

## COMPANY

**QDC - SABS**

## LOCATION

**Doha, Qatar**

## SOFTWARE

**Autodesk® Revit®****Autodesk® 3ds Max®****Autodesk® Navisworks®**

# Design matters BIM Counts

'BIM' as a collaborative approach for complex structure. Autodesk Building suite helps SABS realize a challenging geometric design to customer satisfaction.

The external geometry was too complex and challenging to create having detailed trusses of Geodesic dome and multi-axis hexagons of the football form above it.

Revit came more than handy in developing all these elements.

Besides this, once the model was ready, the other Autodesk plugins were effectively utilized for Consistency checks, Solar studies, Energy Analysis, 3D visualizations and other relative BIM Tasks.

—**Mr. Bhasker Neogi**  
SABS Architects & Engineers Pvt. Ltd

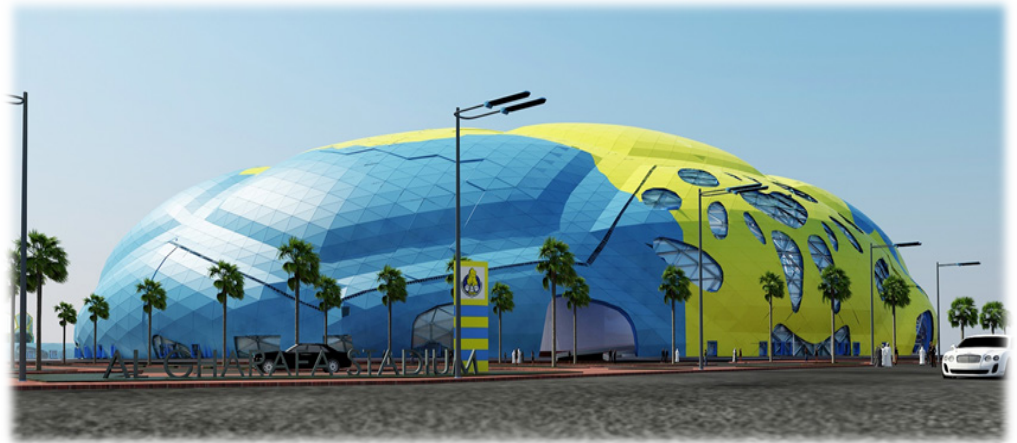


Image courtesy of QDC/SABS

**SABS Quartered in Delhi NCR was established in 2004 with the aim of becoming one of the top offshore service providers to middle east and western countries and is a leader in the field of architecture and building engineering consultancy.**

They specialize in providing BIM (Revit) Solutions and specializes in all aspects from BIM modeling to clash detection besides quantity extraction, 4D simulations and Energy Analysis. Having worked on large scale BIM projects like stadiums for FIFA world cup 2022, Khartoum airport, Children's mall, mixed use developments, they are a one stop shop for all BIM related assignments.

The BIM team at SABS comprises of more than 50 dynamic professionals like architects, engineers, 3D modelers, draughtsman's and technicians from top Architecture and Engineering colleges from India including the IITs. The team is driven by the core values of high quality standards, multi-disciplinary expertise and a vision to contribute to the growth of India and at same time to be a reliable partner for international projects.

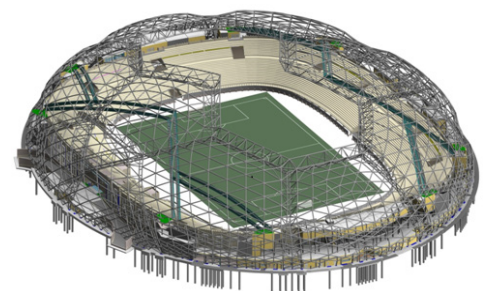
## The Project

Al-Gharafa Sports Club is a Qatari sports club located in the Al Gharafa district of Al Rayyan, Doha. The current stadium, which is the home ground for Al Gharafa sports Club was built in 2003 with a seating capacity of 22000

(spectators).

The club consists of the following (spacial amenities):

- The main football stadium
- Two football training fields
- Administration building
- Multipurpose hall
- Purpose specific entry / exits & parking areas for the ambulatory and emergency services.



**Structural Proposed BIM Model**

Image courtesy of QDC/SABS

The challenge to detail out the football shape was beaten through combination of Revit and 3D Studio MAX. Also Revit came in handy to model the football-like hexagonal panels of a massive trusses with the shapes & elements.



