Fifty Years of Roof Consulting

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EARLY HISTORY

In the early 1970s there were only a few active roof consultants within the United States. At the time I was unaware there were any firms exclusively offering roof consultant services. My father and I, in the late 1960s and early 1970s, would assist/consult with architects in the design of reroofing projects. Consulting would also involve assisting representatives of insurance companies with hail and wind claims.

I became aware of three roof consultants in a small advertisement in the back of a *Sweets Architectural Trade Catalog*,[1] which looked like a set of green encyclopedias. This was obviously pre-internet. The three consultants were Werner Gumpertz/Carl Cash of Simpson, Gumpertz and Heger in Boston, Massachusetts; Frank Moore of Armm Consultants in Gloucester City, New Jersey; and Edward Schreiber of Construction Consultants in Detroit, Michigan.

After reviewing background data on these consultants, I knew I was on the right track to becoming a roof consultant. I met some of these consultants and roofing manufacturers' top technical people at an American Society for Testing and Materials (ASTM) meeting in 1974 in Houston, Texas. This was a revelation to me of the technical aspects of the roofing industry.

The roof consulting business grew to include quality control inspection during construction, laboratory analysis of roofing samples, assistance on large insurance claims, and cost estimating and expert testimony in roof litigation. Most of the initial clients had serious roof problems. One of the biggest obstacles was trying to explain, "What is a roof consultant?"

Things were pretty basic in the beginning of the roof consulting business, particularly compared to today's technology. In this era before cellphones and AutoCAD, all drafting was done by hand. All reports were typed by hand on a manual typewriter. Copy machines were a luxury. We did not have a word processor. The first infrared surveys were performed with equipment that weighed over 70 lb. The infrared equipment required the use of liquid nitrogen poured into the camera on the job site. The most important equipment was a 200-ft cloth tape and a notepad on a clipboard.

FIRST ROOF CONSULTANT ORGANIZATIONS

In the late 1970s the National Roofing Contractors Association (NRCA) asked for a meeting with the major roofing consultants in the United States. The meeting was held in Chicago. The NRCA was represented by its technical director, its president, and a few board members. Fewer than ten roof consulting firms attended the meeting. Three major roof consulting firms, which were invited to the meeting, chose not to participate with the NRCA.

The NRCA took the position that there were several unqualified firms in the United States providing improper and unprofessional roof consulting services. The NRCA asked the consultants present to form an association and set quality control standards for roof consultants. The initial participants in the meeting were from throughout the United States. The roof consultants who were present, less than ten, agreed to move forward. As a result, the Institute of Roofing and Waterproofing Consultants (IRWC) was formed.

Founding members of the newly formed association met several times and established some fairly high standards for membership, which included education, background verification, and long-term experience in various areas of roofing. After the group was formed, the IRWC asked for a meeting with the NRCA to propose a working relationship with the NRCA. For whatever reason, the NRCA had a change of heart and refused to meet with or recognize the IRWC.

Unfortunately, this was a time period where there was a great deal of animosity from the NRCA towards roof consultants. Some of this may have been well deserved. For a while the NRCA would not allow roof consultants to attend the NRCA annual conventions. Fortunately, this changed.

Although the IRWC set very high standards for membership, it floundered. In 1982 Robert "Bob" Lyons founded the Roof Consultants Institute (RCI). Membership in the RCI exploded to Bob Lyons's credit. The roof consultant industry changed dramatically. An excellent book titled *The First Five Years* by William C. Correll,[2] AIA, 1989, documents the early history and key players involved in the start of RCI.

ROOF ENGINEERING INC. AND JIM D. KOONTZ & ASSOCIATES INC.

