

MOTERA STADIUM

Ahmedabad, India

Images: Signify, Bose, Walter P Moore

Built on the 63-acre site of the original stadium in the city of Ahmedabad, the new Motera Stadium – which will be officially known as Sardar Patel Stadium – is now the largest cricket stadium in the world, with a capacity of 110,000.

The new home of the Gujarat Cricket Association includes 76 corporate boxes, four team dressing rooms and facilities, state-of-the-art club facilities with three practice grounds, an indoor cricket academy, and a 55-room clubhouse, which will have an Olympic-size swimming pool.

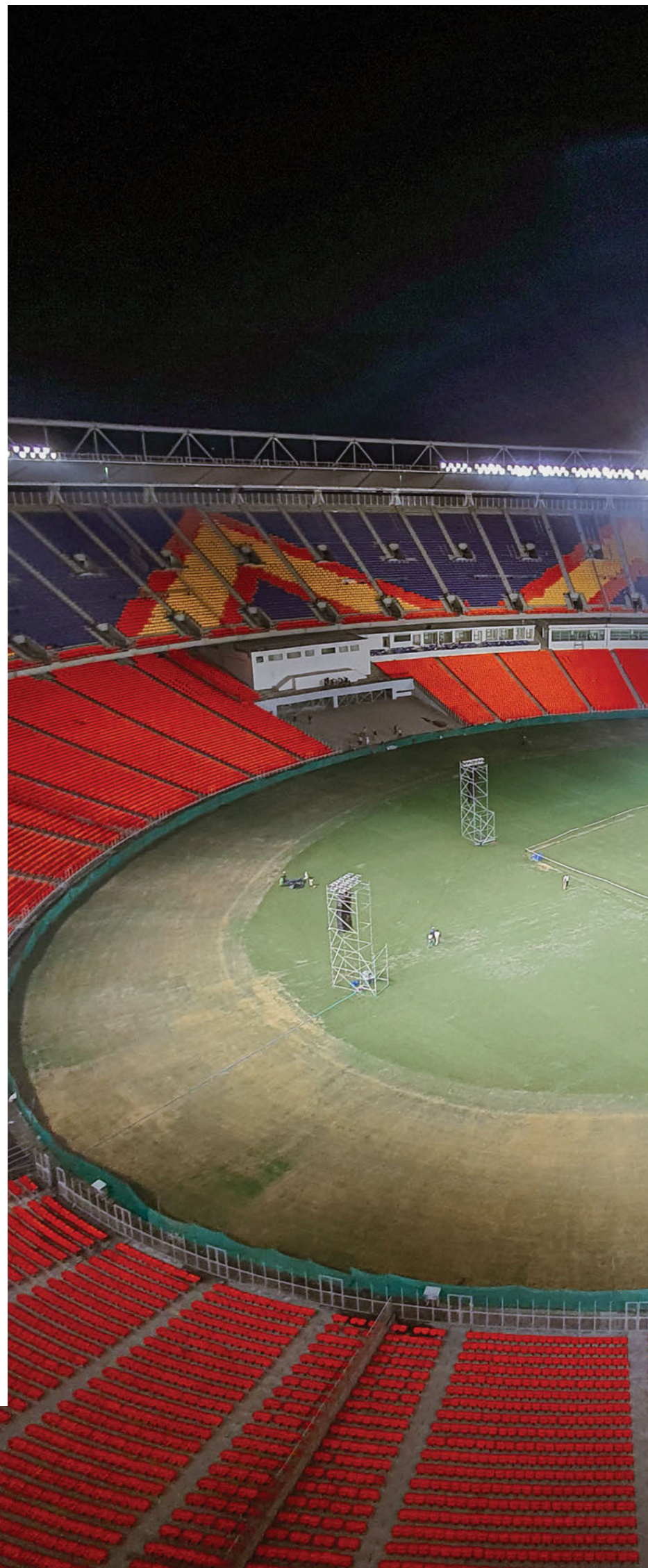
Motera Stadium – which is also the second largest sports stadium in the world overall – was designed and constructed within three years at a cost of US \$100m. The stadium was also the venue for the ‘Namaste Trump’ gala on 24 February 2020, where Prime Minister of India, Narendra Modi, hosted the President of the United States, Donald Trump, during his recent visit to India.

