TRIBHUWAN UNIVERSITY
INSTITUTE OF ENGINEERING
DEPARTMENT OF ARCHITECTURE
PULCHOWK, LALITPUR

A THESIS REPORT
ON

CONCERT ARENA

A BONDING EXPERIENCE

SUBMITTED IN
PARTIAL FULFILLMENT OF THE REQUIREMENT OF
THE DEGREE OF BACHELOR IN ARCHITECTURE

SUBMITTED BY:
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074-BAE-214

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CERTIFICATE

This is to certify that this thesis entitled "**Concert Arena: A Bonding Experience**" submitted by **Diya Gnawali (PUL074/BAE/214)** has been examined and it has been declared successful for the partial fulfillment of the academic requirement towards the completion of the Degree of Bachelor of Architecture.

……..

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Thesis Supervisor

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DECLARATION

I hereby declare that the thesis entitled “Concert Arena: A Bonding Experience” submitted to the Department of Architecture in partial fulfillment of the requirements for the degree of Bachelor in Architecture, is a record of an original work done under the guidance of Asso. Prof. Dr. Ashim Ratna Bajracharya, Institute of Engineering, Pulchowk Campus. This thesis contains only the work completed by me except for the consulted material which has been duly referenced and acknowledged.

…….

Diya Gnawali

074/BAE/214

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1 THE PROJECT

1.1 BACKGROUND

Everyone is devoted to certain music genre and style. **Music** produces beauty of form, harmony, and expression of emotion. One of the universal cultural aspects of all human societies, Music is the art of arranging sounds in time through the elements of melody, harmony, rhythm, and timbre. A **music venue** is any location used for a concert or musical performance. Music venues range in size and location, from a small coffeehouse for folk music shows, an outdoor band shell or bandstand or a concert hall to an indoor sports stadium. Typically, different types of venues host different genres of music. Depending on the type of venue, the opening hours, location and length of performance may differ, as well as the technology used to deliver the music in the venue.

There are about seven different types of concert venues:

Table 1.1 Types of music venues

Stadiums. The largest facilities for concerts, these multipurpose venues offer seating of 30,000+ and typically are configured for sports events. Since such facilities are not designed for live concerts, they require extensive setup/tear-down of concert stages.
Amphitheaters. Outdoor venues typically seat between 5,000 and 30,000, and are used primarily in good weather/summer seasons. These are specifically designed for concerts, with permanent stages.
Festival Sites. Outdoor locations used seasonally typically accommodate between 10,000 and 120,000 patrons for day-long or multi-day concerts. For operators, these venues are attractive because of low overhead costs, resulting in some of the industry's highest profit margins.
Arenas. Smaller than stadiums, these indoor venues typically seat between 5,000 and 20,000. Arenas often have luxury private suites—premium-priced seating areas that amphitheaters lack. Because they are multipurpose facilities, they typically require extensive modification to install stages.
Theaters. Venues designed for legitimate theater can be easily adapted for concerts and typically have seating for 1,000-6,000.
Mid-Sized Music Venues. Designed for concerts, these indoor facilities have ready-built stages and typically have capacity for between 1,000 and 6,500 persons. With this low-capacity seating, however, they don't offer potential for outsized profits, as do the larger venues, even in a sell-out.
Small-Sized Music Venues/Clubs. Music and comedy clubs dominate this category of indoor venue, which sometimes provide beverage and/or meal service for patrons at their seats. Because seating is typically less than 1,000, capacity limits revenue potential and seats are sometimes moveable chairs. But these facilities have built-in stages, which reduces costs.

A stadium is a place or venue for (mostly) outdoor sports, concerts, or other events and consists of a field or stage either partly or completely surrounded by a tiered structure designed to allow spectators to stand or sit and view the event. Although concerts, such as classical music, had

been presented in them for decades, beginning in the 1960s stadiums began to be used as live venues for popular music, giving rise to the term "stadium rock", particularly for forms of hard rock and progressive rock. The origins of stadium rock are sometimes dated to when The Beatles played Shea Stadium in New York in 1965. The tendency developed in the mid-1970s as the increased power of amplification and sound systems allowed the use of larger and larger venues. Smoke, fireworks and sophisticated lighting shows became staples of arena rock performances. In the 1980s, arena rock became dominated by glam metal bands, following the lead of Aerosmith. Since the 1980s, rock, pop, and folk stars, including Madonna, Britney Spears, Beyoncé, and Taylor Swift, have undertaken large-scale stadium-based concert tours. With the recent shift of popular music from western to Korean pop, these concert arenas and stadiums are more frequently used since many groups perform every year at different times.

The basic difference between **theatres, arenas and stadium** is explained below:

Table 1.2 Difference between theatre, arena and stadium

S.N.	THEATRE	ARENA	STADIUM
1.	The tiered or non-tiered seating is always at front of the stage.	The tiered seating either partly or completely surrounds the stage.	
2.	An indoor music venue with complete roof structure.	An indoor music venue with complete or adjustable roof structure.	An outdoor music venue with no roof structure needed.
3.	Mostly used for theatre plays, conference, operas etc.	Mostly used for bigger music events like concerts and fan meets while for sports used for basketball and long tennis.	Mostly used for sports like football, cricket but are alternately used as music venue incase arenas are not present or have small capacity.
4.	10,000 is the largest capacity standard.	40,000 is the largest capacity standard.	At present, 150,000 capacity is the largest stadium.

In music industry, an artist starts their concert with small venue like theatre or concert halls then moves to bigger venue like arena and at their peak success they hold their concert in domes and stadiums. These venues are the mark of how successful an artist is in the industry.

1.2 INTRODUCTION TO ARENA

At present, when music venue is mentioned the first thought is theatre or arena. Theatres are the combination of stage and seating inside a structure with roof for musical activities like plays, dramas, opera and dance. They are smaller in comparison to arenas that are the bigger venues with the same combination of stage and house facilities. The term arena is sometimes used as a synonym for a very large venue such as Pasadena's Rose Bowl, but such a facility is typically called a stadium, especially if it does not have a roof. The use of one term over the

other has mostly to do with the type of event. Football is typically played in a stadium, while basketball, volleyball, handball, and ice hockey are typically played in an arena, although many of the larger arenas hold more spectators than do the stadiums of smaller colleges or high schools. Domed stadiums, which, like arenas, are enclosed but have the larger playing surfaces and seating capacities found in stadiums, are generally not referred to as arenas in North America.

An **arena** is a large enclosed platform, often circular or oval-shaped, designed to showcase theatre, musical performances, or sporting events. It is composed of a large open space surrounded on most or all sides by tiered seating for spectators, and may be covered by a roof. The key feature of an arena is that the event space is the lowest point, allowing maximum visibility. Arenas are usually designed to accommodate a multitude of spectators. The word arena originally meant "place of combat," and it's sometimes still used this way. Its root is “harena”, a kind of sand that was supposedly used on the floor during ancient Roman battles to soak up spilled blood.

Arena originally was an open, sandy place. The Romans used the term to describe the site for gladiatorial combat or an enclosed area in which some public entertainment was staged. The seating for spectators was around the arena. In common usage today the difference between stadium and arena is negligible. Arena, however, is often used as a name for an enclosed building that can serve as a convention center as well as a theater or sports palace.

Figure 1.1 Arena-Di-Venora, Rome

- The first indoor arena was **Madison Square Garden** in New York City. It was completed in 1890 to replace a converted railroad terminal that had been used for public events since 1874. The 1890 arena was replaced in 1925. Today’s Madison Square Garden was opened in 1968 on the site of the former Pennsylvania Station.
- The **Chicago Stadium**, opened in 1928 with a seating capacity of 21,000, was the world’s largest indoor arena for many years.
- **Philippine Arena** is currently the world’s biggest indoor arena, equipped for seating 55,000 fans in a completely encased structure. Since opening, the arena has facilitated

a scope of sports, music, and church occasions. Arranged on a greenfield site north of Manila, at Ciudad de Victoria in Sta. Maria Bulacan, the arena has been intended to have the greatest conceivable number of individuals – 55,000 people inside the structure and another 50,000 as a "live site" outside for significant occasions when required. It opened its doors on July 21, 2014 when it broke the record for the World's Biggest Indoor Arena and it still holds that record until now.

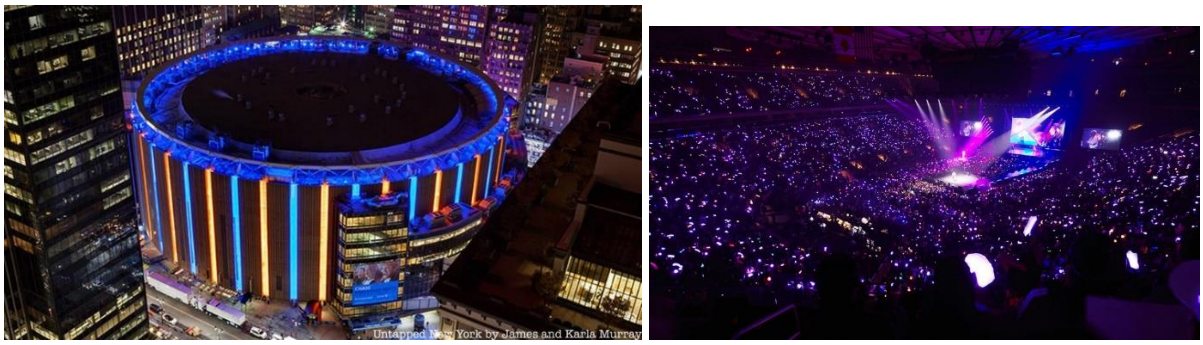


Figure 1.2 Madison Square Garden, New York

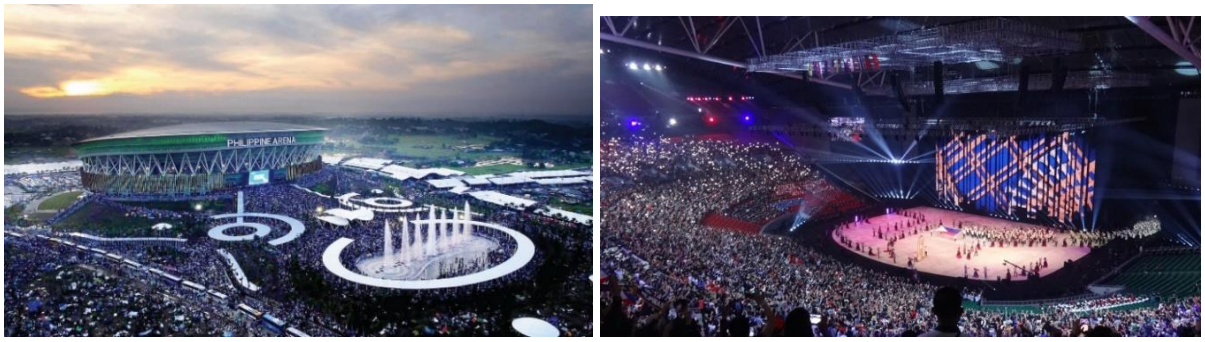


Figure 1.3 Philippine Arena, Philippines

1.3 PROBLEM STATEMENT

As Nepal is rich and diverse in traditional performing arts and culture. Spaces like Dabali or indoor spaces like theatre hall in palaces were the place where performances were done. As the art form (music) flourished the demand for performing spaces proliferated. An effort has been made to bring together public in one place to enjoy such art forms as many multipurpose auditoriums been built in the Capital. But along with the fall of King's rule in Nepal, these venues have not been improved and the need to explore of new venues have stopped leading no development in this area. A dedicated space for musical performances is however has not yet been addressed. Similarly, the need of physical stores for merchandise related to music and an open space in the city can be addressed with my project. Tourism on the other hand is the main source of remittance to Nepal and a concert arena would just assist the business. Many international performers are invited to perform in front of large number of right audience but the problem has always been right space and right acoustics. A concert arena with the absolute requirements would bridge that gap.

1.4 PROJECT: CONCERT ARENA

"Music unites people and there is no language when it comes to music."

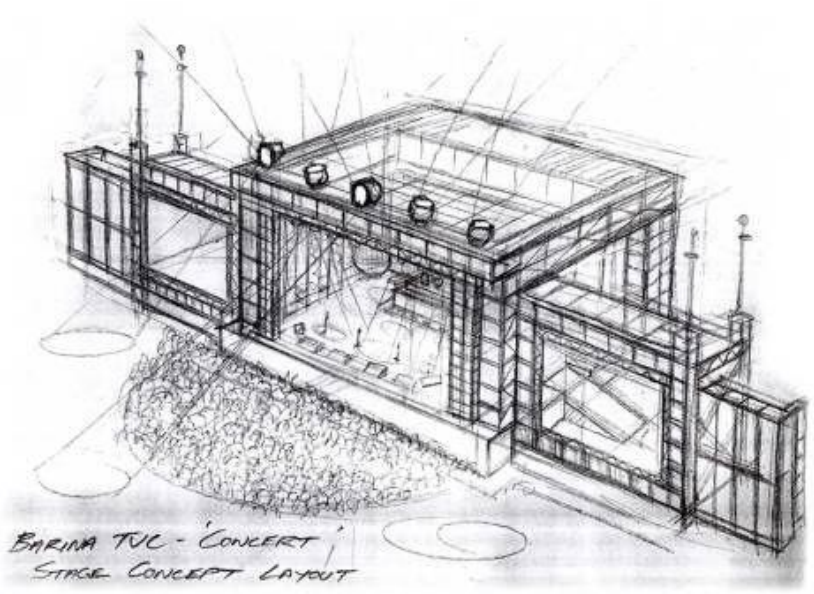


Figure 1.4 Live performance illustration

I am highly indebted to music in my life recently during the Covid times, as they gave me positive environment and a zone to relax my mind in the struggle of fighting the pandemic daily. This might not only be my situation, people started associating more with music as they got a break from their busy daily life in pandemic. Along with our local music, we can see different generations have listened to Indian and Bollywood music since ages as it was easily accessible to us being a neighboring country. It was only in recent 10-12 years, the western and Hollywood entertainment and music had impact in Nepal. Now the flow of music and entertainment from different nations like: Korea, Chinese, Thailand, Japan and Europe have an uphold on people's life here.

"CONCERTS AND BONDING"

Concerts are a bonding experience, and can bring people of different cultures and backgrounds together peacefully. No matter where you come from, once you walk through those venue doors everyone surrounding you is there for the same reason. Even at a sold-out show, the feeling of connection is overwhelming. You just can't get that same feeling in many other places. With my own experience of making friends with shared love for the same band, I am close to them and we understand better than the friends I have made through my academics. Going to concerts can be a deeply personal and emotional experience, and those wonderful moments of vulnerability make friendships stronger. But we are deprived of this opportunity as we can't go to overseas to get this concert experience as it

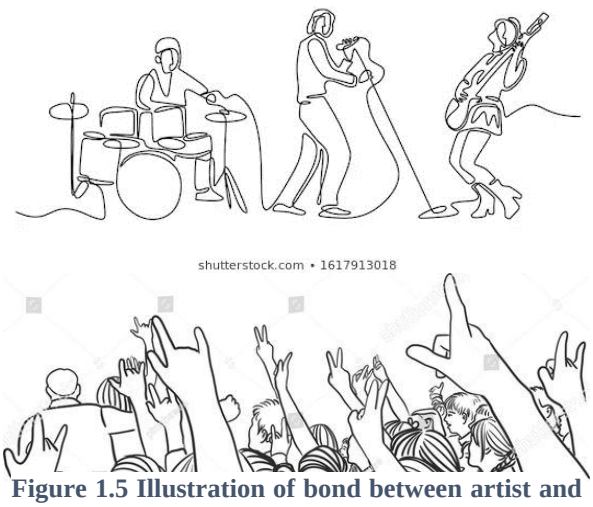


Figure 1.5 Illustration of bond between artist and audience in a concert

is very costly and Nepal does hold concerts but these are too costly without any proper facility because of stage and venue cost.

With better acoustics, maximum view angle, comfortable seating and flow of space; better bonding can be experienced between the audiences. A concert is different from other live performance because the artist interacts with audiences the most thus, inclusion of extra stages and spaces between the seating to meet the audiences creates better experience.

"WHY ARENA?"

- Indoor architectural lighting for both stage effects and visibility is better in enclosed arena and glare can be reduced unlike in stadiums.
- Enclosed arena provides better acoustics with treatments than open stadium.
- Roofing protects from any outside weather conditions unlike stadium.
- Flexible stages can be added according to requirement unlike theaters.
- Better views and interaction due to less slope angle of tiered seating.

1.5 PROJECT JUSTIFICATION

1.5.1 No dedicated music venue in the nation:

The capital city, Kathmandu houses many theatres but they are used for multipurpose rather than being a dedicated music venue. There is no single dedicated music space in Nepal although music and dance has been flourished since the Malla period by building various dabalis. The **biggest concert** Nepal has ever organized was western singer Bryan Adams world tour on 19th Feb, 2011; in Dasharath Stadium, Tripureshwor. At that time the stadium could house about 19,000 audiences but the concert attendees were reduced to 10,000 for security, traffic and space arrangement reasons. It was a sold out 2 hours concert with no any hazards or problems during the show. Although it was sold out, the cost of stage and arrangement was still not covered going into loss.

Similarly, in 2021 it was announced that one of prestigious award show IFFA Awards would take place in Nepal. But it was postponed for the time being due to high cost of the event that Nepal government could not cover. The cost of stage built and arrangement covered about half of the total cost of the event as new stage has to be made in Dasharath Stadium. If an arena was already built in the nation with proper stage facilities and house arrangement, that event would have been successful in about half the total present cost it required.

The recent news claim that popular Bollywood actor Salman Khan will be conducting concert as a part of his Dabbang World Tour in Nepal as well with about 30,000 spectators in same Dasharath Stadium. For this too the stage-built cost has been calculated to be high leading possible low budget facilities during the concert. At the time of writing this thesis report, this concert has been cancelled in Nepal. Thus, these recent happenings have proved the point that Nepal lacks a dedicated music venue which has demotivated the nation in modern development.

Figure 1.6 Inside of arena during concert activity

(Source: JYP entertainment)

1.5.2 Lack of music and merchandise stores:

Another component of my project is the merchandise stores within the arena. For music industry, merchandise is usually those goods that the artist or their company sells during their album release or any occasion where the goods are related to the artist and his works only that are admired by their fans. Simply taking albums as an example; these physical albums are produced during an artist's comeback which the company affiliated to that artist distributes to the stores where the fans buy it as an act of support to the artist for their hard work and influence on their lives. These albums are not only for sale but they also get counted on different music charts determining the artist success and popularity so the fans are more hyped to buy them. Thus, the company too puts effort on the cover design and freebies with them to increase the sales. Other merchandise can include artist's self-designed goods ranging from smaller tote bags to clothing range.

Figure 1.7 A record store in USA

With the recent popularity in Korean music in Nepal, the flow of owning a merchandise from a simple keychain or wall hanger to costly albums and clothes has rose. At present in Nepal, there are about 40+ merchandise stores in online platforms like Facebook and Instagram delivering goods all around the nation. The demand for these merchandise keeps increasing with increase in popularity of these stores. But there are still so many people who do not know these stores exist because of online platforms only. Likewise, the lack of trust in online stores

is also concerning with lack of physical stores. If my project could give these online stores a physical platform to sell goods bringing more customers and a reliable business environment for music lovers. As an arena is within a public structure, the structure can hold different stores and marts for public use.

1.5.3 Lack of green space in capital:

This project visions to combine a public structure housing an arena; in a public park. Open spaces are vitally important to the social, cultural, environmental and aesthetic life of a city but in the Kathmandu Valley, they're fast shrinking. Open spaces play a vital role in the life of a city and its residents. They serve as places for people to rest, relax, and meet others and talk. Ancient squares, including durbar squares, chowks, bahals in Kathmandu Valley, are perfect examples to showcase the political, commercial and cultural significance of open spaces. The greenery and trees in many open spaces can help revitalize the city's air. These spaces, if properly built, can also facilitate urban commingling and social interactions. They help bind communities together and turn a city from an unfriendly space of cement and brick to a welcoming open space of greenery.

If the current trend continues, Kathmandu will soon turn into a city of just buildings and roads. As we know because of population increase and migration for facilities; Kathmandu valley lacks public, green and open spaces as they are encroached to build physical structures. Even the government lands are illegally encroached for settlement leaving not even the riverbanks. According to a 2016 report prepared by the High-Powered Bagmati Civilization Integrated Development Committee, as many as 1,465 households have encroached the banks of the Bagmati and Bishnumati rivers. According to the Kathmandu Valley Open Space Roadmap, published by the Kathmandu Valley Development Authority, open spaces account for just 2 percent of the entire valley. Thus, my project would like to propose a public park for people to visit, interact and refresh themselves with nature as well as creating a favorable micro climate around the area reducing pollution and its affects.

Figure 1.8 A vision of park

1.5.4 Creation of new architectural landmark:

A landmark is an object or feature of a landscape or town that is easily seen and recognized from a distance, especially one that enables someone to establish their location. Kathmandu valley is known for its cultural landmarks like Swayumbunath, Pashupatinath, the Durbar Squares etc. The present Dasharath Rangashala; a modern stadium building does not hold the position of architecture landmark as it is surrounded by bigger walls hiding its architecture as

well as is not easily accessible to public. In context of not much modern landmarks in the valley, my project wants to propose a new landmark to the city that is easily recognized from distance and is approachable for different public facilities like shopping and eating in merchandise stores and restaurants along with the main feature: an arena that houses music lovers for unique experience of live music. As it is a structure with roof, designed long span roof can add to the beauty of the structure and in signifying an architectural landmark of the city.

Figure 1.9 Mall of Asia Arena, Philippines

1.5.5 Secondary points:

Thinking economically and in tourism prospect, holding concert can be beneficial for a developing country like ours. In order to better understand the economic impact of concert and live entertainment industry has across the United States, Oxford Economics developed a customized framework to analyze the impact of the concerts and the live entertainment industry's nationwide economic contributions in 2019 and conducted an in-depth analysis of the economic impacts of live event venues, artists, and visitor spending in terms of economic output, labor income, taxes, and jobs. The report affirms that the Concerts and Live Entertainment Industry is a significant economic engine in the United States, and the report's key findings revealed that:

- In 2019 the industry's total nationwide economic impact of $132.6 billion supported 913,000 total jobs with associated labor income of approximately $42.2 billion.
- The industry generated a direct impact of $55.2 billion in 2019, which included local operational spending by live events venues and off-site spending by out-of-town live event attendees.
- Overall, the live events industry generated a total fiscal impact of $17.5 billion in 2019, including nearly $9.3 billion in federal tax revenues and $8.3 billion in state and local tax revenues.

Due to the pandemic putting a pause on live events in 2020, this report examined 2019 data to ensure a complete analysis could be conducted that is in line with regular performance of the industry. In the wake of COVID-19, live events were shut down for over a year. After a year of isolation, many crave getting back to enjoying memorable live experiences safely in 2021 and into the 2022 and 2023 seasons, which position the industry for growth in the coming years.

Nepal could benefit bringing foreign artist for their concert with economic and tourism mindset but it would actually help popularizing our own music background too when it gets exposure

in the same concert. Collaboration of local and foreign artists is always appreciated, when many other Asian nations are popularizing their music why can't we? Our music needs exposure because language is not a barrier when it comes to music; and concert arenas can help in that exposure. Along with this, the arena drives significant economic activity that supports businesses, households, and government finances. Artists are one of the influencers at present, thus their visit in Nepal for their concert can popularize the nation as tourist destination.

1.6 RATIONAL OF RESEARCH:

This research will talk about the required programs or amenities for the project and will provide the optimum areas required for the different programs inside the arena. Also, it will talk about the orientation of building, its response to ecosystem and how can we integrate the spaces with them for creating better learning environment, playing environment and gathering environment with some glimpse of culture influence.

1.7 OBJECTIVES:

The objectives of this research are enumerated below:

- To have a **designated Arena for music purpose** which has not yet been initiated in the country.
- To Promote Power of Architecture in enhancing music.
- To provide safe structure.
- To provide a public green open space to the community.
- To provide commercial space for economic purpose.
- To bring together concert goers at one place where they can enjoy every kind of gigs whether that be cultural or traditional or something nonnative without much hassle.
- Secondary objectives:
    - To boost tourism sector by providing a platform to let others know about our cultural practices and musical art.
    - To help generate employment opportunities.

1.8 PROPOSED PROJECT COMPONENT:

- Proposed seating capacity: 4,000
- ARENA
- FANMEET SPACES
- BACKSTAGE FACILITY
- FRONT OF HOUSE FACILITY.
- RESTAURANT
- MERCH STORES
- MART SPACE
- PUBLIC PARK

1.9 PROPOSAL METHODOLOGY:

A successful execution of any research follows certain methodologies that becomes the backbone of the whole project. Hence, review of basic prerequisites is mandatory. Following research methods will be pursued out of which required facts, data, codes of conduct and standards will be gathered, analyzed and employed in designing a better concert arena.

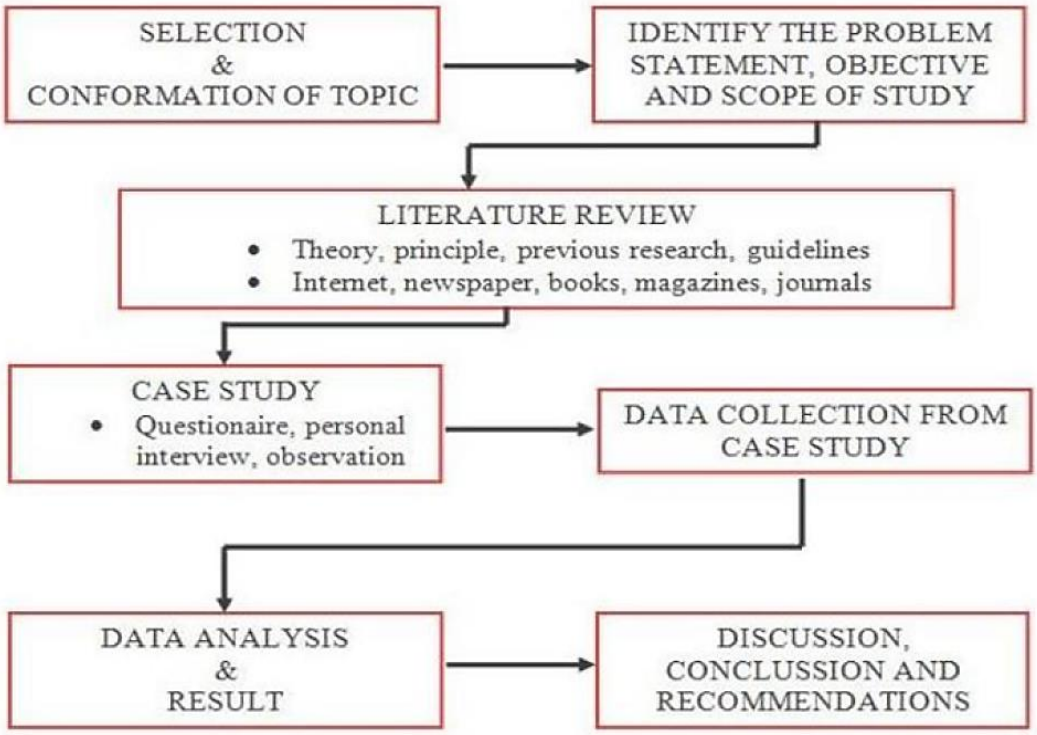


Figure 1.10 Flow chart for dissertation methodology

1.9.1 Literature Review:

The part will comprise guidelines to be considered while designing any built forms. For the purpose necessary questionnaires and interactions needed to be done. For the necessary national and international standards related architectural books of standards to be consulted.

1.9.2 Case Studies:

The collection of first-hand data is accomplished with studies of various national and international projects. The following probable case studies will be conducted in order to formulate the program and incur necessary facts and figures enough to conceptualize the design.

1.10 EXPECTED OUTPUT:

This thesis will introduce a design which is intended to provide better experience of the concert and live music environment and safe and better bonding environment. This design will aim to promote national as well as international music and the awareness that music is one of healing method in life and not a degradation and bad influence to the social environment. The aim is not to isolate humans but to bring them together to their own music community.

- Safe and better bonding live music environment.
- Better and safe sound and lighting
- A landmark for the capital
- Secondary outputs:
    - To promote national music.
    - To generate employment opportunity.
    - Help in tourism sector

2 LITERATURE REVIEW:

2.1 STUDY OF MUSIC AND MUSICAL INSTRUMENTS

Music is regarded as a cultural universal, though definitions of it vary wildly around the world and throughout history. Music is the art of arranging sound. It is one of the universal cultural aspects of all human societies. Music is played in public and private areas, highlighted at events such as festivals, rock concerts, and orchestra performance, and heard incidentally as part of a score or soundtrack to a film, TV show, opera, or video game. Musical playback is the primary function of an MP3 player or CD player and a universal feature of radios and smartphones. Music often plays a key role in social activities (such as dancing, karaoke singing, and attending concerts), religious rituals, rite of passage ceremonies, graduation and marriage celebrations, and cultural activities such as community choirs.

2.1.1 Origin and development of music

(SOURCE: Franklin J; Theater Design)

The origins of music remain highly contentious; often relating it to the origin of language, with much disagreement surrounding whether music arose before, after or simultaneously with language. Many theories have been proposed by scholars from a wide range of disciplines, though none have achieved wide approval. Most cultures have their own mythical origins concerning the invention of music, generally rooted in their respective mythological, religious or philosophical beliefs. It is difficult to make many generalizations about ancient music as a whole, but from what is known it was often characterized by monophony and improvisation.

In ancient song forms, the texts were closely aligned with music, and though the oldest extant musical notation survives from this period, many texts survive without their accompanying music, such as the Rigveda and the Shijing Classic of Poetry. A society's music is influenced by all other aspects of its culture, including social and economic organization and experience, climate, and access to technology as well. The emotions and ideas that music expresses, the situations in which music is played and listened to, and the attitudes toward musicians and composers all vary between regions and periods.

2.1.1.1 Prehistory

Prehistoric music can only be theorized based on findings from Paleolithic archaeology sites. Flutes are often discovered, carved from bones in which lateral holes have been pierced; these are thought to have been blown at one end like the Japanese shakuhachi.

- The Divje Babe flute, carved from a cave bear femur, is thought to be at least 40,000 years old, though there is considerable debate surrounding whether it is truly a musical instrument or an object formed by animals.
- India has one of the oldest musical traditions in the world—references to Indian classical music (marga) are found in the Vedas, ancient scriptures of the Hindu tradition.
- The earliest and largest collection of prehistoric musical instruments was found in China and dates back to between 7000 and 6600 BC.

2.1.1.2 Ancient Egypt

The earliest material and representational evidence of Egyptian musical instruments dates to the Predynastic period, but the evidence is more securely attested in the Old Kingdom when harps, flutes and double clarinets were played.

- Percussion instruments, lyres and lutes were added to orchestras by the Middle Kingdom.
- Cymbals frequently accompanied music and dance, much as they still do in Egypt today.
- Egyptian folk music, including the traditional Sufi dhikr rituals, are the closest contemporary music genre to ancient Egyptian music.

2.1.1.3 Ancient Asia

Asian music covers a vast swath of music cultures surveyed in the articles on Arabia, Central Asia, East Asia, South Asia, and Southeast Asia. Several have traditions reaching into antiquity.

- Indian classical music is one of the oldest musical traditions in the world. The Indus Valley civilization has sculptures that show dance and old musical instruments, like the seven holed flute. Various types of stringed instruments and drums have been recovered from Harappa and Mohenjo Daro.
- Indonesian music has been formed since the Bronze Age culture migrated to the Indonesian archipelago in the 2nd to 3rd centuries BC. Indonesian traditional music often uses percussion instruments, especially kendang and gongs. Indonesia is the home of gong chime, gong chime is a general term for a set of small, high pitched pot gongs. Gongs are usually placed in order of note, with the boss up on a string held in a low wooden frame.
- Chinese classical music, the traditional art or court music of China, has a history stretching over around three thousand years. It has its own unique systems of musical notation, as well as musical tuning and pitch, musical instruments and styles or musical genres. Chinese music is pentatonic-diatonic, having a scale of twelve notes to an octave (5 + 7 = 12) as does European-influenced music.

2.1.1.4 Ancient Greece

Music was an important part of social and cultural life in ancient Greece, in fact it was one of the main subjects taught to children. Musical education was considered to be important for the development of an individual's soul. Musicians and singers played a prominent role in Greek theater and the ones who received a musical education were seen as nobles and in perfect harmony.

- Mixed-gender choruses performed for entertainment, celebration, and spiritual ceremonies.
- Music was an important part of education, and boys were taught music starting at age six. Greek musical literacy created a flowering of music development.
- Greek music theory included the Greek musical modes, that eventually became the basis for Western religious and classical music. The oldest surviving work written on the subject of music theory is Harmonika Stoicheia by Aristoxenus.

2.1.1.5 Classical western music

- Middle Age:

The medieval era (476 to 1400), which took place during the Middle Ages, started with the introduction of monophonic chanting into Roman Catholic Church services. Musical notation was used since Ancient times in Greek culture, but in the Middle Ages, notation was first introduced by the Catholic church so that the chant melodies could be written down, to facilitate the use of the same melodies for religious music across the entire Catholic empire.

- Renaissance:

Renaissance music (c. 1400 to 1600) was more focused on secular (non-religious) themes, such as courtly love. Around 1450, the printing press was invented, which made printed sheet music much less expensive and easier to mass-produce. The increased availability of sheet music helped to spread musical styles more quickly and across a larger area. Musicians and singers often worked for the church, courts and towns. Church choirs grew in size, and the church remained an important patron of music. By the middle of the 15th century, composers wrote richly polyphonic sacred music, in which different melody lines were interwoven simultaneously.

- Baroque:

The Baroque era of music took place from 1600 to 1750, as the Baroque artistic style flourished across Europe; and during this time, music expanded in its range and complexity. Baroque music began when the first operas were written. During the Baroque era, polyphonic contrapuntal music, in which multiple, simultaneous independent melody lines were used, remained important. The late Baroque style was polyphonically complex and richly ornamented.

- Classicism:

The music of the Classical period (1730 to 1820) aimed to imitate what were seen as the key elements of the art and philosophy of Ancient Greece and Rome: the ideals of balance, proportion and disciplined expression. Music from the Classical period has a lighter, clearer and considerably simpler texture than the Baroque music which preceded it. The main style was homophony, where a prominent melody and a subordinate chordal accompaniment part are clearly distinct. Importance was given to instrumental music.

One of the most important changes made in the Classical period was the **development of public concerts**. The aristocracy still played a significant role in the sponsorship of concerts and compositions, but it was now possible for composers to survive without being permanent employees of queens or princes. The increasing popularity of classical music led to a growth in the number and types of orchestras. The expansion of orchestral concerts necessitated the building of large public performance spaces. Symphonic music including symphonies, musical accompaniment to ballet and mixed vocal/instrumental genres such as opera and oratorio became more popular.

- Romanticism:

Romantic music (c. 1810 to 1900) from the 19th century had many elements in common with the Romantic styles in literature and painting of the era. Romantic music expanded beyond the

rigid styles and forms of the Classical era into more passionate, dramatic expressive pieces and songs. Romantic composers such as Wagner and Brahms attempted to increase emotional expression and power in their music to describe deeper truths or human feelings. With symphonic tone poems, composers tried to tell stories and evoke images or landscapes using instrumental music. Some composers promoted nationalistic pride with patriotic orchestral music inspired by folk music.

- The late 19th century:

This era saw a dramatic expansion in the size of the orchestra, and the industrial revolution helped to create better instruments, creating a more powerful sound. Public concerts became an important part of well-to-do urban society. It also saw a new diversity in theatre music, including operetta, and musical comedy and other forms of musical theatre.

2.1.1.6 20th and 21st century

There was a vast increase in music listening as the radio gained popularity and phonographs were used to replay and distribute music, because whereas in the 19th century, the focus on sheet music restricted access to new music to the middle class and upper-class people who could read music and who owned pianos and instruments, in the 20th century, anyone with a radio or record player could hear operas, symphonies and big bands right in their own living room. This allowed lower-income people, who would never be able to afford an opera or symphony concert ticket to hear this music. It also meant that people could hear music from different parts of the country, or even different parts of the world, even if they could not afford to travel to these locations. This helped to spread musical styles.

- The focus of art music in the 20th century was characterized by exploration of new rhythms, styles, and sounds. The horrors of World War I influenced many of the arts, including music, and some composers began exploring darker, harsher sounds. Traditional music styles such as jazz and folk music were used by composers as a source of ideas for classical music.
- The introduction of the multitrack recording system had a major influence on rock music, because it could do much more than record a band's performance. Using a multitrack system, a band and their music producer could overdub many layers of instrument tracks and vocals, creating new sounds that would not be possible in a live performance.
- Jazz and Rock music evolved worldwide.
- In the 1990s, an increasingly large range of computerized hardware musical devices and instruments and software were used. In the 2020s, soft synths and computer music apps make it possible for bedroom producers to create and record some types of music, such as electronic dance music in their own home.
- In the 1990s, some bands in genres such as metal began including DJs in their bands. Innovation in music technology continued into the 21st century, including the development of isomorphic keyboards and Dynamic Tonality.

2.1.2 **Elements of music**

Music has many different fundamentals or elements. Depending on the definition of "element" being used, these can include pitch, beat or pulse, tempo, rhythm, melody, harmony, texture, style, allocation of voices, timbre or color, dynamics, expression, articulation, form, and structure. Below is a list of the three official versions of the "elements of music".

2.1.2.1 Pitch and Melody

Pitch is an aspect of a sound that we can hear, reflecting whether one musical sound, note, or tone is "higher" or "lower" than another musical sound, note, or tone. We can talk about the highness or lowness of pitch in the more general sense, such as the way a listener hears a piercingly high piccolo note or whistling tone as higher in pitch than a deep thump of a bass drum. A melody (also called a "tune") is a series of pitches sounding in succession often in a rising and falling pattern. The notes of a melody are typically created using pitch systems such as scales or modes.

2.1.2.2 Harmony and chords

Harmony refers to the "vertical" sounds of pitches in music, which means pitches that are played or sung together at the same time to create a chord. Usually, this means the notes are played at the same time, although harmony may also be implied by a melody that outlines a harmonic structure.

2.1.2.3 Rhythm

Rhythm is the arrangement of sounds and silences in time. Meter animates time in regular pulse groupings, called measures or bars, which in Western classical, popular, and traditional music often group notes in sets. Meters are made easier to hear because songs and pieces often place an emphasis on the first beat of each grouping.

2.1.2.4 Texture

Musical texture is the overall sound of a piece of music or song. The texture of a piece or song is determined by how the melodic, rhythmic, and harmonic materials are combined in a composition, thus determining the overall nature of the sound in a piece. Texture is often described in regard to the density, or thickness, and range, or width, between lowest and highest pitches, in relative terms as well as more specifically distinguished according to the number of voices, or parts, and the relationship between these voices.

2.1.2.5 Timbre

Timbre, sometimes called "color" or "tone color" is the quality or sound of a voice or instrument. Timbre is what makes a particular musical sound different from another, even when they have the same pitch and loudness. For example, a 440 Hz A note sounds different when it is played on oboe, piano, violin, or electric guitar. Even if different players of the same instrument play the same note, their notes might sound different due to differences in instrumental technique.

2.1.2.6 Expression

Expressive qualities are those elements in music that create change in music without changing the main pitches or substantially changing the rhythms of the melody and its accompaniment. Performers, including singers and instrumentalists, can add musical expression to a song or piece by adding phrasing, by adding effects such as vibrato , dynamics, tempo fluctuations, by adding pauses or fermatas on a cadence, and by changing the articulation of the notes.

2.1.2.7 Form

In music, form describes the overall structure or plan of a song or piece of music, and it describes the layout of a composition as divided into sections. In the tenth edition of *The Oxford Companion to Music*, Percy Scholes defines musical form as "a series of strategies designed to find a successful mean between the opposite extremes of unrelieved repetition and unrelieved alteration.

2.1.3 **Musical Instruments**

There has been speculation about the origin of instruments since antiquity. The development of musical instruments among ancient high civilizations in Asia, North Africa, and the Mediterranean appears to have emphasized stringed instruments. In Central and South America, wind and struck instruments seem to have been most important. It is not always easy to say whether instruments are indigenous to a particular area, however, since their cultivation may well have spread from one country to another through trade or migration.

Figure 2.1 Different musical instruments

2.1.3.1 Percussion Instruments

Drum ensembles have achieved extraordinary sophistication in Africa, and the small hand-beaten drum is of great musical significance in western Asia and India. The native cultures of the Americas have always made extensive use of drums, as well as other struck and shaken instruments. In Southeast Asia and parts of Africa, **xylophones** and, since the introduction of metals, their cousins the **metallophones** play significant roles.

2.1.3.2 Woodwind Instruments

In Europe the practice of constructing instruments in families continued from the 17th century onward. **Trumpets and horns** were used in most areas of Eurasia for ceremonial and military purposes. Sax also invented the **saxophone**, a single-reed instrument like the clarinet but with a conical tube.

2.1.3.3 String Instruments

The idea of playing a stringed instrument with a bow may have originated with the horse cultures of Central Asia, perhaps in the 9th century AD. The technique then spread rapidly over most of the European landmass. The European fiddle existed in various forms: by the 16th century these had settled down into two distinct types—the viol and the violin. The viol has a flat back, sloping shoulders, and six or seven strings; the violin has a rounded back, rounded shoulders, and four strings.

2.1.3.4 Brass Instruments

The establishment of **orchestras** in the early 17th century led to a slight revision of these principles in Europe. The orchestra's sound is founded on a large ensemble of bowed strings, but it adds the previously outdoor instruments (wind and percussion) for color and climax. As concert halls increased in size and popularity, so too did the sound-volume requirements of so-called indoor instruments. One result was that the **violin** family was favored.

2.1.3.5 Key boards

The principle of the **keyboard** has been used successfully to control bells, plucked and struck stringed instruments (the piano and harpsichord), and wind instruments. A similar adaptation of the plucking of stringed instruments led to the harpsichord, the ingenious mechanism of which had been perfected by the 16th century. It is curious that a similar method was not applied to the dulcimer, which was struck with hammers, until the early 18th century, when the Italian maker Bartolomeo Cristofori constructed the first pianoforte, so-called because, unlike the harpsichord, it could vary the tone from soft (piano) to loud (forte).

2.1.3.6 Electronic Instruments

The development of electricity led not only to its use for mechanical purposes—for example, to control the key action and wind flow in the organ—but also as a means of amplification. With advances in electronics technology, players can now also make **use of computers** to generate and store tones and musical patterns. The growth of companies manufacturing electronic and digital instruments has been rapid, and the use of electronic equipment, such as sound synthesizers and recorders, to produce and combine sound unrelated to the musical scale has become common.

