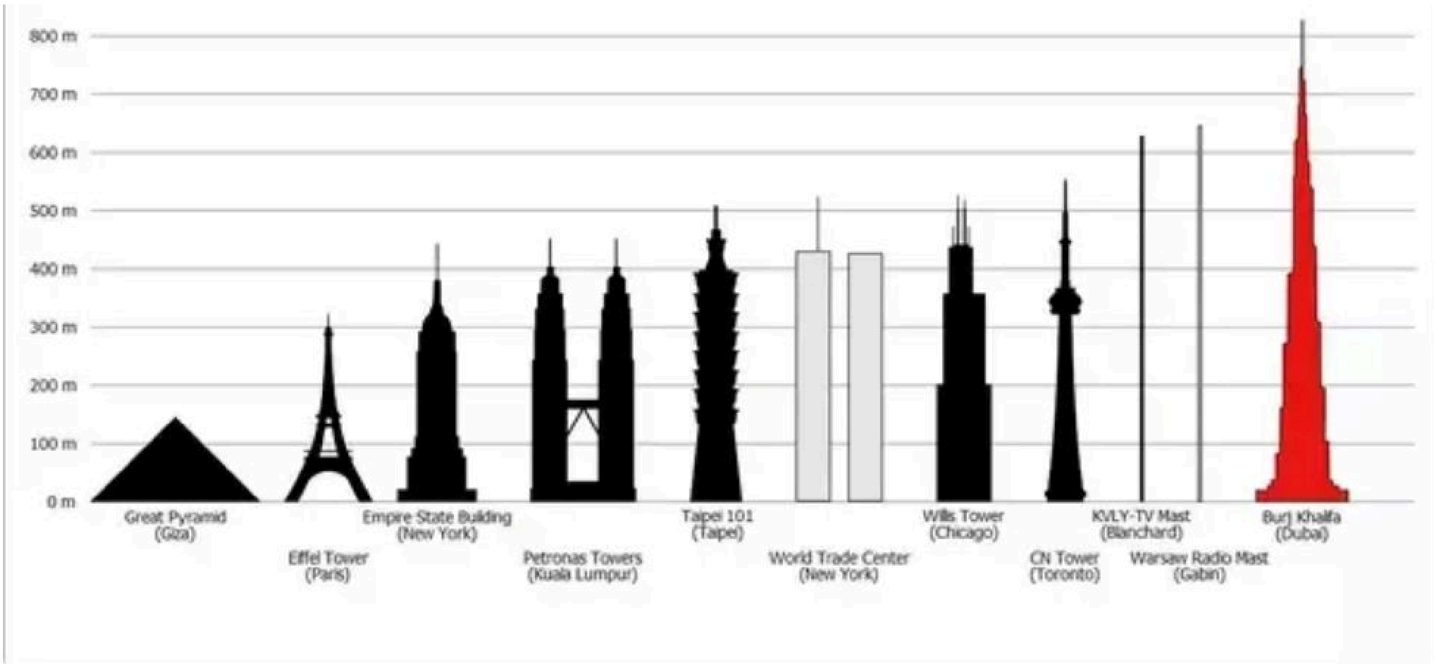
ID	7655
Name	USAMA
Subject	Architecture
Submitted to	Alina Babr
Date	24/04/20

Q1;

Ans;

I chose Burj Khalifa,

from United Arab Emirates based on it size and the game changer it is in construction industry. currently being tallest building of the world. It presented its own challeges with unique solutions to the same challanges. Some of them are as follows;