With world-wide cricket stadium expertise including the masterplan and new Warner Stand at Lord’s, as well as work at the Melbourne Cricket Ground (MCG), Populous was invited to join their team, as the designers, in a fully priced Design and Construction competitive bid tender. Contracted by Larsen & Toubro (L&T), Populous delivered the masterplan, as well architectural design services up to Schematic Design, including landscaping, interior design and wayfinding to create an iconic stadium for India.

Andrew James, Director at Populous, takes up the story: “Cricket is like a religion in India and the Gujarat Cricket Association had a vision to create an iconic venue – a world-class stadium that would bring together the biggest crowd of cricket fans anywhere in the world. So, we agreed on the target of 110,000 people.

“Along with meeting International Cricket Council regulations for Test, Twenty20 and One Day International matches, Motera Stadium was designed to become an iconic sports venue for both aspiring and elite players. When the seating bowl is full, this will be one of the biggest crowds ever assembled in a single space.

“The precinct, masterplanned by Populous, ensures that male and female cricketers of the future have facilities to support their development. Young players can live and breathe the game with an indoor cricket academy housed under the stadium, including a dormitory for up to 40 athletes, as well as access to six indoor practice pitches and three outdoor practice fields. The Hall of Fame will provide emerging players and fans with an insight into the heritage of cricket in India.”







Populous' masterplan also included four team dressing rooms and facilities, state-of-the-art club facilities and a VIP pavilion, an Olympic-size swimming pool, 76 corporate boxes and a media lounge with press rooms.

With such a vast project, the task was huge for everyone involved with the stadium – and there was plenty that Populous had to consider when it came to the design.

“A great sporting venue is not only fit for purpose. First and foremost, it must be a great place to come together – a venue that creates memorable and extraordinary experiences for the fans and players. It also needs to be authentic and true to its location. For a nation like India, where cricket is almost a religion, what could be better than being part of the biggest group of cricket fans in the world?” posed Andrew.

“Operational flexibility is critical for the long-term viability of a stadium like Motera. The design of two open-seating bowls with 360° views allows the operators to fill only the lower bowl for smaller matches and still create an exciting atmosphere for the fans. Four team changing rooms means the venue can host double-headers or cater for youth or community tournaments.”

With the sheer size of Motera Stadium, Populous had to take the fan experience into serious consideration. It was vital that each visitor felt part of the action – something that can be so easily lost in stadiums with a huge capacity. However, Populous had a plan to combat that, as Andrew revealed: “For major cricket matches, the arrival on the main podium outside will be an experience in itself, as 110,000 people make their way into the stadium.

“As you enter the seating bowl, you will have your first view of the whole arena from the concourse, so no matter where you move around the stadium, you stay connected to the action. Every seat has uninterrupted sightlines and 360° views of the field and pitch. When you combine this with a round, open bowl design, you get an amazing sense of be-

ing together and you feel you're a part of what's happening out in the middle.

“Unlike many other stadiums of this size, the majority of seats are general admission, ensuring the widest possible group of fans can enjoy the action.”

Although the project was clearly a successful one, it wasn't without its challenges, with the scale of the stadium presenting issues for the team involved.

Andrew added: “The site was barely large enough to fit the width of the stadium and we needed to preserve an existing temple. The solution was to develop a stadium consisting of two large seating tiers, each of approximately 50,000 seats, along with an additional 10,000 seats for VIPs and corporate patrons.

“The timeframe was also relatively short – the stadium was designed and constructed within three years.”

The roof structure at Motera Stadium was a particularly complex part of the project, with Walter P Moore serving as roof structural engineer. The city of Ahmedabad, where Motera Stadium is located, is in a level three seismic zone, meaning that the roof needed to be lightweight to reduce seismic demand and develop an economical roof system. Viral Patel, Director of Design at Walter P Moore, explained further: “Seismic forces are proportional to the mass of the structure. Therefore, very early in the design phase, it was decided that the best option would be to incorporate a lightweight, cable-supported tensile membrane roof. Additionally, we decided that the reinforced concrete bowl and the roof structure needed to be independent of each other. This decision was motivated by the seismic hazard for the project.

“Achieving a good performance of structure economically under seismic events was the primary reason for separating the roof from the bowl. The bowl is a reinforced concrete structure that is inherently very heavy. The roof of Motera Stadium is a lightweight structure made up of tensile mem-



brane, cables and a steel perimeter frame. If the bowl and roof structures were not separate from each other, it would have created a very high seismic demand on the roof.