2.1.4 **Acoustics**

Acoustics is the science of sound that studies all mechanical waves in gases, liquids and solids including vibration, sound, ultrasound and infrasound. It is concerned with how sounds are employed, function of musical instruments, human voice and analysis of melody.

2.1.4.1 Acoustical Types

- Indoor acoustics: the field of acoustics that describes how sound propagates in a closed or semi-closed space.
- Outdoor acoustics: the field of acoustics concerned with the control of sound and vibrations in an outdoor environment.

2.1.4.2 Acoustical Parameters

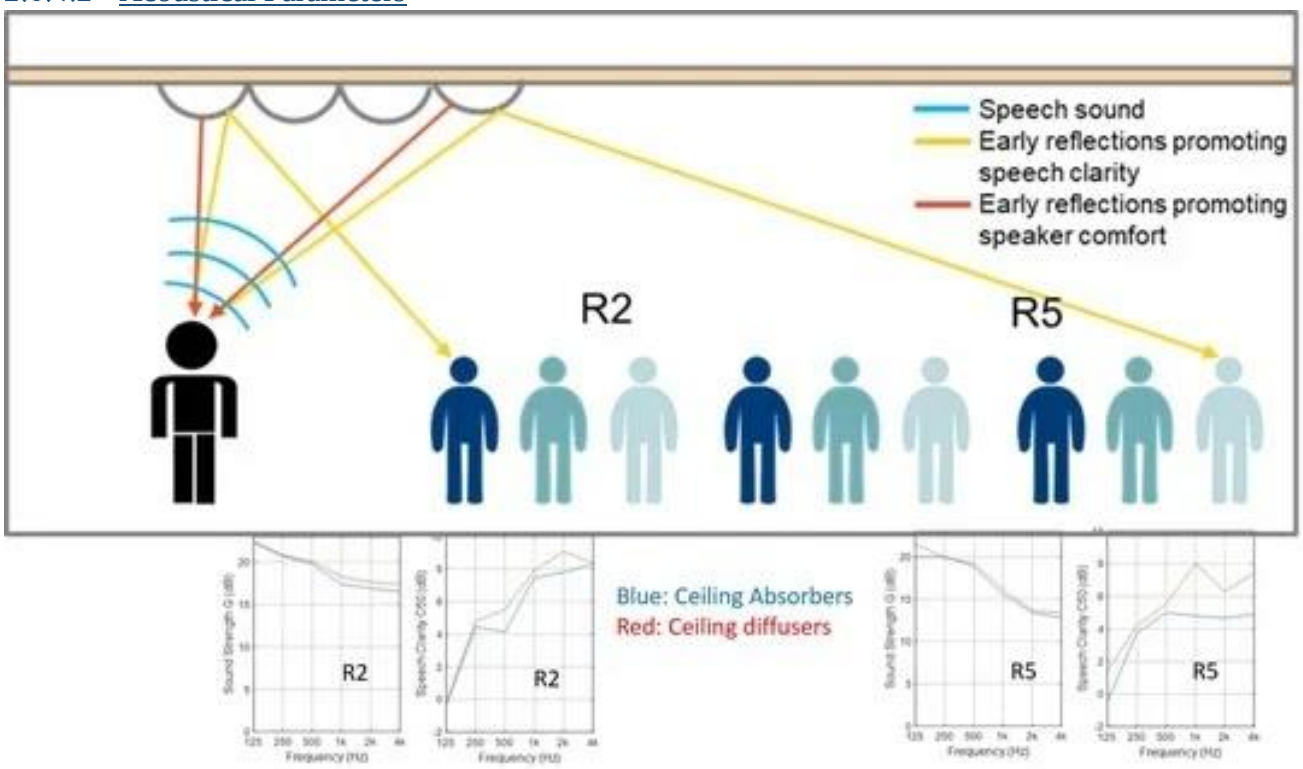


Figure 2.2 Acoustical Reflection

- **REFLECTION**: hard, rigid and flat surfaces reflect incident sound waves striking them.
- **ABSORPTION**: soft porous materials absorb sound waves hitting them.
- **DIFFUSION**: dispersion of sound within an enclosure to maintain uniform energy density.
- **REFRACTION**: when sound waves scatter around an obstacle

2.1.4.3 Reverberation and Reverberation Time

Reverberation is created when a sound or signal is reflected causing numerous reflections to build up and then decay as the sound is absorbed by the surfaces of objects in the space. It is frequency dependent. Reverberation time is a measure of the time required for the sound to "fade away" in an enclosed area after the source of the sound has stopped.

For general purpose for both speech and music = 1.5 to 2.5 secs.

For richer musical sound= 3.5 to 5.5 secs.

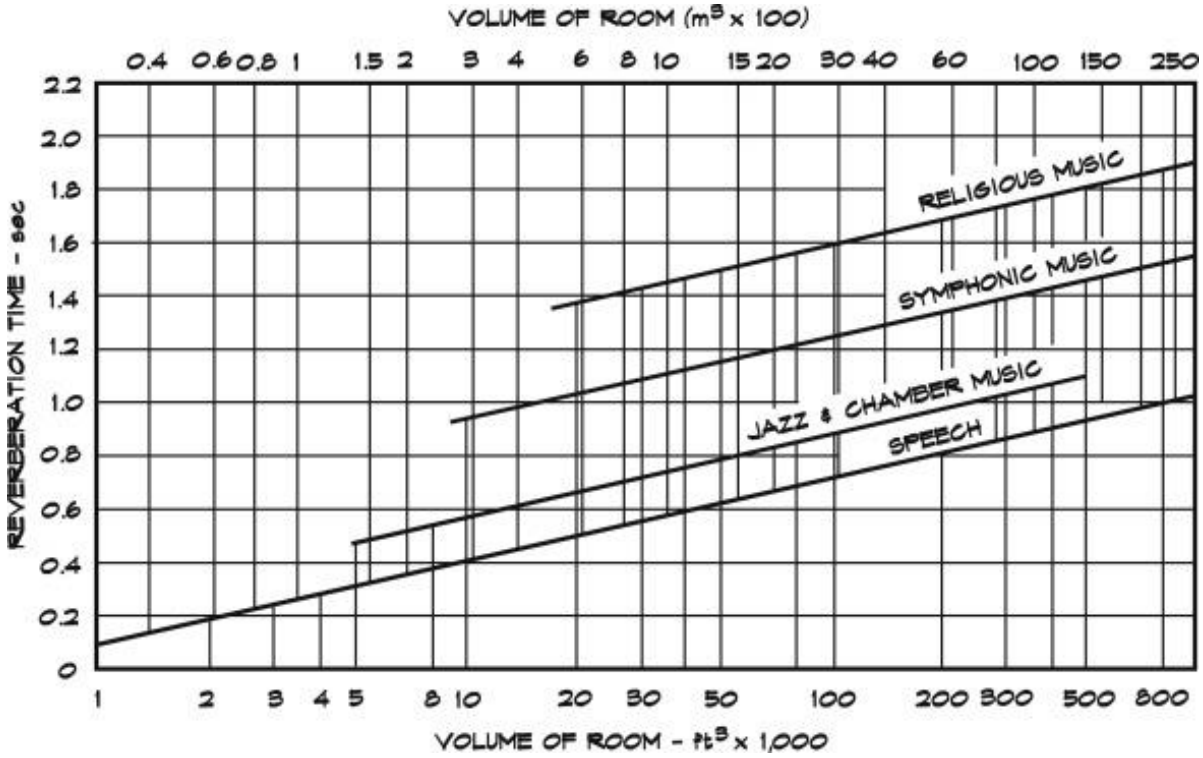


Figure 2.3 Reverberation Time of Different Music Genres

- For speech up to 1 sec
- For symphonic up to 1.5 secs
- For religious up to 2 secs

2.2 STAGE ARCHITECTURE

As an art form, stage performance does not require a purposefully designed building in which to be presented. But when audiences gather regularly to experience a performance, attempts were generally made to organize the space in order to improve on the nature of the experience the audience could have, and this was the beginning of stage architecture. Stage architecture is the practice of designing and building a space by using a staged platform to broadcast live entertainment like theatrical plays, musical performances, award shows, beauty pageants, talk shows etc.; by live performers who are physically present in front of live audience. The simplest stages are cleared areas of ground around which people can stand or sit to view a performance. Stage architecture, however, is concerned with elaborating such space: first, to provide the optimum conditions for the audience to experience a theatre performance and, second, to aid the performers in achieving the fullest expression of their art.

The practice of stage design can encompass open-air spaces or spaces that are fully enclosed. It can involve a temporary structure put up only on certain occasions or a complete stand-alone permanent building. It can include purpose-built areas within larger complexes or the modification of buildings originally built for other purposes. For general understanding, stage architecture is theatre architecture but with technological advancement and scope of different architectural designs; it is not only limited to theatres but large areas like arenas and stadiums which were primarily built for sports entertainment. The space used for performance is most often referred to by the word “stage” while “house” is the most generic term used to refer to

the audience's space. The design of stage architecture is based on the relationship the space establishes between the stage and the house.

Those elements of the design of a theatre or arena that serve primarily the aesthetics of any performance are the stage and the stage support facilities, often referred to as backstage spaces. A stage, regardless of the form of the structure, can be a cleared space on the ground or a simple raised platform. But a stage can also be a remarkably complex machine with areas for scene-changing equipment, such as wing space (at the sides of a stage), trap rooms (below a stage), fly spaces (above a stage), and rear stages (at the back of the stage), all of which also allow for multiple entrances and exits for the actors. Those elements of a theatre's design that serve primarily to optimize the experience of the audience are the house and the audience support facilities. Ensuring that as many members of the audience as is practical can see the stage well seems always to have been a priority in the design of these structures.

2.2.1 History of International Stage Architecture

(SOURCE: Franklin J; Theater Design)

Nearly all modern stage design can be traced back to the theatrical traditions established by the Greek-speaking peoples of the Mediterranean starting in the 6th century BCE. Whenever theatre is introduced into a culture, spaces that already exist for the gathering of people are called into service for its display. Any ideas for stage design that emerge with the introduction of theatre into a culture are therefore transformed as they are blended with the design of these preexisting spaces.

2.2.1.1 The first theatres:

The oldest existing spaces to be classified as "theatrical areas" are in four Minoan palaces on the island of Crete. The oldest of these, at Phaestus, dates to as early as 2000 BCE, while the one at Amnisus may have been built as late as 700 BCE.

- These are L-shaped, open-air spaces built of stone with a rectangular stage.
- The house is a set of wide, low steps terminating in a blank wall on one side of the stage.
- A grand staircase (which leads into the palace) provides additional audience space on an adjoining side. The wide steps seem best suited for the kind of stools that are illustrated in a number of Minoan murals, while the grand staircase could easily accommodate dozens and dozens of audience members either sitting or standing.
- The maximum audience capacity has been estimated to be 500.

Figure 2.4 A painting of Grand Staircase which leads into the palace

Figure 2.5 Present state of Phaestus

2.2.1.2 Classical era:

- **Greece:**

Sometime before 497 BCE, the Athenians moved their theatre from the market square to a precinct dedicated to the god Dionysus on the southeast slope of the Acropolis.

- It is likely that it at first followed the straight-line form of the theatre in the agora, but gradually the seating benches were laid out in sections in the shape of wedges that formed a polygon around part of the northern half of the stage, giving it a thrust stage configuration.
- By the middle of the 5th century BCE, the stage area had taken on the shape of a U, with a polygonal house of wooden benches around just slightly more than half of the northern loop, a straight-line scene building closing off the southern end and an empty space just below the top of the U into which the entranceways led.
- The scene building was substantial enough to provide a small playing space on its roof and at least one set of doors facing the stage.
- The doors may have led onto a porch, raised two or three steps above the orchestra so it could serve as a raised stage or "place of speaking". This was certainly a feature of later Greek theatres when small buildings were actually constructed on each end of the skene to enclose the ends of such a raised stage.
- The performance area of Greek theatres was often divided into two sections, the main stage and a raised stage at the back.
- The scene building had sufficient space for the operation of complex stage machinery both for flying actors onto or off the stage and for revealing a tableau

of an interior scene on a platform rolled out from within. This building also provided up to three entrances along the back of the raised stage.

It was not until 330–325 BCE, at the beginning of the Hellenistic Age, that the house in the Theatre of Dionysus was built in stone and took on a shape, slightly more than semicircular, that has so often been identified with the stage buildings of a century earlier. The semicircular house ran in tiers up the hillside, where it ended in a walkway. Beyond the walkway was a rise in elevation of several feet and another section of seating, which had been added to extend the house farther up the hill. In the largest of its many renovations, the theatre may have held an audience of over 17,000 people. It is not clear whether the Theatre of Dionysus established this form of stage architecture or was merely following a trend established elsewhere, but this was to become the **basic model for stage architecture** for the next 500 years.

Figure 2.6 Theatre of Dionysus

About 440 BCE, Athens became the site of the **first documented indoor theatre**, the Odeum of Pericles.

- This was a square building with seating along all four walls and a performance area in the center.
- It had a seating capacity of perhaps 4,000 people, though the view of the stage of more than half the audience members would have been obstructed by columns.
- This was a theatre used more often for poetry recitals, music recitals, political ceremonies, and religious events than for drama.

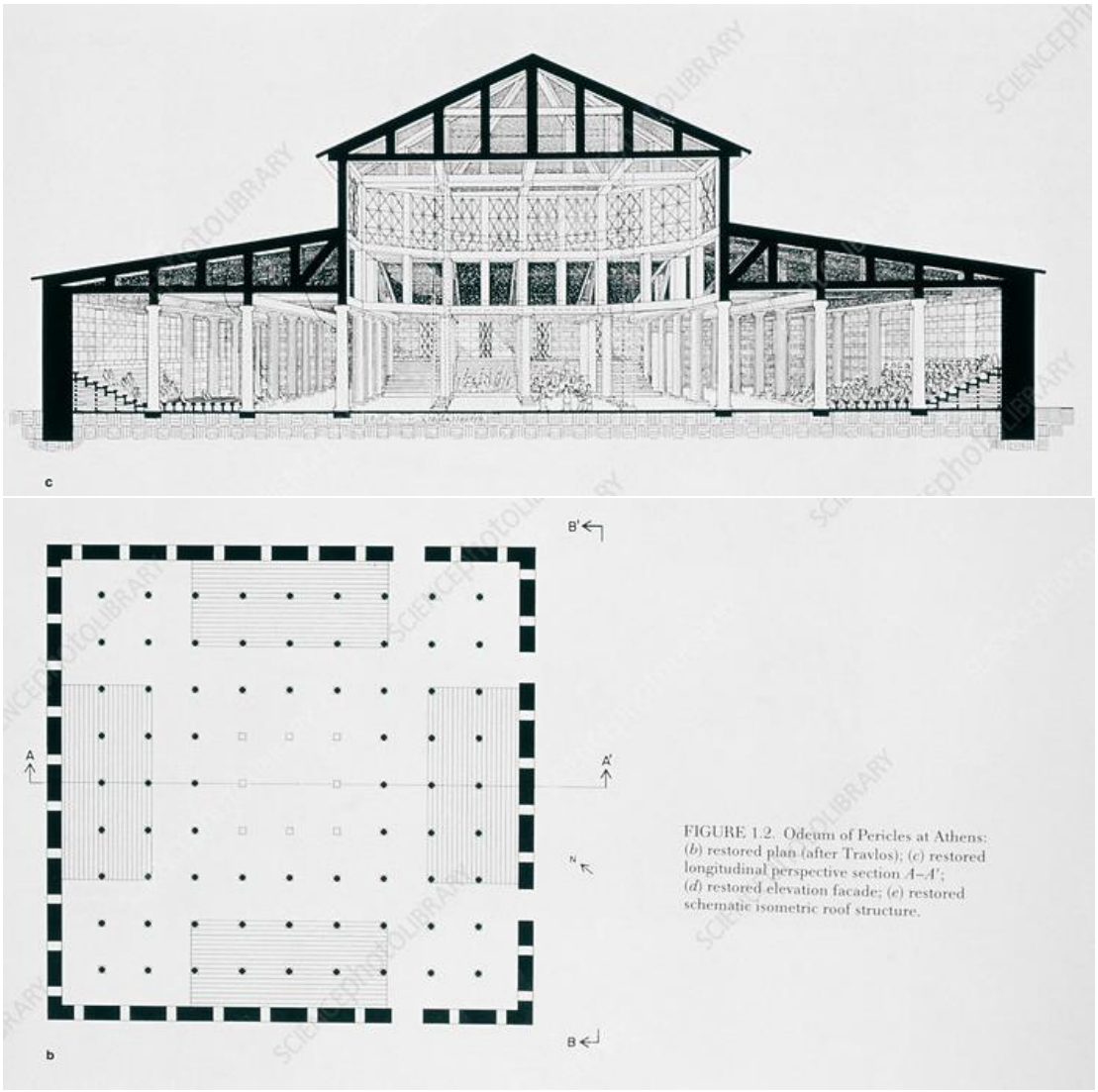


FIGURE 1.2. Odeum of Pericles at Athens: (*b*) restored plan (after Travlos); (*c*) restored longitudinal perspective section *A*–*A'*; (*d*) restored elevation facade; (*e*) restored schematic isometric roof structure.

Figure 2.7 The Odeum of Pericles

- **Rome:**

The start of Roman theatre is usually dated to 240 BCE. The Romans built their theatres of wood for a specific festival; when the festival was over, the entire structure was taken down. Gradually these structures became fantastically elaborate. Pliny the Elder reports that, by about 50 BCE, wooden theatres with audience capacities of up to 80,000 were being built three stories high, with decorations made of glass, marble, and gilded lumber. Stone theatres were gradually built in cities outside Rome in the early part of the 1st century BCE, but it was not until 55 BCE that a stone theatre was finally erected in the city itself. This was the theatre of Pompey the Great, and it became **the model for Roman-built open-air theatres** thereafter.

- The theatre of Pompey was built on flat ground, using arched substructures. These substructures allowed the audience to access several levels of corridors that ran beneath the seating and led to entranceways that opened out into the seating area itself.
- The house was much like a traditional Greek theatre except that there was now a covered colonnade running around the uppermost level. This colonnade was

broken at the center by the entrance to a large temple of Venus that projected out behind the theatre.

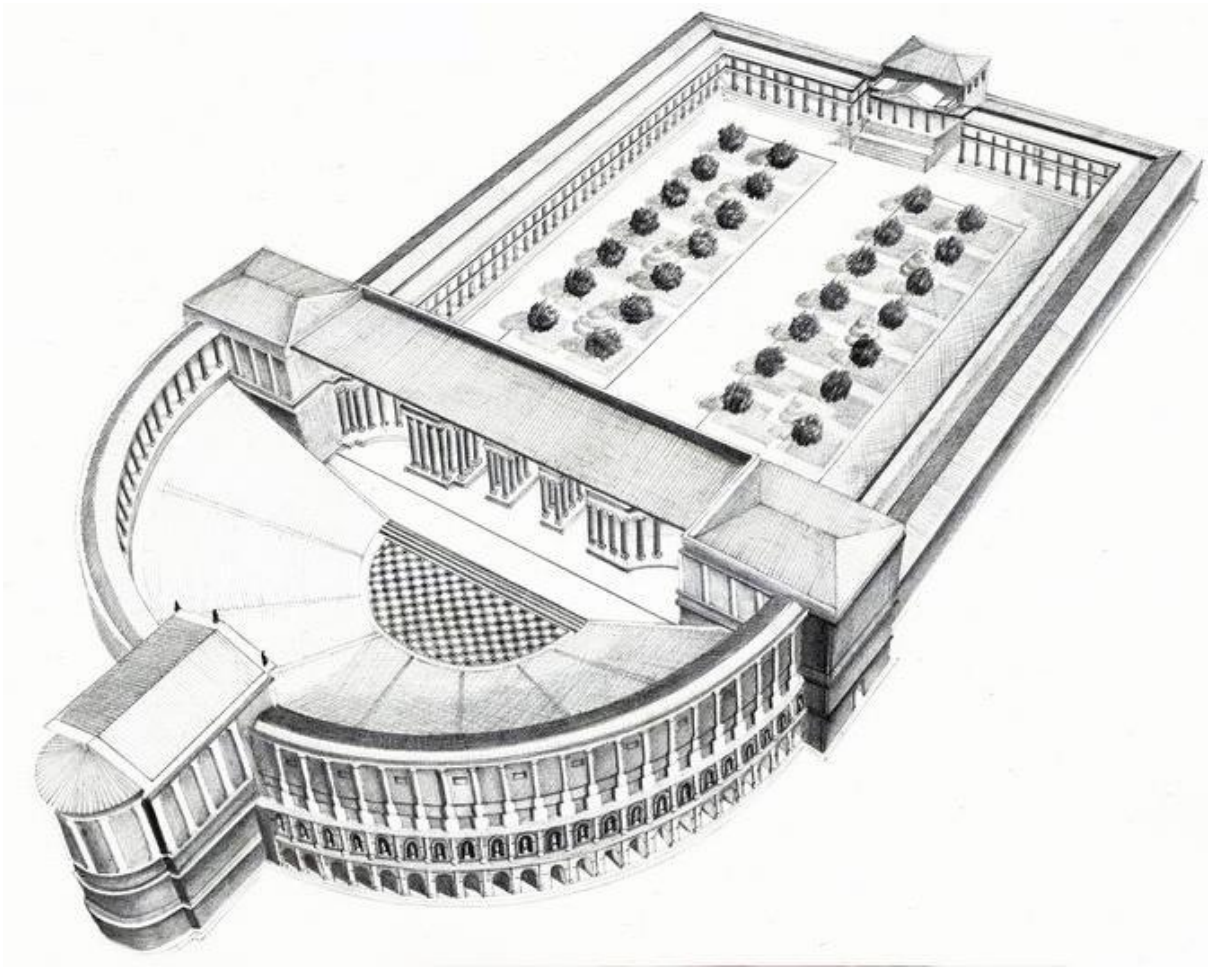


Figure 2.8 Theatre of Pompey

- Designers of later Roman theatres made use of hillsides so as to reduce the cost of building substructures. But while Greek theatres laid out most of the seating directly onto a hillside, Romans terraced the hillsides and built seating on single-level substructures at each terrace level so that passageways under the seating would still be available.

- **Asia:**

India's oldest theatre is in the Sitabenga cave at Ramgarh Hill, now in Chhattisgarh state in central India. It was built during the first half of the Hellenistic Age, between 300 and 200 BCE.

- This is a small theatre carved into the rock at the mouth of a cave facing out over an uncovered area just large enough for a small temporary scene building and stage.
- Its seating is reminiscent of a Greek odeum.
- It includes a large scene building, with an upper stage, cut into the rock.

- The seating area, however, was of wood, like the *ikria* of the Greeks, and only some marks in the stone, where support beams were likely held in place, survive.
- Sanskrit theatres came in three shapes—rectangular, square, and triangular—and in three sizes—large, medium, and small.
- In each form about half the space was given over to the house, a fourth to the stage, and a fourth to the backstage areas.

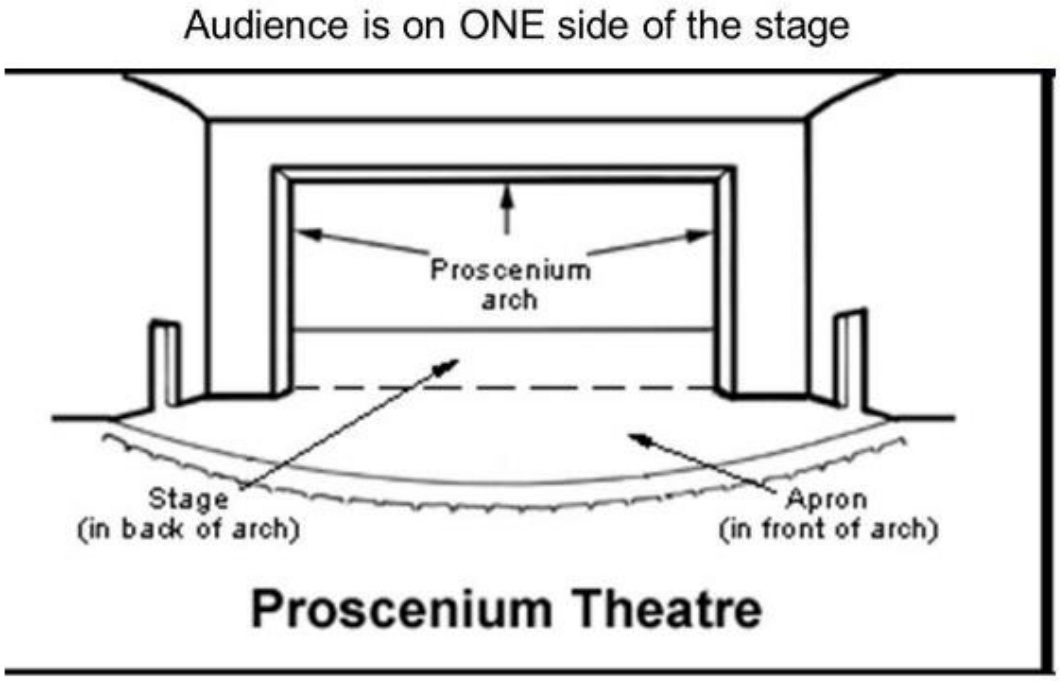


Figure 2.9 Ancient Sanskrit Theatre

2.2.1.3 Middle Ages:

Little is known about theatre in the West from the 6th through the 10th century CE. By the end of the 12th century, it was being performed in found spaces such as village greens, churches, churchyards, halls, and the ruins of Roman amphitheaters. Found spaces were used much as flexible theatres. The only form that is not found in the Middle Ages is the proscenium theatre. What made medieval theatre so adaptable was multiple setting, a staging technique that used localized scenic structures and a generalized stage area. The most complex architectural forms to be developed from medieval theatre were not actually built until the 16th century, as a type of "theatre all around" set up in market squares, such as at Lucerne in Switzerland. But by this time there had already been an explosion of new developments in theatre design brought about by the Renaissance.

2.2.1.4 Renaissance era:

During the late Middle Ages, the Confrérie de la Passion in Paris, a charitable institution that had been licensed to produce religious drama in 1402, converted a hall in the Hôpital de la Trinité into a theatre. This is an early example, however, of what came to be known as a "theatre in the hall", an arrangement that became a dominant form of theatre design in the Renaissance, when formal experimentation was being undertaken by academic institutions.

- These stages, which were hybrids of Classical and medieval designs, were generally installed as end stages in existing halls or in courtyards in which audience members sat on benches around three sides, sometimes on two or more levels.
- The audience also sat on benches or stood in the center area facing the stage, but this area could be left open for incidental entertainment.
- The first known use of perspective scenery in theatre dates to 1508, when it was used on a large painted backdrop.

In 1576, however, a playhouse called The Theatre was built in London. It used the first truly innovative design to be found in a public playhouse.

- Unlike the others, which were rectangular, The Theatre was polygonal with perhaps as many as 20 sides, or bays. Each bay was about 12 feet (3.5 metres) deep and contained three levels of seating covered by a roof, making it look like an evolved form of the buildings.
- The central area of the polygon was open-air.
- Behind the stage was a tiring-house, the backstage area of the playhouse.

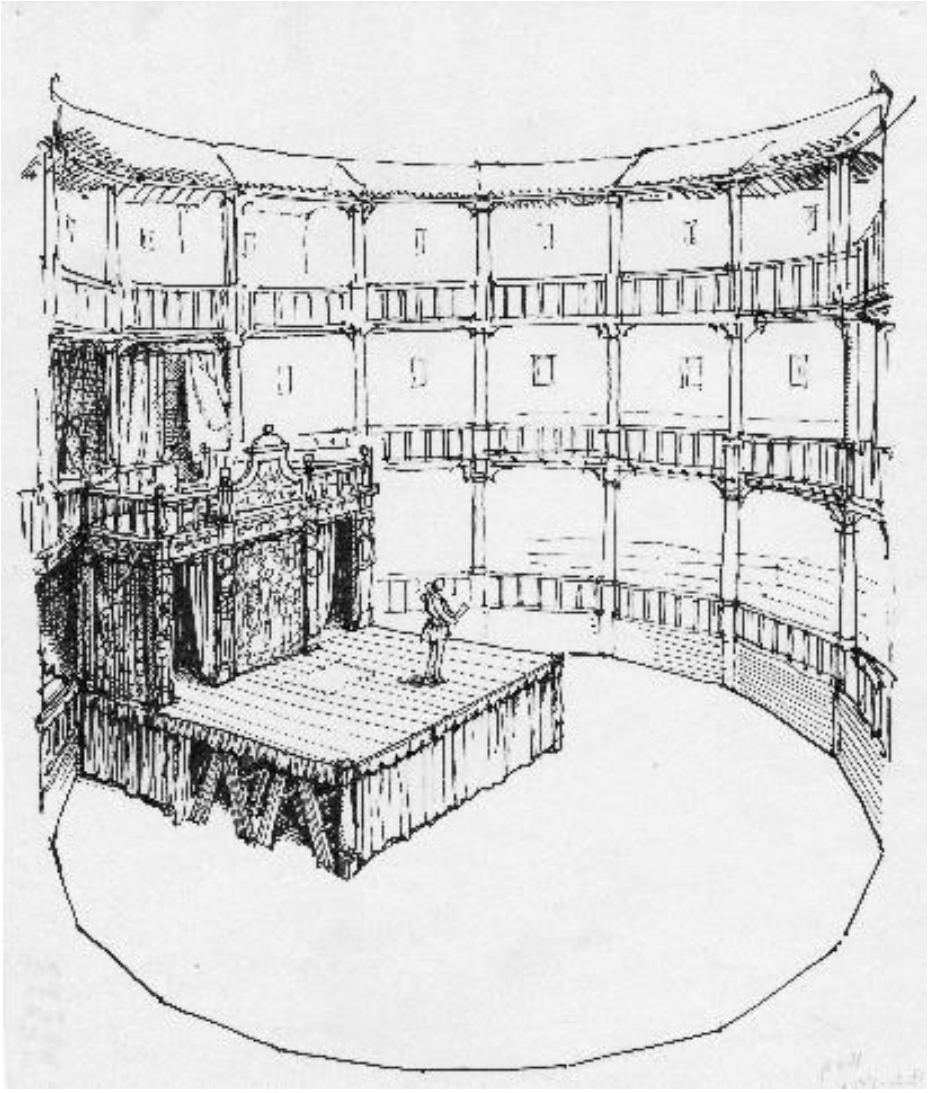


Figure 2.10 The Theatre in London

After the early 17th century, both England and Spain joined the rest of Europe in making their public theatres indoor spaces. By the 17th century, Chinese audiences had stopped standing in the central area in front of the stage and started sitting at low tables where they could be served refreshments during performances. In Japan, by the late 16th century, a design suitable for the 200-year-old Noh drama was finally being established. In its basic form, a Noh theatre was much like a Chinese theatre, with a raised square stage of about 18 feet (5.5 meters) on each side covered by a roof supported by pillars at the four corners. The Noh stage was set on the long side of an existing rectangular courtyard, and the audience sat only on the porches of the buildings that surrounded the courtyard.

Figure 2.11 Noh Theatre in Japan

2.2.1.5 Baroque and Rococo:

Public theatres in Europe did not experiment with perspective scenery until the **first opera house**, the San Cassiano, was built in Venice in 1637. The experimentation with perspective had taken place only in the West and only in court theatres, but it led to the invention of the proscenium arch and the clockwork stage. This was the system in use when Bernardo Buontalenti built the Teatro degli Uffizi (1585) in Florence, the first theatre with a permanent proscenium stage.

- In the Baroque period, architects who designed theatres focused on the layout and decoration of the house.
- At the start of the period, the audience area was most often rectangular, but it also took the shape of a U, a horseshoe, and a bell.
- The shape of the house was determined by the shape of the galleries that formed it.

The Drottningholm Theatre, a court theatre in Sweden, was, for instance, built with only two decorative boxes near the stage and no galleries. Public theatres had an additional incentive for the elimination of boxes. These theatres were becoming so large that they had reached the limits of the ability of actors to project their voices in them. Reducing the number of boxes allowed for larger numbers of people to be into the same volume of space. But the transition to these kinds of arrangements in the public theatres was slow, and it was still slower in the opera houses.

Early in the Baroque period the decoration scheme of theatres was largely restrained, but it became increasingly ornate until it reached the heights of the Rococo in the mid-18th century. Increasing attention also was paid to front-of-house facilities, from ticket offices to lobbies, during the Baroque period.

Figure 2.12 The Drottningholm Theatre in Sweden

2.2.1.6 The 19th Century:

The staging challenges of the works produced under the influence of Romanticism, as well as of the widely popular genre of melodrama, dictated the elimination of painted sets and the wing and boarder systems that had dominated the Baroque period.

- Painted scenery was increasingly replaced by three-dimensional scenery with which the actors could interact.
- The advent of the use of gas; its first successful application was demonstrated in 1803 and, subsequently, electricity made it possible to control lighting as never before.
- It also reduced the need for the actors to work on the apron part of the stage just in front of or just within the proscenium, a development that took the actors out of the volume of space occupied by the audience and put them into a separate world.

- When, in the last quarter of the 19th century, the lights began to be turned off regularly in the house during the performance, the experience of going to the theatre was transformed from a social event to an experience in observation.

The 19th century also marked the advent of increased concern for audience comfort and safety. The gradual decline of boxes which were often located only near the stage, where they provided the best place to be seen but not necessarily the best place to see was causing a reduced level of comfort for some important patrons. As compensation, the pit, which was the largest area from which one could see the entire stage, was significantly improved. In France the standing audience was removed, and seating was installed for the first time; in other counties benches were replaced by individual seats. The use of steel at the end of the 19th century allowed the galleries to be cantilevered, which improved sight lines even further. Fire safety became an increasing preoccupation of city planners, and their regulations became a major component of every theatre design.

2.2.1.7 The 20th Century and beyond:

Theatre design of the 20th century was the most varied in history. It was the first century in which virtually every theatrical design developed during the previous two millennia was available at the same time. After 250 years in which the box, pit, and gallery theatre, with its proscenium stage, dominated the art, there was widespread rebellion against it. As had happened during the Renaissance, a flood of new ideas was started by explorations of past practices.

- A revival of interest in Greek theatres inspired by archaeological excavations at the turn of the century led to numerous attempts to re-create Greek theatre spaces and ultimately inspired the German architect Walter Gropius to propose his "total theatre" (1927), which, had it been built, would have allowed a Greek theatre to be converted into the first complete theatre-in-the-round since medieval times.
- In 1939 the University of Washington in Seattle built the Penthouse Theater, which proved to be a more practical model for the numerous theatres-in-the-round that followed.
- At roughly the same time, a number of theatres designed to imitate Elizabethan theatres—such as the indoor Maddermarket Theatre (1921) in Norwich, Eng., and the open-air Old Globe Theatre (1935) in San Diego, Calif.—were built around the world, with more being constructed later in the century, including the Swan Theatre at Stratford-upon-Avon, Eng. (1986), the Globe Tokyo (1988), and Shakespeare's Globe in London (1997).
- This vogue led to the proliferation of thrust stages throughout the world. In the third quarter of the 20th century, theatre designers focused their efforts on the creation of adaptable spaces that could easily be converted into at least two major theatre forms.
- At the turn of the 21st century, emphasis shifted to performing-arts complexes in which several different styles of theatre were incorporated.

Figure 2.13 Swan Theatre in Stratford (top) The Globe in Tokyo (down)

2.2.2 History of National Stage Architecture

Table 2.1 History of National Architecture

MALLA ERA	RANA ERA	SHAH ERA	MODERN ERA
• 15^{th} to 18^{th} century • Rich folk music and dances of newar community in valley • Built dabali at palace squares for performing	• Limited musical activities to themselves only • Indoor halls were built	• Construction of public hall • Rastriya Nach Ghar constructed in 1960 AD • Rastriya Sabha Griha and Nepal Academy Hall in 1971 AD	• Globalization of culture and technology • Public and private auditoriums and halls constructed • A space solely designed for musical performance still lacks

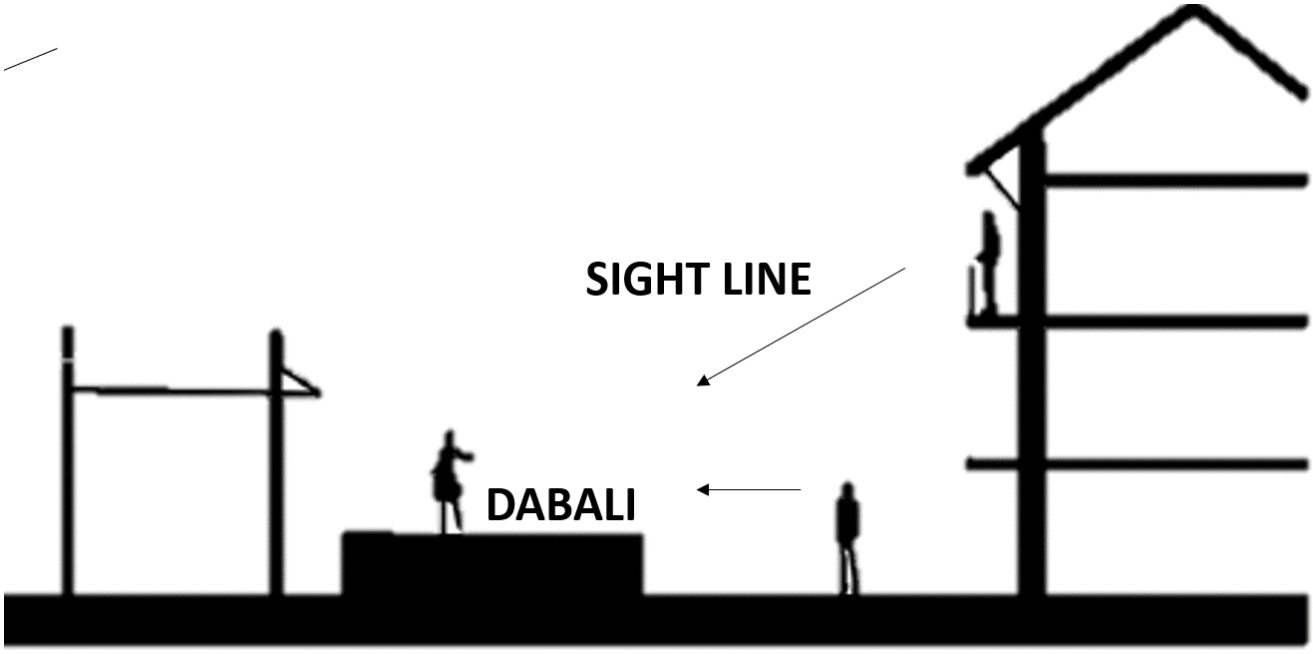


Figure 2.14 Section of Dabali

2.2.3 Nature of Stage Design

The simplest stages are cleared areas of ground around which people can stand or sit to view a performance. Stage design, however, is concerned with elaborating such space to provide the optimum conditions for the audience to experience a performance and also to aid the performers in achieving the fullest expression of their art. Because they are well designed for the gathering of a group of people and generally allow for controlled access, theatres tend to be used as multipurpose buildings that can provide assembly space for lectures, meetings,

concerts, films, performance art, circuses, and even certain types of sporting events. But at its most basic level, a theatre provides a space for the performers to enact their performance and a space for the audience to experience that enactment.

The specific architectural elements considered ideal for improving that experience will differ from culture to culture, but they can still be divided into two general categories: those that serve the aesthetics deemed appropriate for the art of stage in a given culture, and those that optimize the experience of that art for the audience. The space used for performance is most often referred to by the word stage in English. The space occupied by the audience is referred to by a variety of terms, of which auditorium (literally, "hearing place") may be the most common. House is the most generic term used to refer to the audience's space, in that it focuses attention on the experience that can be had by the audience without favoring any one aspect of that experience.

2.2.4 **Form and Space**

(SOURCE: Franklin J; Theater Design)

The elements that are most often discussed in terms of optimizing the experience had by the audience, by contrast, revolve around audience comfort. Comfort in an arena also has both physical and social components. Physical comfort involves the nature of the seating or standing area, the amount of space allotted to each audience member, and the ease of access to the space. Physical comfort also includes the ability of all audience members to see and hear a performance in the manner that their culture has taught them is most desirable for the proper experience of theatre. It also includes the maintenance of a certain level of safety. Social comfort, on the other hand, has to do with each audience member's ability to feel like part of a group at a theatre event. Among the factors that are generally considered when it comes to social comfort is whether the arrangement of the audience within the house reflects the accepted social order within the culture.

2.2.4.1 The Stage and Backstage

Those elements of the design of a stage architecture that serve primarily the aesthetics of performance are the stage and the stage support facilities, often referred to as backstage spaces. A stage, regardless of the form of the structure, can be a cleared space on the ground or a simple raised platform. But a stage can also be a remarkably complex machine with areas for scene-changing equipment, such as wing space (at the sides of a stage), trap rooms (below a stage), fly spaces (above a stage), and rear stages (at the back of the stage), all of which also allow for multiple entrances and exits for the actors. A stage can contain revolves and tracks for the movement of scenery and actors, and it can provide a variety of crossover spaces that allow the actors to exit the stage at one point and enter it at another. It can also be built on multiple levels. Backstage spaces can include dressing rooms, green rooms, and rehearsal rooms. They can also include production services such as design studios; shops for building costumes, scenery, and stage properties; paint shops; electric shops; wig shops; hat shops; laundry facilities; storage areas; loading docks; and stage door security stations. Finally, they can include areas within the house, from positions for the hanging of lighting equipment and speaker systems to control rooms for stage lighting, sound, and special effects. A space for musicians to play music before, during, and after a performance is also part of the stage-support facilities. While this space can be located among the backstage areas, it is more often onstage or in the house near the stage.

Figure 2.15 Stage and Backstage

2.2.4.2 The House and Front of House

Those elements of a theatre's design that serve primarily to optimize the experience of the audience are the house and the audience support facilities, which are generally referred to as "front-of-house" facilities. Ensuring that as many members of the audience as is practical can see the stage well seems always to have been a priority in the design of theatres. In the house, whether the theatre is an arena, a thrust, or an end stage theatre or a flexible one, the surface on which the audience sits (or stands) normally rises in elevation as it moves away from the stage so that audience members can see more easily over those in front of them. Because the ability of members of the audience to see well is also influenced by the distance they are from the stage, many theatre designs try to maximize proximity to the stage by stacking sections of the audience one above the other, either in galleries supported by posts or in balconies cantilevered out from the walls.

