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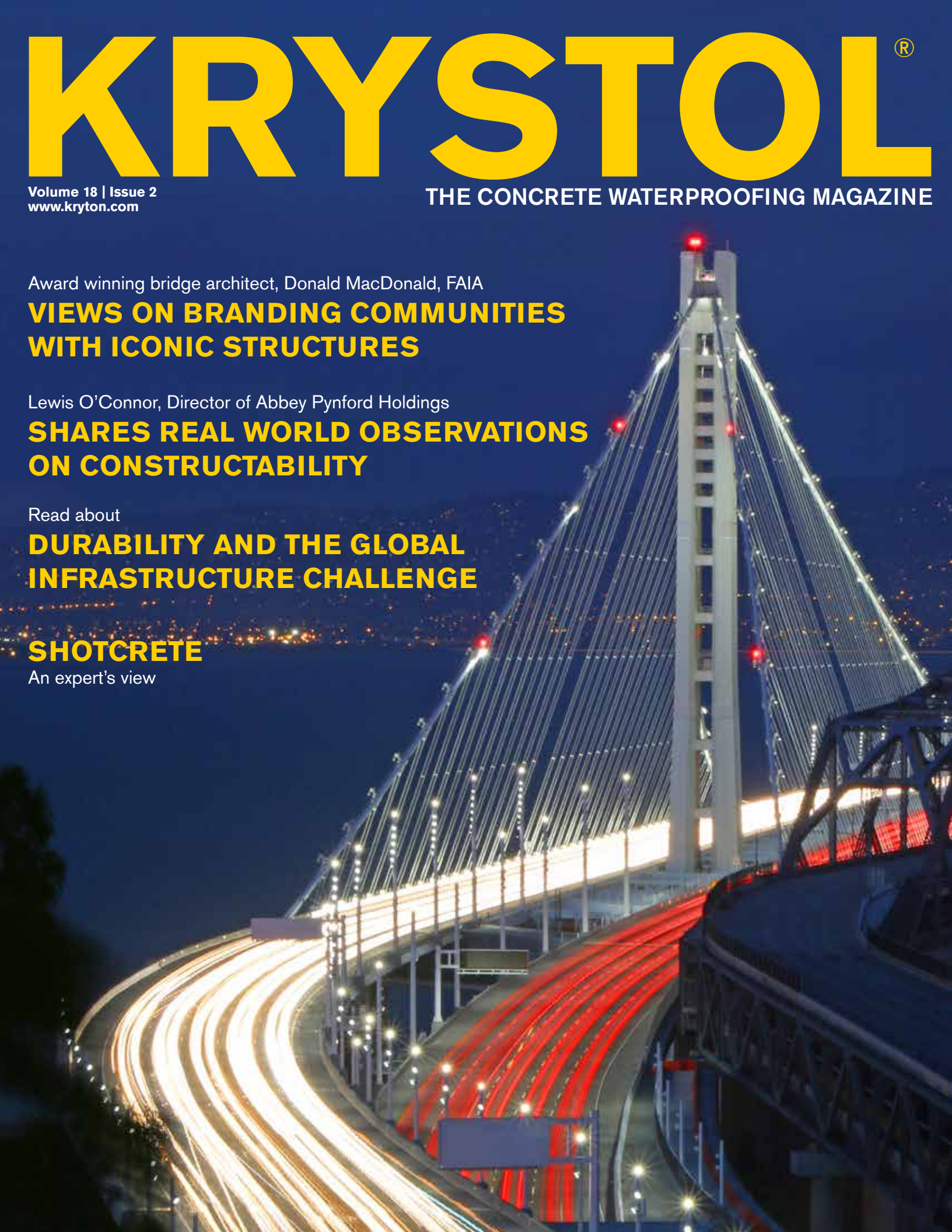
THE CONCRETE WATERPROOFING MAGAZINE



Award winning bridge architect, Donald MacDonald, FAIA

VIEWS ON BRANDING COMMUNITIES WITH ICONIC STRUCTURES

Lewis O'Connor, Director of Abbey Pynford Holdings

SHARES REAL WORLD OBSERVATIONS ON CONSTRUCTABILITY

Read about

DURABILITY AND THE GLOBAL INFRASTRUCTURE CHALLENGE

SHOTCRETE

An expert's view

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Kryton International Inc. provides the most effective concrete waterproofing systems in the world. With over 43 years of experience, 50 distributors worldwide, and more than 10,000 successful waterproofing projects, Kryton is recognized and acknowledged as the global leader in concrete durability. **Learn more at kryton.com.**

