2020 Tokyo Olympics LEED Platinum Football (Soccer) Stadium

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Final Design Paper

Abstract

The 2020 Tokyo Olympics LEED Platinum Football (Soccer) Stadium is the future for new stadiums in the upcoming generations. The stadium will have a LEED Platinum BD+C certification which means the building will use best-in-class building strategies and practices for the future of sustainability building industry. The facility will be located in Kasumigaoka, Shinjuku, Tokyo, Japan. This is close to the Olympic village and public transportation making it easy to get to and from games for both the athletes and spectators. The site has a previous stadium on it from the 1964 Olympics. By building on this site, materials can be reused and no new land will be being impacted. Finally, the new stadium will incorporate smart sustainable strategies, along with the newest technology, in order to create an atmosphere that enhances the experience of the game and promotes protecting the environment.

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Site Selection

When assessing the site selection of the stadium project, the variables that were considered were land development, integration with surrounding land, culture, topography, and natural habitats. When looking at a site it had to be the best location and not impact the culture or land around it. The two locations that were assessed for the soccer stadium were the original 1964 Olympic Tokyo Stadium and the site in Shiba Park in Tokyo. The Shiba Park is near the Tokyo Tower to the east. Both sites have their pros and cons so we had to research further.

After researching further, the site that seems more suitable for the project is the 1964 Olympic Tokyo Stadium. The reason for this is because even though it is further from Olympic Village the site has already been impacted back in 1964. Since it is 71 acres of area impacted already, the site can be reduced to actually give a positive impact on the environment. Also, public transportation is easily assessable for this location from Sendagaya or Shinanomachi stations along the JR Chūō-Sōbu Line; from Kokuritsu Kyogijo Station on the Toei Oedo Line; and from Gaienmae Station on the Tokyo Metro Ginza Line. It is more optimal to build on top of the site for sustainable reasons compared to build on green land. Shiba Park is only 30 acres and has a Buddhist temple on it and hotel. This means that it we wanted to take the park away we would have to relocate the hotel and temple which would not go with LEED's purpose. Going along with LEED's purpose, this park is a green space for the city and taking it away would not agree with the culture and natural habitats of any animals living there.

The 1964 Stadium has everything in order to build and new stadium. The features of the old stadium might have to be brought up to code but this will still be less of an impact to the city and its culture then taking away a temple and green space. Since the foundation is already there for the stadium a lot of variables for building the stadium can be reassessed to make sure the structure will be stable but not a huge research project. The stadium would be in one of Japan's main plains in Tokyo which means it is essentially flat but Japan is extremely impacted by earthquakes. In order to account for the earthquakes, the building will be up to Japan's strict building codes by using Taishin – the basic earthquake resistance required by law and Seishin – vibration control, which is optional. All of these variables went into the site selection of the 1964 Olympic Tokyo Stadium.

Data on Site Selection

	Shiba Park	1964 Olympic Stadium	
Impact on land	1	5	Rate: 1-5 (5 being best)
Impact on Culture	1	3	
Impact on green space	1	1	
Distance from Center	4	1	
Impact on Nature	1	5	
Public Transportation	5	4	
Score (higher better)	13	19	

Building Development

The new stadium will use the foundation of the old stadium to build on. The building of the stadium will entail four main phases. Phase 1 will be mainly gathering reusable materials throughout the stadium. The materials reused will be used throughout the stadium to not only lessen the impact of the new stadium but as a remembrance of the 1964 Olympic Stadium. Some things reused could be stadium seats, Stadium field lights, and some of the materials to be used for something different. Phase 2 will consist of demolition. The demolition will not only include wasting the materials but trying to recycle as much as the materials as possible not just for the new stadium but the community around if wanted. The old stadium is becoming retro-fitted to meet the new needs of the events being held there. But, this does not mean that the things in the old stadium cannot be re-used or even recycled through government recycling. Phase 3 is the stadium major renovation. In this phase the stadium will be renovated from the foundation up after the foundation is reinforce to code. Then the field will be retro-fitted then work its way to the outside starting with the seats ending with the glass on the outside of the building. Finally, Phase 4 is to complete the surrounding infrastructure renovation. This phase will be rebuilding the parking lots, street lights, mechanical systems, electrical systems, and other support agents to the stadium. Note: This phase (Phase 4) and Phase 3 will overlap due to some things that need to go in before the stadium (ex. Geothermal system, electrical wiring, etc).

The phasing of the building will help not only with LEED points but will help the community communicate with each other while the stadium is being built. Since there will be phases there will be a council with members representing Japan, the city of Tokyo, the Olympics, the architects, the main engineers, members high in the surrounding community, etc. Even though it is understood that they will not see eye to eye on every issue it is important to make sure that every voice is heard in the making of this stadium. With every member effectively communicating the building and events held here will be achieved smoothly compared to if it was just the Olympics controlling the building.

Lessen Impact

To minimize the impact that the stadium will have over its life time, it will feature a small data center under the stadium near the athletes' locker rooms and facilities. This data center will be used to manage the facilities meter readings and energy performance of things such as HVAC, lighting, auxiliary equipment, etc. This also means that almost everything that goes into the facility will be able to be moderated by this data center making everything in the stadium state of the art for the upcoming Olympics. This stadium may even be considered a smart stadium in this view. The rest of the impacts that will be reduced are broken up into sub sections that are underlined but not bolded. The subsections end with the innovation section.

