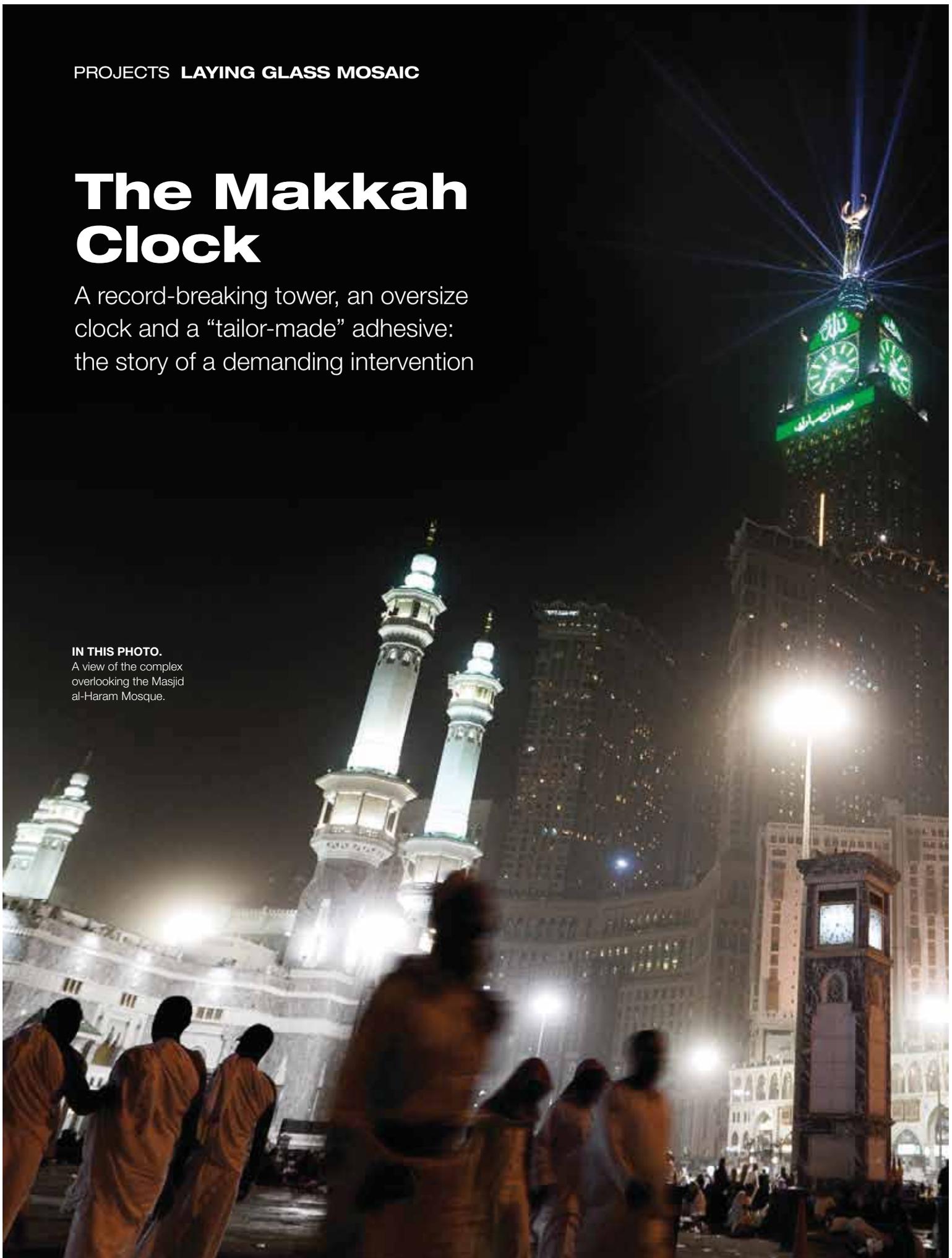


The Makkah Clock

A record-breaking tower, an oversize clock and a “tailor-made” adhesive: the story of a demanding intervention

IN THIS PHOTO.