Editor: Jason Bryant
Art Director: Yvonne Lee

Contributors:
Jason Bryant
Kari Yuers
Rolf Skala
Lewis O'Connor
Donald MacDonald
Stuart Manning

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www.kryton.com

For information about
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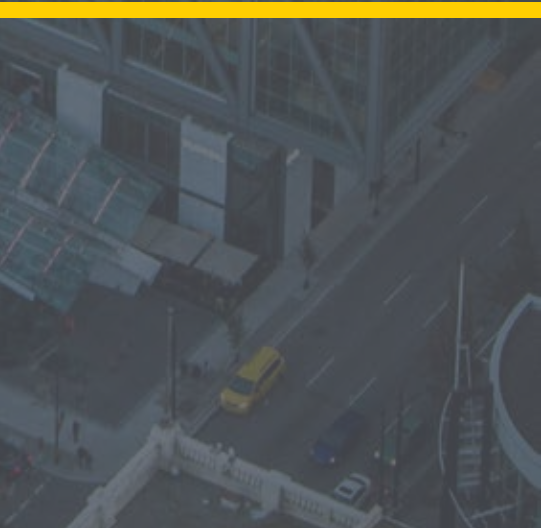


MESSAGE FROM THE **CEO**

The construction world is at a crossroads of sorts half way through 2016. The Canadian government is in the midst of planning and executing economy changing infrastructure, as well as high-rise building in major cities like Toronto, Montreal, and Vancouver. In the United States there have been some significant infrastructure developments, as illustrated by the great addition to the Oakland Bay Bridge linking San Francisco and Oakland, but there also remain many challenges in the coming years.

Moving overseas, the United Arab Emirates is bouncing back from the last economic slowdown. Latin America is spending billions on infrastructure throughout most countries in an effort to move populations outward instead of creating more cramped metropolises. India, China, and Turkey are embarking on huge metro transportation projects that will change the way their residents travel regionally.

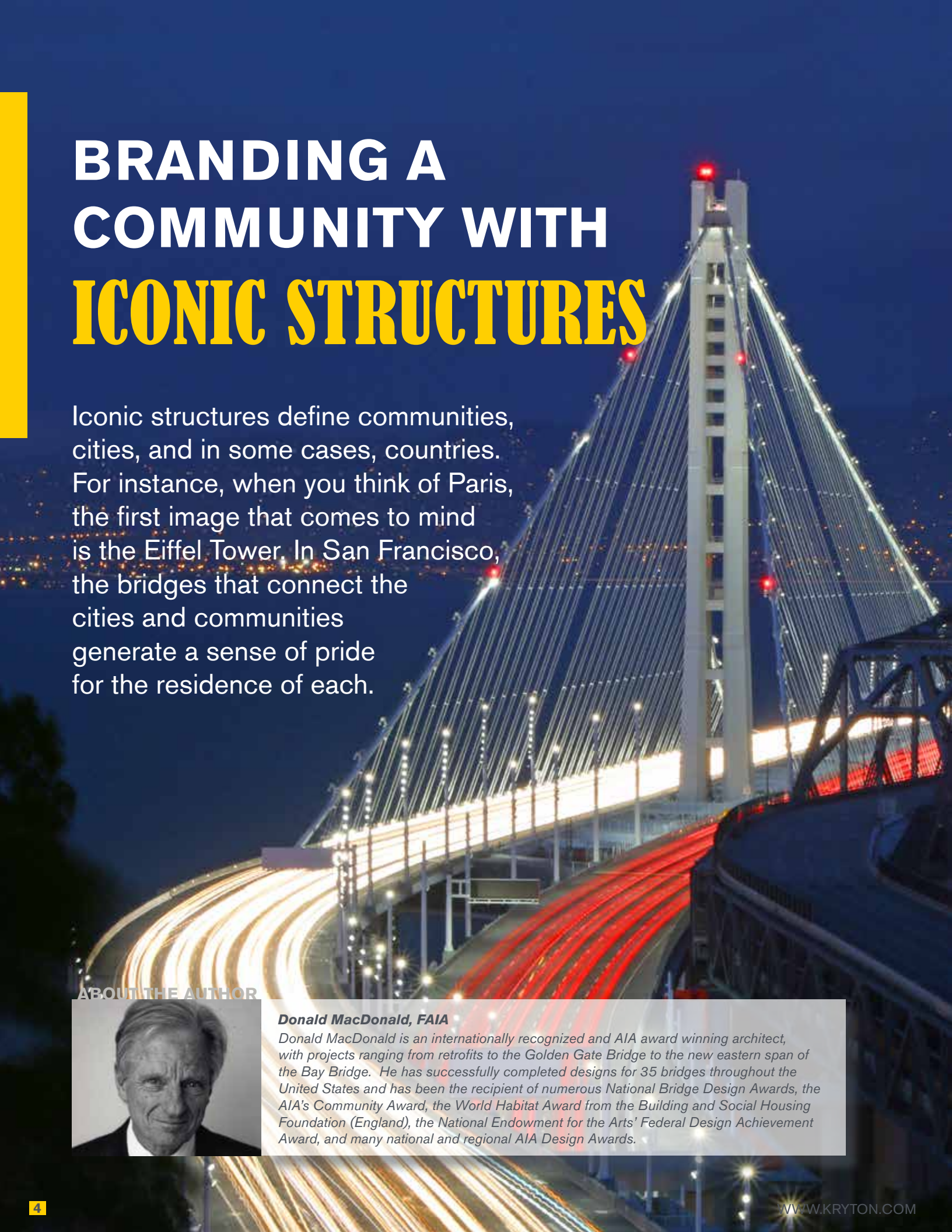
All of this is being done with durability at the forefront. The construction industry and governments now know that all projects must be built to last using products that are time-tested and demonstrate proven success. The call for smarter solutions to deteriorating and crumbling infrastructure is at an all time high. Those solutions must rise from the depths through key partnerships and innovative thinking to ensure a sustainable world is built for future generations.

