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The TALISMAN CENTRE

2012 Canadian Consulting Engineering Awards

Category | Special Projects

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INTRODUCTION

The Talisman Centre is one of North America's largest sports and recreation centres and an integral part of the Calgary, Alberta community. Originally constructed for the 1983 Western Canada Summer Games, the Talisman Centre boasts two Olympic-sized swimming pools, an Olympic calibre dive tank, five full-sized gymnasiums, a 200-metre running track, 2,300 square metres of cardio and weight training space, steam and locker rooms, and a 20-person hot tub. The Talisman Centre is more than just a modest recreation centre; it is also one of only three recreational facilities in Canada capable of holding international swim competitions and hosts more than 1.5 million visitors per year.

To ensure the Talisman Centre could serve Calgarians for another 30 years, the facility required a myriad of upgrades and, as a result, the City of Calgary invested nearly $45 million into the renovation and improvement of the facility. Williams Engineering Canada was hired as prime consultant to identify and complete an investigation of the existing building to determine an appropriate roof replacement strategy; to advise on life-cycle upgrades; and to provide structural, mechanical, electrical, and building science consulting engineering services.

Visually the Talisman Centre is known for its striking white fabric roof. A sculpted, tent-like form, the roof descends in a series of panel ridges from a large arched spine. With a roof area measuring approximately 15,050 m^2, the sheer size of the fabric roof is phenomenal and therefore replacing it posed significant challenges. The problem with the original roof was that the building reached scorching temperatures during the summer while in the winter the building suffered from cold temperatures and much condensation. The solution was to replace the original roof with a similar one in appearance but one with greater thermal and acoustic properties.

INNOVATIVE TECHNOLOGIES

Each individual roof panel was custom designed using layers of Nanogel impregnated fleece insulation wrapped with Teflon-coated fabric. Nanogel is a state-of-the-art insulating material, also used in NASA space suits, and has remarkable thermal properties including the ability to insulate up to four times more efficiently than fibreglass or foam. The fabric is light-weight and can transmit full spectrum light allowing natural light to flow into the facility. The new roof panel fabric also has acoustic benefits with its fine pore structure that slows down the speed of sound – perfect for a large and boisterous recreational facility like the Talisman Centre.

An additional valuable feature of the new roof is the non-toxic and flame-resistant TIo_2 coating on the Shearfill PTFE fabric. This coating neutralizes noxious gases and has self-cleaning attributes.

OUTSTANDING ACHIEVEMENTS

The installation of each roof panel was a substantial achievement on its own. Created precisely for this project, each roof panel was individually installed using a special lifting device and two, massive tower cranes. Safety was of paramount importance during this project, especially for the installation of the roof panels. To perform this work, specialized rope access personnel were required to secure each panel in place. Devising out of the box solutions for the complex fabric roof is evidentiary support towards the unique and complex aspects of the project.

ENVIRONMENTAL BENEFITS

An environmentally-conscious approach was taken to ensure that when the old roof fabric was disassembled it was reused by the City of Calgary Parks Department as a roof and wall material for their new equipment storage shelters.

WEC was also able to assist the Talisman Centre in securing a $50,000 federal energy grant from the Department of Natural Resources, Clean Energy Agenda, and EcoEnergy Retrofit Program.

TECHNICAL EXCELLENCE & PROJECT COMPLEXITY

The critical achievement of this project was designing a mechanical system that moves air across the underside of the fabric roof, in a continuous stream, that prevents the build up of condensation. The mechanical system for the Talisman's new 1.8 metre diameter fabric duct supply and aluminum return air system is unprecedented and may be the only one of its kind in the world. Fitting this complex system into the arch of the building presented the project's greatest challenge due to system's enormity, distinct shape, and the complex nature of working within the facility's unique structural elements.

Since the Talisman Centre is oval in shape, Williams Engineering Canada's engineers needed to design a supply air duct that would handle the facility's curved geometrics. To accomplish this with a fixed aluminum or steel duct would have been exceedingly difficult, so a fabric duct system was specified. The facility has an open concept design and, as such, special care was taken to create a lightweight and harmonious design to ensure the exposed ducts would not interfere with the building's aesthetics.

A patented system of fabric ducts and jet-throw nozzles was also designed solely for this project. These nozzles are attached at specific intervals and angles and direct air to the underside of the roof in a complex pattern.

Two, 45,000 CFM fans were installed into the arch of the building and operate consistently at 800 RPMs while running 24/7. Supporting the massive mechanical equipment in the spine of the building and preventing vibrations within the steel framing was a significant feat of engineering and is one of the project's most noteworthy accomplishments. Modeling tests were performed to determine how to minimize the transfer of vibrations onto the structure. To dissipate the excessive noise produced by the fans, two-stage, upstream and downstream silencers were custom designed.

