

MULTI SPORTS INDOOR STADIUM

A THESIS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Architecture degree

By

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DEPARTMENT OF ARCHITECTURE
SCHOOL OF BUILDING AND ENVIRONMENT

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY (DEEMED TO BE UNIVERSITY)
Accredited with Grade "A++" by NAAC | 12B Status by UGC | Approved by AICTE
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BONAFIDE CERTIFICATE

This is to certify that Thesis Report is the bonafide work of **Sreeja (39210089)** who carried out the Thesis entitled "**Multi Sports Indoor Stadium**" under our supervision from December 2023 to May 2024.

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SREEJA J

THESIS SYNOPSIS

Indoor stadiums have become integral parts of urban infrastructure, facilitating a wide range of sports and entertainment events regardless of weather conditions. These structures, often marvels of modern engineering and architecture, provide controlled environments for both athletes and spectators, enhancing the overall experience and accessibility of events.

The concept of indoor stadiums can be traced back to ancient civilizations, where arenas and amphitheaters served as venues for public spectacles and sports. The advent of steel and reinforced concrete construction allowed for the creation of large, open spaces free from obstructive columns, paving the way for the multi-purpose arenas we see today.

One of the primary advantages of indoor stadiums is their multifunctionality. These venues can host a diverse array of events, from sports competitions like basketball, volleyball, and badminton to concerts, trade shows, and conventions. This versatility makes them valuable assets to their communities, attracting tourism, generating revenue, and providing spaces for local events and activities.

Indoor stadiums are emblematic of modern urban development, reflecting advances in architecture, technology, and sustainability. They provide versatile venues for a wide range of activities, contributing to the economic and social vitality of their communities. As cities continue to grow and evolve, the role of indoor stadiums is likely to become even more significant, offering spaces where people can come together, celebrate, and enjoy a variety of experiences regardless of the weather outside.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The current state of affairs has taken on such proportions that the sporting prowess of athletes representing a nation is regarded on par with the capabilities of the nation. Sports and games continue to occupy a higher status in people's minds, and an increasing number of sporting festivals and events are held. Because of this, every nation is eager to promote sports and games by expanding its athletic venues and hosting more competitions and festivals.

In order to create world-class athletes, it has become increasingly important to stay up to date with and maintain sporting facilities that accommodate changes and advancements due to advancements in science and technology, sports, and the ever-increasing competition in these domains. It also becomes essential to have athletic facilities that are accessible to the general public and to host competitions and festivals in order to inspire people and advance sports in the nation. Along with this come a variety of infrastructure amenities, all of which are warranted by the substantial benefits that come from having them, which span far into industries like trade, tourism, and industry.

The provision of athletic facilities entails unique limitations and issues that are unique to sports structures and distinct from other types of buildings in terms of nature, scale, and size. It also entails decisions on planning and design in addition to structural considerations. My decision to focus on this topic was influenced by both my strong interest in constructing sports facilities and the needs of the nation, particularly those of the newly formed state. Beginning with the idea of offering athletic facilities that would meet the needs of a particular sports facility or event that shall once and relations of the many groups together with the user requirements of each group in light of the facilities established, a variety of possibilities were tried out. So it

Physical needs

Food

Water

clothing

shelter

Health

Social needs

Education

Defence

Transportation

Laws

Games

Occupation

Trade

Family

Government

Money

Language

Psychological needs

Religion

Drama

Music

The project's main goals were to construct the national games' facilities, which would also be used to host other sports and events. These facilities would be situated in a way that makes them an essential component of the city. The amenities offered will be established with consideration for the currently available facilities and will have a single headquarters. In the event of the games, the project will also meet the athletes' and sportspeople's housing demands.

1.2 AIM

The primary aim of the multipurpose indoor stadium project is to create a versatile, state-of-the-art facility that caters to a wide range of sports, entertainment, and community events.

1.3 OBJECTIVE

The objectives of constructing a multipurpose indoor stadium are

1. Facilitate Diverse Sports Events
2. Enhance Cultural and Entertainment Offerings
3. Promote Community Engagement and Well-being
4. Boost Local Economy and Tourism
5. Incorporate Sustainable Practices
6. Ensure Accessibility and Inclusivity
7. Foster Innovation and Technological Advancement
8. Promote Long-term Viability and Flexibility

1.4 SCOPE OF THE PROJECT

.Purpose and Objectives: Define the primary and secondary purposes of the stadium (e.g., sports events, community events, concerts).

.Site Selection and Analysis: Evaluate potential sites for accessibility, size, environmental impact, and proximity to population centers.

.Design and Architectural Planning: Develop architectural designs including floor plans, elevations, and 3D models. Plan for flexible and multi-use spaces that can accommodate various sports and events. Include seating arrangements, locker rooms, restrooms, administrative offices, and other necessary facilities.

.Engineering and Structural Considerations: Plan the structural framework considering durability, sustainability, and resistance to natural disasters. Integrate advanced HVAC systems, lighting, and acoustics suitable for different events. Consider retractable roof options if applicable.

.Amenities and Facilities: Include provisions for concession stands, merchandise shops, and VIP areas.

.Safety and Security: Design for emergency exits, fire safety systems, and security protocols.

Implement surveillance systems and crowd management strategies.

1.5 NEED OF THE PROJECT

The need for a multi-sports indoor stadium is driven by several factors that highlight its importance to a community or region:

Year-Round Usage

An indoor stadium provides a venue for sports and events throughout the year, regardless of weather conditions. This ensures uninterrupted training and competition schedules for athletes.

Diverse Sporting Activities

It can accommodate a variety of sports such as basketball, volleyball, badminton, gymnastics, and indoor athletics, catering to different interests and increasing participation.

Community Engagement

The stadium serves as a hub for community activities, fostering a sense of community spirit and providing a space for social gatherings, cultural events, and recreational activities.

Health and Fitness

By offering a venue for regular physical activities, it promotes health and wellness among community members, encouraging a more active lifestyle.

Economic Impact

Hosting local, regional, and national events can boost the local economy through tourism, job creation, and business opportunities. This includes revenues from ticket sales, concessions, and accommodation for visitors.

Talent Development

Provides athletes with access to high-quality facilities for training and competition, aiding in the development of local talent and potentially leading to higher levels of performance and recognition.

Education and Youth Development

Schools and youth organizations can use the facility for physical education programs, sports leagues, and developmental camps, contributing to the overall growth and development of young people.

Versatility and Multi-Use

Beyond sports, the stadium can host concerts, trade shows, exhibitions, and other large-scale events, maximizing the use of the space and providing a versatile venue for various needs.

Accessibility

Indoor stadiums are designed to be accessible to all members of the community, including those with disabilities, ensuring inclusivity and equal opportunities for participation.

Infrastructure Improvement

Building such a facility can lead to improvements in local infrastructure, including transportation, utilities, and services, benefiting the wider community.

1.6 METHODOLOGY

CHAPTER 2

2.1 INTRODUCTION TO STADIUM

Stadium Architecture first originated in Ancient Greece and Rome where Social Interactions and Public Displays are highly valued. The Greeks utilized two structures, the stadium, and the hippodrome, which closely resemble modern-day stadiums, and the Romans had an Amphitheater and a Circus.

Greece

In Olympia, Greece, in the year 776 BC, Herakles inaugurated the Olympic Games in memory of his father Zeus. The genesis of the Olympic Games is based on myths and tales, like most of ancient history. One such myth states that Heracles walked 600 steps sequentially to ascertain the length of the track for the Olympic running competition. A "stadium" was the term given to this length, which measured roughly 192 meters. From this point on, the running competition and the location of the foot racetrack were both referred to as "stadiums".

Stadium: a 200-meter-long ancient Greek unit of measurement (originally the length of a stadium).

Hippodrome: a stadium for chariot or horse races.



Figure 1 Ancient Stadium at Olympia

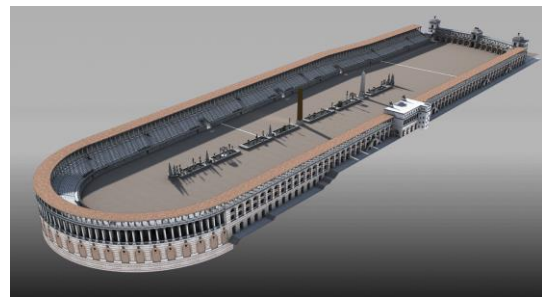


Figure 2 Hippodrome

Rome

The ancient Romans had a reputation for being aggressive and very interested in battle and public displays of might. The Romans created their first stadium-like building in the first century BC, called an amphitheater.

Amphitheater: Gladiatorial fights have been taking place in the Roman Forum from as early as 218 BC, with spectators watching from makeshift wooden platforms. When amphitheaters first appeared, they were distinguished by the arena's oval form and ascending seating tiers.

Circus: Similar to how the amphitheater evolved from Greek theater, the Roman circus tradition grew out of the hippodrome concept. The circus served as a venue for horse racing, just as the

hippodrome. The extended U-shape was used once more, but this time the open end was blocked off by structures. The stables for the horses and chariots were located within this entryway.



Figure 3 Roman Amphitheater



Figure 4 Roman Circus

Notable Roman Amphitheater in Ancient History

Colosseum:

The Flavian Amphitheater, often known as the Colosseum, was the most well-known amphitheater built by the Romans. Emperor Vespasian was in charge of organizing and beginning work on the Colosseum. From a political perspective, it is thought that this was done to demonstrate to the Roman populace that the emperor could give as well as take. The Colosseum is still regarded as one of Rome's finest works of art and as one of the best examples of how engineering, theater, and art can coexist. The construction of the four-story amphitheater, which started in AD 70, lasted 12 years.

The arena elliptical is supposed to have been 88 m by 55 m, while its exterior ellipse was 189 m by 155 m. Although only a portion of the construction is now standing, its overall height is estimated to be around 50 m. The Colosseum had an astounding 48,000 seats, which was more than any other amphitheater of its time and wasn't surpassed until the 20th century.

The Colosseum has a comprehensive basement and foundation design. Drains were installed 8 meters beneath the building, concrete foundations 12 meters beneath the outside walls, and seats increased to only 4 meters below the inner arena.



Figure 5 Colosseum (Ancient)



Figure 6 Colosseum (Present)

Colosseum Roof:

- The Colosseum could be covered, like other amphitheaters of the day, by draping a canvas canopy over the open top.
- The spectators were shielded from the elements and the sun's heat by this canvas known as the "velarium," which was made of sails.
- Two ship crews had to work together to prepare the nearly 24 tonnes of sails. Posts that protruded from the Amphitheater's roof lifted and secured the sails.
- Additionally, it is thought that the sails' ropes reached posts below the earth.
- **Velarium** -A Roman-era awning style was called a velarium. It covered the entirety of the cavea, which served as the amphitheater's shaded sitting area. In the Roman Empire, retractable awnings were rather widespread.



Figure 7 Colosseum with temporary Roof

Stadiums (5th-9th Century)

Middle Ages:

Religion dominated everyone's life during the Middle Ages, which spanned the 5th to the 15th century. Europe was overwhelmed by Christianity, and the church became the center of social attention. The church served as the focal point of daily life, and all technical and architectural effort was devoted to constructing new churches. The amphitheater at Arles was "transformed into a citadel with about 200 houses and a church inside it, built partly with stone from the amphitheater structure".