KARI YUERS, FACI
PRESIDENT & CEO

IN THIS ISSUE

BRANDING A COMMUNITY WITH ICONIC STRUCTURES

Iconic structures define communities, cities, and in some cases, countries. For instance, when you think of Paris, the first image that comes to mind is the Eiffel Tower. In San Francisco, the bridges that connect the cities and communities generate a sense of pride for the residence of each.



ABOUT THE AUTHOR

Donald MacDonald, FAIA

Donald MacDonald is an internationally recognized and AIA award winning architect, with projects ranging from retrofits to the Golden Gate Bridge to the new eastern span of the Bay Bridge. He has successfully completed designs for 35 bridges throughout the United States and has been the recipient of numerous National Bridge Design Awards, the AIA's Community Award, the World Habitat Award from the Building and Social Housing Foundation (England), the National Endowment for the Arts' Federal Design Achievement Award, and many national and regional AIA Design Awards.

QUESTIONS & ANSWERS

Q&A with celebrated Bridge Architect, Donald MacDonald, FAIA

Q: How exactly does a structure become an iconic symbol within a region?

A: Well, before an iconic structure can become a beacon of hope or sense of pride, it must be built with the best of intentions. By which I mean, these structures that will act as a symbol identifying a region must do so for many decades, if not centuries. Ask yourself, would the Golden Gate Bridge be so famous if it had crumbled after only a few short years and had to be replaced? In Vancouver, would the Lions Gate Bridge be an icon of one of Canada's most beautiful cities if it was deemed unsafe after a short time? Likely not. These structures built with the intention of branding must stand the test of time, just like a message needs to be repeated many times before it becomes synonymous with a brand.

Q: Further to branding, how does a designer do so without disturbing the natural elements of the environment?

A: First, bridges aren't just built without regard to the environment, community, and region they are in. For the Tilikum Crossing in Portland Oregon, before a single cable was strewn or concrete foundation poured, I studied the natural elements that made the composition of the area so unique. For Portland, a city always known to have great bridges, encapsulating Portland's stunning surroundings was key. Mount Hood played a big part in this, as it seems to stand guard over Portland. The bridge's dimensions and angles were perfectly aligned to accent the statuesque mountain in the distance. This entrenches the bridge within the community, making it one with its surroundings as if it was built by divine purposes.

Q: Do the surroundings of a bridge dictate the design in a sense?

