialized instrumentation and preservation services to ensure the successful relocation of this unique National Historic Landmark

Buxton, North Carolina

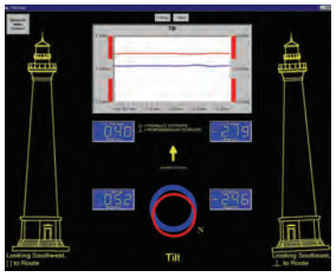
1998

CAPE HATTERAS LIGHTHOUSE

Preservation and Instrumentation for Relocation

Constructed in 1870 to light the treacherous shoals along the Outer Banks of North Carolina, Cape Hatteras Lighthouse withstood many hurricanes but by the 1980s was increasingly threatened by erosion of the nearby shoreline. The National Park Service commissioned a team of engineers, architects, and contractors to move the 200-foot tall lighthouse, adjacent keepers' quarters, and several smaller structures to a new site, 2,900 feet inland from their original location.

The interdisciplinary project team met the complex technical challenges presented by the move, and helped to save this national treasure. The historic move, completed in just twenty-three days, drew an average of 15,000 spectators per day. Relocation of the lighthouse and adjacent buildings was accomplished without damage to the historic structures.



TOP 10

This remarkable engineering feat moved a national landmark out of harm's way. – *Harry Hunderman*

This project represents a comprehensive contribution to the preservation of a well known National Historic Landmark, and an unprecedented, complex relocation. – *Jim Connolly*

By providing critical performance information instantaneously, WJE's innovative and reliable electronic monitoring and data acquisition system reduced the time of the actual move by many weeks. – *Bill Nugent*

Notes of Interest

- There has been a working lighthouse at or near Cape Hatteras since 1803. The first lighthouse was built of sandstone block and stood ninety feet tall. It was demolished in 1871, shortly after the current lighthouse entered service. The ruins were visible until a 1980 storm swept them away.
- The Cape Hatteras Lighthouse is recognized by the National Park Service as the tallest lighthouse in America at 193 feet, 2 inches tall.
- In good visibility conditions, the lighthouse beacon can be seen for twenty miles out at sea.
- Over one million bricks were used in the construction of the structure, which was built at a cost of $167,500 in 1870.

What was learned?

Methods of remote digital acquisition that have been successfully applied to numerous other instrumentation projects

Livermore, California

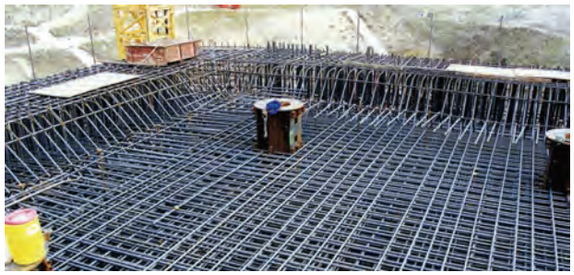
1998

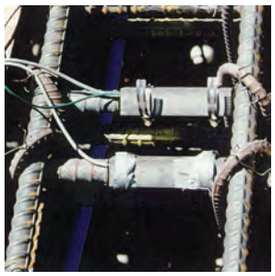
LAWRENCE LIVERMORE NATIONAL LABORATORY

Structural Instrumentation of the Contained Firing Facility

Site 300 Contained Firing Facility at the Lawrence Livermore National Laboratory is a conventionally reinforced concrete structure designed as a reusable facility for the detonation of high explosives. Lawrence Livermore National Laboratory retained WJE to install instrumentation sensors during the construction of the facility to validate the firing chamber's structural system.

The project was one of the most challenging instrumentation assignments ever undertaken by WJE. The lessons on remote digital acquisition systems learned from this project have been essential to the successful completion of numerous other instrumentation projects.





Notes of Interest

- The United States Department of Energy oversees the design of nuclear weapons at two national laboratories: the Lawrence Livermore National Laboratory, which is managed and operated by the University of California, in Livermore, California, and the Los Alamos National Laboratory in Los Alamos, New Mexico.
- A current project is the "small, sealed, transportable, autonomous reactor" or "SSTAR." It is designed to be a "world" nuclear reactor that can give countries with smaller or underdeveloped electricity grids a self-contained reactor that would operate for thirty years without refueling and then be retrieved.
- The Lawrence Livermore National Laboratory is not allowed to have actual nuclear weapons or nuclear explosive devices on site. Plutonium at the lab is stored in a fortified research facility, guarded by a large force of heavily armed and specially trained University of California security police officers.

What was the goal?