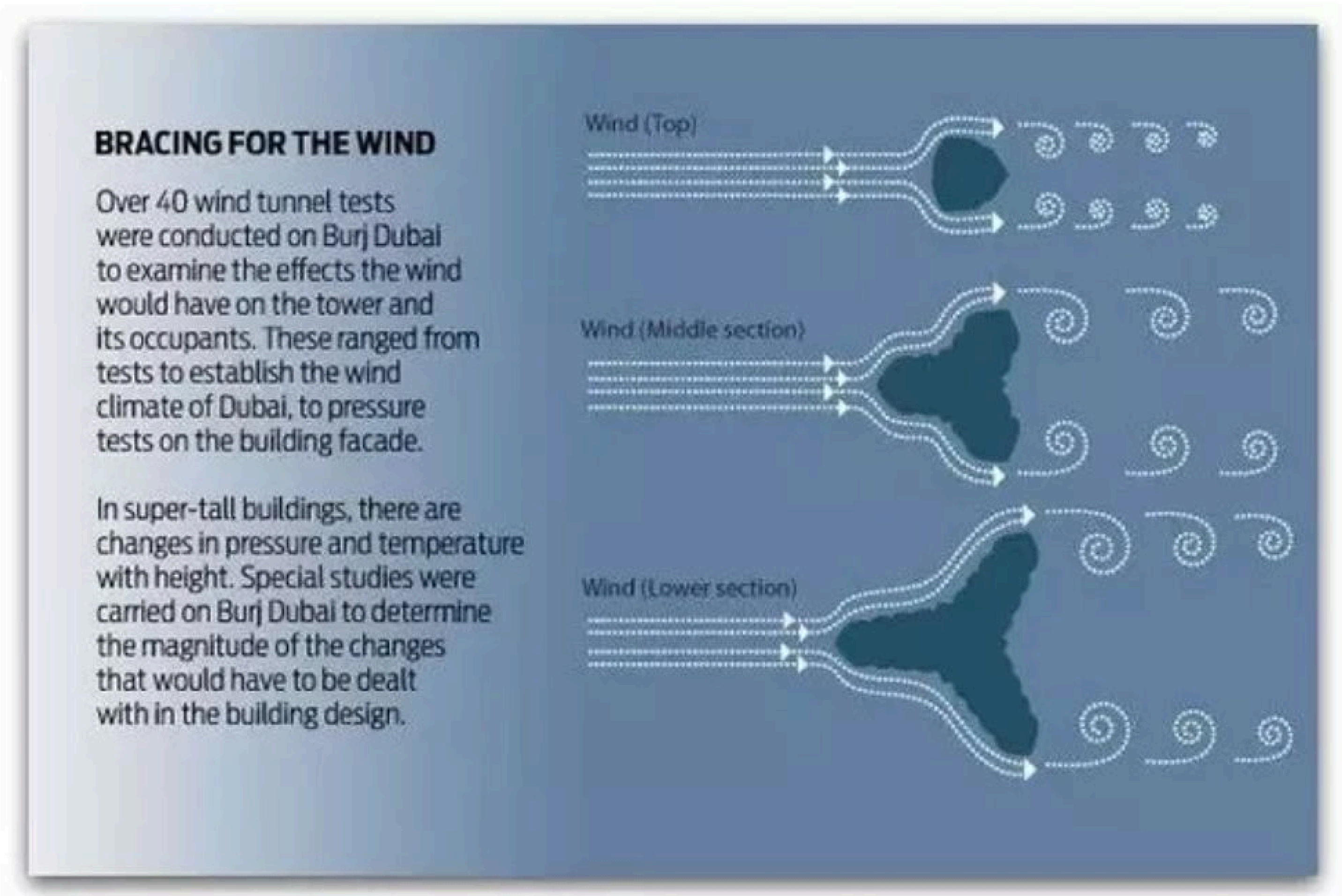
Challenges & Innovations

Building a skyscraper poses challenges that test the mind of any engineer. Burj Khalifa stands a whopping 2,723 feet in the air making it the tallest building in the world. However, this was not accomplished without overcoming several major engineering design obstacles. In order to design such a complex and outstanding structure, many records in physical accomplishments and innovations had to be shattered. The sheer height of the structure posed many challenges for engineers constructing the Burj Khalifa. These challenges caused engineers to think with great creativity and ingenuity to accomplish a truly remarkable feet. Here are some of the challenges and innovations that the designers of Burj Khalifa overcame and engineered:

WIND

As with any tall building, wind plays a major factor in the construction and design process. In order to begin building, the design team of Burj Khalifa conducted over 40 wind tunnel tests. These tests were intended to determine the behavior of the wind in Dubai itself and the amount of stress that the wind would place on the building. Structural analysis models were built in the computer to determine the pressure of the wind placed on the building and the reaction that the building would have to the specific climate of Dubai. These tests also included determining the challenges the wind would pose on the construction process itself. In order to build the Burj Khalifa, tower cranes were placed very high in the air, which obviously can be extremely dangerous. The wind tunnel tests ran before the construction helped to determine how to implement these cranes into the construction process.

Wind force on the tower was one of the critical stressors considered in the design and features implemented into the tower's structure. The overall shape of the tower if looking from above resembles the letter "Y"; this three-legged structure was engineer's solution for the intense wind conditions the tower would face. The center of the tower is a stiff hexagonal-shaped core. Each of the three wings of the structure is buttressed by the others through this central core. Engineers spent months in wind tunnels with scale models perfecting this "Y" shaped design. Wind could strike tower's structure. The overall shape of the tower if looking from above resembles the letter "Y"; this three-legged structure was engineer's solution for the intense wind conditions the tower would face. The center of the tower is a stiff hexagonal-shaped core. Each of the three wings of the structure is buttressed by the others through this central core. Engineers spent months in wind tunnels with scale models perfecting this "Y" shaped design. Wind could strike the tower from any one direction and the opposing leg of the "Y" would remain unstressed.

