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Abstract

In the past the Olympic Games' sustainability of energy and protection of land were not the main focuses. Not until the 2012 games did the International Olympic Committee declare that the fourth and fifth pillars of the Olympic Games are to include sustainability to all parts of the Olympics, including buildings and transportation. We designed our LEED Platinum Basketball Stadium to make it a mix of modern and past Japanese architecture, as well as making it as environmentally friendly as possible. One of our biggest priorities when constructing the building was making sure that the buildings' temperature inside is a comfortable environment for both the audience and players at the event. We focused on Japanese culture when designing the project and we achieved that by meshing the land that we chose to build on with the stadium, creating a "one with nature" feel. Using the LEED v4 BC+D: New Construction and Major Renovation Project Checklist we were able to make our stadium LEED Platinum Certified by using materials we learned in class as well as any additional research needed.

Culture

Our stadium was modeled after Japanese culture so before any construction and design decisions we first learned a lot about the Japanese heritage. Because of our idea to mesh modern Japanese culture with past culture we had to learn the similarities and differences of each time period, architecturally and culturally. As for architecture there were vast differences from past and present buildings. Past architecture focused on very curvy and elegant buildings (Fig. 1), while modern architecture is glass buildings and technologically advanced houses that is very light in color (Fig. 2). We meshed these two aspects of modern and past architecture to keep the culture within the building by making the structure of the building large and oddly shaped to mimic past architecture while using a lot of glass to capture modern archeology and technology. Other things we looked at is the culture of the community and how they strive off of "taru wo Shiru" which is "What you have is all you need", "Omotenashi" which means "The spirit of selfless hospitality", and "Mottainai" meaning "Sense of avoiding waste". We incorporated these three Japanese lifestyles by making the stadium as green as possible by following the LEED v4 BC+D: New Construction and Major Renovation Project Checklist as well as meshing it

with the nature around it and making it feel welcome to guests not just from Japan but from around the world to capture the beauty of their culture.



Fig. 1: Past Japanese Architecture



Fig. 2: Modern Japanese Architecture

Demographics

Tokyo, Japan is a densely populated city with a lot going on. Designing our building for the Olympics, we had to take into account not only the demographics of the city but the demographics of the attending audience. Japan has a relatively old population according to the CIA World Fact Book. That being said, it is the Olympics so we needed to design for people of all ages. We are going to have a pretty even split of men and women attending the events at this stadium so we made sure to have entertainment for everyone, all ages and gender.

Topography

The land we built on previously was a large, flat field that was covered by a practice baseball field. We made sure that the lands area was massive so we can fit the facility without having to tear down any existing structure. As for the practice field we built on, there are baseball fields all around the city of

Tokyo so there will be a plethora of spots for these teams to practice when in Tokyo for the Olympic Games. The stadium is built right next to the Olympic Opening Ceremony Building as well as the Olympic Baseball Stadium which is a perfect location for the stadium because there will events going on all around our basketball stadium, attracting more people to go to the stadium and buy tickets for the basketball games. There are no natural habitats in the area so it was a good place to build since we didn't have to knock any trees down. Although that is a good thing, as we said earlier one of our main focuses was to mesh the land with the structure so we had to find different creative ways to do so.

Location and Transportation



Fig. 3: Location of Stadium (Longitude and Latitude: 35°40'17.07" N 139°43'1.00" E)

The location of our Basketball arena is in the center of Tokyo. Much like the Philadelphia, PA sports complex where the Philadelphia Eagles, Flyers, and 76ers all share stadium locations, we wanted to incorporate that idea into our design because of being located right next to Jingu Stadium (Olympic Baseball Stadium) and the Olympic Opening Ceremony Building. This idea will help with traffic flow, because there are already places to park so we will not have to incorporate many more parking lots. With these limited parking spots that we had to construct we wanted to make sure there was an environmentally friendly impact so we made spots with charging stations designated to electric cars. The location of the stadium allows us to have less parking as well because it is located right near a light rail stop. This is key for environmental purposes because there will be less emissions due to cars, creating a better carbon footprint of our stadium. We also put in plenty of bike racks on the outside of the building to encourage exercise and hopefully minimize the use of cars for transportation. That being said, we are in the middle of Tokyo City so there will be ways to get around town and back to the stadium through cabs, busses, or any other form of public transportation. As for the location, there is plenty to do around town for when there is no game

in action. There are plenty of Japanese Hibachi restaurants all around the area to grab a bite, many museums to walk through, shops, and much more entertainment for all ages and gender to enjoy and use to pass the time.

Climate

Tokyo, Japan's climate is much like the climate of the northeastern part of the United States. This means that the summers are hot and humid with heavier rainfall and the winters are cold and dry. Since we built for the Olympic Games we must build for the summer months, considering the games span all throughout August, the wettest and warmest month of the year in Tokyo. That being said, we implemented plenty of ways to keep everyone comfortable while inside and out when designing the building. The average wind speed monthly in Tokyo is very low, about three miles per hour on average, so we thought adding wind turbines to our design wasn't cost efficient for the energy being outputted by these turbines.

