Green Point Stadium, South Africa
We have been a proud player in global sports development for over four decades, helping clients enrich communities and electrify audiences with striking and sustainable venues.

At WSP, we have a long history supporting the creation of diverse sports facilities for a rich array of clients. Our record covers everything from national stadia to school swimming pools, multipurpose arenas to specialist facilities, in a portfolio spanning the world.

We bring a global skill set, passion for beautiful buildings and matchless experience to every project, working with architects, owners, councils and developers to create iconic and cost-effective structures that reward both users and operators.

With an intimate understanding of international sports dynamics and creative and flexible teams, we tailor global best practice to meet the needs of every project. Whatever the sport, and wherever the venue, our experts know how to boost building performance and enhance spectator experience.
Sports arenas have the power to light up a city’s skyline, put a region on the map and bring together all parts of a diverse community. Getting people into pools and onto running tracks, they quite literally boost the health and vitality of a neighbourhood.

But juggling local needs and sensitivities with the intense pressures of the international sports world can be a challenge.

At WSP we understand that all sports venues, from Olympic stadia to community swimming pools, must enrich the lives of those around them. We know how to respect the heritage of much-loved buildings, while keeping them relevant; how to create world-class facilities for schoolchildren and professional athletes alike; and how to minimise disruption during construction – making sure these crucial spaces stay in play for those who need them most.
BC Place Stadium

Breathing new life into a city landmark

Part of the fabric of British Columbia, Vancouver’s 55,000-seat BC Place Stadium hosts hundreds of events each year, including sports, concerts, trade shows, and conventions. The stadium opened in 1983 as Canada’s first domed stadium, covered by the world’s largest air-supported dome roof. 25 years later, it became clear a revitalisation was needed, both to renew the stadium’s place as a Vancouver icon and make it a worthy host of the opening and closing ceremonies of the 2010 Winter Olympic Games.

As lead consultant, we worked with roof designer Geiger Engineers to produce an integrated design for the upgraded stadium, covering all engineering disciplines. The award-winning project was completed in two phases, starting with the interior upgrades to public spaces within the stadium, and as many structural upgrades as possible prior to the Olympics. In the second phase, the roof was replaced and the entrances and back-of-house areas revamped.

The stadium now enjoys enhanced amenities, including field, seating, audio-visual systems, acoustics, illumination and ventilation. Its cable truss retractable roof transforms the building into an open-air sports venue when needed, while an integrated network of energy-efficient, digitally controlled architectural lighting illuminates the stadium on command, animating the city’s skyline. An innovative and holistic design approach has breathed new life into the stadium, transforming it into a world-class, modern facility and cementing its place as a Vancouver landmark.

LOCATION
Vancouver, Canada

CLIENT
BC Pavilion Corporation

ARCHITECT
Stantec

CAPACITY
55,000

HOME OF
BC Lions

SERVICES
Base building structures, mechanical and electrical services

STATUS
Completed in 2011
New York University in Abu Dhabi is a new arts and science college, fully integrated into a major research university. Designed by Rafael Viñoly Architects, the campus accommodates 2,600 students with expansive academic space and accommodation – plus impressive indoor and outdoor sports facilities.

The project was procured on a design and build basis. We provided building services, infrastructure design and site supervision for the project.

An integral part of the university is an indoor, 21,500m² sports and recreation centre, including an Olympic-size swimming pool, gym and 200m running track. Outside, students benefit from floodlit football fields, tennis and volleyball courts and a 400m synthetic running track with grandstand for 3,000 spectators.

The air-conditioning design of the indoor gymnasium posed a particular challenge due to the facility’s range of uses and removable seating, as well as the need to comply with international badminton’s rules on air velocity. Our solution was to use high induction radial outlet diffusers with a vertical central core to make sure that air flow penetrates to ground level.

New York University, Abu Dhabi
Keeping students on track with a stunning sports centre

LOCATION
Abu Dhabi, UAE

CLIENT
Tamkeen Abu Dhabi LLC

ARCHITECT
Rafael Viñoly Architects

SERVICES
Building services, infrastructure design, site supervision

STATUS
Completed in 2014
The 30,000-seat soccer stadium is located at Najaf, approximately 100 miles south of Baghdad. It features two 1,000-seat training fields with related structures, remote practice field lockers, storage, concessions, ticket buildings and guard houses.

Unlike the oval-shaped Basra and Al-Mina’a stadia, Al-Najaf has an unusual square exterior, detailed with Islamic-influenced latticework reminiscent of the sacred Imam Ali Mosque in the heart of the city.

Our services included MEP and fire protection engineering, with an emphasis on sustainable design solutions. One example is the facility’s passive cooling towers, included to keep the stadium concourse comfortable despite the region’s high temperatures. We also provided sports lighting design.
TD Place Stadium
A Novel Stadium in the Heart of a Major Revitalization Project

LOCATION
Ottawa, Canada

CLIENT
City of Ottawa

ARCHITECT
Cannon Design

CAPACITY
24,000

HOME OF
Ottawa Redblacks and Ottawa Fury FC

SERVICES
Structural Engineering

STATUS
Completed in 2014

Lansdowne Park, a 48-acre site located in the heart of a thriving Ottawa residential community, was a sports, exhibition, and entertainment centre owned by the City. The City wanted to revitalize the site and better integrate it within Ottawa’s overall social fabric. The redevelopment project encompassed the rehabilitation of the football stadium (with stands on the North and South sides), a refurbished 9,862 seat arena, two residential towers, a civic centre, a 360,000 sq. ft. retail and entertainment district, an office tower, an underground parking and a public park. This led to the creation of a sports, retail and entertainment destination in the core of the city that combines modern facilities, heritage buildings and green space.

The redeveloped iconic TD Place Stadium was visualized as a ‘stadium within a park’ that would be open to the public during non-sporting events and would reflect Ottawa’s rich history as a timber town. The stadium has a 24,000-seat capacity, as well as 318 wheelchair accessible spaces, 26 corporate boxes, four locker rooms and FieldTurf field surface. TD Place is designed to accommodate professional, university and community sports. It is home of the Ottawa Redblacks from the Canadian Football League and the Ottawa Fury FC from the North American Soccer League.

When it hosted its first football game on July 18, 2014, it was clear that TD Place Stadium had made, and would continue to make, a lasting impact on the community. The venue brings people together through the enjoyment of sport, concerts and other major events.

Since the project’s inception, the stadium was envisaged as an exuberant entity that would dynamically integrate with the park, rather than being a static monument in isolation from its immediate context. The veil takes its cues from the landscape, rising organically from an engineered
berm and curving over the grandstands to provide shelter and shading for spectators and pedestrians. The veil is also open in some areas, connecting visitors with the natural environment.

The most striking feature of the design is a sinuous $7.5M “veil” of glued laminated Alaskan yellow cedar rising up from the back of the new south stands and curling over the top, creating a flowing system of enclosure and roofing. This innovative use of wood creates an iconic image for the new stadium complex, setting it apart as a unique landmark, connecting it to the surrounding natural environment.

WSP’s services included the structural design of the new South Stands using a hybrid framing system (concrete is used for the lower bowl and steel for the upper bowl), the design of the veil structure comprised of glued laminated timber curved frames, aluminium secondary members and ETFE foil roof covering.

To promote water shedding, we made sure that all surfaces were sloped, we provided detailing of connections to allow for drainage, and developed a structural system that enables individual part replacement. All of these aspects were incorporated to prevent water from ponding. WSP and partners established design criteria and regularly reviewed it to ensure that it was consistently met throughout the project.

Accounting for weather was one of the project’s main challenges. Alaskan yellow cedar glulam was selected as it is one of the hardest known softwoods in the world, and it is naturally durable. It is also resistant to rot and decay and does not require chemical treatment. Without any finish, the material is left to age naturally, developing a beautiful silvery sheen. This material choice was important to protect the structure from the natural elements and ensure its longevity.

The curved frames were shaped through bending processes to create the sinuous, contoured appearance of the veil. Our structural engineers considered the stability of structural systems and the development of architecturally appealing connection details to enhance the appearance of the wood structure.

