



## *Allegiant Stadium Las Vegas, Nevada*

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# CASE STUDY

## Football Stadium

Las Vegas Raiders - Allegiant Stadium

Newly built sports and entertainment venues have high roofs and even higher expectations. Ownership teams are looking for revolutionary designs that appeal to fans, deliver a competitive advantage, and often anchor a massive entertainment district intended to revitalize a community.

**Las Vegas-** When a prominent football franchise moved to the greater Las Vegas area, the expectations for their new home, Allegiant Stadium, were predictably through the roof.

Architects on the project were tasked with delivering a one-of-a-kind design that, in turn, created multifaceted challenges for the engineering team. One of those challenges was HVAC and air distribution in the vast venue. The complex bowl geometry of the space created a myriad of obstacles for air dispersion, ventilation, and airflow. To maximize the fan, player, and attendee experience, the ability to direct airflow was essential.

After evaluating the plans, the mechanical engineers of record on the project, Smith Seckman Reid, Inc. (SSR) and the mechanical contractor, Harris Company, partnered with fabric duct manufacturer DuctSox to find a different approach — an innovative fabric duct solution they felt would better address indoor air quality, acoustics, customization, and cost challenges.

### FAN EXPERIENCE

One of the most important elements in venue design is planning for the fan experience. Temperature and humidity are an important element, as they can make a lasting impression long after gameday - particularly

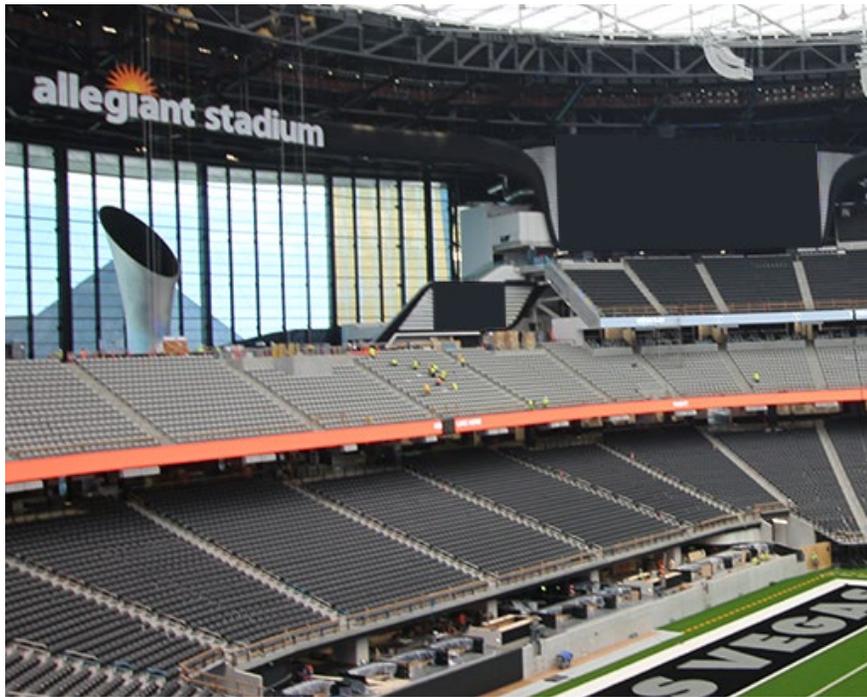


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in a desert locale. The ability to maintain temperature and ensure comfortable conditions for up to 65,000 people was no small task, and proper air distribution and ductwork design would be required.

The architects' original vision for the interior of the Allegiant Stadium bowl included a decorative ribbon to hide the large, round sheet metal duct that would supply air to the upper bowl.

Specifically, they envisioned using large, double-wall sheet metal ductwork with sidewall grilles or jet throw, drum diffusers aimed at the various spectator sections throughout the seating bowl. Unfortunately, this fairly standard design had a potential drawback: the limited number of grilles in the system could create hot and cold zones within the venue. Some fans might receive turbulent cold air, while others over heat due to poor air mixing.



Nested inside the structure, 2,550 feet of 38” – 62” diameter fabric DuctSox uniformly disperses airflow across the surface of the iconic black glass that is critical to the stadium’s aesthetic.

“From the moment we designed the fixed roof stadium, I understood there would be considerable cooling requirements for the seating bowl environment,” said David Manica, President at MANICA Architecture. “Those cooling requirements would need to be supported by massive supply ducts that would be clearly seen wrapping around the building,

so it was critical that we do something new and innovative to simultaneously solve the functional and aesthetic standards of the project.”

DuctSox proposed a unique alternative to solve both the aesthetic and airflow problems. The solution was a 150” x 72” wide vertical oval fabric duct.

The fabric skin was supported using Skelecore™ internal metal framework for superior strength and security while giving the appearance of full inflation even when the air handling is turned off. The black TufTex fabric acts as a single diffuser providing even, consistent airflow. David Manica of MANICA Architecture was pleased to solve two problems with one innovative product. DuctSox eliminated unwanted temperature variances and matched the ribbon visual Manica had long envisioned for the venue interior.

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“The idea of utilizing a black DuctSox as a functional design element that continues the appearance of the building’s theme inside the seating bowl was a directive to the design team from the very beginning,” continued Manica. “The result is everything I had originally hoped and imagined.”

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Besides comfort in the seats, DuctSox also provided an extensive system to cool the perimeter of the stadium. Nested inside the structure, 2,550 feet of 38” – 62” diameter fabric DuctSox uniformly disperses airflow across the surface of the

iconic black glass that is critical to the stadium’s aesthetic. Metal ductwork alternatives would have had harmful impacts to the glass casing due to their non-uniform thermal impact. As metal diffusers are spaced far apart, only the glass in the direct line of the opening would have been cooled, potentially causing an adverse reaction over time.