The building's irregular shape also posed challenges for the lighting upgrades portion of this project. Precise lighting designs and rendering models were essential to achieving targeted lighting design levels within the building. Therefore comprehensive 3D modeling was created using specialized lighting software called AG132.

CLOSURE

When the City of Calgary required major renovations to the Talisman Centre, they envisioned a complete renovation as innovative as their iconic roof. Williams Engineering Canada not only succeeded in capturing their dream but also turned that dream into a reality. The Talisman Centre is now a newly renovated facility with numerous upgrades. This project was an ambitious venture and significant community achievement that Williams Engineering Canada is proud to be part of.

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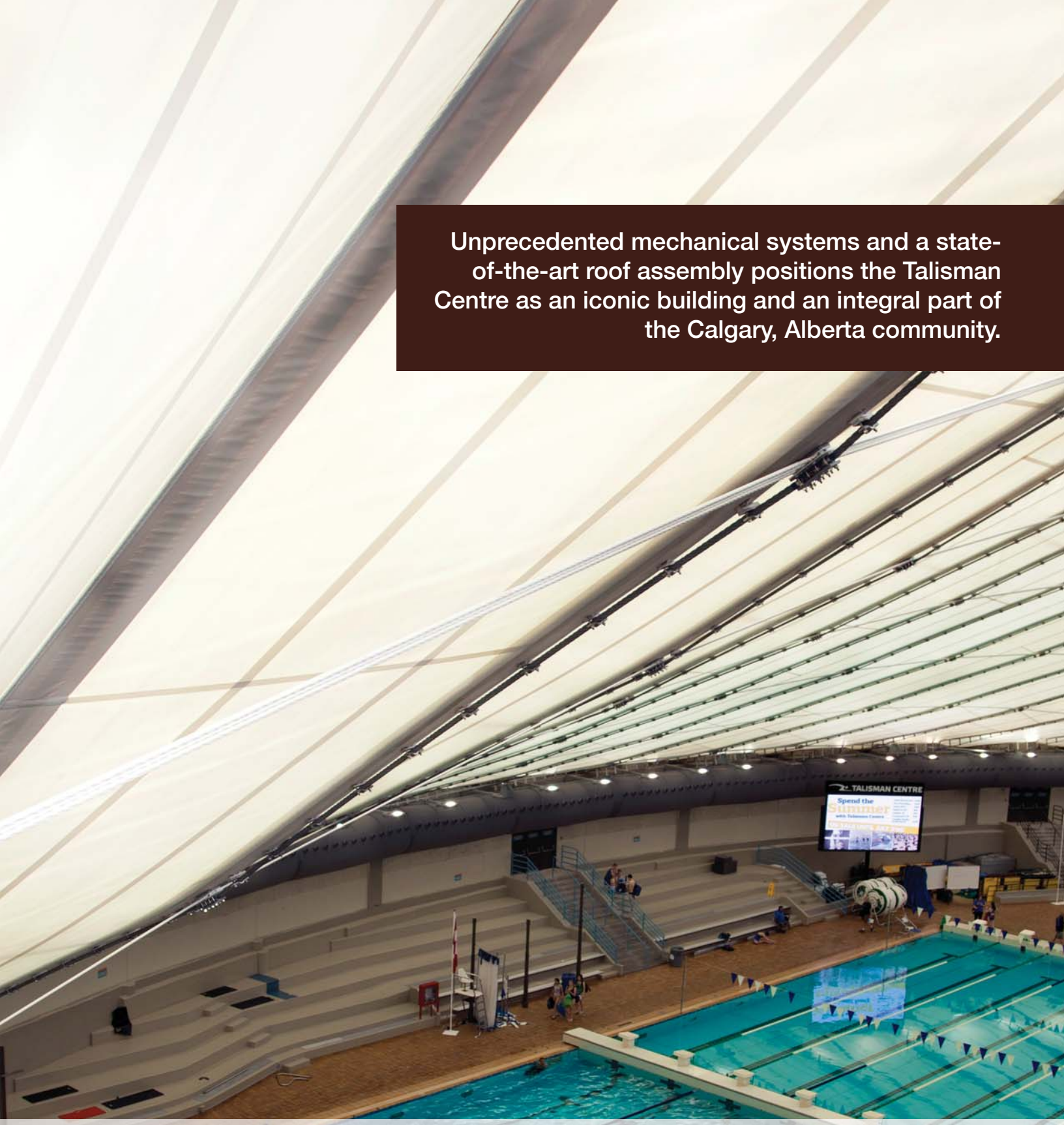
Full Project Detail Report

2012 Canadian Consulting Engineering Awards



Unprecedented mechanical systems and a state-of-the-art roof assembly positions the Talisman Centre as an iconic building and an integral part of the Calgary, Alberta community.