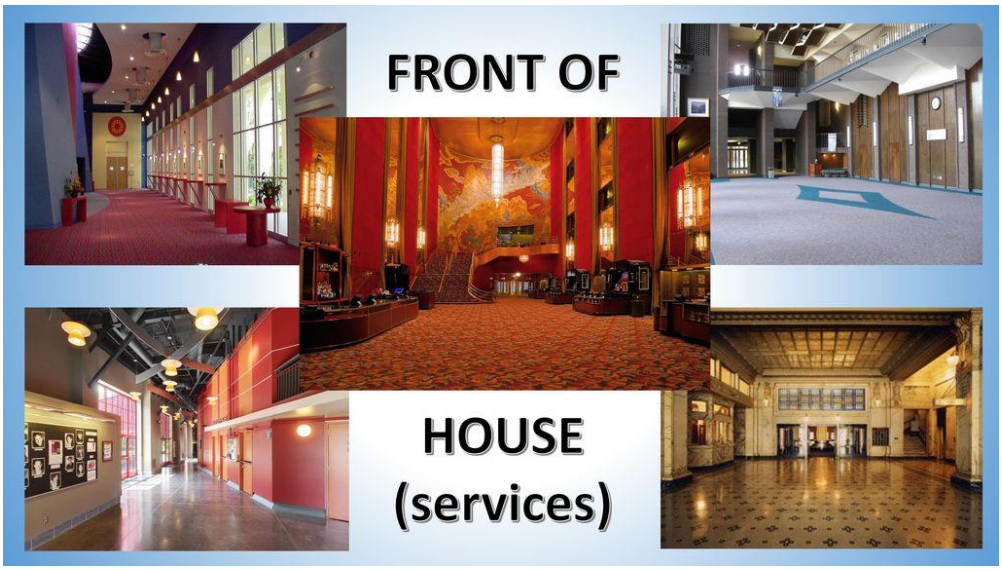


Figure 2.16 Front of House Facility

The front-of-house facilities provide for the needs of the audience before, during, and after a performance. Those needs include everything from the manner in which audience members get information about a performance to the manner in which they access transportation when the performance ends. Front-of-house facilities can include entrances and exits to the building, lobbies, grand staircases, ticket offices, refreshment areas, gift shops, cloak rooms, and restrooms. They can also include facilities for heating, ventilation, and air conditioning and for cleaning and maintaining the structure, as well as the vast array of offices necessary for running a theatre business. A great deal of attention is paid to the decoration of the house, of those front-of-house facilities that are seen by the audience, and of the exteriors of the theatre building. Such decoration can be anything from spectacularly grand to remarkably plain. In each instance, however, the decoration reflects an architect's interpretation of what the culture or subculture assumes to be appropriately inviting to the audience and what will put the audience in the most receptive mood for the type of performance they will be experiencing in the theatre.

2.2.5 Types of Stage Architecture

(SOURCE: Franklin J; Theater Design)

Every stage structure is unique, but, with few exceptions, both Western and Asian, can be categorized into four basic forms: arena stage theatres; thrust stage theatres; end stage theatres; and flexible stage theatres, also sometimes called black box theatres. The design of all these types is based on the relationship the space establishes between the stage and the house.

2.2.5.1 Arena theatres:

Arena theatres are those that have an audience around four sides of the stage. These are often called amphitheaters, island stage theatres, or center stage theatres, or they are referred to generally as theatre-in-the-round. Although the stages can be round, oval, octagonal, square, rectangular, or in a variety of irregular shapes. Arena stages are thought to create a strong sense of community among the audience members and an easy flow of energy between the audience and the actors. They do, however, put major restrictions on the amount and kind of visual spectacle that can be provided for a performance, because scenery more than a few feet tall will block the views the audience members have of the action taking place onstage. In these theatres, scene-changing equipment must be limited primarily to that which can be put under the stage, and special effects are difficult to manage because so little can be hidden from the audience. Arena theatres also complicate the management of the movement pattern for actors, as they must perform to all sides of the stage without having their backs to any one side for too long a time and without preventing one part of the audience from seeing other actors.

2.2.5.2 Thrust stage theatres:

Thrust stage theatres are those in which the stage thrusts out from one side of the space into the midst of the audience. They are also known as open stage theatres and sometimes as courtyard theatres. The audience is most often located around three sides of a thrust stage, though they can be located on two sides opposite each other or on two adjoining sides (as they are in L-shaped theatres). Thrust stages are most commonly trapezoidal, semicircular, rectangular, or square. In both arena and thrust stage theatres, some members of the audience will be looking at other members of the audience across the stage, where they will appear as the background to the performance. Thrust stage theatres are therefore thought to share many of the community-building advantages of arena stages. They also make managing the movement

patterns of the actors and displaying and changing the scenery less difficult because there is always at least one side of the stage that is not occupied by the audience. Often, arena theatres are designed for easy conversion into thrust stage theatres by way of the removal of one section of audience seating.

2.2.5.3 End stage theatres:

End stage theatres are those that have an audience on only one side. Such stages are most often rectangular or square, but they can be triangular (called corner stage theatres) or take a variety of irregular shapes that can include side stages (referred to as extended stage theatres). End stages are thought to focus the full attention of the audience onto the production. End stages also simplify blocking, allowing actors' movement patterns to be more easily composed into aesthetically appropriate shapes, and they greatly simplify the display of scenery and special effects. The house of an end stage theatre can be rectangular or take the shape of a fan, leaving all members of the audience facing the same direction. But the house can also be shaped like a bell or a horseshoe or can be semicircular or square and arranged so that some members of the audience can still look across the space at other members of the audience. The significant difference between this form and the arena or thrust stage forms, however, is that in end stages almost all members of the audience must look away from the stage to see their fellow audience members. They therefore do not appear as a background to the performance. For this reason, end stage theatres are thought to be less conducive than the other forms to building a sense of community within an audience. End stage theatres may have movable ceiling and walls that can be adjusted to increase or decrease the seating capacity in the house.

2.2.5.4 Flexible stage theatres:

Flexible stage theatres are those that do not establish a fixed relationship between the stage and the house. Also known as black box theatres, laboratory theatres, modular theatres, multiform theatres, free form theatres, or environmental theatres, they can be reconfigured for each performance. They can be put into any of the standard theatre forms or any of the variations of those. They can be made into "surround theatres" (sometimes called "total theatres" or "theatre-all-around"), in which the audience sits or stands in the center and the stage surrounds it on four sides. They can also be made into "promenade" spaces in which the audience follows the actors around to different locations within the space.

All of the theatre forms discussed so far put the actors and the audience within the same volume of space. But there is one variety of end stage that intentionally puts the stage in a separate volume of space from that occupied by the house: the proscenium, or "Italian style," theatre. In this form, the stage is separated from the house by a wall with a large arched opening that allows the audience to see through from the house to the stage as if looking through a frame at a large moving picture. Because of this unique feature, the proscenium theatre is often given its own classification. The form's greatest advantage continues to be that it allows for the maximum amount of spectacle in performance.

Figure 2.17 Arena Stage

Figure 2.18 Thrust Stage

Figure 2.19 End Stage

2.3 ARENA DESIGN CONSIDERATION

2.3.1 Types of Arenas by capacity

Arena has two types of resource capacity settings:

- Fixed capacity: Does not change during the simulation run
- Capacity based on schedule: Variable capacity based on time

Types on basis of capacity:

1. Small Arena: 5,000 - 8,000
2. Medium Arena: 8,000 - 12,000
3. Large Arena: 12,000 – 20,000
4. Super Arena: more than 20,000

2.3.2 Arena seating

The human size determines the dimensions of the seat and thus the required space of the spectators and the size of the room. The seating area has taken many forms and shapes from the ancient open theatres marble benches till today's hi-tech chairs of theatres and cinema houses, but the purpose remains almost the same i.e. to provide for the audience the best possible view to the stage - screen, along with a certain comfort. House seating is one of the most important elements of arena design which helps in determining the capability of arena to provide a good performance quality to the audience as well as the stage artists. Some objectives of arena seating are noted below:

- Good visibility, safety and comfort
- Unobstructed view to feel a connection with the event
- Access to and from the seat should be easy and safe
- The chosen seats need to comply with all safety regulations and operating licenses.

2.3.2.1 Seating Layout

The aisle is the space for walking with rows of seats on both sides or with rows of seats on one side and a wall on the other. In order to improve safety when the theaters are darkened during the performance, the edges of the aisles are marked with a row of small lights. The auditorium seating layout can either be set up as multiple-aisle or continental. Horizontal aisles are often required every 10 to 15 rows. To allow for proper ingress and regress, such aisles are often six to eight-feet wide. Although regulations will vary, the aisles often need to be about four-feet wide along the outer walls of the theater, and center aisles often need to be about five-feet wide.

- Multiple Aisle Arrangement:

This arrangement will have a maximum of 14–16 chairs per row with access to an aisle-way at both ends. If an aisle can be reached from one end of a row only, the seat count may then be limited to 7 or 8.

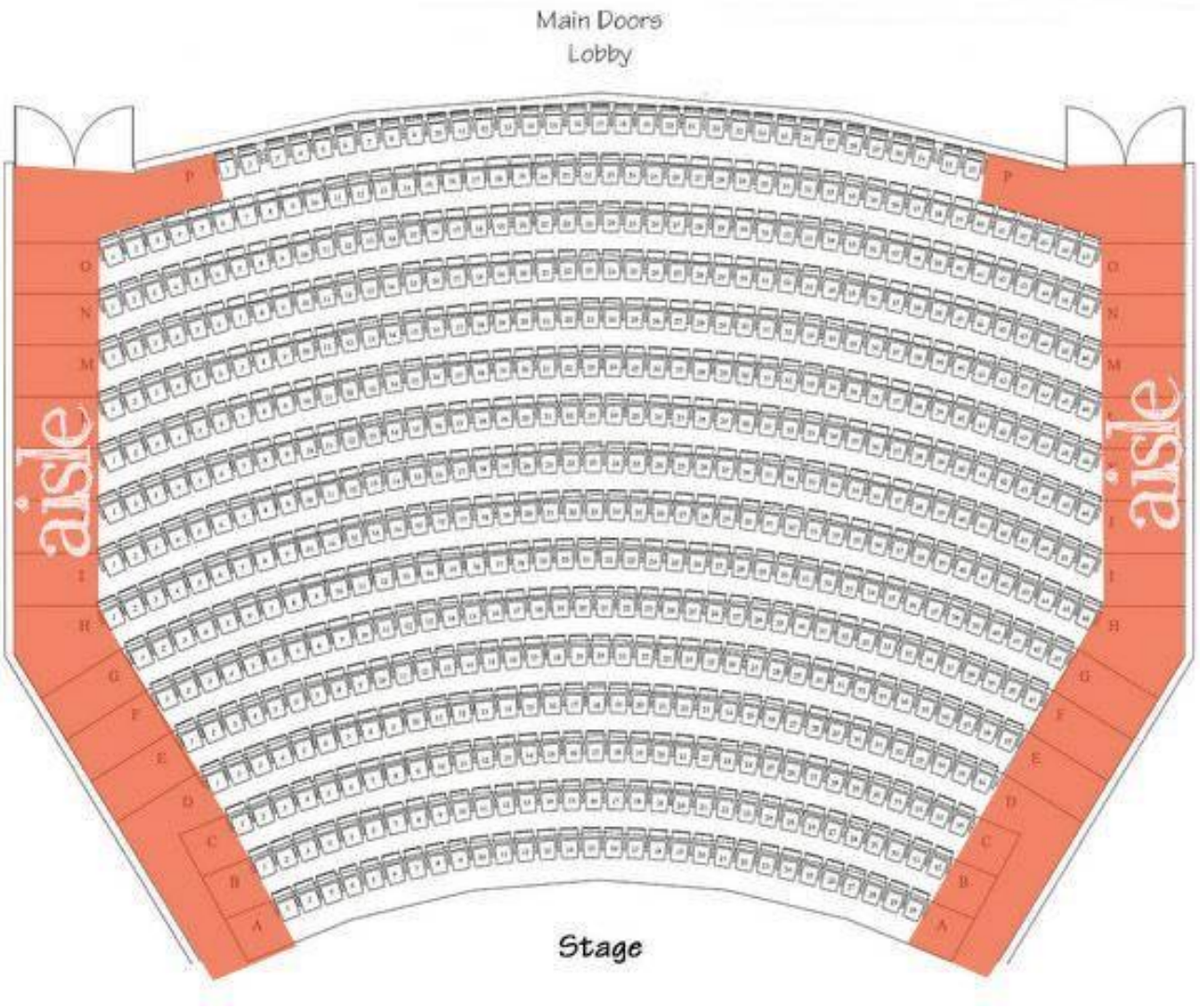


Figure 2.20 Multiple Aisle Arrangement

- Continental Arrangement:

This arrangement, all seats are located in a central section. In the continental style, you can fit even more chairs per row than multiple-aisle arrangement. Usually, it requires an average of 7,5 square feet (2,3 square meters) per person including the seating area and the space for aisle-ways. Perhaps surprisingly, a continental arrangement can often accommodate more seating within the same space.

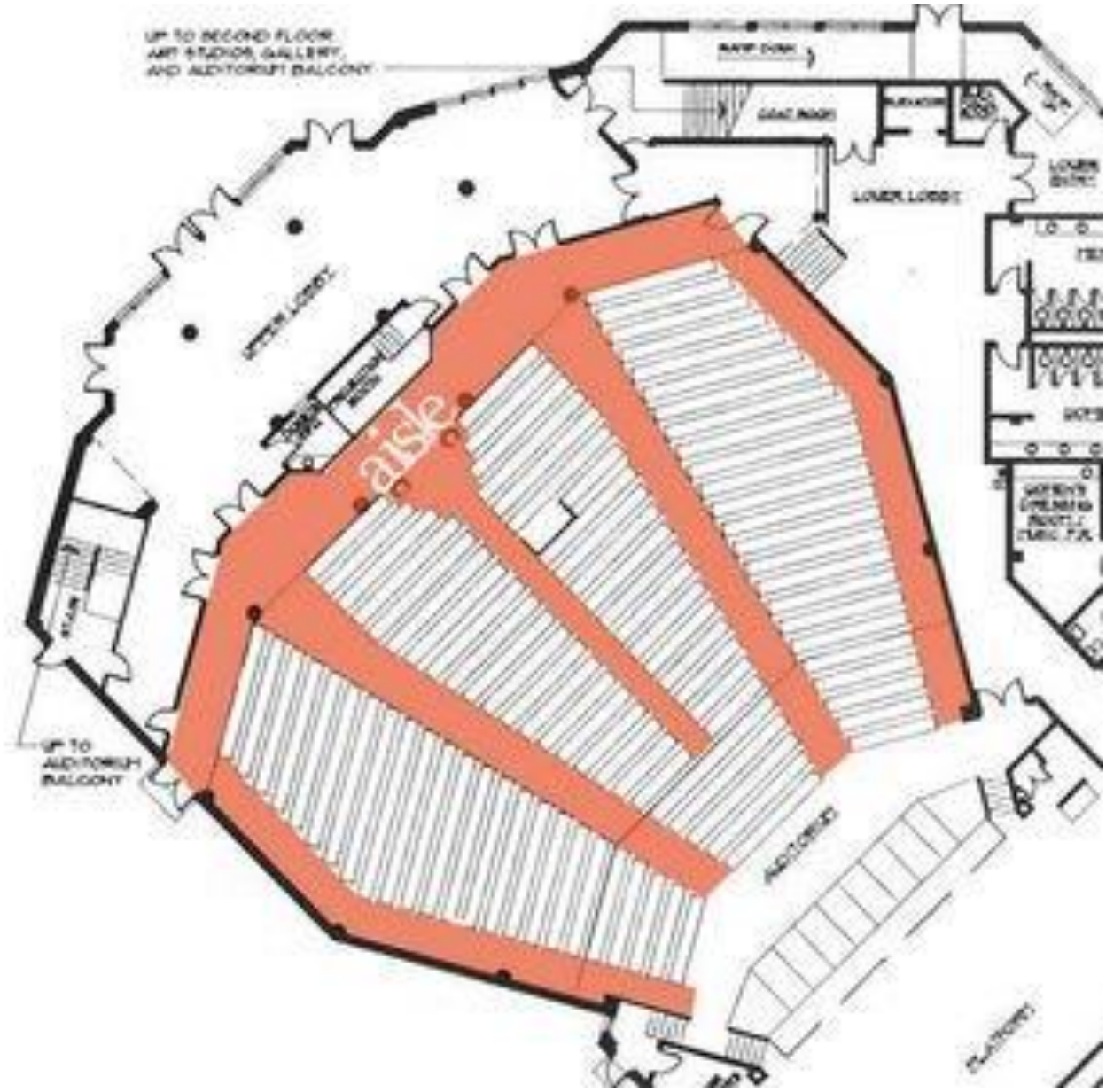
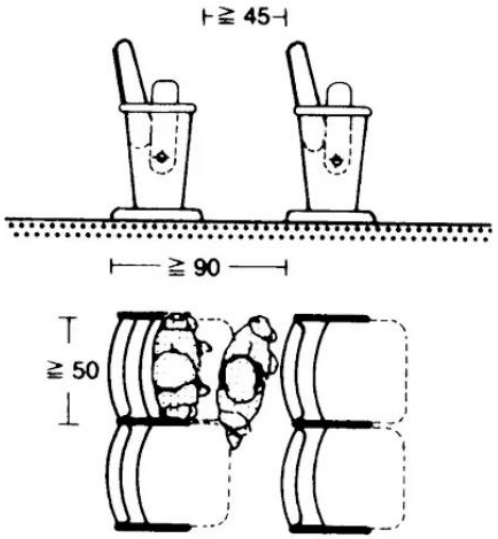


Figure 2.21 Continental Aisle Arrangement

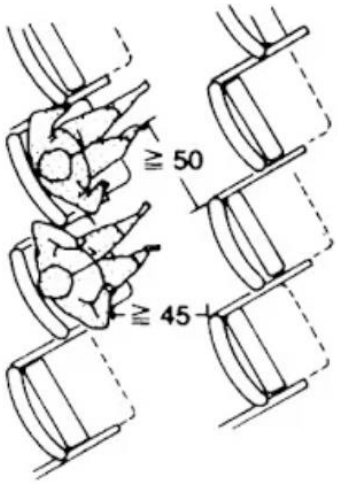
2.3.2.2 Seat layout

The layout of the seats to whether a project involves tiered rows or a sloped floor, the design of the floor will impact both rows spacing and the sightline of the audience. For the visual relation of each audience with performer curved rows is necessary. Centre of curvature is located on the center line of auditorium approximately the depth on the center line of proscenium.

- An area of at least 0.5 sq. m. per spectator is to be used for sitting. This number is derived from a seat width x row spacing of at least 0.45 sq. m. per seat; plus, an additional minimum of 0.5m x 0.9m.



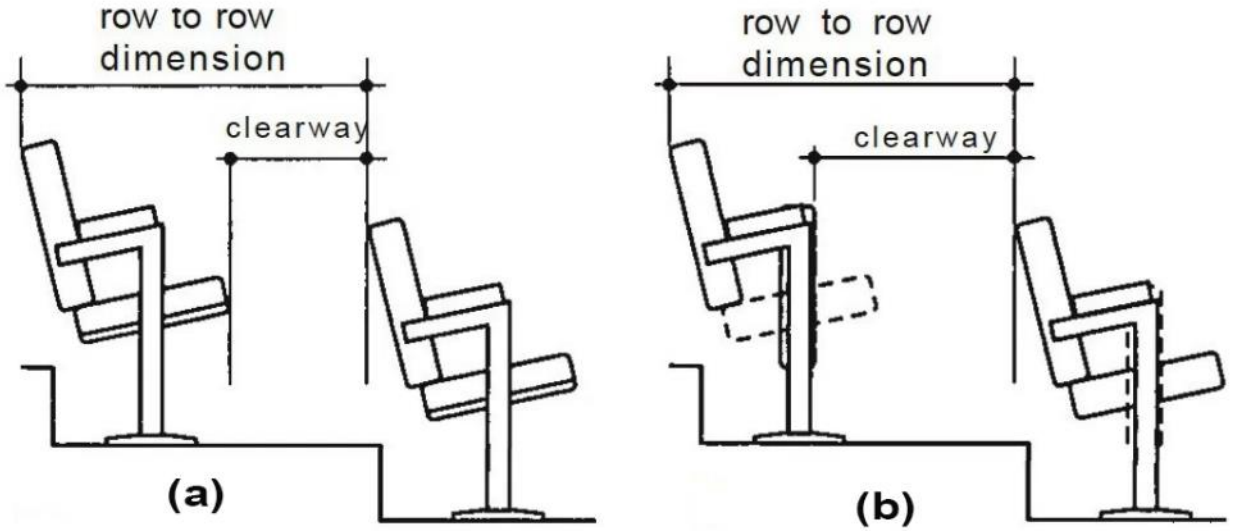
All seats apart from boxes must have fixed, self-operating folding seats with the above minimum dimensions



Offset folding seats provide elbow space

Figure 2.22 Seat Layout

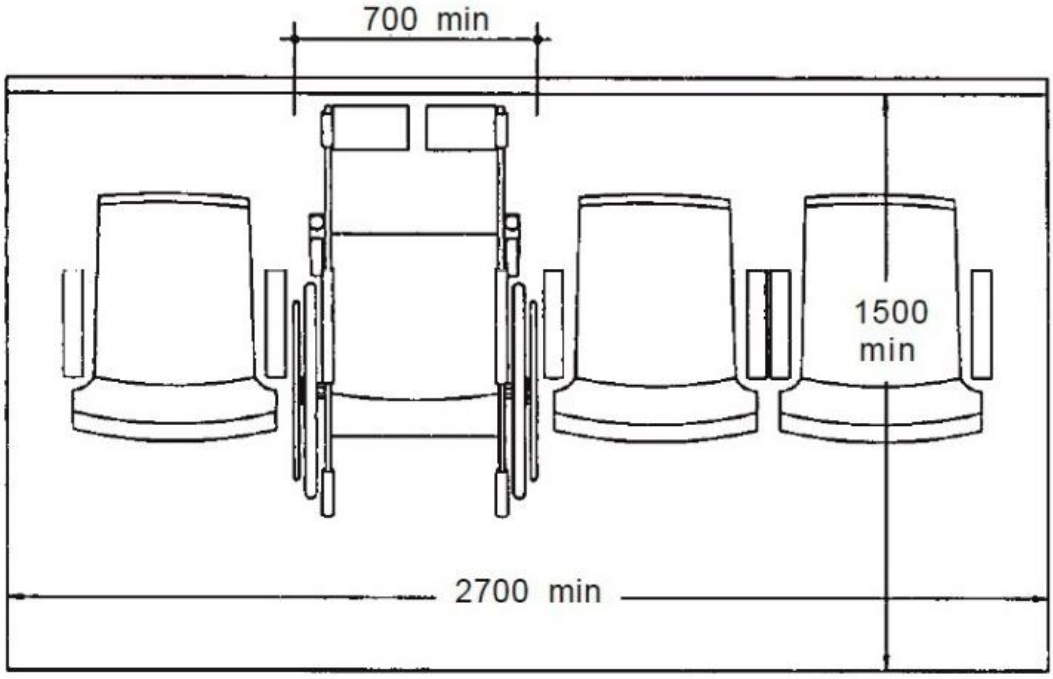
- Spacing is controlled by the clearway between the leading edge of the seat and rear of the back of the seat in front as shown in figure:



(a) *Row to row dimension and clearway with fixed seating.*
(b) *Row to row dimension and clearway with tipped-up seating*

Figure 2.23 Row to Row Spacing

- Seats without dividing arms must allow 450 mm per person
- Escape route should have a width of 1m per 150 persons (minimum width
- can be 0.8m)
- There shall be a space of not less than 350 mm between the back of one seat and the front of the seat behind (clearway)
- At least 1 percent of seats designated for wheelchair users, with minimum of two; preferable if armrests lift up (to allow transfer for wheelchair to seat)



Plan of a box designed for a wheelchair plus loose chairs

Figure 2.24 Plan of a box designed for a wheelchair and loose chairs

2.3.2.3 Types of Seat

Construction and Finish: upholstery variations include spring-edge seats (most luxurious, more expensive); box-spring (nearly as comfortable); spring-back; and padded-back. Veneer-back seating is suitable only for conditions subject to hard usage, as in schools. Acoustical control is more satisfactory with upholstered types.

2.3.2.4 Seat Width

Once fire and other relevant regulations are accommodated, layout decisions in most venues will be seriously impacted by a fundamental decision about how to balance seat width and seating capacity. Theater seats are often between 19 and 22-inches wide, which is quite a range. How audience comfort is balanced with setting capacity will affect operations in important ways. Initial layout efforts may use a figure of about six square-feet per person, excluding aisles, to get a rough idea of potential seating capacity.

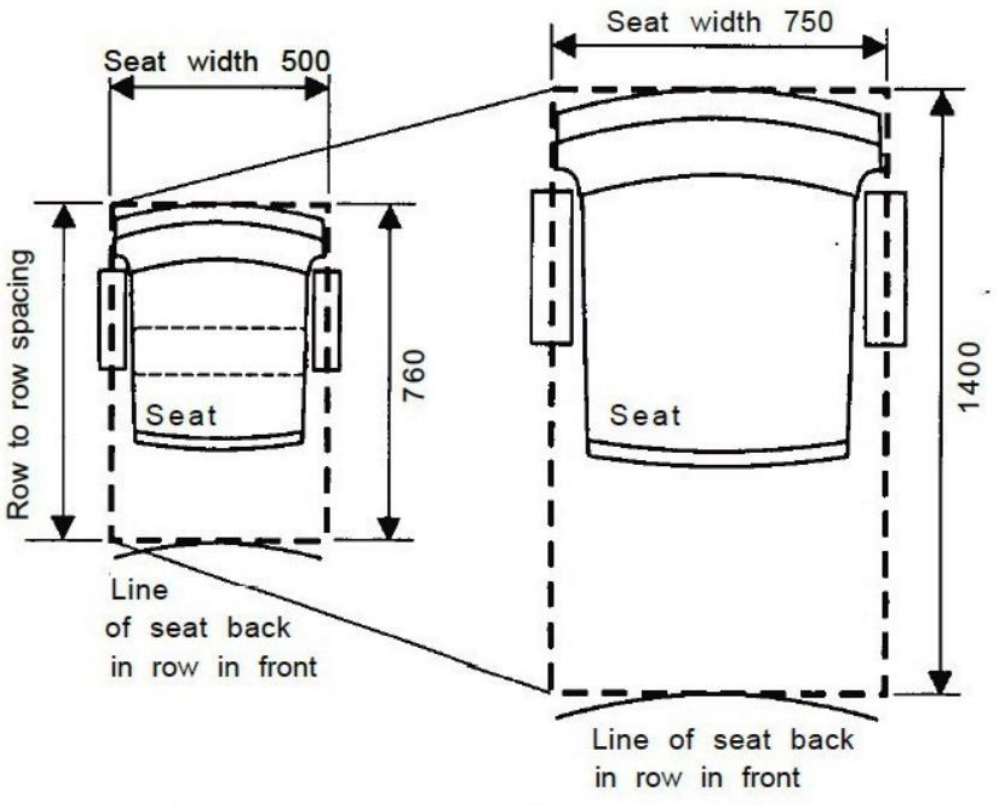


Figure 2.25 Seat width calculation

2.3.2.5 Considerations for Seat

Theatre seating from 19^{h} century forward is a mass-produced commercial product supplied by manufactures following certain specifications. But all auditorium chair manufactures project the aspect of comfort as main part of chair's specifications. But still the criteria's that can be pointed down for the seating design are given as follows:

- quality of the chair - product in terms of durability and maintenance
- materials of the main frame in accordance with ISO
- type and quality of fabric in accordance with fire regulations
- color and color combinations of the fabric and the room itself
- geometry in terms of retractable seat or inclined back
- additional components such as writing table or cup holder
- mounting methods in terms of number of legs and removable or not
- connection ability of the leg's column with the MEP facilities of the house
- acoustic behavior of the chair - sound absorption value and area when the chair is in use or not
- connection with the next chair according to the row layout

2.3.3 Sight Line

Any successful theater or arena seating layout will minimize or eliminate obstructed views. Overhanging balconies, pillars, and low-hanging chandeliers can all significantly impact the layout. Site lines are also impacted in another way. High seat backs are wonderful for neck/head

support and for patron privacy. However, the grade or pitch in the theater must be sufficient to maintain visibility of the stage or screen when high seat backs are used. Seats are often affixed to risers that go up about one-foot per row. In theatre or arena seating, most or all seats are placed higher than the seats immediately in front of them so that the occupants of further-back seats have less of their views blocked by those further forward. This is especially necessary because the stage performance is typically best observed from above, rather than in-line or from below. It is recommended that a spectator's eye height must not be lower than 800 mm above the stage. However, in larger theatres it is acceptable to locate the eye height of the first row on the level of the stage.

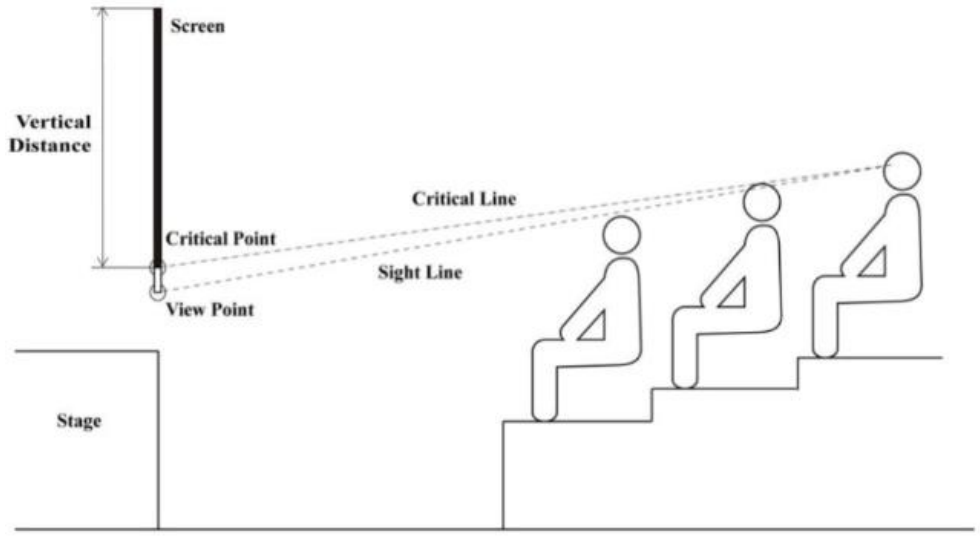


Figure 2.26 Sight Line

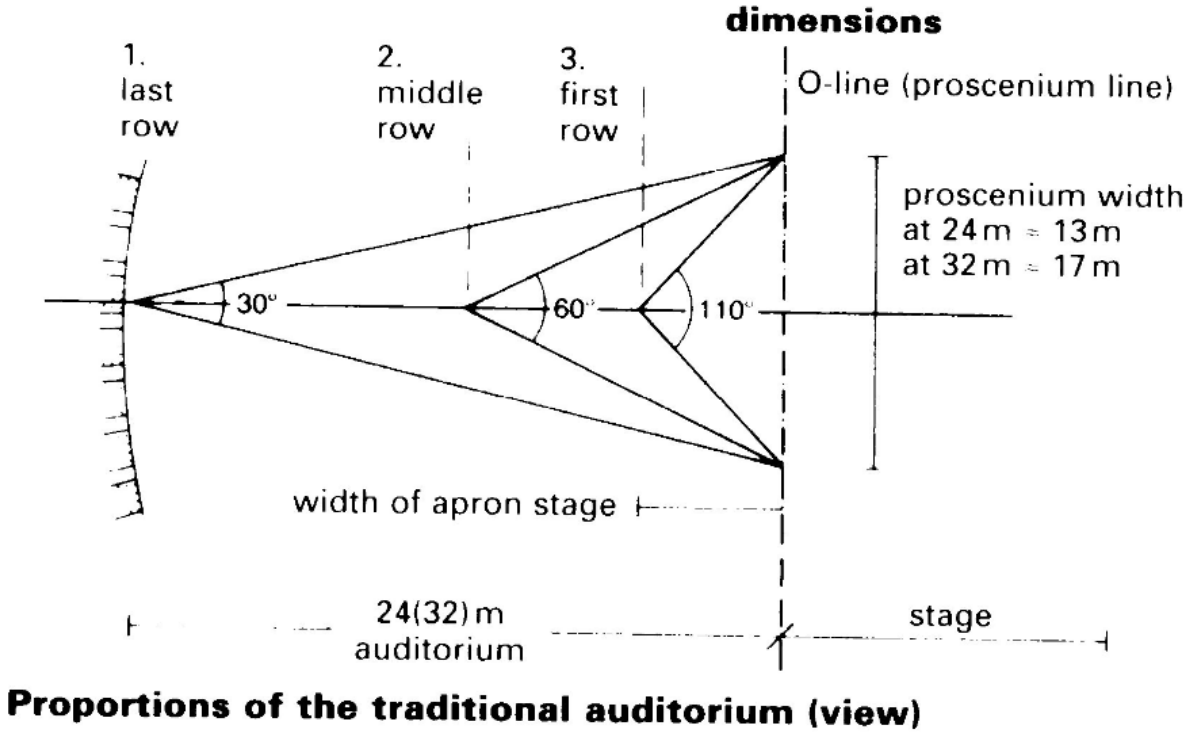


Figure 2.27 Proportions for Sight Line

Because the increased angle of seating, seats are typically (but not universally) installed on a stepped floor surface which also functions as a staircase in the aisles. Due to the stepped layout, it is usually not possible for disabled people in wheelchairs to move about. Venues with this seating generally place handicapped seating among the row which is at the level of the concourse which feeds the seating area, leaving more space than rows above or below it, and leaving chair-less space for wheelchairs.

Table 2.1 Calculation of Vertical Sight Lines

Constant Rise Formula	Isacoustic or Isodomal Rise Formula
Linear Seating slope with uniform riser height, Parallel Sightlines $r \quad c + s \frac{v + c(N \quad 1)}{h}$	Shallower seating slope with varying riser height, Converged Sightlines $- (\bullet \quad Z \quad \bullet) \frac{h + n.s}{h + (n \_1)s} \quad \left(v + \sum_1^{n-1} r\right)$
r = the vertical height to the point of focus c = head clearance s = row spacing v = the vertical distance from the sight point to the eye point of the viewer in the first row h = is the horizontal distance from the sight point to the eye point of the viewer in the first row n = riser number	c = head clearance s = row spacing v = the vertical distance from the sight point to the eye point of the viewer in the first row h = is the horizontal distance from the sight point ti the eye point of the viewer in the first row n = riser number

2.3.4 Seating Elevation and Seat Raking

The rake of seating is as important for sound as it is for sight. Reinforcement of sound by reflections from the ceiling makes it reasonable to provide a rake rather less steep than in ancient classical open-air theatres which had rakes of 35° or more. However, a sight line clearance from one row to the next at any part of the house should never be less than 75 mm

and in large theatres 100 mm or more is desirable. If seats are set out on a circular or part circular plan, there is risk that the concave surface of the risers may cause focusing of sound.

- Seating elevation is obtained from the line of vision

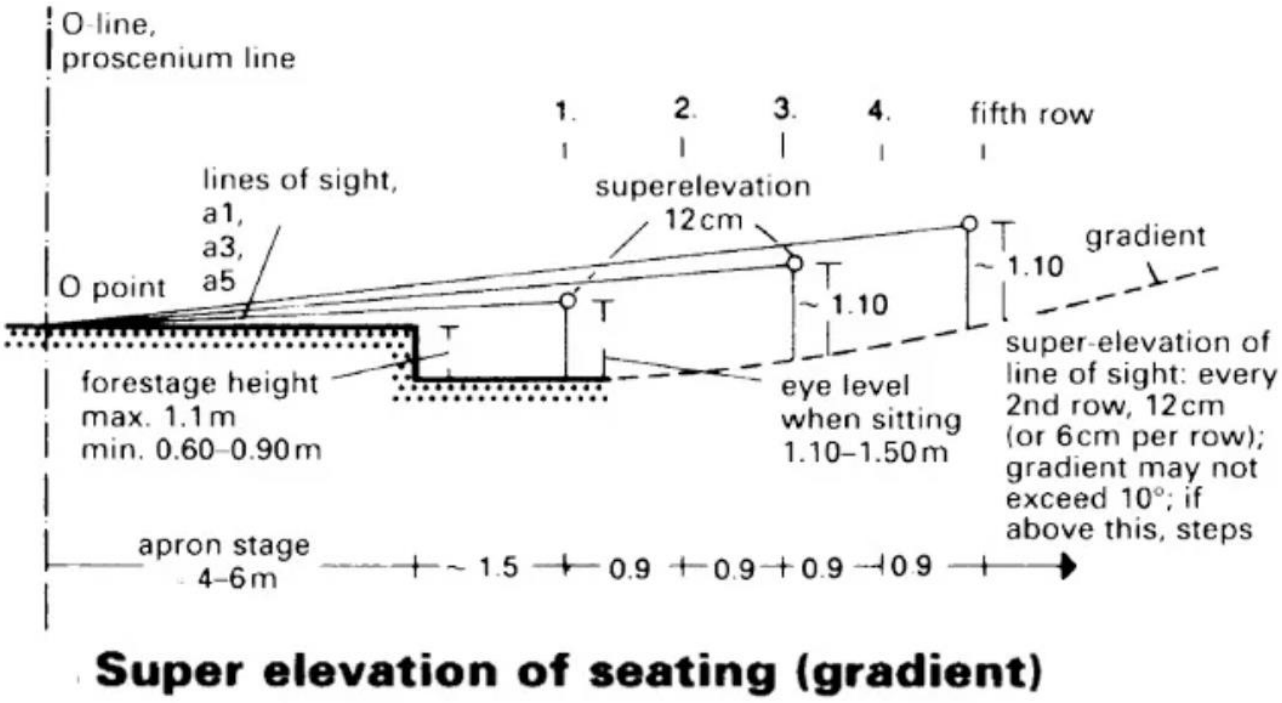


Figure 2.28 Seating Elevation

- Every second row require full sight elevation (12cm)
- Row of spectator should be formed in circular segment with respect to stage.

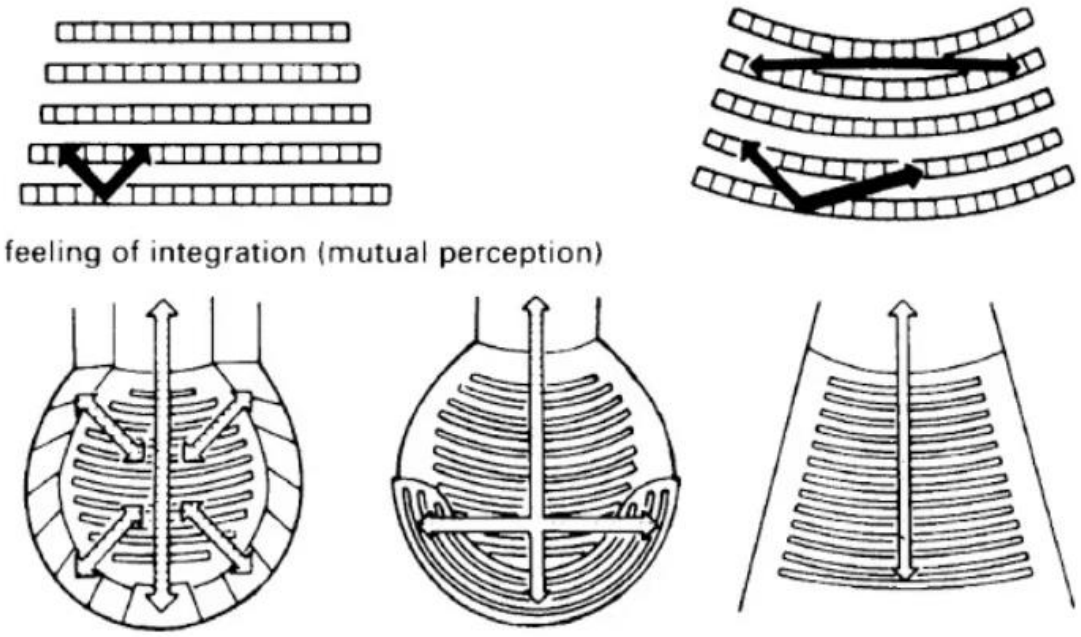


Figure 2.29 Relationship between Stage And House

2.3.5 Stage Design

2.3.5.1 Stage Forms

A stage should be flexible to allow easy movement for heavy stage equipment's. For such flexibility larger wings to the sides of the stage are preferable. The stage may be equipped with many types of machinery such as tracks and cranes for camera, different lighting equipment's, etc. However, there are various support spaces required for stage.

1. **Full Stage:** More than l00m^2 of stage area. Stage ceiling more than lm above top of proscenium arch. An essential feature of a full stage is an iron safety curtain which separates the stage from the auditorium in the event of emergency.
2. **Small stage:** Area not more than 100m^2 of stage area, no stage extension (secondary stage), ceiling not more than lm above the top of proscenium. Small stage doesn't require iron safety curtain.
3. **Set areas:** Set area is the raised acting area in the room without ceiling projection. The peculiarity with set areas is in the regulation with respect to curtain and scenery.

2.3.5.2 Stage Ventilation

Means should be provided for ventilating smoke and hot gases resulting from fire on the stage, e.g., provision of haystack lantern light or fire ventilator sited in highest point in the roof over stage and as near to center of stage as is reasonably practicable. An additional fresh air inlet may prove effective.