A: Absolutely. All of the elements of a region are taken into account in order to design a bridge that will contribute to all factors of that with which it will serve for a century. To become a brand, the bridge, or structure of any kind really, must be unique to the people and environment of the region. You can't put the Golden Gate Bridge in Portland or London's Tower Bridge in Singapore; it wouldn't fit and would end up more of an unseemly eye sore. Thus, these iconic bridges that brand a city must be specific to that place and no other – that's what makes them unique.

Q: Explain what you mean by architectural intuition?

A: Well, by this I mean, an architect must extract their knowledge derived from education and experience, and combine it with artistic creativity. This includes sensitivity to the people who will occupy and view the building, as well as the community and environment surrounding it. Before a single drop of concrete is poured, the architect is at work. For the Bay Bridge and the Tilikum Crossing, extensive study of the site, survey map, and related data took place. This developed the environmental context for the bridge; the natural and physical influences, topographic characteristics, soil conditions, solar impact, views, microclimate etc. As said, taking in this research allows an architect to define the region and create a unique structure specific for a region. It also allows the people within the community to boast a great sense of pride for the one-of-a-kind offering, such as the Bay Bridge in Oakland. In fact, the Bay Bridge is seen as such a pillar to the community that the NBA's Golden State Warriors believed it should serve as their logo. The architectural intuition is the process that led to this, serving to further brand the community.

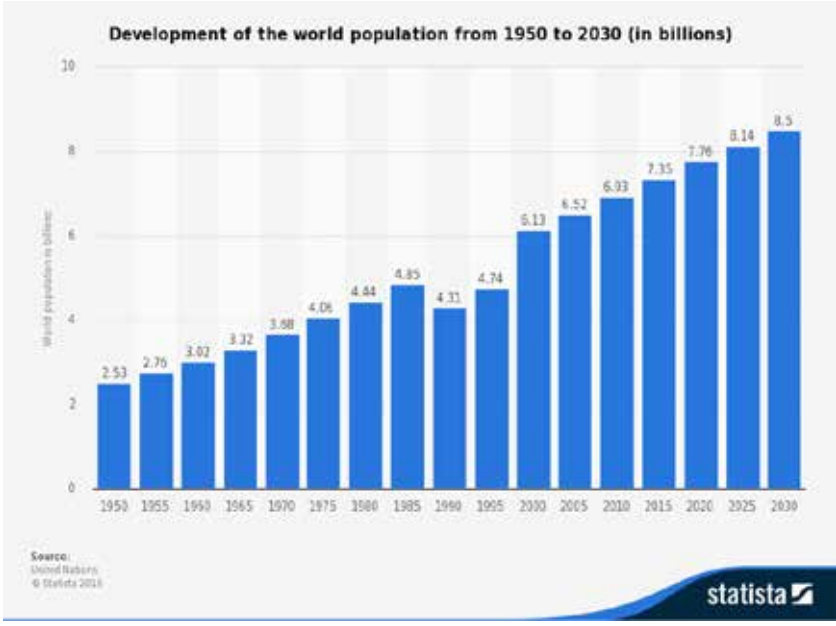
Creating iconic structures is not just about how high they are built or how many features they possess, but instead how they blend with the region to become part of the fabric that binds a region together. The process an architect enters to ensure that each structure is unique and special to that region is how iconic structures brand a community. ■

San Francisco-Oakland Bay Bridge, United States

DURABLE INFRASTRUCTURE: A GLOBAL NEED

All across the globe countries are making infrastructure investment a top priority. Some of this is occurring due to years of under-investment creating crumbling infrastructure, and others because of population and economic growth. In India and regions of the Middle East, growing populations have seen their infrastructure become unsuitable for the amount of people it needs to serve. In North America and many parts of Europe infrastructure neglect has caused a call to refurbish crumbling structures for safety reasons and to cater to growing populations.

In November 2015, some United States Presidential candidates suggested $275-Billion USD in federal infrastructure spending to be allocated over the next five years. Likewise, other leading politicians have stated that major investment was needed to repair and rebuild the crumbling infrastructure across the US.



The Long Bridge over the Potomac River connecting the District of Columbia and Arlington, Virginia is old, corroding, and inadequate.

Photo by Ron Cogswell

The country's aging infrastructure is costing Americans

$130 Billion USD

annually

According to the Federal Highway Commission (FHWA), the annual direct cost of corrosion for highway bridges is estimated to be $13.6 billion USD.