The Talisman Centre is an integral part of the Calgary community and is one of North America's largest sports and recreation centres. Formerly known as the Lindsay Park Sports Centre, this huge sports and fitness complex is minutes away from downtown Calgary with convenient access to the CTrain and located in close proximity to the Calgary Stampede grounds.

The centre was originally constructed for the 1983 Western Canada Summer Games, when it brought together thousands of athletes from across Canada in a "celebration of youth, sport, culture, and community."

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The centre has two Olympic-sized swimming pools, an Olympic calibre dive tank, five full-sized gymnasiums, a 200-metre running track, 2,300 square metres of cardio and weight training space, a steam room, locker rooms, and a 20-person hot tub - all situated under the main building with its dramatic fabric roof. Access leads to a separate annex building, added in 2003, that has two additional Olympic-sized swimming pools. A separate entrance on the north side of the facility is used to access the 1,300 square metre LifeMark Physiotherapy and Sports Medicine Clinic.

Owned by the City of Calgary and operated by Lindsay Park Sports Society, the Talisman Centre entices millions of patrons each year with its full service fitness facility. It also plays host to both amateur and professional sporting events and is one of only three recreation facilities in Canada capable of holding international swim competitions.

The Talisman Centre is more than just a modest recreational facility; it is a centre that thrives on the health and wellness of the residents of Calgary and it brings together communities of athletes to share in sport and friendship.

In 2007, The City of Calgary retained Williams Engineering Canada to complete an investigation of the existing building to determine an appropriate roof replacement strategy and to advise on life-cycle upgrades. Williams Engineering Canada also played an instrumental role in creating QA/QC procedures and protocols for the project.

The renovations were organized to be completed in two concurrent phases with Williams Engineering Canada acting as prime consultant, a role that included structural, mechanical, electrical, and building envelope consulting engineering services.

Throughout the renovation, safe public access to the adjacent buildings had to be maintained. In addition, various building components were shut down, which posed interesting challenges to the engineers as the different building elements were linked to the same building automation network. The project was completed in February of 2011 and opened, on schedule, to patrons shortly after.

The Talisman Centre is one of only three recreation facilities in Canada capable of holding international swim competitions.

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Technical Excellence & Advancement in Technology

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With a roof area measuring approximately 15,050 m², the sheer size of the fabric roof is phenomenal.

The first thing anyone notices about the Talisman Centre is its striking white fabric roof. A sculpted, tent-like form, the roof descends in a series of panel ridges from a large arched spine. It measures approximately 15,050 square metres in area. The roof is a unique aspect of the building both aesthetically and in function.

The problem with the original roof was that the building reached scorching temperatures during the summer while in the winter the building suffered from cold temperatures and condensation. The solution was to replace the original Teflon-coated fiberglass roof with one that looks similar, but has greater thermal and acoustic properties.

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Created precisely for this project and provided by Birdair, the Tensotherm™ roof assembly has layers of Nanogel impregnated fleece insulation wrapped with Teflon-coated fabric. The technical name for the fabric is Polytetrafluoroethylene (PTFE). It is light-weight and efficient and it has the ability to transmit full spectrum light allowing natural light to flow into the facility. Another benefit to the Nanogel is its remarkable thermal properties which helps reduce energy consumption in the building. Nanogel can insulate four times more efficiently than fibreglass or foam and it is hydrophobic. This state-of-the-art insulating material has an R value of 11 and a U value equal to 0.7 per 25 millimetre thickness.

The fabric also has acoustic benefits. According to Cabot Corporation who manufactures the Nanogel, its fine pore structure slows down the speed of sound, especially in the lower ranges, which is a definite bonus for a large recreational facility. A valuable feature of the new roof includes the non-toxic and flame-resistant TIo_2 coating on the Shearfill PTFE. The coating neutralizes noxious gases from the exhaust systems of passing motor vehicles and it also has self-cleaning attributes.

The installation of each roof panel was a significant achievement on its own. Each custom-designed roof panel was individually installed using a new lifting device and two tower cranes. Stuart Olsen Dominion Construction provided construction management services for this portion of the project. A life safety system for the arch was also developed to allow for the roof to be properly serviced over its expected 30-year lifespan.

Safety was of paramount importance during this project, especially for the installation of the roof panels. To perform this work, specialized rope access personnel were required to secure each panel in place.

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An environmentally-conscious approach was taken to ensure that when the old roof fabric was disassembled it was reused by the City of Calgary Parks Department as roof and wall material for their new equipment storage shelters.

On the north and south entrances to the building, the existing Kalwall system had run its service life. As part of the renovation, the entire system was replaced with a new Kalwall system. This was coordinated through Neil Jaud Architect. This system is similar in design to a standard window sealed unit in that it has an inner and outer lens; however, it also has fibreglass insulation and it is fully translucent allowing natural daylight to transmit through it. An additional benefit to the system includes restricted light transmission and glare protection.