Image courtesy of QDC/SABS

<b>Category:</b>	Stadium
<b>Site area:</b>	122,000 sq. m.
<b>Stadium Area:</b>	30, 860 sq. m
<b>No of Gates:</b>	8, including 1 VIP
<b>Capacity:</b>	22,000 seating
<b>No of parking:</b>	520
<b>Location:</b>	Qatar
<b>Status:</b>	Under construction

With the upcoming FIFA 2022, ASPIRE ZONE decided to revamp the existing structure to a modernized stadium complying with FIFA norms. Qatar Design Consortium (QDC) was awarded the contract for the renovation, Outdoor air conditioning, façade/face modification, addition of VIP Lounges, Lobbies and other Standard spaces into the Stadium Complex by ASPIRE, who keeping in view the project intricacies involved and thus decided to use a BIM platform namely Revit from the initial stage. The SABS Team was brought-in to support the BIM initiative.

## Challenges

The foremost challenge was to maintain a temperature below 26 degrees Celsius on the playing field and the grandstand area in the blazing hot summers of Qatar.

The second major challenge was to provide ample amount of sunlight for the Grass of the Field, and maintaining the air conditioning at the same time while keeping the structure as light as possible

A complex geometry of Geodesic Dome structure in the shape of a football that needed to be modeled as an External Facade of the Stadium and skin above it. It altogether was a big technical challenge to handle without expertise and efficient BIM software's.

The other challenges and tasks were:

- Remodeling of External Facade to change

look and feel of the building.

- Addition of an Outdoor Cooling system to make it as a Fully Air Conditioned stadium.
- Addition of a roof over the grand stand area
- Addition of Retail spaces, VIP Lounges, Lobbies and Internal Elevations.
- Refurbishment of Existing services along with addition of new services.
- Integration / optimization of services.

## The Solutions

The challenge of hot temperature conditions were overcome by opting for an outdoors cooling system and a roof cover over the bleacher area. This was made possible only by experimenting and analyzing the conditions in a virtual environment to get optimized results.

A standard BIM Execution Plan was created and implemented throughout the BIM Task to keep the steps of progress in order and recorded for further assistance and developments. The BIM team created all disciplines (ASMEP) models with extensive use of Revit and its collaborative nature. These models are subsequently coordinated with each other to form a functional and interference free holistic project. Naming conventions and stages of LOD levels which are a hallmark of Revit were created and followed in order to support the extensive BIM Use.

## BIM through Revit

The existing ASMEP models were quickly developed based on the as-built drawings provided by the client and visual site inspections. To meet the project's fast-track schedule, delivering the As-built BIM Model as well as Demolition Plans and proposed additions, as per the time schedule was always a "flying instead of walking" situation.

Regular consistency checks with optimized and smart ways of BIM development supported the Project throughout.

The as-built Modeling of Al-Gharafa Sports complex building was being supervised under QDC, which meant that maintaining tight control over budget and schedule was absolutely critical along with providing World Class look and feel to the Existing Stadium.

The form of the stadium is inspired from football as it is directly related to its purpose and subject. Aesthetically it will enhance the built environment with its flexible shape, which consists of 12 regular pentagons and 20 regular hexagons. The familiar 32-panel football design

is sometimes referenced as the truncated dome.

The most complex External Facade of the Complex, Curved planar surfaces, dense steel trusses all around the truncated dome and multilayered skin paneling, wasn't an easy task.

It took a long experimentation to figure out ways to achieve the desired geometry. After much experimentation we were successful in developing this whole complex geometry along with detailed parameters providing desired flexibility to the overall structure.



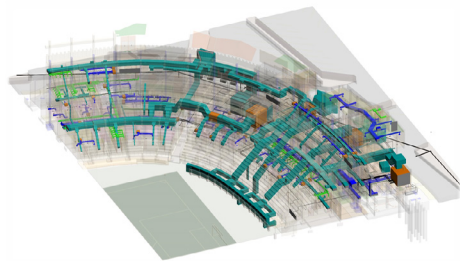
## Facade BIM Model

Image courtesy of QDC/SABS

Typically, there's a wide gap between what you estimate at the end of a schematic design versus what you actually get when those construction documents are almost done. Our gap was very, very tight. Revit provided the freedom to quickly workout various options for Facade and Roof and estimate costing at very Design Development Stage.

—**Mohammad Obaidullah**  
Projects Manager  
BIM Team

The interoperability between the various Autodesk tools is a major advantage and provides a seamless efficiency in quickly developing a basic concept into a fully detailed model.