Our work also comprised the retrofitting and modifications of the North Stands to incorporate a new elevator and stair shaft, as well as modification and addition of ramps on the East side. The rehabilitation also included the massive steel girders that supported the roof over those stands. One of the biggest challenges was that no one has had access to the inside of the steel box girders since the north stands were built. This implied that we needed to take extra care when planning the rehabilitation of the girders and modification of the roof making sure it can deal with the amount of snowfall in Ottawa.
Citi Field

Intimate atmosphere for a retro baseball stadium

Citi Field in New York City’s borough of Queens is home to the New York Mets baseball team. The award-winning, 45,000-capacity stadium includes a restaurant with fieldview seating, a New York Mets interactive museum and a Hall of Fame.

We were the structural engineer for this world-class facility, which uses large cantilevers to create a vertically stacked seating arrangement, offering improved sightlines and an intimate, close-to-the-action feeling. The architecture is based on Ebbets Field, home of the Brooklyn Dodgers until the 1950s.

To achieve the stadium’s ‘retro’ look, most of the support steel was left exposed. The seating bowl, stairs and field walls are made from pre-cast concrete.

The site’s poor soil presented a challenge for our team, calling for piles to support not only the superstructure but also the ground-level floor slab and plaza area. It also increased seismic risk to the complex, while the need for open concourses restricted use of steel bracing. We overcame this by using powerful concrete shear walls around the stair towers to provide additional support and incorporating special concentrically braced frames.

The project was delivered in 36 months, in time for the Mets’ April 2009 home opener, a timeline requiring extremely close coordination across the design team. We used building information modelling (BIM) to coordinate the stadium’s structural and architectural design.

The project won the American Council of Engineering Companies’ Diamond Award for Engineering Excellence in 2009.
The Allianz Arena is home to the world-famous football club Bayern Munich and hosted six of the 2006 FIFA World Cup matches in Germany. With a seating capacity of 75,024, its car park can hold up to 11,000 cars and 350 buses.

We were appointed to develop key infrastructure designs for the project including the planning of several bridges to ensure the smooth flowing of traffic. We were also responsible for the construction management for the entire infrastructure improvement.

In addition, a multi-lane road was constructed between the junctions of the A9 and A99 motorways to connect the stadium with the multi-storey car park.

To allow for intersection-free traffic, both carriageways were vertically offset.

Several other constructions, primarily bridges, were designed to ensure intersection-free traffic across the site such as a 30m footbridge, built over the main road, allowing pedestrians to easily reach the three car parks. In addition, all the bridges on site have been designed to complement each other with recurring design features.

A flyover over the A9, A99 feeder road and Heisenberg-Allee ensured unobstructed access for emergency vehicles and to ensure minimum motorway closure during its construction we developed a modular construction system for the superstructure.
Stamford Bridge has been home to Chelsea Football Club since 1905. The owner has submitted a planning application to construct a new, larger stadium on its historic Stamford Bridge site in London, UK. The expansion will increase the stadium’s capacity to approximately 60,000. Plans for the new venue also include upgrading the football-related facilities, including the museum and megastore, in addition to providing improved stadium access.

Our team provided structural engineering for the planning application working with schlaich bergermann partner, the world-leading roof specialist. We also provided civil engineering, transportation and environmental services.

A key challenge is to increase capacity within the confines of the current site, making maximum use of the space. Solutions include building a basement across the majority of the site and removing the existing hotels and a fitness club. Concrete decks over the Network Rail line to the east of the site and London Underground land to the north will create further space for the stadium and pedestrian egress.

The stadium will have five levels above ground and an extensive basement. It will feature a three-tier bowl which, along with the concourse areas, will be constructed in concrete. A steel roof clad on the underside extends inwards from the edge of the seating bowl. The pitch is lowered by approximately 5m compared to the existing level, to limit the overall height of the stadium and create space for the additional crowd capacity.
The City of Cockburn is partnering with the Fremantle Dockers AFL Football Club and Curtin University to deliver an AUS$109m, world-class sporting centre, the largest of its kind ever undertaken in Western Australia. Facilities will include outdoor and indoor pools, water slides and an AFL football ground, plus community meeting spaces, a six-court stadium and learning facilities for local sports science students. The site is set to be the new home for the Fremantle Dockers AFL team.

The client’s challenge was to create a landmark building that offers state-of-the-art facilities to the community with minimal environmental impact.

We are providing mechanical services engineering for the project, with the original design including a central chilled and heating water system, linked to deep aquifer geothermal to provide environmentally friendly heating for the pools. In such a large, mixed-use centre, it is crucial that all mechanical installations operate costeffectively and efficiently whilst maintaining the comfort of the building’s users.

Our approach has been to collaborate closely with all stakeholders in the large design team and diverse client user groups. To achieve this, we have held a number of workshops tackling some of the more design-intensive elements of the building’s mechanical services.
The Meridian Centre is a new sports and entertainment facility for the Ontario City of St Catharines and home to the Niagara IceDogs ice hockey team. It was designed and built by the Ball-Rankin construction team, which included WSP and Architecture 49. The facility, part of a wider revitalisation of downtown St Catharines, includes a U-shaped bowl with over 5,000 fixed seats and a threelvel scheme with event, concourse and suite levels.

**Meridian Centre**

*An icy triumph for downtown Revitalization*

**LOCATION**
St Catharines, Canada

**CLIENT**
Ball Construction and Rankin Construction

**ARCHITECT**
Architecture 49

**CAPACITY**
5,000

**HOME OF**
Niagara IceDogs ice hockey team

**SERVICES**
Structural, building services

**STATUS**
Completed in 2014
The multipurpose Ryan Fieldhouse and Walter Athletics Center, a 420,000-square-foot building in Evanston, Illinois, will serve as the practice facility for the Northwestern University’s football, basketball and soccer teams. It houses a full-sized football practice field, two sports performance facilities, three basketball courts, locker rooms and offices for the university athletic department.

WSP worked with Perkins + Will, the lead architect, to provide structural engineering design services on behalf of Northwestern University. WSP delivered an efficient and unique design that met the aesthetic goals and requirements of the architect. We provided a lot of coordination services and assisted the rest of the design and construction team to meet the very fast construction schedule.

The $180 million project uses a dozen...
246-foot-long box tube arches over the field to create a functional and beautiful space. The lakeside face of the football field has a 42-foot wall of glass laterally braced back to the arches and kinked arm braces supporting the edge of the roof. The tall glass walls provide an amazing view of the lakefront from inside the building and show off the facilities from the outside.

Each of the box tube arches is formed from 20-by-36-inch curved box tubes of varying wall thicknesses. The profiles of the arches were carefully planned to fit the sports requirements and stay within the strict roof height requirements of the City of Evanston.

The arch erection involved a complex process that began with the prefabrication of two parallel segments of the six arches installed into the building. The horizontal beams segments were then lifted into place and connected to the rafters. The sequence to install the arches required six sequences and took an entire day—and had to be carefully coordinated with the prevailing winds off the lake.

Efficiently designing and constructing long-span structures demanded some creative solutions. The field was raised off the ground floor to allow space between the beach and the building face for vehicle traffic. This required the north side of the arch to be supported on a cantilevered support beam.

We had a very small site for what the program demanded, and that required us to elevate the football field to the second floor of the complex, then cantilever the support for the north side of the field. We also had to do it within a very fast construction schedule to provide early occupancy of the football field. The raised football field created the opportunity to install the two basketball courts and other recreational athletic facilities in the basement.

There was extensive collaboration between WSP and the architect on the fully exposed roof connections to achieve the aesthetic requirements set by the architect and the owner. We worked very closely with the steel fabricator and connection engineer to optimize and simplify the roof beam connections and arch connections.

The building was honoured by the Structural Engineer Association of Illinois with a 2018 Structural Engineering Award, winning the Best Project Award for a project valued over $150 million. The building’s seawall, designed by the SmithGroup JJR, won a Concrete International Decorative Concrete Award.
The Pan Am / Parapan Am Aquatics Centre and Field House on the University of Toronto's Scarborough Campus was a key venue for the 2015 Pan Am / Parapan Am Games, with a 6000-capacity main competition pool. The complex includes two 10-lane, 52m international competition pools and a 5.5m-deep diving tank, plus an indoor recreational track, fitness facilities and a field house for training and competition. The complex will now serve as a national high-performance aquatics and athletics facility and will house the Canadian Sport Institute of Ontario (CSIO), a world-leading sports research facility.

