AECOM

Contact Thomas Webster, Andy Coward
Address 63-77 Victoria Street
AL1 3ER St Albans, United Kingdom
Phone +44 1727535000
Email thomas.webster@aecom.com
Website www.aecom.com

AECOM is a global provider of professional, technical and management support services to a broad range of construction and infrastructure markets.

With approximately 51.000 employees around the world, AECOM is a leader in all of the key markets that it serves, providing a blend of global reach, local knowledge, innovation and technical excellence in delivering solutions that enhance and sustain the world's built, natural, and social environments.

From major road and rail projects to energy generation, water management systems and creating beautiful and successful buildings and places, AECOM in Europe works closely with clients across all areas of the built and natural environment.

Our teams of award-winning engineers, designers, planners and project managers ensure that our solutions outperform convention. Combining global resources with local expertise provides exceptional, high-quality, cost-effective professional and technical solutions.

Software: Scia Engineer

Spartak Moscow Stadium - Moscow, Russian Federation

Spartak Moscow is one of the most high profile clubs in the Russian Federation and they regularly qualify for the UEFA Champions League. However, Spartak Moscow Football Club has never owned their own stadium and has always shared facilities with other teams. AECOM has been appointed to design and manage the delivery of a brand-new 45.000 seat stadium to provide a state of the art venue for Spartak Moscow that meets FIFA World Cup stadium standards, forming part of the Russian 2018 World Cup bid. A pan-European AECOM team, comprising stadium design specialists in the UK and local Russian engineers and architects, has been collaborating to provide a fantastic new home for the team.

Key structural design features

- Uninterrupted spectator views with seating in close proximity to the pitch
- High Snow and Ice Loading
- Designed for a temperature range of -40ºC to +40ºC
- Vibration analysis for Human Structure Interaction
- Design to allow for multiple support removal

Foundations

Rotary bored piled foundations are necessary to suit the ground conditions. A range of diameters have been adopted to provide the most economical solution. These will be drilled to a depth of between 33 m and 43 m below existing site level.

Concrete grandstands

The stadium grandstands have been designed using insitu reinforced concrete frames with precast concrete seating units. The structural frames are on a consistent 7.6 m grid which allows for maximum repetition of the concrete frame and precast. The insitu frames provide a robust solution with continuous ties between structural members. Scia Engineer non-linear analysis was used to investigate the effects of sudden column removal, satisfying a key counter-terrorism requirement.

The concrete structure is divided into 12 segments, each separated by a movement joint. Thermal effects were modelled in Scia Engineer to predict the change in geometry and minimise the build up of thermal stress. Each of the 12 segments has its own stability system allowing them to act independently.
The human structure interaction was assessed by extracting the mode shapes and modal masses from Scia Engineer using Total Commander. The results of these elements where then analysed using guidance produced by the Institute of Structural Engineers (IStructE) joint working group entitled, "Dynamic performance requirements for permanent grandstands subject to crowd action".

Steel roof

The primary roof structure consists of an arrangement of four trusses, with two sets of parallel steel trusses intersecting above the corners of the pitch. This allows the very high design snow load on the roof to be taken to eight points of support and prevents collapse by the redistribution of the load if a support is ever removed. The longer trusses span 217 m along the length of the pitch and the shorter perpendicular trusses span approximately 180 m. A secondary roof structure then spans from the concrete columns at the back of the grandstands to the primary trusses spanning across the stadium. The complete roof structure was modelled in Scia Engineer to minimise structure self-weight and analyse the complicated geometry.

For stability, the roof must act as a continuous diaphragm. Thermal stresses are dissipated by allowing the roof to 'breath' which has been achieved by having one restrained bearing on each side of the stadium to take horizontal forces and bi-directional bearings on all other supports. The anticipated movement have been calculated and assessed using Scia. The anticipated movement is 150 mm at each support.

The natural frequency of the stadium roof was assessed using Scia Engineer, with the conclusion that there is little risk of dynamic roof excitation from wind load.

The complex geometry of the roof was translated into Autodesk REVIT from Scia Engineer using the REVIT-Scia Engineer Link.

Spartak Moscow Stadium

Moscow, Russian Federation

Project information

Owner	Spartak Moscow Football Club
Architect	AECOM Moscow
Engineering Office	AECOM London
Construction Period	From September 2010 to December 2013
Location	Moscow, Russian Federation

Short project description

This project is about the design and construction of a new stadium for the Spartak Moscow Football Club. Up to now, Spartak Moscow Football Club has never owned their own stadium and has always shared facilities with other teams. AECOM has been appointed to design and manage the delivery of a brand-new 45.000 seat stadium to provide a state of the art venue for Spartak Moscow that meets FIFA World Cup stadium standards and that is intended for the Russian 2018 World Cup. The stadium has been designed to overcome large temperature variations and very high snow and ice loads.