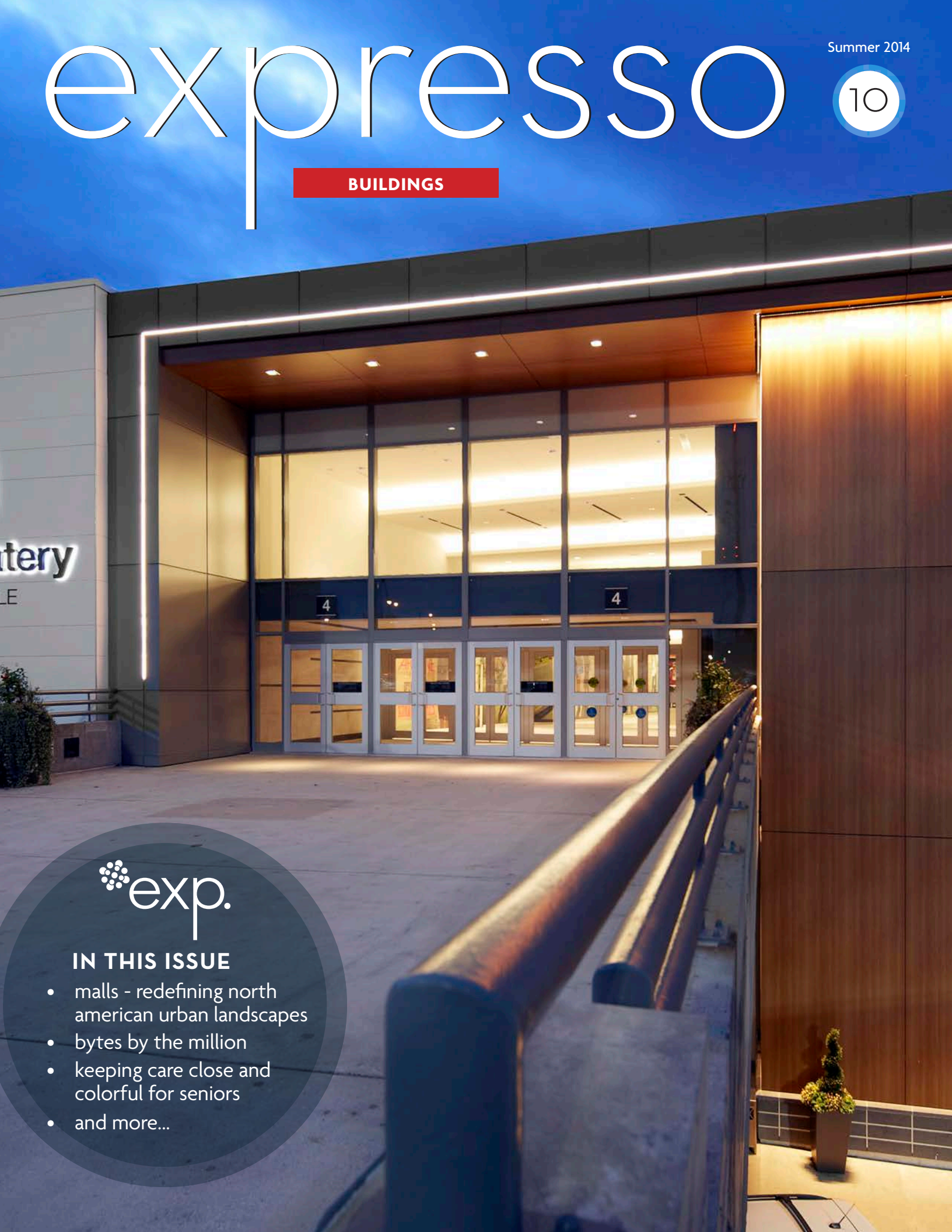
expresso

Summer 2014

10

BUILDINGS



exp.

IN THIS ISSUE

- malls - redefining north american urban landscapes
- bytes by the million
- keeping care close and colorful for seniors
- and more...

building partnerships from inside out

In Ontario, all provincially-funded projects greater than $50 million are subject to consideration for Alternative Financing & Procurement (AFP), as set out in the government's long-term infrastructure plan, Building Together. Under AFP, the public sector establishes the scope and purpose of the project, while the construction work is financed and carried out by the private sector. In some cases, the private sector participant will also be responsible for the maintenance of the infrastructure asset.