“The prescriptive code requirements also allow inelastic behaviour in a reinforced concrete structure when enhanced seismic detaining is adopted. The lightweight roof structure, on the other hand, is not arranged to readily accommodate inelastic behaviour. Without separating the bowl from the roof, the bowl would have been subjected to an amplified seismic demand from the roof.”

Walter P Moore also used Load Response Correlation Method to develop critical wind load patterns from the wind tunnel test.

“Wind load provisions in most codes do not address roof structure for stadiums such as Motera. Additionally, for a structure such as the Motera Stadium roof, it is very important to study the effects of unbalanced wind loads, which is not covered in building codes. Accordingly, we decided to commission a wind tunnel test to ascertain wind loads on the roof accurately.”

The Walter P Moore team faced challenges during the project, too, which Viral highlighted to MONDO | STADIA: “The roof erection involved synchronous pulling roof cables from the compression ring supported on ‘V’ columns. In order to maintain proper cable forces during the entire erection process, it was very important to avoid unbalanced loading on the compression ring.

“This process was challenging due to a limited number of strand jacks that were used during erection. However, various parties including L&T, Walter P Moore, and a specialty contractor for cables came together and worked collaboratively, which resulted in a successful erection process.”

Viral concluded: “Through Walter P Moore, I have worked on a number of sports projects. I grew up in the City of Ahmedabad before moving to the United States over 35 years ago. Designing the roof for the world-class Motera Cricket

Stadium was very special for me.”

When Motera Stadium officially re-opens for international cricket matches, spectators will be treated to a pristine sound experience, courtesy of Bose Professional. The colossal venue boasts an immersive soundscape, due to the new audio system, comprising a total of 162 units of the ArenaMatch series. The system was acquired primarily to efficiently and effectively meet the increased aural demands. It has created a record of sorts for Bose Professional as a brand in India – as it stands, it is the largest comprehensive sound system deployment from Bose Professional in a permanent installation in the country.

Vibhor Khanna, Country Manager – India & SAARC, Bose Professional, commented: “We are extremely happy with the sound system installation at Motera Stadium, and we are proud and honoured to have deployed this system in light of the historical significance of the venue. This is the largest cricket stadium in the world, and I consider this installation as one of the feathers in the Bose cap. This is an amazing opportunity to showcase our latest ArenaMatch loudspeakers from the DeltaQ family of arrays and the whole company is energised by this contract, which is among one of our largest permanent installations in India to date.”

The ArenaMatch system from Bose Professional was chosen as the preferred system for the venue after an on-site simultaneous live demonstration was conducted, featuring three of the most reputed loudspeaker OEMs available in the country.

“The Bose Professional ArenaMatch line of loudspeakers was launched during ISE in 2019 to coincide with the unveiling of the ArenaMatch installation at Philips Stadium in The Netherlands, which provided consultants, Sis, and end users an opportunity to witness the system’s sound quality, consistency, vocal clarity and flexibility in outdoor venues such as sports stadiums, arenas and outdoor entertainment



centres,” Vibhor added.

“After our return from ISE, we approached the Gujarat Cricket Association and L&T, and it was suggested to have an on-site shootout between three of the industry’s most reputed PA brands. After evaluating the performance on various parameters, the authorities hailed Bose’s ArenaMatch system as the clear winner, and this is how we bagged this prestigious project. Our systems are perfectly suited to the demands of this world-class sporting arena.” Since the ArenaMatch system had just recently debuted at the time, the brand had to make special arrangements to ensure that the demo was executed perfectly as planned. Navin Datta, Sales Engineering Head – Bose Corporation, furthered: “At the time of the shootout, the company had just recently launched the product, so it wasn’t even available for demo. We had to request the head office to support us with the demo units, which were then air-shipped to India just in time for the shootout. The outcome of that promptly arranged but wonderful demo almost closed the deal for us.”

Intimately involved in the planning of the sound system deployment, Bose Professional was instrumental in guiding the GCA in setting up a world-class audio system. “The design of the sound system had some inherent challenges of meeting the very high SPL levels required for stadium application, while also ensuring acceptable STI levels, especially given the high ambient noise levels of such large arenas,” said Navin.

The main challenges in commissioning the system involved delivering uniform and clear sound experience to every seat, while maintaining average SPL levels of 100dBA plus, and assuring an STI of 0.5 or above, from already defined loudspeaker mounting locations.

