

Department of Civil Engineering and Geological Sciences  
**Challenges and Innovation in Civil and  
Environmental Engineering**

***Structure in Motion* – Design and Construction of Stadiums  
with Retractable Roofs and Playing Fields**

**Larry Griffis, P.E.\***

**President, Structures Division, Walter P. Moore and Associates**

**Wednesday, November 12, 2008  
126 DeBartolo Hall  
4:30pm – 5:45pm**



Sports stadiums with retractable roofs and fields have ushered in a new era in the evolution of sports stadiums around the world. Gone are The Kingdome, Riverfront Stadium and Three Rivers Stadium. The venerable Astrodome sits idle and the Superdome future is clouded at best. The high cost of new stadiums demands that they be more versatile and not just used on game days. The new stadiums need to accommodate more types of sporting and non-sporting events to be viable. They need to be both open air and enclosed for a wide range of venues. And that means stadiums with retractable roofs.

This seminar will address the structural engineering challenges that go into the design and construction of this new genre of building type – the retractable roof stadium and ballpark. Featured will be the new Reliant Stadium – home of the NFL Houston Texans and the Houston Livestock Show and Rodeo, the University of Phoenix Stadium – home of the NFL Arizona Cardinals and the new Cowboys Stadium in Irving, Texas – the new home of the Dallas Cowboys. These buildings are often hailed for their architectural design, but they are mostly structure and mechanization. In this building type, the structural engineer plays a major role in the success of the project.



With spans typically ranging from 600 to well over a 1000 feet or more, these “long span” roof structures with moving roofs and playing fields present a host of challenges ranging from the economics of spanning long distances with moving loads, the constructability aspects of putting the steel structure in place and the wind loading that such buildings receive depending on their roof configuration – open or closed. How are these enormous

structures moved, what type of steel is used to keep the weight down, how are the steel truss connections made, how are the roofs erected and what role does this play in the structural engineering design, how are the roofs operated for potential thunderstorm and hurricane wind conditions, what happens if a mechanization failure occurs and how is this accommodated in the structural design, how are natural turf fields accommodated in the operation and maintenance of the building – all these types of questions will be addressed in this presentation.



*\* Larry Griffis is President of the Structures Division of Walter P. Moore and Associates, a nationally recognized engineering firm specializing in the design of major sports facilities. He served as principal-in-charge of the stadiums featured in this presentation.*