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LECTURE THEATRE COMPLEX: EXAMINING/REDEFINING CIRCULATION/MOVEMENT FLOW PATTERNS FOR BETTER CROWD CONTROL

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KEYWORDS

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ABSTRACT

The study focuses on addressing the challenges of managing crowd circulation patterns within lecture theatre complexes on university campuses. With a backdrop of increasing student populations and the need for efficient crowd control, the research aims to redefine movement flow patterns to enhance crowd management, adapt to growth, and provide design guidelines for architects. The study employs principles of crowd control to address the collision of inflowing and outflowing crowds, intending to design effective circulation systems in lecture theatre buildings.

The research begins by exploring the concept of circulation as a defining dynamic in architecture, emphasizing the importance of controlling movement flows to optimize space usage. The significance of the study lies in its potential to provide architects with practical design insights for public buildings, particularly theatre complexes, which experience high crowd densities during transitions between events.

The study draws on historical and contemporary examples of lecture theatre designs, analysing the evolution of crowd behaviour and crowd control strategies. It highlights the challenges posed by crowd behaviour and the need for effective circulation and management strategies. The concept of "The Mainstream Flow" is introduced as a one-way movement flow approach inspired by a river system, using crash bars to regulate entry and exit points to lecture theatres.

The case studies of AULA at TU Delft and LT Building at Rivers State University provide concrete examples of the challenges faced in managing crowd circulation within lecture theatre complexes. The proposed "Mainstream Flow" concept is analysed and discussed, using a prototype 400-seat lecture theatre as a basis for simulation. The concept aims to minimize collisions between incoming and outgoing crowds by enforcing one-way movement paths.

The study concludes by recommending the adoption of the "Mainstream Flow" concept to optimize crowd control in lecture theatre designs. It acknowledges the potential limitations of any design approach and emphasizes the need for continuous research to refine circulation management strategies.

1.0 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The concept of circulation as the defining dynamics of a building is the context within which the Lecture Theatre Complex is discussed by examining/redefining circulation/movement flow patterns for better crowd control; designing learning facilities with the adaptability to accommodate subsequent phases of growth and development, as a solution to the increase in population that universities experiences with the pace of change.

A lecture theatre complex is an inter-faculty building that provides a variety of teaching and study spaces, usually on university campuses (ArchDaily, 2022). Population increase is a product of the growth of universities, so learning institutions must adapt to the pace of change to accommodate the accompanying increase in student numbers; these learning facilities must be adaptable in design.

Being aware of the difficulties that abound with buildings of this same typology, an understanding of crowd behaviour and crowd control in common and circulation spaces was necessary, all in an attempt to establish control over the configuration and quality of circulation spaces (movement patterns) whether indoor or outdoor thereby, allowing space for interaction between the number of users, both currently and with subsequent increase in time. The goal is to answer the question "How can circulation/movement patterns be controlled in a building with the potential to render control moot/useless/ineffective?"; to adapt to the pace of change and accommodate the accompanying growth in student population, as a way of determining optimal design practices to give architects a guideline for the future design of public buildings.

1.2 STATEMENT OF THE PROBLEM

The collision between an inflowing and an outflowing crowd together with the accompanying noise levels that ensue is a phenomenon that occurs in buildings that accommodate a large number of users on different time schedules, especially during the end of one event and the start of another. Finding a way to regulate the magnitude of the crowd while entering and exiting lecture theatres will therefore require an answer to the question "How can circulation/movement patterns be controlled in a building with the potential to render control moot/useless/ineffective?"; to adapt to the pace of change and accommodate the accompanying growth in student population, as a way of determining optimal design practices to give architects a guideline for the future design of public buildings.

Circulation is believed to be the concept that defines the dynamics of a building (Portico, 2016). Therefore these acclaimed "spaces between spaces" that have a connecting function; a route or pathway that people use to move in and around a building or urban location (Ching, 2007) should be structured to enhance the three-dimensional experience of body movement in and around buildings over time (Portico, 2016).