The implemented fabric duct system also features DuctSox’s Skelecore™ internal framework to eliminate risk of inflate/deflate, while also protecting the product’s integrity over the stadium’s lifecycle.

### SOUNDS GOOD

In addition to indoor air quality and temperature, acoustics also play a key role in the fan experience. The arena bowl must provide quality sound across a variety of events with different seating arrangements and acoustical demands. The ability to adapt from a rock concert to a football game in a matter of hours without widespread facility changes is a requirement for every new venue, and was especially important for Allegiant Stadium, one of the newest attractions in the “The Entertainment Capital of the World.”

Ductwork is a critical variable in any facility's acoustics. Conventional sheet metal ductwork increases noise generation due to its radiating properties and the sidewall vents distributing air to the space. From instrumentals to referee whistles, their reverberating sounds can negatively impact an attendee's experience.

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Fabric ductwork inherently lacks the resonating properties of metal. By using a fabric system, the HVAC system noise generated by metal grilles and balancing dampers was minimized. Venue sound could be dampened and redistributed evenly throughout the space, making for clear and comfortable acoustics.

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## STAYING FLEXIBLE

Aesthetics are another key aspect of venue experience. From its sleek domed exterior to the iconic black-and-silver color scheme throughout the interior, Allegiant Stadium reflected the cutting-edge charisma of the team's brand. The HVAC and air distribution equipment needed to match that same visual standard.

Unlike metal ducts, fabric duct systems can be produced in an array of shapes, sizes, and colors. This flexibility allowed the design team to rethink the traditional norms surrounding bowl ductwork and provided the architects at MANICA another resource to achieve their artistic vision.

Due to the limited design flexibility of conventional metal duct systems, architects and design teams have long installed the traditional ducts as high as possible in a venue to remove the equipment from view. That was not the case at Allegiant Stadium. Instead, an oval fabric duct system – the world's largest – was suspended from the stadium roof to create an architectural ribbon element along the entire upper seating bowl. Choosing the classic black brand color, the procurement team at DuctSox aligned custom fabric threads to ensure color tones were consistent throughout. This marrying of form and function provided a striking design feature and a comfortable environment for fans as the fabric duct system was fully integrated into the space (and not hidden from sight).

Customization was essential, too. Three scoreboards interrupted the path of the fabric duct system along the exterior of the bowl. To



ensure a smooth transition between the ducts and scoreboards, custom “wings” were developed in a color-matched fabric from DuctSox to help retain visual consistency.

## A CLEAN SLATE

Most of today's stadiums are built to be multi-purpose, hosting as many as 300 events in a single year. Given the limited time between events, the maintenance and cleaning of ductwork and air grilles is often not prioritized by operations staff. With the system the Allegiant Stadium team chose, it didn't need to be.

A fabric ductwork system also provides flexibility for facility operators to allow various sections of the system to be deactivated during a concert where the movement of air might hinder the theatrical performance including fog, smoke, or pyrotechnics. A matching set of removable side panels and detachable cover panels was created as part of the functioning fabric duct system for Allegiant Stadium to provide the facility with full-scale flexibility based on the needs of an event any given night.

## COST ADVANTAGES

A multi-billion-dollar stadium project is always considering costs and Allegiant Stadium was no exception. In the case of its ductwork system, the fabric option offered a \$6 million savings versus metal. Fabric ductwork is typically 30-50% more cost effective than a conventional sheet metal double-wall system, with much of those savings due to lower installation time.

One of the reasons for a reduction in installation time is material weight. Metal equipment is typically fabricated in singular, bulky pieces. This makes any installation process much less flexible, while the inherent weight of the metal calls for extensive equipment to hang the large ducts. Lighter fabric-based systems, on the other hand, require less structure to support them, resulting in reduced costs for rigging the venue roof structure. Additionally, fabric systems come in modular sections making installation an adaptable process for any team.

Erecting the 18-foot-long sections in place seemed straight forward enough, but considering the unusual height (up to 200 ft above field), placement directly below the

catwalks, and constant changing of elevations in addition to maintaining the contour of the oval shaped bowl, it was a tall task. The team at Harris Company, the Mechanical Contractor on site, took on the challenge and developed a unique installation solution. Starting with two zip lines between field level and the scaffolding up near the installation level, segments were prefabricated on the field level then hoisted into a fixed position and indexed down the monorail to their final position. In total, this process saved thousands of hours and allowed the team to finish installation five days ahead of schedule due to the increased efficiency.

“This is Harris’ third indoor NFL stadium and first-time using fabric duct and we saw the benefits of fabric duct, not just in reductions in installation durations, but in the reduced coordination with the building structure which traditionally is half the battle with metal ductwork” said Craig Mickelson, Project Executive. “DuctSox was able to participate in our 3D modeling during design to maintain our vertical and horizontal changes in direction to follow the contour of the stadium’s shape.”



## THE STADIUM OF THE FUTURE

While HVAC systems and supporting supply air ductwork systems might not be the most spotlighted aspect of a newly built arena or stadium, they do have a significant impact on fan and player experience, operational flexibility, and overall costs. Looking ahead, venues around the world will look to fabric ductwork systems to maximize indoor air quality, flexibility, and cost savings.

For more information about how a DuctSox system could improve your athletic facility go to: [www.ductsox.com/applications/athletic-facilities](http://www.ductsox.com/applications/athletic-facilities)

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