Renaissance:

Sports participation was revived throughout the Renaissance, which lasted from the 14th to the 17th century. In wide fields or town squares, running and equestrian competitions were reinstated. Although no permanent buildings were built, there were occasionally temporary stages and covered areas set up. The Piazza del Campo in Siena, the city's main plaza where the races were staged, serves as an illustration of this. Two times a year, horse races are still held at the Pallio di Siena. During the Renaissance, organized sports started to flourish as well. In the Piazza Santa Croce in Florence, a modern version of football was played with the sole objective of throwing the ball into the net of the other team.

19th Century:

In the 19th century, following the Industrial Revolution, both sports and the stadium as a physical structure saw enormous expansion. Different clubs and federations were created, and sports were adequately defined. Organized sport was originally welcomed with great enthusiasm in Great Britain, especially rugby and soccer. The Industrial Revolution enhanced structural technology at the same time as the number of fans increased, enabling the construction of stadiums that were suitable for certain sports.

20th Century

Renowned Olympic Stadiums (20th century)

1960-Rome

The 1960 Olympics in Rome were the first to have many stadiums, and while the larger venues were impressive, the smaller ones ended up being the most intriguing. The main stadium featured three layers of seats, a straightforward oval form, and no roof. Overall, it had a lot of similarities with earlier stadium designs. The smaller, by Pier Luigi Nervi-designed Palazzo dello Sport and Palazzetto dello Sport, constructions were more intriguing.

There are 16,000 seats available in the Marcello Piacentini-designed Palazzo dello Sport. The arena is circular in form, completely enclosed, and has no inside columns, allowing for unimpeded views of the events going place. The same architect who created the main stadium also created the second building, the Palazzetto dello Sport (Figure 9). This arena is circular, completely enclosed, and column-free, similar to the Palazzo, but with a lesser capacity of only 5,000 people. The concrete domed top of this arena is one of its unique features. On 36 precast perimeter supports, the building's concrete shell roof is supported.



Figure 8 Palazzetto dello Sport

1964-Tokyo

Tokyo used the same strategy of dispersing events over many locations as Rome. Two of the smaller venues that have achieved international reputation were created by the Japanese architect Kenzo Tange. The swimming arena, which can accommodate 9,000 standing and 4,000 seated spectators, is supported by a suspension ceiling made of steel cables strung from a single tall pole around its circumference. A semi-rigid ceiling structure made of concrete panels that were suspended from the cables gave the arena a natural appearance. This roof structure was cutting-edge for its time and was the product of several experiments, models, and material research.



Figure 9 Yoyogi National Gymnasium

2.2 STADIUM TYPES

Multipurpose Stadium:

These multipurpose venues can accommodate a range of sporting activities, such as American and association football, baseball, soccer, concerts, and other entertainment events. They may be set up to accommodate the needs of various sports and competitions.

Baseball Stadiums:

These baseball-specific stadiums include a special diamond-shaped field and seating layouts that are ideal for baseball games.

Football Stadiums:

These stadiums, which are mostly used for American football, have a rectangular field and seating configurations that provide for the best possible sight of football matches.

Soccer Stadiums (Football Stadiums):

These stadiums, which are designed specifically for soccer (association football), include a rectangular pitch and seats for the optimum viewing of soccer games.

Basketball Arenas:

These indoor basketball arenas include a rectangular court and seating arrangements that provide a close-knit experience for basketball spectators.

Hockey Arenas:

Ice rinks and seating configurations that provide for a clear view of the action are features of indoor locations created especially for ice hockey games.

Rugby Stadiums:

These stadiums are designed for rugby matches, with a rectangular pitch and rugby-specific seating.

Cricket Stadiums:

These stadiums, which are intended for cricket matches, include a circular or oval pitch with markings unique to cricket and seating configurations for spectators.

Tennis Stadiums:

Tennis courts with seating configurations appropriate for tournaments and retractable roofs are commonly created for tennis matches.

Athletics Stadiums:

These stadiums, which were primarily constructed for track and field competitions, are equipped for a number of other sports, including throwing ranges, leaping pits, and running tracks.

Motor Racing Circuits:

These facilities include a track layout ideal for high-speed racing with spectator seating all around the track, and they are built for motorsport events like Formula 1, NASCAR, or MotoGP.

Amphitheaters:

For live performances, concerts, and cultural events, outdoor venues with a stage and seats are available.

Indoor Arenas:

Indoor facilities with a variety of uses, such as those for concerts, basketball, ice hockey, wrestling, and other entertainment events.

Aquatic Centers:

Designed with specific pool amenities and seats for swimming, diving, water polo, and other aquatic activities.

Velodromes:

Cycling-specific circular tracks with sharply banked bends for high-speed competition.

CHAPTER 3

STANDARDS

3.1 BASKETBALL

The playing area of a basketball court in the UK is 91.8ft (28m) in length and 49.21ft (15m) wide. Indoor courts should be 22.96ft (7m) in height.

Sport England's requirements are split into four levels of play: International, Premier (national competition), Club (regional competition) and Community (schools/recreational). This allows courts to be more flexible with sizes. The dimensions of a basketball court in these cases also include a minimum length and width: 85.3ft (26m) x 45.93ft (14m).

Court aspect	Dimensions
Length (International)	28m
Width (International)	15m
Height (International)	7m
Length (other levels)	26-28m
Width (other levels)	14-15m
Height (other levels)	7m

The length of a basketball court is 28m. These measurements can be reduced to 26m for Premier, Club and Community courts where only smaller spaces are available.

The width of an International-standard basketball court in the UK is usually 15m. The court lines can be reduced by no more than 1m (14m) if required for lower levels of play.

The total area of a professional basketball court is 420m². The minimum area allowed under Basketball England's guidance is 364m². These measurements apply to both indoor and outdoor courts.

Sidelines

The outer edge of the court is denoted by the sidelines, which run the length of the court. On a full-sized court they measure 28m.

Baseline and endline

The terms baseline and endline both refer to the ends of the court running behind the goals. Typically they measure 15m.

The use of the different terms depends on the direction a team is playing. Endline is the term for the end of the court which a team is defending, baseline is the for the attacking end.

Mid court

This is the halfway mark on the court and is used to denote the offensive playing area during a game.

On a full-sized court, the mid court line would be 14m from each endline.

Centre circle

Used for the opening tip off, the centre circle has a 3.6m diameter.

Three point line

The three point lines are the arcs that mark a range boundary from each hoop. Scoring from outside this line is worth three points. The distance of the line will vary depending on the level of game, but is typically 6.75m from the basket.

Free throw line

The free throw line, marked 4.6m from the backboard, is the mark at which a player must stand when shooting free throws.

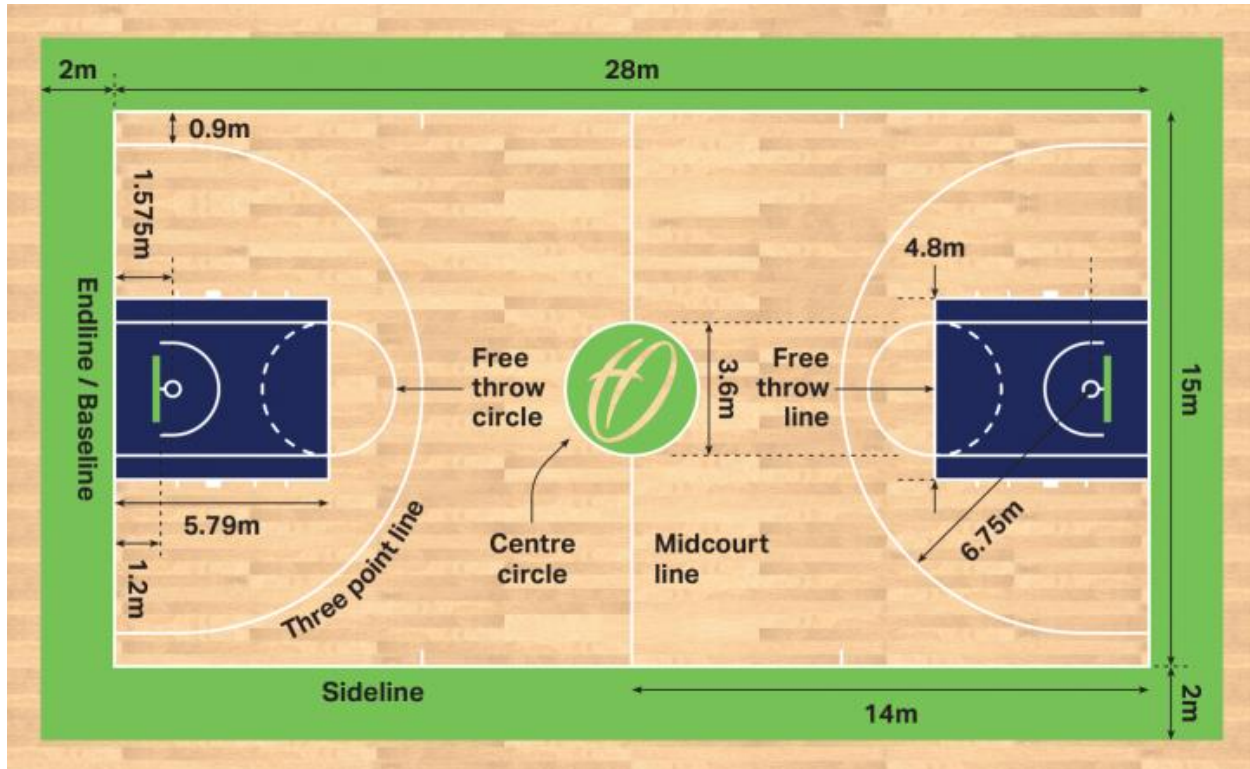
Free throw circle

The free throw circle is the same size as the centre circle (3.6m in diameter). Shooters must stay inside this circle when taking a free throw. The circle is also used for jump balls.

Free throw lane lines/key

Lane lines run from the free throw line to the baseline, to form the 'key'. The shape and width can vary depending on the level of the game, but FIBA (International Basketball Federation) regulation changes in 2010 set it as a 4.9m by 5.8m rectangle.

Some also include space markings to keep opposing players from obstructing the free throw shooter.



3.2 VOLLEYBALL

The three basic parameters to analyse how many feet is a volleyball court:

Length and Width of the Field: The volleyball court measures 18 meters (59 feet) in length, stretching between opposing end lines. Its width spans 9 meters (29.5 feet), extending from one sideline to its counterpart.

Clearance Height: The volleyball court must have sufficient overhead space for seamless gameplay. In indoor settings, the ceiling height of a volleyball court should reach a minimum of 7 meters (23 feet). On the contrary, the outdoor courts must have an unobstructed sky to prevent disruptions.

The Free Zone: The free zone is the space around the court that needs to be clear without anything blocking it. It extends at least 3 meters (9.8 feet) from all the sides and ends of

the court. This area allows players to move safely on the field without bumping into team players or spectators.