The ring beam is a major structural element of the main building, connecting all the roof valley, ridge, and lateral cables. When Rowan Williams Davies and Irwin's modeling indicated that excessive heat loss was escaping through the exposed concrete beam, the beam was faced on the exterior with an R12 exterior insulation finishing system.

With its fine pore structure that slows down the speed of sound, the new roof panel fabric has acoustic benefits - perfect for a large and boisterous recreational facility like the Talisman Centre.

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Unprecedented Mechanical System Upgrades

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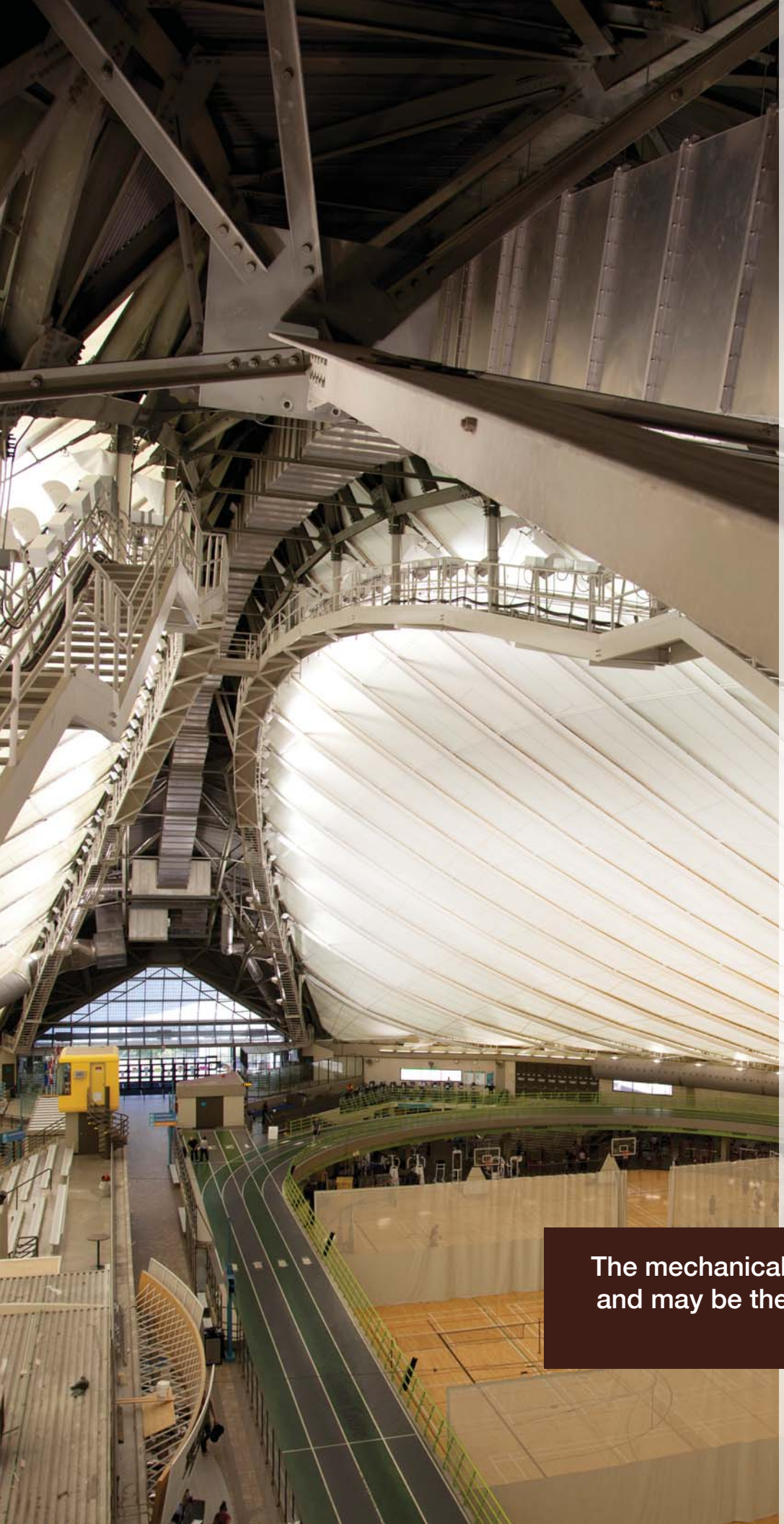

The new mechanical systems were primarily adopted to prevent condensation from building up on the underside of the roof. Prior to the renovation conditions under the roof, during severe cold weather, could become so wet that they produced “raining” inside of the centre.

