Group 1
Sports Stadium
CE 203

Task 1: Outline

Our group was assigned the task of dealing with sports stadium structures. Having a fairly broad category, we decided to look in detail at a single stadium rather than comparing multiple ones. With so many different types of stadiums, and every one being unique, we figured we would learn more and it would be easier for our audience to get a feel for sports stadiums if we focused on unique engineering and economic aspects of a single one while referencing others. We chose University of Phoenix Stadium, which is located in Phoenix, Arizona and home to the Arizona Cardinals, a team in the National Football League. It opened on August 12, 2006, and is one of the premiere sports stadiums in the world. We focus our analysis on two of its most unique features, the roll-out natural grass field and the arc-profile retractable roof.

The University of Phoenix Stadium is one of the best sporting structures in the world. It is located south of Phoenix, in Arizona. The stadium uses advanced technology from all over the world, and was designed by the famous architect Peter Eisenman. One of the main attractions of the stadium is a retractable roof. The stadium also has a retractable field unique to America. The exterior design is based on the profile of a barrel cactus. It can contain almost 73,000 people to watch a match at the same time. The skin is a bluish silver insulated metal, and in the side face there are some small gaps to let the light flow in. The 160 acre area around the stadium is parking, grass areas and other sports space. Considerable retail, amusement and business organization will run round it.

The stadium roof has two large panels and it needs 12 minutes to open and close. The retractable roof uses bird-air fabric. This style provides the air conditioning during the hot days and then opens during the cool days to give abundant sunshine. In addition, the roof also balances the luminosity in the field and seats. It gives fans a pretty climate and blue sky. The closed roof situation can accommodate any good-sized events, including concert, exhibitions, and other sports games, but its security, such as fire protection, is still a primary problem.

The unique, roll-out field is the first in America and it takes approximately 45 minutes to move into or out of the stadium. Rolling it out allows the field to be better taken care of, receiving plenty of sun and watering. It weighs 19 million pounds and slides out on 542 wheels, of which 76 are driven by motors. Under the grass and soil there is a drainage mat, a concrete slab, then the wheel assembly with the motor, sitting on an 18-in deep steel frame. The 13 rails embedded in the concrete have wheels that can move out and into the stadium.

With a project of this magnitude, there were a myriad of original designs. But with so much detail, many of the original ideas for the stadium get lost, and the approved ones are built. One of the original plans for the stadium included press boxes that weren't as nice as the ones that were actually built. This was because more money

became available as construction happened. A non-roll-out field and a non-retractable roof were ideas at one point, but were not included in the final design, obviously.

We thought that the alternative ideas would be to construct a turf field, or to build a grass field that would just sit in the stadium like most others. Obviously, this was not the final result, but they were likely original ideas for the stadium planners.

The cost of the stadium was $450 million. A comparable grass stadium without a roll-out field is located in Denver, and was built for $364.2 million.

The provided technical data shows us a modern stadium by the length 700 feet, height 87 feet, width 17 feet, weight 1,800 tons and the roof weight 5,600 tons.

The Data of the Stadium

Estimated cost	$450 million
Stadium area	160acres
Concrete stadium floor area	152,000ft^2
Field tray weight	7,500t
Field dimension	234ft×400ft
Seating capacity	At most73,000
Lower bowl seating	29,000
Upper deck seating	26,000
Club seating	7,000

A few of the non-technical aspects of the stadium include that it was constructed at an angle in order to maximize sun exposure for the grass field while also maximizing shade for the fans. Also, the stadium has a retractable roof to make the fans as comfortable as possible. Unlike other retractable roofs, this one rides along an arc, and was constructed using eight high-powered hydraulic jacks mounted on four super-columns inside the stadium.

The University of Phoenix Stadium has many advantages in comparison to other stadiums. It is hard to compare to other stadiums because of location and climate, but in Glendale, Arizona the stadium is very effective. To name a few advantages, the stadium has wide concourses, a large number of bathrooms, 88 individual suites, an alignment that allows for maximum sun exposure for the field and minimum sun exposure for the fans, and it is fully air conditioned on those simmering summer days. Some disadvantages are its large cost, its large construction time, and the effects of the controversy of the naming rights. Along with many advantages in design and amenities, University of Phoenix Stadium also has many economic advantages. These include that its construction provided over 3,500 jobs, that it added $400 million to Arizona's economy, and that numerous revenues will come from its playing host to sporting events such as the Super Bowl, the Fiesta Bowl, and the NCAA Final Four Championships.