Volleyball court dimensions in metres:

Court: 18 meters long and 9 metres wide

Center: 9 m × 9 m halves by a one-metre

Top of the net: 2.43 metres

Center line: 5 metres

Serving Arena: 3 metres

Height And Placement of the Net

The net's position is one of the most vital foundations of a volleyball court that acts as a partition between the two teams. Its height and placement are standardized by the authorities to provide fair gameplay.

Standard Net Height: For men's volleyball, the standard net height is 2.43 meters, measured from the court centre. In contrast, women's volleyball sets the net at 2.24 meters high. The net must be firm enough to keep the ball from going underneath but not overly tight to avoid affecting the game.

Net Placement: The net is vertically placed at the centre of the court, dividing the court into equal halves. The sides of the net are firmly attached to sturdy posts, maintaining an even playing field for both teams.

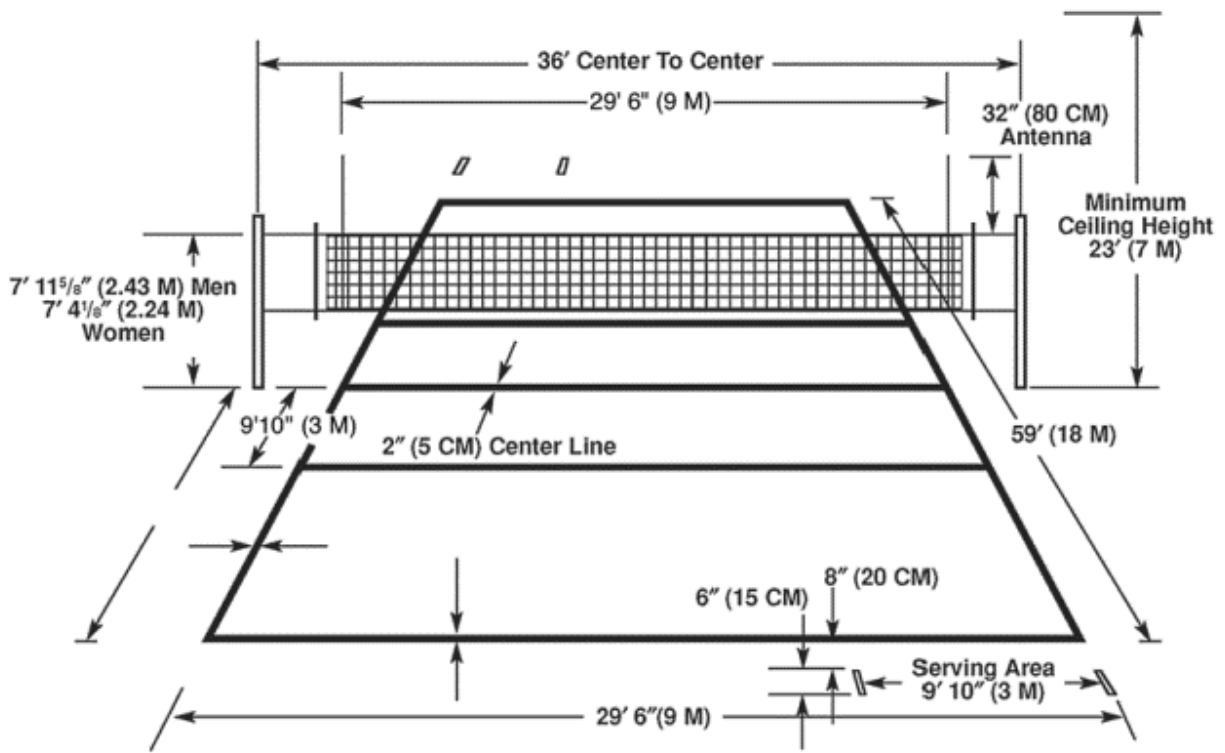
Boundary Lines And Markings: Distinct boundary lines are drawn on the court to show different play zones. These lines consist of end, sidelines, attack, and centre lines. Each line has a unique role in the game, helping players know where to stand and move on the court.

End Lines: Running lengthwise along the court, the end lines indicate the boundaries at both ends. They show where the ball can be served and where it must land for fair gameplay.

Sidelines: The sidelines run horizontally across the court's width, marking the edges on both sides. They decide whether a ball is within play when it crosses these lines.

Centreline: The centreline separates the court into two equal parts and goes under the net. It acts as a guide for players, indicating where to stand and move on the court.

Attack Lines: The attack lines are positioned 3 meters (9.8 feet) away from the centerline on both sides. These lines prevent players from hitting or attacking the ball when standing close to the net, ensuring a level playing field and safety.



3.3 BADMINTON

Court dimensions

The badminton court is 13.4m long and 6.1m wide. For singles the court is marked 5.18m wide.

The lines marking out the court are easily distinguishable and coloured white or yellow. The lines are 40mm wide.

A court may be marked out for singles only. The back boundary lines also become the long service lines and the posts or the strips of material representing them are placed on the side lines.

The diagonal full length of the full court is 14.366m.

Posts

The posts are 1.55m high from the surface of the court and remain vertical when the net is strained.

The posts are placed on the double side lines irrespective of whether singles or doubles

3.4 BOXING

The ring and canvas size

For all AIBA Competitions, the ring is 6.10m square inside the line of the ropes. The size of the apron extends 85cm outside the line of the ropes on each side, including additional canvas necessary to tighten and secure it. The height of the ring is 100cm from the ground.

Platform and corner pads

The platform is 7.80m squared, level and free from any obstructing projection. It is fitted with four corner posts with 4 corner pads to prevent injury to the boxers.

Corner pads are arranged as follows:

In the near left side corner – red.

In the far left side corner – white.

In the far right side corner – blue.

In the near right side corner – white.

Surface of the ring floor

The floor is covered with felt, rubber or other suitably approved material that is soft in quality and elasticity. It is not be less than 1.5cm and no more than 2.0cm thick. The canvas is made of non-slip material and covers the entire platform. The canvas is coloured Pantone blue 299.

Ropes

The ring includes four separate ropes, 4cm thick, on each side of the corner posts.

The heights of the 4 ropes are 40cm, 70cm, 100cm and 130cm from the canvas. The ropes are covered by a thick padding.

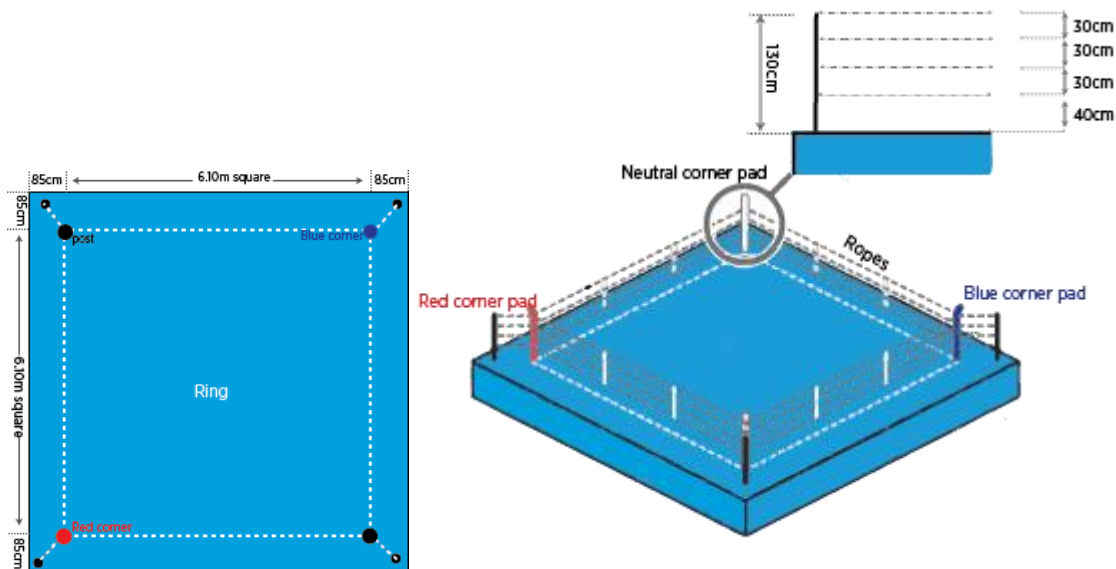
The ropes are joined on each side of the ring, at equal intervals, by two pieces of material 3-4cm wide.

These two pieces are similar in texture to the canvas and must not slide along the rope.

The tension of each section of the top two ropes is tight and the bottom two sections is not too tight.

Steps

There are three sets of steps to the ring, two sets at opposite corners for the use of boxers and support staff and one set of steps in another corner for the use of the referee and ringside physician.



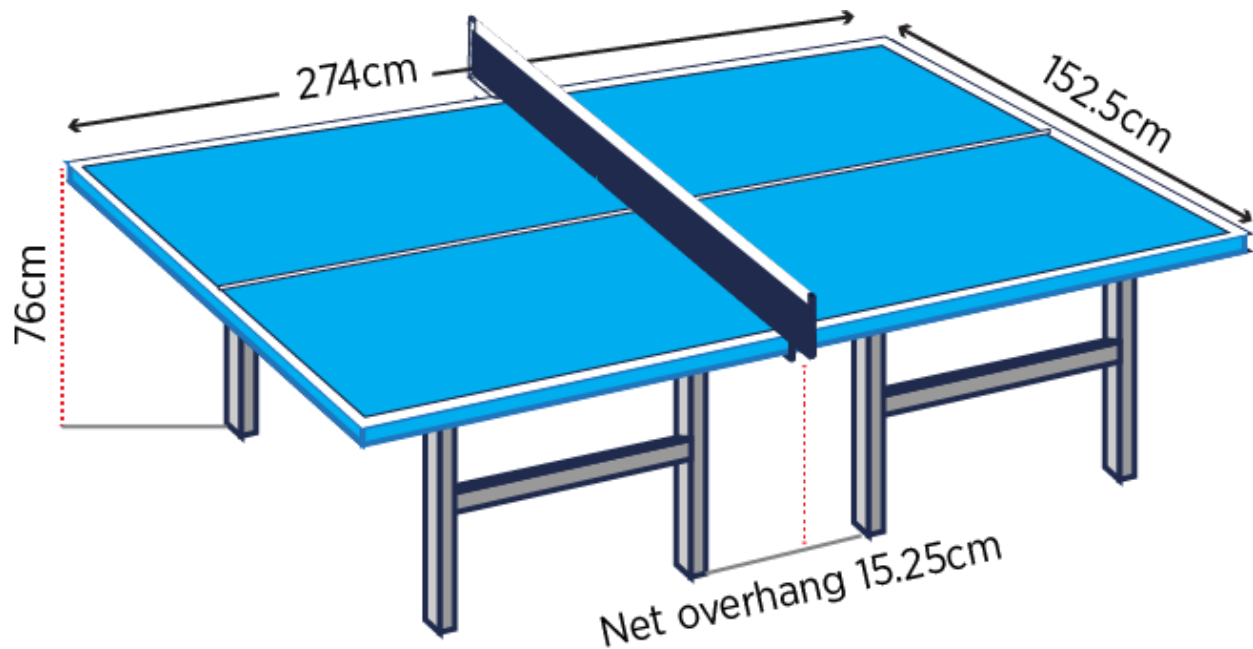
3.5 TABLE TENNIS

The table

The upper surface of the table, known as the playing surface, is 2.74m long and 1.525m wide and is horizontal 76cm above the floor. The playing surface does not include the vertical sides of the tabletop. The playing surface yields a uniform bounce of about 23cm when a standard ball is dropped on to it from a height of 30cm. The playing surface is a matte surface and dark coloured. There is a white side line, 2cm wide, along each 2.74m edge and a white end line, 2cm wide, along each 1.525m edge. The playing surface is divided into two equal courts by a vertical net parallel to the end lines. For doubles, each court is divided into two equal half courts by a white centre line, 3mm wide, running parallel with the side lines. The centre line forms part of each right half court.