After working as a roof consultant in the early 1970s, I obtained my Professional Engineer

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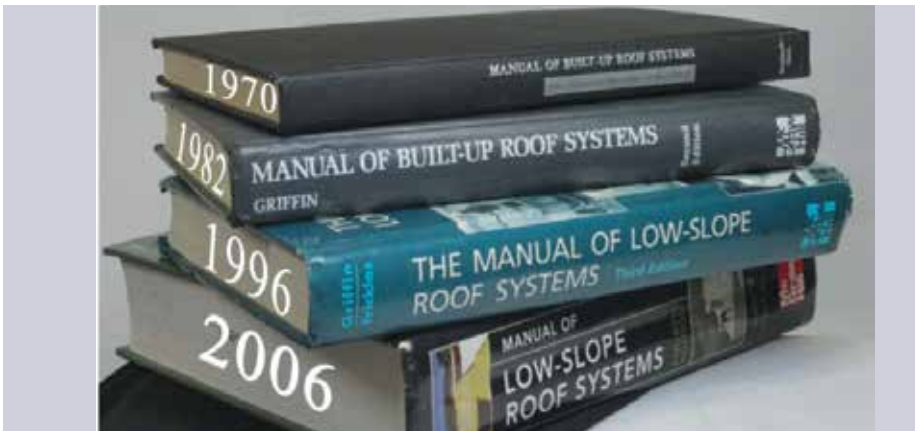

Figure 1. Roofing manuals: Manual of Built-Up Roof Systems, *C. W. Griffin, First Edition 1970;* Manual of Built-Up Roof Systems, *C. W. Griffin, Second Edition 1982;* The Manual of Low-Slope Roof Systems, *C. W. Griffin and Richard Fricklas, Third Edition 1996;* Manual of Low-Slope Roof Systems, *C. W. Griffin and Richard Fricklas, Fourth Edition 2006.*

license and formed Roof Engineering Inc. (REI) in 1976. The business grew rapidly. In 1987 Professional Services Inc. (PSI) acquired REI, and I worked as a vice president with Bob Lyons and PSI for about a year and a half. In 1990 I started Jim D. Koontz & Associates Inc. (JDKA), and I continued to work until 2022.

EDUCATION: TECHNICAL ADVANCES

As a roof consultant, one of the first books I relied upon was the American Institute of Architects (AIA) *Manual of Built-Up Roof Systems* by C. W. Griffin, PE,[3] published in 1970 (**Fig. 1**).

The book was very informative and, at the time, one of the best references in the roofing industry. I read it from cover to cover, multiple times. The book was extraordinary, with no agenda, just letting the reader know where we were in the roofing industry. One of the original reviewers was William C. Cullen of the National Bureau of Standards, now known as the National Institute of Standards and Technology (NIST). As the roofing industry changed, Griffin, with Dick Fricklas, updated the future publications.

In 1996 the name of the Third Edition changed from *Manual of Built-Up Roof Systems* to *The Manual of Low-Slope Roof Systems*.[4] This reflected the increased use of non-built-up roof systems, such as single plies**.** The Fourth Edition[5] in 2006 has approximately three times as many pages as the First Edition. This is an indication of the increase in technical knowledge in the roofing industry from 1970 to 2006.

Paul A. Tente of Colorado Springs was one of the first roof consultants in the United States. In 1977, Tente authored a book, *Roofing Concepts/ Principles*,[6] which was relied upon and referred to by many early roof consultants.

Another early quality reference book includes *Roofs* by Maxwell Baker[7] in 1980 by the National Research Council of Canada.

ROOFING ORGANIZATIONS

Emphasis on technical knowledge within the roofing industry grew exponentially. In 1972 Johns Manville (JM) introduced a four-day seminar on roofing, BURSI (Built Up Roofing Systems Institute). BURSI was directed by Dick Fricklas. The classes, held in Denver, Colorado, were highly successful. Within the roofing industry, contractors, architects, and a few future roof consultants clamored to obtain invitations to attend these technical meetings. During the course of over 50 years, the original BURSI morphed into the Better Understanding of Roof Systems Institute.

The NRCA worked with JM and formed the Roofing Industry Educational Institute (RIEI) in 1979. RIEI was headed by Dick Fricklas. The RIEI seminar, which was also a multiday class on roofing, was held at different locations throughout the United States.

The first RIEI roofing seminar in 1980 was held in Atlanta. The seminar was a huge success. RIEI had more applicants for attendance than could be accommodated. I attended this seminar.

Several other organizations promoted the technical aspects of roofing and would publish articles generated by professionals within the roofing industry. These organizations would also hold technical seminars and symposia on roofing. A few of these organizations included ASTM, Department of Energy, International Union of Testing and Research, National Bureau of Standards, National Research Council of Canada, and Single Ply Roofing Institute.