Global infrastructure spending of nearly $78-Trillion USD between 2014 and 2025, with capital spending to hit $9-Trillion USD by 2025

In Mexico, large Liquefied Natural Gas (LNG) projects and Metro expansions have the federal government investing heavily in infrastructure construction. Moving over to India, the Delhi Metro system will be the 3rd largest in the world by 2021 when it is completed, whose ridership continues to grow exponentially every year, with phase II of IV costing $3.2-Billion USD.

Infrastructure spending is resulting in a huge push for the construction industry all across the globe. In some cases it is to replace failing structures and in others to build what should have been built well before the population explosion in certain regions. In 2014, PricewaterhouseCoopers forecast global infrastructure spending of nearly $78-Trillion USD between 2014 and 2025, with capital spending to hit $9-Trillion USD by 2025.

Infrastructure brings with it many benefits for a population. One of which is to significantly increase economic activity and employment, which is a major aim for any government around the world. However, poorly built and maintained infrastructure can then threaten that economic growth in the future.

Using appropriate products and methodologies to construct infrastructure is vital to the viability of a project. Getting down to the details, the most used man-made construction material in the world is concrete. Spanning from large infrastructure projects to small basements in residential homes, concrete is used. Its versatility, durability, and availability are all contributing factors to it being so widely used.

Taking the LNG project in Coastal British Columbia into account, an immense amount of concrete is being used for all of the billion dollar projects. Diego Orozco, Civil Engineer specializing in LNG Tank Construction, Project and Risk Management, worked on an LNG terminal project in Mexico that used loads of concrete.

"The Mexico project used over 80,000m^3 (105,000 yd^3) of concrete for the outer shells of the storage tanks holding LNG, as well over 35,000m^3 (177,000 yd^3) of additional concrete used to construct the jetty and other buildings within the processing area."

Moving forward to Kitimat, BC, one of the projects alone will be using over 150,000m^3 (196,000 yd^3) to complete, not to mention the plethora of other projects around the coast of BC. Orozco further goes on to state that the durability of the concrete it's integral to the long-term success of this LNG infrastructure.

Concrete has many benefits, but does have a few limitations, including low ductility, tensile strength, strength-to-weight ratio, and is susceptible to cracking. Above all, concrete is permeable, allowing the ingress of deleterious materials, which leaves a structure vulnerable to the attack of chemicals.

> The Mexico project used over 80,000m³ of concrete for the outer shells of the storage tanks holding LNG, as well over 35,000m³ of additional concrete used to construct the jetty and other buildings within the processing area.

DIEGO OROZCO,
Civil Engineer specializing in LNG Tank Construction,
Project and Risk Management

This is not to say that durable concrete will not require maintenance and repairs from time to time to ensure the safety and service life standards of the concrete structure are met. Moreover, a durable structure will lessen the burden of the costly maintenance and repair. This means life-cycle costs (total cost of ownership over the life of an asset, including those costs associated with maintenance and repair) will be significantly lower over a longer lifespan with a durable structure. The monetary savings by building durable structures cannot be understated. For instance, according to the US Government in 2011. 'The country's aging infrastructure is costing Americans $130-billion USD annually'.

Still, the passage of moisture into concrete is the most destructive force attributing to concrete deterioration.

Thus, concrete waterproofing is vital to ensuring the durability of concrete is set and maintained at the highest level possible. To create a durable structure the permeability of the concrete must be lowered. This requires a waterproofing solution. Traditional waterproofing systems use membranes but today many use an internal waterproofing admixture as they are more sustainable.

Externally applied membranes ranging from cold-applied polymer-modified bitumen sheet membrane or a rush applied liquid membrane require perfect application in tight spaces with highly skilled and suitably trained installers done in dry weather. They are also labor intensive, can easily be damaged or torn, and some need the use of toxic chemical additives. Furthermore, once there are leaks, repairs (or outright replacement) for external waterproofing membranes can be expensive,

Photo by Sam Beebe

Kitimat, BC, Canada – The LNG projects in Northern British Columbia, Canada will use an immense amount of concrete to durably construct.

The Cheniere LNG tanks are seen at the Sabine Pass LNG facility in Louisiana, USA. Costs for constructing the facility have been estimated at $18-billion.

Photo by Roy Luck

AROUND THE WORLD

GOROGONE, AUSTRALIA'S LNG QUICK CONCRETE FACTS

- 107,000 m^3 (140,000 yd^3) Precast
- 130,000 m^3 (170,000 yd^3) In-Situ
- 13,000 m^3 (17,000 yd^3) Lean
- 1.29 Million m^3 (1.68 million yd^3) Earthworks

complicated, and sometimes, impossible. This is especially true for below-grade applications. These limitations are some of the main reasons why global infrastructure projects aren't living up to the increased demands on lifespan.

