
# CONCRETE
# CONCRETE FOR HIGH RISE REFERENCE BOOK

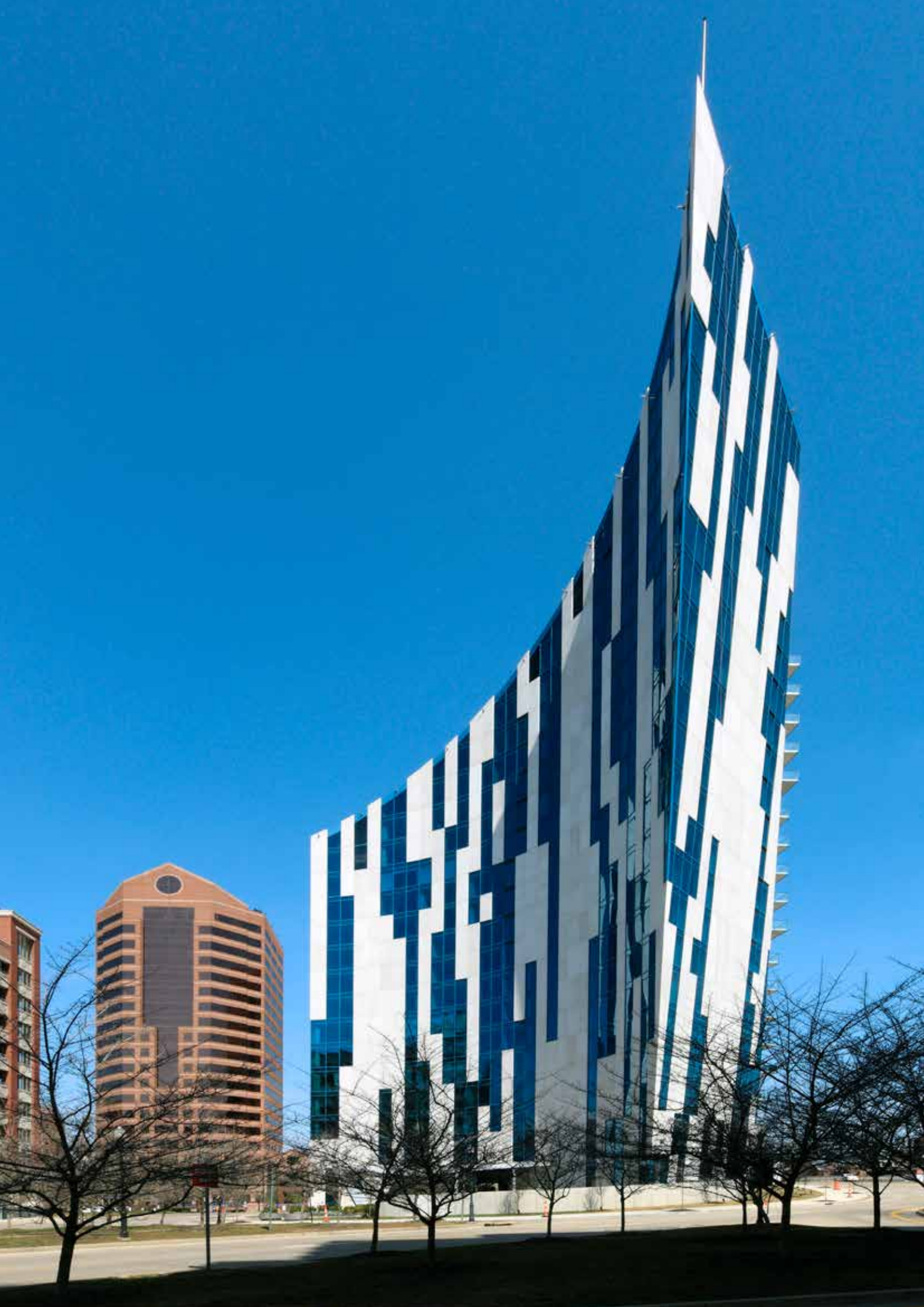
BUILDING TRUST

# CONCRETE FOR HIGH RISE APPLICATIONS

## EXPERIENCES AND EXPERTISE

The growth worldwide for bigger, taller and more prominent structures places higher demands on concrete mix designs. Developers who wish to maximize the lettable space require designers to use thinner elements, whilst at the same time the need is to increase the building's stiffness for improved wind, vertical shortening and load supporting requirements.
This means concrete with high strength in excess of 60 MPa, up to >100 MPa is becoming more typical.