Doing so will also require that the following questions be answered:

1. How to control the crowd inflow?
2. How to regulate the crowd at the venue?
3. How to control crowd outflow?

1.3 SIGNIFICANCE OF THE STUDY

Public buildings in one way or another have design issues; in terms of circulation and the like, which will most certainly change with each new project. Therefore, the study will look into circulation as the defining dynamics of a building (Lecture Theatres) by examining/redefining circulation/movement flow patterns for better crowd control, with the adaptability to accommodate subsequent phases of growth and development. Hence, determining optimal design practices to give architects a guideline for the future design of public buildings, regarding circulation/movement pattern control.

2.0 LITERATURE REVIEW

A lecture theatre complex is an inter-faculty building that provides a variety of teaching and study spaces, usually on university campuses (ArchDaily, 2022). The lecture theatre is not a new development. Other than being part of a complex, lecture theatres have a long history which according to historical findings have been around for centuries. Going through a series of changes, evolving, and finally arriving at what we know now to be a "lecture theatre" (Wiley, 2014 and Leeds Institute for Teaching Excellence, 2018).

2.1 HISTORICAL BACKGROUND

2.1.1 EVOLUTION OF LECTURE THEATRE

It was originally a 'theatre', derived from the Greek word meaning 'viewing area' (theatron) where patrons sat to look at their spectacles. First built in Athens around 500 BC, this building is one of the earliest homages paid to Dionysus, the Greek god of wine, and it was used for religious services. A few generations later, the Romans found a similar use for them and called them "auditoria", and rather than "observing" like the Greeks, the Romans were listening to the audio aspect of the events. All was good and these spaces served their intended purposes very well (Beichner 2014).

About a thousand years later, Pope Gregory VII decided that it was necessary to educate the clergy in the doctrine of the Church. This was recognised as the first time in history that a large number of people had to undergo training at the same time. Economies of scale as at then required a new approach, and the Pope had found a great solution. The clerics often lived in monasteries with chapels, which were filled with monks sitting and copying the words read by the "lecturer" (from the Latin word for "reader") while reading the manuscript. These later became to be known as Lecture Halls (Beichner 2014).

A typical auditorium with tiered seating dates back to the Italian Renaissance anatomy auditorium. The first permanent auditorium had six concentric tiers of spectators' viewing decks, and it was built in Papua in 1594, followed by Leiden in 1597 and the Barber-Surgeon's Hall in London in 1636. In this regard, various forms were developed for improved sight lines in the seating arrangement. (Leeds Institute for Teaching Excellence, 2018).

Over the decades, the classroom has seen many innovative design developments, coming together to improve the learning experience it enables. The Horseshoe is an alternative style of seating developed at Harvard Business School in the 1920s, usually having a U-shaped arrangement of seats not as steep as a traditional auditorium. This enabled an interactive and immersive discussion between the instructors and the students, as the instructors would move around into the "U" for the presentation.

Mega-theatres are becoming more popular as they seek to reinvigorate faculty-student connections, One such theatre is located at Oregon State University, and it houses 630 students. Design-wise, the auditorium features a perfect circular space with the lecturer on a raised platform in the middle, and display screens all around the interior. Instead of rows of benches and tables, the students sit in individual chairs with written boards on low tiers. Even larger is Harvard Business School's Klarman Hall, which houses an entire MBA class of 1,000 students. This is a multi-level auditorium, again with individual seats and no desks.

2.2 WHAT IS CIRCULATION?

Francis DK Ching (2007) in Architecture: Form, Space & Order opined that "Circulation is the movement through space". Portico (2016) argues that the concept of circulation in architecture is not that different from the concept of circulation in biology, referring to this as the mechanism by which the blood of a building (a person) flows through space. The term "circulation" refers to the movement of people around and between buildings, through other parts of the building and built environment, (Designing Buildings, 2021).