The application of the innovative crystalline technology is simple as it is added directly to the concrete mixture. Unlike surface applied membranes, an internal waterproofing admixture actually improves over the lifespan of the structure because of its ability to reactivate and 'self-seal' cracks. Further, crystalline products permanently seal all new cracking, and if larger cracks occur, they can be repaired from the negative or dry side.

Crystalline technology not only provides waterproof concrete, but essentially increases the durability of the structure as a whole by lowering permeability.

Building durable infrastructure leads to sustainable construction. In order to achieve concrete assembly with this enduring longevity, the permeability of the concrete mix must be as low as possible. This can be achieved by choosing the proper waterproofing method. External waterproofing methods damage easily, have shorter shelf lives, and can be time-consuming, costly, and sometimes impossible to repair. Internal admixtures turn the concrete into the waterproofing barrier for the life of the structure.

However, this is just one of the solutions in the larger context of durability. Deteriorating infrastructure is one of the defining engineering and construction challenges of the 21st century – which many countries need to address today. ■

ABOUT THE AUTHOR

Kevin Yuers, Vice-President of Product Development

Kevin heads up new product development, acquisitions, and corporate development, as well as advising the Technical Services, Sales and Marketing department at Kryton International Inc. Kevin's time is focused on innovation and providing customers with real-world best practice solutions to their challenges for today and in the future.

CONSTRUCTABILITY & THE PROCESS OF BUILDING BETTER

Constructability helps us integrate processes to **build better**. This means engaging design and construction players at the earliest stages before a substantial design is complete, helping to take full advantage of available construction knowledge and pragmatic experience.

The notion of constructability does not happen in isolation as it's the product of several factors coming together. They range from integrity in spirit and product, quality of workmanship and material, innovation to provide efficiency, and co-operation to deliver as desired by the client whilst securing the health, safety, and wellbeing of all involved.

All construction projects have many stakeholders; including clients, financiers, designers, tradespersons or contractors, and success relies upon the co-operation of the whole team. If one area fails, the constructability of a project could be at risk.

Communication and workmanship allows the design team to incorporate innovative solutions and improve project results. Harnessing pragmatic job site experience allows designers to seek new approaches to construction in order to build better, more durable structures, without risking structural integrity or their reputation.

ASUC
FULL MEMBER

ABOUT THE AUTHOR

Lewis O'Connor, Director, Abbey Pynford Holdings

Leading Basement Engineering, Underpinning & Geostructures specialists. Finalists for the Ground Engineering "Geotechnical Project of the Year Award 2015" and Construction News "Ground Engineering Contractor of the Year Award 2015". Lewis is also an active representative on Build UK Health and Safety Leadership Group at ASUC.

ABBEY PYNFORD GEO STRUCTURES

This is critical as structures can be susceptible to defects or failure as a result of not engaging the full knowledge of all the players involved. This is especially true when working with concrete. Although concrete is very durable, once cured, it can still be vulnerable. Good workmanship and professional installation practices are critical to avoid long term defects – just like any other material.

Whether it is a major infrastructure contract or domestic development, the best mitigation against risk is to engage people, materials, processes, and professional bodies that promote better building practices. This is why institutions such as the Association of Specialist Underpinning Contractors (ASUC) in the United Kingdom have become a benchmark in credibility for the ground engineering market. ASUC was formed to provide and promote professional and technical competence within a foundation industry where ill-informed and improper techniques are commonly leading to defective products. This resulted in poor public opinion, failing projects, wasted investment on remedial works, and sometimes complete demolition and rebuild.

ASUC engage experienced stakeholders to provide guidance on safe and efficient construction. ASUC has recently published guidance that has been adopted by government authorities for Basement Construction in London, UK. This commitment to positively change the paradigm for ground engineering has resulted in some of London's Hereditary estates introducing a compulsory requirement that basement construction work only be undertaken by ASUC members.

Furthermore, quality assurance given by ASUC members is underwritten by a totally unique, independently insured one-off Latent Defects Insurance Policy covering workmanship, materials and design of all works completed. This Guarantee is totally unique and provides peace of mind to all stakeholders that a single umbrella policy exists for every part of the project.