Typically projects require self-compacting concrete and this needs to be pumped to increasing heights, ensuring the plastic properties are stable while the concrete is pumping and placed. Sika is often involved at an early stage working alongside the premix producers and contractors to ensure all the concrete mix requirements are practical. Admixtures play an important role in this process and this Sika at Work is a selection of Sika's abilities in this field across the globe.



# CONTENT

# HIGH RISE SOLUTIONS

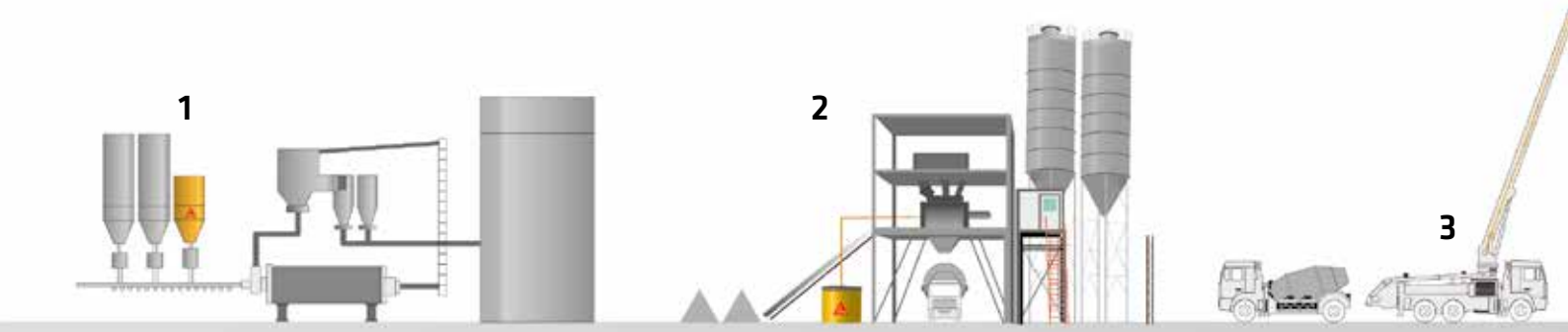
## CEMENT PRODUCTION

**1. SikaGrind®-Technology for optimised grinding process and quality improvement**

## CONCRETE PRODUCTION

**2. A full range of admixtures and additives**

- Sika® ViscoCrete® – Powerful superplasticizers
- Sika Viscoflow® – For very long workability enhancement
- Sika® Retarder – To delay concrete setting
- SikaPump® – A viscosity modifier for better cohesion
- SikaFume® – Increase strength to support heavier loads
- SikaFiber® – Reduce cracking and improve fire resistance
- SikaControl® – Air entrainment for extending durability
- Sika® FerroGard® – For extra protection to the reinforcement
- SikaCem® – Different colours to improve aesthetics