Parking

For this stadium one of the biggest impacts on the land is parking. The site is 71 acres and it is safe to say that 50 percent of the site is parking if not more. In this project we would like to reduce the parking by half making the area of impact for the site lessen. This will be achieved by using the reduced parking area as a green space for things such as grass, trees, gardens, etc. This will help the Olympics and the stadium have a more green experience for everyone that visits the stadium from around the world.

Transportation

The stadium is a little over a five minute walk from two major lines for the train stations in Tokyo. This will help the spectators get to and from games easily and efficiently. Using public transportation can be sponsored by the stadium events through ads while selling tickets. The stadium will also feature green buses provided by the Olympics in order to get the athletes and staff to and from the stadium. The buses will also have designated routes for the spectators to use as well. The bus route will run from the Olympic Village for the athletes and for the spectators it will run on a similar route but the athletes and spectators will be separate.

Lighting

For the competition area lights the stadium will feature new LED stadium lights that are more energy efficient but will not affect the players or the spectators experience during the event. People lights around the stadium will also be LED to create a more efficient building nd reduce the energy consumption of the lights already existing at the site. We will use daylighting by having the outside of the building feature glass and be oriented in a way that can use the suns light in order to not use any lights or few during the day while most games are being played. Another aspect that the facility will incorporate is solar. One way solar will be incorporated is that the street lights around the facility will have solar panels and a small battery to hold its charge. These lights will purely run off of the battery storage from the solar energy that is captured during the day. This is possible because the site does not have many obstacles near it that disrupt the suns rays.

HVAC

The HVAC system will be abandoned entirely for the outdoor section of the arena because of the surrounding environment. Even though some places use cooling for their stadiums, it has been proven that the HVAC system can only alter the temperature in a stadium by two or three degrees. This is a way to save a tremendous amount of energy and help the stadiums efficiency. HVAC will still be used in the lobby and corridor areas incorporating geothermal that is residential. The residential geothermal is different than commercial because with residential the wells will only be anywhere from 200-400 feet deep where commercial can go over 1000 feet deep. This will help with the upfront cost be less because drilling multiple residential wells is less than drilling one commercial well. The geothermal main incorporation to the stadium will be for hot water in the bathrooms, the athletes' bathrooms, the athletes' showers, and the HVAC for the area surrounding the playing field like the lobby and corridors. The stadium's orientation will also help will cooling the stadium. The direction of the stadium will help the spectators stay cool by making sure that the sun is hitting an extremely small portion of the spectators' seats in the stadiums seating in order to reduce the temperature the spectators feel throughout the event.

Water

The water system for the facility will try and use a geothermal system. At the time it seems practical because of the need for domestic water for the bathrooms and athletes' showers along with the big budget of the Olympics. This could extremely help the energy to be reduced in the facility.

Innovation

The facility will utilize many innovating features. Some simple ones are geothermal heating, solar energy power, green transportation, and turf instead of grass. But, the biggest innovating feature for this facility is the soccer pitch will convert energy from players' footsteps into electricity. Researchers at British technology company,

Pavegen, have built this facility in Lagos, Nigeria. This could possibly be a great step towards a more sustainable soccer pitch. This energy isn't meant to power all of the stadium or even all of the lights, just to supplement the power grid so there is less strain on it during the Olympics. Also, this project is intended to help Pavegen develop more ways to cut costs and make them more efficient.

LEED Self Assessment

In this project it is desired to achieve LEED Platinum Certification in Building Development and Construction under New Construction and Major Renovation according to the version 4 of LEED. As the project anticipated, LEED Platinum is set to be achieved due to how the checklist is filled out. According to the checklist, the range that the project could get is from 81-95. This is because of the different ideas the council in charge of the project came up with.

Under the Location and transportation the project achieved 16 out of 16 points. This is because the site selection was in a place where there was already a stadium. Instead of building a new stadium that council had decided to do a major renovation of the existing stadium in order to preserve the land, stadium, and the existing materials. This location is also perfect because it is near two major train stations. Another thing that the council decided on was that the Olympics will provide green buses for the events that can be handed over to the city after the Olympics to help the city with transportation. The Olympics and the city will split the cost accordingly.

In the sustainable sites category of the check sheet 7 points were awarded out of 10 points. This can be seen because the stadium does not just due a renovation of the stadium but the site as well. As mention above phase 4 under the Building Development section, there will be a renovation of the surrounding area. This renovation includes but isn't limited to new storm water management, more open green space, and protecting the environment around the stadium.

When looking at the water efficiency category of LEED v4 BD+C the project achieved 9 points out of 11 points. This was done by not only trying to use less water but by using run off water of the site to go through the domestic water system. This will help the stadium require less water from the city and move towards a more renewable site environment. Also, the site's water will be metered by the data center in the stadium.