With an emphasis on building partnerships and creating innovative solutions, we've assembled a Planning Design and Compliance (PDC) team out of **exp** expertise and disciplines from Canada and the U.S. to pursue the various phases of these projects. The PDC team's responsibility is in part, to prepare the planning and design documents including the Project Specific Output Specifications (PSOS). These documents would be for hospitals, courthouses, correctional facilities, post-secondary institutions, transit facilities or other infrastructure projects.

This provides huge cross-selling opportunities for **exp** with Infrastructure Ontario. Recent PDC projects include: Providence Care Hospital, McMaster Children's Health Centre, Joseph Brant Memorial Hospital, Humber College Learning Centre and the London (ON) Child & Parent Resource Institute.

Combining our strengths to meet the standards of the public infrastructure Alternative Financing & Procurement model is a good example of how we can provide high-standard, creative and value-added solutions for our clients regardless of the size and complexity of the projects.

Generally, the PDC team will consist of an architect as prime consultant with sub-consultants from all of the major discipline groups required for the project.

Typically, disciplines include: mechanical, electrical, structural and civil engineering, traffic management, landscaping, facility planning, code compliance, interior design, security, information technology, LEED certification, and any other relevant discipline.

bytes by the million

MISSION CRITICAL: SERIOUS BUSINESS

Did you know?

A typical data center has the capacity to use as much electricity as a small town in Canada or the U.S.

Managing stock exchanges, calling 911, accessing medical records, monitoring earthquakes and any other operations dependent on a computer and communication systems, have to be protected against downtimes or shutdowns due to the system's mission-critical functions.

To meet the growing Internet data storage appetite, thousands of data centers are now operating worldwide. The city of New York can now rely on the dense network access of the new CoreSite Secaucus (NY2) mega datacenter.

CoreSite NY2, a 280,000 SF data center, is one of the biggest of its kind in the New York/New Jersey market. We provided fast-track, MEP and construction administration services for the reuse of an existing building. The facility has been designed (application submitted) to meet LEED® Silver certification.

The project utilized innovative technologies such as chillers with magnetic, oil-free compressors, combined with dedicated evaporative condenser cooling towers to achieve unprecedented energy efficiency (20% to 30%) and reliability.

We've learned a lot in over 50 years of designing telecommunication system and data centers. Our expertise helps us to apply several simple design choices to improve the efficiency of the facility, reduce costs, and reduce the impact on the environment.

A mission critical system is a computer, electronic or electromechanical system that is essential to maintain services required for day-to-day operations of a business or an organization.

If the system fails or is interrupted, it could cause substantial financial losses, environmental damage, injuries or even death.

revitalizing heritage housing

VANCOUVER, BRITISH COLUMBIA

The Burnaby Building Science Division has been involved in the first Public Private Partnership project in Canada involving the restoration of social housing. The rehabilitation of 13 provincially-owned Single Room Occupancy hotels in the downtown eastside of Vancouver has been in progress for the past 3 years and will continue for the next year as the construction is completed.

All 13 of the hotels are recognized heritage buildings listed on the Vancouver Heritage Registry with 4 of them located within the Gastown historic district.

For our client, the BC Housing Management Commission, we are acting as the Technical Team prime consultant in the Compliance Role. Our team prepared performance specifications and heritage conservation plans for each building with 13 individual specific design requirements in all construction disciplines.

As the technical compliance team, we now oversee the design and construction of all 13 buildings which consist of various levels of specialty consulting including seismic, security, building envelope and the conservation of their heritage.

Upon completion, the previously in-need buildings will provide warm, safe, and dry social housing, improve the standard of living for residents, and reduce the risk of homelessness for the occupants.

keeping care close and colorful for seniors

STANLEY, NEW BRUNSWICK

The new 30-bed Nashwaak Villa nursing home was designed to LEED® standards and built to replace the existing aging installations in Stanley, N.B. The project is part of the provincial government's 2011-2016 Nursing Home Renovation and Replacement Plan, under which 354 nursing home beds and 704 specialized care beds are being created.

This new 29,000 SF wood-framed facility sits on the hillside overlooking the scenic valley of Stanley. The brightly-colored facility offers 23 single rooms, three double rooms, one bariatric room, a rehabilitation therapy room, dining, living and family rooms, service areas such as a hair salon, canteen and gift shop along with a bright enclosed exterior courtyard. This new facility has an inground water and sprinkler cistern for onsite storage, backup generator and Heating Ventilation Air Conditioning systems. The new sanitary system was connected to the Village of Stanley's municipal infrastructure.