# CONSTRUCTION SITE

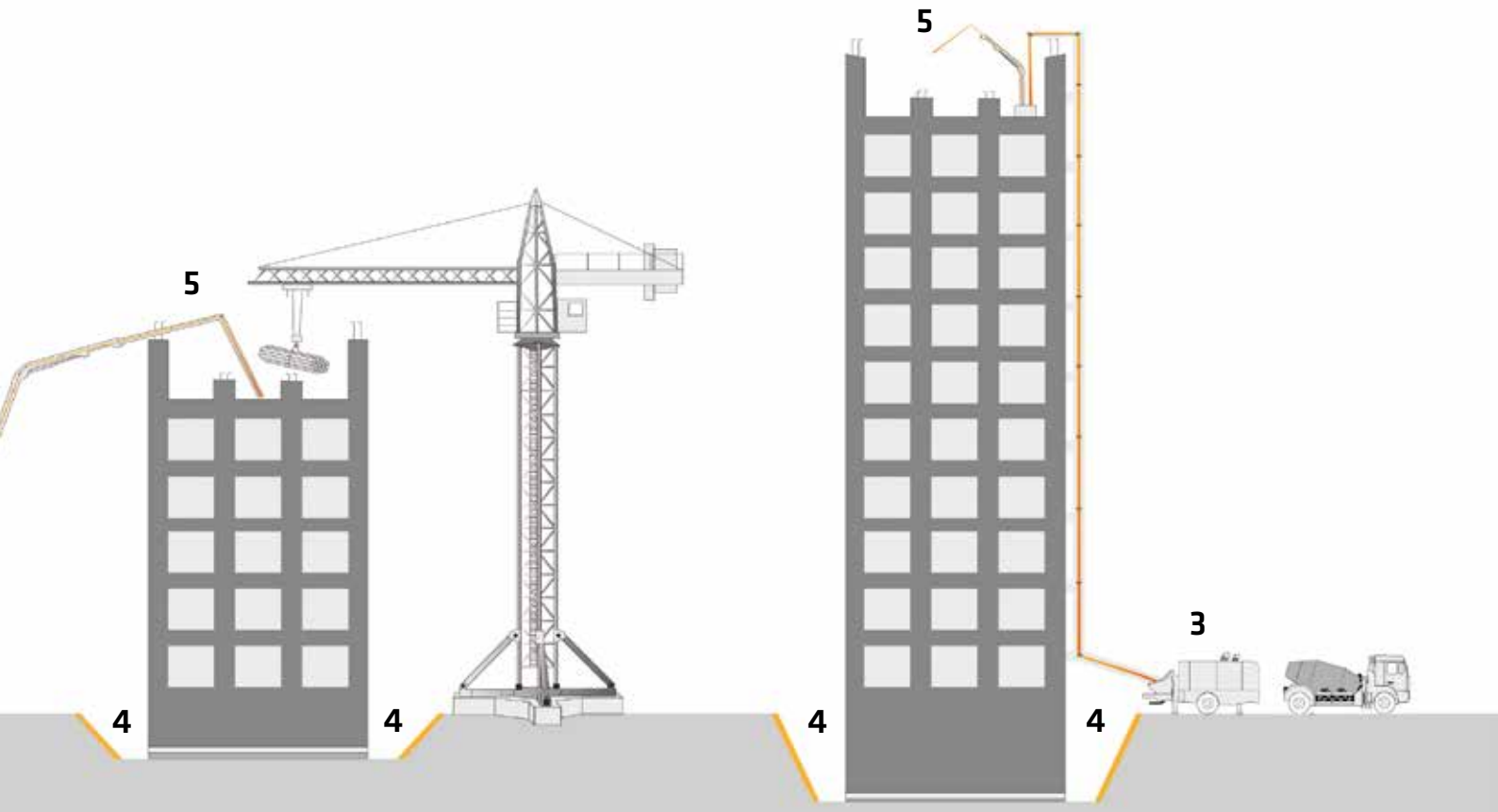
**3. For pumping equipment**

- Sika® Care – For machine and equipment protection
- SikaPump® – Essential lubrication of pump lines

**4. Sika® Sigunit® – Fast stabilisation of the ground**

**5. Concrete essentials**

- Sika® Separol® – For a clean release of formwork
- Sika® Antisol® – Reduce the early moisture loss from exposed surfaces
- Sika® Rugasol® – To roughen the surface of concrete



# EUREKA TOWER, MELBOURNE, AUSTRALIA

The Eureka Tower, opened in 2006, was at the time the tallest residential building in the world. The tower gained its name from the Eureka Stockade rebellion that took place during the gold rush of 1854. It stands 297 metres high, 91 storeys above ground and has one basement level.
The concrete had to have high workability retention, at a high ambient temperature (~35°C), with very low shrinkage, very high compression strength (>100 MPa), low heat of hydration and not sticky. The central concrete core was built-up using the slip form technique and the final mix design ustilised Sika® ViscoCrete® admixture technology to pump concrete nearly 300 metres high.

# WORLD FINANCE CENTRE, SHANGHAI PEOPLE'S REPUBLIC OF CHINA

The Mori Tower, left, which contains a Hyatt Hotel, offices and shops, became the tallest structure on the Chinese mainland at 492 metres when topped out on 14th September 2007. Sika carried out all trial mixes for 300,000 $m^3$ of concrete on the project. This was the first major project in China to use PCE based admixtures technology and required pumping concrete to a height of 490 metres.
The 4.5 m thick basement slab, with volume 28,000 $m^3$ and cast in a continuous pour needed a careful mix design. Admixture selection was key to the low heat and quality self-compacting concrete.