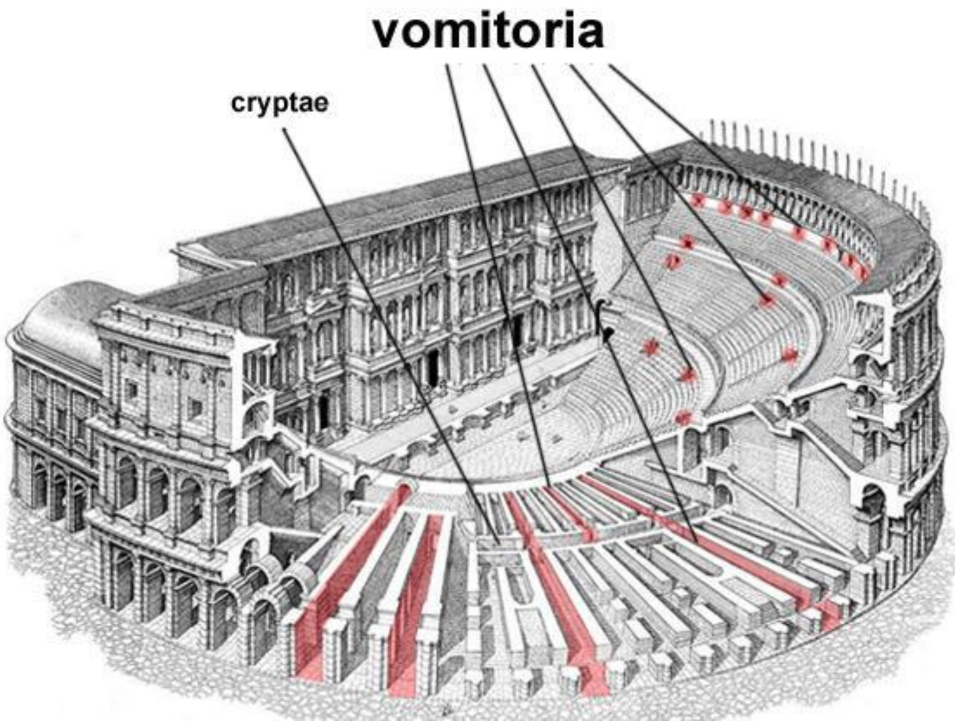
Circulation is often thought of as the "spaces between spaces" that have a connecting function; a route or pathway that people use to move in and around a building or urban location. Ching (2007. It is also believed to be the concept that defines the dynamics of a building, which is the three-dimensional experience of body movement in and around buildings over time (Portico, 2016)

2.2.1 CIRCULATION IN ANCIENT THEATRES

In ancient theatres, the "vomitoria" (a term for the vaulted passageways of theatres and amphitheatres) was used as entry and exit from the internal lobbies leading to or from the theatre seating. The vomitoria were connected to the sideward part of the cryptae beneath the cavea, forming an efficient network of exits and entrances for the spectators (The Ancient Theatre Archive Project, 2020).

Figure 2.1: The vomitria in a theatre

SOURCE: https://www.whitman.edu/theatre/theatretour/glossary/glossary



Figures 2.2: Section of a theatre showing the vomitria

SOURCE: https://www.whitman.edu/theatre/theatretour/glossary/glossary.htm

Circulation paths are sometimes interrupted by choreographed furniture for architectural reasons. This is to add architectural interest and level changes to define changes in place, slow people down, or provide focus (Portico, 2016). Lampaki (2021) believed that sculpted monuments directed the path of the audience towards and within ancient Greek theatres and strived to prove this theory. But in the end, it was discovered that some of the statues erected in the theatre were done without a care for the fundamental purpose of theatrical spaces, which were intelligible sound, and an uninterrupted view of what was happening on stage. These statues were erected in the theatres as it was a choice location for the display of an honorific representation of one`s status and not as earlier hypothesized.

2.2.2 CIRCULATION DESIGN

There are two rules of thumb when designing for optimum circulation. This means that the circulation paths should:

1 be free from obstruction;

2 Lead straight to the desired space (Portico, 2016).

The reason for these two rules of thumb is the fact that people want to move easily and efficiently through buildings without getting lost. Although circulation and movement paths are often affected by crowds and the behaviour they exhibit

2.3 CROWD BEHAVIOUR

Crowd behaviour is an occurrence that may be exhibited by people gathered in a crowd, which individually would not normally occur. Crowds are common and seem to be seen at sporting events, music concerts, shopping sales, amusement parks (Study.com, 2021), and theatres as it would seem.