The building’s original HVAC equipment in the basement was upgraded and left in place; however, substantial new systems needed to be added. To save on valuable floor space, it was decided that the new HVAC system should be placed into the roof arch. Fitting the mechanical systems into the arch presented the greatest challenge.

Since the building is oval, our engineers needed a duct that would handle the curved geometrics. To do this with a fixed aluminum or steel duct would have been exceedingly difficult, so a fabric duct system was specified. A fabric duct is more flexible and can be built off-site. The centre has an open concept design, so care was taken to create a lightweight, harmonious design to ensure the exposed ducts would not interfere with the building aesthetics.

The mechanical system is unprecedented and may be the only one of its kind in the world.

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Various types of fabric duct were researched and a Danish supplier was identified to supply a patented system of fabric ducts and jet-throw nozzles. The nozzles are attached at specified intervals, on the eleven o'clock and the two o'clock positions of the fabric duct, and direct air to the underside of the roof in a complex and specific pattern.

The mechanical system for the 1.8 metre diameter fabric duct supply and aluminum return air system is unprecedented and may be the only one of its kind in the world.

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Supporting the massive equipment and preventing vibrations within the steel framing was a significant feat of engineering and is one of the project's most noteworthy accomplishments.

Two, 45,000 CFM fans were installed in the arch and required additional structural support for positioning into the architectural elements of the building. Supporting the massive equipment and preventing vibrations within the steel framing was a significant feat of engineering and is one of the project's most noteworthy accomplishments.