Exp provided a full range of design services for the project, including architecture, civil, mechanical and electrical engineering, geotechnical, surveying , and materials testing services.

The new facility is an important asset for the Stanley community. Seniors now have access to the care and support they need close to home, family and friends.

malls - redefining north american urban landscapes

RISE OF THE MEGAMALL

Shopping malls have played a fundamental role in the North American retail landscape since their emergence in the 1960s and 1970s. Our first mall project in Canada dates back to the 1950's with the Place Belvedere in Sherbrooke, QC, and, in 1976, with the completion of the landmark Toronto Eaton Centre. This demonstrates the history of **exp**'s retail experience and expertise.

Since then, the physical retail marketplace has evolved. The lack of commercial space in urban cores has further pushed retailers to shift their outlets towards power centres or to renovate and expand within their existing space (building upwards and adding additional floors).

Our successful relationships in the retail industry opened the door for **exp** to collaborate on various redevelopment projects like the Las Vegas Premium Outlet Mall South (NV), Festival Bay (FL), Sherway Gardens in Mississauga (ON), Yorkdale Shopping Centre in Toronto (ON), the Hillside Shopping Centre in Victoria (BC), Champlain Place Mall – Dieppe (NB) and Quartier Dix30 (QC).

Our client relationships, supported by our reputation and project experience also led to our service offering of mixed-used development projects, such as:

- **The Bridgewater Residences on the Lake project in Burlington (ON)** - combining luxury condos, hotel, retail space and parking;
- **The Maple Leaf Gardens Redevelopment** - built in 1931, abandoned in 1999, this building was completely transformed to house retail space, athletic facilities, an NHL-sized hockey rink on the third floor and multi-level underground parking;
- **Redevelopment of Toronto Sun Building** - built in 1975, this building was transformed into a mixed-use commercial office, retail and educational facility and the new headquarters for Coca-Cola in Canada.

Throughout the evolution of the retail building market, our experts have successfully contributed to redefining the North American urban landscape – providing viable retail and living spaces.

Markville Shopping Centre, Markham, ON


FOREVER 21
PANDORA
STARBUCKS
LE CHÂTEAU
SALE

a sustainable facelift of a heritage railway station

TORONTO, ONTARIO

With 250,000 commuters a day, Toronto Union Station is the busiest public transportation structure of its kind in Canada. Built in the thirties, the station and the train shed were designated a National Historic Site of Canada in 1975.

Over the years, the train shed roof original structure has deteriorated significantly. **Exp** is currently working as the prime consultant on this large-scale and multidisciplinary project. The work is expected to take six years to minimize the disruption to daily train service. We will restore, repair and renovate all elements from the top of the roof down to track level.

Our services include project management, structural, mechanical and electrical engineering, building envelope consulting as well as landscape and heritage architecture. Sustainable design features include an extensive green roof system integrated with the roof of the shed, with the potential for future installation of a photovoltaic system.

The station's revitalization will result in many benefits, including an expanded public transit concourse, an increase in the number of exits and entrances, alleviated commuter congestion, and restoration and preservation of the station's heritage elements.