Collaboration and integration from design to execution on the job site helps us all build better. Indeed, constructability can be seen as a pragmatic, common sense approach to design, preconstruction and the construction process which helps to build better more durable structures by harnessing key player best practices.

Ultimately, it fosters clearer communications between all the players promoting better specifications, budget, and time management – resulting in building better. ■

FROM AN
EXPERT

THE GROWTH OF **SHOTCRETE STRUCTURES**

The concrete application method of shotcrete has been growing in popularity around the world. MarketsandMarkets forecasts that the shotcrete/sprayed concrete market is projected to grow annually by 8.0% over the next five years, registering a market size of USD $7.6-billion in terms of value by 2020.

There are many reasons for the growth, including the continuous industrialization and the growth of the underground construction sector. Further, modern shotcrete produces a strong, durable, and high-quality concrete product. Not to mention the fact that shotcrete's versatility and ability to perform with complex forms or shapes makes the method particularly valuable. This can be seen in particular with above ground Free Form concrete structures.

Free form structures have always attracted high costs due to specialist bespoke formwork with some shapes proving impossible to form with traditional concrete placement methods. Shotcrete has paved the way for the free form concrete design and innovation for these structures around the world. The ability for sprayed concrete to form abstract shapes can enable concrete's use in both artistic and functional structures. Using shotcrete for these applications also eliminates the need for traditional forms because it can be placed on a variety of substrates including flexible 'lost shutters' which are cast into the structure.

The spray concrete process allows architects and designers to build weird, wonderful, and innovative shapes with concrete. Other forms, like that of wood and steel are not only far more expensive, but much more extensive to construct, using machinery on the job-site that could be allocated elsewhere. On the other hand, shotcrete can use an expanded metal mesh tied directly to the reinforcement which has been shaped and tied into the required geometrical position.

... shotcrete/sprayed concrete market is projected to grow annually by

8.0%

over the next five years, registering a market size of USD $7.6-billion in terms of value by 2020.

DID YOU KNOW?

Europe is the largest market for shotcrete in terms of value with a 37% Global Market Share in 2014.

GLOBAL TREND

Underground construction is the largest industry for shotcrete and this trend is expected to continue in the near future due to increasing infrastructural developments, need for transport, and the growth of underground developments.

> "The spray concrete method allows architects and designers to build creative, wonderful, and innovative shapes with concrete."
>
> **STUART MANNING**

The use of shotcrete in the construction of commercial and residential basements is now becoming common place. The Contractor can complete the perimeter pilling, install the capping beam, and excavate the basement. Once the base slab is poured he can cast the ground floor slab and continue his superstructure construction. The basement liner walls can then be installed using the shotcrete process reducing the need for single sided formwork, crane time, and associated labor. Often further sub-basements are then constructed by excavating down under this first floor slab without affecting the construction above.

As we all know, saving time on the jobsite allows the project teams to save money on the bottom line.

The use of shotcrete still creates joints and needs to be waterproofed. Simply installing an external membrane can create a lot of needless risks on an innovative jobsite. Instead, shotcrete utilizes admixtures, such as concrete waterproofing additives like Kryton's Krystol Internal Membrane™ (KIM®) to apply another element of performance and efficiency. Not only is the shotcrete becoming the waterproof barrier for the structure, but installation of an external membrane is not required, saving further time and money.

Using KIM allows the shotcrete both in above ground shotcrete shells and basement structures to perform as the watertight barrier preventing water ingress.

The flexibility of the Kryton product range enables shotcrete projects to be unrestricted in their design and saves time by being added to the shotcrete mix without the need for extra equipment. This allows shotcrete application projects to ensure an efficient jobsite without sacrificing on design. ■

ABOUT THE AUTHOR

Stuart Manning, Managing Director Shocrete Services Ltd.

Over the past 30+ years, Shotcrete Services has become renowned for their expertise in sprayed concrete design and construction. Examples of success include the Selfridges building, Birmingham, and the new Darwin Cocoon housed within the Natural History Museum extension.

BUILDING INTELLIGENCE

SMART® CONCRETE WITH KRYSTOL® TECHNOLOGY

Research, cooperation, and innovative thinking – the raw materials which will build a more durable future.

The STEHM is an ultra-high resolution electron microscope that can magnify down to 35 picometers and is one of only two in the world. This machine allows researchers to unlock hidden innovations to build a more durable future.