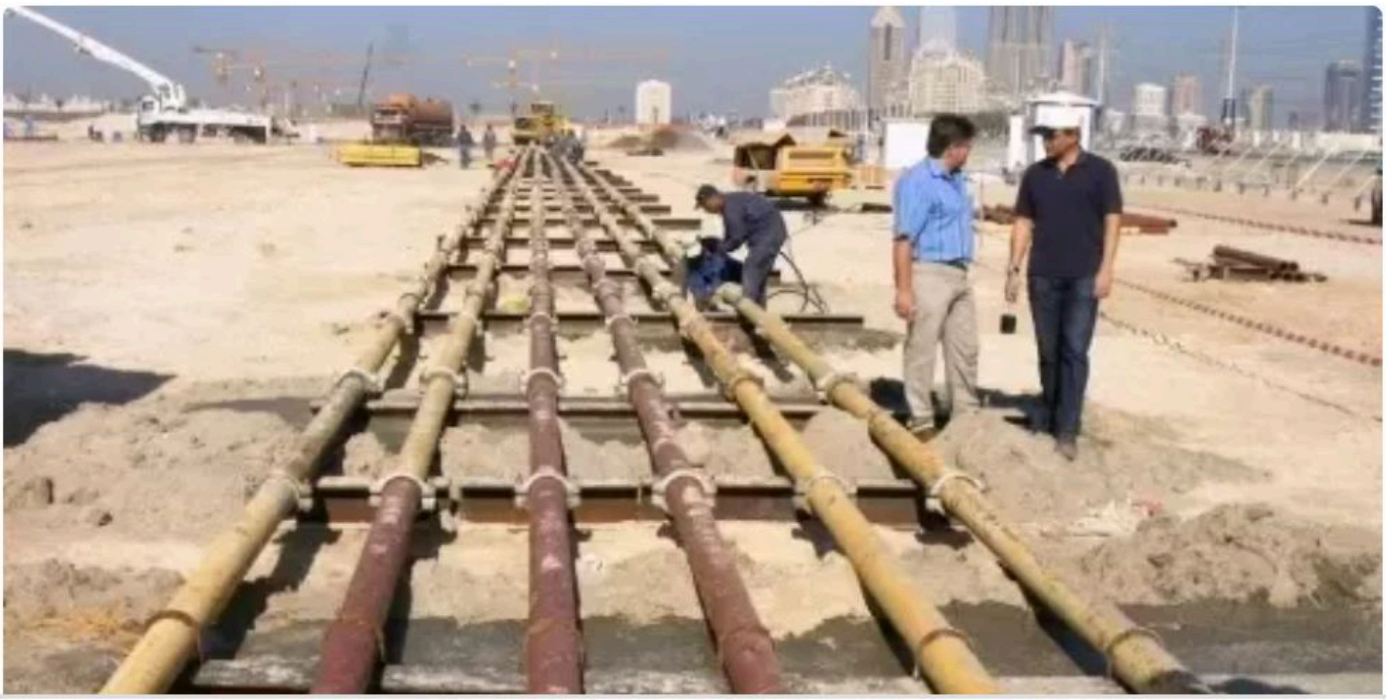


THE STACK EFFECT

The stack effect is a common problem in most high rise buildings and is also prevalent but less pronounced and dangerous in everyday buildings and houses. The stack effect is the movement of air into and out of buildings. Commonly, the warmer air is lighter and less dense than cold air. Therefore the warm air will rise to the top of the building while the cold air will try to fill the cracks in the bottom of the building. This is very pronounced in the winter. The problem this causes is that the pressure in the bottom can build up and can cause more cracking. This could be disastrous to a building as tall as Burj Khalifa. Cracks in the foundation could cause complete structural failure. To mitigate this effect, the designers of the building used several air duct systems to move the warm air out of the building. The stack effect cannot be completely eliminated however it can be mitigated and used as a ventilation system for the upper part of the building.

CONSTRUCTION

Common construction principles, such as laying concrete, applying façades, installing windows, etc. soon became feats of engineering themselves. Not only was the record of world's tallest building shattered, but many more construction-related records followed in similar fate. The task of laying concrete from ground level to heights soaring above 1600 feet had simply never been done before. To do this, engineers simulated the effects of pumping concrete to grand heights by testing concrete through horizontal pipes on the construction site. The effects of friction and volume flow were studied so researchers could estimate the pressure needed to pump concrete upwards of 1600 feet. Setting a world record in the process, engineers successfully used 80 MPa of pressure to pump concrete to a height of 1972 feet. This shattered the previous record of pumping to a height of 1542 feet at the Taipei tower in China.



Other records shattered include the installation of the tower's aluminum and glass façade. This had never been done at the heights of the Burj Khalifa and was a feat in itself. The combined weight of all the aluminum used on the tower surpasses that of five A380 aircraft. The panels were lifted using a series of cranes and installed by crews of hundreds of specialists. The glass used on the tower was often time handcrafted and installed one-by-one by a crew of skill workers. This had to be done because of the complex and variable design on the tower's upward progression.

