

# Reliant Stadium



## CASE STUDY

HOK SPORT + VENUE + EVENT



### First Natural Grass Stadium with Retractable Roof

As the first stadium to ever have both a natural grass playing surface and a retractable roof, Reliant Stadium has forever changed the paradigm of major sports stadium design. Finished in 2002, Reliant Stadium is home to the NFL's Houston Texans, as well as the Houston Livestock Show and Rodeo.

Because of Houston's near year-round sunshine, Uni-Systems was tasked with creating a stadium that could offer a live grass playing surface, as well as protection from the unpredictable Texas weather. Uni-Systems created an op-

### RETRACTABLE ROOF

#### TECHNICAL DESCRIPTION



The retractable roof at Reliant Stadium consists of two translucent, fabric-covered panels, weighing a total of 2,243,000-pounds. The roof panels meet directly over the 50-yard line when in the closed position and rest over each end-zone when in the open position.

Each panel is 240 feet long, and is supported by five tri-chord trusses that span 385 feet across the field. A transporter supports each end of each tri-chord truss, with a total of ten transporters supporting each roof panel. The east end of each tri-chord truss is connected to the transporter by a 4-bar linkage lateral release system. The 4-bar linkage accommodates 21.5 inches of relative lateral movement between the fixed building and the retractable roof that may be caused by wind, heat and other loading conditions.

Each transporter rides on two traction wheels that are each powered by a 5-horsepower motor. The traction drive system moves the roof panels 35 feet per minute to fully open or close in approximately seven minutes.

The five transporters in each roof quadrant are connected by linkage arms that rotate vertically as needed to accommodate vertical changes in the steel rails. This linkage system evenly distributes the roof loads, and prevents any wheel from becoming overloaded.

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erable roof with the ability to withstand severe hurricane conditions. Consisting of two large panels that bi-part at the 50-yard line and open a full 385' across the field after they come to rest over the end zones when fully open.

Built to withstand variety of wind loading and thermal conditions, the roof panels were designed to allow movement both back and forth laterally and left to right upon the superstructure rails. To achieve this "flex", while still ensuring that the carrier wheels remain parallel and symmetrical to the rail in all conditions, Uni-Systems placed a patented 4-bar linkage assembly between the tri-chord trusses and the carriers. The linkage assemblies allow up to 21.5" of relative movement between the super-trusses and the tri-chord trusses. An amazing feat that will, hopefully, happen only very rarely.

Completely closing the more than four-acre opening can take place in just 7 minutes, at its top speed of 35 ft/minute. The 2,243,000-pound retractable roof is functional in winds gusting up to 50 miles per hour, and fail-safe spring-set brakes automatically engage in the unlikely event of a power outage.