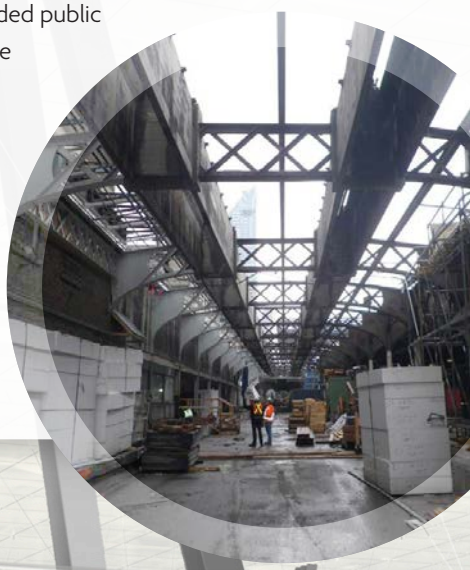
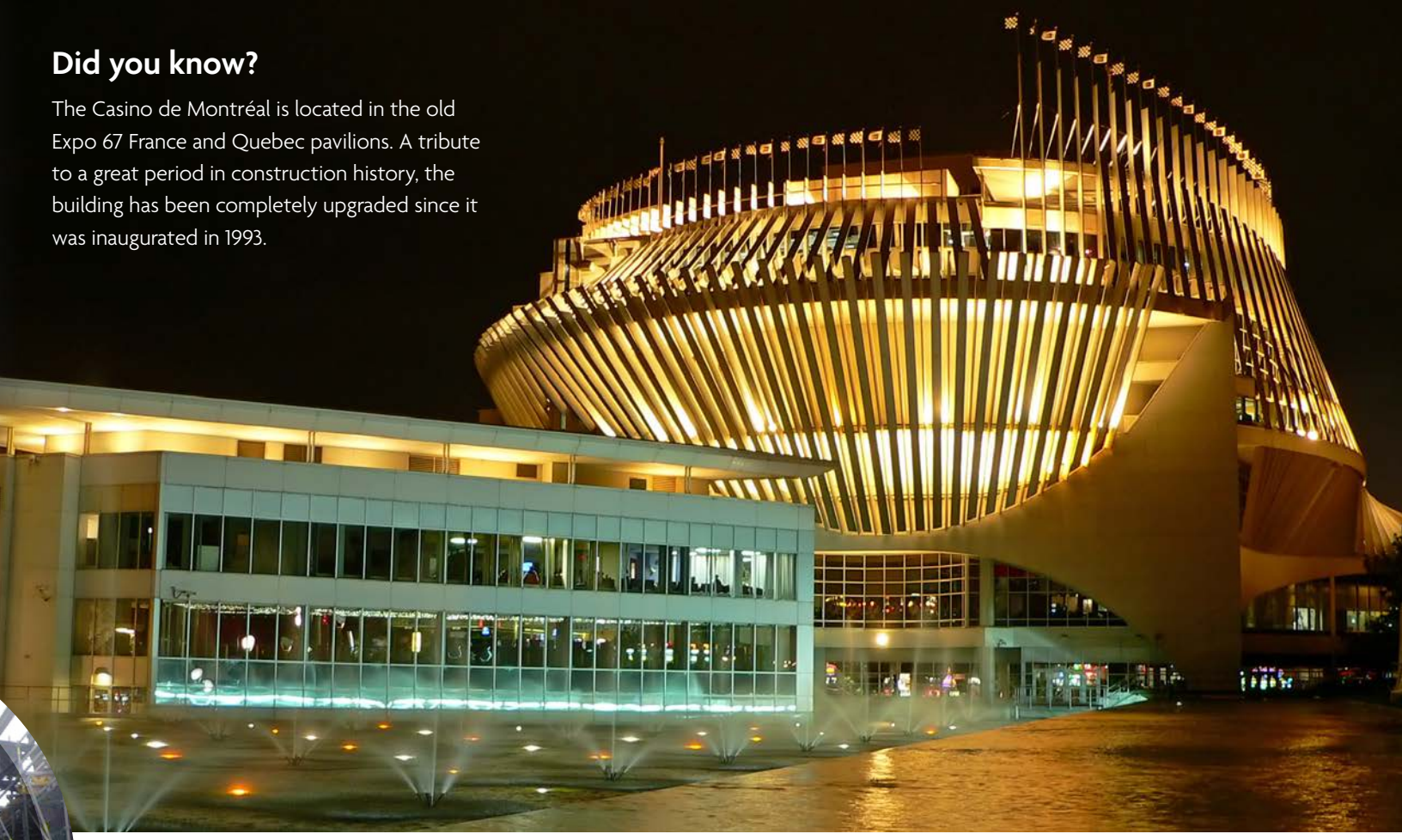


Photo Courtesy of Zeidler Partnership Architects

Did you know?

The Casino de Montréal is located in the old Expo 67 France and Quebec pavilions. A tribute to a great period in construction history, the building has been completely upgraded since it was inaugurated in 1993.



fast track retrofit

MONTREAL, QUEBEC

The Casino de Montréal is one of the world's largest casinos. Open day and night, it currently welcomes some 17,800 visitors per day. To allow the casino to maintain its ranking in the North American market, major renovations were undertaken in the fall of 2009.