Simultaneously over the years, the various roof contractors' associations would hold technical seminars. This would include the NRCA, the Midwestern Roofing Contractors Association, RCI, and several others. There was basically an explosion of technical knowledge within the roofing industry.

GOVERNMENT INVOLVEMENT IN ROOF CONSULTING

In the late 1970s and early 1980s, several government agencies began to use roof consultants. This included the General Services Administration (GSA), Air Force (USAF), US Navy, and US Army. As a roofing contractor I had a great deal of prior experience working on government contracts.

REI was awarded a GSA contract for five states: Texas, New Mexico, Oklahoma, Arkansas, and Louisiana. Services included design of new and reroof projects, full-time quality control inspection, laboratory testing, evaluation of existing roof systems, and cost estimating. This first GSA contract generated a substantial amount of business. The GSA expanded the contract to include six additional states from Colorado to North Dakota. REI was very busy.

Other contracts followed with the USAF, US Post Office, US Army, and US Navy. The government contracts injected a great deal of work into the roof consulting industry. Several other roof consulting firms benefited from this work.

In 1980 the USAF adopted a technical manual, AFM 91-36,[8] authored by a roof consultant from Detroit. Overall, the document was a good quality control manual on the application of built-up roofing. The document had some strict quality control requirements that in some cases were objectionable to the NRCA.

Interply bitumen tolerances of 15% plus or minus was required. One of its recommendations was the removal of roof samples and testing of newly installed built-up roofing on a daily basis. At the time the USAF had approved one laboratory to perform testing on samples per ASTM D2829 requirements. Over a period, REI was able to obtain contracts for laboratory testing with five Air Force bases.

The NRCA was very opposed to this testing. At least two articles published were critical of the AFM 91-36: "Quality Assurance for Built-Up Roof Construction"[9] by William C. Cullen, NRCA 1985, Proceedings of the 1985 International Symposium on Roofing Technology, and "The Air Force Goes under the Knife"[10] from *Roof Spec/ Professional Roofing* in 1987.

The US Army developed a program in 1989 called "Roofer: An Engineered Management Systems for Bituminous Built-Up Roofs."[11] The document was developed by David Bailey, Donald Brotherson, Wayne Tobiasson, and Al Knehans, all well-known technologists in the roofing industry. The document was designed to assist army personnel in how to make the best use of maintenance and repair funds for built-up roofs.

ROOF FAILURES

Roof failures have played a key role in advancing roof consulting (see sidebar "Roof Failure Articles," p. 32) New, unproven, untested roofing material systems came on the market just as roof consulting was getting started. Roofs would fail! The bigger the roof failure, the greater amount of money would be in dispute. Roof failures were the result of:

- Material failure
- Quality-of-work errors on the part of the roofer
- Improper design on the part of the architect/designer

In numerous cases, roof failures were a combination of all three factors. In some situations when new products were introduced it took time or somewhat of a learning curve to understand the failure mode.

As some built-up roofing systems failed, there became an increased market and demand for roofing experts. These initial roof failures, along with the introduction of a variety of new, unproven roof systems, created a market for the roof consulting industry. In the late 1970s and early 1980s an emphasis on technical research on both conventional and newly introduced roofing systems, (e.g., single-ply and modified bitumen membrane) fueled the roof consulting industry.

Many newly introduced roofing systems were problematic and added to the roof failure portion of roof consulting. Early on the NRCA had concerns about problematic "unqualified" roof consultants with unsupportable opinions.

Two-Ply Built-Up Roofs

In the late 1960s and early 1970s, the two-ply built-up roof was introduced to the market. Instead of the traditional four-ply, 15-lb built-up roof, the new roofing system only required two plies of 40-lb organic felts. These 40-lb felts were 15-lb felts with extra asphalt. The manufacturers marketed two 40s equal to four 15s. Perhaps they were numerically similar, but they were not the same in tensile strength. The extra asphalt coating also made it more difficult to properly adhere the two membranes with hot asphalt. The two plies failed, split, and delaminated. This created a lot of lawsuits, thus the need for the "expert witness" on roofing.