It was not a matter of simply installing new fans. The fans have to consistently operate at 800 RPMs and they are designed to run 24/7. Therefore, prior to any work being undertaken, sub consultants reviewed the existing structure and performed modeling tests to determine how to minimize the transfer of vibrations onto the structure. After construction was complete, an acoustic and vibrations consultant was hired to ensure the facility was operating within the design guidelines.

The high-efficiency 45,000 CFM fans produced excessive noise so two-stage, upstream and downstream silencers were custom designed to dissipate the sound. The silencers are massive - comparable in size to that of an apartment kitchen. Not only do the fans have enclosures of their own to muffle the sound but the fans also have a silencer on the supply and return air.

Since a prime goal was to prevent condensation from building up on the underside of the roof, during the design phase special data logging was done to monitor and gather information about the temperature and humidity of in-situ conditions over different seasons.

The models for the ductwork in the new design showed some potential dead spots in the building itself. Glycol heat and fin tube radiators were installed on the ring beam to heat up those areas that lacked air movement. By simple heat convection, they prevent the accumulation of condensation.

Dehumidifiers were installed to reclaim heat and moisture out of the air and to displace it directly into the swimming pools.

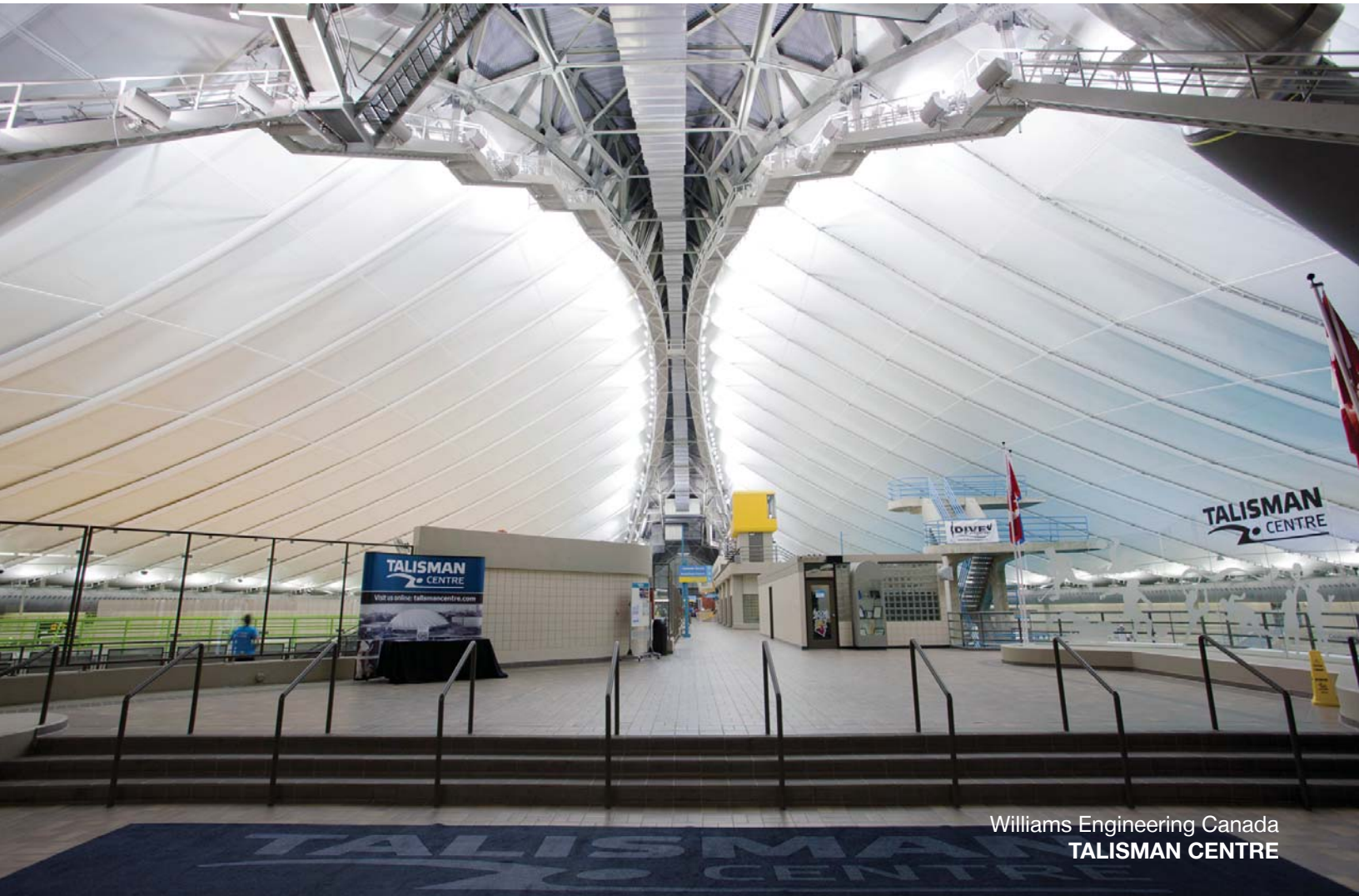
To guarantee that the remainder of the building is not contaminated with impure air, a filter wall was custom-built to allow the return air to flow through. These return air filter walls are wide open as opposed to being partially enclosed by grates, which provides additional benefits. During events, large banners and balloons occasionally float up into the ceiling space. Instead of blocking air flow and being expelled into the fans, the balloons and the banners are sucked into the return air and are taken back down to the filter wall where they are trapped and can be retrieved.