Up until now, the casino's security services and administrative offices had been located in the former Expo'67 France pavilion. The corporation wished to have those offices moved to another location and use the space to offer visitors more gaming tables and features, restaurants, and a new cafeteria for employees. **Exp** was in charge of developing integrated mechanical systems for the France pavilion and its auxiliary structures. Project work, which stretched over four years, had to be completed while allowing for all casino operations to be maintained 24/7, and ensuring public and employee safety.

For Padraig O Carroll, "transforming a casino in continuous management and fast track mode is like managing a hospital emergency room. Working with more than a dozen of different firms - construction, project management, architecture and civil and electrical engineering - we prepared plans while adapting them daily to meet stakeholders' demands, at all project phases."

As opposed to similar projects for which timelines typically range from 5 to 6 years, the Casino de Montréal's France pavilion retrofit project was completed within 4 years.

With its spectacular décor and completely redesigned architecture, the newly modernized Casino de Montréal shines brighter than ever.

a structured group

Our buildings group plays a variety of roles in the development of today's buildings. Together, their expertise makes them a comprehensive team at **exp** to help create spaces for all kinds of uses, and all kinds of clients!

Our featured buildings experts are:

1. What is your role at **exp**?

Tom: I lead the design on all of our projects within the US Central Buildings Group.

Van Hiep: I manage the Air quality and industrial hygiene division, a position that I've held for over ten years now.

Paul: Chief Engineer for the Structural Group in Markham, ON.

2. What is your specific area of expertise?

Tom: Building design (which encompasses "vertical" architecture, in our case primarily Higher Education, Corporate, Aviation (Terminals/concourses), Rail Stations, Federal Buildings/Courthouses (within the U.S.), as well as other building types.

Van Hiep: My expertise extends to a number of specific areas: industrial hygiene, occupational health and safety, asbestos removal, decontamination, noise, mold and chemical contaminants assessment, air quality, industrial ventilation, and radon, Legionella, lead and other hazardous materials management.

Paul: All areas of structural design but with emphasis in structural steel.

3. How did you become an expert in this area?

Tom: I've been practicing for 26 years, the first seven of which at Holabird + Root, in Chicago under an extraordinary designer and mentor, Jerry Horn, FAIA. Mr. Horn taught me to always challenge assumptions and strive to do exceptional work. I then joined Teng & Associates, as Principal Design Architect. At the time, Teng was noted for its exceptional engineering, but the architectural work had not yet matured. Since that time, my team and I have continued to strive to do excellent

work. I seek to advance my expertise through engagement in conferences, leadership in design committees for both the AIA and Chicago Architectural Club, participation as a National Design Excellence Peer for the U.S. General Services Administration, and since 2008, teaching graduate design studios at the Illinois Institute of Technology.

Van Hiep: Completing a master's degree in industrial hygiene and safety helped me acquire knowledge in all areas relating to workplace health and safety. My work with regulatory agencies such as the CSST and the IRSST have also allowed me to gain further understanding of the health and safety, and contamination fields.

Paul: After graduation from university, I worked as a development engineer with the Canadian Institute of Steel Construction. In the five years I was there Canada became metric and Limit States Design was introduced. Because of these simultaneous changes, I became familiar with the current research in structural steel design and the people doing the research. By understanding the background behind what is now in the Codes and Standards it allows me to solve problems that may not be routinely covered in the Codes and has allowed me to work on many unique structures.engineering training and of field experience. Possessing road signage, road geometry and road traffic, notions, including flow analysis, is a must. Extensive knowledge of the different phases of construction (work and execution methods) is also critical to understanding how work will be carried out and what will be needed.

4. What are some of the more interesting projects you've worked on?

Tom: One of the great things about practicing architecture within our Buildings Group is the range of project types that we work on as the prime Architect/Engineer. For example, I am currently working on several projects (at various stages of completion), including:

- O'Hare International Airport South Air Traffic Control Tower
- Margaret Chase Smith Federal Building and U.S. Courthouse Modernization in Bangor, Maine
- Chicago Transit Authority (CTA) Washington/Wabash Elevated Station in downtown Chicago
- Charles F. Prevedel Federal Building and Campus Master Plan and Renovations in St. Louis, Missouri
- Nanoscale Theory Center at the University of Illinois Urbana-Champaign, Illinois Lambert-St. Louis
- International Airport Main Terminal Renovation in St. Louis, Missouri
- CTA Blue Line Illinois Medical District Stations in Chicago

I would say that the Control Tower and the Washington/Wabash CTA Station are two of the most interesting at the moment. Both are high-profile, highly complex and technically challenging projects, and the charge from our client, the City of Chicago, is to make "iconic designs".