To ensure that the high performance concrete will meet its required one hundred year service life

Chicago, Illinois

1998–present

WACKER DRIVE

Structural and Durability Studies for Reconstruction

Based on the findings of an earlier WJE investigation, the Chicago Department of Transportation (CDOT) concluded that the badly deteriorated Wacker Drive Viaduct needed to be rebuilt using high-performance concrete. In addition to developing and testing concrete mix designs, WJE studied the durability of virtually all structural elements and details. WJE also designed and tested a full-size prototype to evaluate structural performance. During construction, WJE engineers were on site to help assure that the high-performance concrete met specifications.

In the broadest terms, CDOT hired WJE to ensure that the city's $173 million investment would last one hundred years. This project is an excellent example of the practical application of WJE's construction materials research and testing. WJE was subsequently hired to develop and carry out a long-term health-monitoring program for the viaduct.

Notes of Interest

- In 1909, architects Daniel Burnham and Edward Bennett drew up a plan to improve traffic flow in Chicago, and presented it to the Commercial Club of Chicago. One of the key components of the plan was a two-level roadway along the river. Charles H. Wacker, chairman of the Chicago Plan Commission, expressed strong support for the idea. When the original roadway was completed in 1926, it was named Wacker Drive, in honor of the chairman.
- The primary characteristics of the high performance concrete mix for this project were defined as follows: early age strength of 2,500-3,000 psi in twelve to sixteen hours; ultimate strength of 6,000 psi at twenty-eight days; good workability, placeability, and finishability; and an extended service life in a harsh environment.
- Notable movies featuring Wacker Drive include *Batman Begins, The Fugitive,* and *The Blues Brothers.*

What was the challenge?

To integrate a seismic upgrade into the existing historic fabric of the building

San Francisco, California

1999

ALCATRAZ CELLHOUSE

Stabilization and Seismic Upgrade

Alcatraz Cellhouse, completed in 1912, is one of the earliest reinforced concrete buildings in the Bay Area. Severe deterioration and concerns about seismic integrity prompted the National Park Service to engage WJE to perform an initial investigation of the complex. Following completion of detailed condition surveys, state-of-the-art corrosion testing, petrographic evaluation, and materials testing, WJE designed the structural stabilization and seismic upgrade.

The project utilized WJE experts in corrosion, materials sciences, and seismic design to upgrade this historically unique structure. Because of the complexities of the repair project, WJE assisted the National Park Service in all aspects of the construction planning. Public visitation by more than one million people per year continued during the repairs.

Notes of Interest

- When the Spanish first entered San Francisco Bay in 1775, a naval lieutenant, Don Juan Manuel de Ayala, named Alcatraz Island "Isla de los Alcatraces" (Island of the Pelicans).
- During the years in which the penitentiary was in service, there were about 300 civilians living on Alcatraz Island, including women and children. Residential facilities included Building #64, as well as three apartment buildings, one large duplex, and four large wooden houses for senior officers. Families enjoyed their own bowling alley, small convenience store, and soda fountain shop.
- Records from the National Park Service indicate that thirty-six inmates were involved in various attempts to escape the island. The most famous escape was that of Frank Morris and the Anglin Brothers. All three were successful in swimming off Alcatraz, but all three are believed to have drowned.
- The cellhouse was built on top of a nineteenth century fortress that was used by the military to protect San Francisco Bay.

What did WJE accomplish?

A highly innovative and cost effective repair—the first seismic retrofit of its kind

East St. Louis, Illinois

2001

POPLAR STREET COMPLEX

Seismic and Redundancy Retrofit Project

The Poplar Street Complex is a system of elevated roadways connecting the Poplar Street Bridge to several local, state, and interstate roads converging in East St. Louis, Illinois. When these elevated structures were built in the late 1960s, no consideration was given to potential seismic demands. The Illinois Department of Transportation (IDOT) retained WJE to conduct a comprehensive structural evaluation, and to design retrofit measures to address seismic deficiencies. A key step in the design was modification of the concrete pier columns so they would be the weak link in the seismic load path. The department also engaged WJE to evaluate and develop retrofit measures to enhance the redundancy of the bridge superstructure.

WJE's innovative seismic retrofit approach for the pier columns cost less than half the amount of installing isolation bearings, as recommended by another consulting firm. IDOT later funded a research study by the University of Illinois to extend the seismic retrofit technology to other structures. The redundancy retrofit approach for the superstructure was the first of its kind.

Notes of Interest

- The Poplar Street Bridge, officially named the Bernard F. Dickmann Bridge after a former St. Louis mayor, carries approximately 120,000 vehicles daily. It is one of the most heavily used bridges on the Mississippi River.
- Interstate 55, Interstate 64, Interstate 70, and U.S. Highway 40 cross the Mississippi on the Poplar Street Bridge, and the official eastern endpoint of Interstate 44 is at the state line on the bridge.