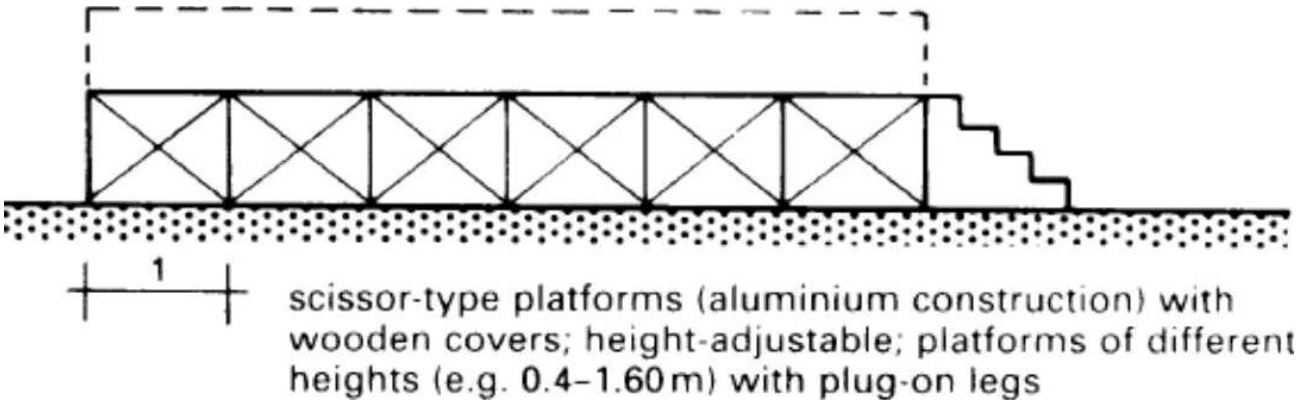


Figure 2.30 Stage Ventilation

2.3.5.3 Stage Preparation

Stage preparation areas must be allocated besides the stage so that the equipment's for stage, for example properties for drama performance can be set and transported easily to the stage. The space should be a large horizontal extension of the stage and must also provide as a green room for performers to wait till stage going without disturbing technicians to prepare for the stage.

2.3.5.4 Stage Height

The space above the stage is called stage tower. The vertical extension of the space facilitates room for stage lighting, curtain, and vertical storage of sceneries. The elaboration of the methods of changing scenery depends upon the prospective use of the building. The more frequent the changes of production are likely to be, the more extensive should be the provision of facilities and space for handling scenery. Those that demand less space in plan are more valuable than elaborate machinery. Scenery can be moved in and out of the view of the audience

vertically above by using a flying system and vertically below by using lifts. It can be moved horizontally to the sides and rear on movable stage sections or rotated on revolves.

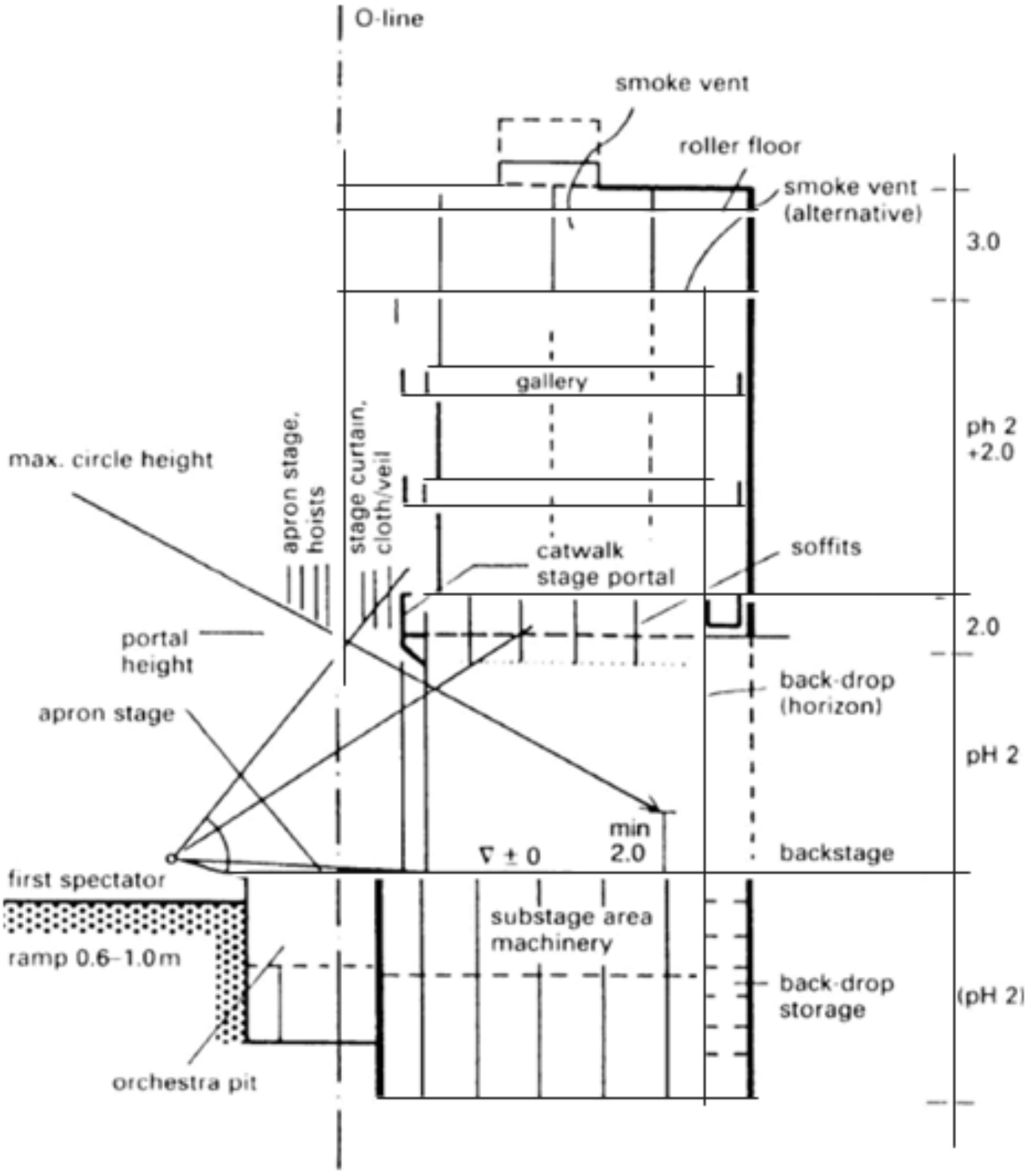


Figure 2.31 Typical Vertical Section of Stage

2.4 ARCHITECTURAL ACOUSTICS

Architectural acoustics (also known as building acoustics) is the design of buildings for a good design. It is associated with noise control but can have other objectives such as speech intelligibility, music acoustics, theatre acoustics or environments designed for pleasant ambient sounds (Spacey, 2017). The following are the common elements of architectural acoustics:

2.4.1 Common elements

2.4.1.1 Building envelope

A building envelope is the outer shell of a structure that shields it from elements of the outsideworld such as wind, water, heat. Light and noise. They can be designed to reflect and/or absorbto reduce noise.

2.4.1.2 Interior surface

Rooms, ceilings, walls, floors, doors, windows and ducts may be structures to reduce noise or produce a desired acoustic environment. For example, a theatre shaped to allow sound to flow unobstructed form the stage to all seats and prevent sound from echoing back.

2.4.1.3 Materials

Building materials selected for their sound properties such as reflection, absorption, refraction, diffusion, diffraction and transmission of sound. For example, a partition walls between two apartments that contains layers of sound insulation that absorbs noise.

2.4.1.4 Equipment

Selecting equipment such as elevators that are quiet both in terms of mechanical operation anda lack beeps and other nosy features.

2.4.1.5 Sound masking

Ambient sounds that cover noise such as a water fountain or electronic noise control that generated noise-canceling waveform in real-time in response to sound.

2.4.1.6 Acoustics defects

- Echo
- Reverberation
- Background Noise
- Sound Foci
- Dead Spots

Acoustics should be mainly considered because human psychology is directly linked with the environment, he/she is roaming through. Acoustic as well as lighting parameters must not be offensive to the viewers but be welcoming and tranquil as much as possible.

2.4.2 Acoustics Consideration

- Sound reflecting surfaces
- Absorption, Reflection, Period of reverberation
- Longer better for music and singing
- Shorter for the speeches or some other performances
- Geometry of the hall determines the volume and the reflection levels inside the hall

2.4.3 Environmental Acoustics

It is concerned with noise and vibration caused by traffic, aircraft, industrial equipment and recreational activities around the provided structure.

- background noise preferred is <40dB
- if >40dB, then noise control techniques required

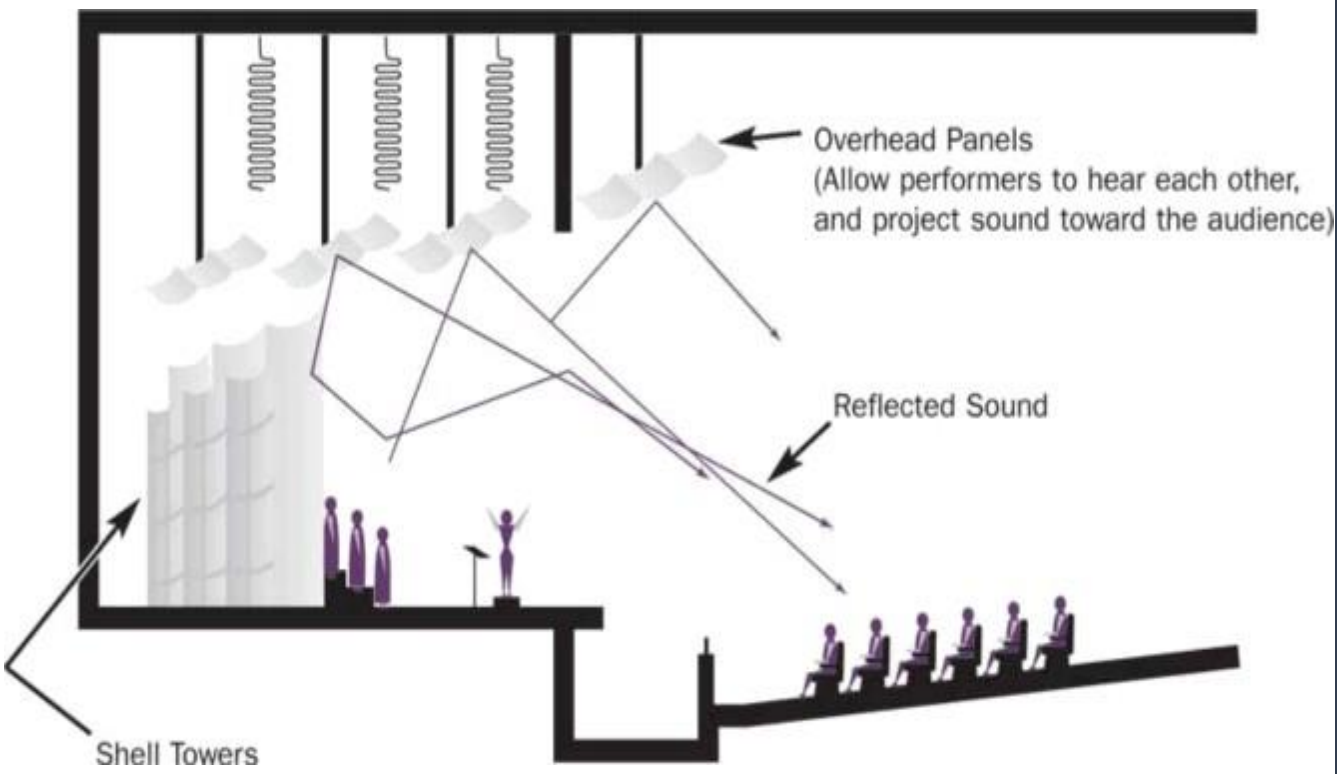


Figure 2.32 Reflection of Sound In Theatres

2.4.4 Acoustics Materials

- SOUND ABSORBENTS: to eliminate sound reflections
    i. Porous: soft materials with pores
    ii. Resonant: semi-hard materials fixed to timber panels with air gap between them
    iii. Cavity: consists chambers with a narrow opening
    iv. Composite type: consist of perforated fixed over an air space containing porous absorbents
- SOUND DIFFUSERS:
    i. to effectively reduce distinct echoes and reflections
    ii. help in scattering the sound by reflecting to different directions

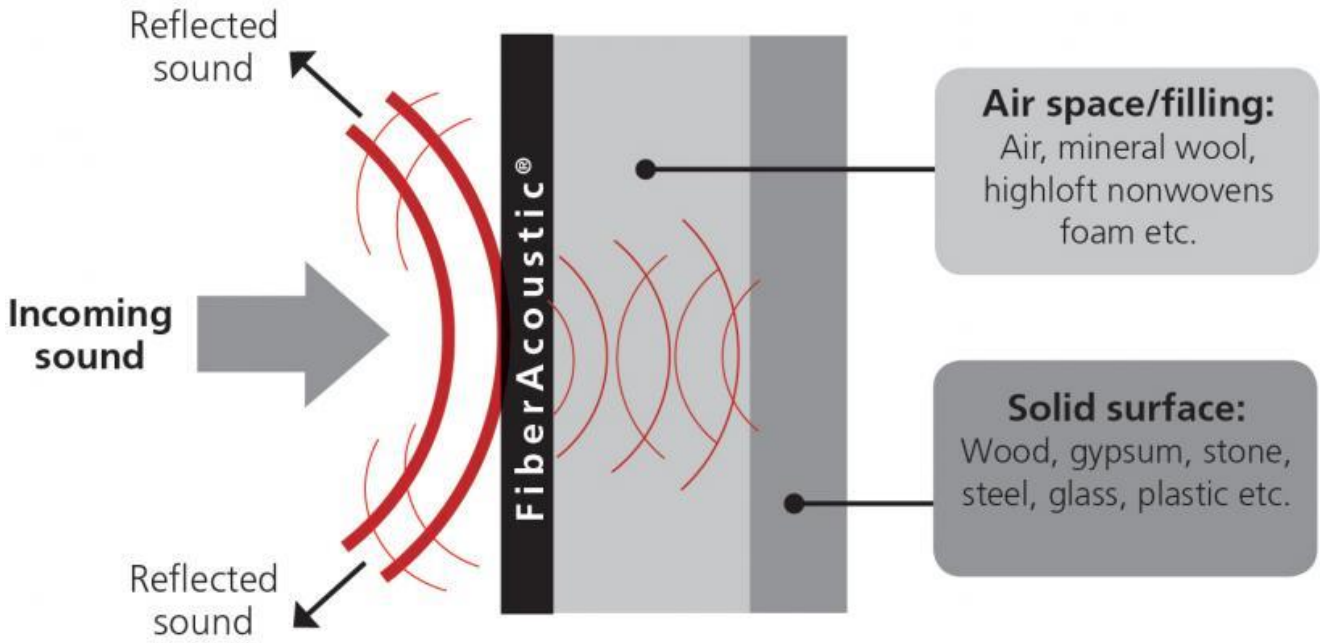


Figure 2.33 Mechanism of Acoustic Material

2.5 ARCHITECTURAL LIGHTING

- To bring in **dynamism** in performances
- Step lighting should be considered
- Lights are fixed to **certain heights** along the stage borders and also in its **floor**

- SPOTLIGHTS: to illuminate specific portion
- FLOODLIGHTS: for consistent coverage across a stage
- STRIP LIGHTS: to add large amount of color coverage to stage

Figure 2.34 Types of lights used in concert

2.6 LONG SPAN ROOF STRUCTURES

Long span roofs are generally defined as those that exceed 12 m in span. Long span roofs can create flexible, column-free internal spaces and reduce substructure costs and construction times. They are commonly found in a wide range of building types such as factories, warehouses, agricultural buildings, hangars, large shops, public halls, gymnasiums and arenas. Their primary function, similar to normal roofs, is typically, protecting against the weather, restricting the spread of fire, providing sound and thermal insulation and so on. However, as they may offer the only structural system other than the perimeter walls, they may also have to provide support for building services, access routes, lifting equipment, lighting, and so on.

Long span roofs can be fabricated in from a number of materials, such as steel, aluminum alloy, timber, reinforced concrete and prestressed concrete. Steel is often preferred due to its high strength and because it will not spread fire over its surface. The design of long span steel and (steel-concrete) composite beams is generally carried out in accordance with BS 5950, BS EN 1993 or BS EN 1994.

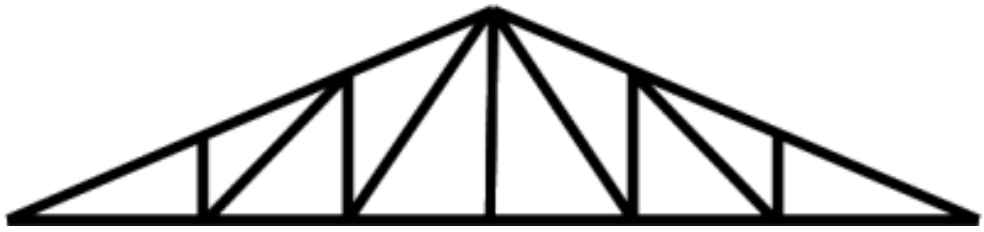


Figure 2.35 Pitched Truss

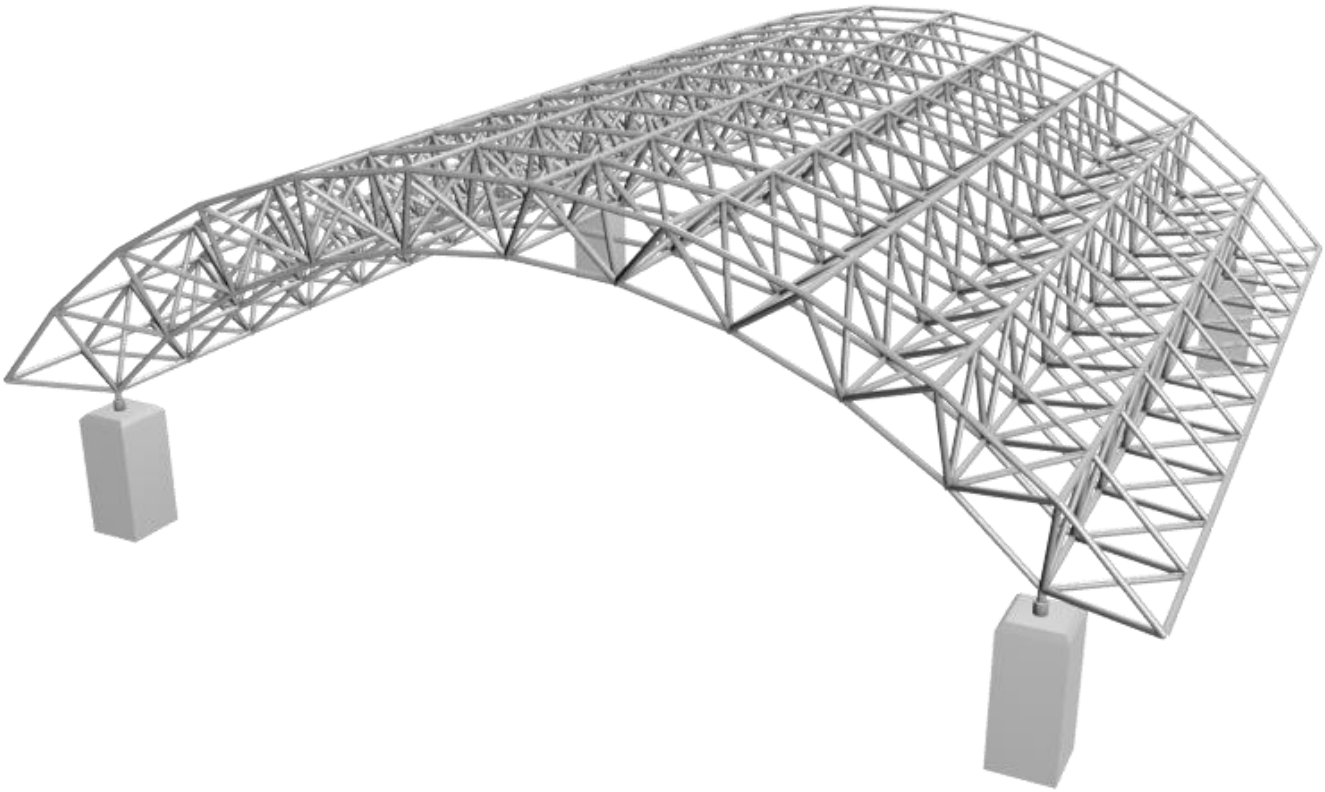


Figure 2.36 Space Truss Frame

2.7 INFERENCES FROM LITERATURE REVIEW

❖ A complete arena must:

- Accommodate an audience,
- Accommodate a performance and
- Bring audience and performance together in the most efficient way

❖ An arena must have the following salient feature

- Interdependence of functions- optimizing the audience performance relationship in order to increase the appreciation of audience towards the performance and also to encourage the performers to give their best effort.
- Universality — functional requisites are identical irrespective of the origin of the building project.
- Harmony between functions and architectural stage theatrical functions must be the primary determinants of the site, shape and arrangements of the parts of the arena building.
- Appropriate selection of site- the site must be big enough to hold the arena and to provide access and outside audience landing facilities.
- Development of plan — shape and size of the stage and auditorium, acting area and orchestra pit according to the audience.
- Variation in program- all production type must be chosen for performance in order to keep the theater running.
- Variable house capacity- many designs are there which can vary the size of the arena as per the number of people and production type.
- Attractiveness of the house can generate potential audience for the performance and visual arts exhibitions.
- Storage facility (in order to maintain the efficiency of the theater and the exhibiting spaces)
- Acoustics and lighting (in order to grab audience, it is essential that their seeing and hearing experience is highlighted to the maximum level)

3 CASE STUDIES

3.1 KSPO DOME ARENA, SOUTH KOREA

3.1.1 Introduction

Located in the Olympic Park, one of the largest public parks in Seoul, allows it to be easily accessible to the public. A perfect site to leave memorable experience to a large number of visitors. The Olympic Gymnastics Arena is a milestone that marks the 1988 Seoul Olympic Games, which was a significant event that transformed modern Korea. Since then the arena has been one of the most prominent performance venues in Korea. The newly completed arena is an intersection between a historic legacy and a premiere performance venue that showcases the ever-evolving popularity of the Korean culture around the world. The renovation preserves a cultural landmark and also establishes a new typology of hyper-public cultural performance facility which fulfills the needs of its various users and accommodates a vast range of concerts and other cultural events.

Figure 3.1 KSPO Dome Arena, South Korea

- COMPLETED: 1984-1986; 2018 renovation
- ARCHITECT: HAEAHN Architecture
- LOCATION: Seoul, South Korea
- CAPACITY: 15,000
- FUNCTIONS: Olympic Gymnastic arena before renovation; after totally concert arena

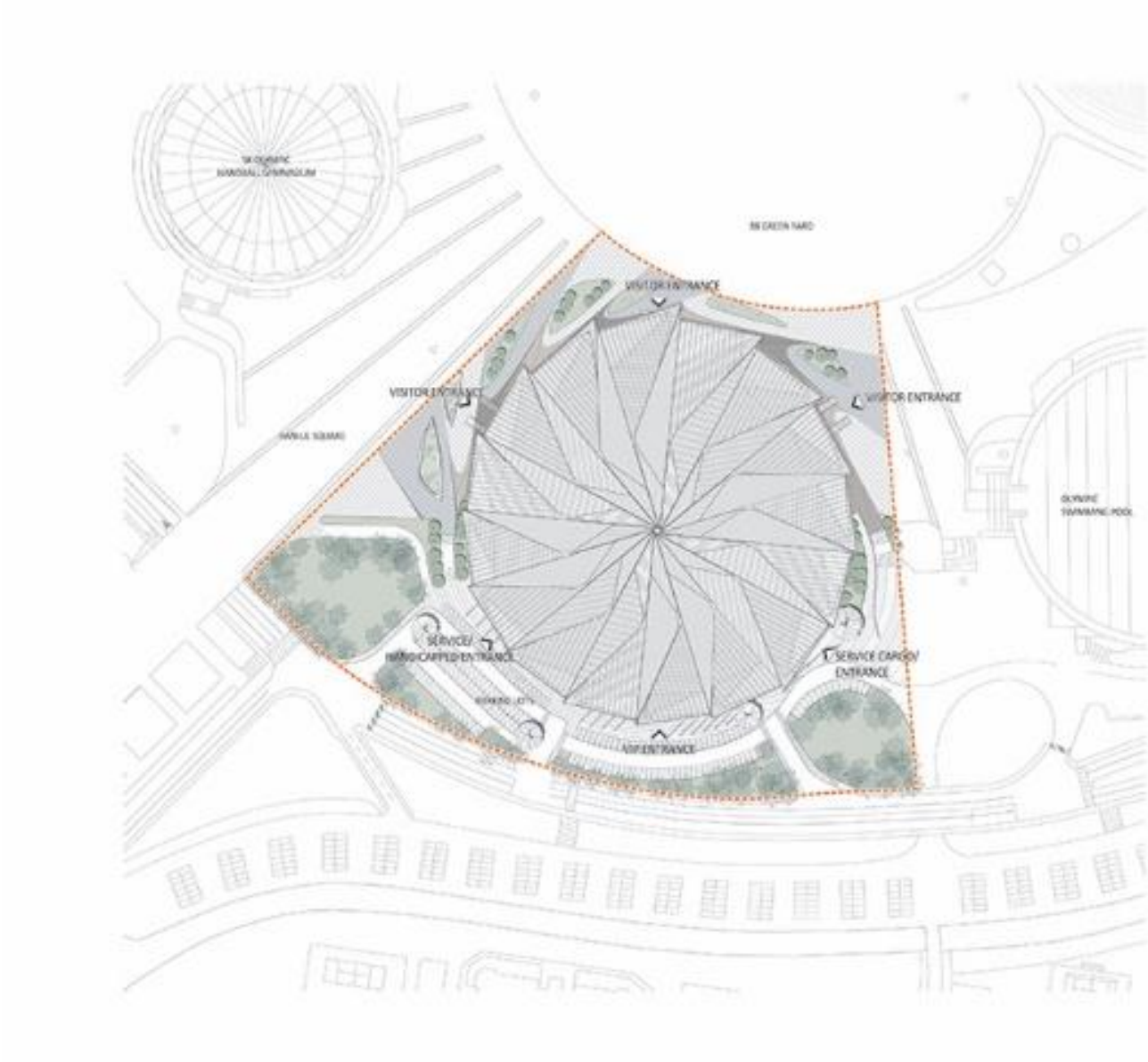


Figure 3.2 Site Plan of KSPO Dome Arena, South Korea

3.1.2 Scope of Study

- Space analysis in arena
- Acoustic treatment
- Arena and its seating
- Roof structure
- Services

3.1.3 Space Analysis

- The arena is placed at a public park so easily accessible.
- The building consists arena and its backstage facilities only.
- The front of house consists of ticket counter and foyer circling the entire arena.
- The entrance is on ground floor.

3.1.4 Arena and Seating

The circular plan of the arena houses audience around four sides of the stage. Often referred to generally as theatre-in-the-round the stage is round and at the lowest point on the arena giving maximum visibility to audience at all sides. Arena stages are thought to create a strong sense of community among the audience members and an easy flow of energy between the audience and the actors. Scenery changes are limited as it might block the audience and also the performers are said to perform facing all sides time to time so that their back is not shown for longer time to certain audience.

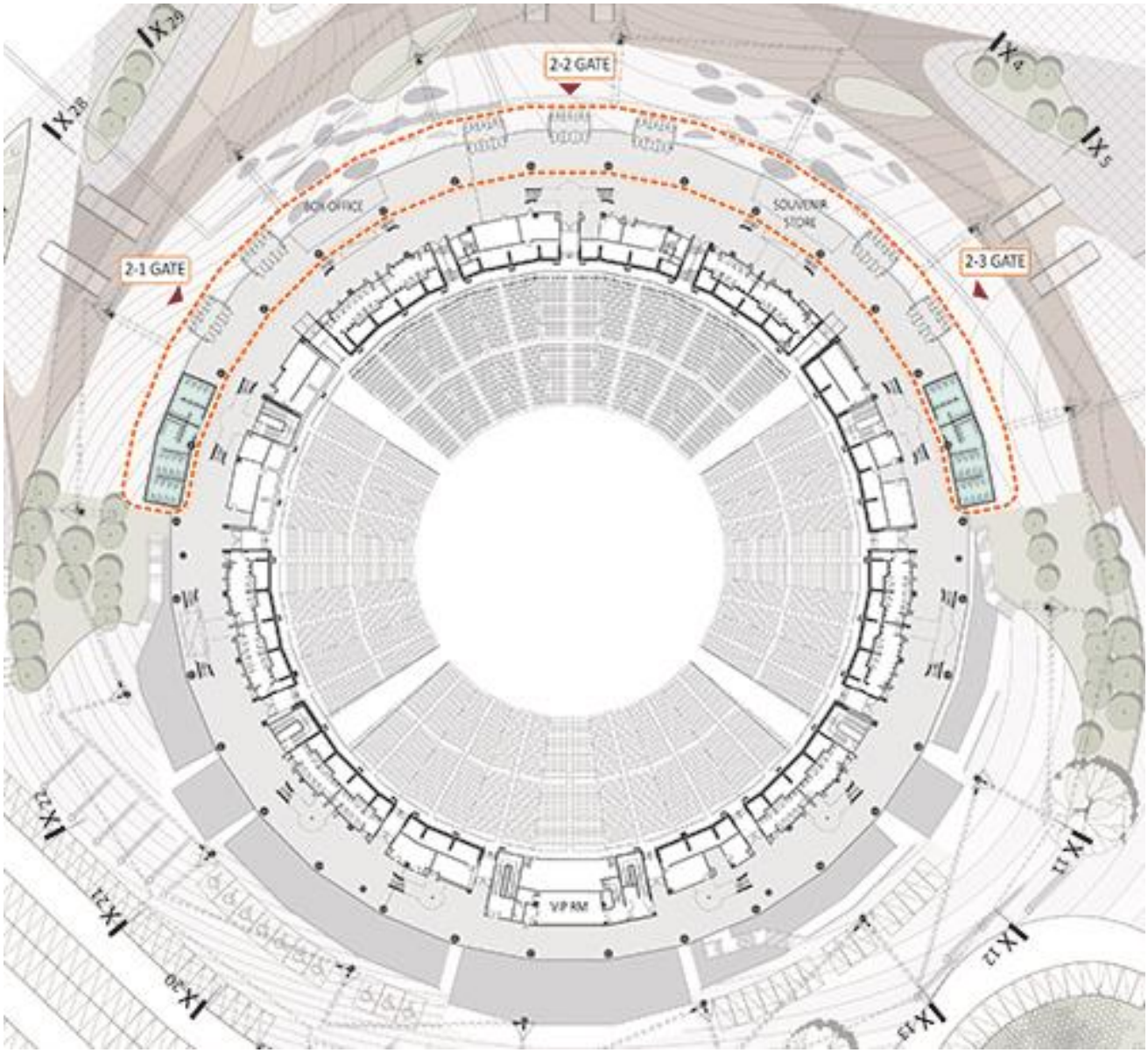


Figure 3.3 Ground plan of KSPO Dome Arena

3.1.5 Acoustics treatment

- soundproof wall and doors
- Irregular ceiling profile holding lightinstallations
- Lobby designed as buffer space
- Irregular wall panels for directedreflections

3.1.6 Roof Structure

- before renovation self-supporting cable dome with a four-layer fabric cladding
- now replaced with a tornado inspired dynamic 3D truss system

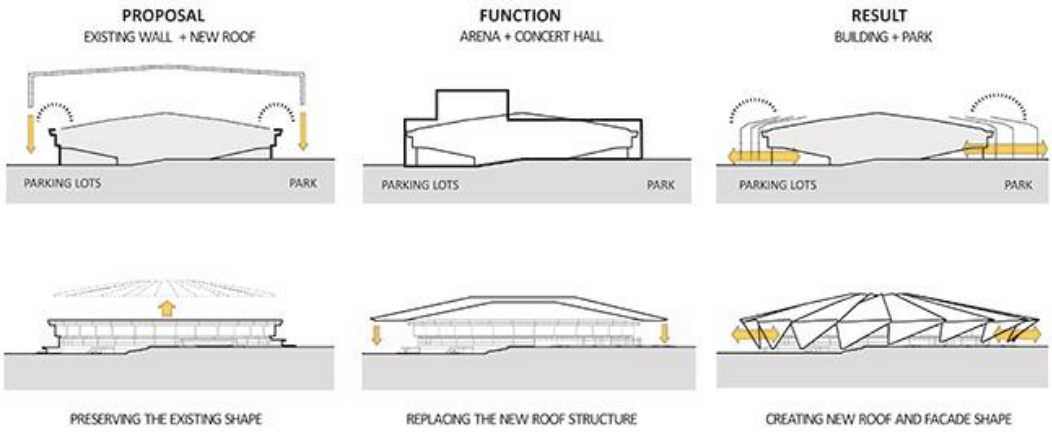


Figure 3.4 Roof Structure of KSPO Dome Arena

3.1.7 Safety and Services

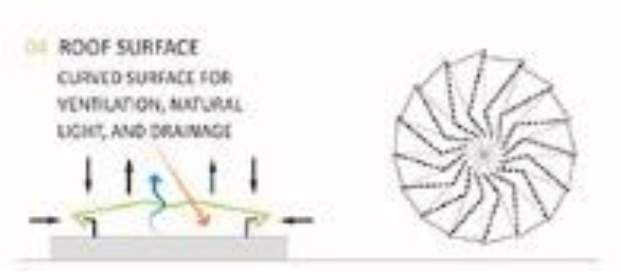


Figure 3.5 Roof Structure and Ventilation of KSPO Dome Arena

- Well-ventilated roofing system
- Easy access and circulation throughout the building
- Well-lit and ventilated underground rooms
- Use of fire extinguishers and sprinkler system

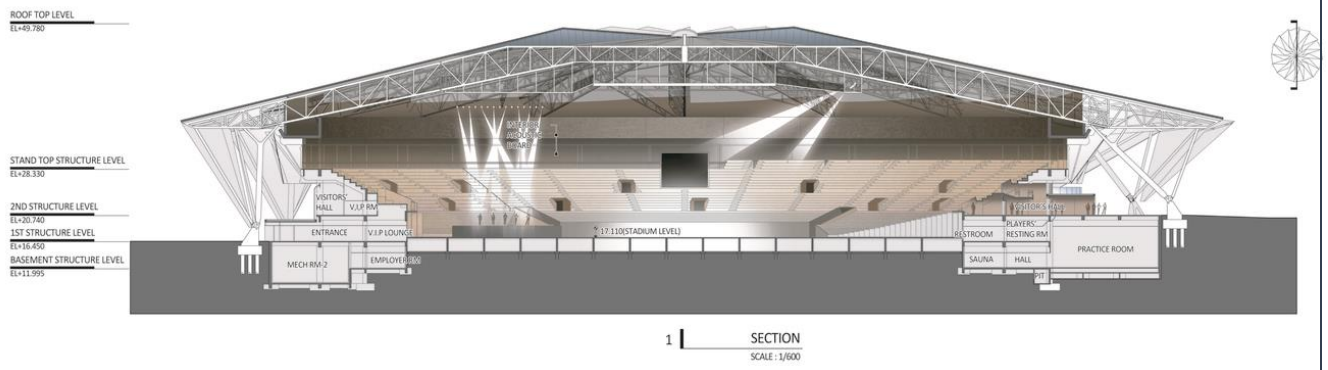


Figure 3.6 Section of KSPO Dome Arena

3.2 IMPACT ARENA, THAILAND

3.2.1 Introduction

Established in 1999, IMPACT Arena and IMPACT Exhibition and Convention Center are an integrated venue offering a diversity of events with versatile facilities and services. IMPACT is one of Asia's largest and most modern exhibition and convention centers with a usable indoor space over 140,000 square meters, comprising a variety of venue sizes to meet all kinds of events requirement. IMPACT Arena 4,000 sq. meter arena with 11,000 seating capacity suitable for large scale events, international concerts, sporting and entertainment events

Figure 3.7 Impact Arena, Thailand

- COMPLETED: 1997 – 1999
- CLIENT: Bangkok Land Public Co. Ltd.
- ARCHITECT: Mati Tungpanich
- LOCATION: Bangkok, Thailand
- AREA: 4,000 sq. m.
- CAPACITY: 12,000
- FUNCTIONS: Concerts, Sports events, Large scale conferences and ceremonies demanding performances

3.2.2 Scope of Study

- Space analysis in arena
- Acoustic treatment
- Arena and its seating
- Roof structure
- Services

3.2.3 Space Analysis

- The arena building is at the entrance so easily accessible.
- Landscaping done as a buffer zone and for aesthetics.
- The entire area has Arena, Exhibition halls, 25 private suites and a hotel.
- The front of house consists ticketing offices, merchandising spaces, food court.
- The entrance of arena is at ground floor.

Figure 3.8 Site Plan of Impact Arena

3.2.4 Arena and Seating

The arena stage at the lowest point is surrounded by tiered seating from three sides. The stage is thrust stage type and can be extended up to the center of the arena according to the stage concept and requirement.

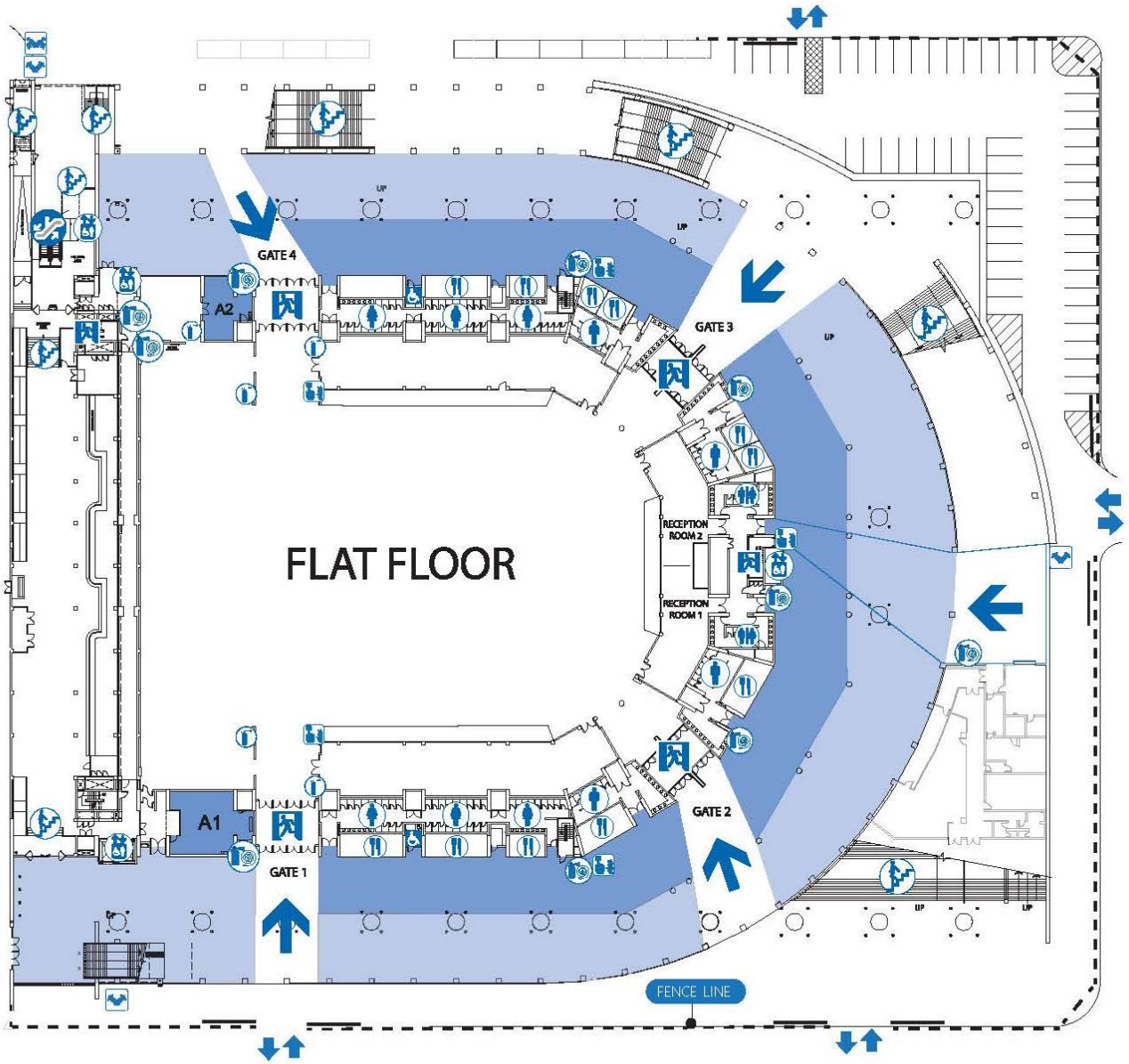


Figure 3.9 Ground Floor Plan of Impact Arena

Figure 3.10 Top Floor Plans of Impact Arena

3.2.5 Acoustics treatment

- Sophisticated audio-visual system
- soundproof wall
- Irregular ceiling profile holding lightinstallations
- Lobby designed as buffer space
- Irregular wall panels for directedreflections

Table 3.1 Materials and Treatment Done in Impact Arena

Dimension	73.70 x 49.70 x 34.00 / 18.00 – 21.00 m. (L x W x H)
Gross Useable Space Level 1, Flat Floor Level 1, Foyer Level 3, Foyer	 4,000 sq.m. (43,055.64 sq.ft.) 5,500 sq.m. (59,201.50 sq.ft.) 5,500 sq.m. (59,201.50 sq.ft.)
Floor Material	Concrete sealed material (hardened concrete)
Floor Loading Capacity Flat Floor Loading Area Foyer	 2,000 kg. / sq.m. 2,000 kg. / sq.m. 750 kg. / sq.m.
Ceiling Material	Rockwool insulation and exposed steel structure
Ceiling Loading Capacity Flat Floor Stage Area Other Area	 2,000 kg. / 24 sq.m. 2,000 kg. / 34 sq.m. 2,000 kg. / 40 sq.m.
Catwalk	2.00 m. in width, handrails are 1.10 m. in height on both sides
Freight Door	1 set at service area each measuring 8.00 x 4.80 m. (W x H), 26.24 x 15.74 ft. (W x H)
Entrance and Exit	L1: 16 double doors 1.90 x 2.00 m. (W x H), 6.23 x 6.56 ft. (W x H) L3: 16 double doors 1.90 x 2.00 m. (W x H), 6.23 x 6.56 ft. (W x H) L4: 24 double doors 2.00 x 2.00 m. (W x H), 6.56 x 6.56 ft. (W x H)
Restroom	19 For male, 22 for female, 2 for disabled persons and 41 private restrooms

3.2.6 Roof Structure

- curved roof of the Arena has a span of 100 m at 25 m high

3.2.7 Safety and Services

Table 3.2 Mechanical and Electrical Treatments Done in Impact Arena

Main Feeder	Energize high voltage 24 kilovolts 2 feeders (power distribution through meter 4,500 Amps 24,000 volts/feeder) by Metropolitan Electricity Authority
Electrical Loading	Dry-type transformers: 7,500 kilovolt-Amps (7.50 megavolt-Amps)
Generator	Capacity 2 x 1,250 kilovolt-Amps (2 x 2,000 Amps 3 phases) supply power to emergency light connected circuit through automatic transfer switch, supply 30% of light illuminance
Floor Pit	2 electrical units at back stage and control stage (each consists of 1 set 63 Amps 3 phases ,1 set 100 Amp 3 phases) 2 units of telephone outlet, each is 4/ C and 0.50 millimeter 2 units of cold water and drainage at back stage and control stage (each consists of control valve ø ½" and drain pipe ø 3")
Air-Conditioning System	Water-cooled chilled water air conditioning system with maximum cooling capacity 1,000 tons of refrigeration
Compressed Air	Available for all booths upon request
Water Supply	Cold water tank 1,050 cubic meters (maximum of 1-day stand by) Pressure 40-60 pounds Direct connection available to all booths (typical booth layout)
Drainage Point	Direct connection available to all booths (typical booth layout)
Lighting system	Metal halide lamp 400 watts and metal halide lamp 1,000 watts,high bay type,par 300 watts, high bay type with 300 luxes average illuminance
Broadcasting and Communicatiom	Cat5E Cable With RJ-45 Modoular Jack Connected to data/voice equipment rack
Emergency system	Fire sprinkler system, fire hose cabinet, fire extinguisher and fire alarm bell with manual station
PA System	Paging and announcements system Emergency line support
Security	Surveillance system

3.3 MOA ARENA, PHILLIPINNES

3.3.1 Introduction

The SM Mall of Asia Arena, the latest and biggest venue to rise at the foremost entertainment and retail destination—the **Mall of Asia Complex**. This Architectural "Eyecon" prides itself on having exceptional world-class amenities unique in the Southeast Asia region. With an impressive land area of over 64,000 square meters, the SM Mall of Asia Arena is a world-class facility equipped with state-of-the-art technology. Its eye-shaped exterior represents what patrons will experience at every event at the venue, a "feast for the eye."