The roof expert would determine the cause of the failure, assign blame, generate reports, and eventually become an expert witness. This generated large fees for the roof consultant. In many roof failure cases, regardless of the facts, the initial blame was placed on the roofer.

In 1974, The National Bureau of Standards published *Preliminary Performance Criteria for Bituminous Membrane Roofing*, by Robert Mathey and Bill Cullen.[12] They tested the physical properties of various four-ply built-up roofing systems. The tests included:

- Tensile strength
- Thermal expansion
- Flexural strength
- Tensile fatigue strength
- Flexural fatigue strength
- Shear strength
- Impact resistance

This groundbreaking research changed the roofing industry. The two-ply roofing systems were discontinued. The two-ply systems could not meet these recommended performance standards. The cause of some roof failures could be attributed to the roofing system and not the roofer or architect. In some cases, the qualifications and knowledge of the new roofing expert were called into question. Unqualified experts created a lot of animosity with roofers and thus roofing associations.

PVC Roofing Systems

New, unproven, untested roofing systems came on the market just as roof consulting was beginning to develop. This included single-ply roofs. When polyvinyl chloride (PVC) single plies were first introduced they were marketed as easy to install, free of blisters, lightweight, and clean. The PVC roofs were marketed as superior to built-up roofing, based on advanced German technology.

Unreinforced PVC roof systems, using unstable plasticizers, in some cases would shatter like a pane of glass after a few years of service. The chemical mix of the PVC could not stand up to UV exposure over a period of time. The PVC shatter failures were in some cases cataclysmic. Entire buildings would be flooded, resulting in the loss of all equipment, inventory, and items within the building. Whatever businesses were in these buildings would be completely shut down for months. The insurance claims were staggering.

Thus the need for a "roof expert" to take samples, perform lab testing, evaluate the roofing system, and offer expert advice to the insurance carrier, its attorneys, and the building owner.

Asphalt Shingles

Roof failures also occurred with asphalt shingles. After just a few years of service, many fiberglass asphalt shingles would split. Several shingle manufacturers were required to issue "recall notices" for their products. The subject of splitting shingles was discussed by several parties. I myself wrote articles on the topic: "Fiberglass Shingles: Shingle Splitting Problem Observed in a Number of Western Applications" from the May/June 1990 issue of *Western Roofing*,[13] and "Performance Attributes of Fiberglass Shingles" from the July 2007 issue of *RCI Interface*.[14]

Foam Insulations

In the late 1970s, following the Arab oil embargo, there was a growing concern about energy conservation. Gas prices at the time increased from 0.30 to 1 USD per gallon.

Increasing the *R*-value of roofing systems was seen as a way to save on fuel for heating and cooling. Roof insulation at the time, fiberglass, wood fiber, or perlite had a minimal *R*-value of approximately 2.7 to 3.7 per inch. Additional insulation with higher *R*-value was installed in roofing systems. This was primarily driven by changes in the building code. Polyurethane and polyisocyanurate board stock roof insulations with higher *R*-values were manufactured and marketed by the roofing manufacturers. The insulations, however, had not been subject to long-term "field evaluation."

The increase in thickness of roof insulations complicated roof designs. As these products were used, various problems began to develop. This included facer sheet delamination, which obviously exacerbated uplift problems resulting in roof blow-offs. Many times, the facer sheet problems were accompanied by the presence of "knit-lines" that were formed in the roof insulation at the time of manufacture.

Problems reported included dimensional stability issues, cupping, and bowing, particularly shrinkage, and edge cavitation, and crushing or powdering. The NRCA issued a technical bulletin 2000-3 recommending a cover board over polyisocyanurate roof insulation.[15] This provided some temporary relief. Many of the problems were not solved until manufacturers researched and implemented changes to the chemistry of the foam formulations. The NRCA also recommended changes in compressive strength, dimensional stability, and *R*-value determination.

Phenolic Foam

One roof insulation introduced by the Koppers Co. was phenolic foam. The new insulation had somewhat of an orange color. The insulation was marketed with an *R*-value of 8.2 per inch. The insulation, however, had a serious issue. When exposed to any moisture from roof leakage to humidity within the building, the chemicals within the phenolic foam would become acidic and leach out. The net result was corrosion or rusting of the steel deck. The failure of the steel deck in some cases would occur in as short as five years.