Van Hiep: The most interesting work I've done on a project consisted in designing air filtration systems for aircraft paint shops. The client, Bombardier, wanted the paint shops' ventilation and air filtration systems to provide effective control of contaminants to protect the health of workers, reduced release of contaminants to outside air, and savings on energy costs for paint shop air heating and moistening.

At the international level, I worked on the development of a safe work program for asbestos removal in all public buildings in Rwanda. I also recommended solutions to improve ventilation and thermal comfort at the Canadian Embassy in Bogota, Colombia.

Recently, I headed a team tasked with sanitizing many Legionella-contaminated cooling towers found to have led to the Legionnaire's Disease outbreak that killed 13 people in Quebec City. Also, during the summer of 2013, I supervised all the health and safety aspects of the site decontamination work carried out in the aftermath of the train derailment and explosion in Lac-Mégantic, Quebec.

Finally, my team has worked on several projects that called for the remediation of fungi in schools and the removal of asbestos in public and commercial buildings.

Paul: I have done projects in most sectors but projects that stand out include: General Motors of Canada, Canadian Tire Centre (home of the Ottawa Senators), Toronto Centre for Performing Arts, St. Michael's Hospital, Ontario College of Art and Design, Roy Thomson Hall, Metro Toronto Convention Centre and the Redevelopment of Maple Leaf Gardens.

5. How will your expertise help **exp** win more projects? (cross-selling services)

Tom: As the Design Principal I see my role as leading the team to produce work of exceptional design quality, which meets all of the programmatic, technical and budget parameters of our clients. Great design is a prerequisite for our clients. For the CTA Blue Line project, we were one of five firms invited to compete, and our design proposal was selected as the winner. Our design expertise gets us to the table to win the work.

Van Hiep: Our expertise has been called upon by teams from **exp**'s Infrastructure, Buildings, and Laboratory groups needing to draw up inventories of asbestos-containing materials for bridge, building retrofit or demolition, and decontamination projects. We also work with teams from the Sustainability group to support the process leading to buildings achieving LEED certification, and with teams from the MEP group to increase comfort and air quality in public buildings.

Paul: By being able offer innovative solutions for unique projects in many sectors of the building industry, **exp** can position itself as the go to design firm for the iconic projects of the future.

6. Why do you think your expertise (your practice) is important for **exp**?

Tom: In terms of challenges/opportunities in the overall profession, I think we need to continue to design and produce projects of exceptional quality in an ever-more integrated manner within an ever-shortening timeframe - connecting the sometimes disconnected processes of architecture, engineering and construction. As it relates specifically to **exp**, seemingly we may be well situated to cross-sell services between architecture and engineering across the continent.

Van Hiep: Occupational health and safety risks and air contaminants are increasing in number: asbestos, molds, Legionella, lead, radon, volatile organic compounds, formaldehyde, silica, etc. Our employees need to work as multi-disciplinary teams, to know how to promptly respond to emergency situations threatening public health or the environment (such as the recent outbreak of Legionnaire's Disease in Quebec City and the train derailment and explosion in the town of Lac-Mégantic), and to be able to recommend preventive measures to our clients. As public awareness about environmental, air quality and sustainability issues continues to grow, our experts believe that the need for our expertise will also continue to grow in the future.

Tom: As technology advances, we as engineers are expected to do more in less time. To meet these goals, systems and methods must be developed to ensure that our designs are efficient, safe and meet the needs of our client. But as we develop our systems we can offer more to our clients in terms of coordination between disciplines and streamlining of the design process.

better care for patients

CAMPBELLTON, NEW BRUNSWICK

The Restigouche Hospital Centre is a 26,942 m^2 Psychiatric Care facility that is currently under construction in Campbellton, New Brunswick.

Designed in blocks, the new facility will provide better care for patients with mental disorders and will increase focus on recovery, rehabilitation and community-based support. Once the new facility is completed, the existing one will be removed. Users of the new building will immediately be aware of the changes in the new facility where there is improved natural lighting and fresh air, community styled groupings, courtyards for each block connecting users to the natural world, a cardio room, gymnasium, greenhouse, and a zoo therapy building. The overall living environment will better respond to individual needs for improved delivery of mental health services.