The net assembly

The net assembly includes the net, its suspension and the supporting posts, including the clamps attaching them to the table. The net is suspended by a cord attached at each end to an upright post 15.25cm high. The outside limits of the post are 15.25cm outside the side line. The top of the net is 15.25cm above the playing surface. The bottom of the net, along its whole length, is as close as possible to the playing surface. The ends of the net are attached to the supporting posts from top to bottom.



CHAPTER 4

TYPES OF ROOF STRUCTURES IN STADIUMS

1. FORM ACTIVE
2. VECTOR ACTIVE
3. SURFACE ACTIVE
4. RETRACTABLE

4.1 FORM ACTIVE

Form Active

Form Active structures are those in which the form or geometry of the structure carries the loads. These are sometimes referred to as adaptable mechanical structures since they may mechanically modify their shape in accordance with changes in the environment.

FORM ACTIVE STRUCTURAL SYSTEM TYPES:

- Cable Structures
- Tent Structures

- Pneumatic Structures
- Arch Structures

Cable Structures

Cable structures, also known as cable-supported structures, are architectural and engineering designs that rely on tensioned cables to provide structural support for various types of buildings and structures. These cable systems have a distinctive and eye-catching look while also providing practical benefits such as large spans, flexibility, and minimal use of traditional support columns.

Cable Structure Types:

- Cable Suspended Roof
- Cable-Stayed Roof

Cable Suspended Roof:

A roof supported by wires directly carries the roof's weight. There are two variants on these principal circumstances where the roof deck is supported directly on the cable and cases where additional loads, such as ceiling frames, are suspended directly from and below the cable.

Cable-Stayed Roof:

Steel cables extending downward from masts above the roof's surface support the cable-stayed roof from above. To form the bicycle-wheel ceiling, two layers of tension cables come from an inner tension ring and an outer compression ring, both of which are supported by columns.



Cable Suspended Roof



Cable Stayed Roof

Tent Structures

A tent typically a form of shelter that is constructed of cloth or other materials that are draped over or fastened to a framework composed of rods or cables. Some tent designs are free-standing, while others require ropes to be fixed into the ground.

Tent Structures Types:

- Saddle Roofing
- Mast Supported Roofing
- Arch Supported
- Combinations

Saddle Roofing:

Using four or more points, the fabric expands among a sequence of oscillating lows and highs.

Mast Supported Roofing:

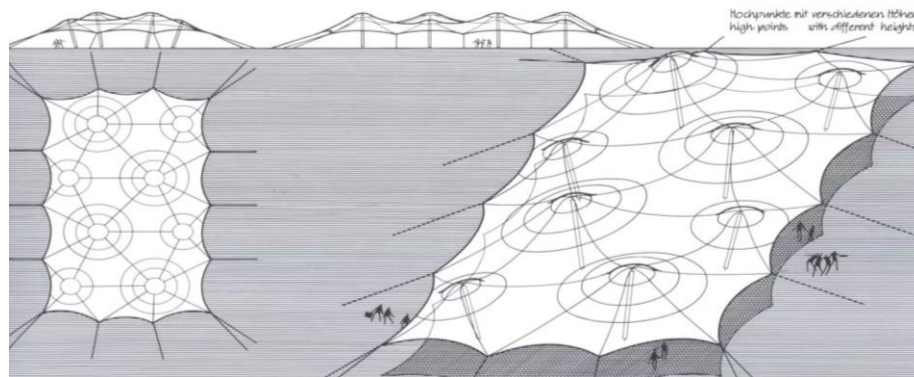
Mast-supported structures often contain a peak or peaks supported by either internal or exterior masts, giving them a tent-like appearance.

Arch Supported:

The primary supporting parts are curved compression members, while cross arches are employed for lateral stability.

Combinations:

It is a combination of several forms of support.



TENSILE ROOF

Pneumatic Structures

Pneumatic structures are those that offer enclosed spaces and structural support using air pressure. These structures are renowned for their adaptability, lightweight, and suitability for a variety of uses. Pneumatic structures can be temporary, semi-permanent, or permanent structure.

Pneumatic Structure Types:

- Air Supported Structures
- Air Inflated Structures

Air Supported Structures:

The envelope is supported by air pressure higher than the atmospheric pressure, and airlocks or revolving doors maintain the internal pressure. Air must be constantly provided. Air Supported Structures have a life span of 20-25 years. To stop the leak, they are either secured to the ground or to a wall. They are quite inexpensive, and installation is simple.

Air Inflated Structures:

Supporting frames are made of highly pressurized air. The structure's interior pressure is maintained at atmospheric pressure. The quantity and size of openings are not constrained. They could be able to sustain an attached structure.



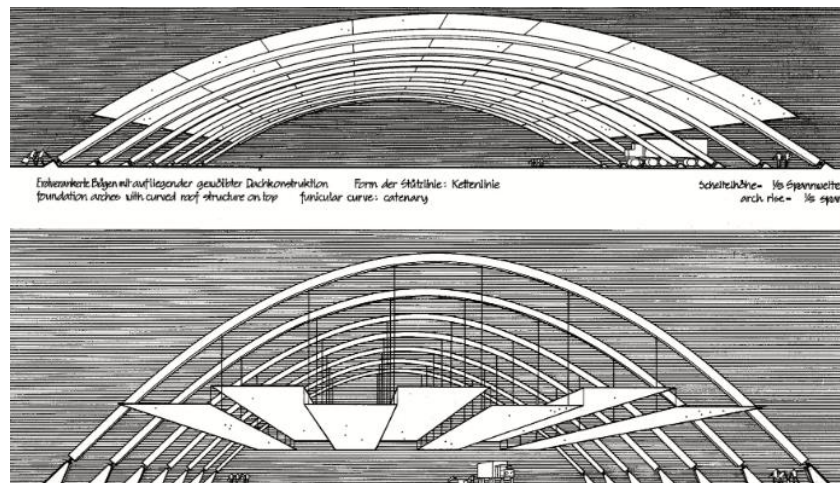
Air Supported Structures



Air Inflated Structures

Arch Structures

Arch structures are based on the arch principle, which is a curving structural element that spans an open area and generally bears loads by axial compression. Arch constructions are well-known for their strength, stability, and aesthetic appeal.



Arch Structures

3.2 VECTOR ACTIVE

Vector Active structural systems are made up of brief, sturdy, flat linear portions that can split a single force into many directions to apply tension or compression to different parts of the structure. Compressive members and tensile members in a triangular assembly form a stable composition that transmits loads over long distances without any intermediate support.

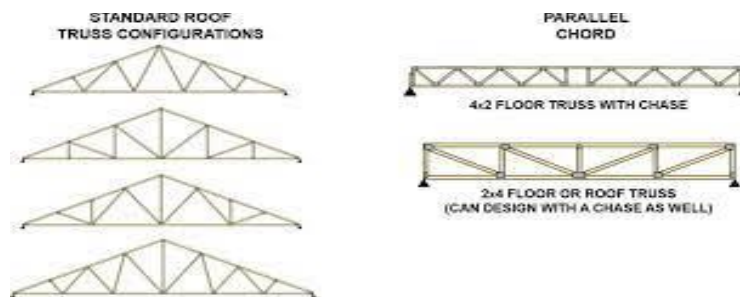
VECTOR ACTIVE STRUCTURAL SYSTEM TYPES:

- Flat Truss

- Curved Truss
- Space Frame Structures

Flat Truss

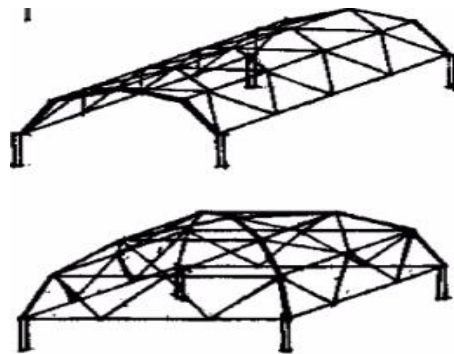
A flat truss is a structural framework designed to support a flat or nearly level roof. These trusses are widely employed in a variety of construction applications, including residential, commercial, and industrial structures. They play an important role in the stability and load-bearing capability of flat or low-slope roof systems.



Flat Truss

Curved Truss

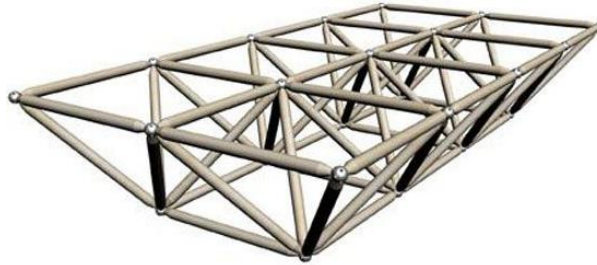
A curved truss is a structural framework or collection of curved or arched truss components. Because they can span enormous expanses and provide distinctive architectural features, curved trusses are popular.



Curved Truss

Space Frame Structures

A space frame, also known as a space structure, is a lightweight, rigid structure that resembles a truss and is made of geometrically arranged, interconnecting struts. Large-span sections with minimal interior supports can also benefit from the utilization of space frame constructions.



Space Frame Structures

4.3 SURFACE ACTIVE

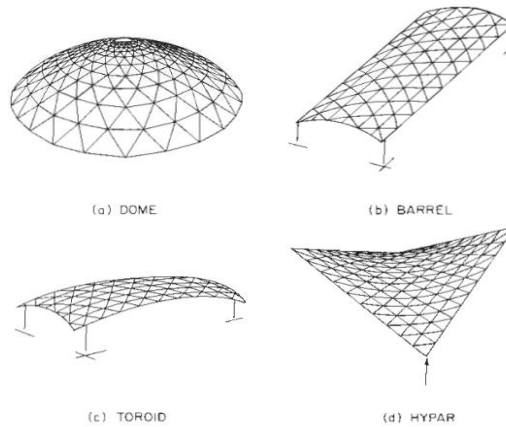
A geometric system defines the span both inside and externally. Here, a huge span of the weight is supported by a few small parts.