The SM Mall of Asia Arena is a flexible venue that can adapt to all sorts of events. Its massive all-glass facade can accommodate a seating capacity of 15,000, with a full-house capacity of 20,000. The arena forms an integral part of a larger mixed-use masterplan built on reclaimed land facing Manila Bay. The masterplan is centered around the Mall of Asia, and includes the SMX convention center, the E-com office complexes, future hotel and serviced apartment developments, and a multi-storey carpark annex.

Figure 3.11 MOA Arena, Philippines

- COMPLETED: 2012
- CLIENT: Mall of Asia Complex
- ARCHITECT: Arquitectonica, Jose Siao Ling and Associates
- LOCATION: Manila, Philippines
- AREA: 64,000 sq. m.
- CAPACITY: 15,000
- FUNCTIONS: Concerts, Sports events, Commercial complex

3.3.2 Scope of Study

- Space analysis in arena
- Acoustic treatment
- Arena and its seating
- Roof structure
- Services

3.3.3 Space Analysis

- A limited 16,000 sq. m. site required the arena to span over an adjacent road; and a high-water table, which placed a limit on basements and required the construction of an 8-storey carpark annex, housing over 1,400 parking spaces
- Backstage, changing, and press areas are located on the ground floor
- Admin areas are located on interstitial mezzanines
- VIP restaurant and lounge is located on the corporate suite level

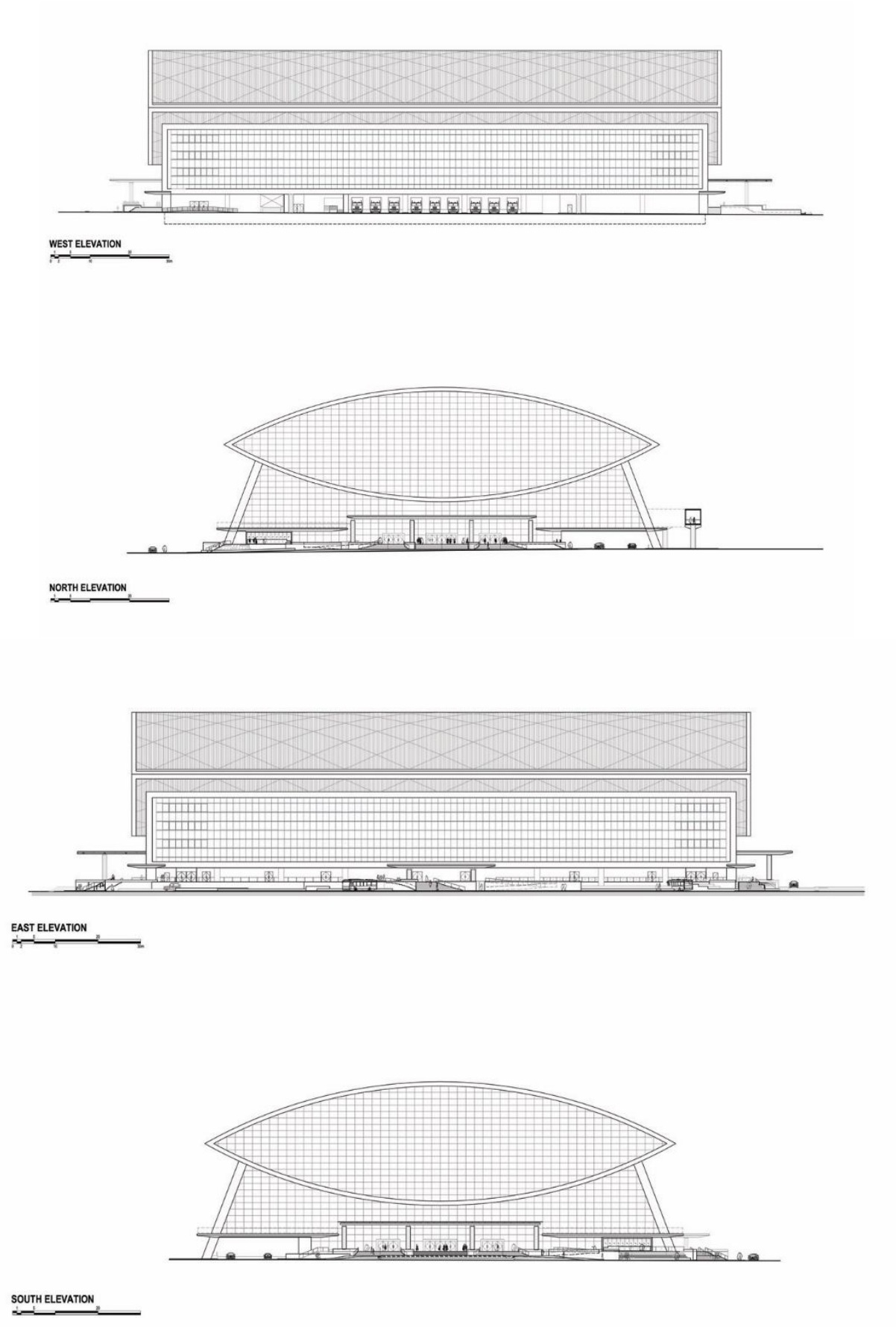


Figure 3.12 MOA Arena Elevations

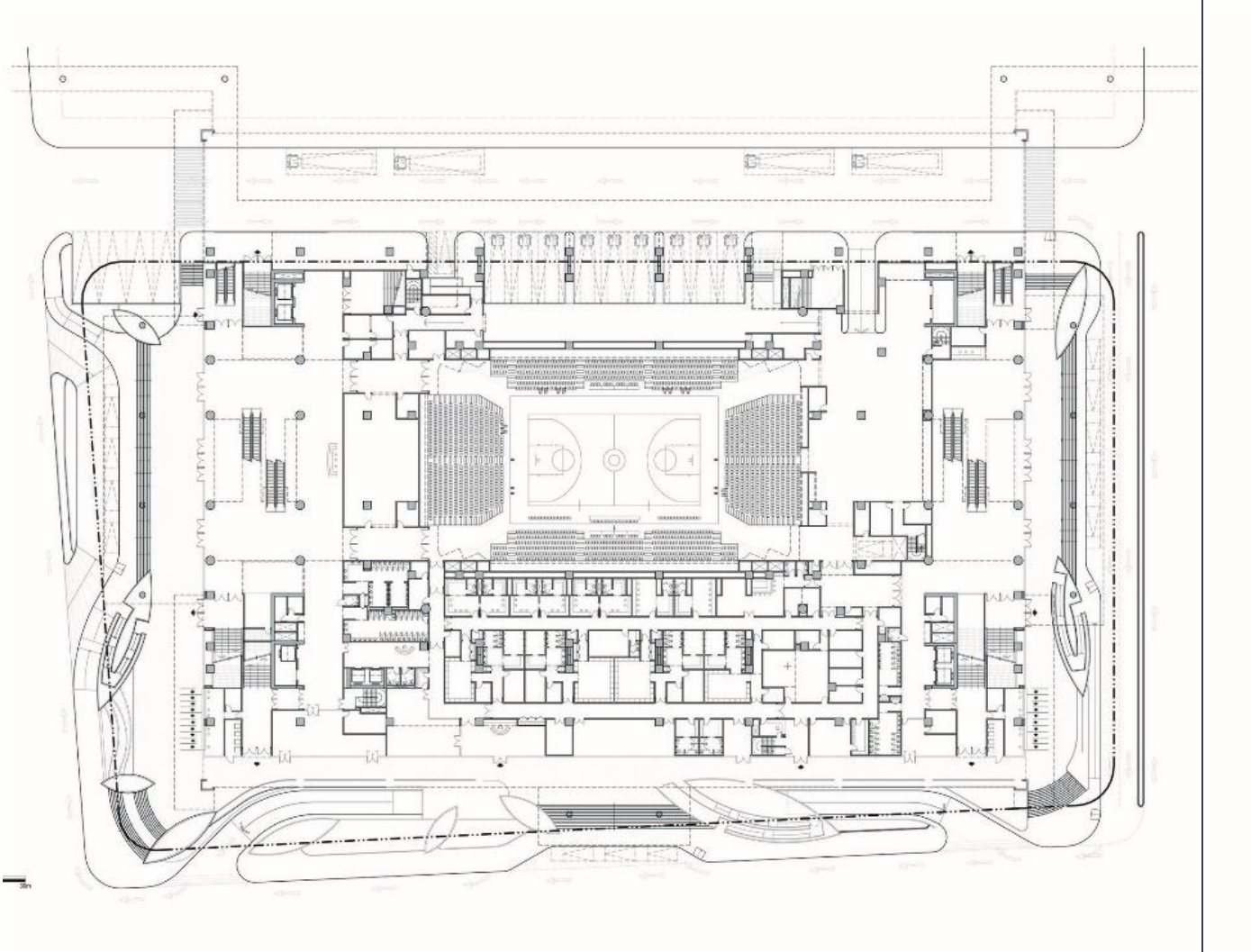


Figure 3.13 First Floor Plan of MOA Arena

3.3.4 Arena and Seating

The arena form is designed like a big eye, resting on top of a slanted podium plinth. This allows it to hold the large volume of the interior court within a dramatic vaulted space, while providing a distinctive identity to the arena as a whole. The whole eye is intended to function as a multi-media screen, projecting images of ongoing or future events, and forms a dramatic view from the arrival circle of the larger masterplan complex.

The arena is arranged on two tiers, with a ring of corporate suites separating the lower seats from the balcony levels.

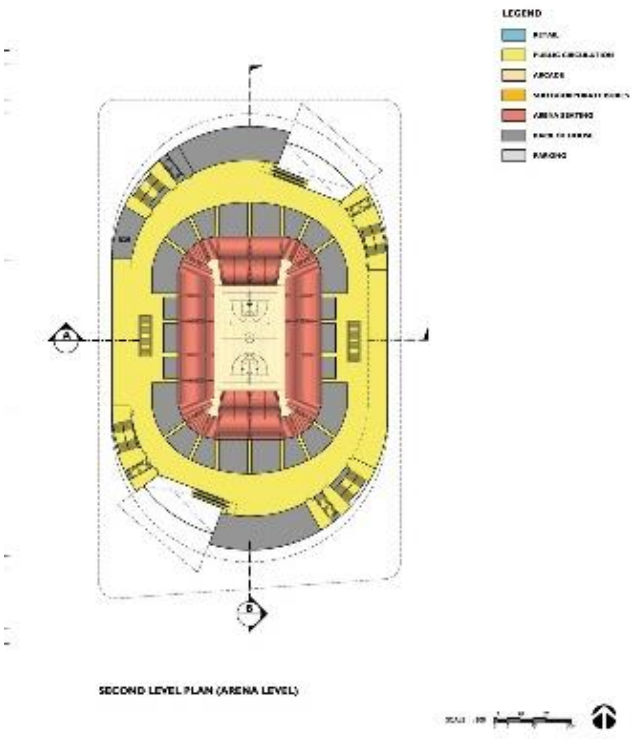


Figure 3.14 Seating Layout Top Floor of MOA Arena

3.3.5 Concept of eye

The arena form is designed like a big eye, resting on top of a slanted podium plinth. This allows it to hold the large volume of the interior court within a dramatic vaulted space, while providing a distinctive identity to the arena as a whole. The whole eye is intended to function as a multi-media screen, projecting images of ongoing or future events, and forms a dramatic view from the arrival circle of the larger masterplan complex. It also provides the perfect architectural image for a venue dedicated to spectator sports and events.

Figure 3.15 Front Elevation of MOA Arena

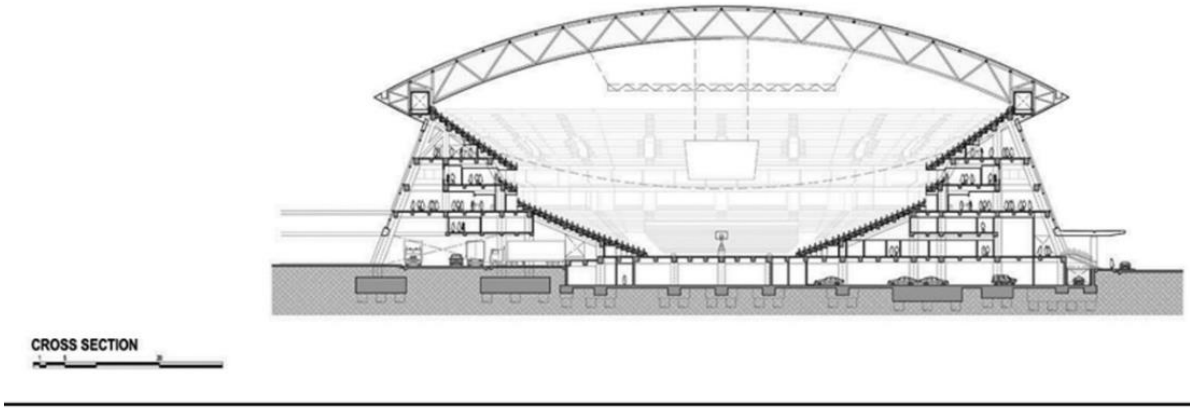
3.3.6 Acoustics treatment

- Soundproof glass walling
- Soundproof doors

- Irregular ceiling profile holding lightinstallations
- Lobby designed as buffer space
- Irregular wall panels for directedreflections

3.3.7 Roof Structure

The installation of the arched roof-trusses proved particularly challenging, requiring the coordination of multiple construction teams & cranes to hoist them up.



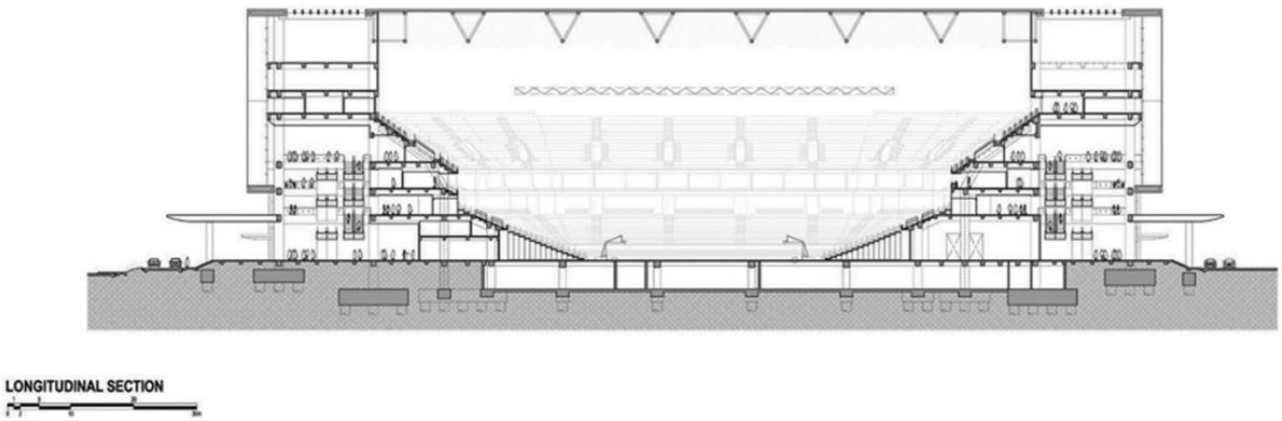


Figure 3.16 Sections of MOA Arena

3.3.8 Safety and Services

- employs grey water recycling, rainwater harvesting and waterless urinals
- car parking facilities
- well equipped with elevators and escalators
- a public transport interchange with the Mall of Asia
- uses low-e coated and fritted IGU's throughout its facade.
- awarded as a PWD-friendly events venue that considers Special Access lanes and seating areas for PWDs located around the venue.

3.4 ROYAL ARENA, DENMARK

3.4.1 Introduction

Royal Arena is a multi-use indoor arena in the Ørestad South area of Copenhagen, Denmark. The ground was broken for construction on 26 June 2013 and the arena opened in February 2017. It has a capacity of 13,000 for sporting events and up to 16,000 (either sitting or standing) for concerts. The area alone is an architectural experience, and its modern design is a striking contrast to the city center's cobbled streets. Danish architecture firm 3XN is behind the design of Royal Arena, which expresses the Scandinavian design tradition that values quality and functionality. The arena is not just a new venue but contributes to the urbanization of Ørestad by incorporating the adjoining neighborhood. The arena is based on a unique podium that links to the surrounding area, and small public plazas encourage visitors and locals to visit, even when the building is not in use.

Figure 3.17 Royal Arena, Denmark

- COMPLETED: 2017
- ARCHITECT: Danish architecture firm 3XN
- LOCATION: Copenhagen, Denmark
- AREA: 35,000 sq. m.
- CAPACITY: 16,000
- FUNCTIONS: Concerts, Sports events, Commercial complex

3.4.2 Scope of Study

- Space analysis in arena

- Acoustic treatment
- Arena and its seating
- Roof structure
- Services

3.4.3 Space Analysis

- The arena is made up of a single podium, wide stairs and entrances to facilitate crowd movement.
- Physically, it does not distort its surroundings and subtly blends in with the urban decor with the help of numerous windows and exterior wooden shutters.
- With a podium that offers different public areas for social meetings and daily activities
- Its design encourages active interaction and those characteristic values which make a neighborhood enjoyable.
- The building has an open ground floor and a public plateau at the first-floor level.

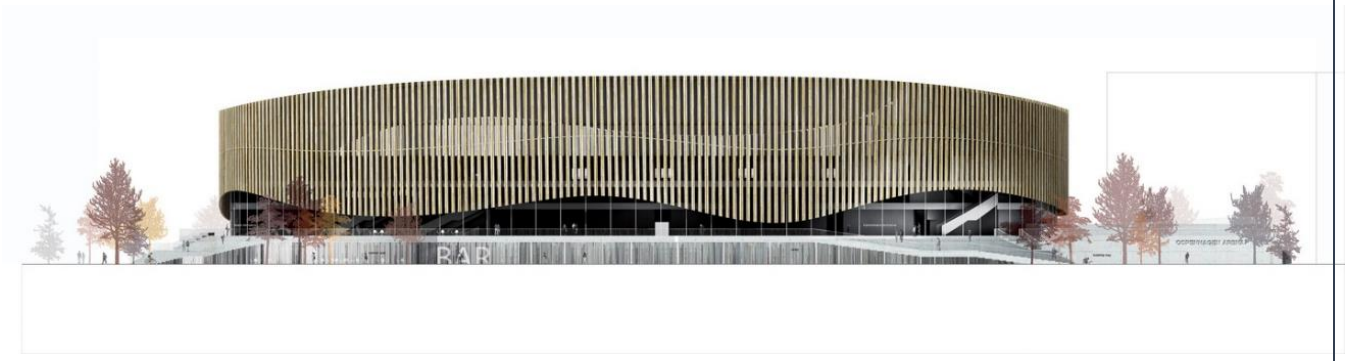


Figure 3.18 Elevation of Royal Arena

3.4.4 Arena and Seating

The bowl contains a variety of design features to improve performance experience, such as angled walls to improve sightlines, a flat ceiling, acoustic walls, vomitories to facilitate access and a stage set up which is first rate. With a 22-meter height around the stage, it is the focus point no matter where one is seated. The flexibility of the design allows for the widest range of events; and possible configurations that is therefore almost infinite. As concerts will make up a large proportion of events at the Royal Arena, the end stage configuration is very important.

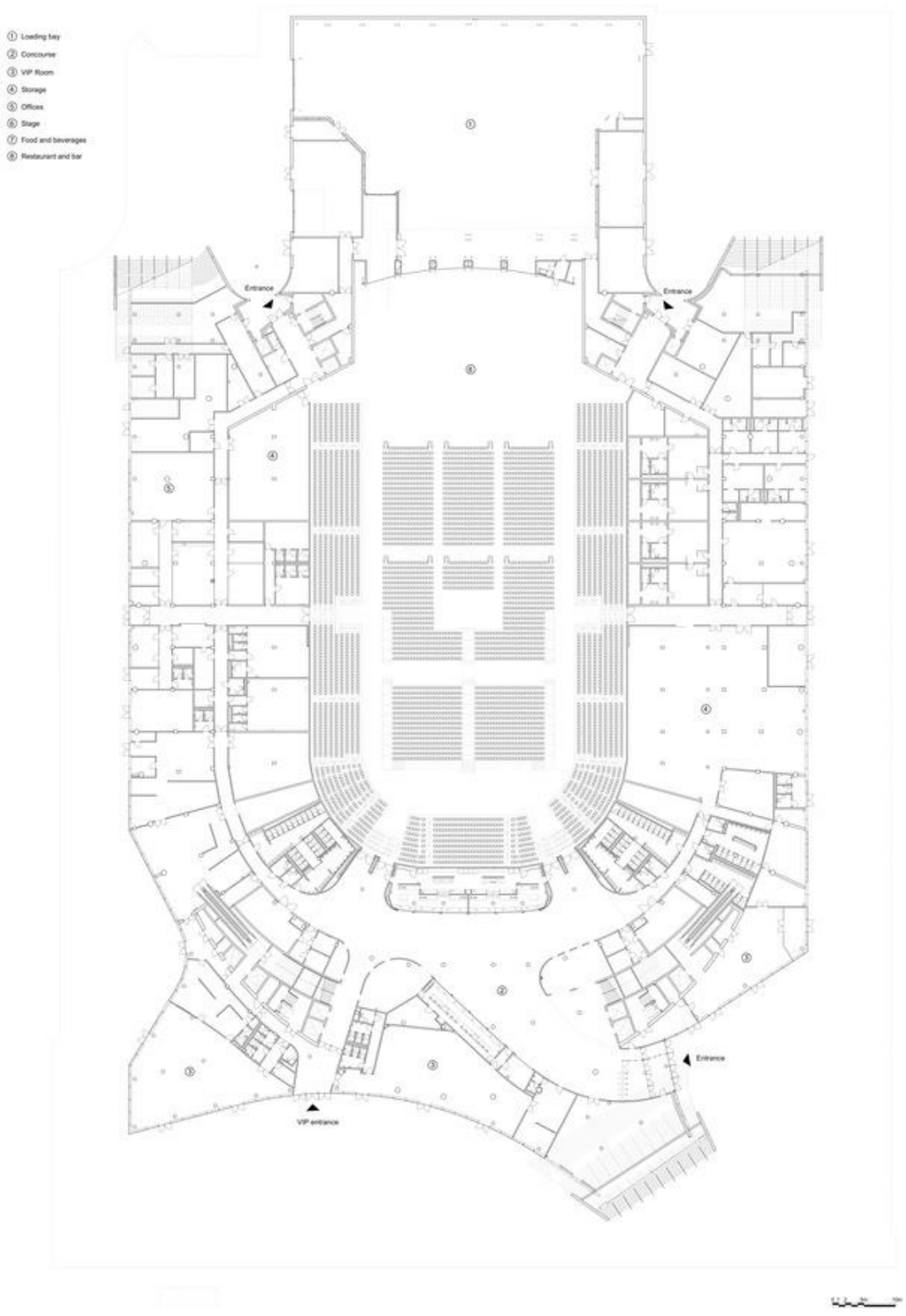


Figure 3.19 Royal Arena first floor plan

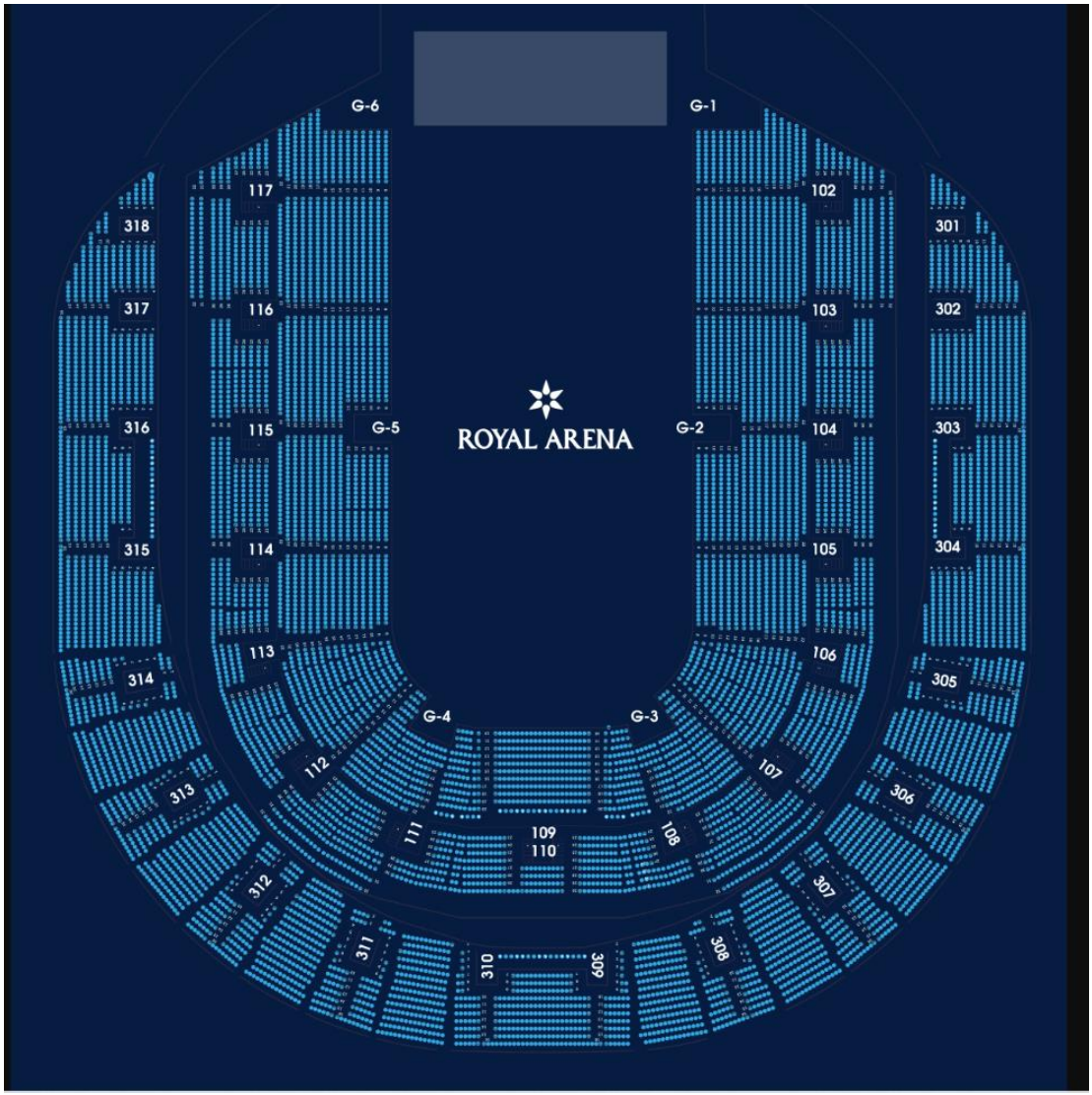


Figure 3.20 Royal Arena Seating Plan

The Arena is also extremely flexible. It allows for a comprehensive range of staging options with a 22-meter height surrounding the stage. In addition, the symmetrical block layout, allows seating to be built up, reduced, expanded or sectioned off in the most appropriate ways for each concert, but also highly capable of adapting to quick operational changes and requirements based on ticket sales. Most of the spectators are seated on three sides of the stage/track/court, with the option to accommodate further visitors on the fourth side for sporting events and special cultural events. In concert-mode, the arena floor can be retracted.

Figure 3.21 Royal Arena Section

3.4.5 Acoustics treatment

- Soundproof walls
- Irregular ceiling profile holding lightinstallations
- Lobby designed as buffer space
- Irregular wall panels for directedreflections

3.4.6 Roof Structure

- flat roof with exterior wooden shutters to blend in with the urban decor

Figure 3.22 Roof Wooden Shutters in Royal Arena

3.4.7 Safety and Services

- HVAC system
- Offers public spill out areas
- **Scandinavian design tradition** that values quality and functionality
- Fire sensors and water nozzles

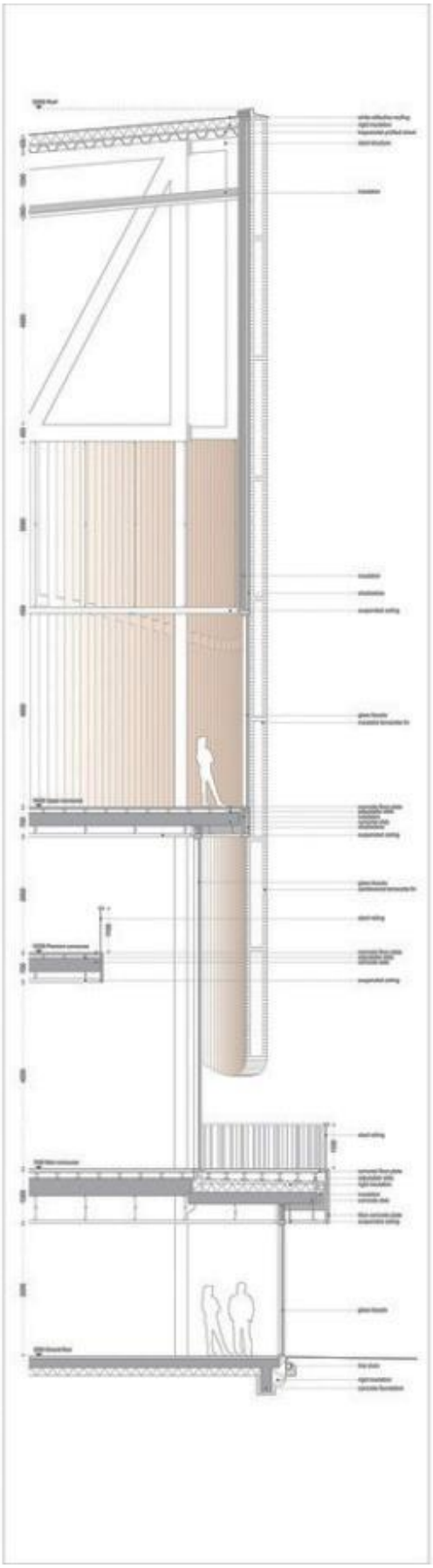


Figure 3.23 Section of Stage of Royal Arena (22 m)

3.5 RASTRIYA NACH GHAR, KATHMANDU

Figure 3.24 Rastriya Nach Ghar Front Façade

3.5.1 Introduction

Rastriya Nach Ghar was established in 2016 B.S. It was conceived as a "Center for PerformingLive Arts" by the government. The building is located at Jamal, Kathmandu. It had worked under various departments such as cultural department, Archaeological department etc. In 2029 B.S. Cultural corporation was established and Nach Ghar was operated under the corporation. Previously, Rastriya Nach Ghar was used for organizing various cultural programs and the functions of birthdays of royal dignitaries etc. The theatre has undergone through different phases of change. But from 2053 B.S, national activities are being held on and off fully supported by government.

- Location: Pradarshani Marg, Kathmandu
- Architect: Ar. Deepak Panta and Dr. Sushil B. Bajracharya
- Architecture Style: Neo-traditional Style
- Auditorium capacity: 750 seats
- Zone: Commercial Zone
- Building Type: Mixed Use Building (commercial and theatre)

3.5.2 Scope of Study

- Acoustic treatment
- Auditorium and its seating
- Spaces in auditorium
- Parking requirements

3.5.3 Space Analysis

- Auditorium away from noisy road, foyer as buffer space
- The entrance leads to the gallery on the ground floor engaging people with various displays before the commencement of programs.
- The public entrance to the auditorium is from the first floor since the ground floor is occupied by rental shops in the front.
- Audience are directly led through curved staircase near the entrance to the hallthrough a terrace on the first floor.
- Each floor is well equipped with rest rooms, fire extinguishers in case of fire hazard.
- Lift has been provided with the purpose to serve the disables and aged peoples.

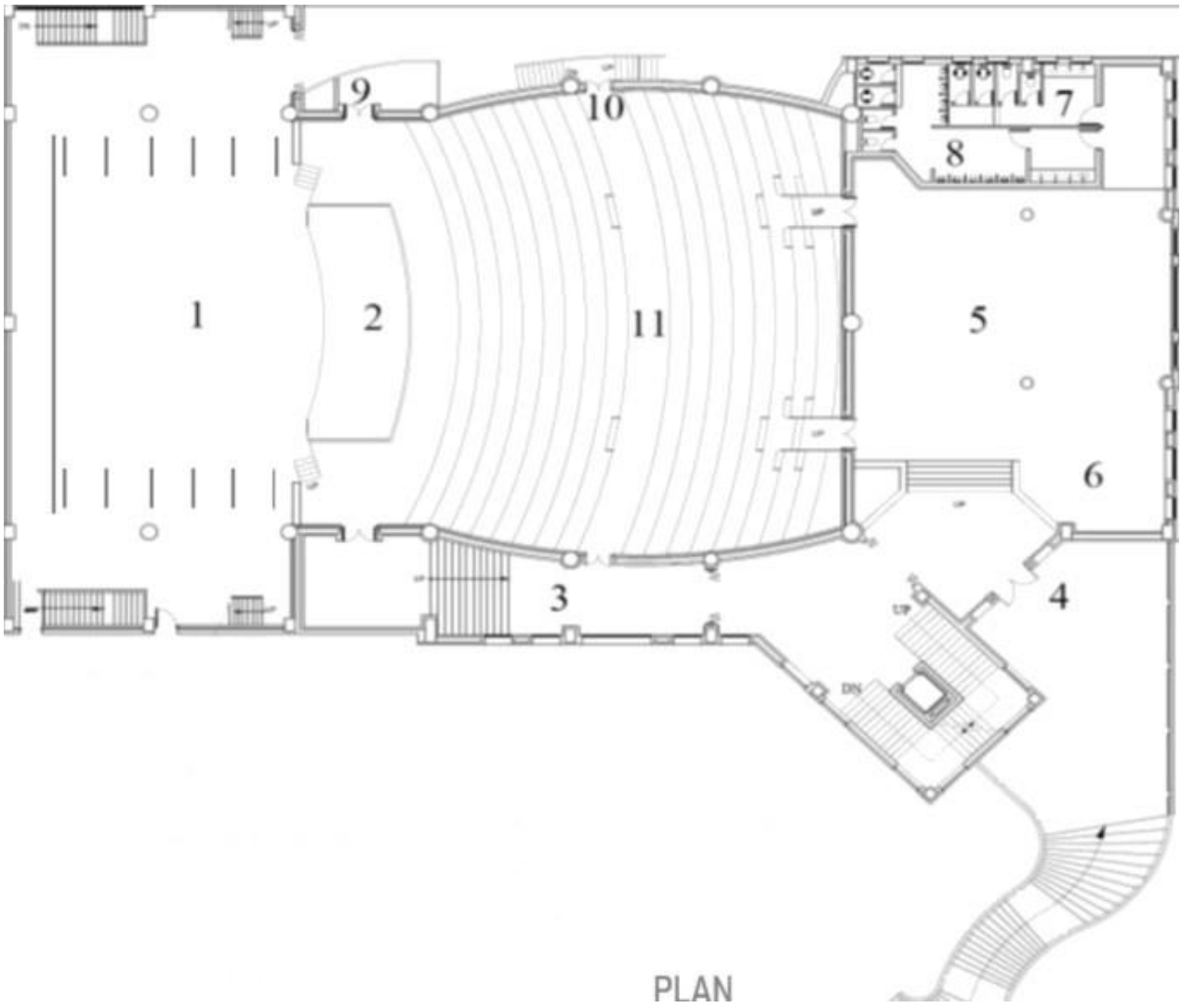


Figure 3.25 First Floor Plan of Rastriya Nach Ghar

3.5.4 Auditorium and Seating

- The auditorium space is divided into 3 parts:
  1. Front of House: Entrance, ticket counter, foyer, etc.
  2. House
  3. Stage
  4. Stage facilities: Back stage, wings, green rooms, rehearsal rooms etc.
- Seating arrangement:
  - Concave Shape
  - Concentric seat plan and first row at a distance of 5.8m form stage
  - Stage raised 1.8m above the floor level
  - Rise of seats is l5cm
  - Inclination of seat is 11 degrees

3.5.5 Acoustics treatment

- Diffusive acoustic panels used on ceiling.
- Irregular ceiling profile holding light installations.
- Thick cavity walls with sound absorbing materials.
- Lobby designed as buffer space.

3.5.6 Safety and Services

- Basement parking- 35 cars and 50 bikes
- 6-person capacity vertical lift
- Fire sensors and water nozzles in main hall and lobbies.
- HVAC system for air conditioning.

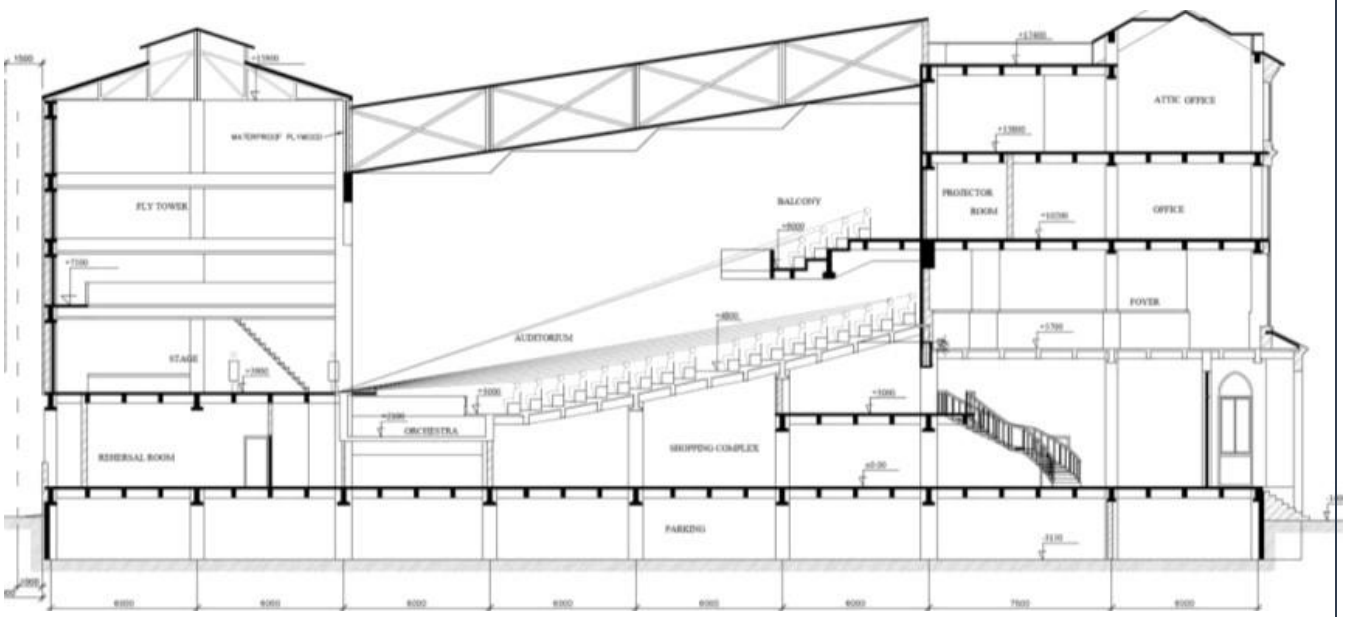


Figure 3.26 Section of Rastriya Nach Ghar

3.6 NEPAL ACADEMY HALL, KATHMANDU

Figure 3.27 Nepal Academy Hall Front Facade

3.6.1 Introduction

Nepal Academy at Kamaladi was built in 1971. It is the first theatre built considering the theatrical activities. The academy complex houses an auditorium, administrative buildings and a publication. The main auditorium building comprises of a theatre, library, multipurposehall, seminar hall, and offices.

- Location: Kamaladi, Kathmandu
- Land Area: about 50 Ropanies
- Architecture Style: Neo-traditional Style
- Auditorium capacity: 1266 seats
- Zone: Commercial Zone
- Building Use: Cultural Shows, Dramas, Dance, Music, Award Ceremonies, College Programs

3.6.2 Scope of Study

- Acoustic treatment
- Auditorium and its seating
- Spaces in auditorium
- Parking requirements

3.6.3 Space Analysis

- The site consists of two buildings: auditorium building and administrative building.
- Landscaping done at front of auditorium building as buffer zone and for aesthetics.
- The public entrance to the auditorium is from the ground floor.
- Foyer provided at both the levels i.e., lower deckand the balcony seating spaces.
- Adequately sized stage is provided with propergreen room and backstage alley.

- Orchestra pit is provided but it is not properly used, the space is currently used for sound controls.
- The height of stage tower provides for adequatetechnical support for vertical arrangement of sceneries, curtain, and lighting provision for stage.