A view of the complex overlooking the Masjid al-Haram Mosque.





World's largest tower clock, its clock face is more than five times the size of Big Ben's in London

The crescent of the clock tower is the largest ever built with a diameter of 23 meters

The tower top with the Makkah Clock has a weight of approximately 83,000 tons



PROJECTS **LAYING GLASS MOSAIC**



Beacon lights

Additional beacon lights

Loudspeaker system

Takbir

Retractable lightning rods

Clock drive

Front clock face

Visitors' platform

Crescent

Solar panels for clock drive power

Glazing

Creed

Clock face steel structure

Clock hands on side face

Steel construction



ABOVE. The top of the Tower with its clock and the phrase "God is great".

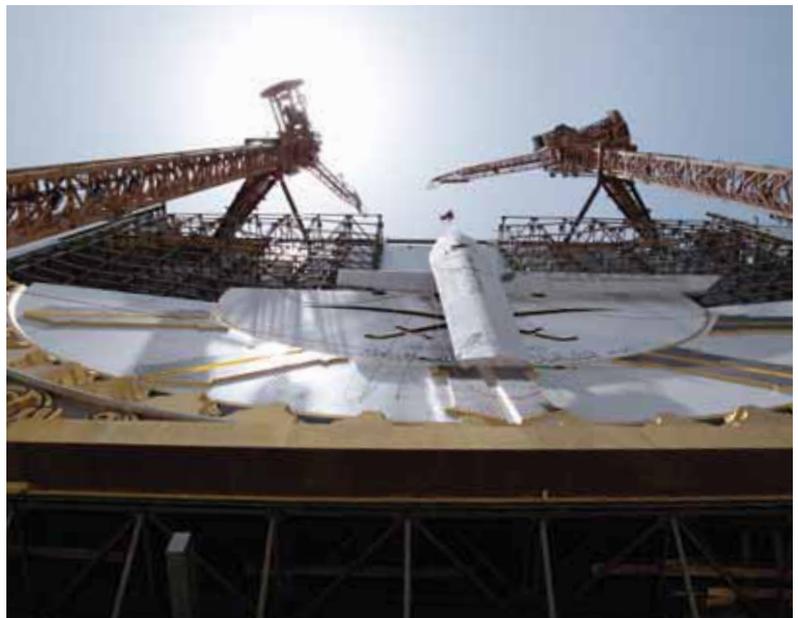
BELOW. Various phases during the making of the clock.

After the Emirate of Dubai with its Burj Khalifa skyscraper, it is now Saudi Arabia's turn to boast about having one of the tallest skyscrapers in the world. In fact, last year at The Mecca – the holy Islamic city – the Al-Bait Abraj Towers, known also as the Makkah Clock Tower, were inaugurated.

This complex has been built to offer high quality lodgings and recreational facilities for visitors to the Masjid Al Haram Mosque next to the Makkah Clock Tower. The largest mosque in the world can now host up to a million wor-

shippers. The complex, designed by the Dar al-Handasah Shair & Partners design studio, has a total surface area of 1,500,000 m² and is made up of seven towers split into residential units and hotels, erected on a low, 15 storey main body. It has numerous shops, two heliports and a large car-park and can host up to an estimated 100,000 guests.

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Mapei Intervention

Mapei played a part in this ambitious project by supplying products to install and grout the mosaic tiles made by Trend Group. This Italian company from Vicenza supplied 98 million glass mosaic tiles, some of which with a 24 carat gold leaf finish, for a total of 40,000 m² installed on the facades of the structure of the clock. The adhesive used to bond the tiles at the top of the Tower had to take into consideration that it is exposed to the sun all day long. The products recommended, therefore, apart from guaranteeing very high performance from the bond itself, had to be able to resist the high temperatures. This is why a tailor-made product was developed to install and grout the mosaic on the clock, KERAPOXY ADHESIVE FR, which is re-

sistant to high temperatures and has excellent resistance to fire. This new product was developed in the Mapei R&D laboratories in Milan, starting from the formula used to make KERAPOXY ADHESIVE, a two-component adhesive with no vertical slip for ceramic tiles and stone. The tiles were installed and grouted on panels in Dubai under the supervision of a team from the Technical Services Department of IBS Mapei (Innovative Building Solutions), Mapei's subsidiary company from the United Arab Emirates. The panels were then transported to Saudi Arabia, taking the greatest care possible. The joints, on the other hand, were sealed directly on site. Mapei also supplied KERAPOXY two-component, anti-acid epoxy mortar, available in 26 different colours.