SURFACE-ACTIVE STRUCTURAL SYSTEM TYPES:

- Shell structures.
- Folded Plate Structures
- Hybrid Structures

Shell Structures

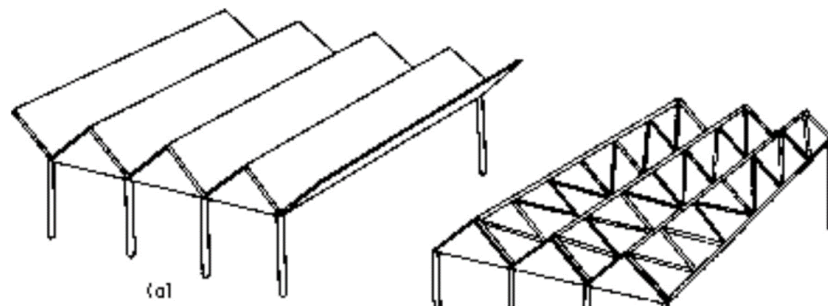
To transmit applied forces, stresses such as shear, tensile, and compression operating on the surface plane are employed to build thin, curved plate structures called shell structures.



Shell Structures

Folded Plate Structures

A folded structure is made up of several flat plates that are linked at the top along their edges and are inclined in various directions. This kind of construction is advantageous since it can handle loads without the need for extra support beams.



Folded Plate Structures

Hybrid Structures

A hybrid structure is a combination of one or two structural systems.

4.4 RETRACTABLE STRUCTURAL SYSTEMS

Retractable roof structures are implemented in stadiums and athletic venues to allow the execution of numerous activities within the building regardless of weather conditions, allowing the playing surface to be used for a variety of purposes. Different types of retractable roof structures with

varying opening and shutting frequencies have developed as a result of design, construction, use, and maintenance considerations.

The following are the frequency-based retractable roof structures types:

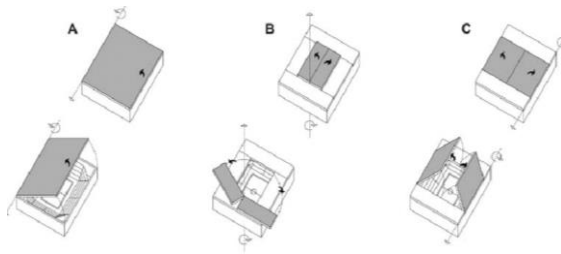
1. Roof structures that can be opened and closed twice a year. (Mostly utilized in smaller structures for indoor events, while the open roof is only used on rare occasions)
2. Roof structures that are retractable and can be opened and closed as needed. (This design is utilized for bigger structures that hold outdoor events and only sometimes retract the roof structure due to bad weather)
3. Roof structures that can be opened and closed on a regular basis. (The roof opens and shuts on a monthly, weekly, daily, or multiple times per day basis, even when activities are taking place)

The following are the retractable roof structures types based on the structure of its movable and immovable components:

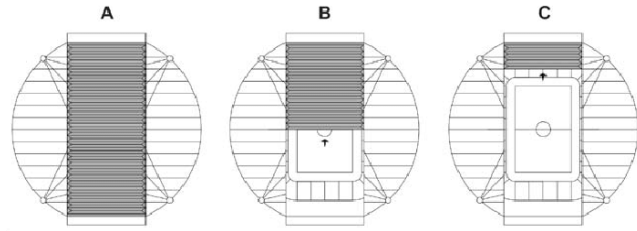
1. Roof Structures made of rigid elements.
2. Roof Structures made of membranes.
3. Roof structures that combine several components.

The following are the retractable roof structures types based on the movement type:

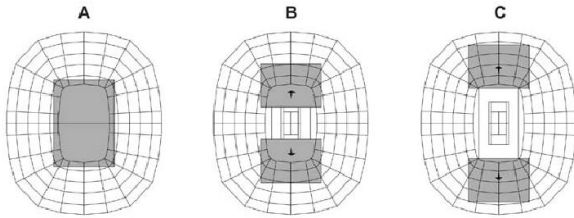
1. With Rotating System.
2. With Folding System.
3. With Sliding System.
4. With Lifting System.
5. With Expandable System.
6. With Combined System.



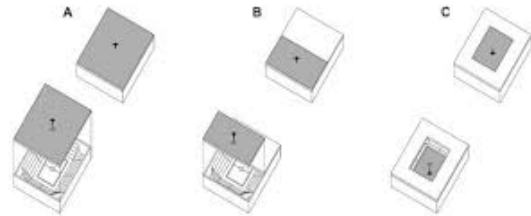
Rotating System



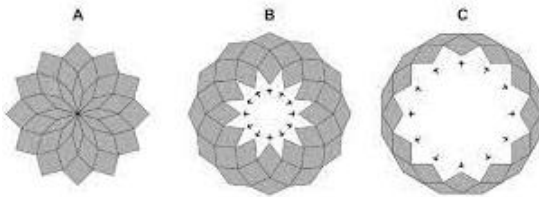
Folding System



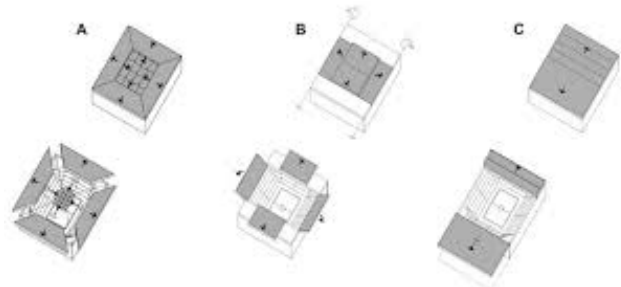
Sliding System



Lifting System



Expandable System



Combined System

CASE STUDIES

A. J

TRANSTADIA EKA ARENA.

-CASE STUDY



LOCATION: AHMEDABAD
AREA: 100,000 SQFT
DESCRIPTION: SPORTS ARENA
ARCHITECT: HOLMES & MILLER

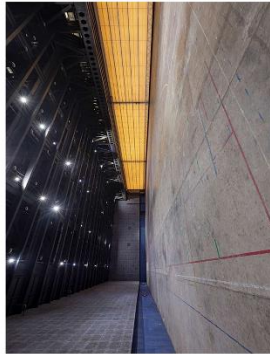
EKA ARENA BY TRANSTADIA OR SIMPLY EKA ARENA IS A MULTIPURPOSE STADIUM IN AHMEDABAD, GUJARAT, LOCATED IN KANKARIA LAKE. IT HAS A CAPACITY OF OVER 25,000 PEOPLE IN THE OUTDOOR AND OVER 5,000 IN THE INDOOR ARENA AND A FIFA STANDARD FOOTBALL PITCH. IT IS CONSIDERED TO ASIA'S BIGGEST AND INDIA'S FIRST CONVERTIBLE



TENNIS COURT



GYM



INDOOR ARENA

AUDIENCE SEATINGS

HOSPITALITY BOXES:
 14 HOSPITALITY BOXES
 OVERLOOKING PITCH WHICH
 CAN BE CONVERTED TO
 GUEST ROOMS

INDOOR ARENA:
 ENCOMPASSING AN IMPRESSIVE 32000 SQ. FT., WITH DIMENSIONS OF 18 M X 38 M X 41 FT., IT SERVES AS A DYNAMIC HUB FOR DIVERSE EVENTS, FROM SPORTING SPECTACLES LIKE PRO-KABADDI AND PRO-BADMINTON LEAGUES TO CULTURAL EXTRAVAGANZAS LIKE LIVE CONCERTS AND EXHIBITIONS. THIS SPACE, EQUIPPED WITH T-BOXES SEATING TECHNOLOGY, ADAPTS EFFORTLESSLY.



SWIMMING POOL

STADIUM ARENA CONVENTION CENTRE:
 PILLARLESS FACILITY FOR HOSTING EVENTS, CONVERTIBLE IN 6 MINUTES.
PRICE:
 CAPACITY-
 EVENTS-3000PAX
 BANQUET-2000PAX
 2 MAJOR ACCESS POINTS

SWIMMING POOL:
 SWIMMING POOL IS IN THE 5TH FLOOR WHICH HAS THE VIEW OF FOOTBALL STADIUM.

LOUNGE/TENNIS COURT:
 EKA LOUNGE WITH TERRACE GARDEN, TENNIS COURT IS IN THE 11TH FLOOR OF THE ARENA.

BANQUET 1 CAPACITY: 450PAX
BANQUET 2 CAPACITY: 300PAX
BANQUET 3 CAPACITY: 200PAX



T ZONE BADMINTON COURT

MULTIPLE BANQUETING FACILITIES:
 EKA LOUNGE WITH TERRACE GARDEN, TENNIS COURT IS IN THE 11TH FLOOR OF THE ARENA.



THE ARENA HAS SIX ACCESS POINTS AND TEN EMERGENCY EXITS

T BOX:
 .THE LOWER TIER ON ALL FOUR SIDES OF THE ARENA USE 8,852 T-BOX SEATS.
 .DURING NON MATCH DAYS, THIS SPACE IS USED FOR TENNIS, VOLLEYBALL AND BASKETBALL COURTS

VEER SAWARKAR SPORTS COMPLEX..

-LIVE CASE STUDY



LOCATION: AHMEDABAD
AREA: 8500 SQ.M
DESCRIPTION: SPORTS COMPLEX
ARCHITECT: ARYA ARCHITECTS

VEER SAWARKAR SPORTS COMPLEX IS LOCATED IN THE EASTERN PART OF AHMEDABAD, WHICH IS LARGELY AN INDUSTRIAL AREA WITH DEFUNCT TEXTILE MILLS. THE PROGRAM EVENTUALLY INCLUDED A CHILDREN'S CRECHE, A RESTAURANT, A LIBRARY, AN INTERNET CAFE, AN AUDITORIUM, SOME CONFERRING, AN AMPHITHEATRE AND A PUBLIC GARDEN.



FIRST FLOOR PLAN

- G.F. LEGEND:**
1. PLAZA
 2. PARKING
 3. ARRIVAL PORCH
 4. RECEPTION
 5. LIBRARY
 6. AY. ROOM
 7. AUDITORIUM
 8. PAVILION
 9. SQUASH COURT
 10. CAFE
 11. MED ROOM
 12. BADMINTON
 13. AMPHITHEATER
 14. LAUN TENNIS
 15. VOLLEY BALL
 16. BASKET BALL
 17. JOGGING TRACK
 18. PLAY AREA
 19. CLASHING POOL
 20. SWIMMING POOL
 21. CHANGING ROOM

- F.F. LEGEND:**
1. STAGE
 2. VIP AREA
 3. WAITING AREA
 4. VIP LOUNGE
 5. OFFICES
 6. ELEVATORS
 7. GYMNASIUM
 8. BOARD GAMES
 9. CHANGING ROOMS
 10. RESTAURANT