We provided structural engineering services, green building and energy services, and building envelope design and construction review for the project.

The building is depressed approximately eight metres into the ground, enabling its high volume spaces to be accommodated without overpowering the surrounding area. The foundations are made from cast-in-place concrete with a structural steel superstructure. Long span roofs are framed with structural steel trusses and beams, and the floors with concrete on steel deck, supported by composite steel beams. The competition and training pools are prefabricated.

Using energy modelling and design feedback, we helped the project’s sponsors achieve an ambitious energy target. Green roofs cover around 60% of the structure's roof area. We also carried out daylight simulation to support strategies for controlling glare within the competition spaces.

**LOCATION**
Toronto, Canada

**CLIENT**
PCL Constructors Canada Inc.

**ARCHITECT**
Norr

**CAPACITY**
6,000

**SERVICES**
Structural, green building and energy services, building envelope consulting

**STATUS**
Completed in 2014
World-class Experiences

GOOD DESIGN IS THE FIRST STEP IN GIVING FANS AND ATHLETES THE TIME OF THEIR LIVES.

Sports events are special. They are times of excitement and tension, highs and lows, moments that make and break careers and are retold for generations.

The buildings where they happen are special too. Giving spectators and players outstanding experiences depends on inspiring, comfortable and reliable structures. At WSP, we know that the venue and the action are intimately entwined.

We are experts in creating sports facilities that deliver every time, whether we’re enhancing views of the pitch, using specialist lighting to impress the crowds or engineering retractable roofs that let play continue whatever the weather. So when that goal is scored, or finishing line reached, everyone can be in on the action.
Yas Bay and Yas Arena

A waterfront destination and a multipurpose venue

Yas Bay is a new waterfront destination development located on the southern part of Yas Island in Abu Dhabi. It will be one the UAE's most iconic and vibrant waterfront destinations offering a broad array of entertainment options including restaurants, hotels and a state-of-the-art multipurpose arena. The destination will include a waterfront promenade and a pier with more than 50 cafés and restaurants, 20 retail outlets, a cinema, a beach club, and two hotels.

Yas Bay will also include Abu Dhabi’s first multipurpose arena designed to expand from an intimate 500-seat theatre to an 18,000-spectator venue. This will enable hosting of diverse sports and entertainment events and will position Yas Arena as one of the most adaptable arenas in the world. Additional retail space near the arena stretching down the promenade will enable a vibrant atmosphere throughout the year.

WSP’s role as Design Lead Consultant includes all architectural and engineering services, most of which are provided through WSP’s local offices in Abu Dhabi, Dubai, and Sharjah. WSP and its partners are providing a total of 21 technical engineering services, working in partnership with international architects HOK (arena) and HKS (hotel), as well as local Architects of Record, Pascall+Watson. WSP will also be the Supervisory Consultant during the construction phase.
Al Shaqab, Qatar Foundation’s equestrian complex in Doha, is the region’s leading equine education resource centre. We provided civil and structural engineering, building services and infrastructure design for the award-winning project, which includes a performance arena, equestrian club, riding school, mosque, museum, veterinary hospital, stable facilities and Royal accommodation. The centrepiece of the 980,000m² complex is the International Equestrian Arena, a combined indoor and outdoor competition facility capable of hosting Olympic-standard events.

We delivered the structural design for the internal arena’s clam-shaped steel roof. Our visually strong and simple solution provides a clear expression of the 350m-long roof as an all-encompassing entity shielding the activities below from the harsh Arabian climate. We completed the design in just six months, a challenging time-scale dictated by the need to be ready for the 2006 Asian Games.

The roof profile is curved in two directions, with clear spans of up to 120 metres, and supported on steel trusses of triangular cross section. As it has no movement joints, our engineers had to find a way to reduce the locked-in forces caused by the large temperature range. We also carried out a wind tunnel aerodynamic stability study to minimise vibration risk.

In addition, the roof supports the high-intensity performance lighting within the envelope instead of conventional high-mast configuration.

LOCATION
Doha, Qatar

CLIENT
Qatar Foundation

ARCHITECT
Leigh & Orange Architects

SERVICES
Structural, civil, building services, infrastructure design

STATUS
Completed in 2006
Hong Kong Jockey Club

An enhanced experience for race-goers

Founded in 1884, the Hong Kong Jockey Club is one of the oldest institutions in Hong Kong. It recently upgraded the grandstand facilities of its two racecourses, Happy Valley and Shatin, to create more interactive, brighter and more stylish facilities for the punters. These included modernised public and members betting halls, new coffee shops and private boxes. The air-conditioning was also upgraded at both racecourses.

We were employed in a partnership arrangement to provide the engineering design of the building services. This included surveying the condition of the MEP infrastructure, modernising the lifts, upgrading the air-conditioning infrastructure, implementing fire safety improvements and developing energy management and sustainability design initiatives. In addition, we introduced a Horse Trakus system. This offers a tracking system which determines the exact location of each horse throughout a race to improve the race viewing experience.

LOCATION
Hong Kong

CLIENT
The Hong Kong Jockey Club

ARCHITECT
Aedas

SERVICES
Building services

STATUS
Completed in 2014
The Mercedes-Benz Stadium is the new Georgia home of the Atlanta Falcons American football team and Atlanta United soccer club. The multipurpose stadium has an eight-panel retractable roof, resembling a camera oculus, responding to the Atlanta Falcons’ desire to play outdoors except in the most extreme weather. The stadium was built with an eye to hosting a future Super Bowl and seats around 70,000 people, with 180 luxury suites and 7,500 club seats.

Mercedes-Benz Stadium

Trailblazing lighting design to boost flexibility, performance and fun

LOCATION
Atlanta, USA

CLIENT
Arthur M Blank Group Sports and Entertainment Group

ARCHITECT
HOK

CAPACITY
70,000

HOME OF
Atlanta Falcons American Football team

SERVICES
Building services, specialist lighting design, sustainable design consultancy

STATUS
Completed in 2017
Our team provided building services, specialist lighting design and sustainability consultancy. Our goal was to create a reliable and efficient building, maximising the fan experience and highlighting the unique architecture of this signature building for Atlanta. We also supported the client’s target of a LEED Platinum rating, with sustainable features including high-efficiency water fixtures that cut sanitary water consumption by 40%.

The stadium mostly uses LED lighting, including for sports lighting, an unusual step for a facility of this size. This gives the owners ultimate flexibility, while significantly cutting energy and maintenance costs. Other innovations include the use of light fittings as wayfinding devices for fans and colour-changing LEDs to illuminate the building’s façade. We have also been exploring the use of different light qualities for locker rooms, to help players achieve peak performance for the game and enjoy a relaxing post-match atmosphere.
We provided MEP engineering, fire protection and full lighting design services for Basra Sports City, which hosted the Gulf Games in 2013. The project was split into two phases, with phase 1 covering the 65,000-seat main stadium, a 10,000-seat practice stadium, four practice fields, athlete housing, a VIP guesthouse, fire station and surface parking.

Phase 2 consists of around 20 new sporting venues in separate buildings. When complete, the government-backed project will be akin to an Olympic venue. The main stadium was built to International Building Code and FIFA Standards. In addition to its 65,000 seats, the complex features a range of suites, VIP lounges and restaurants, facilities for spectators, athletes and employees, and building operation facilities, covering security, housekeeping, maintenance and trash management. It also has underground parking and a tunnel connecting the main stadium to the practice stadium.
Al-Mina’a Stadium

Bringing a stadium to life with specialist lighting

LOCATION
Basra, Iraq

CLIENT
Iraq Ministry of Youth and Sports

ARCHITECT
HOK

CAPACITY
30,000

HOME OF
Al-Mina’a SC

SERVICES
Building services, sports lighting design, fire protection

STATUS
Completed in 2013

The Al-Mina’a Stadium project in Basra includes a 30,000-seat soccer stadium, two 1,000-seat training fields, VIP lounges, a press box, ticket buildings, restaurants, concession areas, guard houses and offices. We provided MEP and fire protection design services for all parts of the Al-Mina’a Stadium. We also provided sports lighting design for the entire site including the stadium and training fields and stadium façade.
Levi’s Stadium
A sustainable arena that keeps fans close to the action

LOCATION
Santa Clara, USA

CLIENT
HNTB Corporation

ARCHITECT
HNTB Architecture

CAPACITY
77,000

HOME OF
San Francisco 49ers American Football team

SERVICES
Building services, fire protection, environmental, event lighting

STATUS
Completed in 2014
Levi’s Stadium is an open-air, multipurpose venue, home to the San Francisco 49ers American football team. The 77,000-seat facility, which opened on schedule in July 2014, is set up to host a variety of sports, including soccer, wrestling and motocross, as well as concerts and conferences. Its 200 luxury suites, built across two levels, are clustered on one side of the field, meaning fans in the upper deck of normal seating can be closer to the action.

