WHAT WE TALK ABOUT WHEN WE TALK ABOUT RESILIENCE

Think resilience is only about disaster response and recovery? Think again.

by Stefan Riches

"It was my sister Ellen's birthday, and she'd always wanted a Victrola record player. Mom saved up for a long time," recalls Transportation senior principal Marsha Anderson Bomar (Atlanta, Georgia). "While Mom was walking home from the store after buying the Victrola, the rain got *intense*. And by the time she got home, the cardboard box the Victrola came in was gone, stripped away by the storm. Fortunately, the record player survived."

That storm was Hurricane Donna, which struck Marsha's hometown of Brooklyn, New York, in the fall of 1960, when Marsha was nine. The storm intensified as Marsha and her mom picked Ellen up from school. "Ellen jumped in the car; we hadn't driven five feet when a tree crashed down—right where we'd been parked," says Marsha. The Victrola. The frightening near-miss. Vivid early memories. But then Marsha—now the vice chair of the American Society of Civil Engineer's Infrastructure Resilience Division—went years without hearing about another hurricane. Now they're almost annual events.

Extreme weather events like Katrina, Irene, Sandy, and the Alberta floods—plus droughts, economic downturns, infrastructure decay, aging populations, hackers, earthquakes, terrorism, and more—draw our attention to a growing movement in architecture and engineering: resilience. *spark* is dedicating four issues to this complex topic. So what do we talk about when we talk about resilience? Let's hear from some of our experts.

We Talk about Adaptation

Resilience: The capacity to recover quickly from difficulties; toughness (Oxford Dictionary). Disaster recovery is a critical part of resilience, but Stantec's Sustainable Development vice president, Marty Janowitz (Halifax, Nova Scotia), thinks *Oxford*'s definition is too limiting. "After a disaster, if we bring a community back just to the way it was, we're waiting for the next punch." Resilience should include adaptation, he argues.

Community Development principal Larissa Brown (Boston, Massachusetts) agrees. "The Community & Regional Resilience Institute developed my favorite definition of resilience: 'The capability to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change.'" The post-Katrina New Orleans city master plan says it well: "Don't build back, build better."

We Talk about Creative Destruction

Creative destruction was popularized in the mid-1900s by Harvard economist, Joseph Schumpeter. He defines it as a process of disruptive innovation that incessantly destroys old ways of doing things to create new ones, causing pain for some (think buggy makers and Polaroid) but benefits to others (think automobile and digital camera companies).

Marty argues that our business could use more creative destruction. "When there's a calamity or other significant change to a system, we can return to the status quo or view the disruption as an opportunity for fundamental system redesign," he says. Massive disturbances caused by climate change could spur cities to

- Expand access and opportunities for urban agriculture
- Protect against floods with engineered wetland parks
- Augment or replace electrical grids and water treatment plants with onsite renewable energy and water cycling systems
- Provide equitable access to systems and services that protect socially vulnerable people

We Talk about Risk

Senior environmental engineer Roger Rempel (Winnipeg, Manitoba) helps clients understand and manage risks associated with climate change. He sees reasons for both concern and optimism. "A lot of critical infrastructure is designed using codes and standards based on historical climate data, so the infrastructure isn't resilient to future impacts of climate change. When unprecedented weather events impact that infrastructure, communities can be devastated," says Roger. "Low resilience means high recovery costs, no ability to predict

A safe haven: Our design of Pier 4 in Boston, Massachusetts, promotes community cohesion—a critical component of resilience—through well-appointed common spaces where neighbors get to know each other. The apartment building is also resilient to storm surges, thanks to a concrete wall around the perimeter, elevated electrical systems, and a first floor that sits above the 100-year flood level.

Forward planning: We prepared an entire chapter in Stamford, Connecticut's master plan on planning for a resilient future. It focuses on waterfront and open spaces, context-sensitive development, environmental protection, energy, and other improvements.

or manage the timing and magnitude of those costs, and increased demand for a community's limited emergency response capacity."

To help infrastructure managers understand and prioritize risks and to assist clients in managing these risks, Roger and his colleagues apply frameworks such as Canada's Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol and the United States's Vulnerability Assessment Scoring Tool (VAST). "These tools contribute to the ongoing risk management effort that's central to infrastructure management programs," says Roger.

We Talk about Planning

Stantec's Disaster Management program manager Bob Schreibeis (Washington, DC) has frontline experience helping communities recover from disasters like Katrina. "The disaster cycle has four parts: preparedness, response, recovery, and hazard mitigation," he says. "Resilience is an outcome we plan for by using the disaster manager's preparedness and hazard mitigation toolkits to reduce disaster risk."