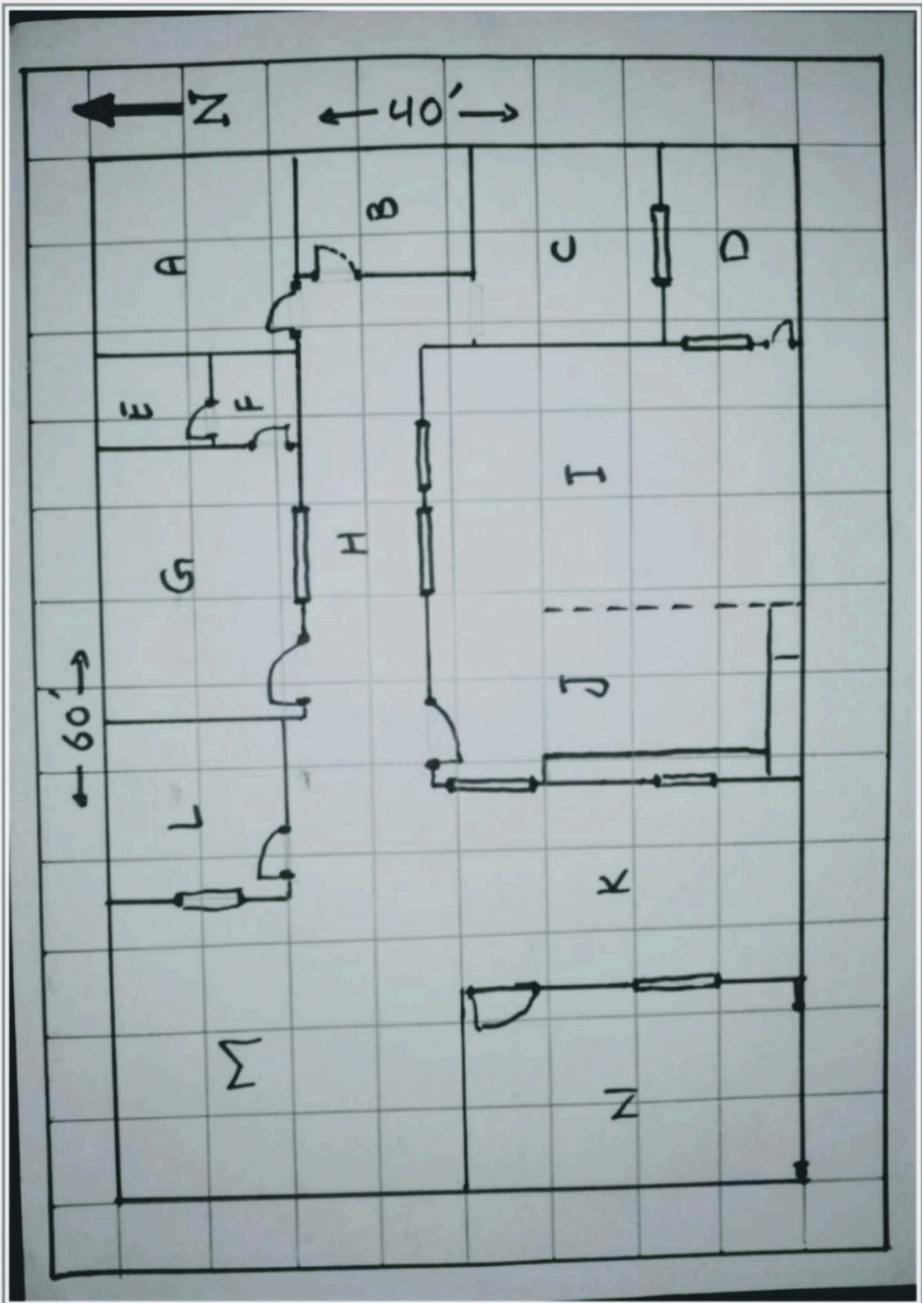
Although not new to skyscrapers, the use of data recording sensors on the tower is enormous. The scale of the network of sensors innovates how engineers understand the complexity behind the design and concrete structure. Starting from the foundation, these sensors were originally installed to monitor the weight of the building and its effect on the concrete as the structure grew taller. As construction progressed, these sensors became numerous and now give engineers the ability to scope how structures behave under immense pressures. This innovation allows engineers and analysts to turn this data into results that are able to be applied to structures of the future.

SAFETY DURING DISASTER

With a building of sheer proportion such as the Burj Khalifa which can facilitate up to 12,000 people at once, safety became a priority. One major problem prevalent in the Burj Khalifa is the ability to get to a place of safety during a fire or other disaster. It is completely unreasonable for a person to have to walk down 160 floors if there is a fire; therefore, the designers of Burj Khalifa implemented pressurized, air-conditioned refugee areas every 25 floors. An example of the Fire & Life Safety Plan for Level 42 of the tower can be seen below. The building also possesses a service elevator that can hold 5,500 kg and is the tallest in the world.

These are just a few to be named.