Sustainable Sites

By not having to knock down any structure or trees we are in a good sustainable position to build. We are not building on top of any structure that is very important to the culture of Tokyo City nor are we ridding of any wildlife that may have been on site. We chose this spot specifically so these environmental impacts would be limited. The thing we had to deal with most is the cleanup from construction of the new building

Water Efficiency

To reduce the amount of indoor water use we did several things. First off, we have a green roof hanging off the second story of our building. We will have any runoff from rain flow to the green roof so it can store the water. The water that is stored in the green roof will be collected and filtered and then used for functions in the stadium. We want the green roof to filter the water through pipes that run down the columns of the outside to an underground reservoir where all the water is stored. The main functions of the rain water runoff that we store is to use it for plumbing in the bathrooms and also for the irrigation of plants around the stadium. As for the men's rooms, we placed in non-flush urinals in so there is no waste water. Our final issue with waste water were the sinks in the bathrooms and kitchens. We put automatic faucets in the sinks in the bathrooms so people cannot leave the water on after washing their hands. As for the kitchens we decided that it would be too much of a hassle for the chefs to cook with automatic faucets so we designed them to have

regular sinks, which may leave room for extra waste water but in contrast will be easier for the employees to work with.

Energy and Atmosphere

Our most implemented form of green energy on our stadium is our use of solar panels. We wanted to make sure since the stadium will be in open land with not much blocking the sun that we wanted to put as many solar panels as possible. We decided to place them flat on the roof because with the slant on the roof and the way the sun moves that will be almost the optimal amount of sunlight. We placed a majority of the solar panels on the north side of the building because that will be where the solar panels will catch most of the peak sun hours.

Materials and Resources

We will limited the amount of resources going into the building by building on open land, meaning we didn't disturb any natural habitats. The stadium will be reusable as in it will be used for future events. The stadium will be the newest stadium in Tokyo so the Tokyo Apache, a professional Japanese Basketball Team, can use the stadium as their new home venue. The stadium can also be used for concerts and other events like that. After years of use and time for the stadium to no longer be in use, instead of the stadium being torn down it will be reconstructed. The stadium matches the culture fairly well so it will not be a nuisance to keep up and build over rather than completely destroy. We also reduced the amount of pollutants emitted from the stadium into the air as possible. We did this by; reducing the amount of lights that are present in the building as well as the types of lights, having all of our kitchens using natural gas instead of charcoal burning grills, having recycling bins all around the stadium, and using locally grown food in the kitchens and having local vendors. The one that is huge for reducing our emissions is using locally grown food and having local vendors. This will cut down on the carbon emissions due to the transportation of goods. When thinking about it, most of these foods would be transported from all over the world but if we can cut a majority of that down the carbon emissions that come off of planes and trucks that transport the goods will be significantly less.

Heat Control

The Olympics Games happen in the summer so when we designed the building we wanted to make sure that everyone was comfortable in temperature. We did this by using plenty of passive cooling and active cooling tools to make sure no one is too hot. The players are going to be running around and performing so we made sure temperatures in the

building are slightly lower than usual. We put in vents on the roof of the stadium so we could have natural ventilation to cool down the building. Some passive cooling tools we used were night flush cooling to cool the arena down during night with vents on the roof, high ceilings and open stairwells to create air flow in the stadium, smaller trees on the south side of the stadium for shading and larger trees and vegetation on the north, east, and west sides for natural shading, and a solar chimney on the roof to create vertical air flow. The reason we want smaller trees on the south side of the building is because in the winter we do not want these trees to block the sunlight blocking the heat from the sun. For the most part our exterior walls are glass so we had to make sure the glass we used didn't let in too much heat. We decided to use low-E Heat Reflective glass for our walls because we want to have as much lighting in as possible with the least amount of heat flow into the stadium. We knew that passive cooling wouldn't be enough for the building to stay comfortable for the whole time in use so we decided to put HVAC systems in the stadium as well. The HVAC systems will be on a temperature limit, so once the temperature hits a certain degree inside it will turn on and start cooling until it is cooled to that comfortable temperature.

Lighting

Lighting was one of the most key things we looked into when designing the building. We knew we wanted the stadium to be well lit but we also didn't want to put many lights in, creating more heat and using more energy than preferred. This is why we made all of the exterior walls in the hallways glass, except for the bottom floor because we don't want the natural light coming into the court and affecting the gameplay. Over the court we have flood lighting so there is a high distribution of light that shines. We placed enough floodlights over the court for regulation games to be played there. The light bulbs being put into the flood lights will be the high-pressure sodium bulbs because of how efficient they are. The various rooms inside of the stadium will be monitored by a motion sensor so whenever someone enters the room the lights will go on but if there is no motion after a minute passes the lights will turn off, creating lights that will be on only when needed. The light bulbs that are in the rooms are florescent because even though they may not have the most appealing light, they are energy efficient and do not give off as much heat as incandescent light bulbs. The scoreboards, advertisement strips, and backboard lights will all be LED lights. Because we have such a massive overhang from our first floor to our second, we will have lights hanging outside that will be more

for show so we made sure they fit into the culture of Japan.

Layout

Level 1:

Level 1 is where everyone enters and leaves the stadium. Because we designed it that way we made sure that there were sufficient amount of doors attached to the exterior walls so the flow rate of

people entering and leaving the stadium can remain high. Level 1 is where most of the action is happening in the building

LEED Analysis

Conclusion