Achieving a resilient outcome means assessing risk at the earliest possible stage. "Resilience should be baked into project and master plans—right from the start—not simply bolted on later," says Bob. How? By identifying threats and hazards such as storms, earthquakes, and attacks; evaluating our client's vulnerability to them; and helping clients establish project priorities by encouraging them to be honest about their tolerance for the consequences of being unprotected.

We Talk about Envision

The Envision Infrastructure Rating System—think LEED for civil infrastructure—rewards projects designed for flexibility, durability, and adaptability, while prompting design teams to more thoroughly consider climate projections and anticipated impacts where infrastructure is built. For example, the Grand Bend Area Wastewater Treatment Facility (see "Local Sparks") received a Platinum rating in part for flexibly meeting expected future sewage demands and for incorporating anticipated rainfall, storm, and seismic hazard trends into the design standards.

We Talk about Combining Environmental and Urban Agendas

When the City of Boston, Massachusetts, proposed building a huge storm gate in the harbor to protect against storm surges, Community Development senior principal David Dixon (Boston, Massachusetts) cringed. "We'll spend a lot of money on resilience, but unless we simultaneously address other things cities need—like infrastructure renewal, livability, and equity—we're going to run out of money." Instead of building storm gates, David suggests we restore wetlands to protect us from storms and to provide recreational opportunities for residents.

"To borrow Bob's metaphor, most clients I work for want to bake resilience in, but don't want resilience to make up the entire recipe," says David. "However, we don't want to taste environmental resilience; we want to taste great quality of life."

We Talk about Sustainability

Is resilience simply the next sustainability? Nope. Simply put, *sustainability* focuses on strengthening a system's health and vitality over time. *Resilience* means preparing for and adapting to adversity. To have both, we consider social, environmental, economic, and stakeholder impacts holistically.

But the two can be in conflict. A bridge can be designed to the highest environmental standards but be vulnerable to floods. That same "green" bridge can be designed to survive a 1-in-100–year storm but accelerate environmentally destructive urban sprawl. "We must be guided by resilience *and* sustainability when designing infrastructure systems," says Roger Rempel.

We Talk about Unity and Equity

"The more fragmented we are as a society, the tougher it is to be resilient. So be a united community first," advises David Dixon. "Resilience is about

"My greatest reward is to make a difference, to leave a better world than I found. Resilience is a galvanizing issue that gets people to take a holistic view and realize that we have a major challenge to overcome."

David Dixon
Senior Principal, Community Development (Boston, Massachusetts), and TEDx speaker on "Redefining Resilience"

protecting the cultures, economies, and communities we invest in." But with cities increasingly divided by ethnic, racial, and economic differences, is there hope? "We can't be pessimistic about something that's so serious," says David. "We're in this together, so we need to bring marginalized people into the economy. If we don't do it with our resilience investments, we'll have no dollars left to address social equity issues."

We Talk about Hardening Infrastructure

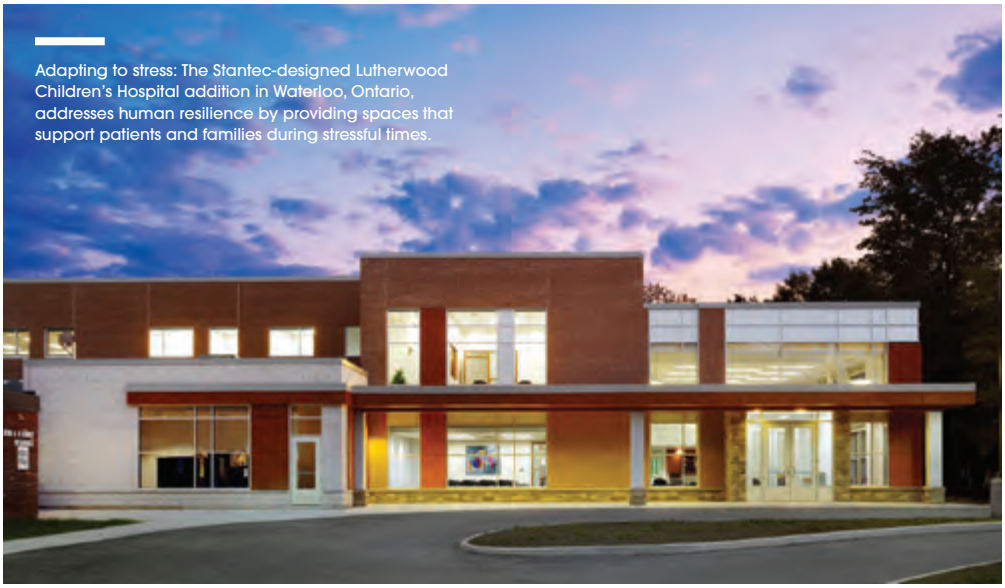
Fallen power lines. Submerged substations. Damaged refinery cooling towers. "Resilience means dealing with conditions we haven't seen before," says Power business leader Bill Shelley (Scarborough, Maine). In our Power and Oil & Gas sectors, we help clients roll out "hardening" programs that make infrastructure better able to withstand extreme weather and other challenges. Concrete or steel, instead of wood poles and structures. Substations bolstered and elevated above revised potential flood levels. Wind girders installed inside cooling towers. And all infrastructure hardened against physical and cyber terrorist attacks.