We were the engineer of record for the stadium, designed with a strong focus on spectator experience and green technology. Our services included MEP, fire protection and sports lighting, as well as sustainable design.

The building is one of the most sustainable sporting venues in the United States, and currently the only professional football stadium to achieve LEED Gold certification. Environmentally friendly features include a heating, ventilation and air-conditioning system that avoids CFC-based refrigerants, instead relying on materials that minimise ozone-depleting compounds; use of recycled water for landscape irrigation; and a solar-panelled roof deck that powers the stadium through home games.

In addition to typical spectator amenities, such as clubs, restrooms and shops, the stadium features day-of-game team facilities, stadium and team administration offices and related back-of-house areas.
Arthur Ashe Stadium is the largest outdoor tennis-only venue in the world by capacity and the main stadium of the US Open. Named after champion player Arthur Ashe, the arena has over 22,500 seats, 90 luxury suites, five restaurants and a two-level players’ lounge. It is part of the United States Tennis Association (USTA) Billie Jean King National Tennis Center, located in Flushing Meadows Corona Park in the New York borough of Queens.

We were the structural engineer for the stadium, which opened in 1997 on the site of the 1939 and 1964 World’s Fairs. Following years of bad weather wreaking havoc with the US Open’s schedule, USTA announced plans to put a roof on the stadium as part of a $500m renovation.

We have been appointed structural engineer for the new retractable roof, which will continue to allow open-air events while providing all-weather protection. The primary challenge has been to create a visually compelling structural design for the tennis world’s largest long-span retractable roof, on poor soil and within a tight budget. Our solution includes the use of just eight columns to support the lightweight fabric roof, maintaining good sightlines for spectators.
Queensland Tennis Centre

A world class legacy to be proud of

Queensland Tennis Centre opened in January 2009 to provide a much-needed, world-class tennis centre for Queensland. It has 23 International Tennis Federation standard tennis courts including grass, clay and hard court surfaces and a 5,500-seat covered centre court, named the Pat Rafter Arena. In addition there are corporate suites, function venues and all the public and player facilities required to host an international tennis tournament.

We provided mechanical, electrical, fire, vertical transportation, and specialist sports lighting design services for the design and construction phases of the project.

Centre court is provided with a translucent, glass fibre, lightweight fabric roof that is open at the perimeters to allow cross ventilation. We also helped with comfort modelling of conditions within the seating bowl and centre court to allow the architects to fine-tune their roof design.
Avaya Stadium

New status for soccer in a magnificent stadium

The Avaya Stadium in San Jose, California, is the brand new home of Major League Soccer's San Jose Earthquakes. The specialist soccer stadium is located on a site to the west of San Jose International Airport and forms part of a mixed residential, retail, R&D and hotel development. The venue's steeply raked seating is designed to deliver the best experience for spectators. And with fans flooding in, the new facility looks set to propel a sport rapidly gaining popularity in the US to new heights.

We provided complete MEP systems and lighting design for the 18,000-seat stadium, which benefits from a lighted playing field and two-sided video display scoreboard. In addition, our building systems design covers all spaces for teams, officials and spectators on game day, including team locker and training facilities, press and broadcast facilities, administrative and ticket offices, concessions and spectator amenities.

LOCATION
San Jose, USA

CLIENT
City of San Jose

ARCHITECT
HOK

CAPACITY
18,000

HOME OF
Major League Soccer's San Jose Earthquakes

SERVICES
Building services, lighting design, fire protection, technology systems and commissioning

STATUS
Completed in 2015
Successful arenas juggle many roles without losing their distinctive character.

From hosting world-class tournaments and international concerts to training sessions and corporate away days, handling the competing needs of diverse events is par for the course for most sports venues. Ensuring such large spaces are used to the full, best serves the public – and makes good business sense.

But being the go-to place for a wide array of users is not easy. A multiuse facility must effortlessly adapt to its different roles, whatever the site’s constraints. And it must do so without diluting the unique atmosphere that inspires all who visit.

We are experts in creating integrated, mixed-use spaces that combine commercial viability with stunning structures. Using cutting-edge technology and imagination we find ways around even the toughest engineering challenges. We also have a track record in innovative and cost-effective adaption of existing facilities, because sports venues must keep up with a changing world.
Tele2 Arena

Ingenious steelwork conquers a challenging site

LOCATION
Stockholm, Sweden

CLIENT
City of Stockholm via subsidiary, SGA Fastigheter AB

ARCHITECT
White Arkitekter, Arup Sport

CAPACITY
40,000

SERVICES
Project management, structural, precast, building services, geotechnical, fire and risk, traffic, sustainability consultancy

STATUS
Completed in 2013
The 40,000-capacity Tele2 Arena is a world-class entertainment centre in Stockholm. The complex includes a football stadium with retractable roof and facilities for other sports, concerts, conferences and exhibitions, plus an entertainment area with bars, restaurants, mini golf and more.

We played a central role in this development, providing project management, structural analysis and preconstruction technical studies, among other services. We also produced the basic design for the whole structure and detailed design for the steel roof and façade, generating tens of thousands of drawings for the steelwork and precast concrete. The accuracy of our work contributed significantly to the venue’s rapid construction and successful completion, while Building Information Modelling (BIM) helped coordinate design work and boost cooperation between the many consultants involved.

An initial challenge was to fit a stadium of this size into a narrow, irregularly shaped site, hemmed in by a major road, railway sidings and large hotel. The finished arena is actually larger than the site’s footprint, the floor space growing as the structure rises from its foundations and inclines outwards. With no room to store building materials, steel and concrete elements had to be positioned as soon as they were delivered, increasing logistical pressure.

Due to space and height limitations, the stadium has an asymmetric design, with a north stand that is taller and wider than the south stand. This prevented us from standardising the steel structure on the upper levels, meaning every element had to be individually designed.

The height differences also challenged designers of the vast sliding roof. Their solution was to span the roof space with two huge primary trusses, supported on pylons. The retractable roof runs on wheels on rails along these trusses, which also support lattice girders holding up the surrounding fixed roof.

Tele2 Arena was named Venue of the Year at the Stadium Business Awards 2014.
Craven Cottage

New Riverside Stand for Fulham Football Club

LOCATION
London, UK

CLIENT
Fulham FC

ARCHITECT
Populous

CAPACITY
Riverside stand – 9,000;
total – 30,000

HOME OF
Fulham FC

SERVICES
Structural, geotechnical,
built environment, façade and
fire engineering, environmental,
security, transport planning
and acoustics

STATUS
Ongoing

Craven Cottage has been the home of Fulham FC for over 100 years, and for the past twenty, WSP has been providing the club with engineering advice. In 2013, we helped them gain planning permission for the replacement of their Riverside Stand; but when the club was sold, the project was shelved. The new owner appointed Populous, the architects who designed their stadium, to revive the scheme. We were delighted to be appointed in the summer of 2017 to provide all engineering services for the new, re-imagined Riverside Stand. These include structural, geotechnical, building services, façade and fire engineering, environmental, security, transport planning and acoustics.

For Fulham FC, the new stand is a chance not only to enhance the experience for its supporters but also to contribute to and interact with the Thames riverside.
The club is very proud of its attractive location on the banks of a stretch of the River Thames popular for walking, sailing and rowing, with nearby parks and leafy residential development. One problem with the existing stand is that it interrupts the Thames Path. With the new stand, we are creating a walkway alongside the river, and the stand itself will contain restaurants, cafes, bars, corporate hospitality suites and event space, all accessible to the public. There will also be serviced apartments. Capacity of the stand will be doubled to just under 9,000, bringing the total ground capacity to nearly 30,000.