The motors that run the fans were upgraded to be variable frequency drive (VFD) compatible and are becoming a more conventional and innovative motor and fan combination for facilities of this nature. All existing chillers and fans were retrofitted with VFD compatible motors and controls to reduce energy consumption.

During the renovations, the entire spine of the building was exposed. Air quality testing, performed by Golder Associates, was done to mitigate any issues that might arise from the steel deteriorating due to the high levels of chlorine emissions from the swimming pools. These tests also helped to ascertain the type of materials that were required to the building equipment enclosures.

To ensure the fire suppression, fire alarm, and smoke evacuation systems continued to work during an emergency, a custom built damper system within both the filter system and within the filter wall was added. The fire protection system is designed so that in the event of a fire, the fabric duct system will shut down and the damper will open and allow the infrastructure to continue to function as the smoke escapes. Leber Rubes, a fire and life safety firm, performed the fire/emergency exiting review on the catwalk.

During the renovation, the entire spine of the building was exposed.



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Electrical Innovations & Unique Equipment

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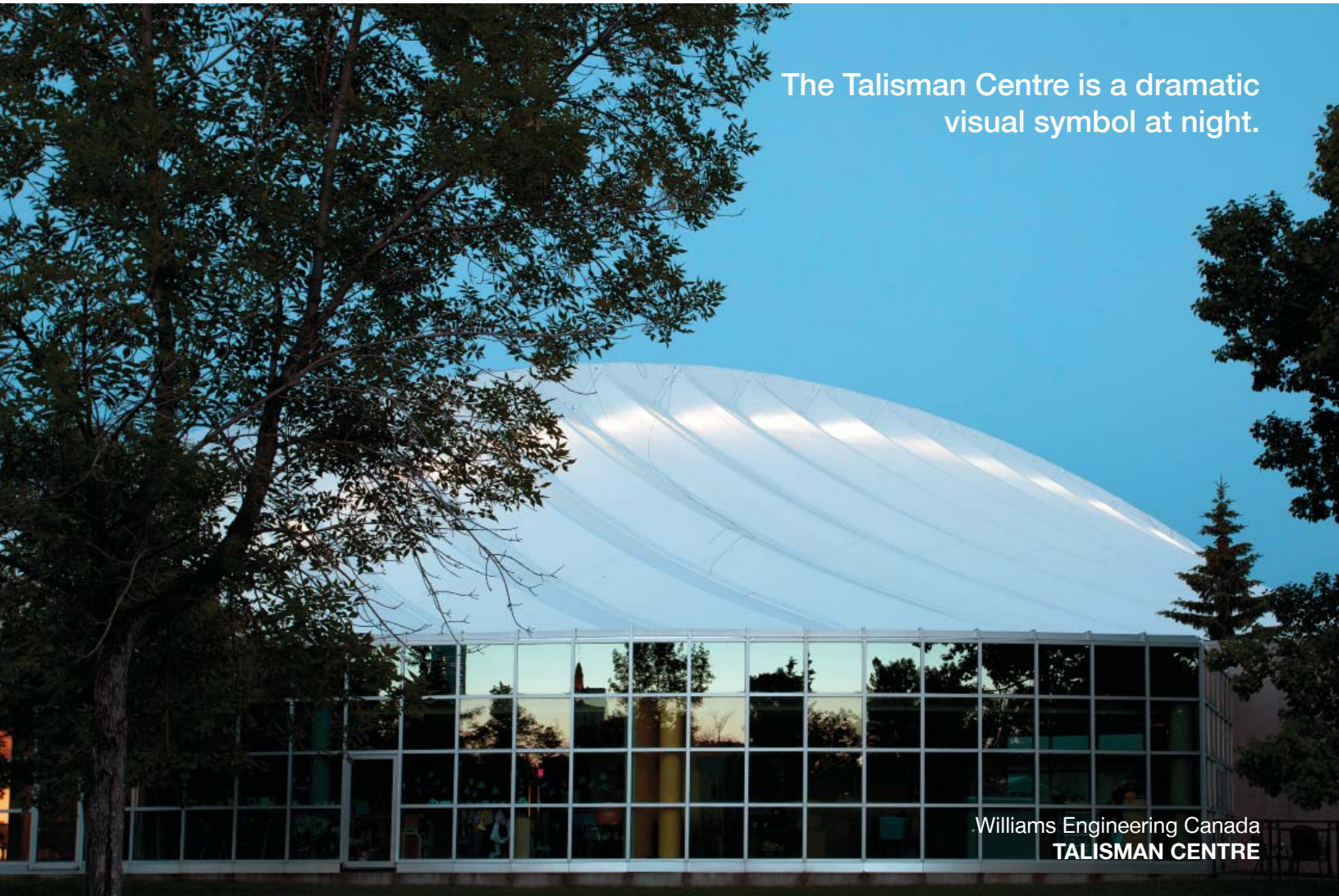
The building's irregular shape posed a few obstacles in terms of creating precise lighting designs and rendering models. The 3D lighting models were essential to achieving targeted lighting design levels and simulating various options for architectural lighting evaluations and thus extensive time and resources were used to create customized lighting reflectance measuring instrumentation and sophisticated 3D lighting models.

Comprehensive 3D modeling was created using the specialized lighting software, AG132, to establish the lighting design. Overall the upgrades changed the lighting from 300 lux lighting levels to 600 lux levels. In addition, vertical illuminance levels and lighting uniformity were improved and direct and reflective glares were reduced. One of the changes was to exchange the existing exterior flood lights for new interior direct and indirect lighting. The redesigned lighting glows up through the new Nanogel fabric roof, making the Talisman Centre a dramatic visual symbol at night.



The Talisman Centre is a dramatic visual symbol at night.