CELEBRATING 50 YEARS

WJE

ENGINEERS
ARCHITECTS
MATERIALS SCIENTISTS

50

1956-2006

CHAPTER 5

Looking Forward: The Fiftieth Anniversary and the Future

Looking Forward: The Fiftieth Anniversary and the Future

The commemoration of WJE's fiftieth anniversary provides an opportunity to celebrate our accomplishments and reflect on the firm's history and growth, and to consider the extraordinary possibilities that lie ahead. As 2006 draws to a close, a substantial upgrade and consolidation of the Northbrook campus is nearing completion. The new headquarters stands as a testimony to the company's commitment to its future, and to the next generation of extraordinary employees.

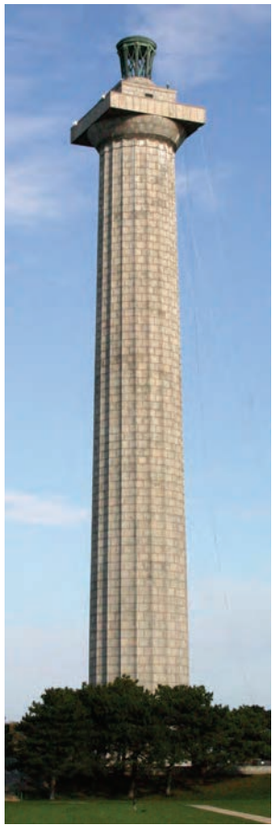
In May of 2006, all current staff and a number of distinguished past employees gathered in downtown Chicago to commemorate the fiftieth anniversary of WJE's founding. The three-day conference opened with a private event hosted by the Museum of Science and Industry and the screening of a film on the storied history of the firm. During the next two days of Conference 2006, the 430 attendees participated in many technical presentations and the World of WJE (WOW!) exhibition, featuring twenty-nine booths displaying the various services and areas of technical expertise that the company provides. The fifty most significant projects presented in this book were first announced and displayed at a special conference exhibit.

As we reflect upon the most significant projects of our first fifty years, WJE continues to undertake new and challenging assignments. Among the noteworthy and demanding assignments received this year are the investigation of the Perry's Victory and International Peace Memorial, a 350-foot-tall granite and concrete column on an island in Lake Erie; the restoration of the marble facades of the New York Public Library; and the seismic assessment and strengthening of Congregation Sherith Israel in San Francisco. In August 2006, the firm was retained by the Commonwealth of Massachusetts to undertake a comprehensive safety audit of the Central Artery/Tunnel project in Boston, also known as the Big Dig. More than sixty WJE employees participated in the first phase of the investigation, which was successfully completed within the ambitious ninety-day timeframe required by the client.

In the midst of these and many other significant assignments, the company mourned the loss of Jack Janney, who passed away on October 9, 2006, at the age of eighty-two. Jack will be remembered as the founder of the firm, but it is his pioneering vision and commitment to excellence that will be his strongest legacy. On October 17, the company was saddened to learn that Peg Janney had also passed away. Peg played a vital, yet largely unsung, role in the development of the firm: she was WJE's first technician, first accountant, first administrative assistant, and first human resources manager.

Since its founding in 1956, WJE has grown from a one-man consulting engineering company to an interdisciplinary corporation with more than 400 employees in nineteen offices nationwide, undertaking more than 6,000 projects a year. These impressive statistics would not be possible without WJE's exceptional staff of dedicated professionals. The character, commitment, expertise, and enthusiasm of WJE's employees have made the company a success in decades past, and will continue to do so in the future.

As we embark upon our next half-century, WJE continues to advance the nature of its practice by providing innovative solutions to particularly complex problems and by continuing to make important contributions to the profession. Each new assignment has the potential to be another one of the firm's most significant projects, and we look forward with keen anticipation to those future challenges and unique opportunities.



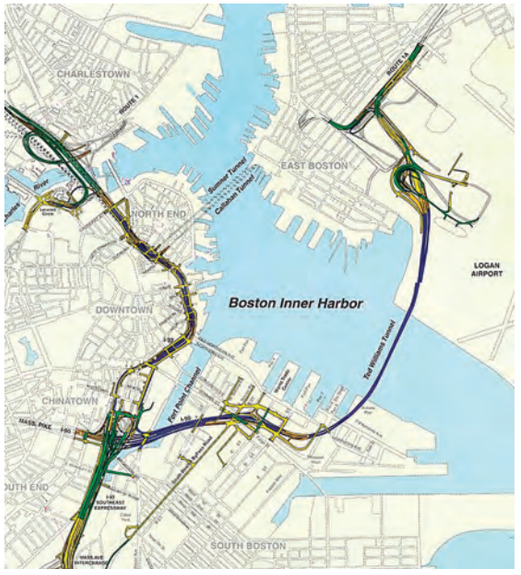

CHARLESTOWN
EAST BOSTON
NORTH END
DOWNTOWN
CHINATOWN
SOUTH END
SOUTH BOSTON
LOGAN AIRPORT
Boston Inner Harbor

Photo Credits

Leslie Schwartz Photography, Chicago, Illinois

Tribune Tower, page 70

Reliance Building, page 96;
top right, bottom right, page 97

Alcatraz Cellhouse, top right, page 119

Bob Parker, Photographer

Kingdome, page 98

The Positive Image, Houston, Texas

San Jacinto Monument, aerial photos,
pages 82 and 83

Photo Identification

Introduction (page 5)