To achieve this, various models of the Bose ArenaMatch were deployed throughout the facility – with the three sections in the venue; the Lower Bowl, the Upper Bowl and VIP

area featuring multiple units of the AM10, AM20 and AM40 boxes in meticulously planned specific configurations.

While the Lower Bowl area features 16 arrays of four units each of the AM10, AM20 and AM40; the Upper Bowl area has a total of 19 such arrays. Bose Professional products are also used in three of the VVIP sections, as well as the banquet area within the VIP section.

With the Panaray 402 featuring a full-range-driver array and being fully outdoor rated, a total of 11 units have been installed in the VIP section and 10 units in the VVIP section, eliminating the need for tweeters and crossovers, to provide unsurpassed reliability and vocal clarity. Furthermore, 10 units of the Panaray 402 and six units of AM40 have been deployed as point source to cover the banquet area within the VIP section.

The Articulated Array design, with wide 120° x 60° coverage, reduces the number of required loudspeakers, while the 73Hz low frequency range reduces the need for subwoofers, providing a cost-effective solution.

“The system, as a cohesive unit, delivers clearly audible commentary and voice announcements to every seat in the venue,” Navin added.

“We used a Bose EX-1280 C processor, which is a Dante-enabled (64X64) DSP. It has on-board logic/control to interface with third-party devices, and the same is used to interface with fire evacuation systems of the BOH areas. Being Dante enabled, it can communicate seamlessly to various amplifiers installed across four control rooms.”

The new Bose Professional system has certainly impressed since its installation at Motera Stadium, as Vibhor concluded: “This design provides seamless coverage, volume and clarity for fans in all areas of the stadium. This major installation illustrates the depth and clarity of our high-performance loudspeaker systems and we look forward to further installations in similar venues in the future.”

When it came to the lighting system at Motera Stadium,



L&T commissioned Signify to provide the perfect solution for the venue.

“We were involved in this project from a very early stage and worked closely with L&T to design and deliver the lighting to the ultimate end user – the Gujarat Cricket Association,” said Sumit Padmakar Joshi, Market Leader for Signify’s Indian operations.

“The lighting design was finalised after multiple iterations to suit the need of the end user. The final design features a unique ring lighting solution on the canopy – a first for any stadium in India, which meets the customer’s requirements of vertical illumination, uniformity ratios, glare calculations, shadow-free play and spill-over light.

“The stadium also has the distinction of being India’s first LED floodlit cricket stadium that meets the International Cricket Council’s (ICC) broadcasting standards for sports illumination. The lighting system has been designed exclusively for sports and multipurpose venues, offering outstanding light quality, higher energy efficiency, effective thermal management and a long lifetime.”

Signify provided 580 Philips ArenaVision LED flood lighting luminaires for Motera Stadium, with the current installation being future ready, too.

Sumit explained further: “The luminaires are arranged in the form of a ring all around the stadium canopy, leaving the forbidden zone as per the International Cricket Council’s broadcasting standards for sports illumination. As the luminaires are arranged all around the stadium, it ensures excellent vertical illumination for different camera positions located in the stadium. This lighting design, which is currently deployed in leading sports stadiums globally, also

minimises the effect of shadows during play.

“The lighting illumination levels are configured to three switching modes to suit three different playing conditions – international, national and practice games. These switch modes are controlled through a relay controller and the control command can be sent through a computer and keypad setup located in the Field of Play (FOP) control room.” Motera Stadium is the first sports venue in India that features the unique ring lighting arrangement of LED luminaires installed on the catwalk of the stadium. This meant that the Signify team had to do a mock-up installation of the lighting at ground level to ensure the actual installation would be a success.

“The Philips ArenaVision LED luminaires had to be installed at a height of 43-metres all around the catwalk of this stadium. This presented a unique challenge of lifting all the material at that height, which was done with the help of construction cranes and pulleys. Installing equipment at such a height also required a certified skilled workforce along with the use of special PPE,” added Sumit.

“The project material was supplied within three months on site and the installation, testing and commissioning of the lighting system was completed in just three months – much faster than usual for projects of this scale.”

Everyone involved in the Motera Stadium project has delivered a venue that Gujarat – and India as a whole – can be proud of. With expert design and state-of-the-art technology in place, it is surely ready to become a truly iconic venue – and one of the world’s greatest cricket stadiums.