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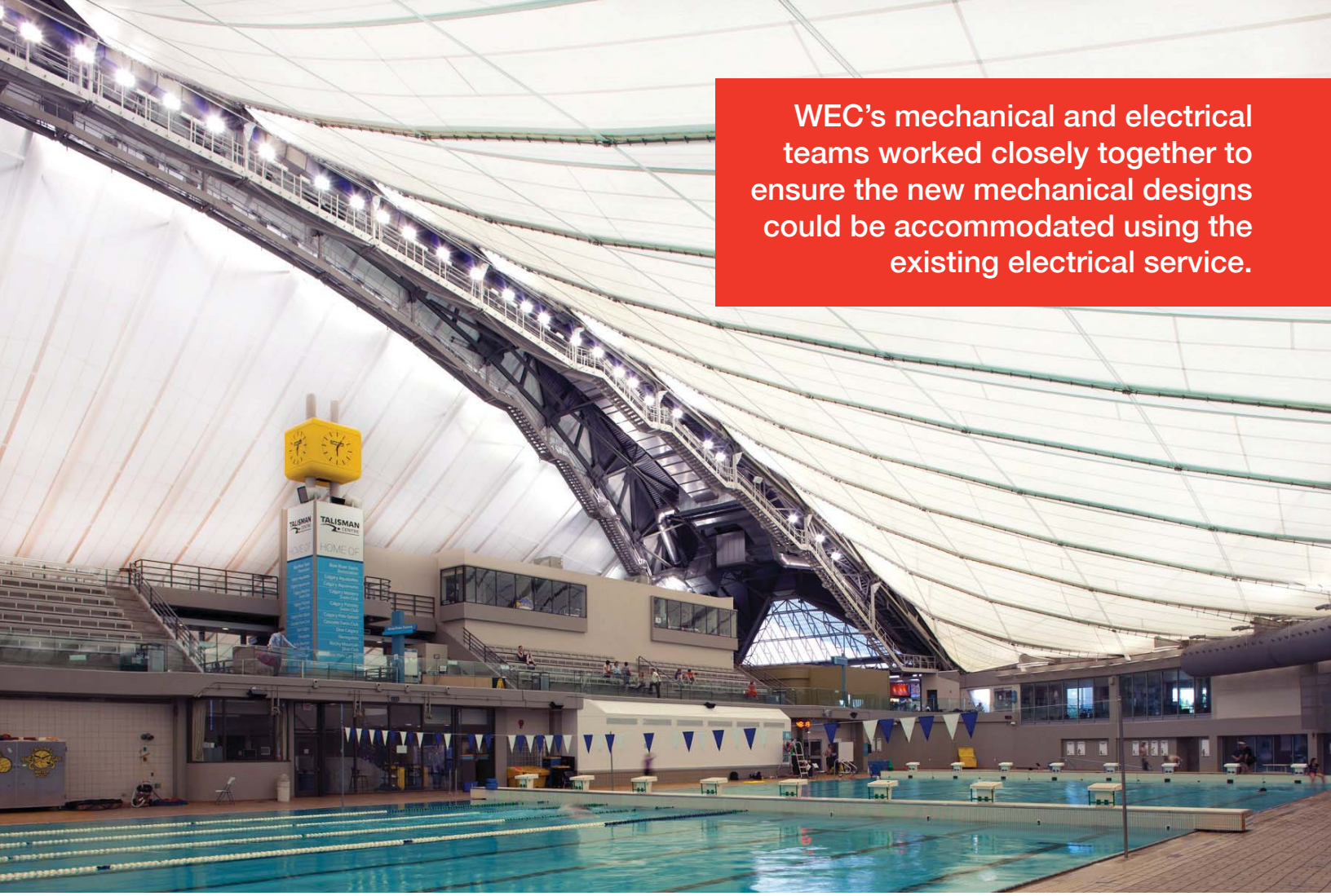

WEC's mechanical and electrical teams worked closely together to ensure the new mechanical designs could be accommodated using the existing electrical service.

Existing pendant lights over the pool presented both maintenance and accessibility difficulties. Each time a lamp or ballast required replacement, the pool had to be emptied. Therefore, these fixtures were removed and replaced with indirect metal halide and fluorescent lights which were added around the ring beam on the structural supports for the fabric duct.

Throughout the project, our mechanical and electrical teams worked closely together to ensure the new mechanical designs could be accommodated using the existing electrical service.

Fluorescent light strips are hidden in between the large fabric duct and the walls. They render a cove lighting effect that blends with the architectural and building systems. The strip lighting also eases shadow effects caused by the large fabric ducts. Due to the large size of the ducts, noticeable dark spots by the perimeter of the building would have been present if the strip lights were not installed.

Since the Talisman Centre plays host to national swimming competitions, Williams Engineering Canada's electrical team verified that the new lighting designs were in adherence to the Federation Internationale De Natation (FINA) standards.

Additional lighting that was used throughout the building included 1,000 Watt metal halide direct sport lights; 1,000 Watt with 250 Watt emergency lamp sport lights; 400 Watt indirect lights; T8 lamp vapour tight fluorescent lights; T5 lamp indirect lights; and various compact fluorescent down lamps, and shower lights.

Project Budget

During construction, the Canadian currency dropped significantly causing monetary fluctuations and introducing a degree of difficulty in terms of budgeting for the project. With tax payer's money invested in the project, it was imperative for Williams Engineering Canada to be cognizant of the exchange rate when sourcing international materials because of the lack of currency certainty and to show good value for the money that was used.

Significant Community Achievement

When the City of Calgary required major renovations to the Talisman Centre, they envisioned a complete building renovation as innovative as their iconic roof. Williams Engineering Canada not only succeeded in capturing their dream but our firm turned that dream into a reality. Through the in-house, collaborative consulting engineering design team of experts at Williams Engineering Canada, in addition to the support from an assortment of skilled sub consultants, the Talisman Centre is now a newly renovated facility with numerous upgrades. The Talisman Centre's upgrades and renovations were an ambitious venture and a significant community achievement that Williams Engineering Canada is proud to be a part of.

Through the multi-disciplinary engineering design team of experts at Williams Engineering Canada, in addition to the collaboration from Rowan Williams Davies & Irwin, Neil Jaud Architect, Leber Rubes, Comtec Associates, Golder Associates, Stuart Olsen Dominion Construction, and Birdair the Talisman Centre will continue to play a dynamic and fundamental role in sport and wellness.

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