

An Idea's Journey

A Texas roofing contractor invents and brings to market one-of-a-kind technology

by Jim D. Koontz, P.E., RRC

On March 22, following a winter with some of the most significant snowfall in history, Beldon Technologies Inc., San Antonio, launched Roof Monitor,[™] a product that offers a technological solution to a serious problem.

According to a survey conducted by Paramount Disaster Recovery, Palos Verdes, Calif., more than 3,000 roof collapses occur in the U.S. every year. These collapses cost businesses and insurance companies millions of dollars in building repairs, damaged inventory and lost business—and they endanger lives.

With no way to know the actual weight of snow on a roof, building owners sometimes undertake unnecessary roof clearings. Such roof clearings can be just as dangerous and costly as collapses even though they may prevent them. Workers clearing roofs face a variety of hazards, including hidden skylights and slippery surfaces. Clearing snow and water can damage a roof membrane, resulting in a patched roof with a shorter life span, and forced shutdowns during clearings can result in lost business.

Although Roof Monitor is an innovative approach for managing safety risks and minimizing business interruption caused by large loads of water or snow on roofs, the real story is how this product was conceived, developed and brought to market by a roofing contractor whose passionate determination was to find a solution to a problem.

The **idea** guy

Brad Beldon, president and chief executive officer (CEO) of Beldon Roofing Company, San Antonio, has been involved in his family's roofing business since he was 12. Together with other companies in The Beldon Group of Companies, Beldon Roofing is a family-owned business that has been

in operation for more than 68 years and currently employs more than 500 people.

Active in the roofing community his entire career, Beldon served as president of the San Antonio Roofing Contractors Association and has served multiple terms on the board of directors for NRCA and the National Roofing Legal Resource Center.

During the years, Beldon has seen every roofing threat from building head pressure on drain systems to accumulating snow. He has witnessed first-hand the damage caused by roof collapses and has worked directly with affected building and business owners.

In 2002, a roof drain collapsed at Penner's Men's Store in San Antonio.

"As I surveyed the damage, the spark of an idea formed in the back of my mind that there has to be a solution to prevent such occurrences," Beldon recalls. "What if there was some way to alert building owners that something was wrong?"

Proper drainage is an essential component for roof system performance. It prevents long-term and excessive accumulation of water, which can contribute to the deterioration of most roof systems and, in worst-case scenarios, be responsible for structural collapses.

Clogged roof drains can be caused by a number of factors—from trash to leaves to dead animals. In some cases, especially reroofing projects, roofing contractors alter the designs of roof drainage systems and do not bring roofs up to current building code standards. Lack of regular maintenance and monitoring can lead to disaster, and many historical cases of roof collapses point to clogged drains and water accumulation.

Photos courtesy of Beldon Technologies Inc., San Antonio.





ON the WEB

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WHAT IS IT?

Roof Monitor™ is a technology-based system designed to monitor live loads of water and snow on low-slope roof systems and inform businesses of potential risks.

It takes the guesswork out of knowing when to take action by providing objective metrics with actual load measurements, a single point of technology for real-time monitoring of live load conditions, and alerts and alarms with protocols defined by the end user.

The system consists of several components:

- **Nonpenetrating battery-operated wireless sensors** installed on the exterior surface of the roof measure live loads, providing real-time information about even small changes in the environment.
- **Ethernet-based controllers** receive the wireless signal from sensors and send data to multiple redundant servers in data centers across the U.S.
- **A custom web-based interface** works with any operating system, delivering a live, pictorial representation of load conditions and using inferential data to reduce false alarms.
- **Monitoring and alert service operators** have access to live data and can dispatch information simultaneously to multiple users, including service representatives.

The system is designed for low-slope roofs on which water and snow can easily accumulate. These types of roofs are common in commercial buildings, such as large retail facilities and warehouses. Although retail businesses face the threat of damage to or loss of inventory, which can be costly, the same safety risks and threats of business disruptions occur in almost every industry, including government and education.

At a 30-year-old mall in Beaumont, Texas, which had recently been reroofed, the roofing contractor installed smaller inserts to all existing drains. During the first heavy rain following the reroofing project, the mall's roof collapsed in seven places. With the event occurring just before Christmas, stores inside the mall lost millions of dollars in inventory, and the mall remained closed for a year.

In another more tragic incident that resulted in the deaths of two people, the collapse of a loading dock roof area at a Houston grocery store was blamed on pine needles blocking two scuppers in the drainage system—a situation that could have been prevented with active monitoring and roof system maintenance.

Beldon says: “This is a major threat to businesses, especially because building and business owners expect drains to function properly in severe weather, such as heavy rain. They aren't necessarily watching their roofs closely for standing water, so when damage occurs, it's a complete surprise. With the number of situations like this that occur every year, I'm surprised an adequate warning system did not already exist.”

In August 2006, Beldon attended a peer meeting with fellow roofing contractors Jack Scalo, president of Burns & Scalo Roofing Inc., Pittsburgh; Bob Bechtholdt, president and CEO of Douglass Colony Group, Denver; and Doug Sutter, president of Sutter Roofing, Sarasota, Fla.

“I noticed a common issue emerging in our discussion,” Beldon says. “We all agreed that, in snowy conditions, there was no good way to prioritize one customer's request to remove accumulating snow over another's. In inclement weather, everyone is scrambling to prevent serious

damage, and businesses are getting pressure from regulatory bodies to clear snow or shut down for safety reasons. Without measurements to compare and help prioritize situations and proactive notification systems that catch problems before they cause serious damage, roofing contractors are left guessing where they should most urgently send their crews.”