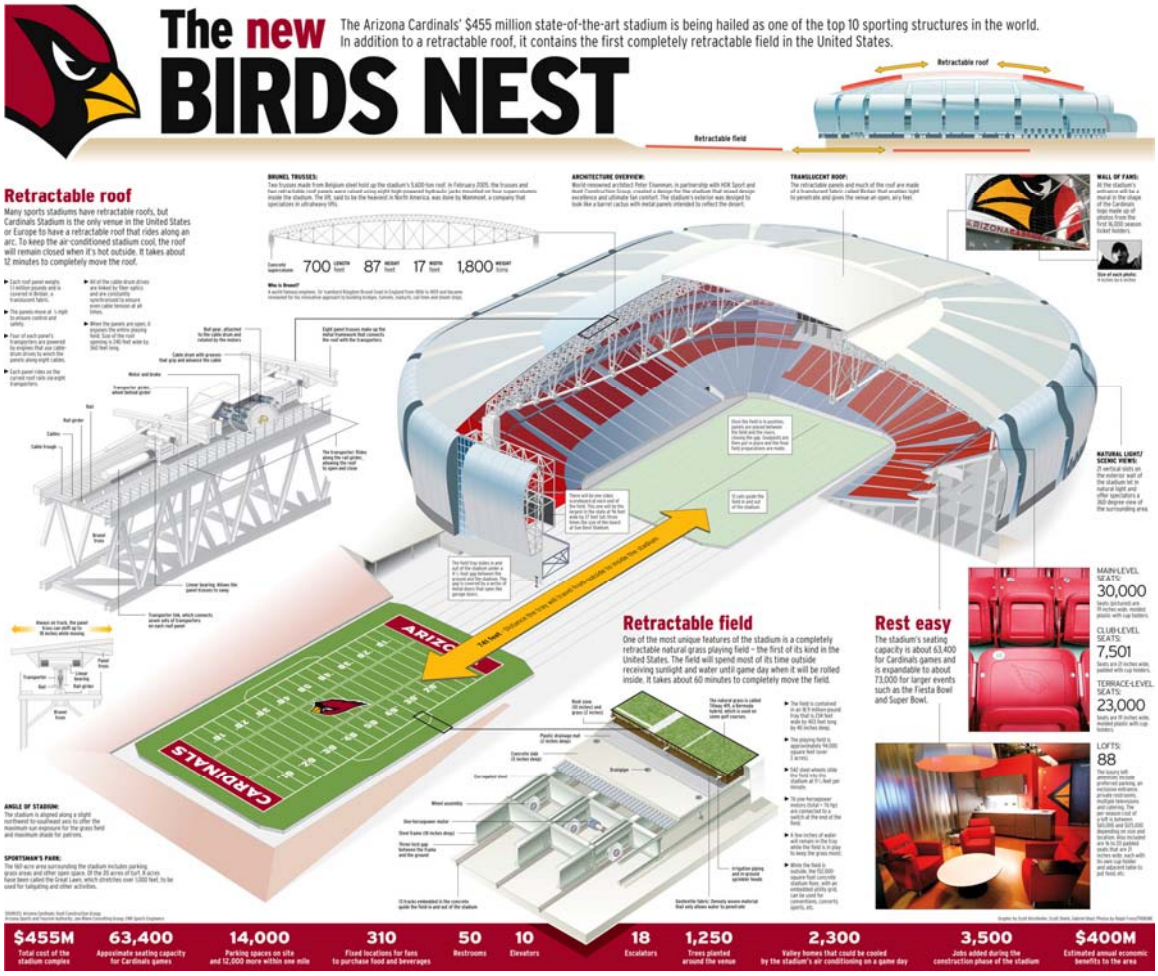
One of the problems with implementing this plan was how to pay for it. It ended up being funded by the state, meaning higher taxes for Arizona residents. Another

problem designers worried about was how to evacuate fans in the event of a fire. After running simulations to determine the most effective evacuation technique, a passive smoke control system was adopted, which would allow 65,000 people to be evacuated before smoke reached hazardous levels.

The original plans for the stadium didn't have much data, but the roll-out field had some data. It saves $50 million by choosing to have the field roll out instead of having the sunlight for the grass come only from opening the roof. This value is a large chunk of the net savings by choosing the implemented stadium plan.

The stadium seats 63,400 for Arizona Cardinals games, and can seat 70,000 at its maximum capacity. The stadium features suites and lofts. There are video screens at each end of the stadium also, 27 ft. tall by 96 ft. wide.

To sum up, the new stadium of the Arizona Cardinals is a modern multipurpose stadium. It contains all of the new technologies owned by humans and shows us a new thought about sports buildings by using accurate data. It is the production of the architect and engineers. As a professional stadium, the Arizona Cardinals Stadium is the one of the best stadiums in the world. In the future, it will be proven that the retractable roofs are the best part of the stadium, and control the stadium's structure.



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