

Stadium's Open-Roof Design Requires Open Minds on Compliance

Challenge. Reliant Stadium in Houston, which has the first retractable roof in the National Football League, is home to the Houston Texans and is the centerpiece of the \$449 million revamped Reliant Park complex with various venues for sports, entertainment, conventions and other functions. Reliant Stadium measures 1.9 million square feet and has a 69,500-seat capacity for sporting events with the option of accommodating an additional 10,800 occupants in field-level seats for concerts or other events.

The stadium's retractable roof is built on grade and has two moving, Teflon-coated fiberglass panels on each side of the football field's centerline that retract toward each end of the stadium. The 800- x 385-foot structural steel roof is framed by 10 trichord trusses, five for each panel, eliminating the need for columns in the seating stands. Four columns, each rising 150 feet high outside the seating bowl and containing about 2,000 cubic yards of concrete, support the roof.

Solution. As part of the design team for the project, Rolf Jensen & Associates (RJA) provided a comprehensive range of fire protection and building code consulting services, ranging from developing a detailed code summary and fire protection outline report to conducting drawings review and alternative methods of compliance.

A challenge that exists with large, open-air assembly facilities is the mitigation of smoke and the required egress of its occupants. RJA evaluated computational fluid dynamics models, which determined how much smoke would be generated in a fire and the optimum ways to control smoke in the building for modeling the design of the smoke control system. Even more important was RJA's work on conducting exit calculations and timed egress for occupant evacuation.

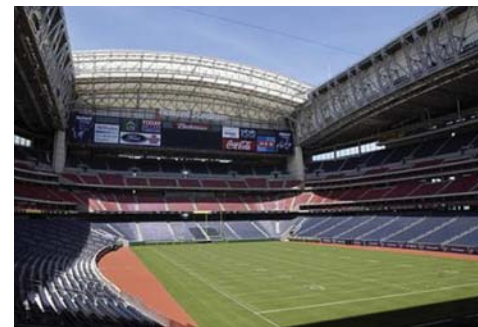
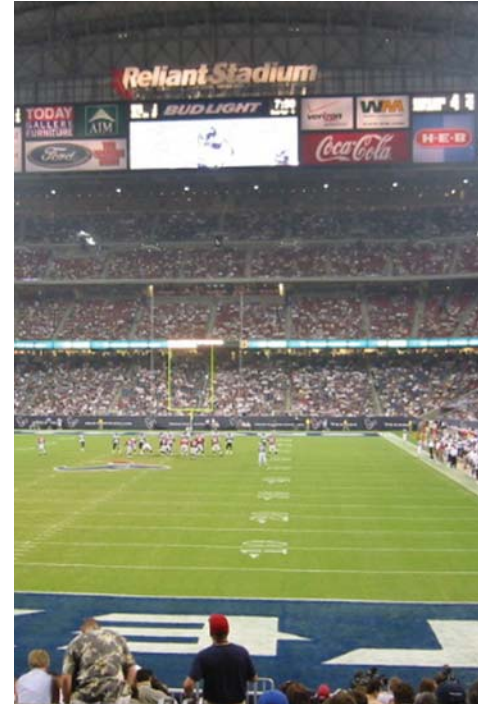
Achieving complete and total code compliance is difficult in these types of facilities, however. RJA worked with the City of Houston to gain acceptance for alternative methods of compliance for the smoke-control system, exiting and other features unique to the facility.

When discussing smoke ventilation at the initial design meetings, RJA considered using the retractable roof, which is constructed of steel with a fabric covering and completely opens in about 10 minutes. The roof cannot be opened when wind speeds exceed 35 mph, however. Because wind speeds are typically in the high teens at the roof's peak, the city required RJA to design the stadium as a smoke-protected assembly with the assumption that the roof would not be open.

Result. RJA's evaluation showed that occupants would have adequate time to exit before obstruction even though the plans did not include sprinkler system coverage for large portions of the stadium, mostly the playing field and select seats that are 200 feet below deck.

Audible notification also posed challenges, because most speakers and horns do not have the appropriate coverage range for a large stadium. RJA negotiated with local officials to use the stadium's public address system and to add redundancies, such as emergency power, to provide alarm notification to stadium occupants. Because RJA had previously worked with City of Houston officials on gaining compliance for this notification approach when doing rework for the Compaq Center, officials were more accepting of this design for Reliant Stadium.

RJA also negotiated a code variance with the City of Houston to allow 3,000 additional standing room-only occupants to be added to the existing configuration on the main concourse, as well as providing for special fire department access to hoses at alternative standpipe locations.



- Code Consulting
- Fire Protection Design



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