Architect: Kohn Pederson Fox
Engineer: Ove Arup Hong Kong

# MACAO TOWER, MACAO, PEOPLE'S REPUBLIC OF CHINA

Based on the Auckland Sky Tower, the Macao Tower forms the centre piece of the Macao Convention and Entertainment Centre. Opened in 2001 and situated on a waterfront site the tower is 338 metres high and can withstand winds of 400 km/h. The main observation level is 223 metres above the ground and it is possible to see for 55 km from the upper viewing platform.

Sika® ViscoCrete® admixture technology was in all concrete mixes produced for this project, which included concrete pumped to 250 metres high.

Architect: Craig Moller

# BEIJING TV CENTRE, PEOPLE'S REPUBLIC OF CHINA

Completed in 2006, the Beijing TV Centre housed the world's media during the 2008 Olympics. It stands 239 m high with 41 floors above ground and 3 basement levels.
The construction of the building uses embedded concrete-filled tubes (CFT) to facilitate rapid construction and improve efficiency. The structural framework consists of hollow tubes filled with self-compacting concrete (SCC).
The concrete mix requirements was for very high strength concrete ~100 MPa and pumping of the concrete to a height of 240 m. Sika worked closely with the ready mix supplier using Sika® ViscoCrete® admixture technology to meet the high specification requirements.

# NINA TOWER, HONG KONG

The Nina Tower is a twin tower 320 m high tower with 80 floors. The project used 80,000 $m^3$ of high strength concrete using Sika® ViscoCrete® admixture technology. The robust mix design enabled the pumping of concrete to a height of 320 m.

Architect: Casa Design International Ltd
Engineer: Ove Arup Hong Kong
Contractor: Chap Kai Investment Co Ltd

# LANGHAM PLACE TOWER, HONG KONG

Completed in 2004, the 59 floor building is the tallest in Kowloon at 255 m and has an additional five floors below ground for car parking. Sika® ViscoCrete® admixture technology enabled 30,000 $m^3$ of pumped concrete up to a height of 250 m.

Architect: Jerde Partnership / Wong and Ouyang (HK) Ltd.
Engineer: Arup Hong Kong

# LAKHTA CENTER, SAINT PETERSBURG, RUSSIA

The Lakhta Center is an 87-story skyscraper built on the outskirts of Lakhta in Saint Petersburg, Russia. The impressive structure, at 462 meters high, is the tallest building in Russia and Europe. The center is used for public facilities and offices. Construction started 2012 and was completed in 2018. The concrete pour for the bottom slab is registered by the Guinness Book of Records as the largest continuous pour at 19,624 cubic meters, comprising Sika® ViscoCrete®, Sika® Retarder and Sika® Antisol® curing compound. Sika® ViscoCrete® was used to maintain the workability sufficiently in 24,000 cu.m of concrete to construct the main tower core.

General Designer: Samsung C&T
Designer Consultant: GorProject
Contractor: Renaissance Construction

# BRIDGEWATER PLACE, LEEDS, UNITED KINGDOM

When topped out in September 2005, this 32-storey building was the tallest in the North of England at 110 metres high. Sika® ViscoCrete® admixture technology was used to pump concrete more than 100 m high.

Architect: Aedas Architects
Contractor: Bovis Lend Lease
Frame Contractor: P C Harrington
Concrete Supplier: Hanson Premix

# BEETHAM TOWER, MANCHESTER, UNITED KINGDOM

The Beetham Tower in 2006 was the tallest building in the UK outside of London at 179 metres high, and at the time the highest residential building in Britain.
The Architect, Ian Simpson, bought and lived in the top floor and was at 48 storey the highest living space in Britain. Sika® ViscoCrete® admixture technology and a robust mix design enabled the pumping of concrete to a height of nearly 180 metres.