Koppers sold its phenolic foam manufacturing business to JM in 1989. JM manufactured and sold phenolic foam until 1992, at which time serious corrosion problems of the phenolic foam over steel decking were well known. JM and Koppers were the subject of a class action lawsuit in 1996. The US District Court granted a final approval settlement involving Koppers and JM in December of 2000. At the time this was the largest class action settlement in the roofing industry.

Articles concerning the corrosion problems of phenolic foam appeared in 1991 and 1993. This included "Metal Deck Corrosion: Three Case Studies" by R. P. Cannon[16] and "Steel Deck Corrosion Associated with Phenolic Roof Insulation" by Thomas L. Smith and James D. Carlson (NRCA).[17] An excellent follow-up article was published in *Professional Roofing* by the NRCA in 2005, entitled "The Aftermath of Phenolic Foam" by Rex Greenwald.[18]

Coal Tar Type III

Historically, a four-ply coal tar pitch membrane with gravel was one of the best-performing systems in the roofing industry. A life span of 30 to 40 years was not uncommon. Working with coal tar pitch fumes, however, was very problematic. The roofs had to be installed on low-slope or no-slope structures. The fumes would cause eye and skin irritation, and it was later learned that prolonged exposure to these fumes could cause cancer.

In response to the fume problem, the manufacturers of coal tar pitch changed the formulation and provided an additive that cut down on the fuming. Roofing contractors jokingly referred to the new coal tar as "perfumed pitch." The installation of the coal tar bitumen minimized eye and or skin irritation. Safety was touted as an advantage. The low-fuming "coal tar bitumen" was given its own ASTM designation in 1978: ASTM D450, Type III.[19]

After a few years of use of the coal tar bitumen, problems began to develop. The flood coat surface would begin to harden, crack, and split, unlike a typical coal tar pitch. An oily brownish residue would also develop on the surface of the roof. When questioned, the manufacturers denied asphalt had been added to their product. It turned out the additive being used was some type of paraffin or candle wax material.

The bitumen also had a higher softening point. As the roofs aged, cracks would develop in the surface of the roofing system. Overall, the roofs did not appear to be defective other than the oily surface. The cracking occurring in the bitumen, however, would go completely through the system. This would allow water to flow through the roof and into the interior of the building. I tested a number of these roofs which had prematurely failed.

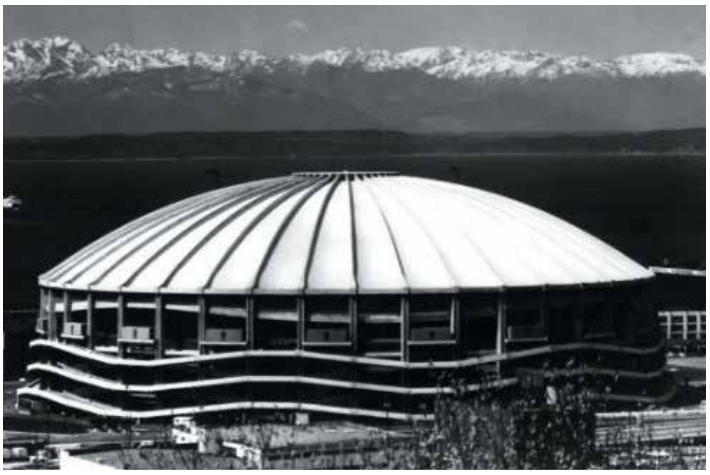

Figure 2. The Kingdome, Seattle, Washington.

FAILURE SUMMARY

Roof failures from workmanship, materials, or design have historically accounted for a considerable portion of business for the roof consulting industry. A big part of roof consulting over the last 50 years has been the introduction of new, unproven roofing systems. One of the problems is the new systems have to be in place a number of years in different geographic locations to see if they will perform. Some of these new systems have difficulty surviving the test of time. I am confident this trend will continue.