The Riverside Stand’s architecture reflects its riverfront heritage using aspects of boathouse design that are synonymous with development along this section of the river, while on the pitch side the sweeping roof adds a landmark element to the project.

The riverside location creates the greatest engineering challenges on this project. These started with the planning process and preparing the environmental statement which formed part of the application. This involved tree surveys, consideration of the impact of the development on fish and other marine life and ensuring that nocturnal species such as bats would not be disturbed by the stadium lights. While moving the river wall further out, we have minimised the amount of construction in the river. The walkway is supported on piles, and we had to conduct studies to understand the impact of this on the water flow to ensure it didn’t upset fish spawning. We carried out wind tunnel testing to demonstrate that the new stand wouldn’t adversely affect the wind environment for the local sailing clubs. We also had to prepare an energy statement for the development, demonstrating that it would meet very stringent targets for energy use and carbon emissions.

The greatest structural challenge relates to the constraints of the site, which the new stand hemmed in by the river, the field of play and the two adjacent existing stands. Despite the challenging site we have attempted to make the structure as simple as possible for efficiency and to aid construction. As usual, we have developed a detailed model of the structure and MEP that describes every element at the right size, coordinated with all the other engineering disciplines as well as the architecture.
Diocesan School for Girls Aquatic Centre

Two pools in one for mixedability students

The Diocesan School for Girls Aquatic Centre is the first school facility in New Zealand to feature a pool with a movable floor. The cutting-edge centre houses a new swimming complex with two indoor pools, a classroom, gym, offices and amenities, across three levels.

The main swimming pool can be lowered to a depth of 2m for sports such as water polo, and raised for learn-to-swim classes. The floor also acts as an efficient insulation blanket when the pool is not in use.

We provided an integrated design service to the project, including mechanical, electrical, hydraulic services, communications, vertical transportation, fire protection and pool water treatment. The project incorporates significant sustainable design features, such as heat recovery systems, a rainwater storage tank and intelligent ventilation for the pool hall.
Salt River Fields at Talking Stick

A Native American home for major league baseball

Set on 140 acres of Native American resort land, Salt River Fields at Talking Stick is the spring training home for the Arizona Diamondbacks and Colorado Rockies baseball teams. The complex houses an 11,000-seat stadium, which includes team locker rooms and two club houses, plus other facilities required for the dual training needs of two professional baseball teams.

The site also has two observation towers with observation deck, concessions, novelty stands and restrooms at Minor League Cloverleaf Fields, and provides top-of-the-line facilities for players and fans alike.

We provided MEP and specialist environmental design consultancy for the project, plus a master plan for the site’s lighting design. Our goal was to maintain a strong community identity throughout the complex while meeting the training requirements of two professional baseball clubs.

The project is located in the Salt River Pima-Maricopa Indian Community, near Scottsdale, Arizona. It is LEED Gold Certified.
The Montreal Tower

Repurposing a Montreal symbol and the world’s tallest inclined tower

LOCATION
Montreal, Quebec, Canada

CLIENT
Parc olympique

ARCHITECT
Provencher_Roy

SERVICES
Structural Engineering, Envelope Assessment, 3D Scanning and Modelling

STATUS
To be completed in 2018

The Parc Olympique, one of Montreal’s symbols, was built in 1976. This urban complex, designed by architect Roger Taillibert, includes a large esplanade, a sport centre, a 56,000-seat stadium, as well as a 175-metre-tall and 45-degree angled tower called the Montreal Tower. The Tower was completed in 1987, becoming the world’s tallest inclined tower.

The space inside it was originally meant to be used by various sports federations as training gyms for their athletes. Unfortunately, this idea never materialized and the tower was left vacant for about 30 years.

The tower’s height is equivalent to a 50-story building and, as one of its main functions, holds up the stadium’s roof with suspension cables. Located in Montreal’s east-end borough and currently one of the city’s main attractions, the Tower’s curved back has a funicular bringing visitors to an observation deck situated atop the structure that offers views on the city and Mont-Royal mountain. At the tower’s base, sits the largest aquatic centre in Canada, Centre sportif du Parc Olympique, featuring seven swimming pools, as well as sports halls and training gyms. The sports centre is also the home of the Institut national du sport du Québec.

The Olympic Installation Board (La Régie des installations olympiques), the agency that oversees operations and maintenance of this large urban park, has repeatedly tried, during the last few decades, to find a new purpose for the tower’s vacant space.

When Mouvement Desjardins, the leading financial cooperative group in Canada, showed interest to occupy nearly 80% of the available space, the Olympic Installation Board decided to upgrade the interior of the tower in addition to the already planned repairs of its envelope. Desjardins had been looking for a space to bring together their online services employees spread over three sites and offer them an innovative and stimulating workplace. They have picked the Montreal Tower due to its location, access to public transport, including two metro stations, and a range of services for employees.

As the tower floors were initially meant to house sport gyms, massive concrete panels were installed along the outside of the tower structure during construction, only allowing for smaller windows at the top of each floor to provide natural lighting that would allow practicing different sports without the blinding effects of excessive sun glare.

As modern office spaces are usually flooded with natural light, replacing the concrete panels with a glass curtain wall was the logical choice. The regeneration of the space would also involve a thorough update of all electrical and mechanical systems while the interior would require a complete overhaul including the entry hall, new elevators and other facilities.

But that wasn’t all – the tower’s 1.2-metre thick concrete shell would require examining to assess how permeable it was to humidity and cold, and how it would interact with a fitted-out and fully air-conditioned interior.

WSP’s building science experts came to the rescue, conducting detailed assessments to determine the need for additional insulation for the concrete walls and for treatment of the external membrane. This was needed to ensure that once the building was up and running there would be no consequences on the tower’s envelope and interior.

The assessment was done by taking concrete samples from various parts of the structure and studying their characteristics.

Over several years, WSP has worked on various projects at the stadium and, as a result, our engineers have become well-acquainted with the stadium and the tower’s complex and unusual structure. Our team was selected to provide...
structural engineering on the project as well as the 3D scanning and creation of a complex model of the tower using Revit.

The first task for our engineers was to figure out how to install two enormous cranes needed for the construction. At more than 200 metres, the main crane “The Giraffe” is one of the tallest tower cranes ever used in Canada. Two additional cranes were used to put together this giant.

“The Giraffe” needed to be close enough to the tower but, at the same time, remain at a safe distance from the top of the inclined tower and the cables supporting the roof. As a result, it was installed within the stadium which meant piercing through the existing stadium roof made of a metal structure, a flexible roof fabric, and two floor slabs. The crane was installed on a concrete base anchored in bedrock. Two bracing beams attached the crane to the stadium’s base with two more connecting it with the tower near its top to ensure stability.

The other smaller crane was installed on the back of the tower sitting atop the inclined surface of the lower funicular station roof, which functioned without disruption during the whole construction process.

Removing massive concrete panels was one of the most difficult steps of the project. Due to the tower’s complex geometry, curved both vertically and horizontally, all panels had different shapes and weighed up to five tons each. Tests were undertaken to better understand how it could be done, considering the sensitive positioning of the panels, some of which were situated above the sports centre while others sat above the stadium roof. The results of the tests were used to guide and support the contractor.

Replacing the concrete panels with a glass curtain wall while retaining the same curved form would have been very costly and, in the long run, would imply a significant risk in terms of potential problems with weather tightness of the facade. Consequently, the decision was made to eliminate the horizontal curve of the tower to simplify the new facade, while respecting the original architecture. Our structural engineers designed slab extensions for each floor, which turned out to be quite a task due to the building’s complex angles and the different dimensions and form of each slab. A 3D BIM model was used to make calculations and design a secondary steel structure to support the curtain wall as well as for the construction of slab extensions. Once the design was completed, our team closely monitored the construction process.

Project deadlines were also quite stringent: our work on the project started in the spring of 2015 and finished in November 2017. The result, however, is impressive. The new facade complements and enhances the existing iconic architecture while letting loads of natural light inside the new office space. On the outside, depending on the time of the day and weather, the new facade either reflects the sky or exposes the tower’s complex structural elements.