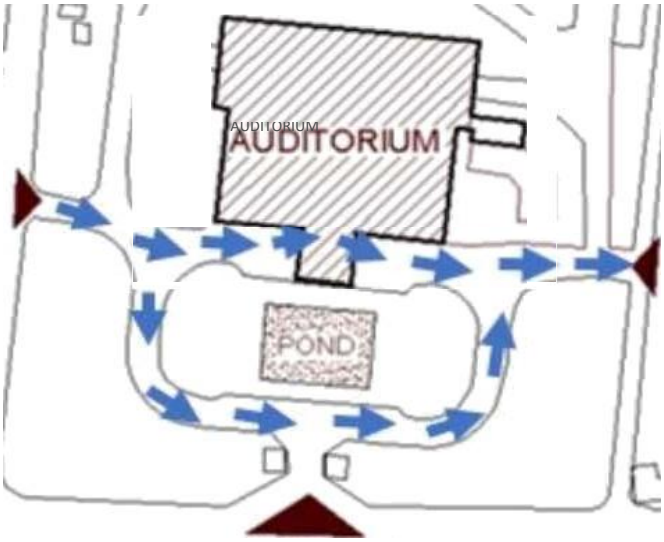


Figure 3.28 Illustrative site plan of Nepal Academy Hall

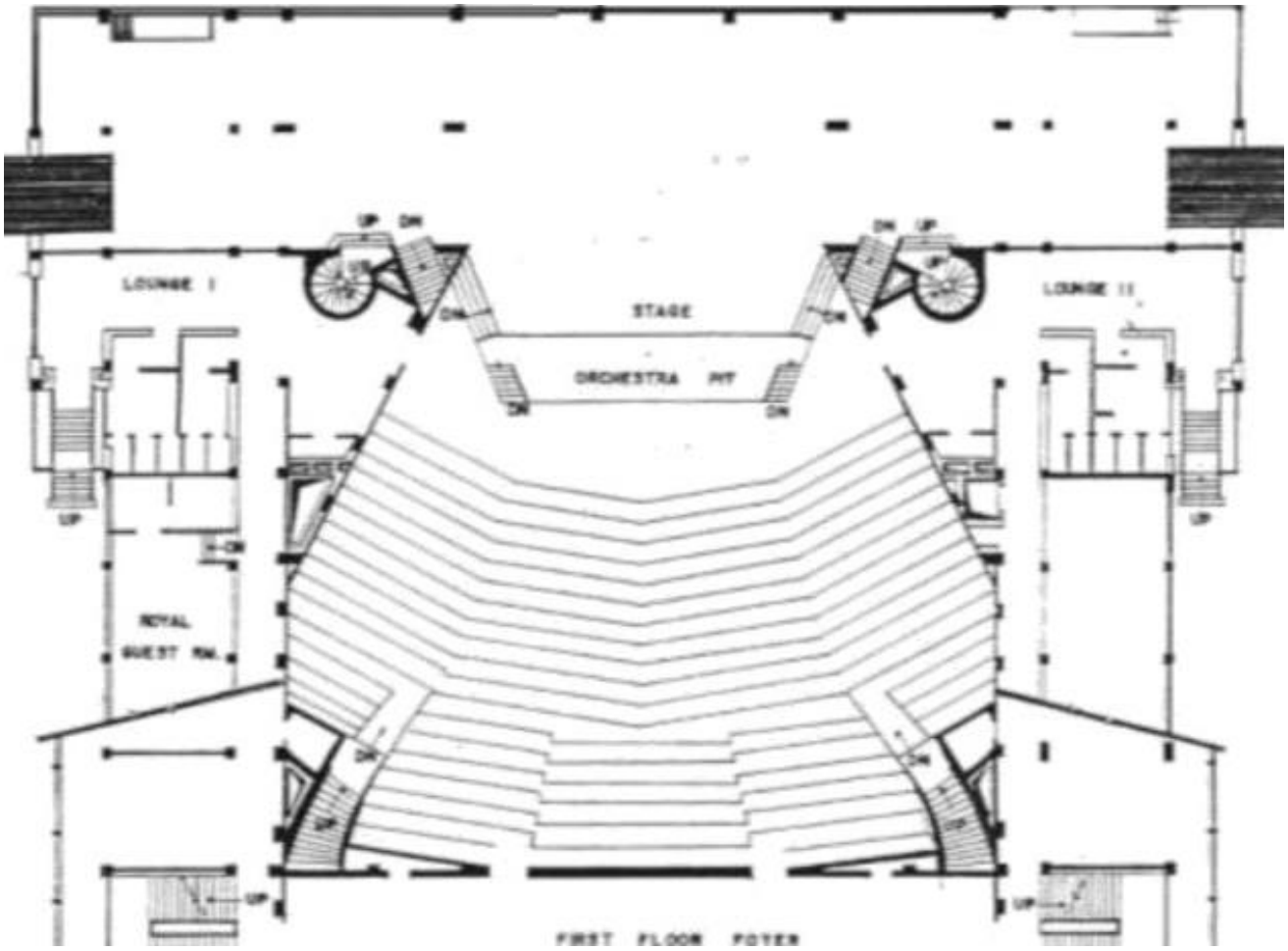


Figure 3.29 Ground Floor Plan of Nepal Academy Hall

3.6.4 Auditorium and Seating

- The auditorium space is divided into 3 parts:
  1. Front of House: Entrance, foyer, etc.

2. House
3. Stage
4. Stage facilities: Back stage

- Seating arrangement:
  - Fan shape seating arrangement
  - Concentric seat plan
  - Proscenium width: 14.6m x 6.7m
  - Proscenium depth: 13.4m
  - Horizontal viewing angle: 31-69°
  - Max. vertical angle from last row: 37°

3.6.5 Acoustics treatment

- Carpets on floor
- Side walls diverging and made with Wooden panels
- Perforated acoustic panels and velvetseat covering
- Irregular ceiling profile holding lightinstallations
- Lobby designed as buffer space
- Irregular wall panels for directedreflections

3.6.6 Safety and Services

- Fire sensors and water nozzles in main hall and lobbies.
- HVAC system for air conditioning.

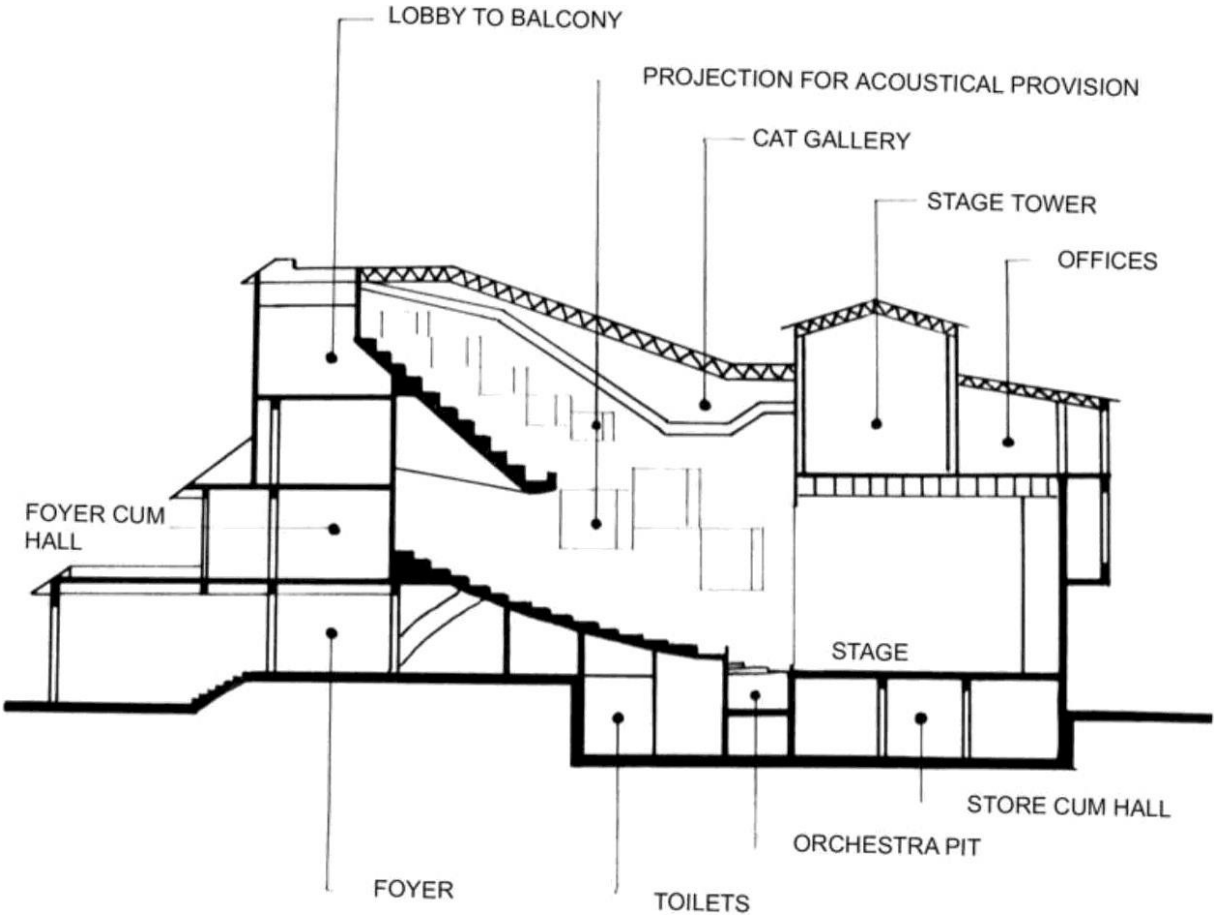


Figure 3.30 Section of Nepal Academy Hall

3.7 CITY HALL, KATHMANDU

Figure 3.31 City Hall, Kathmandu

3.7.1 Introduction

City Hall, Kathmandu also known as Rastriya Sabha Griha is one of the good examples of the modern architecture of Nepal. It is one of the appreciated built forms in terms of architectural expression. The designer of the City hall, Gangadhar Bhatta was the first architect of Nepal. The City hall was built in 2057BS, when the architecture was blooming from its bud. The importance of hall lies in its architectural expression and space efficiency. The city hall is managed by the Metropolitan City Office of Kathmandu.

- Location: Brikutimandap, Kathmandu
- Land Area: about 32 Ropanies
- Architecture Style: Modern Style
- Auditorium capacity: 546 seats
- Zone: Commercial Zone
- Building Use: Conventional hall

3.7.2 Scope of Study

- Acoustic treatment
- Auditorium and its seating
- Spaces in auditorium
- Parking requirements

3.7.3 Space Analysis

- There are various entrances that leads to the different parts of the buildings.
- There are separate entrances that lead to the main hall, administrative office and also separate entry is provided for the VIP at the west.

- The ground floor houses administrative office and cafe. The staircase in the center is there providing a vertical access to the first floor.
- This is a provisional access of the office and can be defined as an escape route in case of emergency.
- A large skeletal staircase at the front leads people directly towards the main foyer whereas the office area is hidden from direct approach.
- Service entrance is also hidden which is located at the east side with a provision for vehicular access. The complex seems to be planned about the axis centered by the main entrance.

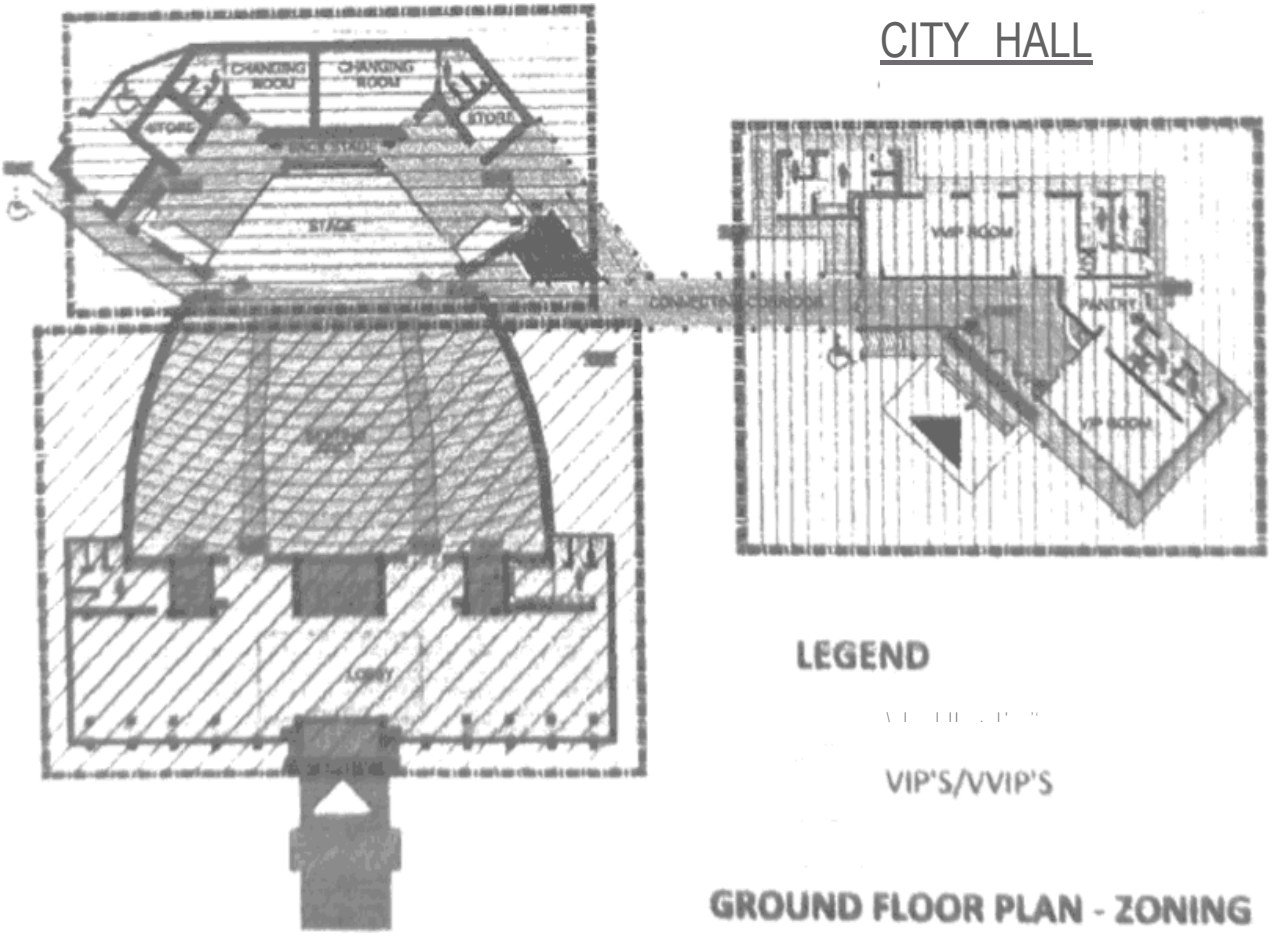


Figure 3.32 Ground Floor Plan of City Hall with Site

3.7.4 Auditorium and Seating

- The main hall had the capacity of 700 + 24 (balcony) persons
- For the l8th SAARC summit in 2014, the seating of the hall was rearranged and now it has the capacity of 546 persons.

- The auditorium is accessible through the main staircase via a foyer.

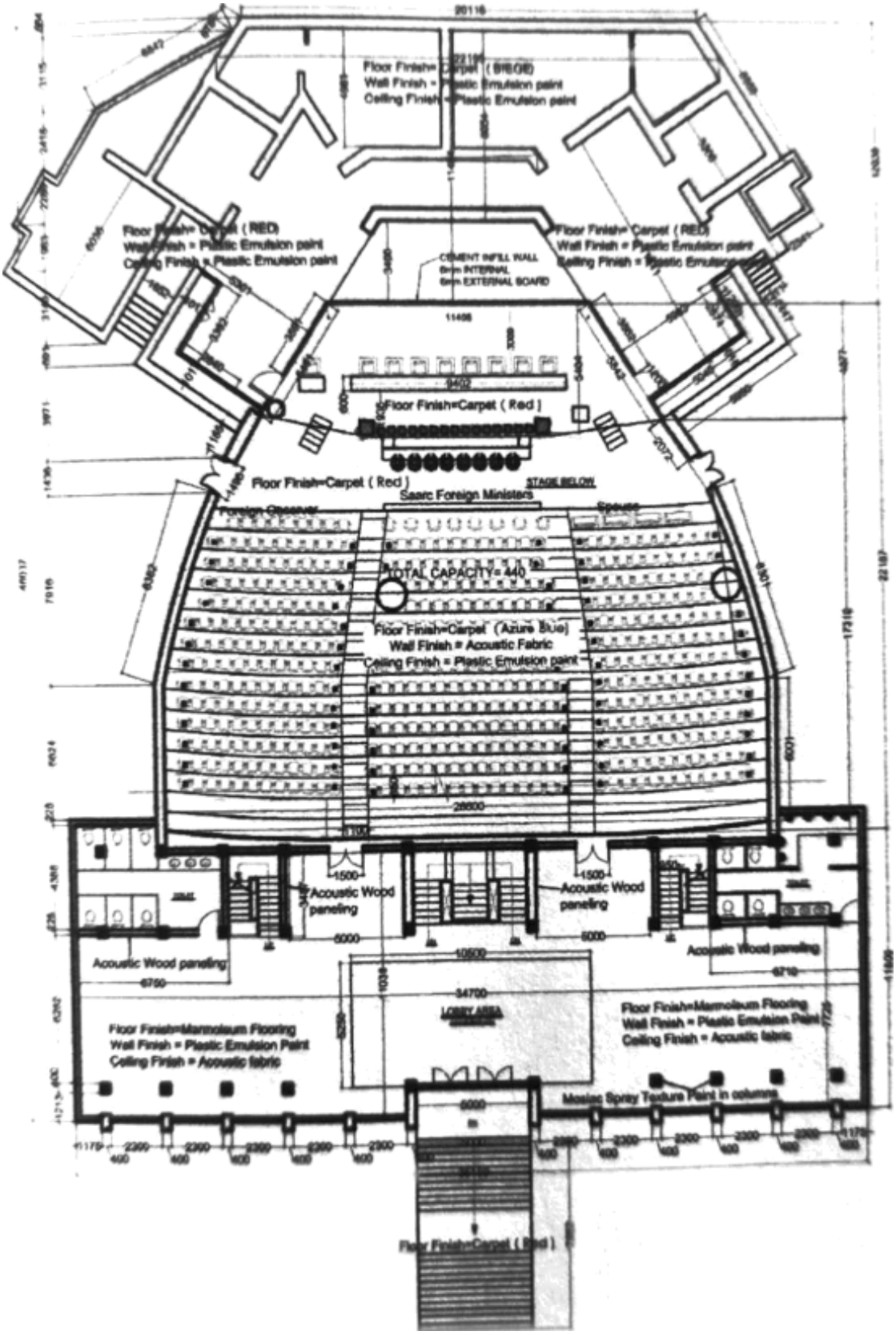


Figure 3.33 Auditorium Plan of City Hall

- The hall is made by erecting 21” thick brick wall. The auditorium has two aisles, which divides the seating into three parts. As the hall is not designed for theatrical performances, there is no orchestra pit. Separate changing rooms and dressing room have been provided at the back stage.

3.7.5 Acoustics treatment

- Timber truss and asbestos sheet
- Steel frames with glass glazing
- RCC beams and columns
- Carpet on floor

3.7.6 Safety and Services

- Segregated parking space
- Fire sensors and water nozzles in main hall and lobbies.
- HVAC system for air conditioning

3.8 INFERENCES FROM CASE STUDIES

- An arena is a public building that facilitates the community along with its main purpose of entertainment
- Arena is an architectural landmark for the nation
- The house and stage rely to each other in terms of both design and function
- Inclusion of enough parking space is important
- Use of various acoustic materials in different parts of structure and treatment techniques
- Landscape included as an aesthetic approach, green space and as noise barrier.
- Use of long span roofs with proper ventilation
- Proper access, adequate foyer space and emergency exits for safety

Table 3.3 Inference from case studies

TOPICS	RASTRIYA NACH GHAR (KATHMANDU)	NEPAL ACADEMY HALL (KATHMANDU)	RASTRIYA SABHA GRIHA (KATHMANDU)	IMAPCT ARENA (THAILAND)	KSPO DOME ARENA (S. KOREA)	ROYAL ARENA (DENMARK)	MOA ARENA (PHILIPPINES)	INFERENCE
STAGE TYPE	Theatre with end stage	Auditorium with end stage	Auditorium with end stage	Arena with thrust stage	Arena with arena stage	Arena with thrust stage	Arena with arena stage	**Arena with thrust stage**
BUILDING FUNCTION	Theatre and commercial spaces	Auditorium for performances and conventions	Auditorium for conventions	Concert arena, conferences and exhibition halls	Concert arena	Concert arena and commercial spaces	Commercial building with concert arena	**Arena and commercial spaces**
CAPACITY	750 seats	1266 seats	546 seats	12,000 seats	15,000 seats	16,000 seats	15,000 seats	**8,000 seats (small capacity)**
ZONING	Commercial shops at lower floors and theatre at top	Separate buildings for auditorium and administration	Auditorium after large foyer space	Arena zoned before halls to segregate traffic	Park leads to arena through foyer space	Arena at center surrounded by commercial spaces	Commercial spaces at lower floor and arena at top	**Arena at back, commercial space at opening**
PUBLIC ENTRANCE TO ARENA	2 entrances at front side led by foyer	2 Entrances led by foyer	2 Entrances led by large foyer	4 Entrances at 3 sides led by foyer	3 Entrances at 2 sides led by foyer	6 Entrances at 4 sides led by foyer	4 Entrances at 2 sides led by foyer	**4 Entrances led by foyer**
BACKSTAGE FACILITIES	Backstage and defined green rooms	Only 1 large backstage	Backstage and defined green rooms	Backstage and defined green rooms	Backstage and underground green rooms	Backstage and defined green rooms	Backstage and defined green rooms	**Backstage and defined green rooms**
FRONT OF HOUSE	Facilities in foyer space	Facilities in foyer space	Facilities in foyer space	Facilities in foyer space and landscape area	Facilities in foyer space and park area	Facilities in foyer space	Facilities in foyer space	**Facilities in foyer space and landscape area**
ACOUSTICS	Foyer, wooden planks, cavity walls, carpet floors	Foyer, wooden planks, cavity walls, carpet floors	Foyer, wooden planks, cavity walls, carpet floors	Irregular ceiling, angled walls, wall panels, long span roof	Irregular ceiling, angled walls, wall panels, long span roof	Irregular ceiling, angled walls, wall panels, long span roof	Irregular ceiling, angled walls, wall panels, long span roof	**Irregular ceiling, angled walls, wall panels, long span roof, cavity walls**
LIGHTING	Architectural	Architectural	Architectural	Architectural	Architectural	Architectural	Architectural	**Architectural**
LANDSCAPE	No	As buffer space, traffic control	No	As buffer space, traffic control	As buffer space, traffic control	As buffer space, traffic control	No	**As buffer space, traffic control**

4 SITE ANALYSIS

4.1 SITE SELECTION

The site was selected based on the criteria listed below:

- Abundant land for the project
- Accessibility
- Geographical conditions
- Environmental acoustics
- To facilitate the site with new landmark
- Urbanize the site and surrounding
- Pocket space for unplanned settlement

4.2 SITE JUSTIFICATION

Figure 4.1 Thimi Area and The Proposed Site

The site at Madhyapur Thimi, Bhaktapur at present is in unused condition. Across the main road, newly planned settlement with commercially active zone is present. The construction of direct road connecting ring road of Bhaktapur at western side of the site has been started. The purpose of my project is to create a new architectural modern landmark in the site so that it might create better opportunities for urbanization of the community. My project also consists of green landscape that will help the community to escape from their concrete environment as well as introducing many recreational activities in park like walking spaces, playing area etc. The project's attraction might help in conservation of the Manohara River.

4.3 GENERAL CHARACTERISTICS

- LOCATION: Madhyapur Thimi, Bhaktapur
- GEOGRAPHICAL LOCATION: 27°41'00.80" N Latitude and 85°21'52.79" E Longitude
- ALTITUDE: 4270 ft
- ZONE: Mixed-residential zone (Residential, Commercial, Industrial)
- TOPOGRAPHY: Slight slope at boundary edges
- CURRENT USE: Temporary structures and small agricultural production

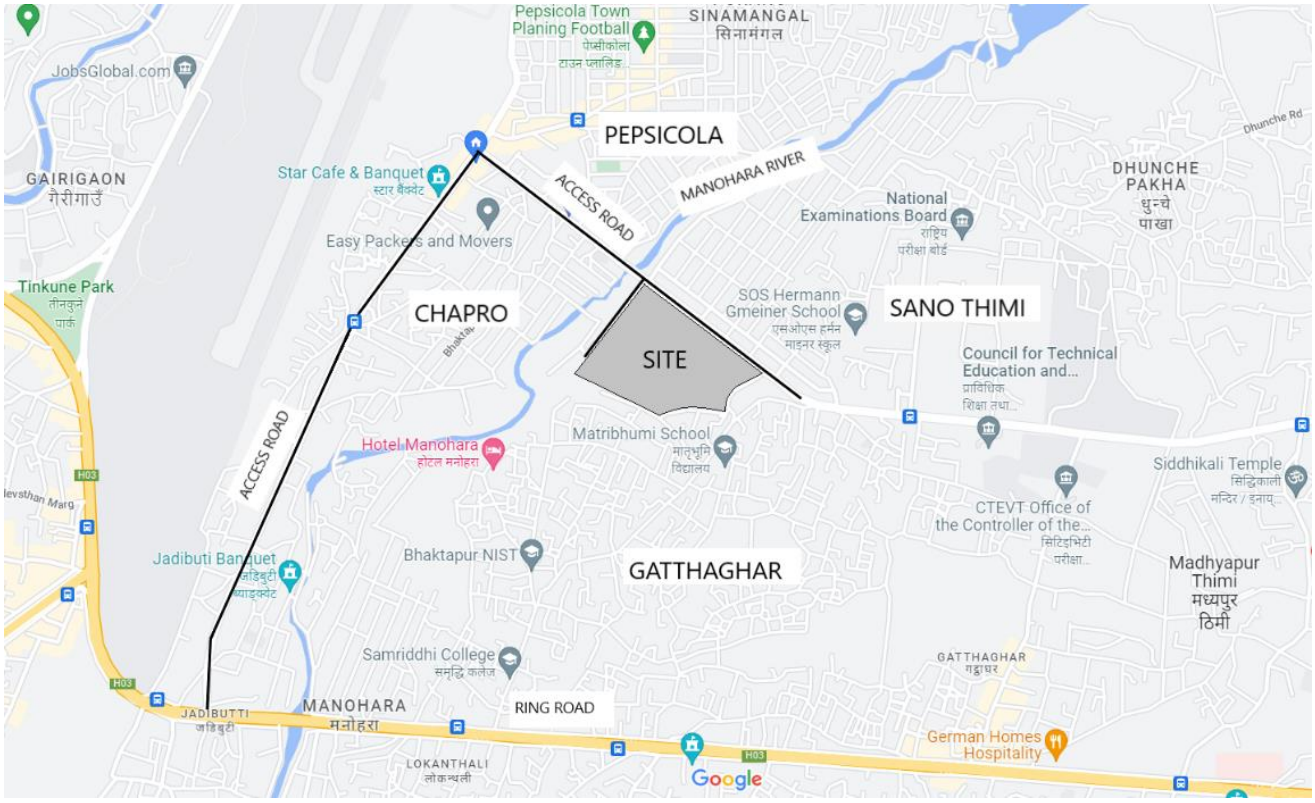


Figure 4.2 Map of Thimi, Bhaktapur

4.4 SITE SURROUNDINGS

- At West:
  - Manohara river.
  - Town planned residential areas of Pepsicola (north-west) and Chapro.
  - Tribhuwan International Airport.
- At South:
  - Residential areas of Gatthaghar.
  - Bhaktapur ring road.
- At East:
  - Sano Thimi residential and office areas.

4.5 SITE AREA AND ACCESSIBILITY

- AREA: 45,000 sq. m. (88.45 ropanies)
- ACCESS: 2.31 km away from ring road
- Main road width 20m
- East access road width 13m
- South access road width 10m
- BY- LAWS:
    - FAR 2.5
    - GCR- 60%

Figure 4.3 **View of Site from North East**

Figure 4.4 East Access Road Under Construction to Link with Ring Road

4.6 ELEVATION PROFILE

The elevation profile showed the site does not have much difference in elevation heights along its short and long length. Thus, it has been assumed as flat land for my project.

The elevation profile of the site shows:

the maximum difference along east-west is about 5 feet.

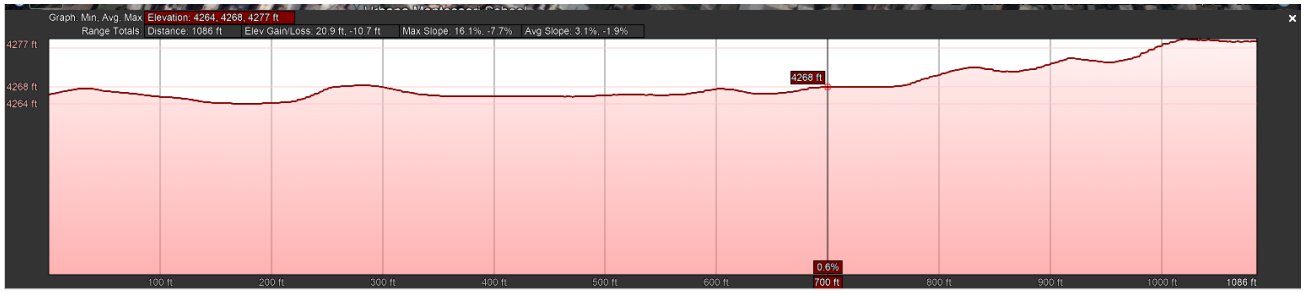


Figure 4.5 Elevation Profile of Site Along East-West

the maximum difference along north-south is about 6 feet.

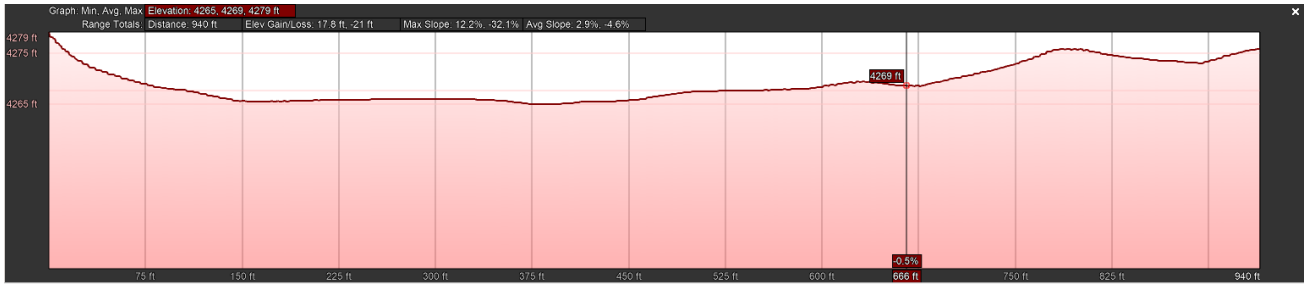


Figure 4.6 Elevation Profile of Site Along North-South

4.7 NATURAL CHARACTERISTICS

The site is located at border of Kathmandu and Bhaktapur near Manohara River. According to data of weather and climate from meteorological forecasting division of department of hydrology and meteorology of Nepal; the average maximum temperature is about 30 degree Celsius in summer and average lowest temperature is about 18 degree Celsius in Kathmandu valley.

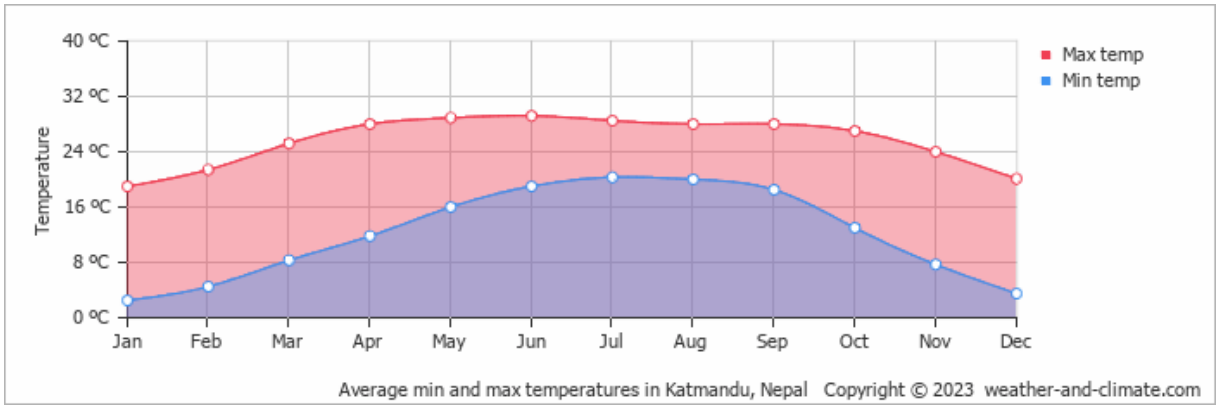


Figure 4.7 Average Min and Max Temperature of Kathmandu Valley

The site is accessible to sun path through out its area without any disturbance. The wind blows from north to south and north west to south east. The wind path and sun path for the proposed site is clearly shown below:

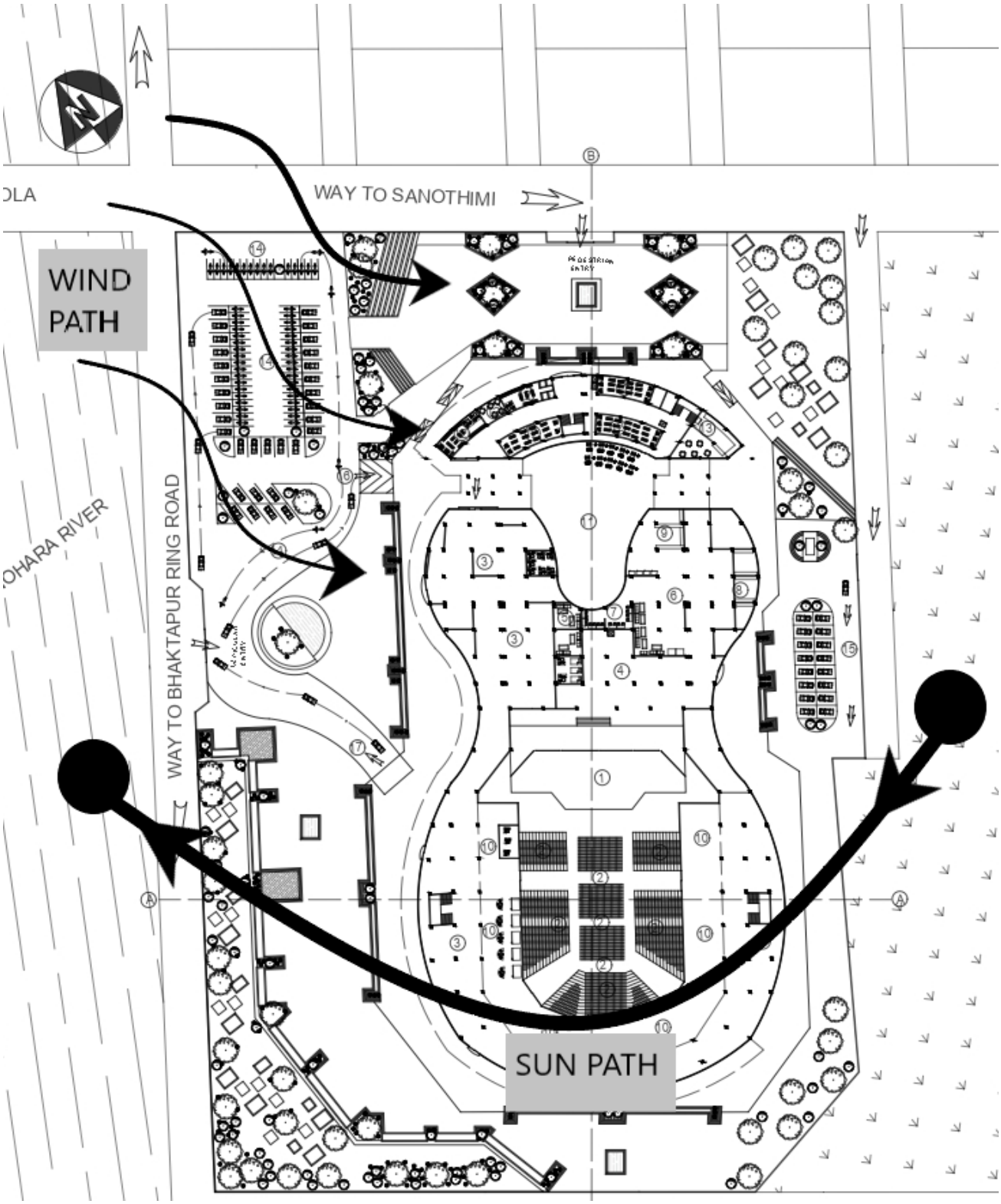


Figure 4.8 Sun and Wind Path in The Site

4.8 SWOT ANALYSIS

4.8.1 STRENGTH

- Open environment
- Easy and fast connection with ring road
- Mixed used zone

4.8.2 OPPORTUNITIES

- Urbanization opportunity
- Green landscape for populated settlement
- New Landmark

4.8.3 WEAKNESS

- Location in outskirts of main city
- Traffic

4.8.4 THREAT

- Water pollution
- Flood
- Risk of landslide of constructed roads

Figure 4.9 Present Condition of Manohara River and Road Construction

5 PROGRAM FORMULATION:

5.1 ARENA AND STAGE SPACES

Table 5.1 Arena and Stage Spaces Program

S. No.	DESCRIPTION	DIMENSION	REMARKS
1.	Seating	0.5/person	Standard
2.	Stage	1/3rd of seating	Standard
3.	Rehearsal Room	Similar to that of Stage	Standard
4.	Green Room	1. 4m²/ person	Standard
5.	Changing Room	1.5m^2/ person	Standard
6.	Single Dressing Room	21.5m^2	Standard
7.	Shared Dressing Room	2m^2/person	Standard
8.	Communal ChangingRoom	3m^2 /person	Standard
9.	Toilet for Performers	lw/c per 6 1w/b per 6 1 urinal per 4	Standard
10.	Storage	20-25%	Standard
11.	Toilet	w/c=1 per 100 Urinal= 2 for 75, l w/b for200	Standard

12.	Foyer	25% of Arena	Standard
13.	Circulations	30% of total	Standard

5.2 ADMINISTRATIVE AND FRONT OF HOUSE SPACES

Table 5.2 Administrative and Front of House Spaces Program

S. No.	DESCRIPTION	DIMENSION	REMARKS
1.	Director	15 m^2	Standard
2.	General Manager	12 m^2	Standard
3.	Technical/ Production/ Stage Manager	12 m^2	Standard
4.	Front of House Manager	12 m^2	Standard
5.	FOH/Box Office/Bar Staff	4 m^2/person	Standard
6.	MarketingOfficer	12 m^2	Standard
7.	Cleaner	4 m^2/person	Standard
8.	Meeting Room	2.5m^2/person	Standard
9.	Toilet	1w/c per 6, 1w/b per 6, 1 urinal per 4	Standard
12.	Pantry		
13.	Circulation	15% of total	Standard

5.3 RESTAURANT

Table 5.3 RESTAURANT PROGRAM

S. No.	DESCRIPTION	DIMENSION	REMARKS
1.	Dining	1.7 m^2/sitting	Royal Arena Case Study
2.	Kitchen	0.6 m^2/seat	Standard
3.	Reception Counter	5 m^2	Royal Arena Case Study
4.	Restroom	2 w/c for 150 females 2 urinals for150 males	Standard

5.4 FINAL AREA CALCULATIONS

Table 5.4 Final Footprint Area Calculation

S. No.	Description	No. of users	Area (m^2)	Circulation (m^2)	Footprint Area (m^2)
1.	Arena	4000	6921	3244	10165
2.	Backstage		1875	795	2670
3.	Foyer space			1916	1916
4.	Commercial block		936	544	1480
5.	Total				16231

5.5 SITE AREA CALCULATION

- SITE AREA= 48,873 sq. m.
- TOTAL BUILDUP AREA= 14751 + 1480 = 16,231 sq. m.
- PARKING SPACE= 10-15% of 45,000 = 4,800 sq. m.
- AREA FOR LANDSCAPE= 28,033 sq. m.
- GCR % = 35%

6 CONCEPT

6.1 CONCEPT: BOND

Following the concept of bonding experience between the artist and audience within the arena, the concept of the building also is inspired by the bond initiation. Bond in the form of connecting the architecture with the community.

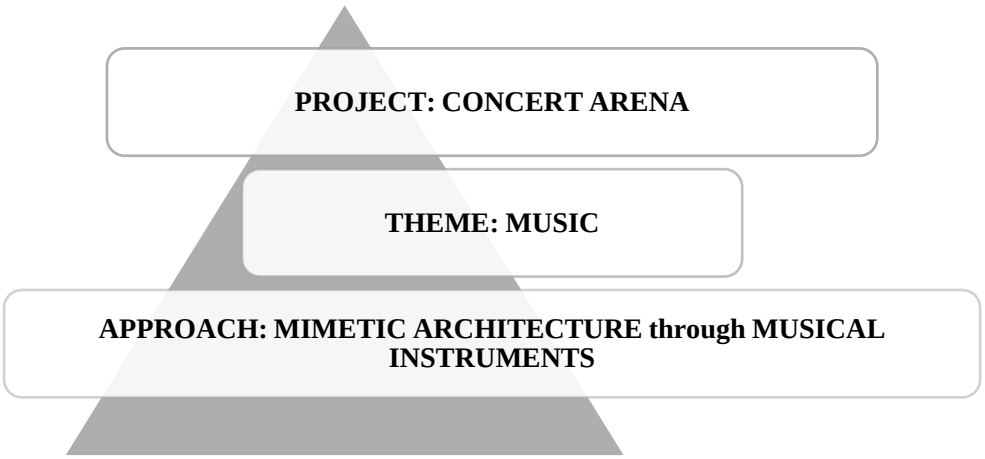


Figure 6.1 Illustration of concept

As generated through the international case studies, an arena building is a public building which houses private zone an arena. The building can be accessible to the community at any time within their working hours. Thus, the concept of bonding the community with the commercial block of my project through commercialization is the first bond concept approach.

The present community is within the cemented environment who wants to spread their freedom in nature. At present there is a park just in front of my site that is used by the residentials of Pepsicola, Chappro and Sano thimi. Thus, it is so much over populated that it has lost its nature. Another park could reduce its burden and bring balance to the community needs which my project wants to achieve. This is another bond concept approach between the architecture and community.