University of Victoria

When companies and universities work together to push the frontiers of knowledge, they become a powerful engine for innovation and future economic growth. The fuel for this is the exchange of ideas and of the development of people. People's skills and professional competencies will be needed as new innovation and patents transform accepted conventions, markets and industries.

Clearly, it's more than just the physical and scientific outcomes that drive innovation – it's also about the human capital. Relationships based on mutual respect and long-term alliances, build trust and confidence that cross the university/industry divide.

An example of this is the collaborative relationship between the University of Victoria (UVic) and Kryton International Inc. The partnership is framed by the application of the Smart Concrete® philosophy, which at its core is about the identification of better building practices. This collaborative relationship resulted in UVic and Kryton jointly being awarded a U.S. patent for a scientific testing.


The United States of America

The Director of the United States Patent and Trademark Office

United States Patent

The patent on the Method, Apparatus and System for Testing the Self-Sealing Capabilities of a Concrete Sample quantifies and proves the self-sealing properties of concrete to which a mix of specialty chemicals has been added. Spearheaded by UVic's Dr. Rishi Gupta in tandem with Kryton's Alireza Biparva, M.A.Sc, their collaboration has resulted in pioneering new concrete durability methodologies being developed to help the construction industry in general. In brief, their research was focused on testing the healing and sealing abilities of concrete with the addition of various admixtures and fibers.

In fact, their work has resulted in the only technique in the world that can be used to measure how fast structures like these can heal themselves. As concrete reacts and adjusts to water ingress, without human intervention, the test methodology and data will provide valuable knowledge in creating better more durable structures in the future.

This is critical as we enter an age of deteriorating infrastructure, climate change, concrete lifespan concerns, and the need for potential solutions to rebuild or extend the lifespan of existing structures. The lifespan of concrete is dependent on having appropriate resources, insights, expertise, and knowledge to support the construction of durable, more resilient, and indeed smarter concrete. With the work of Uvic and Kryton and the application of the Smart Concrete philosophy, we can see that innovation is being driven forward. ■

GOING GLOCAL WITH THE CANADIAN TRADE COMMISSION

95% expect export sales to increase or remain the same over the next six months.

One of the most pressing challenges for a global company is to remain relevant to local market demands, expectations, and conventions. This is no easy balancing act in terms of resources, time, and consistent brand messaging. We need to be agile and respectful as we seek to act globally but interact on a local level – a peculiar alchemy we label as being "Glocal".

At Kryton International, a Canadian company, we're alert to the global environment. Local relationships, market intelligence, and sensitivity to the local traditions are seen as the key to long term success. Moreover, in the quest to gain a rounded understanding of the challenges and opportunities our partners face in their local markets we've found the support of the Canadian Trade Commission invaluable.

The Commission has helped us to reach out to industry leaders, key contacts, and important associations in the region to gain helpful insights. Recently, the Canadian Trade Commission was able to facilitate the use of their offices in Canada House located in Trafalgar Square, London, for a major industry event. Together with the Commission, our exclusive UK distributor, Source One Environmental (S1E) and their customers and key partners, Abby Pynford, Lethwaite Construction, and Shotcrete Services, the event was a great success.

Apart from the great location, Jason Kee and his team at the Commission facilitated penetrating insights into the local economy, construction trends and provided meetings and discussions. As a result our UK distributor and their customers and partners are pursuing several sales opportunities. So what's the learning of this? Ensure that you access all resources in the pursuit of a 'balanced Glocal approach' when entering markets. Intelligence on the ground is extremely valuable, which includes your customers, their influencers and stake holders as well associations and governmental bodies. ■

Kryton Director of Marketing, Rolf Skala with representatives from Source One environmental, Leathwaite, Shotcrete Services, and Abbey Pynford in the McDonald room at the Canada House in London, UK.

Canadian High Commissioner, Gordon Campbell (L) with Rolf Skala, Director of Marketing - Global (R).

DID YOU JUST SPEC THE END OF YOUR CAREER WITH THE WRONG WATERPROOFING SOLUTION?

ONLY KRYTON PROTECTS YOUR CONCRETE STRUCTURE AND YOUR REPUTATION.

Our crystalline technology has been tested and proven by independent labs and decades of performance in the field.

Find out how we take the risk out of concrete waterproofing by visiting us at **www.kryton.com**.

KRYTON

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