Architect: Ian Simpson Associates
Engineer: Cantor Sienuk Group
Contractor: Carillion
Frame Contractor: MPB Structures
Supplier: Tarmac Topmix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# ALTITUDE 25, CROYDON, LONDON, UNITED KINGDOM

Altitude 25 is an apartment building in London, completed 2009. It has 26 floors and a structural height of 94 m. Sika® ViscoCrete® admixture technology enabled pumping concrete from 10th floor upwards.

Architect: Devereux Architects
Frame Contractor: FDL
Supplier: London Concrete

# IYLO PROJECT, CROYDON, LONDON, UNITED KINGDOM

The IYLO project in Croydon London is a 20 storey residential apartment building. It comprises of a glass clad elliptical tower of two equal halves that will appear to be sliding past each other. It sits on an island site in a key location close to Croydon centre and will house 183 private apartments including 11 penthouses. Sika concrete admixtures were used in a 250 cubic metres of 115 MPa high strength concrete. The project was further complicated by the location and local traffic conditions, as well as the size of the pour. Pre-planning, preparation and close site support was one of the key success for the concrete application.

Architect: Darling Associates
Contractor: Lancsville Construction Ltd,
Client: Phoenix Logistics and E3 Property.
Structural Engineers: Matthew Consultants
Concrete supplier: Hanson Concrete London

# ONE ST PETER'S SQUARE, MANCHESTER, UNITED KINGDOM

Sika concrete admixtures played a key role in the construction of the 65 metre high 160 $m^3$ central concrete lift shaft at One St Peter's Square, in the centre of Manchester. The 270,000 sq ft building will incorporate office space on the upper floors together with an active mix of uses at ground floor level.

The concrete core was constructed using a slipform construction with a consistent rate of rise of 4.2 m per 15 hour shift. Successful slipform construction relies on a well-designed concrete mix, a skilled workforce and a reliable delivery from the concrete supplier. The concrete needs to have controlled setting to match the rate of climb of the formwork. It requires a soft consistence to obtain full compaction around the steel and give an excellent surface finish but without segregation and grout loss. To retain the excellent surface finish, the concrete also needs to be 'drag free' as it leaves the formwork, eliminating any surface damage caused by friction.

Architects: Glenn Howells Architects
Main Contractor: Carrilion
Slipform Contractor: PC Harrington

# SIR CHRIS HOY VELODROME, GLASGOW, UNITED KINGDOM

The 2,500 seat Sir Chris Hoy Velodrome was a showpiece arena for the 2014 commonwealth games held in Glasgow, UK. Admixtures from Sika played a vital role in the specialist concrete mix design for the construction. The service towers consisted of 600 $m^3$ of concrete built using slipform construction at a rate of 4.5 m a day.

Owner: Glasgow City Council
Architect: 3DReid
Main Contractor: Sir Robert McAlpine
Slipform Contractor: PC Harrington
Concrete Supplier: Hanson concrete


SIDEWALK CLOSED
SIDEWALK CLOSED
LANE CLOSED
STOP

# 7 WORLD TRADE CENTRE, NEW YORK, USA

The new 7 World Trade Centre building is 52 storey and 226 m high. The concrete was a joint development with a ready mix supplier using Sika® superplasticizer admixture technology. Later the mix designs were a template for the concrete on the adjacent Freedom Tower.