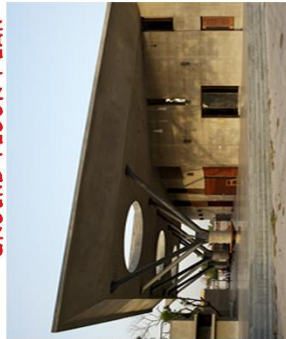
INDOOR
 OUTDOOR



TABLE TENNIS



SWIMMING POOL



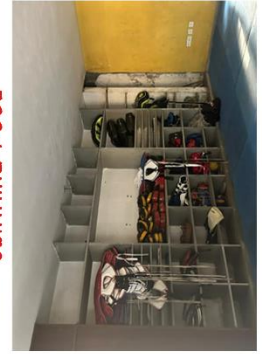
ENTRANCE Foyer



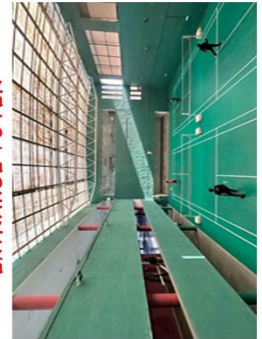
BILLIARDS



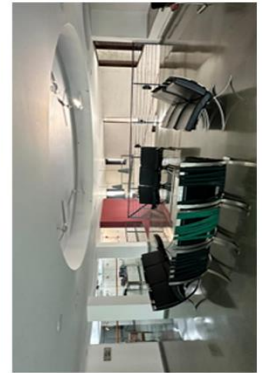
GYM



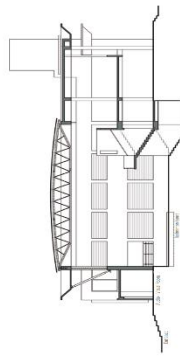
STORAGE



BADMINTON COURT

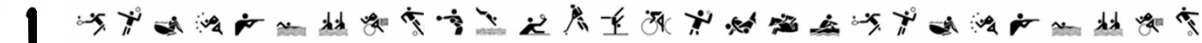


WAITING LOUNGE



SECTION

39210089-00EEJA.J



SPORTS HAVE A LONG HISTORY IN INDIA.THERE ARE MANY SPORTS ENTHUSIASTS IN INDIA WHO PLAY AND PRACTICE FOR THE LOVE OF SPORTS AND ASPIRE TO MAKE SPORTS THEIR CAREER AND PLAY FOR THE COUNTRY.SPORTS LIKE EDUCATION AND POLITICS IS ONEOF THE MOST SOCIALE ACTIVITIES IN THE WORLD,BRINGING PEOPLE FROM ALL OVER THE WORLD TOGETHER DURING COMPETITIONS.



Why?

A MULTI-SPORTS INDOOR STADIUM IS A VERSATILE FACILITY DESIGNED TO HOST VARIOUS SPORTING EVENTS AND ACTIVITIES UNDER ONE ROOF. THESE STADIUMS TYPICALLY FEATURE A LARGE, OPEN SPACE THAT CAN BE CONFIGURED TO ACCOMMODATE DIFFERENT SPORTS SUCH AS BASKETBALL, VOLLEYBALL, BADMINTON, TENNIS, AND MORE.



TENNIS:
TENNIS IS AN UPCOMING AND A WELL KNOWN SPORT .



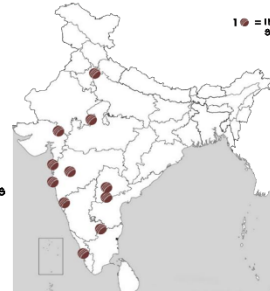
KABADDI:
THE SECOND MOST POPULAR SPORT IN INDIA KABADDI THE STATE SPORT OF TAMIL NADU



BOXING:
WELL KNOWN SPORT IN CHENNAI



KARATE
THE POPULARITY OF KARATE IN INDIA HAS BEEN GROWING STEADILY, OF ALL AGES



10 = INDOOR STADIUMS.



TENNIS:
TENNIS IS AN UPCOMING AND A WELL KNOWN SPORT .



WEIGHT LIFTING
INDIA HAS PRODUCED NOTABLE WEIGHTLIFTERS IN STATES LIKE KERALA ,TAMIL NADU.



VOLLEYBALL
THE SPORT IS POPULAR IN STATES LIKE KERALA ,TAMIL NADU.



BADMINTON
INDIA HAS PRODUCED SEVERAL WORLD CLASS BADMINTONS



TABLE TENNIS
A SPORT WITH BRIGHT FUTURE IN INDIA

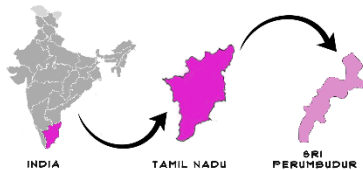
AS SEEN IN THE MAP THERE ARE VERY LESS INDOOR STADIUMS IN INDIA.SO THERE IS A NEED OF INDOOR STADIUM IN INDIA THERE ARE MANY STADIUMS IN TAMIL NADU WHEREAS VERY LESS INDOOR STADIUMS.

WHY MULTI SPORTS INDOOR STADIUM IN SRI PERUMBUDUR ?

THE ESTABLISHMENT OF A MULTI-SPORTS INDOOR STADIUM IN SRI PERUMBUDUR IS A STRATEGIC MOVE AIMED AT FOSTERING THE HOLISTIC DEVELOPMENT OF SPORTS INFRASTRUCTURE WITHIN THE REGION.

SRI PERUMBUDUR, SITUATED IN THE INDIAN STATE OF TAMIL NADU, HAS EMERGED AS A SIGNIFICANT HUB FOR VARIOUS ECONOMIC ACTIVITIES, INCLUDING MANUFACTURING AND COMMERCE.

HOWEVER, THE IMPERATIVE TO NURTURE SPORTING EXCELLENCE AND PROVIDE AVENUES FOR ATHLETIC PURSUITS IS EQUALLY VITAL FOR THE COMPREHENSIVE GROWTH AND SOCIETAL WELL-BEING OF ITS POPULACE.



LOCATION: SRI PERUMBUDUR
SITE AREA: 28 ACRES
LATITUDE AND LONGITUDE:12.941533, 79.922864

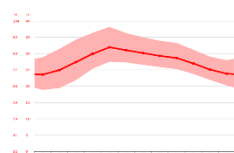
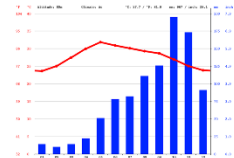
CHENNAI AIRPORT- 45KMS

BUS STOP- 10 M

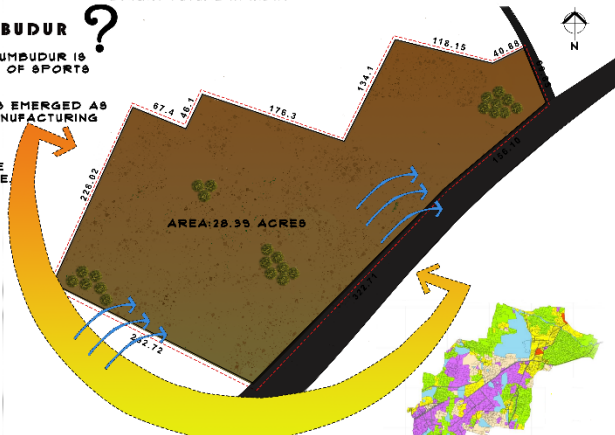
RAILWAY STATION- 15 KM

MAJOR WATER SOURCE: CHEMBARABAKAM RIVER

SOIL-CLAY SOIL

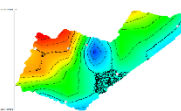


THE LEAST AMOUNT OF RAINFALL OCCURS IN FEBRUARY. THE HIGHEST AMOUNT OF PRECIPITATION OCCURS DURING THE MONTH OF OCTOBER.



LANDUSE MAP

THE SITE IS IN MAIN ROAD AND EASILY ACCESSIBLE AND HAS GOOD VIEWS. THE SITE HAS A VERY GOOD VIEW. MIXED LANDUSE



CONTOUR MAP

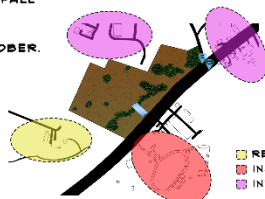
THE BLUE ZONE IS THE LOW LYING POINT, RED ZONE IS THE HIGHEST POINT AND THE GREEN ZONE IS THE MODERATE POINT

S THE SITE IS LOCATED IN THE HIGHWAYS AS IT IS EASILY ACCESSIBLE

W THE SITE IS LOCATED IN THE HIGHWAYS WHICH HAS MORE TRAFFIC AND POLLUTION.

O THE SITE IS LOCATED IN THE HIGHWAYS WHICH HAS MORE TRAFFIC AND POLLUTION.

T TRAFFIC ZONE



RESIDENTIAL
INSTITUTIONAL
INDUSTRIAL



MULTI SPORTS INDOOR STADIUM

39210083-SREEJA.J BATCH 2019-24

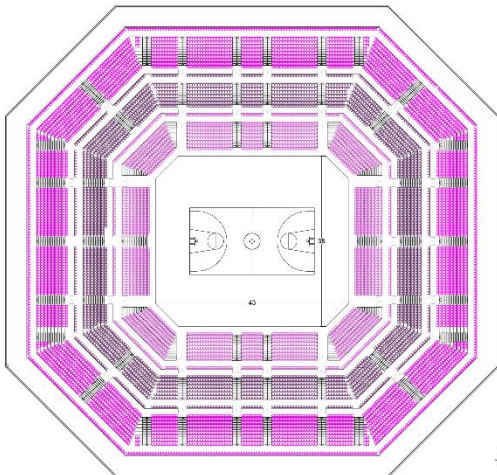
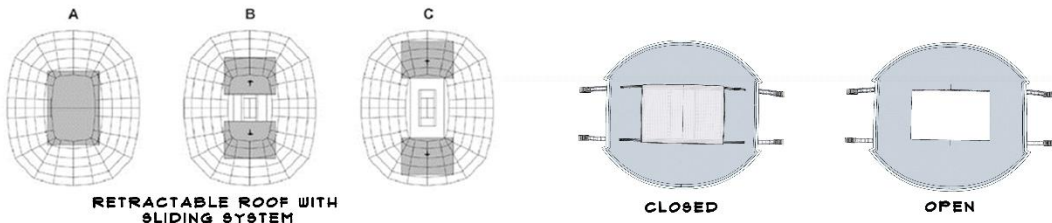
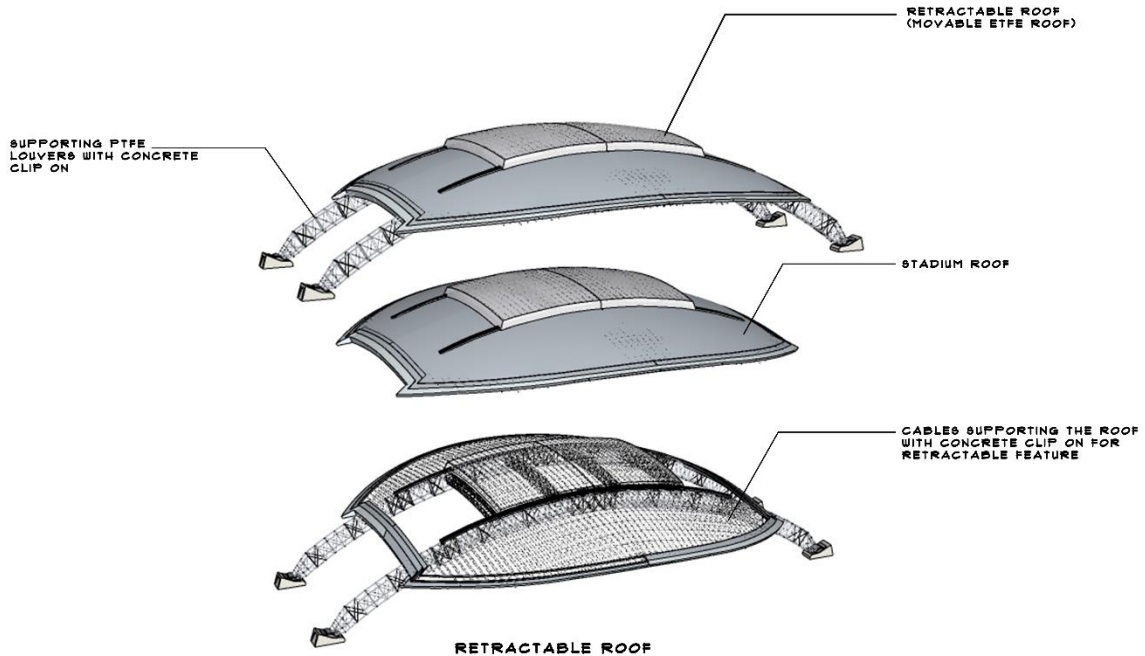
CHAPTER 6

DRAWINGS

Architectural drawings serve as essential communication tools in the design and construction process, providing visual representations of building designs, layouts, and specifications. From conceptual sketches to detailed construction documents, architectural drawings play a crucial role in conveying design intent, documenting project requirements, and guiding the realization of architectural visions.