Designed to LEED® Silver Standard, this 140-bed complex has care and treatment amenities for a variety of Psychiatric services. The facility is intended to accommodate a range of client needs from respite care to fully secured detention while reaching out to the broader population as a significant institution within the community. The center will also serve as the New Brunswick forensic psychiatric facility.

Exp provided Architectural and LEED® Consulting Services for this impressive $120,000,000 healthcare facility which is scheduled to be completed by October 2014.

a new life for a signature construction

INDIANAPOLIS, INDIANA

The US General Services Administration (GSA) plays a critical role in preserving and adding to national architectural and artistic legacy. In 1994, they established the Design Excellence Program to encourage the design of memorable, high-quality, and efficient federal government buildings. It brings public and private sector experts together to select architects and building designs in a carefully planned process. **Exp** has been working with the GSA nationwide for over 15 years.

Through this program, we've been awarded numerous design excellence projects, including the renovation of the Minton-Capehart Federal Building as prime Architect/Engineer. Our work included renovation of the lobby to improve "first impressions" and integrate new security, lighting and conservation of the rainbow-colored mural. Other upgrades included; new ceilings and lighting along with replacement of the majority of the HVAC system, new Direct Digital Controls and replacement of the perimeter hot water heating system and control valves. A new fire sprinkler system, voice fire alarm system and an emergency power generator were also included. Our work dramatically improves energy efficiency and user comfort while reducing maintenance for the building owner and occupants, and has achieved LEED® Gold Certification.

Also included in our scope was the development of the Design Standards Book that describes appropriate materials and methods to assist building owners and managers in making design and renovation choices that are sensitive to the historic quality of the building.

The Minton-Capehart building has received the 2014 GSA Design Award, the 2013 Interior Architecture Award, AIA Indiana and the 2013 Best of the Year Finalist from Interior Design Magazine. This is the second award-winning project that we've completed for the GSA under their Design Excellence program.

Did you know?

Built in 1975, it utilizes an inverted ziggurat shape in which each higher floor is slightly larger than the one below. The exterior of the building features Milton Glaser's rainbow-colored mural that covers the building's lower level - one of the world largest continuous mural.

The Minton-Capehart building is an exceptional example of a unique style of architecture.

old orsainville prison sentenced to major upgrade

QUEBEC CITY, QUEBEC

Built in 1970, the Établissement de détention de Québec - the province's second largest prison - needed to undergo renovations which included upgrading its mechanical and electrical systems to meet current standards.

Our team successfully took on the challenge of significantly improving the capabilities and functionalities of electromechanical systems of the holding areas, while limiting architectural impacts to a minimum. Carrying out any redevelopment or construction work in a detention establishment where detainees are being held requires special logistics and careful planning of the partial or complete evacuation of areas undergoing renovations. To address those challenges, **exp** established a precise sequence for all work and operations to be carried out, both as specifications and plans, part of which was done using Revit MEP.

In the end, this major renovation project allowed for the implementation of 11 new ventilation systems, the construction of a new chilled water plant with heat recovery system, the reconstruction of all plumbing networks, the complete upgrade of automatic control systems, the major reconstruction of the electrical distribution, utilities and lighting systems, and the construction of a dedicated room for the new security and telecommunications system used to control over 340 doors, 400 cameras and 800 paging devices and intercoms.

The upgrades also aimed to provide improved response during prisoner riots. With the new ventilation system, smoke will be effectively and rapidly cleared in case of fire.

roofing systems that can withstand storms and hurricanes: could that be?

DRUMMONDVILLE, QUEBEC

When high winds strike a building, the roof is the first element to be affected. Although no roofing system can be built to be completely fail proof, tests conducted on roofing systems under conditions that mimic extreme weather events can help improve the way they are built and, ultimately, increase their resistance.

In our state-of-the-art laboratory in Drummondville, Quebec, we can simulate the dynamic effects of wind gusts on different types of roofing systems. In fact, **exp**'s roofing laboratory is the only one in North America where resistance of roofing systems to wind uplift forces can be tested. Our clients can even watch water-tightness testing, in real time, from their mobile device.

Provided with such results, clients and manufacturers can adequately assess the resistance of the materials they plan to use, thus ensuring the safety and sustainability of what they build.