The tower revitalization project will bring more than 1,000 employees to the area on a daily basis, potentially enhancing the vibrancy and the local economy of the neighbourhood.
Nelson Mandela Bay Stadium

Boosting control and efficiency with intelligent ICT

Nelson Mandela Bay Stadium is one of three coastal stadia built for the 2010 FIFA World Cup. The 46,000-seat stadium hosted eight World Cup matches, was a venue for the 2013 African Cup of Nations and regularly hosts largescale rugby union and soccer games. It has also been used as a concert venue. The facility has 49 hospitality suites, two business lounges and gym, as well as lecture, function and conference rooms.

We provided all mechanical services and electronics installations for the stadium, pioneering a cuttingedge information and communication technologies (ICT) system that integrates a wide range of services – from closed circuit television and access control to air conditioning, plumbing and fire detection – onto a common Internet Protocol (IP) platform. The magnitude of the ICT installation matched the design ambition, from the 16km of fibre cabling to the 55m² LED video walls.

A human machine interface (HMI) provides a userfriendly, intuitive tool for the stadium operator to keep tabs on all aspects of the venue, from the switching on of lights to the opening of doors. We believe such a highlevel monitoring and control system provides a significant boost to operational performance, safety and efficiency in a venue of such magnitude. Intelligent ICT installation brings other benefits too, including opportunities for additional revenue streams such as advertising on TV screens and video walls.

LOCATION
Port Elizabeth, South Africa

CLIENT
Nelson Mandela Bay Metropolitan Municipality

ARCHITECT
Gerkan, Marg and Partners, Architectural Design Associates, Dominic Bonnesse Architects

CAPACITY
46,000

SERVICES
Building services, ICT, audio-visual

STATUS
Completed in 2009
Lucas Oil Stadium

A moveable wall and retractable roof for maximum flexibility

Lucas Oil Stadium is a multipurpose stadium in downtown Indianapolis and home to the Indianapolis Colts American football team. It is no stranger to major competitions, as host of the 2012 Super Bowl and annual National College Athletic Association’s Final Four basketball tournaments. It is also the venue for two high profile US music competitions, the Bands of America Grand National Championships and the Drum Corps International Championships. The building can also be configured for conventions, exhibitions, fairs and concerts.

The nine-storey, state-of-the-art stadium features a fully retractable roof with seating for up to 63,000 spectators, expandable to over 70,000 for large events such as the Super Bowl. It also has 150 luxury suites.

Designed by HKS, the stadium incorporates brick, steel and glass. In addition to the retractable roof, it features a moveable north wall system and hinged tall entrance doors at all four main entry points, enhancing flexibility and functionality.

We were initially appointed to provide unit concept engineering for the project feasibility study, used to secure legislative approval. Our brief was then extended to cover MEP, fire protection and sports lighting design services. We used Computational Fluid Dynamics (CFD) modelling to analyse air flows in the stadium seating bowl and optimise our air-system design, so as to provide maximum comfort for spectators. All designs were required to meet stringent industry standards for television broadcast.
Kennedy Town Swimming Pool, Phase II

More pools with a view on Hong Kong Island

Kennedy Town Swimming Pool is a local landmark overlooking the Hong Kong’s Victoria Harbour. The first phase of the pool, with two outdoor pools, opened in the summer of 2011. Phase II will add two indoor pools and two indoor Jacuzzis.

Structured into a triangular space-shuttle-like shape with steel roof and metal cladding, the new swimming complex has been strategically designed in a low rise complex to complement the views of the harbour whilst minimising obstruction to neighbouring residential buildings.

We are providing civil and structural engineering and building services design for Phase II of the pool.

The pools are spanned by a column-free roof of lightweight PTFE (Polytetrafluoroethylene) synthetic sheets. Our civil and structural design scope is to review, modify and enhance the steel roof design for mounting the PTFE panels, and to meet the new user requirement of fire resistance protection. In addition we are modifying the foundation design of the swimming pool and rationalising the civil works interface so that its construction is not affected by the current West Island Line tunnelling works.

The scope of our MEP design is to modify the swimming pool filtration plant to meet the updated code of practice and optimise the maintenance space inside the plant rooms; to review and modify the fire services design so that it meets the prevailing buildings’ fire safety requirements; and to enhance the MEP designs to suit the unique needs of the venue management and maintenance teams.
Kai Tak Sports Park
A multipurpose sports complex for major events and the local community

The Kai Tak Sports Park will be the largest sports complex in Hong Kong and will include a stadium, a public sports ground, an indoor sports centre, a park and residential, office and retail space. This complex development will sit on a 320-hectare site fronting Victoria Harbour in Hong Kong that used to be home of the Kai Tak airport. The vision for the project is to create a sports and recreation hub with rich touristic and entertainment offering that won’t be used exclusively for major events but will be open for use to the local community. This is one of the most important government investments in sports infrastructure in the last few decades.

WSP is providing structural, building services and fire engineering, environmental and sustainability consultancy, project management and traffic planning services.

The central feature of the sports park is a 50,000 seat-stadium with a retractable roof that will allow the hosting of major international sports and cultural events to be held under all weather conditions, and to contain possible noise nuisance from events such as large-scale concerts.

The public sports ground will include permanent seating for 5,000 spectators and it will be a venue for public jogging, athletics training and matches, football and rugby matches as well as a warm-up venue for major sports events taking place at the main stadium.

The indoor sports centre will have two parts: a main arena with permanent seating for 4,000 spectators and a secondary arena with seating for 400 spectators and will accommodate sports such as basketball, volleyball, badminton, table tennis and wushu.

The park will feature spaces suitable for use by people of all ages, such as children’s play areas, tai chi areas and fitness stations.

The complex will also include at least 10,000 sq.m of office space and at least 31,500 sq.m commercial space that will be able to accommodate retail and food and beverage outlets.
WSP carried out the technical project management, programming, budgetary control, planning, procedures before authorities, BIM modeling and technical evaluation of the structural designs for renovation of the Movistar Arena in Bogotá, Colombia.

The scope of Movistar Arena’s architectural and technological renovation includes 70% of the old Coliseum Cubierto El Campin, built in 1973. With over 500 square meters, the site offers support areas, such as backstage, warehouses, control and changing rooms, among others. It is expected to host 14,000 spectators per event and can offer a wide variety of sport, cultural and artistic performances.

The building offers VIP rooms, 21 suites, 20 boxes, 1 party suite, restaurants and a building with over 300 parking lots to provide a new experience to the people of Bogotá.

Service areas, such as restrooms (with over 46 spaces for this purpose), offices, lounges (5 multiple areas) and other areas for stands, food, beverage and private events were fully redesigned.

Furthermore, to ensure a smooth and secure flow for each of the events, circulation areas with over 6,100 square meters for entrance and exit, corridors, access points, waiting areas and exclusive rows for each sector of the arena have been modernized in innovative ways.

As part of the urban intervention, over 13,000 square meters of existing gardens and plazas were renovated to improve audience accessibility conditions and characteristics. The goal was to amplify the area development and to reclaim the public space.
Perth Arena
Adaptable air-conditioning puts the wind behind a major regeneration scheme

LOCATION
Perth, Australia

CLIENT
WA Department of Housing & Works

ARCHITECT
ARM Architecture, RTKL, Cameron Chisholm Nicol

CAPACITY
15,000 seats

SERVICES
Mechanical, electrical and fire protection services, specialist environmental design, specialist lighting design

STATUS
Completed in 2012
Perth Arena is an entertainment and sporting venue in the heart of Western Australia’s city of Perth, designed to hold up to 15,000 people. With its geometric architecture, the landmark building is the first stage of a major urban regeneration programme. The venue has a retractable roof and supporting facilities including VIP boxes, multipurpose event rooms, refreshment outlets and a 700-space basement car park.

We provided mechanical, electrical and fire protection services engineering, along with specialist sustainability and lighting consultancy for the arena, first assisting the architectural consortium win the design competition and then working on the concept and detailed design.

Although the architectural vision was bold, it responded to an ambitious and functional brief aiming to maximise the facility’s commercial potential while minimising environmental impact. We met this challenge with a flexible design, incorporating a variety of air-conditioning solutions that deliver considerable savings in both energy and operating costs. When fully occupied, the arena is cooled with displacement ventilation, supplied through the tiered seating stands. The public circulation area surrounding the stadium is treated with natural ventilation but can operate in mixed-mode if needed.