2.3.1 EXAMPLES OF CROWD BEHAVIOUR

According to the National Disaster Management Authority (NDMA) Government of India (2014), some examples of crowd behaviour may include the following:

1 A wild rush to force the way toward an entrance or exit

2 Attempts to enter a venue after the start or closing time

3 A Collision of large inflows and outflows and vice versa

4 Sudden mass evacuation

5 Fits of tantrums due to delays at the start of an event, or a sudden/last-minute change in the venue

While a crowd is defined as a collection of people who share a purpose, many theories have been developed to explain crowd behaviour, including contagion theory, convergence theory, and emerging normative theory. If a plan for controlling them is to be generated, it is important to understand how crowds move and operate, especially in buildings. Inappropriate or poorly managed crowd control techniques are more likely to cause crowd incidents rather than prevent them.

2.3.2 CROWD CONTROL

Crowd control and management in normal circumstances are said to include functions necessary to comfort crowds, to limit crowd gathering in undesirable positions, to improve circulation, and to control and evacuate said crowd for as short a period as possible.(Ikibe and Akande, 2018).

Ikibe and Akande's (2018) interpretation of crowd dynamics is a spectacular study of how crowds work and how their environment (space and interaction with other people) affects them. Explaining further the effects of crowd density per square metre on the ease of transitioning from one space to another, as well as its influence on individual behaviour and reaction in said space. They also argued that determining the appropriate crowd density for each space goes beyond strict adherence to design standards and requires the involvement of architects and engineers in crowd design decisions.

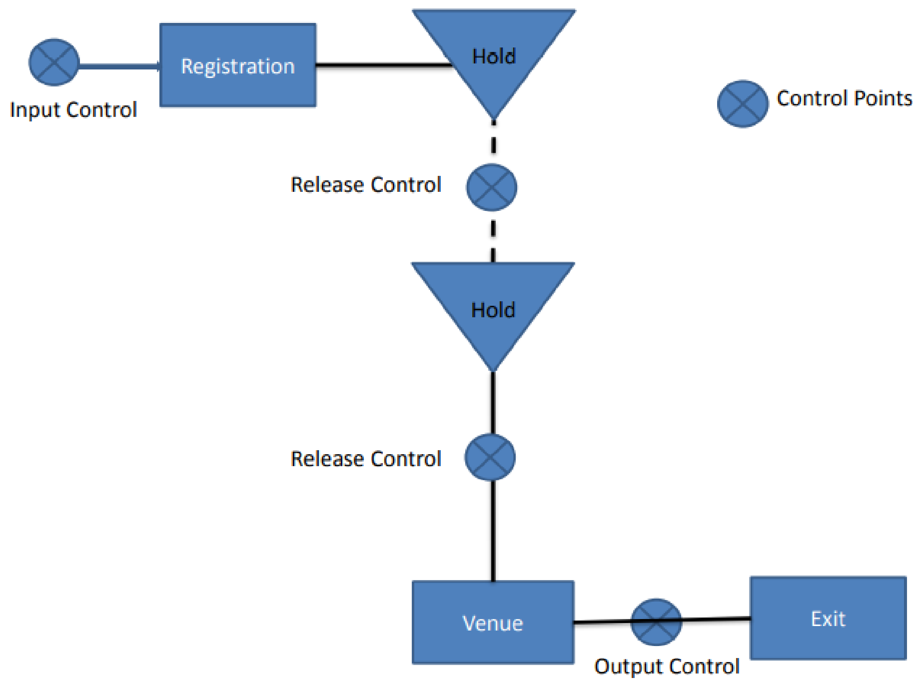
The NDMA (2014) explains that the guiding principle for crowd control is managing the gap between demand and supply through

1 Control of large inflow

2 Coordination of congestion at the venue

3 Mass spill control

and this is represented in Figure 2.3.