6.1.1 Why theme music?

My project houses concerts and concerts are a **live music performance**. Thus, choosing the theme music for the concept is a reasonable approach. Music also **symbolizes togetherness** in the sense that it brings people together putting aside the various differences in them. By choosing music as the theme, I want to symbolize my project as something that brings people together for better. It is said that music **brings out emotions** in people. Likewise, I want my project to be used by people when they are feeling different emotions like: when they are happy, they can shop; when they need time, they can walk through the park; and when they need to socialize, they can come to concerts.

6.1.2 Concept Approach

Moving along the theme music, to approach the bonding concept **musical instruments** have been analyzed and used.

6.1.2.1 **Approach 1**: musical instruments used in concerts

Various musical instruments ranging from woodwind, string to bass is used in concerts daily. Among them, piano, guitars and drums have been said to be the basis of musical notes and beats. They have been used from the start and cannot be replaced by other

instruments because they offer higher range of notes than others. They are the main components of live music of any genre be it band or modern music.

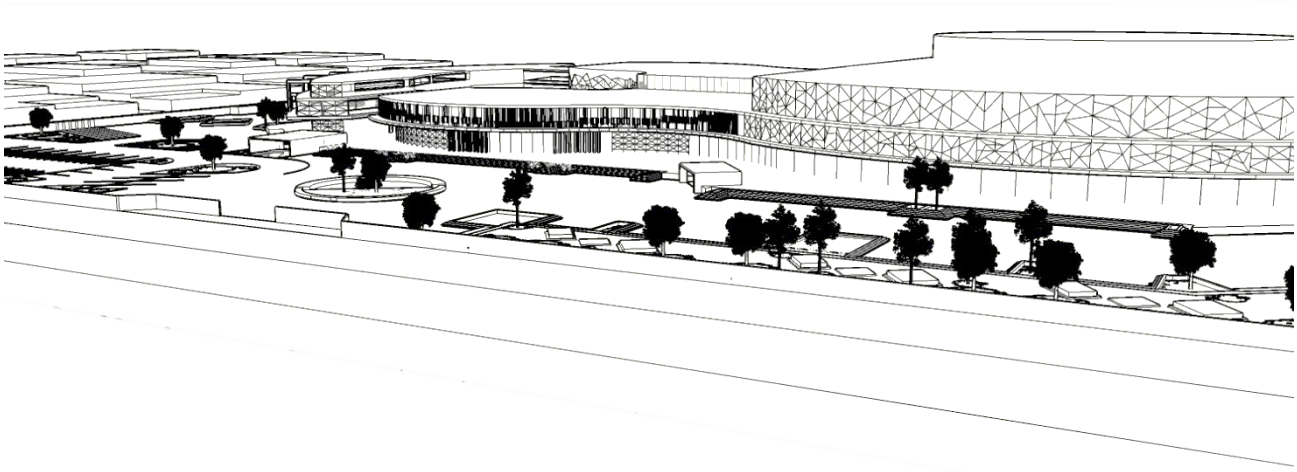


Figure 6.2 Initial approach of building form

6.1.2.2 **Approach 2**: musical instruments symbolizing bond

Musical instruments show bond with the user, with the person's emotion listening it and within its parts. Piano, guitar and drum seems to fulfil these bonding criteria perfectly. Piano and guitar is even mentioned as the best instrument for singers while without the use of drums the live music can never be as real as it is now.

6.1.2.3 Piano

The piano is a keyboard instrument that produces sound by striking strings with hammers, characterized by its large range and ability to play chords freely. The piano has the widest range of tones of all instruments. A piano plays a note lower than the lowest note on a double-bassoon and higher than the top note of a piccolo – an entire orchestral range in one instrument. This makes the piano capable of producing melody and accompaniment to any song or instrument. Thus, it is referred as the king of instruments.

Figure 6.3 A Keyboard Piano

- WHY **PIANO**?

i. Symbol of bond

Since early times, mainly in western part of the world; the families did not spend much time with the family so started using piano as a means to gather. They used to listen to piano and spend their family time at evenings after everyone was home bringing the feeling of togetherness.

ii. Symbol of status

Until today classic piano is one of the most expensive musical instruments. Thus, during early period only rich people used to inherit a piano. As a result, it indirectly became a symbol of status. Thus, I want to include this symbol of status as a symbol to uplift the community through my project.

iii. Bond of instruments

Musically speaking, piano is itself a bond between a keyboard instrument with string instrument. Its wire strings that sound when struck by felt-covered hammers operated from a keyboard. The main reason behind this combination to produce piano was due to the lack of range of notes made by string and woodwind instruments.

6.1.2.4 Guitar

The guitar is a string instrument which is played by plucking the strings. It normally has six strings, a fretted fingerboard, and a soundbox with a pronounced waist. The guitar is one of the most widely played instruments in the world. It is incredibly versatile and is used in many different genres of music. Guitar places itself as one of the most commonly used musical instrument because it is portable and can be brought to any place and enjoyed in any genre.

Figure 6.4 A Classic Guitar

- WHY **GUITAR**?

i. Symbol of bond

Since guitar was made it has formed a different bond with the individual who uses it. Maybe it is because of its portability or because it is one of easy learning instrument, one that uses guitar will always care it like another being rather than a lifeless object. Study shows that playing guitar is a form of mindful escapism, a way to create space between an individual and their busy mind helping to develop a greater sense of personal achievement.

ii. Symbol of joy and social bond

Guitar is an instrument that is brought to smallest gathering as well. People play guitar share music and enjoy their time. Thus, it is a symbol of social bonding. It is a great way to relieve stress. It can also help one connect with other people who share passion for music.

6.1.2.5 Drums

Drum is a musical percussion instrument consisting of a hollow cylinder with a thin layer of material (as animal skin or plastic) stretched over one or both ends that is beaten with a stick or with the hands. The primary role of the drum is to resonate with the vibration of the head. As the "keeper of the rhythm," the drum provides the foundation for the overall sound of music. Because a drum only has to be hit to make a sound, it is also one of the simplest of the instruments. The drum kit is a group of drums & cymbals to make beats for music. Drum kits are used in most types of popular music.

- WHY **DRUMS**?

i. Symbol of bond and origin

It symbolizes origin of music. Drums are the world's oldest musical instrument, and while the technology in drums has improved over centuries, the basic design of the drum has virtually remained the same for thousands of years. There is no sustained period of time or civilization that has risen, existed, and fallen without being touched, in some way, by drums. They have been used in a wealth of ways: to announce celebrations, to declare war, to psyche up soldiers, and to quicken the pace of movements of everyone from rowers to soldiers on the march.

Figure 6.5 A Typical Drum Set

ii. A need in concert

The physical sensory nature of drumming provides a unique aesthetic experience. Scientifically, it alerts senses and triggers the need to move our body. This is why concerts feel alive because we move along the beats instantly.

iii. Symbolizes 'creation-existence-destruction'

Culturally people believe that destruction happens for new creation to happen at the same spot. This is linked with drums because in Hindu culture, Lord Shiva played the same drum during destruction of a place to recreate it after. So, drums are used in my concept to symbolize that people destroy or overcome their negativity and unhappiness of their life and create positive environment around them after attending concerts as drums awakens creative energy of human soul as well.

6.2 CONCEPT DEVELOPMENT

6.2.1 Zoning

- **Commercial block is public zone**

  As a public building, the commercial block has been placed near the entrance for greater accessibility. People who come for shopping can access the shops without any difficulty. Even the restaurant and cafes are placed at commercial zone to seclude more population from the arena premises.

- **Arena block is private zone**

  Only open during concerts, the arena block is secluded from all other activities going on in the venue. The foyer space is large to encompass maximum audience as well as for thorough checking of tickets before entering the arena.

- **Courtyard and bridge as buffer and connection**

  The courtyard formed between two blocks and the bridge connection between the foyer spaces are used as connection for audience as waiting space before the concert starts. They are used also used to increase the buffer zone between commercial and arena blocks.

- **Landscape as buffer**

  Landscape is created along the axis of roads to increase the buffer zone. It hosts as waiting area before the start of the concert. It also acts as park for the community people.

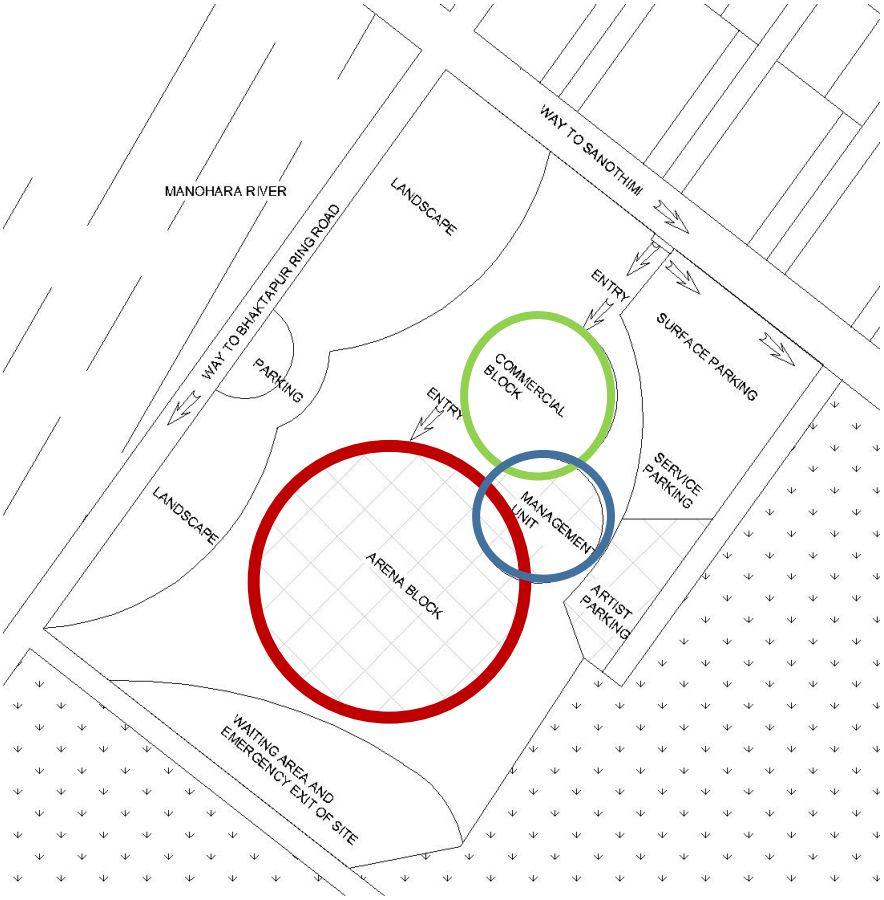


Figure 6.6 Bubble Diagram

- **Axis along access road**

  Pedestrian axis is along the north main road while vehicular axis is along the east access road to divert the traffic from main road. The east road will also be connected to ring road so people can have easy access to the site in future. For the artists, a separate access road at west has been used for maintaining their security during the events.

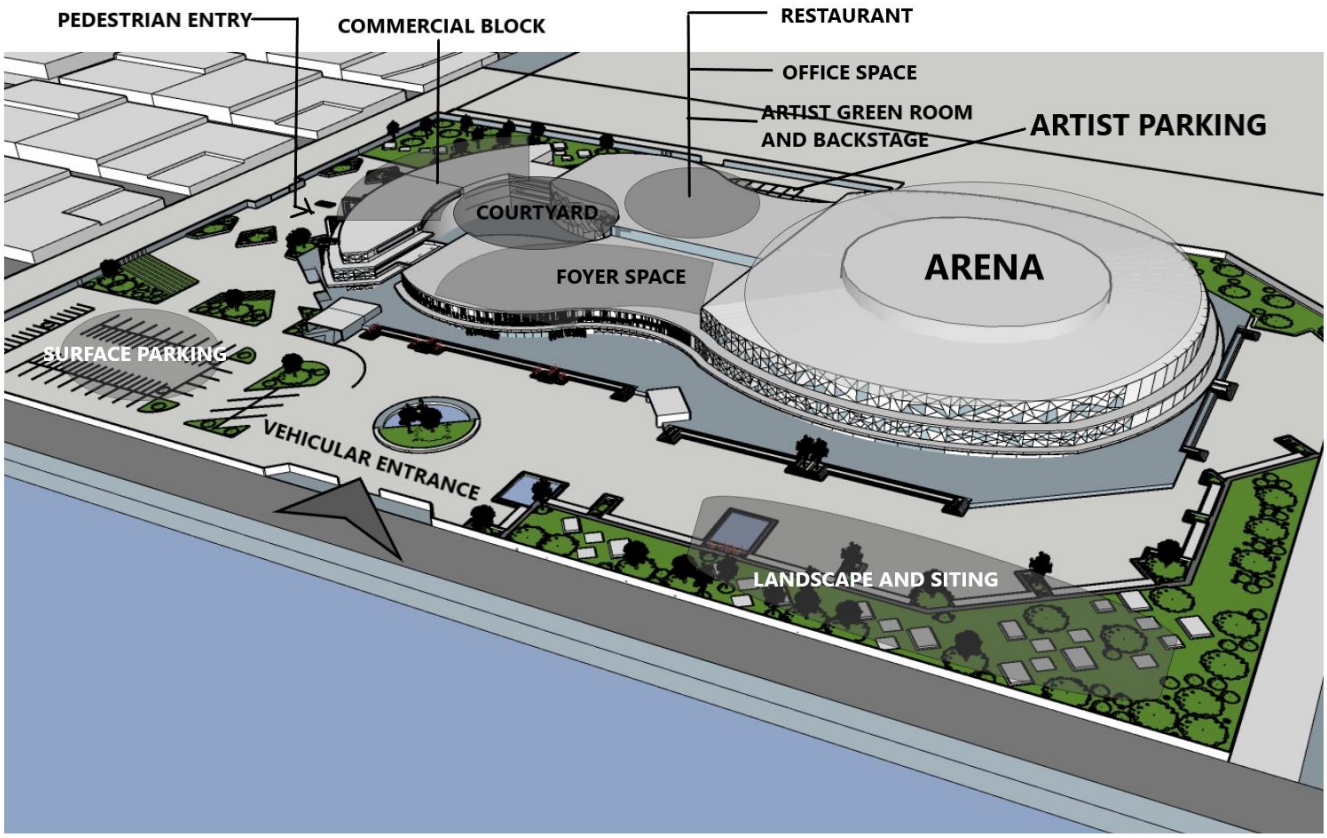


Figure 6.7 Zoning diagram of the site

6.2.2 Inferences from study

- Separate commercial and arena block
- Pedestrian axis along main road where landscaping is introduced
- Vehicular axis along east access road at north
- Bridge introduced to create buffer zone
- Multiple arena entrances and exits

6.3 DESIGN DEVELOPMENT

6.3.1 Approach 1: Shape to encase Arena

The approach of arena is with thrust stage and 3 side seating which generates curved almost semi-circular form. So, following the approach of musical instruments, the guitar body was best suited to house arena with its curved shape that gave aesthetic appeal as well. The arena houses 4,000 audience and the curved body of guitar fitted the required size and did not obstruct much space in the site.

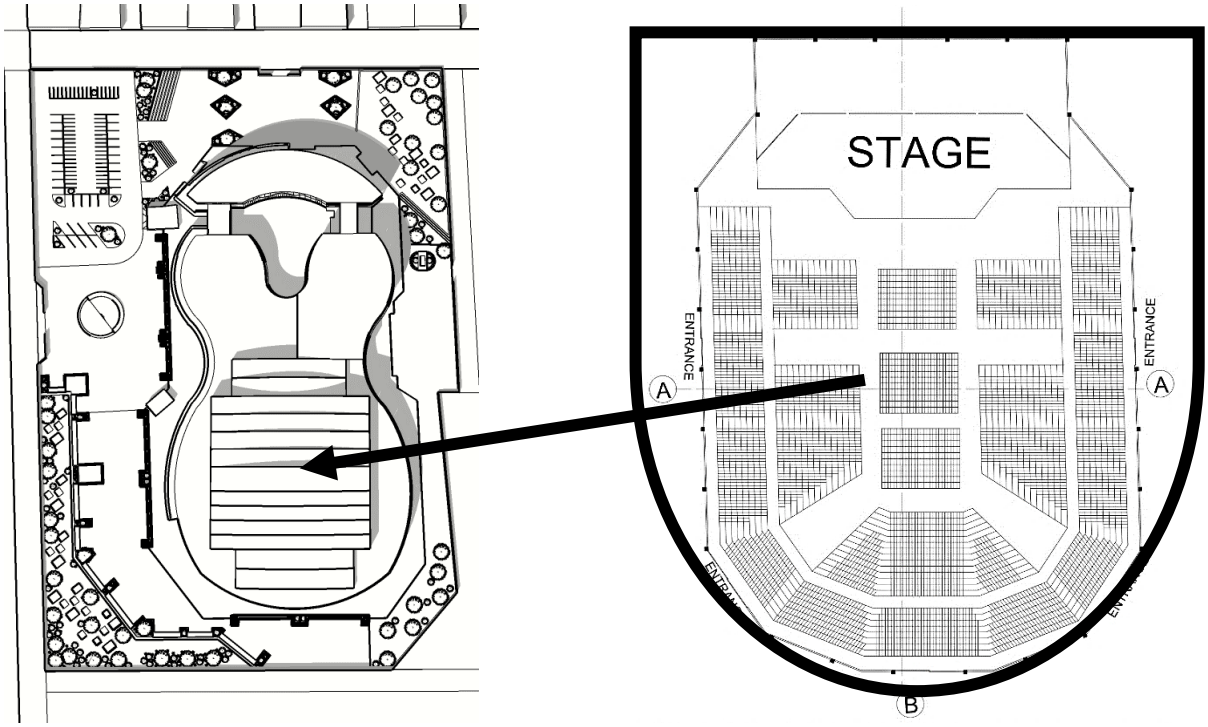


Figure 6.8 Encasing the shape of arena in guitar body

6.3.2 Approach 2: Mimetic Architecture

Mimetic architecture, also known as 'novelty' or 'programmatic' architecture, is a style of building design popularized in the United States in the first-half of the 20th century. It is characterized by unusual building designs that mimic the purpose or function of the building, or the product it is associated with. It is more like "FORM IS FUNCTION" rather than "FORM FOLLOWS FUNCTION".

As a concert arena functions as musical venue, use of musical instruments used inside the venue is a part of the concept of this project. The curved body of guitar houses the arena, its elongated shape provides the larger foyer space at one end needed for circulation and activities like merch showcase while another end provides the backstage activities.

Likewise, the semi-circular cut part of the drums has been used for commercial activities as curve is an aesthetic approach in a building. Even the overall layout of the vertical form of the building is made to look like a guitar is sub-merged within the earth giving the meaning music is rooted deeply in our lives and also it represents Mimetic architecture at its best from any angle.

- Overall elevation to show guitar submersed in earth

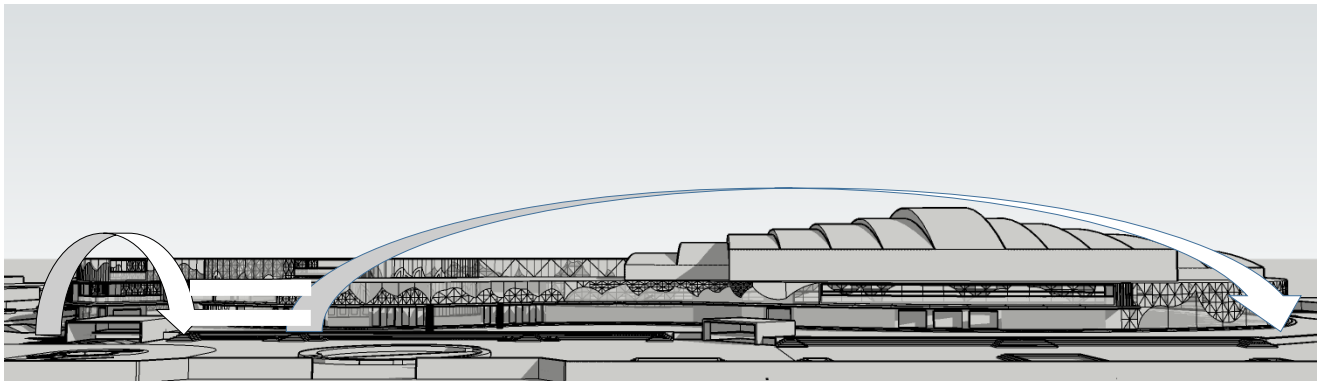


Figure 6.9 Form to mimic guitar submerged in earth

- Extended middle floors resemble cymbal placement in drum set

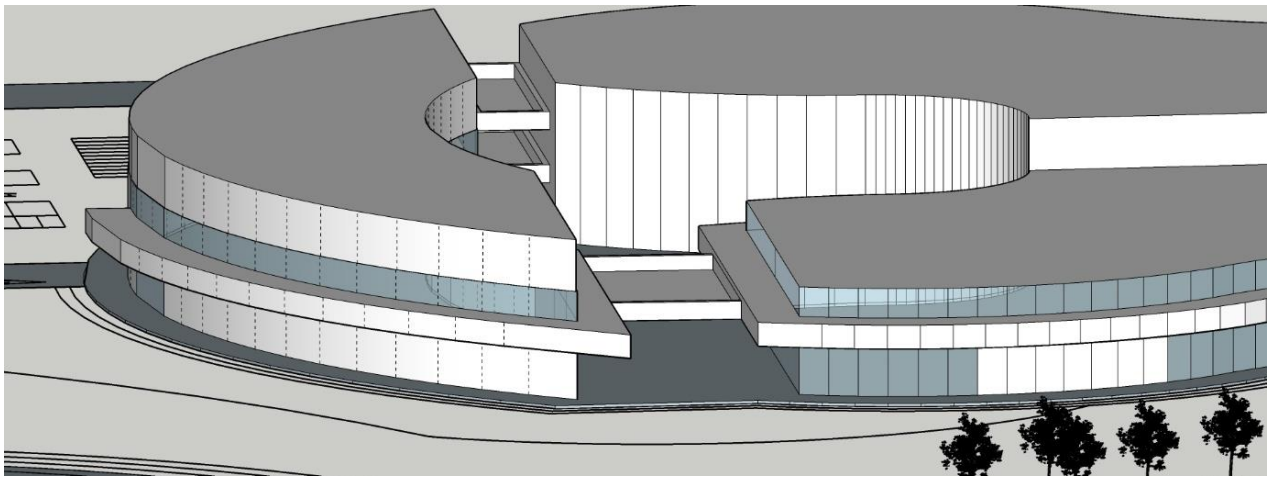


Figure 6.10 Form to mimic cymbal of drum set

6.3.3 Form Development

6.3.3.1 Identification of geometrical shape

- The geometrical shapes of the chosen three instruments were identified.
- The cylinder shape of the drum was cut into half and used for the commercial block.
- The guitar shape was used as it shows symmetry in itself and to house a large arena the lower circular shape was preferrable.

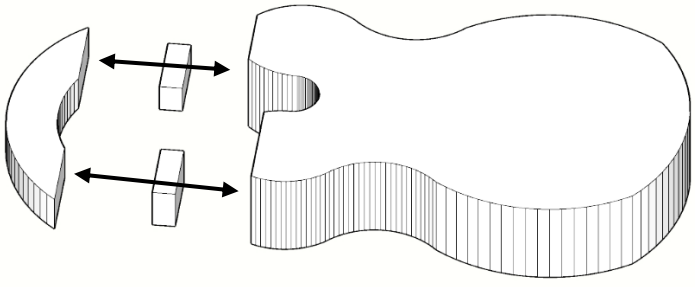


Figure 6.11 Identification of Shapes

- The rectangular blocks of piano have been used as bridge between the blocks.

6.3.3.2 Geometric bonding

Then the acquired shapes were bonded together as shown to create a form. The rectangular pieces were used as connection in the upper floors.

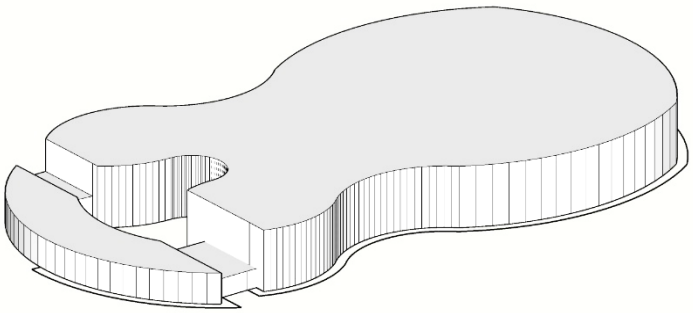


Figure 6.12 Geometric Bonding

6.3.3.3 Scaling the form

The acquired form was then scaled as per requirement and placed on the plan. The curves were used as an appeal to the entrance. The form formed a spacious courtyard between the blocks that can be used as recreational space.

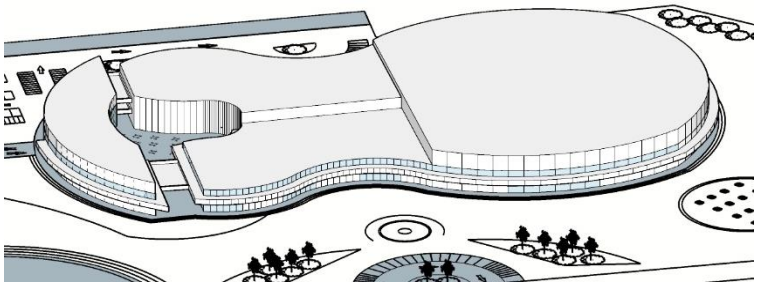


Figure 6.13 Acquired Scaled Form

6.3.4 3D Visualization

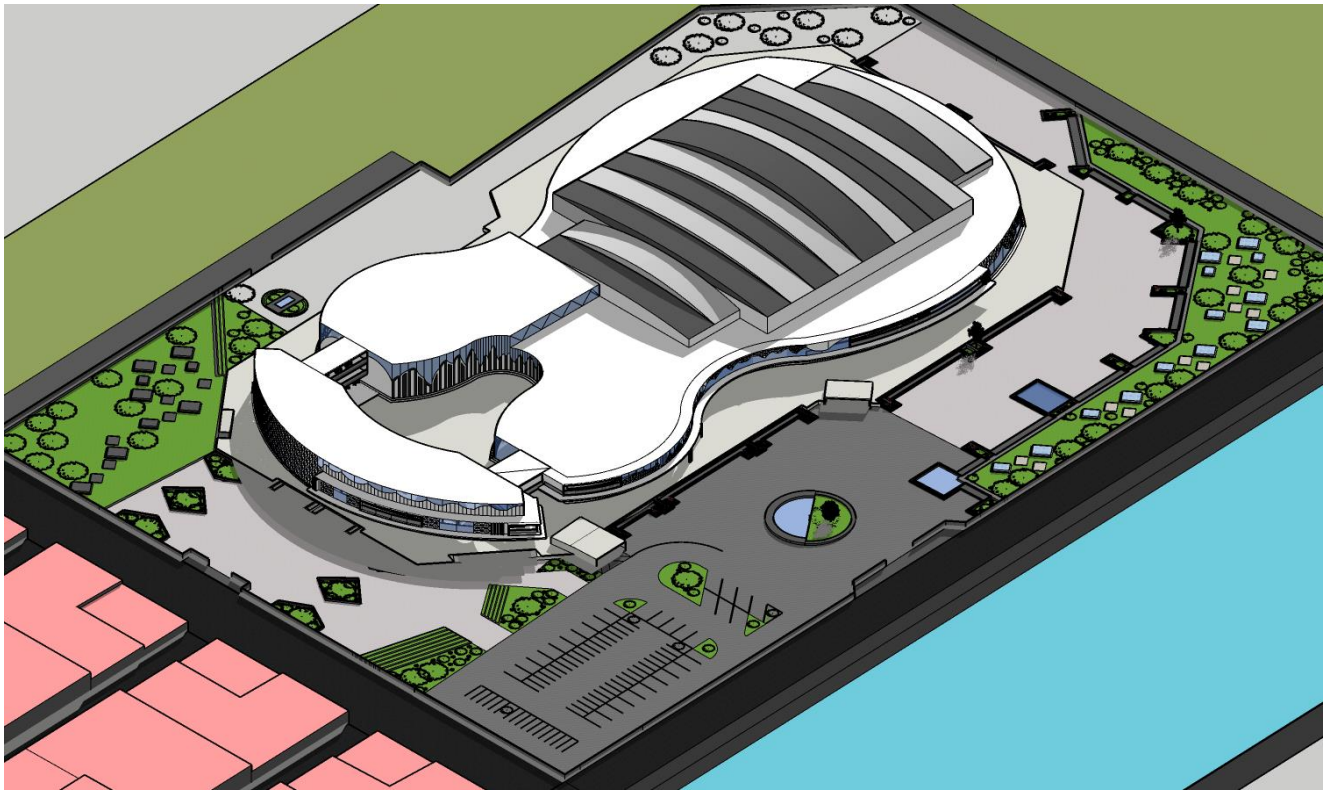


Figure 6.14 Isometric View

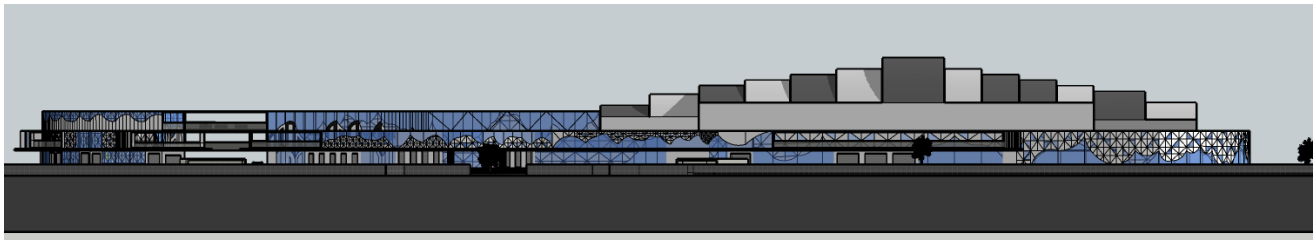


Figure 6.15 West Elevation (front)

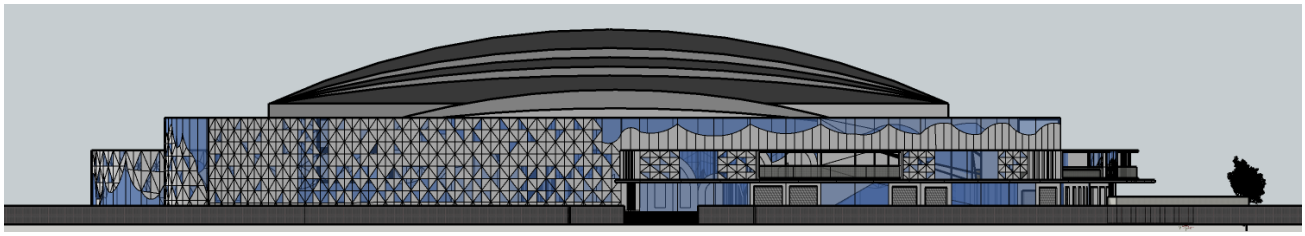


Figure 6.16 North Elevation (front)

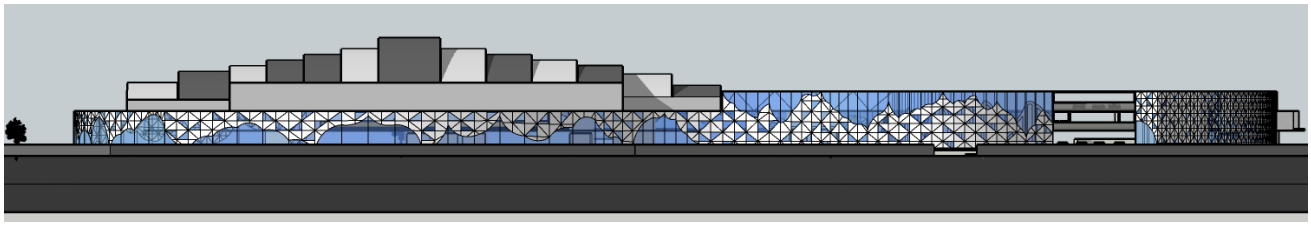


Figure 6.17 East Elevation

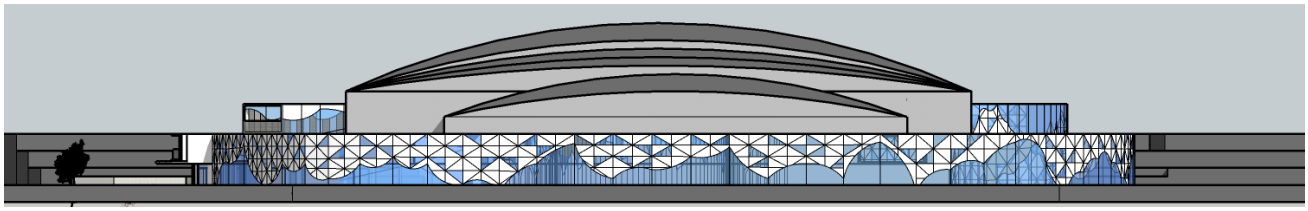


Figure 6.18 South Elevation (back)

6.3.5 Designed Spaces

6.3.5.1 Public Entrance

The main entrance to the site is divided into two as pedestrian and vehicular entrance ways. The pedestrian entrance is located at north of the site along the main road near the commercial block for easy access to shops and restaurants even if people are not attending the concerts. It is just in front of the residential community as well. Likewise, the vehicular entrance is located along the west road that connects to the ring road of Bhaktapur. This helps in diverting the traffic of main road while entering the site. This west entry can act as service road as well.

Figure 6.19 Pedestrian entrance at North

Figure 6.20 Vehicular entrance at West

6.3.5.2 VIP Entrance

The VIP entrance is along the West vehicular entrance which links with the surface parking and also leads to the basement parking for easy access. VIPS are dropped at a grand porch which leads to the galley foyer leading to VIP room directly of the arena block; the vehicles that they use follow to the surface parking.

6.3.5.3 Artist Entrance

The artist entrance follows from the north main road to the east side of the site. The artist entrance is placed near the green room and backstage area of the arena block for private access to evade the traffic created by the crowd for one glimpse of the artist. The artist are dropped at the porch leading straight to the green room entrance.

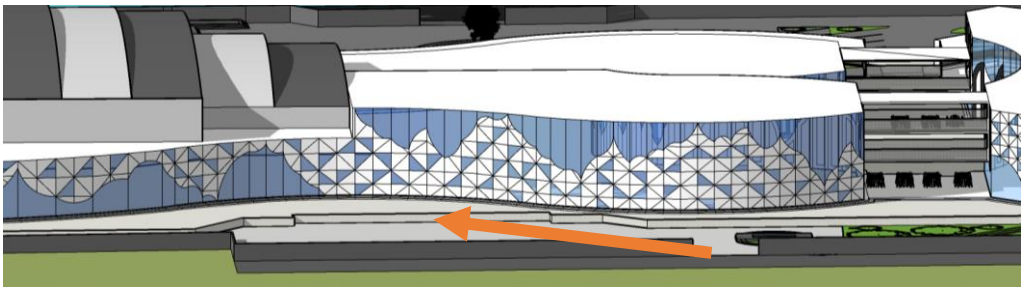


Figure 6.21 Artist Entry

6.3.5.4 Parking

Both the surface and basement parking entry is located at west side of the site. The surface parking is near the vehicular entrance while the basement parking is located right below the arena block. The entrance and exit of basement parking are placed at two sides of grand porch of the arena block.

(Refer Annex 10.d.)

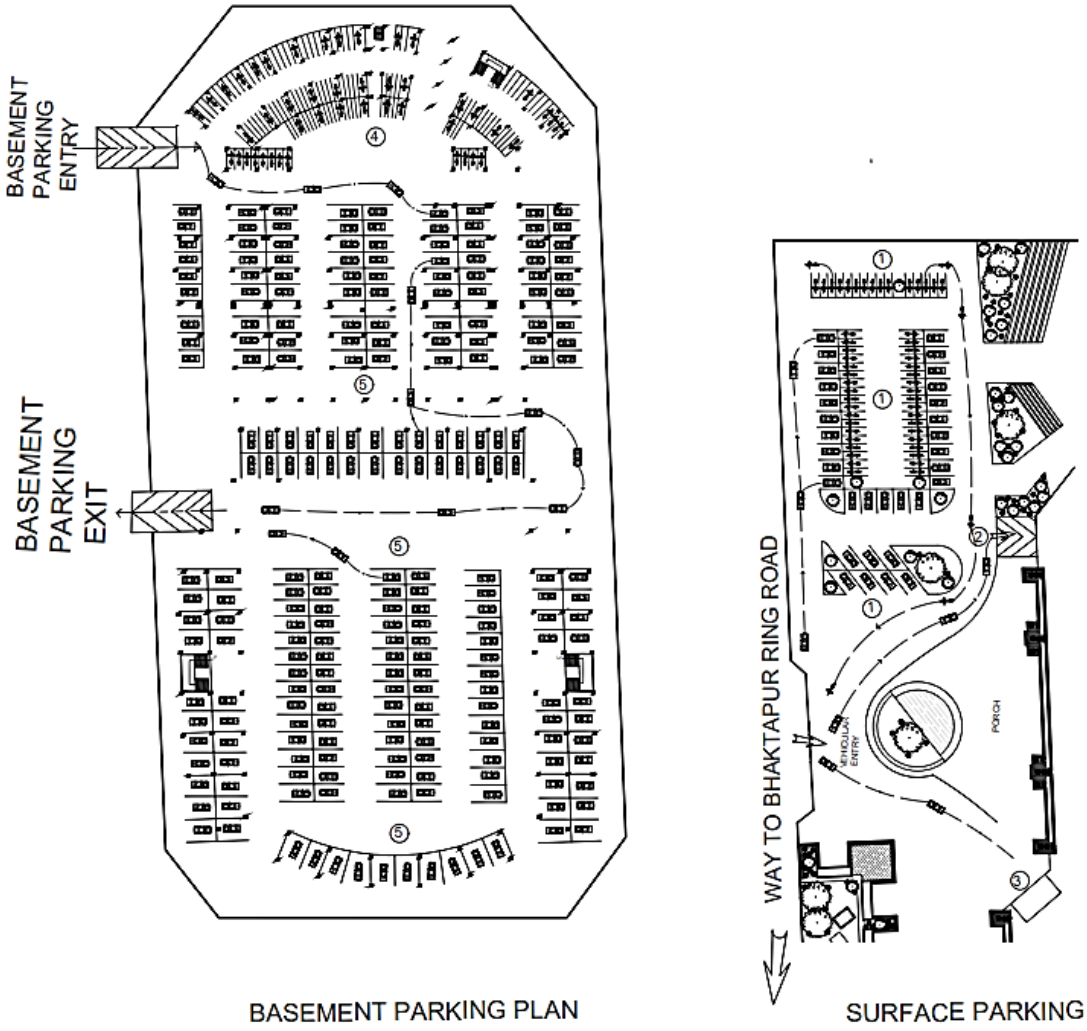


Figure 6.22 Parking Plan

6.3.5.5 Commercial Block

The commercial block is located at the north side of the site with its entrance along the axis of the pedestrian entrance. The block consists of different shops, cafes, merch stores and marts. There is a restaurant at the second floor connecting with the top floor of arena block. The first floor also consists of management office that extends up to the first floor of the arena block.

Figure 6.23 Commercial Block

6.3.5.6 Arena Block

Figure 6.24 Entrance of Arena Block

The arena block comes after the commercial block extending from middle to south side of the site. Both blocks are linked by bridge and form a courtyard space between them which can be used for as outdoor merch display arena during concerts. The arena block consists of arena at its south part housing 4,000 audience. The front elongated part of this block is foyer space required for the circulation of large audience but can also be used as gallery space to showcase artist's information and it extends two floors. Like wise the east side of the arena block is used by artist and staff as backstage and green rooms at ground floor while at first floor the management office resides. The second floor is for the restaurant.

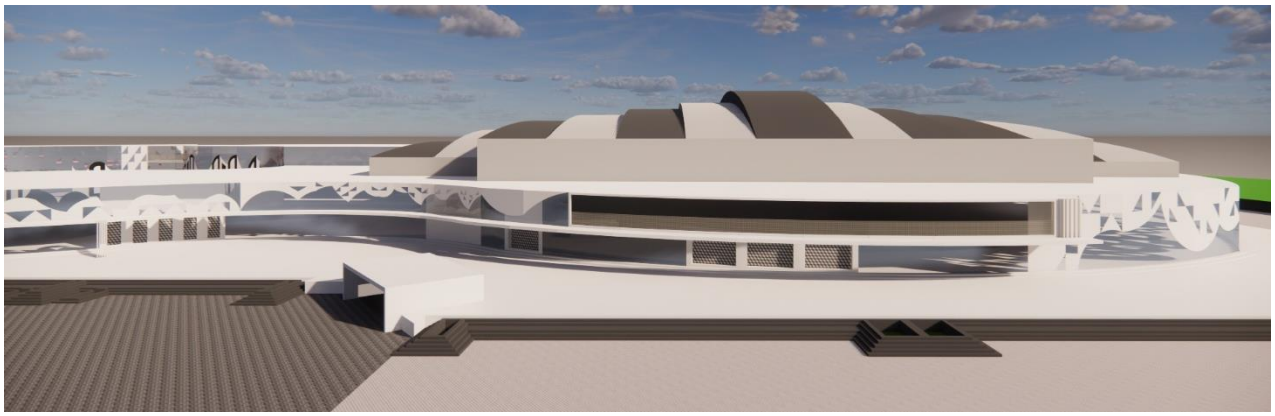


Figure 6.25 Arena Block

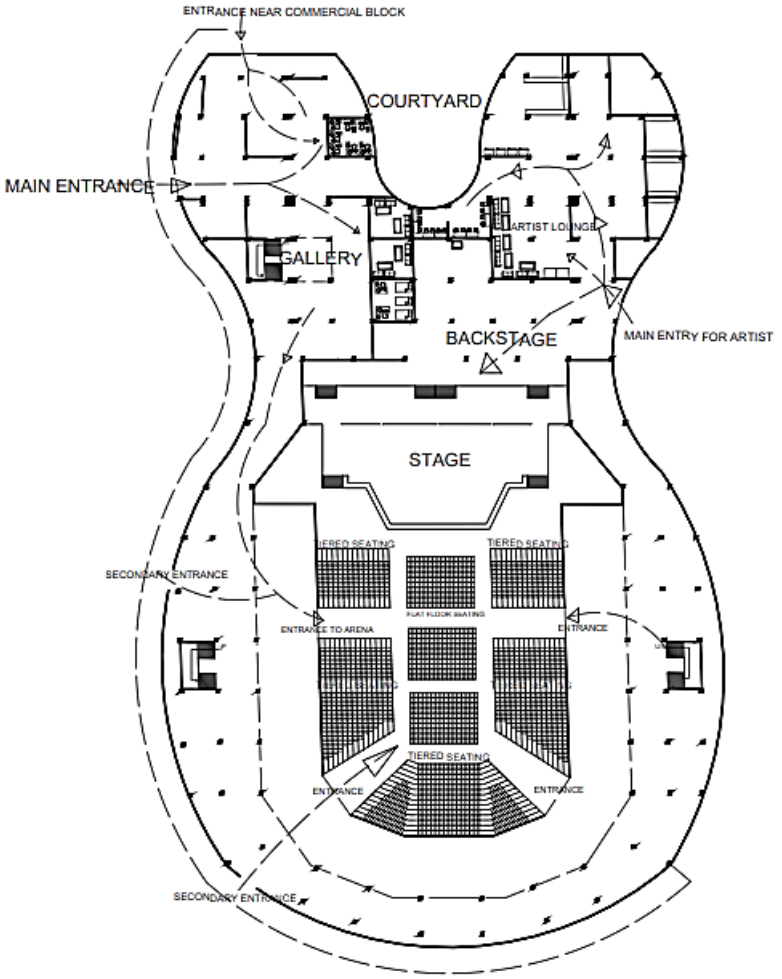


Figure 6.26 Blowup plan of Arena block with path illustration

The arena has thrust stage that can be extended according to the requirement of the performance along three-sided audience house. The viewing angle of audience in an arena is 90-90 so this type of stage-house is made possible. The audience house is at three levels: flat floor, lower tired seating and higher tired seating. The stage is at height of 1.2m above the ground. The highest roof level is at 18m. There are four entrances at ground floor and other four at the first floor leading inside the arena.

