Rio 2016 Olympic Tennis Stadium

Students: Bruno Carvalho & Eduardo Sztrajtman **Advisors: Professor Mohammad Alhassan & Professor Andres Montenegro**

Abstract

The Olympic Games is the most important sports event in the world. The next edition of this major international event is going to be held in Rio de Janeiro, Brazil, in 2016. The city is not yet prepared to host the games, since it does not have many of the venues needed for the Olympic sports. One of the venues that have to be designed from scratch is a tennis complex. The complex to be designed in this project will use already existing complexes as a model. The last Olympic Games were held in London, Great Britain, which is a city that is already prepared for a tennis event of this magnitude, since it hosts a major event yearly, the Wimbledon Championships. Therefore, the All England Club tennis complex, in London, and many other complexes around the world will be used as a model for the one to be built in Brazil. Basic models of tennis complexes have a main stadium, two smaller stadiums, and several ground courts.

The main objective of this project is to develop the structural design of the main stadium, taking into consideration mainly safety, aesthetical and economical characteristics. The structural model of the main stadium is to be developed using the ETABS software. In addition, an overall architectural project for the whole complex is to be developed using the Autodesk® Maya® 3D software. Information provided by the Brazilian Olympic Committee and the International Olympic Committee are intended to be used to define key aspects of the project, such as the location of the complex, capacity of the main stadium, and the budget available for the facility.

Location

Alternative Designs

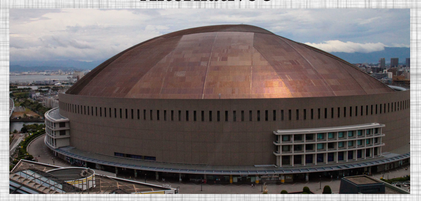
Alternative 1: Simple rectangular concrete structure with no cover.
Alternative 2: Rectangular steel structure with rounded corners, exterior glass finishing and partial cover for the concrete stands top level.
Alternative 3: Completely covered circular steel structure with concrete stands.
Alternative 4: Rectangular steel structure with rounded corners, partial cover for the concrete stands top level and retractable roof for the court.

Alternative Examples

Alternative 1

Alternative 2

Alternative 3



Alternative 4

Alternative Characteristics & Selection

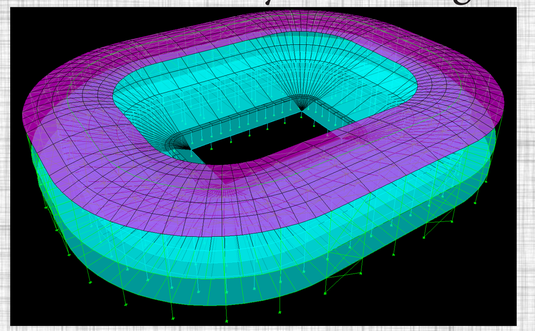
Design Alternatives	Shape	Stands Material	Outside Structure Material	Cover	Cost	Ease of Construction	Maintanence Cost	Aesthetically Pleasant	Service Area	Shadows on Court	Interaction with Enviroment
Alternative 1	RECTANGULAR	CONCRETE	CONCRETE	NONE	LOW	HIGH	LOW	NO	NO	LOW	YES
Alternative 2	ROUNDED	CONCRETE	STEEL AND GLASS	PARTIAL	MODERATE	MODERATE	LOW	YES	YES	MODERATE	YES
Alternative 3	CIRCULAR	CONCRETE	STEEL	COMPLETE	HIGH	LOW	HIGH	YES	YES	NO	NO
Alternative 4	ROUNDED	CONCRETE	STEEL	RETRACTABLE	EXTREMELY HIGH	LOW	EXTREMELY HIGH	YES	YES	MODERATE	YES

Decision Matrix

Goals (Relative Weight)

Design Alternatives	Safety (100)	Construction Cost (95)	Ease of Construction (85)	Aesthetics (70)	Public Acceptance (70)	Maintenance Cost and Ease of Maintenance (60)	Reliability (Weather Influence) (40)	Public Comfort (25)	Environmental Protection (10)	Total
Alternative 1	1	4	4	1	1	4	1	1	4	1305
Alternative 2	3	3	3	4	4	3	2	2	3	1740
Alternative 3	4	2	1	3	2	2	4	4	1	1415
Alternative 4	2	1	2	2	3	1	3	3	2	1090

Structural Analysis & Design

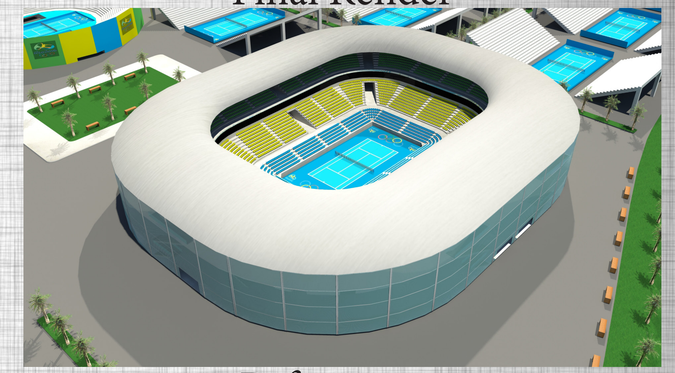


Stadium Model on ETABS Software for Analysis of Loads and Design of Concrete and Steel Members

Conclusion

The Rio 2016 Olympic Tennis Stadium will be located at the Olympic Park Tennis Center in Rio de Janeiro, Brazil, and will be used for the XXXI Olympic Games in 2016. The dimensions of the stadium are the following: 367 feet in length by 307 feet in width by 72 feet in height. The court is located in the middle of the stadium, occupying an area of 120 feet in length by 60 feet in width. The stadium is divided into four main levels, three levels for seating and one level for the media. The total capacity of the stadium is 10568 seated spectators. The media communications center is located between the second and third level of seating, containing the media broadcast area and press box. In addition, the stadium has an aluminum roof cover for the entire third level of seating. There is a service area and access zone located behind the grandstands, consisting of 3 floors containing restrooms and concessions. The first floor also contains the area for the players which include locker-rooms, trainer's room, press conference room, and press mixed zone. The access system between each floor is consisted of six staircases and four elevators strategically located for optimum public circulation, while the access to the grandstands is made through twelve access corridors. The structural design of the grandstands is mainly a system of columns, beams, and slabs, which are made of reinforced concrete. The support of the service area corridors is made with a steel system containing floor beams, girders, and columns. The roof cover is supported by a system of bowstring steel trusses connected to each other, which is supported by the columns. The space in between the outside columns is filled with a glass cover, giving a clean and modern look to the stadium.

Final Render



References

Rio 2016 Olympic Committee, American Institute of Steel Construction, American Concrete Institute, American Society of Civil Engineers, International Building Code, Brazilian Association of Technical Norms, International Tennis Federation, and Google Images.

Acknowledgements

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