A FEW NOTABLE PROJECTS

The Kingdome, Seattle, Washington

REI was retained by the insurance carrier for King County on two different occasions. The first inspection involved a problem with a solvent-based coating applied over a polyurethane foam (PUF) roof also known as spray polyurethane foam (SPF) roof. The roof on the Kingdome consisted of a Tectum panel covered with reinforced concrete deck that was overlaid with SPF roofing, which was covered with an elastomeric coating (**Fig. 2**).

Two passes of solvent-based elastomeric coating had been applied over an existing SPF roof in 1993. The first pass of coating had not fully cured prior to the application of the second coating; the cool, cloudy, rainy weather in Seattle may have exacerbated this problem. The second coating did cure.

After the two coatings were applied, birds began to peck at the foam roof. One theory was the birds were getting high on the underlying uncured solvent, like sniffing glue. The peck holes were about an inch in diameter and extended into the polyurethane foam.

A meeting was held with King County, their architects, engineers, contractors, and the coating manufacturer. I represented the insurance carrier. The consultants to King County tried to put forth a claim on the roof indicating the holes were not related to pecking but were caused by hail or some other singular weather event phenomenon. When I tried to explain the bird pecking issue, the management representative with King County responded loudly, "Oh [expletive], you really don't expect us to believe the holes in the roof are caused by birds."

After some back-and-forth discussion, particularly with the coating manufacturer, the consensus of the various parties in the meeting was that the holes in the roof were in fact caused by birds. King County took the position that the bird peck holes were a covered peril under their insurance policy. The insurance carrier said yes, but each bird peck at a different time period has a "separate deductible." The fight was on! Eventually a resolution was reached.

A tragic event occurred at the Kingdome in 1994, resulting in the deaths of two workmen. The King County decided in 2000 to implode or