Figures 2.3: Crowd Control Diagram

SOURCE: https://southwestgarohills.gov.in/pdf/ndmg_crowd.pdf (2022)

Fundamental design measures for crowd control and management in high-capacity buildings must address factors that can shorten evacuation times in high-capacity buildings (Daoliang et al., 2006 and Helbing et al., 2002, Ikibe and Akande, 2018)

These factors which include the location and width of entrances and exits, and the location of surrounding objects, make it even more necessary to address passive crowd control issues. These issues are:

1 Building size and capacity

2 Characteristics of building materials (combustibility, etc.)

3 Entrance to the building

4 Building layout

5 Walking distance

6 Ways and number of doors

7 Walkway and door dimensions (Sagun et al., 2008)

Regulating the crowd at the venue will require understanding the gap between demand and supply. This will require that specific details be obtained. Such as:

1 Historical numbers, crowd arrival patterns, growing population, the cadre of users

2 Create mass arrival windows and identify peaks (seasons, days of the week, times of day, festivals, holidays, etc.).

3 Reservation/Registration.

ETH Zurich has an application request to reserve and organise lecture rooms before the start of the semester, organised by the department's timetable coordinator, (ETH Zurich Staffnet)

The Course Scheduling Office is the central point for the overall coordination of these room reservations, and reservations for individual dates are made by the Room Reservation Office. The following details are required to process a booking enquiry:

1 Course: Course number, type and title

2 Lecturer`s name

3 Day and time

4 frequencies

5 Location and room size (number of seats)

6 Exceptional technical or other space requirements

7 Contact information including name and phone number of clients

8 Possibility of carrying over to the next semester.

Likewise, to understand the Supply, calculations need to be made for

1 The capacity at the venue: number of seats; hourly worship, offerings, prayers, etc.

2 The capacity of the waiting room/queuing complex.

Demand simply exceeds supply, leading to overcrowding. This is why there is a need for control. A mandatory registration/application request makes this possible. Another possibility consists of influencing the arrivals. Queues cannot be avoided, and it is impossible to increase supply capacity. Therefore, in such a case, there is no choice but to wait, relax and be comfortable.

2.3.2.1 TRANSITION SPACES

According to the University of Queensland, Australia Technical Guidelines: TG21 Teaching Facilities (2012), transition spaces are required to help regulate the circulation within teaching/learning facilities. The Transition spaces are typically outside large lecture theatres or formal teaching rooms where students wait for class.

Figures 2.4: Transition Spaces

SOURCE: https://www.fm.pitt.edu/sites/default/files/pictures/Design_Manual/DIVISION-N.pdf

Although these spaces are typically a portion of the capacity of the theatres and formal teaching rooms, they should be fitted out with casual seats to accommodate quick group meetings, snacking, conversations, and the like. Toilets and washrooms should also be made available located adjacent to the transition spaces and away from doors and movement paths, as it often presents a problem with people`s movement. Additionally, sound-absorbing materials should be considered to muffle ambient noise.

3.0 RESEARCH METHODOLOGY

The architectural research method was used as it encompasses a relatively large diversity of thematic focuses and methodological decisions (Groat and Wang, 2013). Using this method enables a seamless collection of data which gives access to a wealth of knowledge contained in other research methods.

Descriptive case studies are used to understand the situation better by identifying and describing specific aspects of a phenomenon and analysing it in terms of theoretical categories. A Problem-solving approach to descriptive case studies is used to investigate a problem in a particular complex and recommend a solution to the problem based on analysis and theory.

3.1 SOURCES OF DATA

Relevant data were collected from both primary and secondary sources.

4.0 CASE STUDY

Using the modified version of Robert Yin's definition of a case study by Groat and Wang (2013), being an empirical inquiry that investigates a phenomenon or setting (the explicit inclusion of historic phenomena and both historic and contemporary settings)

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defines the focus of the case study. A Problem-solving approach to descriptive case studies is used to investigate a problem in a particular complex and recommend a solution to the problem based on analysis and theory.

4.1. AULA, TU DELFT, NETHERLANDS

Figure 4.1: A perspective view of AULA, TU Delft, Netherlands

Source: https://architectuul.com/architecture/aula-technical-university-delft (2022)

Delft University of Technology's AULA (TU Delft) on the north side of the campus, was built between 1959 and 1966 by the Dutch firm Van den Broek & Bakema. The building houses a 1,300-seat auditorium, four trapezoidal auditoriums with 250 to 350 seats, the Senate Hall, and the university cafeteria.