Question No 2:



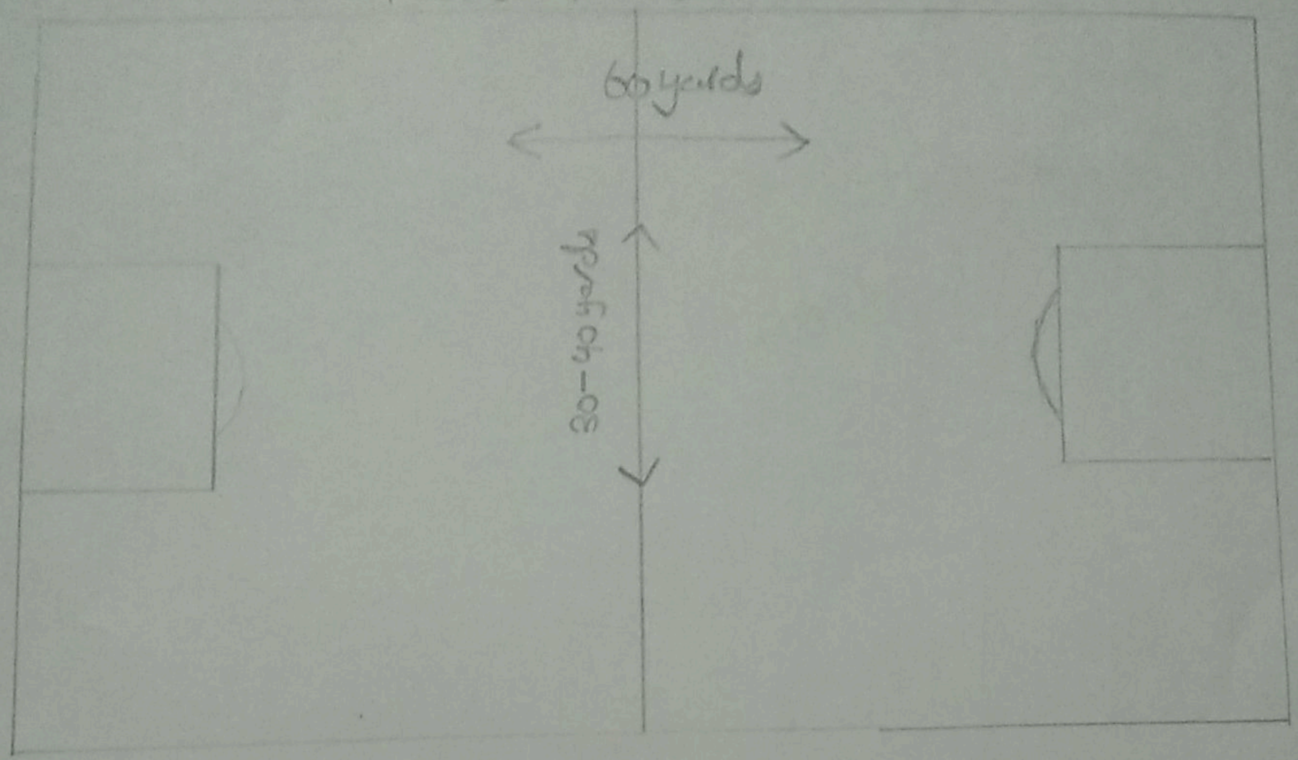
In the Design above the Alphabets represents the following;

A. Bedroom (12x12)= Here it should be safe from noice, Summer hot airs as well as bad smell of drainage.
B. Main Bathroom (10x6) = Here it is in between both rooms.
C. Bedroom (12x12)= Here it should be safe from noice, Summer hot airs as well as bad smell of drainage.
D. Open to Sky (8x12) = Provide fresh air and natural light for rooms and Living room.
E. Attached bath to Masterroom (6x5) .
F. Dressing room (6x5).
G. Masterroom (12x16) = Here it should be safe from noice, Summer hot airs as well as bad smell of drainage.
H. Cooridoor (6x29) = Provide easy excess to rooms as well as ventilation.
I. Livingroom and Dinningroom (22x15) . Here it is attached to Kitchen.
J. Kitchen (12x10) = Here it has an easy approch from Maindoor.
K. Verenda (22x8).
L. Store (10x8).
M. Lawn .
N. CarPorch (20x12).