Regarding the Energy and Atmosphere section in the LEED v4 for BD+C the project received 31 points out of 33 points. Almost all of this section will be achieved by the data center in the stadium that does all of the management and metering of the facilities throughout the stadium. As further described above in the section, this data center will be hooked up to all that facilities in the stadium in order to track energy consumption by each individual facility in order to help maximize performance of the stadium and help reduce energy where the stadium can.

Under the materials and resources section of the LEED check sheet 13 points were rewarded of a possible 13 points. This was done by making sure that the site uses a green way to reuse, recycle, and get rid of the waste of the stadium renovation. Also, what helped this section was the phasing of the project in order to make sure that every aspect of the stadium's development was done correctly according to masterplan created by the council. When everything goes accordingly the stadium's renovation will be extremely sustainable according to the LEED standards.

Indoor Environmental Quality is the second to last section on the Certification that applies to the project. In this section the project was rewarded 13 points out of 16 points. This section includes quality of the conditions inside of the stadium from HVAC to lighting to low emitting materials. All of these things were touched on in the master plan above. Some of the key points that helped to achieve this standard were the LED lights involved in the stadium, the daylighting, and the air quality assurance by the data center management.

Finally, the last section on the LEED v4 BD+C for new construction and major renovation that applies to this project is Innovation. The main innovation things done with this project were in the innovation subsection above. Some of those things include solar panels, geothermal, and Pavegen pressure panels.

In conclusion, this project was a success in the master planning stages. If the master plan is followed as above there should be no problem achieving LEED Platinum Certification for v4 BD+C under New Construction and Major Renovation. This is a bottom estimation meaning that the points will go no lower than 81 but will probably exceed this getting close to 95. This is what needs to be done to achieve the goals set by the council before the planning stages of this renovation.

Annotated Bibliography

1. "Olympic Venues | The Tokyo Organising Committee of the Olympic and Paralympic Games." *The Tokyo Organising Committee of the Olympic and Paralympic Games*. N.p., n.d. Web. 20 Oct. 2016.
We used this citation to get a better idea of where we could place the LEED Platinum football (soccer) stadium. It allowed us to view multiple sites where Olympic stadiums are already in place. By doing this we are able to consider building on top of or using the materials of a pre-existing building. We are also able to see the best locations near the Olympic Village.

2. "Sport Facility." Sport Facility. N.p., n.d. Web. 20 Oct. 2016. <http://www.jpnsport.go.jp/corp/english/activities/tabid/391/Default.aspx>.
Using this website we were able to get a more visual understanding of the area we would be working with. It allowed us to see the pre-existing stadium that is there. We were then able to discuss how we would modify this building to fit the needs for this project. We can see the way the acres are used up and make a new plan to make it more sustainable and environmentally friendly. By using this citation we could then make sketches and plan what we want the new and improved stadium to look like.

3. Williams, Casey. "This High-Tech Soccer Field Generates Its Own Electricity — From The Players." Huffington Post. N.p., n.d. Web. 20 Oct. 2016. <http://www.huffingtonpost.com/entry/pavegen-soccer-field-lagos-nigeria_us_569d467ae4b0778f46fa602c>

   This citation opened our eyes to a different way of creating energy and doing so in a sustainable way. This is harvesting energy with every step the players make while running on the field. This occurs with Pavegen tiles that are placed under the filed. These tiles will be generating energy during every game and be able to provide power to the grid because of this.

4. "Japan - Topography." Topography. Nations Encyopedia, n.d. Web. 20 Oct. 2016. <http://www.nationsencyclopedia.com/Asia-and-Oceania/Japan-TOPOGRAPHY.html>.
We looked at multiple site locations, including Shiba Park. If we used this site we would have to completely start from scratch and build from the ground. We realized in doing this we would be destroying a lot of the environment in the area. This article also describes all the obstacles because there are multiple mountains in the location. Shiba Park has public transportation which would reduce the amount of land that would need to be made into parking lots. This would be a sustainable alternative to using many acres of land for parking alone. Although, after reading the remaining of the article there are more cons than pros to building in a location that does not have a pre-existing building placed there.

5. "Earthquake Building Codes in Japan." Japan Property Central. N.p., 01 Aug. 2016. Web. 20 Oct. 2016. <http://japanpropertycentral.com/real-estate-faq/earthquake-building-codes-in-japan/>
Japan is prone to earthquakes and because of this it is important to have a structure that will outlast one of these natural disasters. This website informed us on the best way to support a building in preparation for an earthquake. We now have the knowledge of this and can be strategic in the planning of the architecture of our stadium.

6. "Tokyo Metropolitan Park Association | Parks in Tokyo Metropolitan." Tokyo Metropolitan Park Association | Parks in Tokyo Metropolitan. N.p., n.d. Web. 20 Oct. 2016. <http://www.tokyo-park.or.jp/english/park/detail_03.html#shiba>.
This website tells us more about our second location we were considering, Shiba Park. It shows a map of the park and all the features that go along with the park. From this we were able to see that the park is a great green space for the community. By building here we would inevitably be destroying a lot of green space and this is the opposite of what our goal is to be doing. There are a

few pros to this location but the cons outweigh them. Shiba Park should be preserved and not destroyed.