This introductory overview explores the diverse types, purposes, and elements of architectural drawings, highlighting their significance in the architectural profession and the built environment. By delving into the fundamentals of architectural drawing, this overview aims to provide a foundational understanding of how drawings are used to communicate ideas, convey information, and facilitate collaboration among stakeholders in the architectural industry.

Through an exploration of key concepts, techniques, and applications, this overview will demonstrate the importance of architectural drawings in shaping the form, function, and aesthetics of built structures. From hand-drawn sketches to computer-generated renderings, architectural drawings serve as a medium for creativity, innovation, and problem-solving in the field of architecture.



FIRST TIER SEATINGS-2122 SEATINGS
SECOND TIER SEATINGS-2660 SEATINGS
THIRD TIER SEATINGS-4191 SEATINGS
TEMPERORAY-100 SEATINGS
TOTAL SEATINGS-9073 SEATINGS



SEATINGS

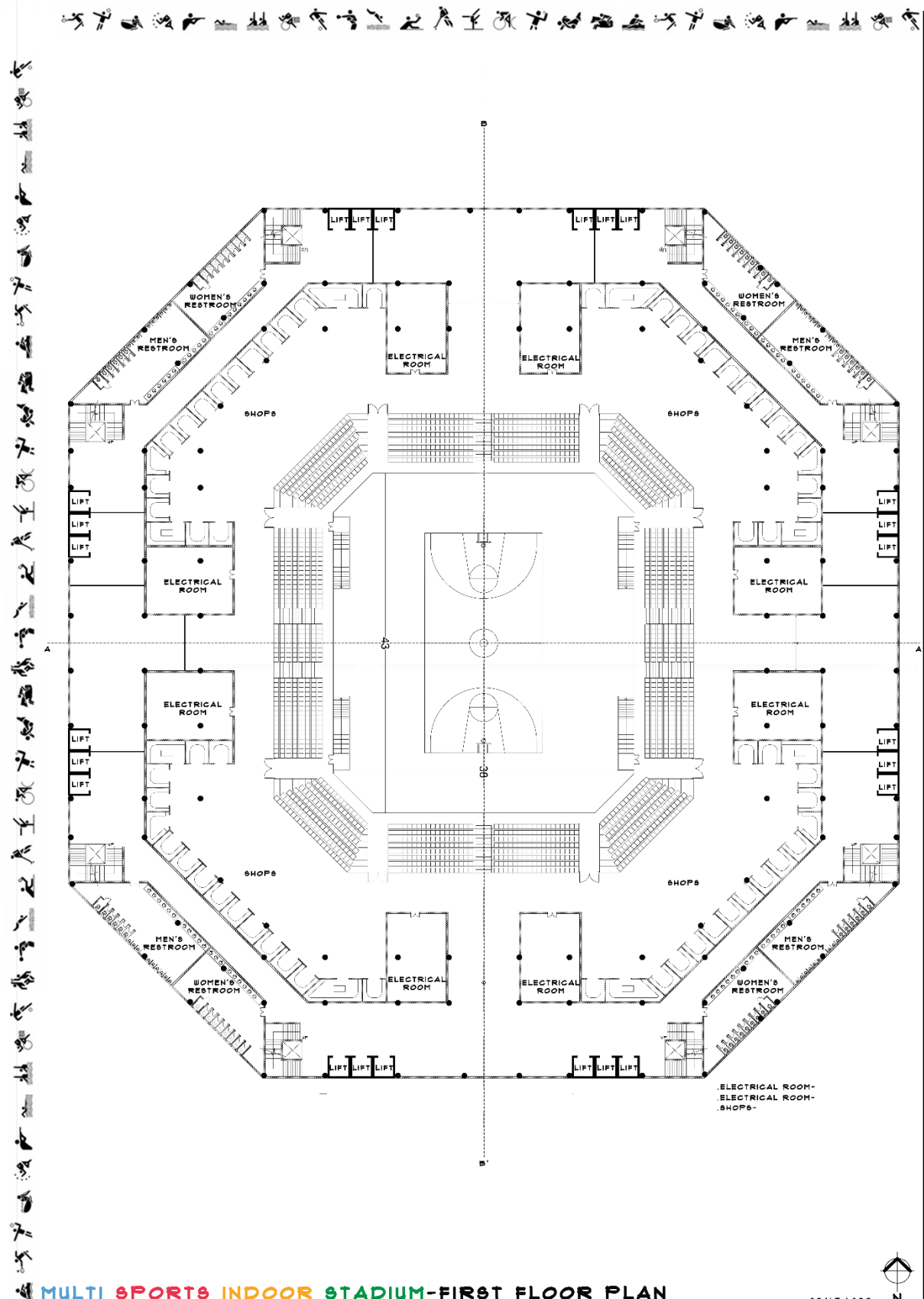


TEAM ROOM

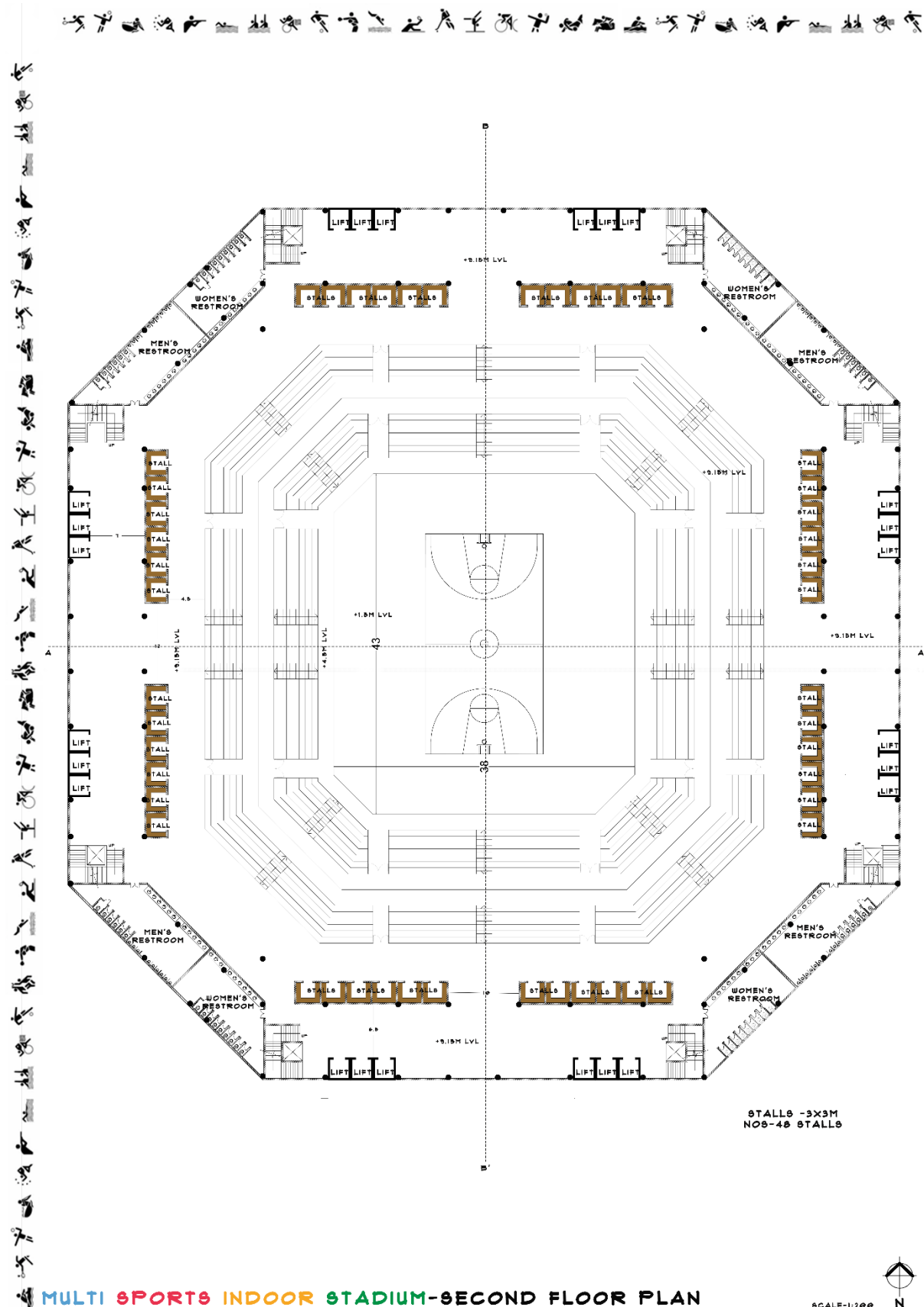