# FREEDOM TOWER, NEW YORK, USA

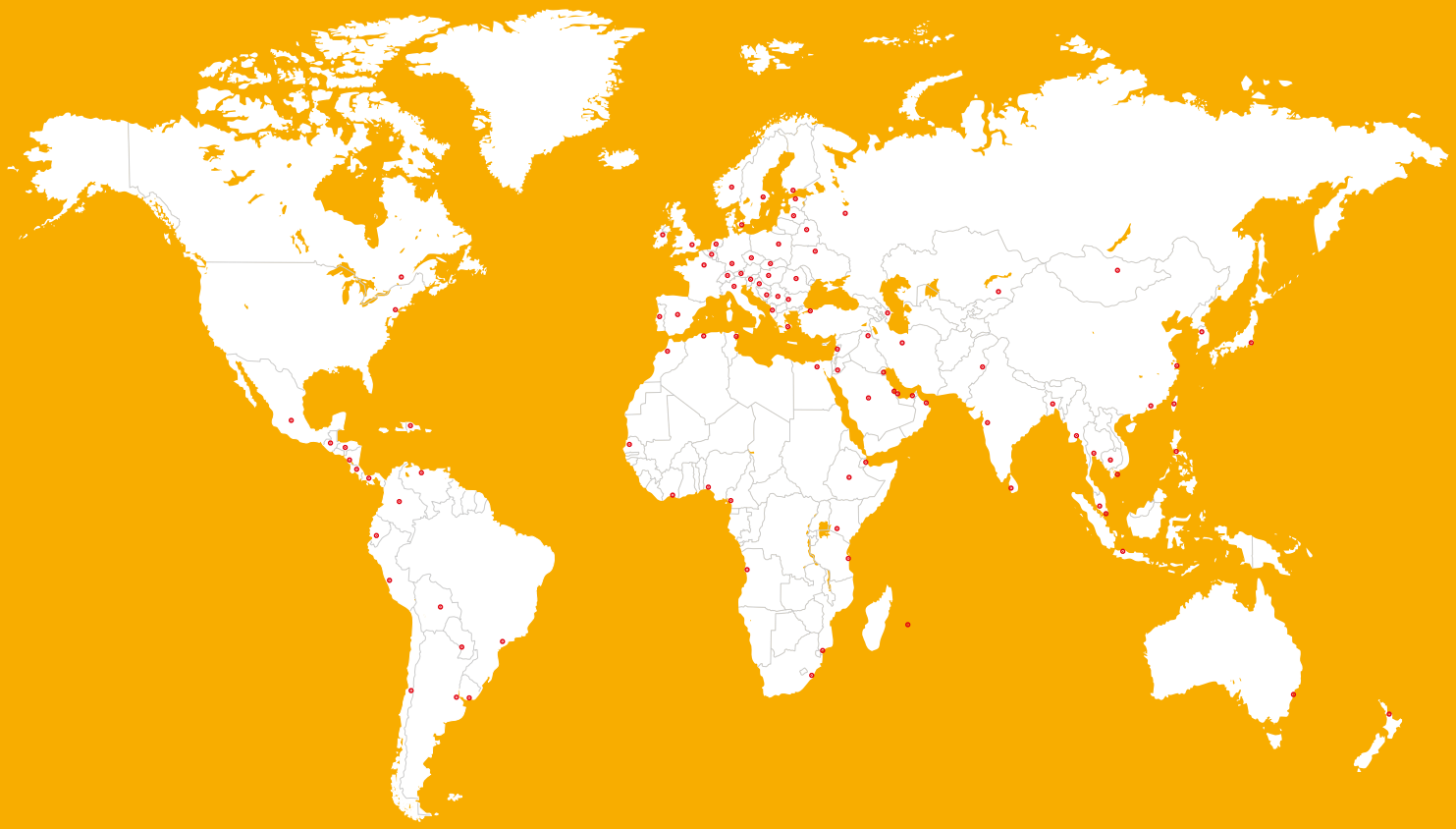
The 94 floor and 5 basement level One World Trade Centre, or the Freedom Tower, is a centrepiece building of the 65,000 m2 World Trade Centre complex in Lower Manhattan. Sika® supplied admixtures for all applications on this 540 m high project. Experience gained on 7 World Trade Centre, subsequent development work and testing undertaken by Sika, has resulted in a suite of mixes incorporating Sika® ViscoCrete® admixture technology.

# COMCAST BUILDING, PHILADELPHIA, USA

The Comcast Corporation is a global telecommunications conglomerate. Designed by Robert A M Stern Architects, the Comcast Tower is 297 m high and has 58 floors.

Three designed self-compacting concrete mixes containing Sika® ViscoCrete® admixture technology had to meet strict project requirements for high compression and flexural strengths, a high e-modulus and very low chloride permeability. The pumping of 30,000 $m^3$ of self-compacting concrete for the central core was to a height of 300 m. This pre-development work and cooperation resulted in simplified construction process and reduction in construction time and costs.

# GLOBAL BUT LOCAL PARTNERSHIP



# FOR MORE CONCRETE INFORMATION:

**WE ARE SIKA**
Sika is a specialty chemicals company with a leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing and protecting in the building sector and the motor vehicle industry. Sika's product lines feature concrete admixtures, mortars, sealants and adhesives, structural strengthening systems, flooring as well as roofing and waterproofing systems.





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