Top: Metropolitan Museum of Art, New York, New York; Jefferson Davis Monument, Fairview, Kentucky; Wisconsin State Capitol, Madison, Wisconsin

Center: Wrigley Field, Chicago, Illinois

Bottom: Jesse H. Jones Hall for the Performing Arts, Houston, Texas; Koror–Babeldaob Bridge, Koror, Republic of Palau; Bank of America, San Francisco, California; Bluff's Edge Bridge, Lake Forest, Illinois

Chapter 1 (page 9)

Top: Artist's rendering of new WJE headquarters in Northbrook, Illinois, circa 1966

Center: Model of O'Hare International Airport elevated road wishbone support, Chicago, Illinois

Bottom: Early laboratory equipment, Northbrook, Illinois; Soldier Field, Chicago, Illinois; Jack Janney's basement, Glenview, Illinois

Chapter 2 (page 33)

Top: WJE Corporate Headquarters, Northbrook, Illinois; Jack Janney, Dick Elstner, John Hanson, and Jack Wiss, Northbrook, Illinois

Center: Model of American Airlines Hangar, California; Bob Hanson performing tests in the Northbrook laboratory circa 1980

Bottom: Roof collapse in Chicago (Blizzard of 1979); USG logo; Gene Perrine performing a roof condition survey circa 1975; Woolworth Building, New York, New York

Chapter 3 (page 57)

Top: WJE Officers (Jerry Stockbridge, Fred Metz, Rich Miller, Don Pfeifer, Ian Chin, Bill Hime, and John Hanson), circa 1990; Cline Avenue Bridge collapse, 1982; damage from the Loma Prieta Earthquake, 1989

Center: Barbara Shelley using the universal test machine in the main laboratory, Northbrook, Illinois, 1981

Bottom: Michael Bresler performing a DAT inspection, circa 2001; cyclic tension and compression loading in the main laboratory, Northbrook, Illinois; Lincoln Center for the Performing Arts, New York, New York; Westmoreland County Courthouse, Greensburg, Pennsylvania

Chapter 4 (page 87)

Top: Fox Plaza, Los Angeles, California; Holy Family Church, Chicago, Illinois; damage from Hurricane Katrina, Gulf Coast; WJE Difficult Access Team training session, 2004

Center: State Route 69 Bridge, Clifton, Tennessee; Husky Stadium, Seattle, Washington

Bottom: Kim Beasley at Ground Zero, New York, New York, 2001; Neal Anderson, Joe Zachorowski, and Don Meinheit in the Northbrook laboratory, circa 2000; Gary Klein at the World Trade Center, New York, New York, 2001; Buffalo and Erie County Conservatory, Buffalo, New York

Chapter 5 (page 125)

Top: Congregation Sherith Israel, San Francisco, California; Perry's Victory and International Peace Memorial, Put-in-Bay, South Bass Island, Ohio; Leonard P. Zakim Memorial Bridge, Boston, Massachusetts

Center: Una Gilmartin using a spotter scope for visual survey at Perry's Victory and International Peace Memorial

Bottom: New York Public Library, New York, New York; New York Public Library, New York, New York; map of the Central Artery/Tunnel, Boston, Massachusetts

ACKNOWLEDGEMENTS

Wiss, Janney, Elstner Associates gratefully acknowledges the contributions of the many employees over the past fifty years who made possible the remarkable accomplishments documented in this monograph. In addition, our thanks go to those who provided nominations for the 50 Most Significant Projects competition, and to the members of the panel who evaluated the nominations. And finally, WJE appreciates the efforts of those who participated most directly in the development of this publication: Gary Klein, project direction; Jamie Wild, John Reins, Deborah Slaton, and Lauren Van Damme, writing and editing; Penny Sympson, research; Heather Garrard and Monika Glockner, coordination; Marilyn Kearns Davis and Sue Klein, graphic design; and Barry Weiss, printing coordination.

WJE

ENGINEERS
ARCHITECTS
MATERIALS SCIENTISTS

CELEBRATING 50 YEARS

1956-2006