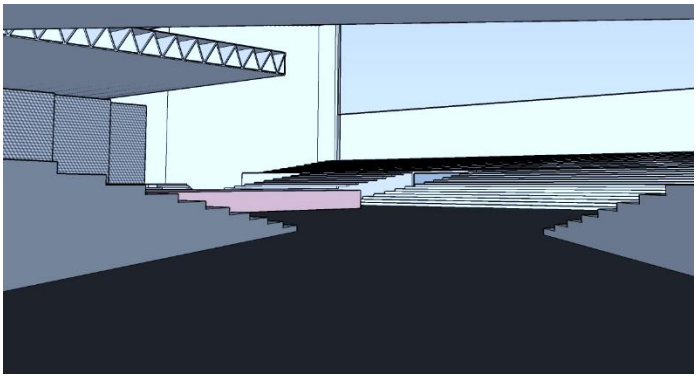


Figure 6.27 Entrance to the arena

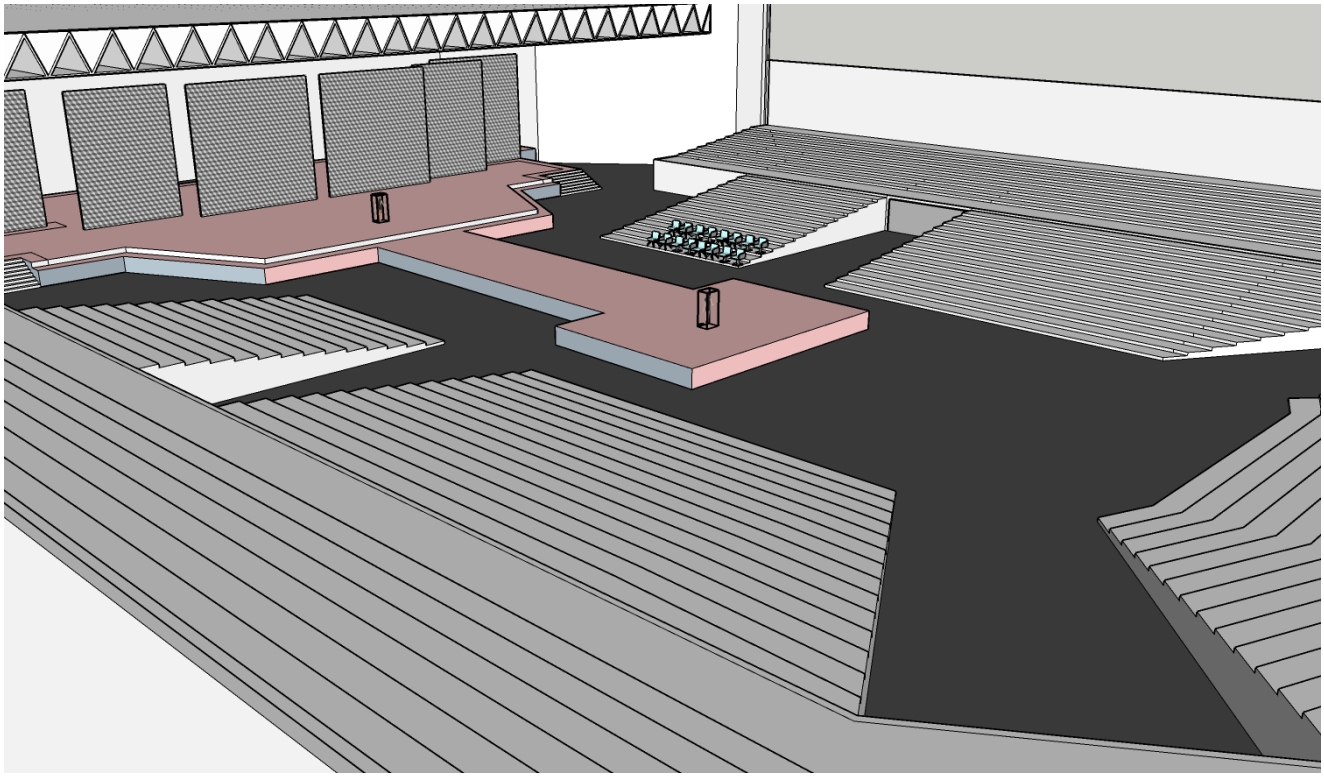


Figure 6.28 Isometric view of arena

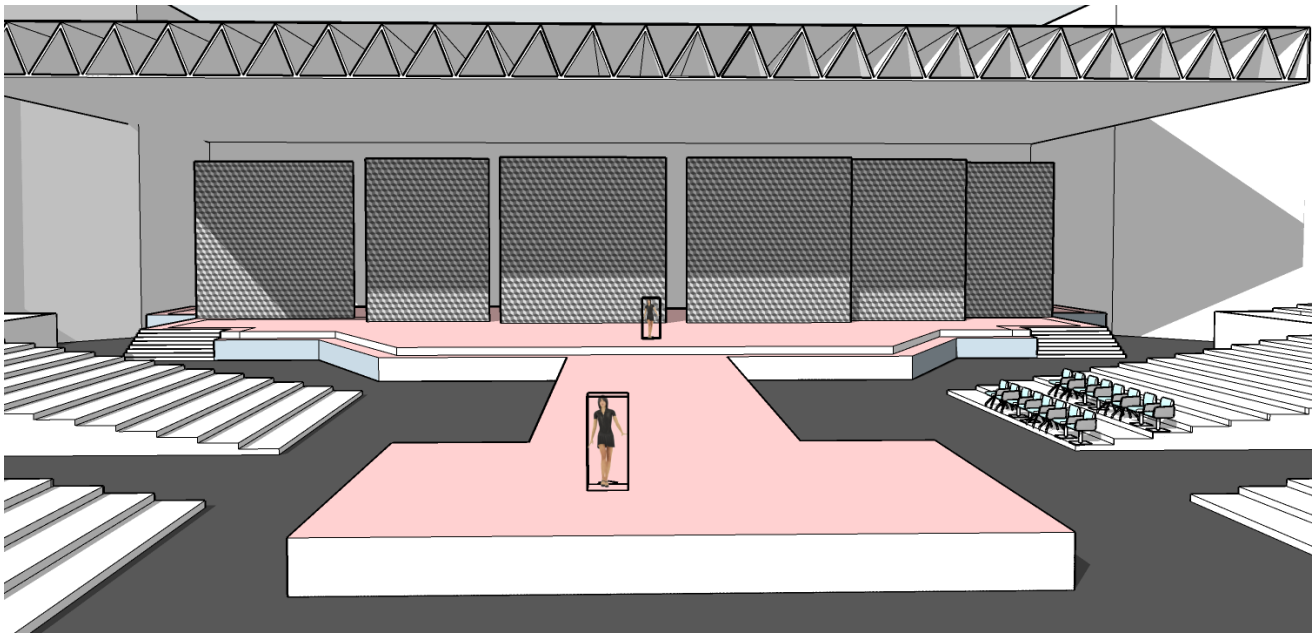


Figure 6.29 Stage

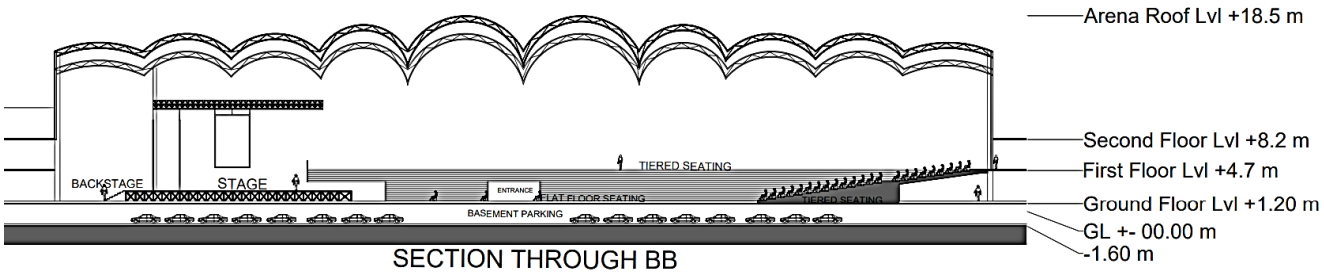


Figure 6.30 Section of the arena

(Refer annex 11.d.)

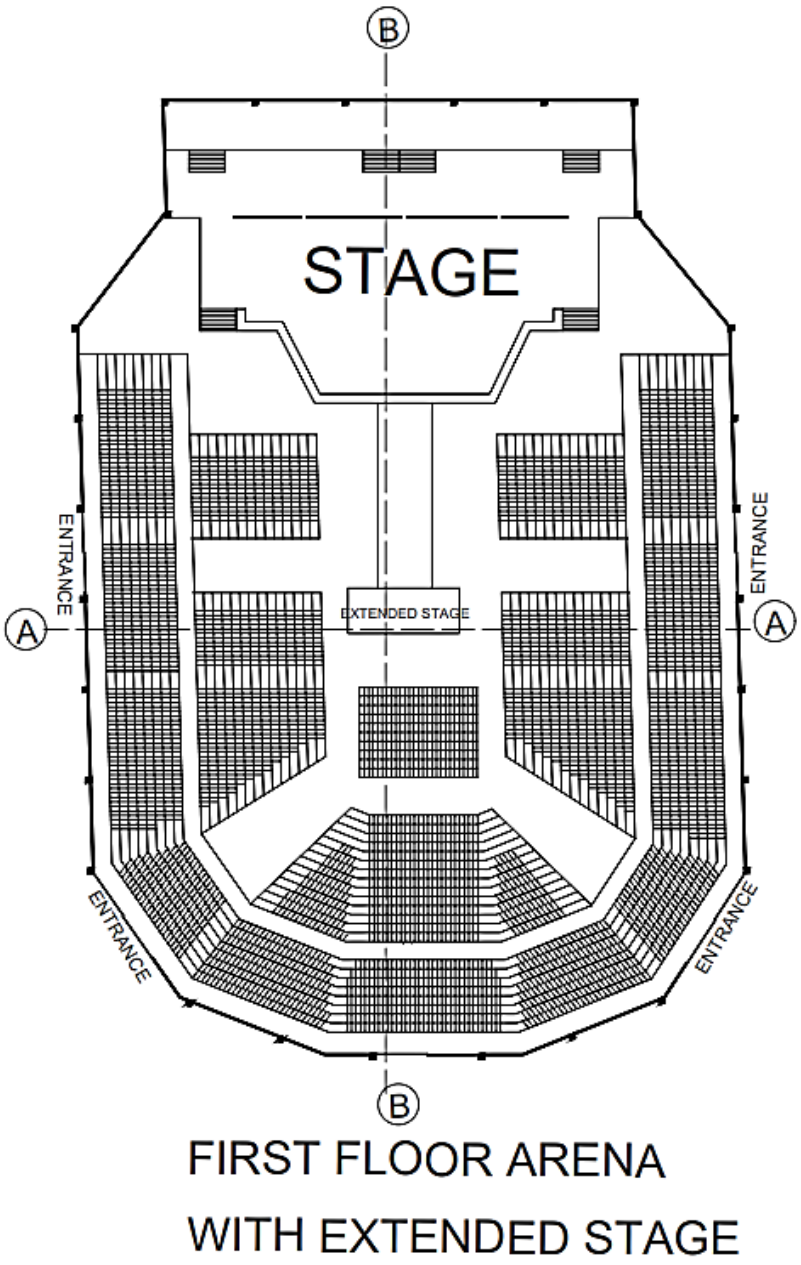


Figure 6.31 Blowup plan of arena with extended stage

(Refer annex 11.c.)

6.3.5.7 Landscape and Sitting spaces

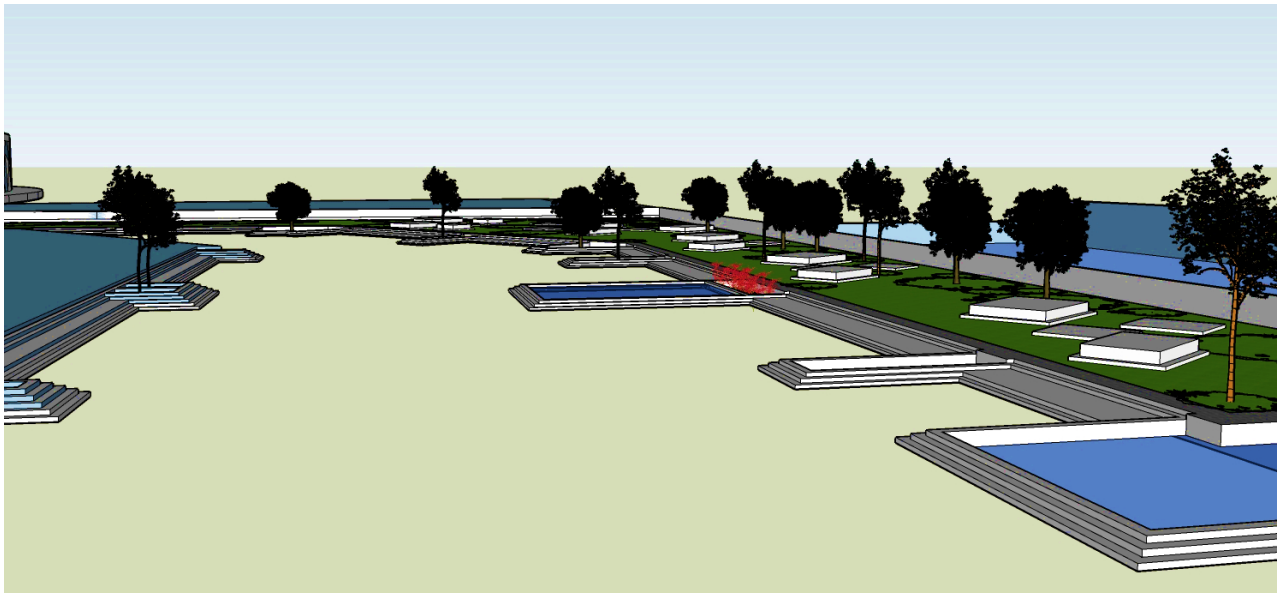


Figure 6.32 View of landscape from vehicular entrance

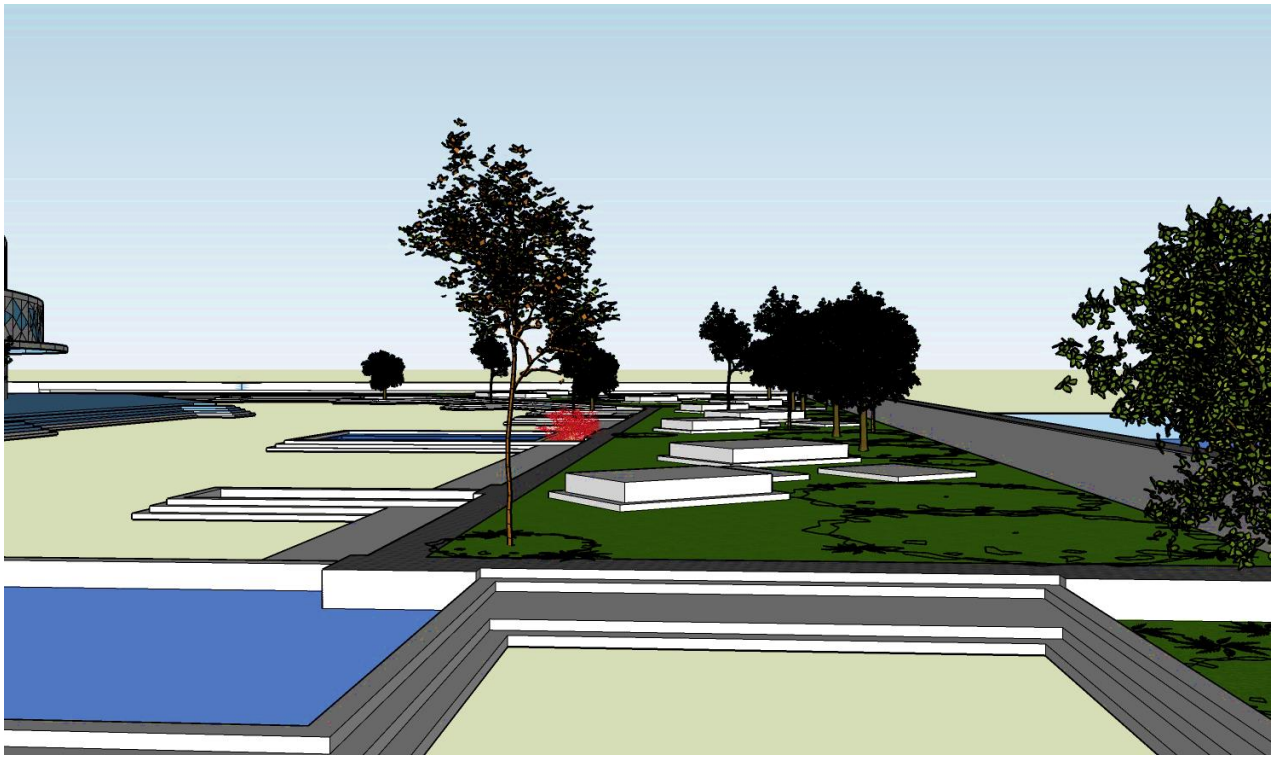


Figure 6.33 Siting and landscape Infront of Arena block

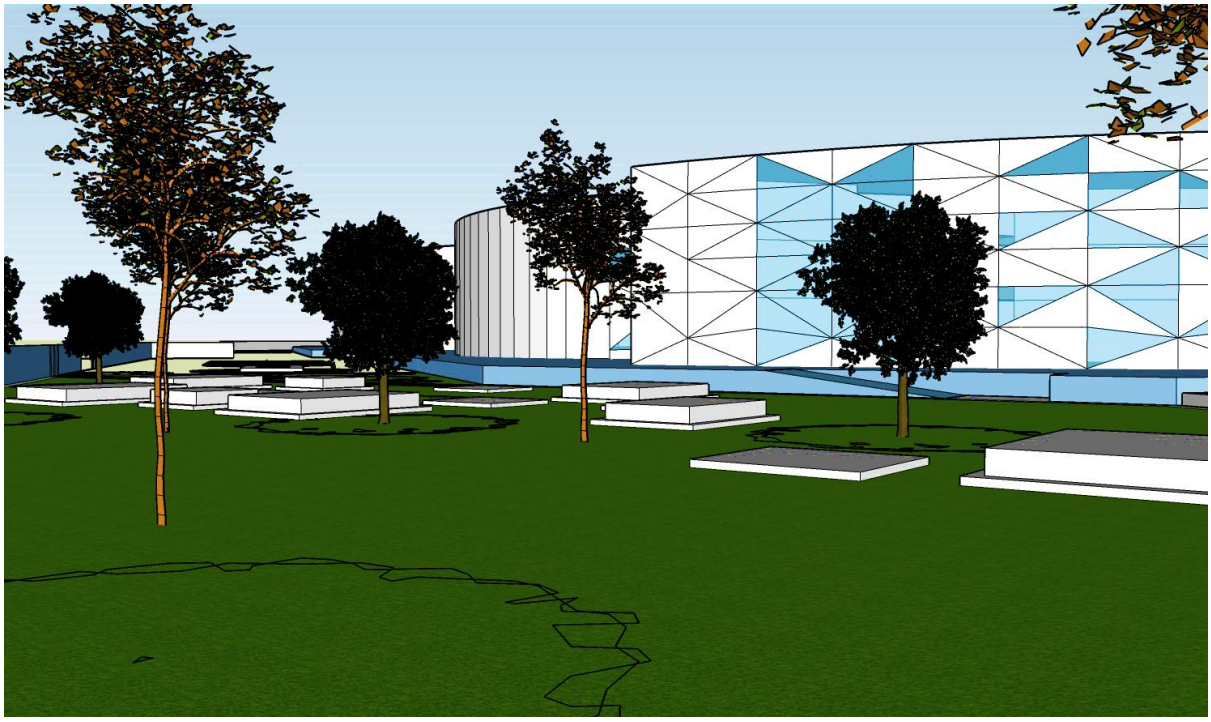


Figure 6.34 sitting and landscape near commercial block

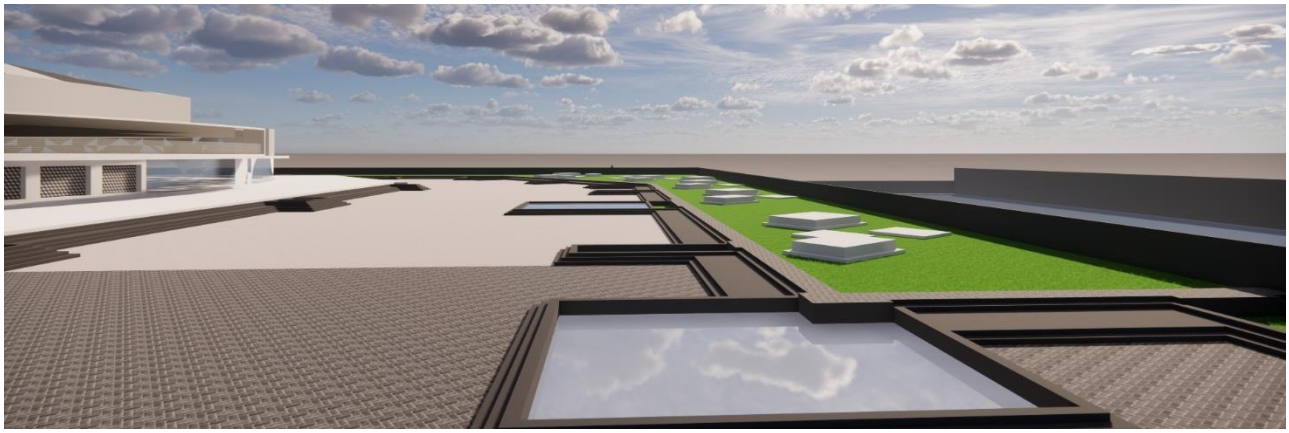


Figure 6.35 Rendered view from entrance

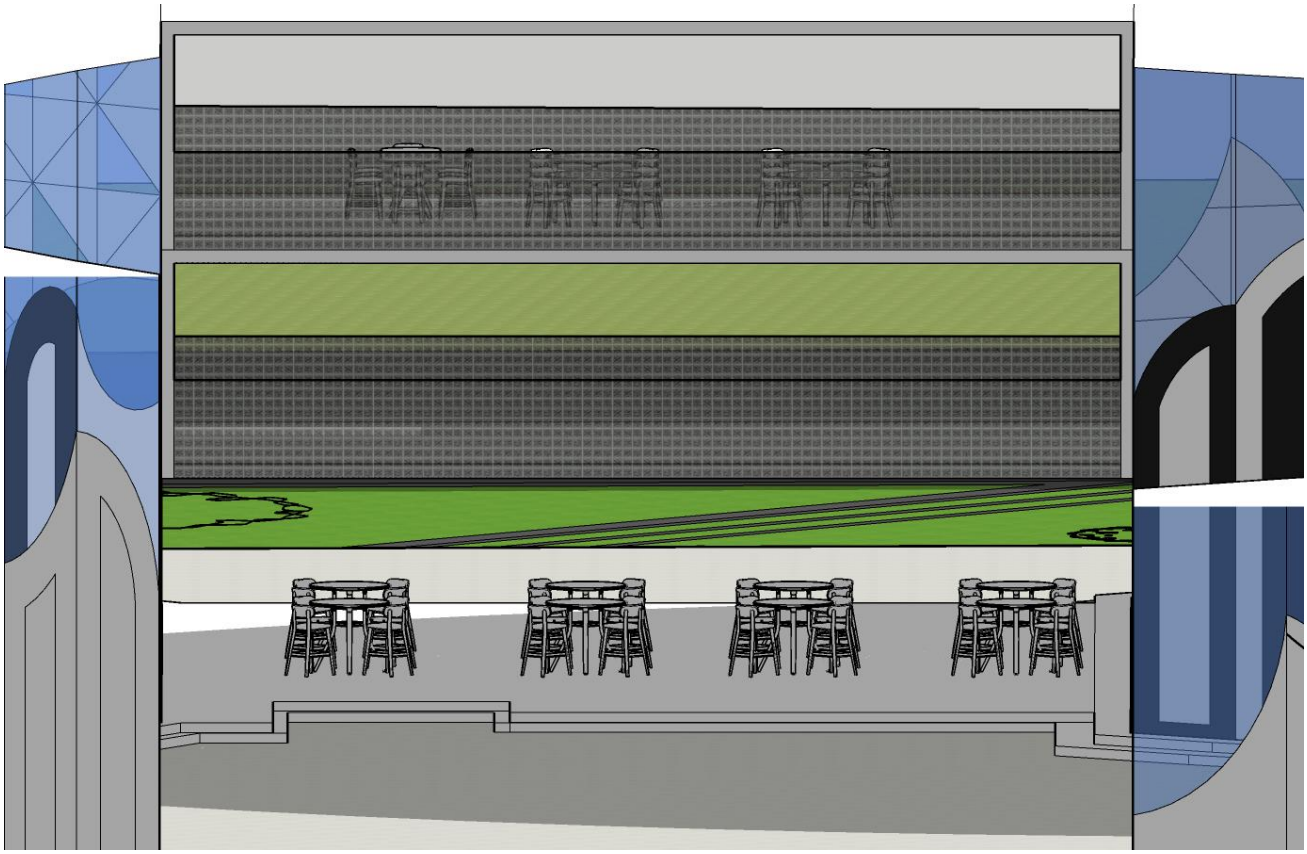


Figure 6.36 View of dining area from the courtyard

Figure 6.37 Rendered west elevation

7 STRUCTURAL DETAILS

- COLUMN = 600 x 600 mm
- MAIN BEAM = 400 x 600 mm
- SECONDARY BEAM = 300 x 400 mm
- PERIPHERAL BEAM =400 x 1000 mm

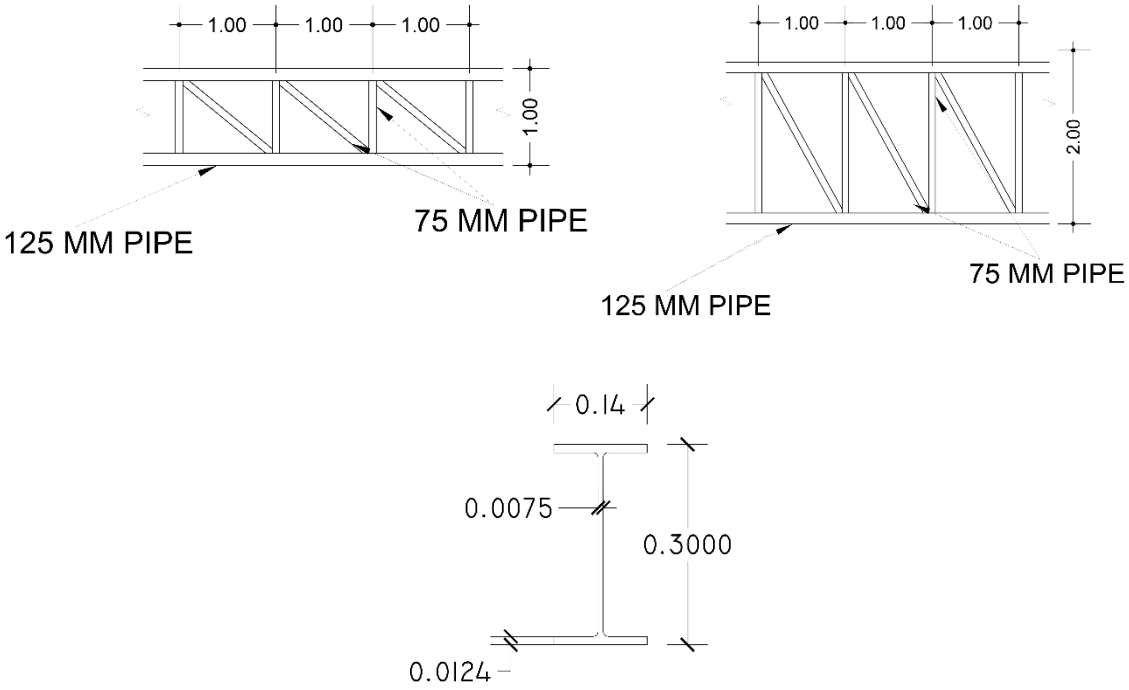
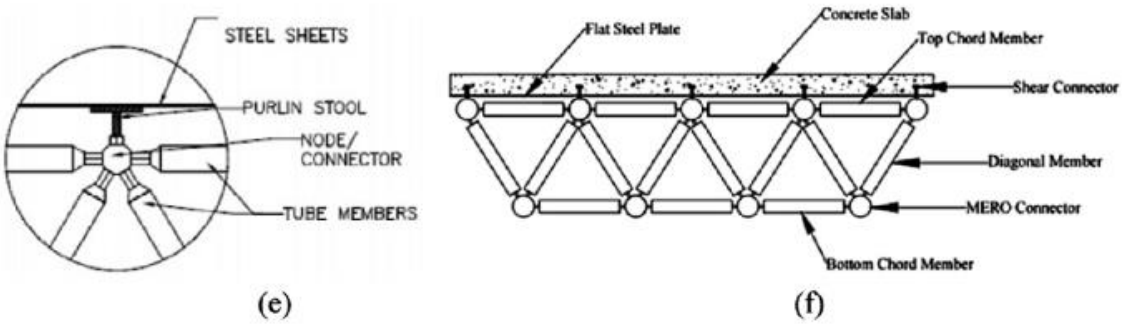


Figure 7.1 ISMB 300 Detail



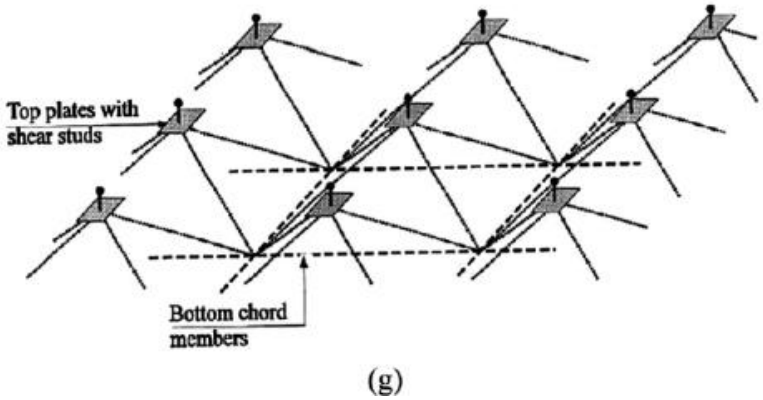


Figure 7.2 Steel connection in Space frame

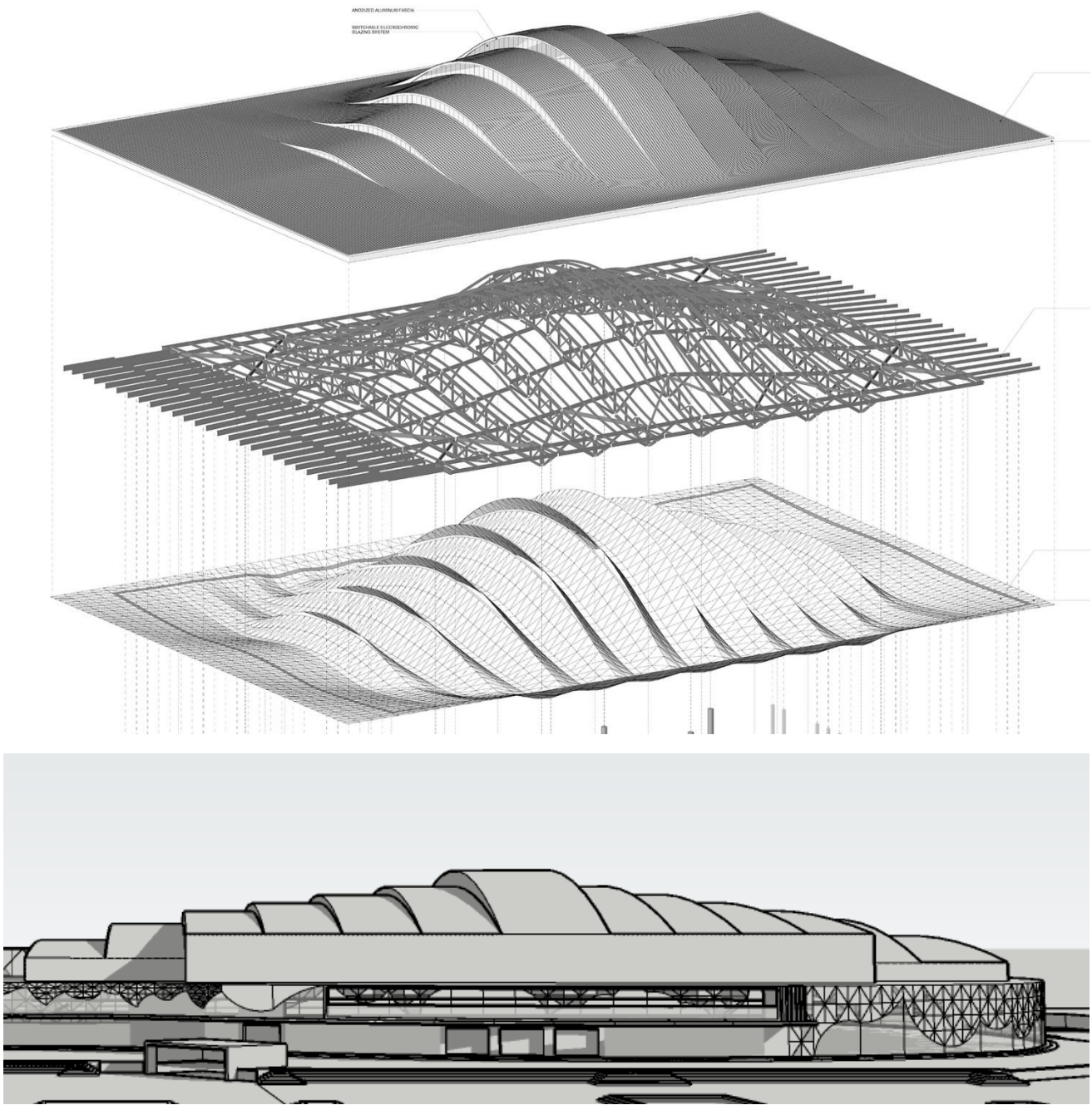


Figure 7.3 Concept of roof

(Refer Annex 13.a.)

8 ACOUSTICS

What all these performances have in common is that audience want clear audio coming from the stage. Various comfort and design aspects in arena like quality of the seats, décor and lighting all are important but also acoustic calculations and design is as important as the aesthetic and luxury inside the arena. In the design of this project the site was so selected in the outskirts of the main city of Kathmandu, to have a lower environmental noise from the surrounding. Also, internal acoustic design was attempted through selection of proper materials

based on research of standards relevant to the topic and also the research on national case studies. The main aspect to be calculated mathematically in the acoustic design of an Auditorium is thereverberation time.

8.1 Calculation for Arena (Capacity 4000)

RT value of 1.30 Seconds was achieved in the calculation by proper selection of materials. This range of RT value is suitable average range for speeches, drama, music and dance performances.

Table 8.1 Acoustic Calculation of Arena

S. No.	Description	Area (m^2)	Coefficient	Area x Coefficient (m^2 SABINE)	Material	Remarks
1.	Acoustic panels on walls	2796	0.90	2516.40	Rock wool 50mm, 33 kg/m3 directto masonry, behind thin Gypsum board cover	Standard
2.	Stage a. Floor b. Curtains	1133 400	a. 0.67 b. 0.05	7593.11 20	a. Teflon with air gap 500mm and steel material b.Velvet curtains	Standard
3.	Roof covering	4152.6	0.9	3737.34	Teflon (ETFE) with air gap 1000mm	Standard
4.	House seating	536.14	0.5	268.07	Acoustic plaster	Standard
5.	Doors	336	0.08	26.88	Acoustic ceiling board	Standard
6.	Seating	4000	0.62	2480	Seating, slightly upholstered, Occupied, Velvet, Plastic and Steel Material	Standard
7.	TOTAL VOLUME	13353.74	TOTAL	16641.8		

9 SERVICES AND ENERGY

Building Services is one of the important portions of the design, it comprises of services that are used in day-to-day life as well as services used for emergency purposes. Listed below is the calculations required.

9.1 Water Services

Table 9.1 Calculation of Water Supply

S.NO.	DESCRIPTION	QUANTITY/DAY	USERS	TOTALLCPD
1.	Management Office	15	30	450
2.	Main Auditorium	45	4000	180000
3.	Green Rooms	15	80	1200
4.	Commercial shops	15	100	1500
5.	Restaurant	50	200	10000
	TOTAL			193150

1,93,150 liters per day + 5,000 liters backup for fire fighting

2-day reservoir = 3,86,300 liters water reservoir underground

40% of 1,93,150 = 77,260 liters overhead tank

Hence, 15 numbers of 5000 liter capacity tanks are placed in different places below the roof's cladding.

10 CONCLUSION

This thesis project was mainly focused to understand the various aspects of Concert Arena, its history, its scope and need in present context. The objectives were to research and design harmonized arena spaces in indoors, commercial spaces and landscape. The relationship among the various disciplines in the arena is clearly understood through this research.

The attempt of this design is to create a common sharing platform of idea and knowledge about the architecture of Concert Arena. Through research of arena, I was able to research and understand it as music venue to showcase an art form of music. The arena provides well designed spaces to conduct concert and other music and entertainment activities that require large stage and big performances. This project gives sense of translation of the abstract meaning to a built form, which makes a visitor nostalgic and joyous to be in that scale and surrounding. It is common for the visitors in Kathmandu valley to indulge in cultural and religious exchange, whichpoints the need of this arena. The main space arena is accompanied by commercial needs of the community through merch stores, marts and restaurant for daily needs of living.

Also, cultural awareness and appreciation are important in any society. Learning to appreciate and engage in music, dance and drama from different cultures, communities and traditions is an important component in helping build a unity in society. So, a space like concert arena lets people to gather and celebrate music cultures around the world in a common platform.

Including all the learnings of architecture the objective of the design was also to justify the need the arena itself. The lack of sufficient architectural spaces for the functionality of the concert all over Nepal, this project is an attempt to create a platform with all necessary spaces for the proper and adequate functioning of concert in Nepal.

Thus, it is concluded that the research objective is fulfilled with the knowledge in the related topics and also the need of proper music venue arena is seen.

11 REFERENCES

2020, T. (2020). NEPAL ACADEMY HALL, KATHMANDU.

2020, T. (2020). RASTRIYA NACH GHAR, KATHMADU.

2020, T. (2020). RASTRIYA SABHA GHAR, KATHMANDU.

Ankit Sharma, V. V. (2019). Design of Long Span Structures. *SEA Archives*.

Architecture, 3. C. (2022). ROYAL ARENA, DENMARK.

Architecture, H. (2018). KSPO DOME ARENA, SOUTH KOREA.

Architecture, I. M. (2022). IMPACT ARENA, THAILAND.

Architecture, J. S. (2021). MALL OF ASIA ARENA, PHILLIPINES.

Architecture, Z. D. (2019). National Dance Theatre, Hungary.

Architekten, G. (2016). Baku Crystal Hall, Azerbaijan.

Chhetri, S. (2020). Wide, open spaces: the state of public land in Kathmandu. *The Kathmandu Post*.

ECONMICS, O. (2021). *The Concerts and Live Entertainment Industry: A Significant Economic Engine.*

Farrell, S. (2019). Why is PTFE such a good roofing material? *Global Sports Matter*.

First, A. (2020). *Sound Diffusers.* Retrieved from Acoustic First Corporation.

Hildy, F. J. (2021). History of theatre. Britanicca Encyclopedia.

Hildy, F. J. (2021). Musical Instrument. Britanicca Encyclopedia.

Hildy, F. J. (2021). Stadium and Arena. Britanicca Encyclopedia.

Hildy, F. J. (2021). Stage architecture. Britanicca Encyclopedia.

Hildy, F. J. (2021). Theatre design. Britanicca Encyclopedia.

Hildy, F. J. (2021). Types, form and space of stages. Britanicca Encyclopedia.

INTEGRATION, I. (2021). *Stage Lighting.*

Joseph De Chiara, J. C. (2001). In *Time Saver Standard 4th Edition.* McGRAW-HILL Publishing Company.

Monarch, A. (2022). Theatre Design. *Theatre*.

Poudel, D. (2021). Celebration, censorship, and indifference: Nepali theater in the shadow of the state. *The Record*.

shah, s. (2015). *space frame design.* Retrieved from slide share.

Simplicable. (2020). *5 Types of Architectural Acoustics*. Retrieved from https://simplicable.com/new/architectural-acoustics

Singh, P. (2011). *Bryan Adams Live in Dashrath Stadium, Nepal.*

Theatres, T. (2019). Tampa Bay Week.

Wilson, A. (2020). Design for Leisure Entertainment. Butterworth and Co. Ltd.

ANNEX