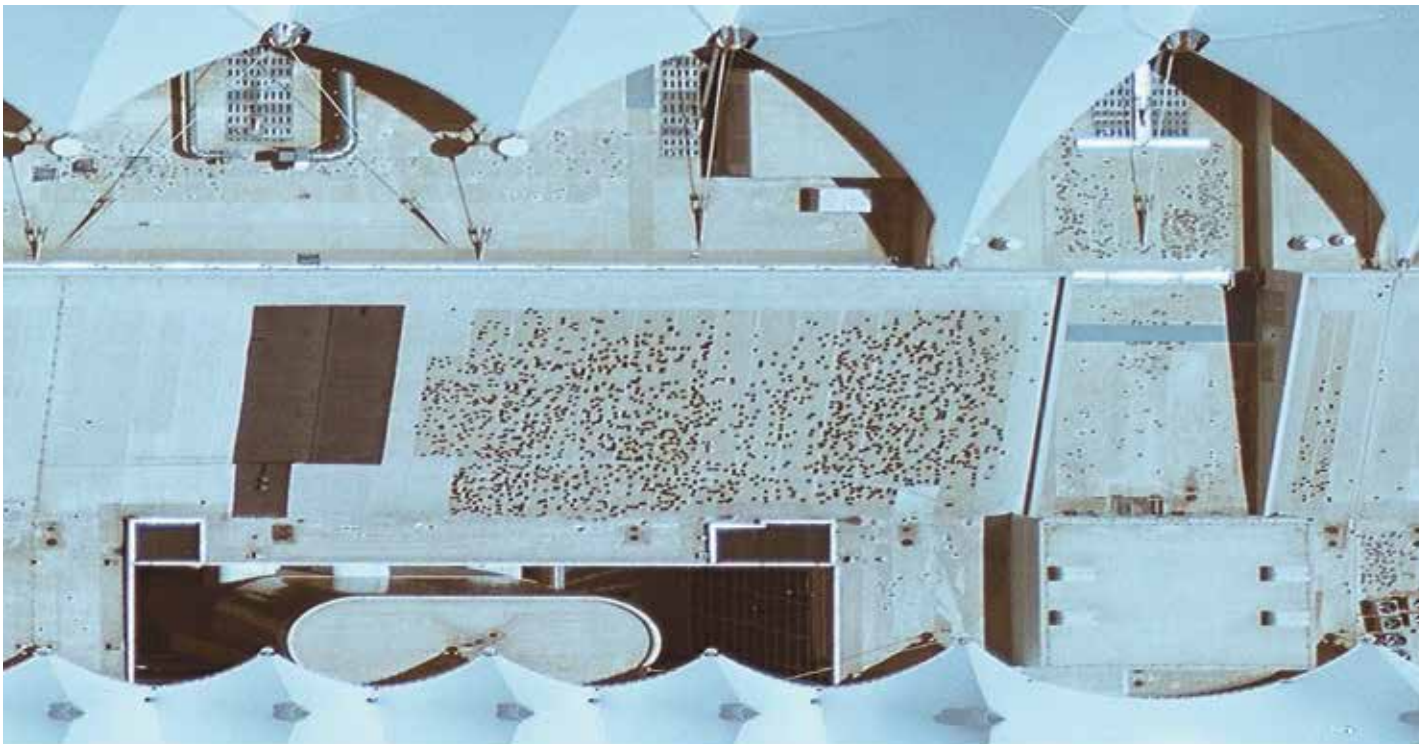

Figure 3. Denver International Airport roofs.

destroy the Kingdome. The two deaths and the eventual destruction of the Kingdome had all started with a coating and bird pecking problem on the SPF roof.

Stapleton International Airport, Denver, Colorado

I was retained to examine the PVC roof on the old Stapleton International Airport in 1997. The City of Denver had closed Stapleton International Airport and in turn opened the new Denver International Airport (DIA) in 1995. The roof consisted of a mechanically attached, non-reinforced PVC membrane. The PVC roof had shattered and completely failed, causing the unoccupied airport to flood. If the airport had still been in operation, it would have been a complete disaster.

While walking Stapleton International Airport's roof with the management for the City of Denver, the facilities director about halfway through the inspection stopped and exclaimed, "We have the same roofing system on the new Denver International Airport. Will the new DIA roof fail in the same manner?"

Denver International Airport, Denver, Colorado

The new DIA was constructed in phases. The south main terminal was initially constructed, followed by concourses A, B, and C. The roofs on all four areas consisted of PVC nonreinforced membrane. I was retained by the city of Denver to examine and test all four roof areas at DIA (**Fig. 3**).

The examination involved removal of 76 samples, each 2 × 2 ft. in size, from the main terminal and the three concourses. All of the samples were impacted with ice spheres per National Bureau of Standards 55 procedure. It was determinted that all of the PVC roofs were vulnerable to hail. Because of slight variations in the type of plasticizer used in the PVC membrane and age from the terminal to concourses A, B, and C, it was determined the main terminal was vulnerable to hail 1 inch in diameter.

Concourses A, B, and C were also vulnerable to damage from hail slightly larger than 1 inch. After a report was completed for DIA, a hail event did occur there.

The main terminal roof failed exactly as I had predicted. Fortunately, there was a relatively minor amount of rain following the hail event. The main terminal roof was temporarily repaired with 6- x 6-in. black membrane peel-and-stick patches. The PVC roof was replaced.

MURRAH FEDERAL BUILDING, OKLAHOMA CITY, OKLAHOMA

The Alfred P. Murrah Federal Building opened on March 2, 1977, and was named for an Oklahoma native who was one of the youngest federal judges in US history. I had worked on the building for the GSA. The roof was a ballasted EPDM (**Fig. 4**).

Former US Army soldier Timothy McVeigh parked a truck in front of the Alfred P. Murrah Federal Building on April 19, 1995. Within the truck was a homemade bomb built by McVeigh.

At 9:02 a.m. the homemade bomb exploded. Once the explosion occurred the surrounding area looked like a war zone. The Murrah building was reduced to rubble.

After the bombing of the Murrah Federal Building, JDKA was retained by several insurance companies to examine and evaluate damage to various buildings in the immediate area of the blast zone adjacent to the Murrah Federal Building.

The blast or shock wave from the explosion blew out windows and doors, resulting in the pressurization of the inside of the buildings. Consequently, roofs and structural decks were uplifted and damaged.

One of JDKA's clients was Zurich Insurance. A meeting was held in Oklahoma City with the president of Zurich Insurance, several building consultants, and senior property adjusters. The president of Zurich instructed the consultants that the primary goal was to restore the insureds to the pre-explosion conditions just as quickly as possible.