Figure 4.2: Entrance view of AULA, TU Delft, Netherlands

Source: https://www.delta.tudelft.nl/sites/default/files/styles/1200x/public/images/Aula%20voorkant.jpg?itok=5Gy7_H64

The auditorium is dish-shaped and towers above the main entrance hence, the building`s nickname "the UFO", and is supported by triangular concrete columns. The lecture halls at the rear are supported by a similar structure, with exterior walls made of steel frames. Prestressed concrete had to be used to support the 15-metre-long overhang, leaving the prestressed cables exposed. The building has a folded roof (based on the folded roof system) that envelopes the building and directs the natural light obliquely through all the open spaces of the AULA until it reaches the access level.

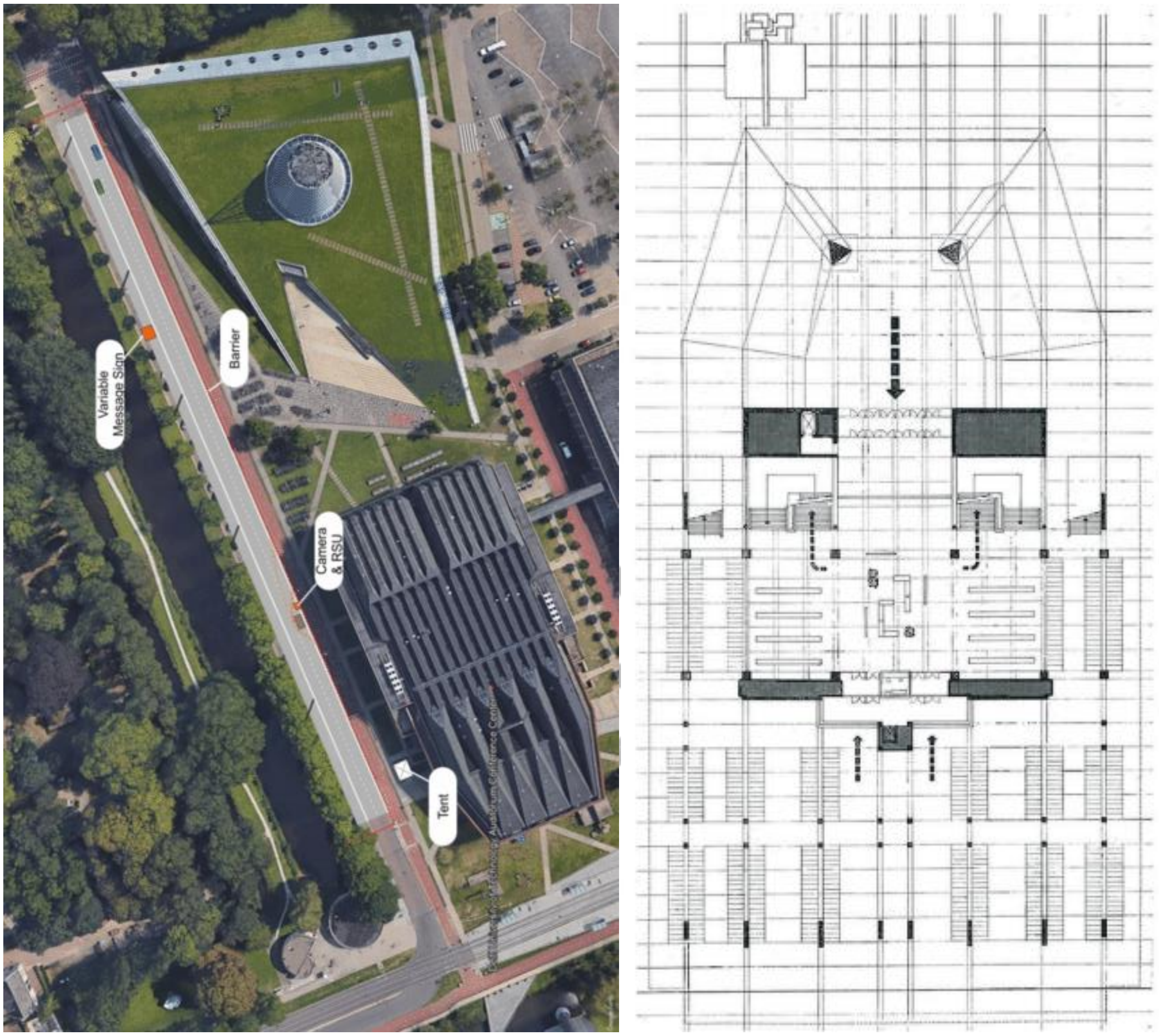

Figure 4.3: Site Plan and Floor plans of AULA, TU Delft, Netherlands

SOURCE: LA ARQUITECTURA DEL ESTADO DEL BIENESTAR EN LOS PAÍSES BAJOS: EL AULA DE LA TU DELFT 1948-1968 (2022)

With the four trapezoidal theatres designed and placed closely together, the circulation spaces between them become insufficient, considering the seating capacity for each as well as the entry and exiting requirements for lecture theatres. The access level from which all of the theatres gain entry becomes congested during each successful end of a lecture session.