Our team also works with the *Special Interest Group for Dynamic Evaluation of Roofing Systems* (SIGDERS), a North American consortium of specialists working to create new ways for testing and simulating real wind-induced dynamic loads and effects on roofing systems, to support and reflect changes to the National Building Code of Canada (national standard CSA A-123.21-10).

Considering the climate changes that we face today, can we expect our roofing systems to withstand the storms and hurricanes that tomorrow will bring? Building on our unique expertise and equipment, we believe that **exp** can help increase the resistance of the roofs that shelter us, and improve public safety.

For more information on the tests conducted in our roofing laboratory, please contact Michel Desgranges.

Did you know?

The University of California, San Diego Health System is consistently recognized among the nation's "Most Wired" hospitals

defining state of the art medical center

SAN DIEGO, CALIFORNIA

A new hospital is being built to support the University of California, San Diego's (UCSD) growing Thornton Healthcare Campus. UCSD's Jacobs Medical Center is one of the largest healthcare projects in California. It involves the construction of a 10-story, 509,500 SF building and a separate 40,000 SF central plant, as well as the renovation of the existing hospital.

The Jacobs Medical Center will include three new specialty hospitals for advanced surgery, cancer care, and women and infants services – will provide an innovative and supportive healing environment for patients.

Exp is providing mechanical, electrical, plumbing and fire alarm engineering services for the design of the patient tower and central plant.

The project also includes a helicopter landing pad with direct access to all floors, garden-based design to maximize natural light as well as dedicated family areas on each bed floor.

Other design features include:

- **State of the art operating rooms** - built larger than standard size to accommodate rapid changes in technology.
- **Intraoperative magnetic resonance imaging machines** - a first in the industry.
- **A 36-bed bone marrow transplant unit** using pressurization design to filter all of the air in each rooms, hallways and common areas - allowing patients to move outside of their rooms in a sterile controlled space.
- **245 beds**, including 108 medical/surgical beds and 36 Intensive Care Units

This project incorporates an Integrated Project Delivery (IPD) approach for the design and construction. This IPD method is a collaborative process that puts the owner, builder and designer together as a true team to work as a single entity from beginning to end. Specifically, our project team created a Board of Directors, including representatives from the Owner, Structural Engineer, General Contractor and us as the MEP engineer.

This new tower will further expand Medical Care and Research at the UCSD East Campus to truly create an Academic Medical Care facility. The project, which is on schedule and on budget, is targeting LEED® Silver certification and is scheduled to open for patient care in 2016.

shaping the future of the industry

CHANGING WITH TECHNOLOGY

Drastic changes are occurring in the building industry as designs are conceived, completed and delivered. In order to meet the ever advancing standards of collaboration and technical building requirements, we have to innovate and think in new directions.

Virtual integration of project delivery and collective design (lean construction practices) are transforming the way we generate and manage building data during a project's life. Three-dimensional, real-time, dynamic building modeling software allows for increased synergy between structural, mechanical, electrical and architectural elements; improving a project's total overall design efficiency and accuracy. This coordinated design model improves construction time and accuracy when incorporated into the construction teams models.

In our work on the Sherway Gardens shopping center (a 970,000 SF building revitalization and expansion project) in Toronto, we utilized Building Information Modeling (BIM) to redesign the space. The use of technology like BIM - Revit® which integrates geometry, spatial relationships, geographic information, quantities and properties of building components facilitated the review of the structural designs BEFORE the construction phase.

To review drawings, we also use other devices, like tablets. On the University of California San Diego Medical Center project, advanced BIM models were shared and used to work collaboratively with all stakeholders during the design and the construction phase.

We're currently in a beta-testing phase of Mobile Data Capture Device idea from Joel Luis, Engineering Designer. It's a tablet system (mobile phones, tablets, PC's compatible) that will be functional for all engineering divisions of **exp** and allowing us to provide a differentiating service to our clients, set a new standard for engineering service, and result in substantial cost savings.

Technology is redefining how our work is organized inside and outside **exp** - moving away from a division of tasks between specialties to collaboration and convergent or consensus bound data management for a project.

The use of virtual integration technologies has a number of benefits:

- Improved visualization (for clients, owners, and specialists).
- Enhanced quality control and allows for early detection of design problems during "walkthroughs" and clash detection
- Increased speed of delivery
- Reduced costs and accurate evaluation of building materials quantities (e.g. concrete or steel)