The result is a commercially viable stadium with a high level of adaptability, capable of hosting large-scale live events, from international concerts and dance spectacles to World BMX, netball and basketball championships and major tennis tournaments, including the Davis Cup.
Pace and Efficiency

A spectacular finish starts with pragmatic design.

Deadlines are deadlines in the fast-paced world of international sports. No matter what challenges the construction process throws up, opening matches don’t wait. But the need for efficiency doesn’t stop when the season begins. Even the most impressive structures must operate cost-effectively and energy efficiently to ensure commercial viability and a sustainable legacy for future generations.

With a calm, creative and high-tech approach, we make sure tight construction timelines are met with the minimum fuss. And we deliver high-quality buildings that continue to save money, energy and time without sacrificing spectator experience, whether through cutting-edge ICT or innovative green solutions.
Videotron Centre
An iconic amphitheatre delivered on time and budget

LOCATION
Quebec, Canada

CLIENT
City of Quebec

ARCHITECT
ABCP and GLCRM Architects and Populous

CAPACITY
18,000

SERVICE
Project management

STATUS
Completed in 2015
Quebec’s long-awaited amphitheatre opened in September 2015 after a three-year building process hailed as a model of cost-effective, efficient construction. The multipurpose arena, which can seat more than 18,000 people, is set up to accommodate hockey and basketball games and to host cultural events of international scale.

We served as project manager throughout the process, playing a key role in delivering this ambitious scheme on time and budget. Our work included preparation of a realistic budget and work schedule, management plans for all aspects on that massive undertaking as well as directing and supervising the professional and engineering teams, and overseeing the work of the construction manager.

Site coordination was a complex task on a project of this scale, and required frequent meetings, efficient communication and precise day-to-day collaboration. A key challenge was ensuring that all 500 workers working daily on site were able to perform their jobs efficiently, without posing any risk to each other.

In the final months of construction, the team horeographed a ballet of cranes and bucket trucks to enable installation of the communications, audio-visual and staging equipment as the mechanical and electrical facilities were being brought into service. These efforts allowed the facility’s inaugural show to go ahead on September 12, 2015—as planned five years earlier.
Barclays Center

Bringing energy-efficient design to the heart of Brooklyn's revamp

LOCATION
New York, USA

CLIENT
Brooklyn Events Center, LLC

ARCHITECT
Ellerbe Beckett/AECOM

CAPACITY
19,000

HOME OF
Brooklyn Nets Baseball team

SERVICES
Building services, lighting design, specialist environmental design, commissioning and security

STATUS
Completed in 2012

The Barclays Center is a 19,000-seat arena in the heart of Brooklyn, New York. Home to the Brooklyn Nets basketball team, the arena hosts professional and college basketball games, concerts, fine arts performances, circuses, hockey tournaments, graduation ceremonies, trade shows and other events. The project is the centrepiece of the Pacific Park mixed-use complex, a development at the forefront of Brooklyn’s revitalisation.

We provided MEP, lighting design, sustainable design consulting and structural steel detailing for the project, in an approach that involved subcontractors in the design phase. This collaboration helped speed up construction through fast resolution of buildability issues and early procurement of long-lead equipment.

Our energy-efficient design includes free cooling for the majority of the year provided by a 100% air-side economiser with heat recovery systems to pre-heat and precool the vast amount of outside air required for ventilation. Demand controlled ventilation allows the system to adapt to more intimate events, thereby saving energy.

High efficiency gas-fired domestic water heaters supply the whole arena including showers, kitchens and hydrotherapy equipment. Hot water is delivered via a centralised system to ensure availability at all times. Low-flow plumbing and waterless systems conserve water in restrooms, while two underground storage tanks collect and retain storm water to control outflow.

The lighting is designed to maximise audience experience while minimising energy consumption. It is directly controlled by a building-wide programmable system, capable of tailoring lighting effects and levels for a wide variety of events.

The Barclays Center was the first professional sports and entertainment venue in the New York metro area to achieve LEED Silver Certification for New Construction.
Louis Armstrong Stadium

The world’s first naturally ventilated retractable roof tennis venue

LOCATION
New York, USA

CLIENT
United States Tennis Association

ARCHITECT
ROSSETTI

HOME OF
US Open Tennis Championships

SERVICES
MEP engineering, fire protection, natural ventilation

STATUS
Completed in 2018

Louis Armstrong Stadium, a new 14,069-seat venue located at the National Tennis Center in Queens, New York, hosted its first official matches at the 138th U.S. Open in August 2018. The new stadium replaces the original venue named in honour of the legendary jazz musician, which hosted tournament matches from 1978 until its demolition in 2016.

ROSSETTI as the design architect, together with the United States Tennis Association (USTA), selected WSP to provide the mechanical, electrical, plumbing (MEP) and fire protection engineering design, along with conceptual design and analysis of the world’s first naturally ventilated tennis stadium that features a retractable roof.

When the weather is clear, Louis Armstrong Stadium functions as it always has as an outdoor venue. The challenge comes when inclement weather forces closure of the roof to eliminate game delays and postponement. If a stadium is simply enclosed without thought for passive design, it will either need air conditioning or conditions will become intolerable inside the structure. One of USTA’s priorities was that the new stadium maintains an outdoor feel, even when the roof was closed.

Once a stadium roof is closed, the amount of airflow into the stadium is limited and there is a risk of heat building up. With the new Louis Armstrong Stadium, we were focused on making sure that wouldn’t happen.

The idea of using natural ventilation was first considered when a retractable roof was built over Arthur Ashe Stadium, but it was determined to not be a viable option, given the constraints of the existing...
building. When the decision was made to design and build Louis Armstrong Stadium with a retractable roof, it seemed like the perfect opportunity.

While temperatures might not be as cool as it would be with air conditioning, the design maintains spectator expectations for an outdoor summer sporting event. It encourages air flow throughout the stadium, while keeping the playing surface dry enough to continue tournament play. Since the venue is never completely sealed shut, the presence of outdoor conditions is still felt by everyone inside, and the temperature inside will usually be within a few degrees of what it is outside.

The design process began with analytical models that demonstrated how the wind in the area around the stadium typically behaves — such as seasonal wind directions and wind speeds — and how the air would ultimately flow through different configurations of the stadium. It was also critical that the air had a pathway to flow through the stadium without influencing conditions on the tennis court. The stadium seating consists of a lower bowl, with an open concourse on its upper level to allow breeze to pass through from all directions. Additionally, the upper seating is built only on the east and west edges, with the north and south faces featuring an impressive terra cotta-louvered façade. This façade has been carefully designed to allow cross ventilation of the stadium, but keep out most rain and direct sun.

In addition, an underground air pathway was developed to passively cool the courtside seating without impacting gameplay. The system requires wind speeds of at least 5-7 miles per hour to maintain the desired temperature levels. If wind speeds fall below that threshold when the roof is closed, fans will operate to provide the required air movement within the stadium.

WSP demonstrated how the retractable roof and the ventilation system could be used to improve game-time climate conditions even when games aren’t being played, such as closing the roof between sunrise and when play starts to protect the thermal mass of the stadium from the direct sun.

In addition to helping strategize the natural ventilation concept, our Built Ecology team leveraged the analytical capability of computational fluid dynamics (CFD) and bulk air flow modelling to understand and communicate air speeds and to model human comfort expectations.
The new Hazza Bin Zayed Stadium in Abu Dhabi’s Al Ain is home to the city’s football club. With room for 25,000 spectators over three tiers, it is a compact and intimate arena, inspired by the natural landscape of Al Ain and encompassing both traditional and innovative design. As well as the football stadium, the development includes a six-storey commercial building and sports complex with kids’ club.

We were commissioned by contractor BAM to review the initial design and identify areas where the client could make savings. And we met this challenge head on, significantly reducing construction costs and building time by rationalising the concrete-based structure while retaining its original shape and form.

Our team worked closely with the roof designers to ensure that all aspects of the steel roof’s unique and complex geometry were coordinated and compatible, using parametric modelling to increase efficiency and simplicity of fabrication through repetition of details and elements.