### Proposed HVAC Model

Image courtesy of QDC/SABS

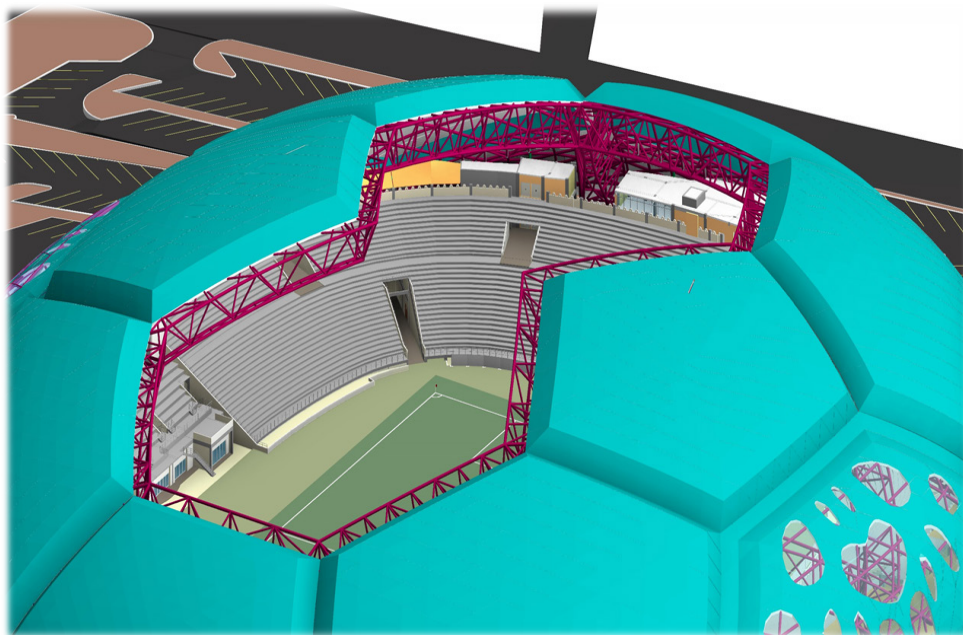
It was a challenge to detail out the football shape only through Revit, Therefore with the little help of 3DStudio MAX, Revit was able to generate even the complex geometry.

Also to make Hexagons (football has hexagonal panels) and Massive Trusses, Revit came more than handy to be able to make all these elements.

The External facade 3Ds Max model was saved as a .sat file and imported as a Revit family under massing Family template and loaded as a family into a project file. Once the family was loaded into a Project file, we modified the mass into actual Roof elements. It only needed one face of the object to do this, so we could further simplify our process by only importing a Face from Rhino to Revit. The existing MEP model is also being utilized to enhance the new design. We carried out multiple Solar studies, and Geometrical analysis for different construction components to support the functionality and efficiency of the design.

Since HVAC is a major component of the design exercise, and with a limited time frame, close coordination with the BIM team and the HVAC designer was essential. The proposed HVAC elements were directly modeled based on the sketches provided by the designer and interference resolved at the initial stage. The DD/GFC drawings are being generated directly from Revit Models. This benefited in reducing the time loss in the traditional methods of producing the GFC drawings at the first place and then developing the BIM model.

The interoperability between the various Autodesk tools is a major advantage and provides a seamless efficiency in quickly developing a basic concept into a fully detailed model. Other advanced Autodesk plugins are effectively utilized for Interference checks, Solar studies, Energy Analysis, 3D visualizations for this Project. In further upgrades of the Revit tool the BIM Model's MEP components can be directly linked to fabrication and construction.



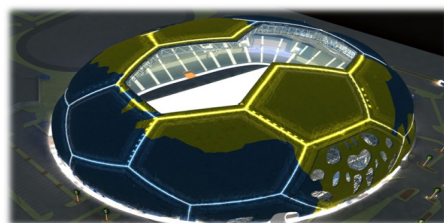
### External Skin Model

Image courtesy of QDC/SABS

### The Result

1. Client satisfaction is ensured since all interferences could be identified and resolved, prior to tendering.
2. The use of Virtual Construction through the BIM Model resulted in enormous time saving, since the deadline of the project is FIFA world cup in 2022.
3. Use of Revit will also enabled the contracting agency to swiftly proceed with the construction, as major issues would have been resolved in the BIM Model.
4. The BIM Model can be further enhanced for downstream operations like facilities management.

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### Final Completed Model

Image courtesy of QDC/SABS