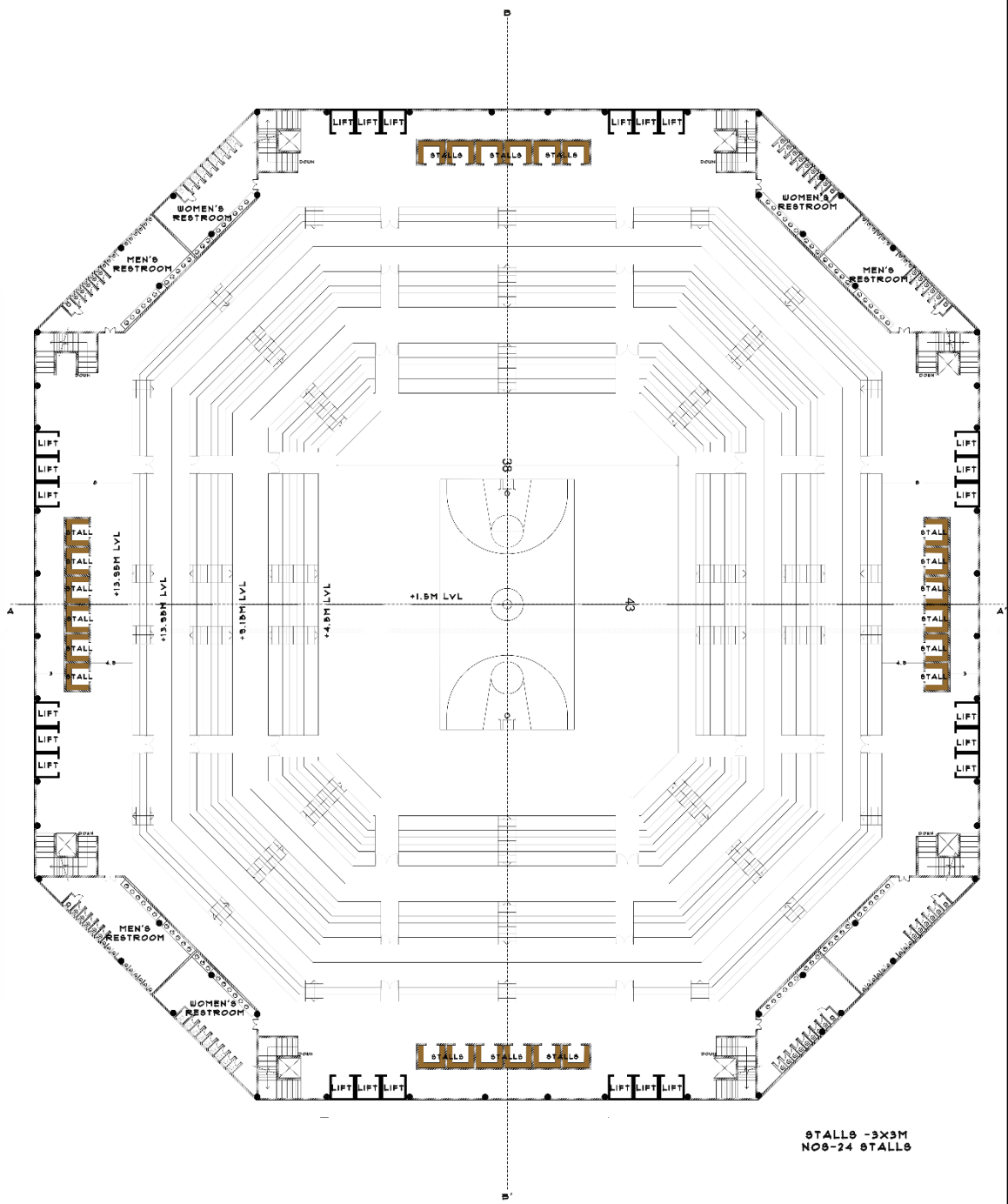
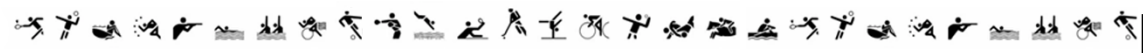
VORMITORIES

MULTI SPORTS INDOOR STADIUM-ROOF AND SEATINGS..



MULTI SPORTS INDOOR STADIUM-FIRST FLOOR PLAN



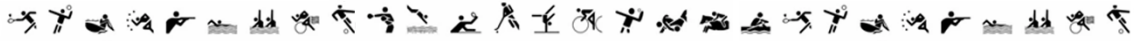


STALLS - 3X3M
NO8-24 STALLS

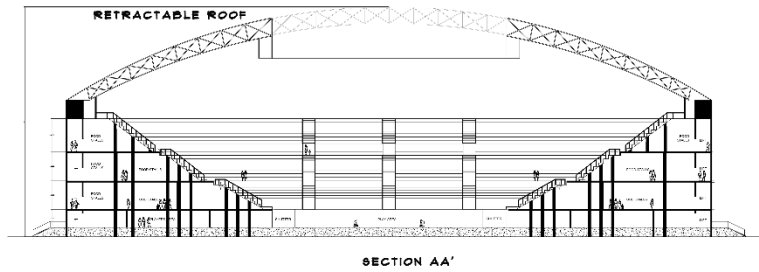
MULTI SPORTS INDOOR STADIUM-THIRD FLOOR PLAN

SCALE:1:200

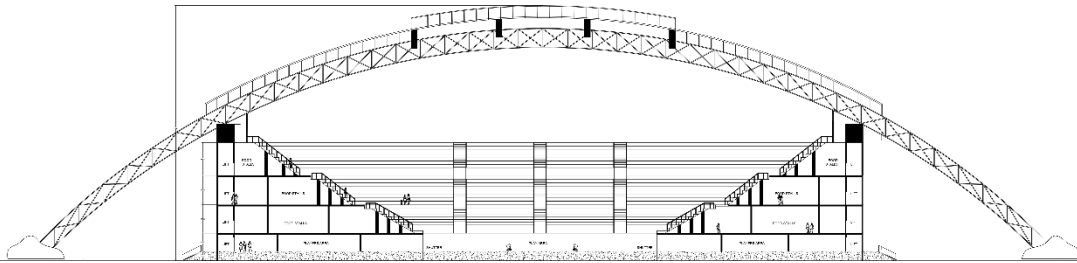
39210089-SREEJA.J BATCH 2019-24



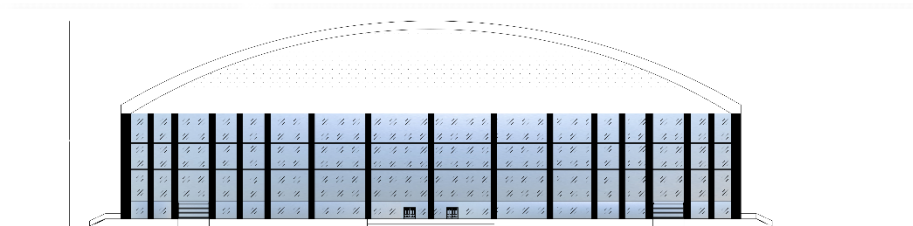
Multi Sports Indoor Stadium - Sections & Elevations



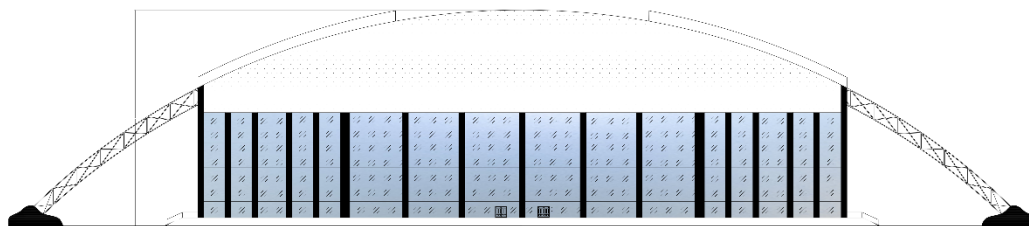
SECTION AA'



SECTION BB'



ELEVATION



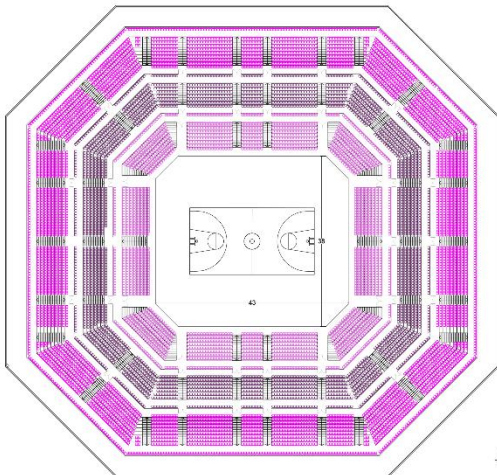
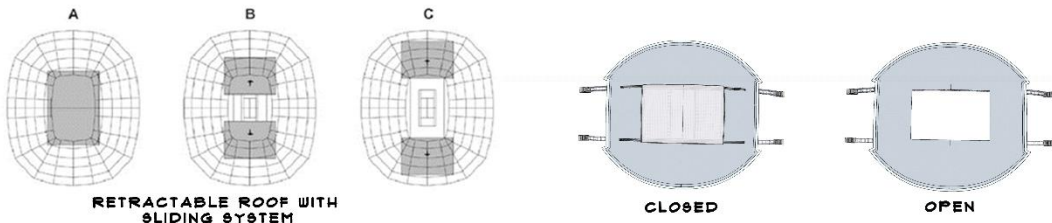
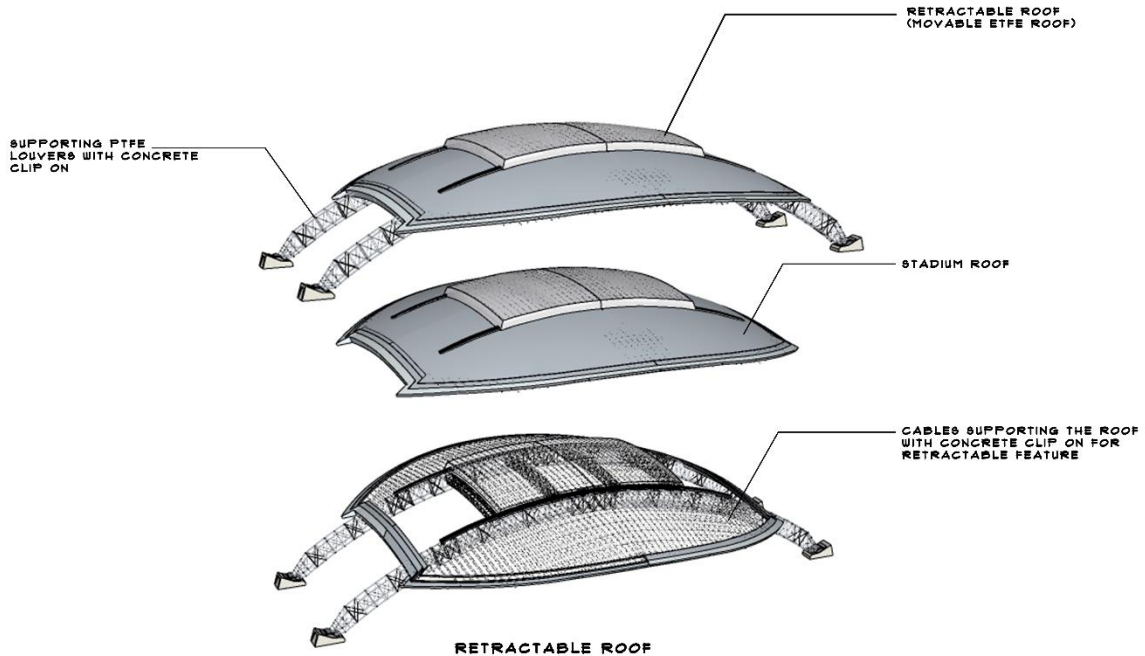
ELEVATION

MULTI SPORTS INDOOR STADIUM-SECTIONS & ELEVATIONS..

SCALE-1:200



39210009-SREEJA.J BATCH 2019-24



FIRST TIER SEATINGS-2122 SEATINGS
SECOND TIER SEATINGS-2660 SEATINGS
THIRD TIER SEATINGS-4191 SEATINGS
TEMPERORAY-100 SEATINGS
TOTAL SEATINGS-9073 SEATINGS



SEATINGS



TEAM ROOM



VORMITORIES

MULTI SPORTS INDOOR STADIUM-ROOF AND SEATINGS..

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