The planned opening game in January 2015 created a fixed deadline for the stadium’s completion. To fast-track the construction process, we made innovative use of pre-cast concrete and aligned our design process with the contractor’s programme, making sure pre-cast elements were ready at each stage. We also used Building Information Modelling (BIM) to coordinate with the rest of the construction team, minimising the risk of problems on site and completing the project within the tight time frame.
With 90,000 seats, Wembley is the second-largest stadium in Europe and serves as England’s national stadium. It is the home venue of the England national football team and hosts major matches, including the FA Cup Final. The stadium opened in 2007 on the site of the earlier Wembley Stadium, which was demolished in 2003.

Our involvement with the project dates back to 2000, when we carried out due diligence on behalf of the financiers. We were then appointed technical advisor, and provided consultancy on detailed design development during construction and commissioning. We gave advice on cost planning, civil and structural engineering and building services design and construction. The challenge for our client was to gain a clear understanding of the financial implications of design decisions and construction delivery on potential future income streams.

We acted as project manager for the technical review process, in which we were supported by the architectural and cost consultants. And we continued as the Lender’s Advisor through the construction phase and for the first five years of operation.

During the project our work covered the whole range of technical issues relevant to a major stadium and landmark building, from planning consents to risk analysis, environmental assessment to safety and licensing.
Cape Town Stadium

Moving the earth to meet an immovable deadline

The Cape Town Stadium was built for the 2010 FIFA World Cup, during which it hosted nine matches. Able to seat 68,000 people for sports events, the stadium also features corporate hospitality suites, plus medical, training and conferencing facilities.

Our team provided ground engineering for the stadium and surrounding urban park and was lead mechanical consultant and ICT consultant.

Construction began in 2007 with a fast-track programme of ground engineering for foundations and bulk earthworks. A lengthy planning process left us with a tight timeline that called for a rapid and innovative approach. We responded with creative reuse of excavated soil materials to eliminate waste and cut importation of earth fill.

As the site was in use as a golf course, only limited geotechnical investigation was possible before construction. In collaboration with BKS Consulting Engineers, we used non-invasive seismic refraction and ground penetrating radar to inform the foundation design and pitch level selection. Our hands-on quality control programme and ability to adapt to variable ground conditions contributed to the project’s punctual delivery.

For the building itself, we introduced a new, sustainable system of air conditioning with flexibility to cater for both large-scale matches and quiet periods. And we were behind the stadium’s cutting-edge, centralised computer network, which links all stadium functions – from smoke detection and electrics to turnstiles, score boards and access control – to a single point of control. The first of its kind in South Africa, the system significantly boosts energy efficiency and performance.
Glasgow’s Commonwealth Games Athletes Village is set to become a 1,400-home mixed-tenure community on the banks of the River Clyde. We were integral to planning and designing the first phase of this ambitious scheme, which delivered 700 residential units, transport hub, care and energy centres in time to host 6,500 athletes, officials and media at the 2014 Commonwealth Games.

Our multidisciplinary team provided transport and infrastructure investigation and design, plus detailed engineering and structural design. We were also responsible for the environmental impact assessment, geo-environmental consultation and archaeological investigations, and provided acoustics services, fire consulting and thermal modelling.

With the approach of the 2014 games, we faced an extremely challenging, inflexible deadline. This was exacerbated by the fact the site contained one of the first public health water treatment works in the UK, requiring archaeological investigations that impacted significantly on the programme. In the end, work on the superstructure could not start until May 2012.

We demonstrated our ability to co-ordinate with all members of the client consortium, Glasgow City Council and the other contractors and suppliers involved to overcome the project’s many challenges and deliver an impressive and lasting legacy for Glasgow’s communities.
The Duhail Handball Sports Hall was built for the 2015 Men’s Handball World Championship. The 5,500-capacity facility includes an indoor stadium, two practice courts and back-of-house facilities suitable for hosting international sports events. It also houses 60-bedroom player accommodation and a 25m, four-lane swimming pool with grandstands.

Our aim was to provide an efficient system that would be simple to build and meet the client’s need for a very fast construction programme with rigid deadlines. We also sought to maximise the building’s sustainable credentials, designing an efficient heating, ventilation and air-conditioning system to reduce the arena’s cooling and energy requirements.

The venue is the headquarters of the Qatar Handball Association and home ground for Qatar’s national handball teams.
The Hong Kong Velodrome, in Tseung Kwan O bay, has a 250-metre cycling track and spectator facilities for 3,000 people. In addition to providing a world-class training base for cyclists and premier venue for cycling competitions, it is designed to accommodate basketball, volleyball, badminton, gymnastics and other sports, plus concerts and exhibitions.

We provided full building services engineering consultancy for the project, incorporating a significant number of green features. Solar panels are integrated into the roof to generate renewable energy while a 3m vertical green wall screens the mechanical plant rooms and integrates with the walkway of the landscaped park. The heating, ventilation and air-conditioning system uses high-efficiency motors, occupancy sensors and other advanced features to reduce energy consumption. Watercooled frictionless chillers, a greywater recycling system and rainwater harvesting further save power and water.

We also conducted a discounted cash flow analysis to compare the efficiency of air-cooled and water-cooled air-conditioning systems, concluding that a water-cooled system would start to pay for itself after six years, subject to the operation and usage of the building.
Melbourne Park Redevelopment
Eastern Plaza – National Tennis Centre

A breath of fresh air for Victoria’s top sporting precinct

LOCATION
Melbourne, Australia

CLIENT
Major Projects Victoria via Watpac Construction

ARCHITECT
Jackson Architecture

HOME OF
Australian Open Tennis

SERVICES
Building services, specialist environmental consultancy, specialist lighting design, structural, civil and CFD

STATUS
Completed in 2012
Melbourne Park is the premier tennis venue of Australia’s Victoria state, hosting events including the Australian Open, the first tournament on the Grand Slam calendar. The venue hosts more than two million visitors each year and is one of the world’s most prestigious sporting facilities.

As part of a major redevelopment to maintain Melbourne Park’s status as a world-class sporting precinct and cater for increased use, the National Tennis Centre and elevated Eastern Plaza added 16 ‘Plexicushion’ tennis courts as well as an elite training facility with gymnasium and pools, administration offices for Tennis Australia, and large public plaza / gathering space above a multistorey car park.

We were commissioned to provide a wide range of consultancy services to this award-winning project, including mechanical, electrical and hydraulics engineering, specialist lighting design, fire protection, structural and civil services.

The $115M Design & Construct project includes the construction of eight indoor tennis courts, 8 outdoor tennis courts, all on a suspended slab above the multi-deck carpark, plus another five clay courts at ground level to better prepare Australia’s tennis athletes for the French Open.

Our integrated brief also covered environmental consultancy. Sustainability is a key feature of the redevelopment and was incorporated into all aspects of the design to ensure optimal efficiency and maximum comfort. No mechanical ventilation is needed in the high performance tennis centre, as the building form draws controlled, natural fresh air across the indoor tennis courts, while the high-level windows are designed to restrict direct sunlight onto the playing surface. In the car park, jet fans support predominantly natural ventilation during peak use only, keeping energy demand low for much of the year.

Our proposed strategies were validated through detailed thermal and computational fluid dynamic (CFD) modelling, as well as sophisticated daylight modelling. The project achieved a Gold LEED rating for new construction and a Master Builders Award for Excellence in Commercial Construction over $80M.
Our Services

Our wide-ranging expertise ensures a specialised service for every client.

We deliver landmark structures and highly efficient systems, as well as a broad range of essential technical services – just some of which are highlighted on these pages.

At WSP, we understand that every sports projects presents a range of unique challenges, and that no two venues are ever the same. We can draw on our global network of experts to provide a bespoke team tailored to the demands of every project, from the earliest planning stages to a successful completion and faultless operation throughout the life of the building.

So whether our clients need a fully integrated multidisciplinary service or expert consultancy in a very specialised field, we can help.
Employees Around the World

About WSP

WSP is one of the world’s leading engineering professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, architects, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals.

We design lasting solutions in the Transportation & Infrastructure, Property & Buildings, Environment, Industry, Resources (including Mining and Oil & Gas) and Energy sectors, as well as offering project and program delivery and advisory services. With approximately 44,000 talented people in 550 offices across 40 countries, we engineer projects that will help societies grow for lifetimes to come.

Figures on September 30, 2018
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Can we trace horizons, hold true to our ambitions, and hold ourselves accountable?

What if we can?