In the Power sector, clients are also investing in distributed energy and microgrids—small-scale power grids connected to the main grid that break off and operate on their own in times of crisis. "If a storm knocks out one section, the grid uses real-time communications technologies to instantly isolate the problem and reorganize the grid to prevent wider blackouts," says Bill.

We Even Talk about Smart Pigs

"Pipelines, as linear infrastructure, are inherently resilient," says vice president of Pipelines, Ziad Saad (Calgary, Alberta). The Government of Canada declares that "between 2000 and 2011, 99.9996% of crude oil and petroleum products transported on federally regulated pipelines moved safely." Yet one pipeline spill is one too many, so Ziad and his team use management systems to help clients improve pipeline integrity.

From blight to sight: It's hard to believe that Sydney, Nova Scotia's Open Hearth Park was once the Sydney Tar Ponds, one of Canada's most contaminated sites. Thanks in part to Stantec's landscape architects, planners, and environmental specialists, the park provides Sydney residents with recreational and entertainment opportunities, and wildlife with a place to call home. It also serves as a natural buffer against stormwater surges.



Adapting to stress: The Stantec-designed Lutherwood Children's Hospital addition in Waterloo, Ontario, addresses human resilience by providing spaces that support patients and families during stressful times.

But what are smart pigs? "These devices, developed by specialized companies, are similar to medical diagnostic equipment," Ziad explains. Smart pigs travel through pipelines and use ultrasound, X-ray, or electromagnetic technology to find defects. As part of our Stantec Lifecycle Integrity Management (SLIM) system, we design "piggable" pipelines and help clients interpret data that the smart pigs collect.

We Better Not Talk about Silos

"During Hurricane Sandy, high water levels caused pumping stations to short out," says Marty Janowitz. "Pumping station designs that weren't integrated with the transit system caused water to back up into New York's subways, so the subways couldn't run. Then other systems stopped functioning because the people running them couldn't travel."

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"Resilient infrastructure is society's circulatory, skeletal, and digestive system," says Marty. "We'd never design a hand without considering the heart; however, we often design infrastructure in silos. Designing with resilience in mind means looking at how all systems—power, water, transportation, communications, buildings, and others—impact one another."

For resilience program manager John Malueg (Winston-Salem, North Carolina), resilience isn't a topic to think about, but rather a holistic approach to the way we do our work. "Resilience is good business. We want to reduce the risk of loss of life and property damage, plus consider the social, economic, and environmental impacts and benefits."

Envision promotes holistic thinking by providing a framework and language for entire project teams to discuss sustainable design challenges and opportunities. On the Grand Bend Area Wastewater Facility project, engineering and environmental teams met to vet ideas to ensure they were cost effective, helped achieve project goals, and didn't create regulatory issues.

But We Must Talk about People

"We use design to promote human resilience to life's unexpected tragedies," says Health & Wellness sector leader Annie Coull (San Francisco, California). Since the 1990s, healthcare facility designers have focused on the physical environment's impact on patients, families, and healthcare providers, primarily on their experiences in stressful circumstances. Walk into any modern hospital; you'll notice ample daylight, access to nature, intuitive wayfinding, and quieter environments than in the past. "These design elements aren't new, but evidence is growing that suggests they positively impact human resilience," says Annie.

We examined human resilience while working for the Nova Scotia Climate Directory. "Communities with a higher degree of citizen cohesion and trust than others are more resilient and adaptive, even when they have similar infrastructure," says Marty Janowitz.

Finally, We Need to Talk More

"When I was working with the City of New Orleans after Katrina, resilience was minimally understood and two-dimensional," says David Dixon. "Leaders focused on what they could build on the water to protect New Orleans, and they talked about a retreat strategy—how to relocate communities. But relocating thousands of people is too complicated and would cost far more than protecting people where they live."

Annie Coull echoes David's thoughts. "When people in the industry talk about resilience, they're talking about emergency preparedness," she says. "Our team is trying to broaden their definition by showing how design impacts all kinds of resilience. Human resilience, the ability to adapt buildings to user needs over time, and more."

So the next time you're talking about resilience with clients and peers, keep the nuances in mind. As Larissa Brown points out, "Knowing how to talk about resilience and understanding that it adds value can help Stantec become a leader in designing resilient communities."

Learn more about what motivates more of our resilience experts by visiting the *sparkonline* landing page.