IN THE SPOTLIGHT KERAPOXY ADHESIVE

Two-component, epoxy adhesive with no vertical slip for ceramic tiles and stone material. KERAPOXY ADHESIVE is used for internal and external bonding of ceramic, porcelain and stone to floors and walls, on all substrates normally used in the building industry. It has an excellent durability and resistance to ageing, a perfect bonding on all types of substrate commonly used in the building industry, it hardens by chemical reaction without shrinking, becoming extremely strong. It can contribute up to **3 points** to obtain the LEED certification.





The Figures Behind the Challenge

The 120 storey Clock Tower is the tallest in the complex: it measures 607 metres to the top of the spire with its scintillating crescent moon, 11 less than the Burj Khalifa skyscraper in Dubai. At the very top of the tower there is a steel structure, similar in shape to the Eiffel Tower, in Paris, measuring 251 metres in height and weighing 12,000 tonnes. There is an enormous clock installed in the tower. A masterpiece of engineering, the clock has been located on the top of the tower according to the wishes of the King of Saudi Arabia Abdullah Bin Abdul Aziz Al-Sand, a gift to the holy city and to the pilgrims visiting Mecca. The clock is the largest in the world and is made up of four faces, two round and two oval, one for each side of the structure. Visible from a distance of 8 kilometres, it is more than five times bigger than the famous Big Ben clock face in London.

It is powered by a series of solar panels, but it may also be connected to the main grid in Mecca. Running three hours ahead of Greenwich Mean Time, the size of the clock is really impressive: the longer sides are 45 metres long and the clock face is 46 metres in diameter. The four clock faces are lit up by a total of 2 million LED so that the phrase "Takbir" ("God is great"), positioned on top of the tower, is visible, and light up five times every day to coincide with prayer time. Floral decorations in classic Islamic style ornate the corners of the structure where the mechanism is housed, while geometric designs complete the face and hands.

The top of the tower where the clock is housed was designed by a team of German and Swiss engineers, along with the help of specialists from all around the world. The clock was designed by the German studio SL-Rasch, specialised in the construction of "lightweight" structures.



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Technical Data

Makkah Clock Tower, Makkah, Saudi Arabia
Designers: Dar al-Handasah Shair & Partners; SL-Rasch (Leinfelden-Echterdingen, Germany)
Period of Construction: 2008-2012
Period of Intervention: 2008-2012
Intervention by Mapei: supply of products to install and grout glass mosaic tiles at the top of the Tower (performed in Dubai)
Client: Premiere Composite Technologies LLC - (Dubai UAE)
Contractor: Saudi Bin Ladin Group (Gedda, Saudi Arabia)
Laying Company: Premiere Composite Technologies LLC - (Dubai UAE)
Laid Material: glass mosaic tiles made by Trend Group (Vicenza, Italy)
Mapei Co-ordinators: Nisreen Salman, Tarana Daroogar and Daniele Spiga, (IBS-Mapei); Enrico Geronimi and Cesare Misani, (Mapei SpA)

Mapei Products

Laying and grouting of the mosaic tiles: Kerapoxy, Kerapoxy Adesive FR*
 *Product formulated specifically for this site

For further information about the products see the websites www.mapei.com and www.mapei.ae

» *Not only is The Makkah Clock Tower a marvel of engineering, its design is also something for Saudi Arabia and the whole of the Middle East to be proud of. It is an honour for Mapei to have been part of this project».*

Tarana Daroogar, Technical Services Manager, IBS Mapei