Q3;
Ans;

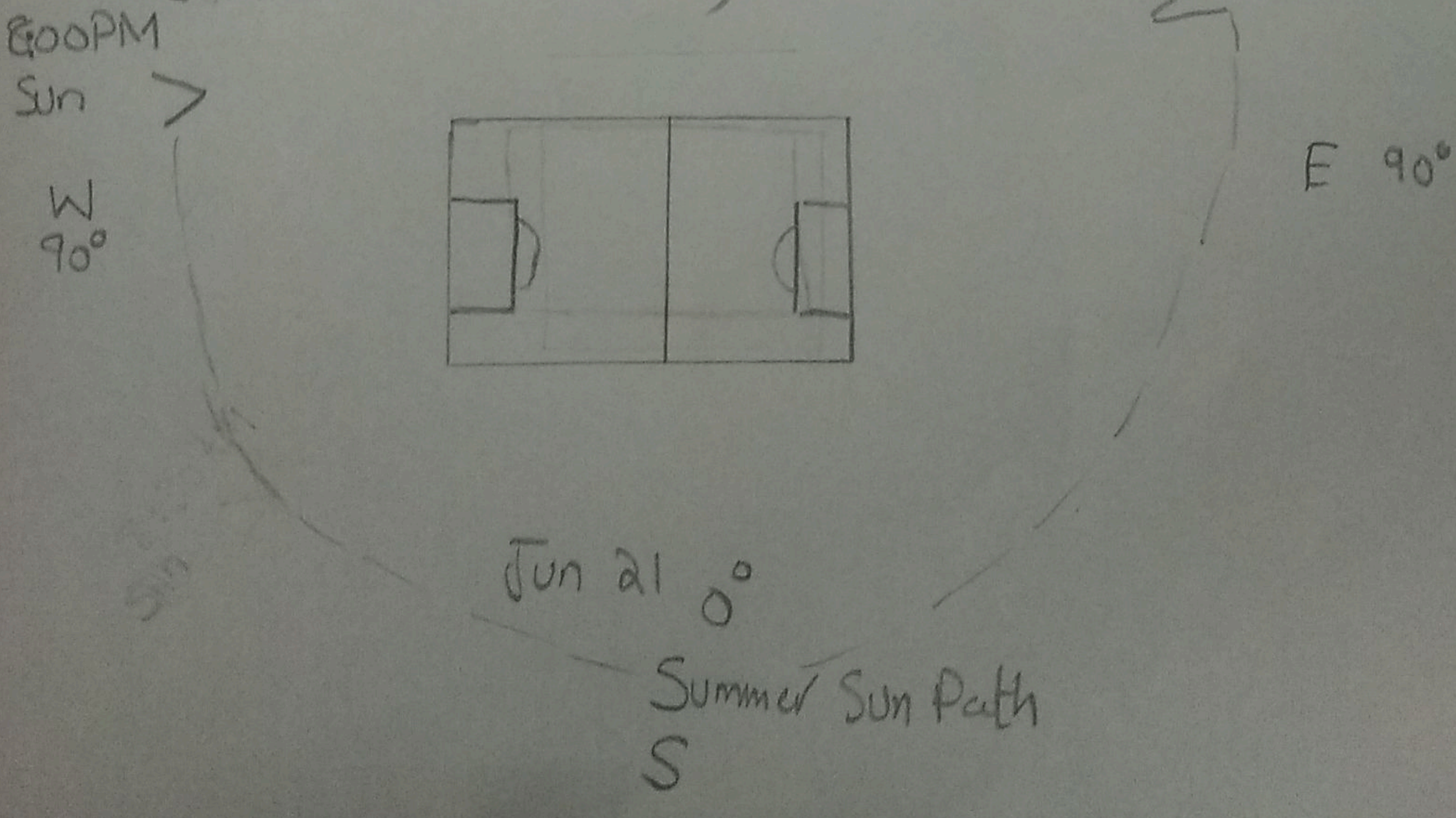
Solar Path Diagram on Football field;

Football field



→ Orientation of sun in winter and Summers

For Summer the orientation;



For

Winter the orientation becomes