Beldon recalls the moment an idea occurred to him: “Although one was related to water and the other to snow, the Penner's Men's Store drain collapse and the roofing contractors' issue shared a connection. In both cases, there was a need for a way to objectively measure load accumulation on a roof and alert necessary parties when a situation needed attention.”

Of all the alert solutions that exist in the roofing industry, none address snow and water; they ignore the need to measure head pressure on drains. Existing solutions also are reactive in nature because they only measure a structure's deflection. By the time a problem has been detected, the damage is done. Beldon set out to provide a solution that would tell building owners and other appropriate contacts when action was needed before damage occurs.

Building on an idea

Although it would later morph into something quite different, Beldon's initial idea took shape in the form of an array system with solar-powered cameras that would be set in place to actively monitor a roof, measuring snow and water as they accumulate and providing live information at all times. In addition to measuring live loads, the concept was to include a monitoring service, similar in structure to a typical alarm company.

“I saw a lot of similarities in my proposed system to that of a security monitoring system,” Beldon says. “I consulted Vallance Security Systems, Schertz, Texas, to better understand the monitoring business model, and I learned, among other things, that there is a market for reselling the monitoring service that security companies offer. This confirmed the feasibility of my idea and provided me a potential resource that I could later tap into.”

With the invention beginning to take shape, Beldon began his search for a product development team.

“I attended an educational session July 18, 2008, on commercialization delivered by Dr. Cory Hallam of the University of Texas at San Antonio's (UTSA's) Center for Innovation and afterwards approached Hallam requesting his assistance,” Beldon says. “Along with a team of graduate students and Dr. Arturo Ayon, a UTSA associate professor and dean of physics and astronomy, Hallam researched my proposed system to determine the feasibility of the concept.”

The UTSA team concluded the camera array system might not be the best solution because snow could potentially bury the cameras. However, the team proposed a more technological system that would measure

live loads using pressure sensors—a concept that would develop into the basis for Roof Monitor.

To secure the invention, Beldon hired New York patent attorney Sean J. Grygiel of Fish & Richardson. Four patents are pending in 50 countries, and a fifth has been filed as of press time.

Commercialization

Beldon needed partners to transform a product concept into a business.

“I needed the guidance of someone who had been here before, so I asked a business consultant friend of mine, Richard Wilson, for a recommendation,” Beldon explains. “He referred me to Rich Glomski, a former CEO with experience launching a successful business from scratch. Glomski helped me develop the business plan and assemble the right team.”

With the help of Glomski, Beldon registered the company to do business in all 50 states and hired an operations director with 15 years of experience, a chief financial officer who also is a certified public accountant, and an executive assistant with an extensive call-center and customer service background.

The next step was to find local partners to help with the commercialization.

“I wanted to be able to drive over to a building and sit down face to face,” Beldon says.

He spent the past couple of years sourcing and working with commercialization partners, starting with an engineer to help develop the product for commercialization and two separate manufacturing facilities—one to build the sensors and controllers and one to build case molds and cases. Additionally, he contracted a firm to develop software and hired a packaging company and creative firm to develop the brand, marketing collateral and website. The components were all in place for a successful product launch, pending product testing, which would require multiple stages.

Product testing

From 2010-14, the Roof Monitor team went through seven sensor prototypes, testing and revising different shapes, plastics and electronic components. Although the electronics and casings will be fabricated in the U.S., injection molds for the sensors were manufactured in China. Beldon describes the final stages of lab testing as a whirlwind of activity.

“We kept getting prototypes of the injection molds that didn’t work, and the turnaround time to get each test in hand took too long,” Beldon says. “I booked a flight to China with only five days to plan, and it took four days to get a visa. I spent a busy three days in China testing the product—adding and shaving components off the existing mold—to get to a prototype we could work with. Every time we changed the mold, we had to create another and retest it.”

Size and shape weren’t the only quality control concerns.

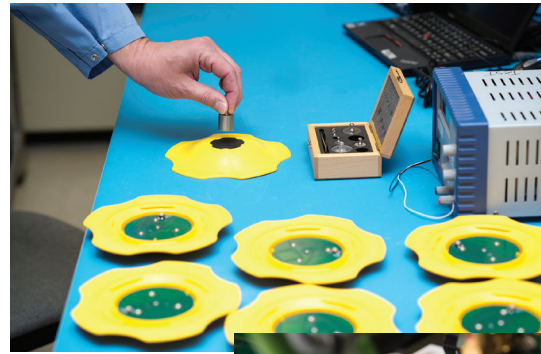
“It was important our casings were a certain color, but units kept coming out in different shades of yellow,” Beldon says. “We had to find an expert to help develop a new colorant that would be more stable. To get this done in three days wasn’t easy. I had to find somebody who knew somebody. From what I’ve learned, that’s how this works—it’s all about leveraging relationships.”

At the completion of lab testing, installing the product on actual roofs is the final step. The first systems are planned to be installed on buildings in Colorado, Florida, New York, Pennsylvania and Texas to test the monitoring and functionality before releasing the product to the public.

If Beldon has learned anything throughout this long process, it’s that a great idea does not make a successful product. It takes dedication and an investment of time and money.

“I never thought it would be so expensive or take so long to develop a new product,” Beldon says. “Changes in the roofing industry typically are changes to existing products. This is a brand-new system, and we are learning the science daily. To date, we have spent more than \$900,000 on research and development. We’re writing algorithms that didn’t exist before, taking into account, for example, the relative density of dry snow, wet snow and water. This has been a grueling process, but I’m excited to introduce this product into the market.” 🏠❄️

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Top and middle: To date, more than \$900,000 has been spent on research and development, including lab testing on electronics and casings for system components. Bottom: From 2010-14, the Roof Monitor team went through seven sensor prototypes, testing and revising different shapes, plastics and electronic components before the final product was achieved.