The president of Zurich stressed that the building consultants had a free hand to spend whatever was necessary to accomplish this goal, although they should not let it get out of control. Competitive bids for building repairs were not

Figure 4. The Alfred P. Murrah Federal Building in Oklahoma City, Oklahoma, after it was bombed.

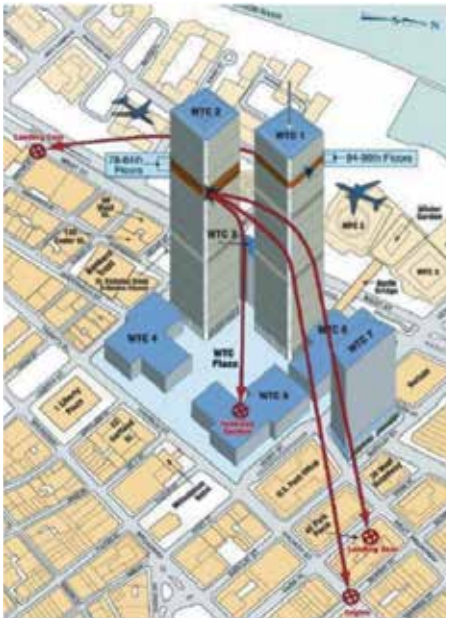

Figure 5. United States Post Office, 90 Church Street, New York, New York.

required. This was accomplished with several of the insureds in downtown Oklahoma City. Other JDKA insurance company clients took the same position. Often, insurance companies are criticized for not authorizing sufficient funds to repair damage to buildings. That did not happen in this case.

MedStar Washington Hospital Center, Washington, DC

On the morning of September 11, 2001, I was inspecting the roof on MedStar Washington Hospital Center in downtown Washington, DC. A roofer and several hospital representatives were on the roof with me. The hospital is approximately five miles northeast of the Pentagon.

I was walking the roof with my head down and taking photographs. During the roof inspection, one of the roofers yelled, "Look at that!" Smoke could be seen rising from the Pentagon, which had just been impacted by a hijacked airplane.

The roof inspection was obviously over. The clients and all of the people at the inspection left to return home. I stayed at the hospital for a few hours and helped move patients from one floor to another in order to have one floor open for incoming casualties from the Pentagon.

Initially, all flights out of Washington, DC, were canceled, and there was a long waiting list for the first available flights. I spent the next week at a hotel, along with at least a hundred other stranded people from all over the United States. I would see the same people every day for breakfast, lunch, and dinner, and by the end of the week, I had become friends with quite a few of them.

Finally, I was able to take the first American Airlines flight from Washington, DC, to Dallas. I sent a brief report to my client, specifying that the roof leakage was a flashing problem. I never heard back from my client about the hospital job.

United States Post Office, New York, New York

Following the September 11, 2001, attack by terrorists on New York, I examined the roof of the United States Post Office (USPO) located at 90 Church Street, New York.

United Flight 175, flying at 446 mph, had hit the World Trade Center Tower 2. A jet engine from Flight 175 penetrated through the building, exited, and hit the roof of the Church Street USPO (**Fig. 5**). The engine bounced off the roof and landed at the intersection of Murray Street and Church Street. The impact knocked a hole in the structural concrete deck of the USPO about the size of a small car.

Other falling debris hit the roof, resulting in impact damage. At the time of my inspection, temporary repairs had been performed to the roof. Some of the debris from the towers also partially obstructed the internal roof drains.

Special interest

Conventions Are Back! Will the Economy Cooperate?

The numbers don't lie: In-person conventions have come roaring back as concerns about COVID-19 have receded.

"Convention halls … across the country are filling up again, restoring a vital source of economic fuel that had been cut off during the pandemic and was slow to recover in many cities," wrote Austen Hufford in the *Wall Street Journal*. The Events Industry Council reported that its indexes show that conference and hotel demand in the fourth quarter exceeded the same in 2019.

What does that mean for you? More opportunities to travel and network. But for how long? Hufford noted that one Dallas, Texas, visitors bureau "is preparing for a short-term slowdown in tourism because of the possibility of a US recession." He also pointed to travel-budget cuts at Microsoft and 3M as further evidence of a possible downturn.

Source: Wall Street Journal

Mike Flippo/shutterstock.com