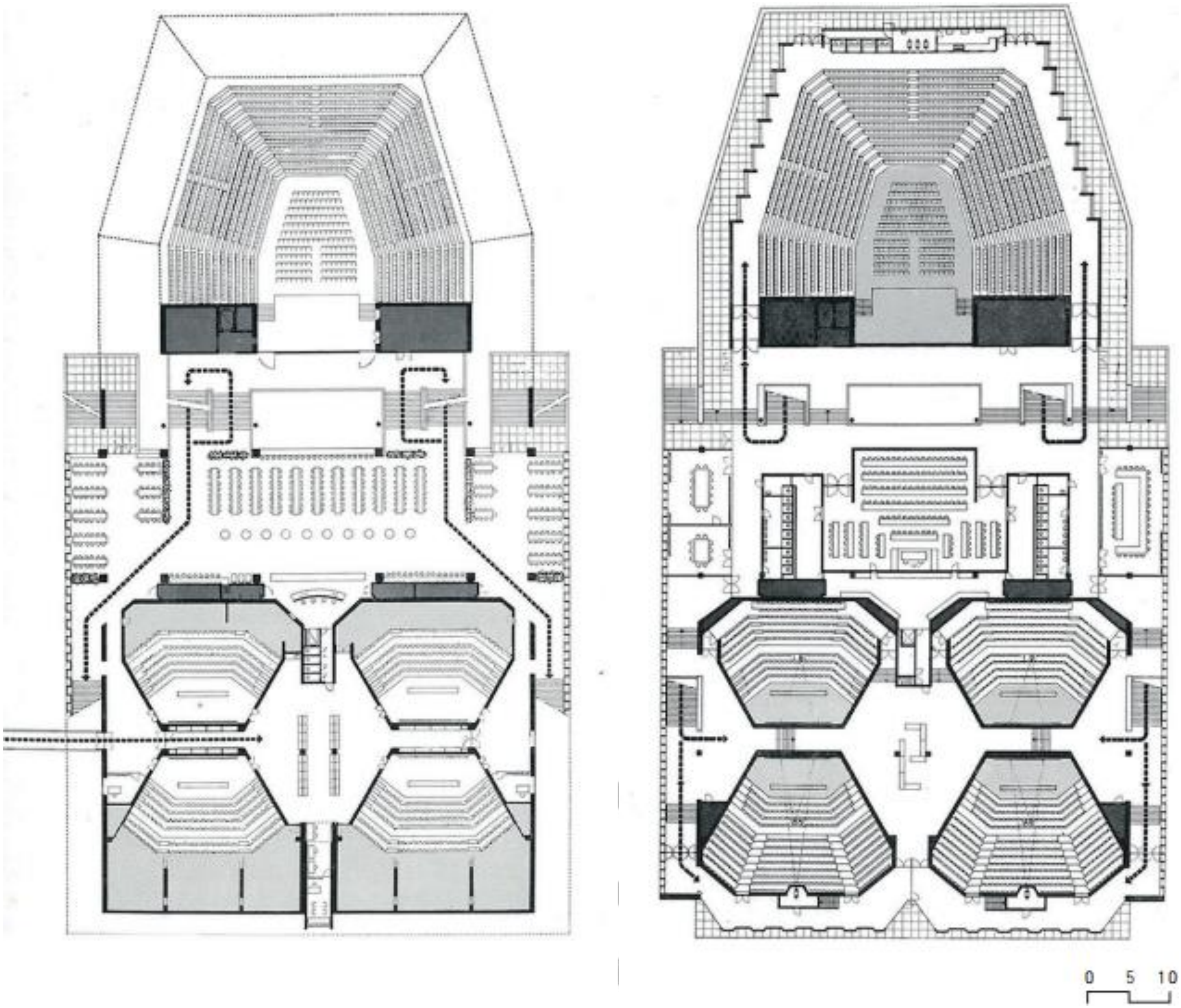

Figure 4.4: Floor plans of AULA, TU Delft, Netherlands

Source: LA ARQUITECTURA DEL ESTADO DEL BIENESTAR EN LOS PAÍSES BAJOS: EL AULA DE LA TU DELFT 1948-1968 (2022)

The 1300-seat auditorium also suffers from a deficiency in the circulation flow pattern as no other circulation route is provided to ease the transition of the crowd that uses the facility.

The auditorium is also connected to the physics department via an overhead walkway. This connection will bring more students into the complex and would impact negatively the already deficient circulation flow on the access levels.

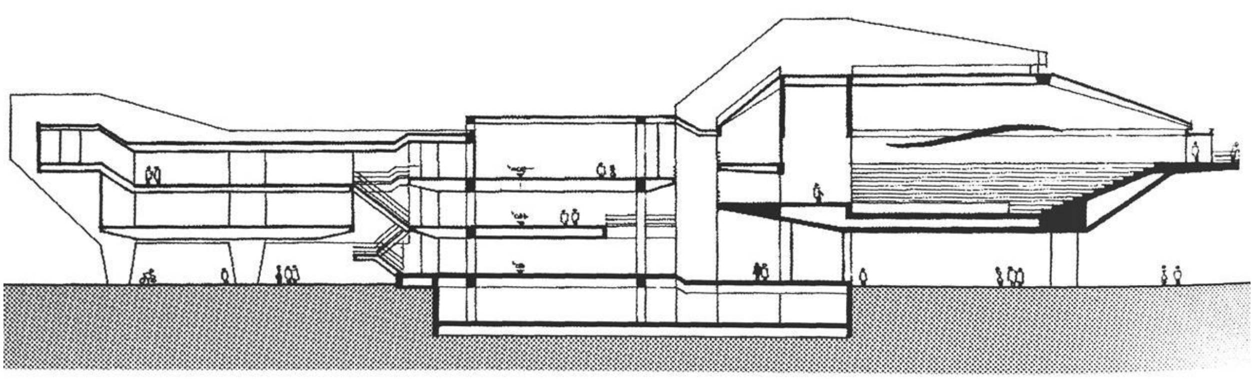

Figure 4.5: Sections of AULA, TU Delft, Netherlands

Source: LA ARQUITECTURA DEL ESTADO DEL BIENESTAR EN LOS PAÍSES BAJOS: EL AULA DE LA TU DELFT 1948-1968 (2022)

4.2. LT BUILDING, RIVERS STATE UNIVERSITY, PORT HARCOURT

Plate 4.1: A perspective view of the LT building, Rivers State University, Port Harcourt

Source: Author (2022)

The LT building was designed and built by Dar Al Handasah consultants and Shair & Partners Lebanon - Nigeria in 1978 for the faculty of engineering as part of its commission to design and construct the then College of Science and Technology.

The building is connected to other buildings by a covered walkway. It features 4 lecture theatres with a seating capacity of 70 to 135, prep rooms, bathroom stalls and stores.

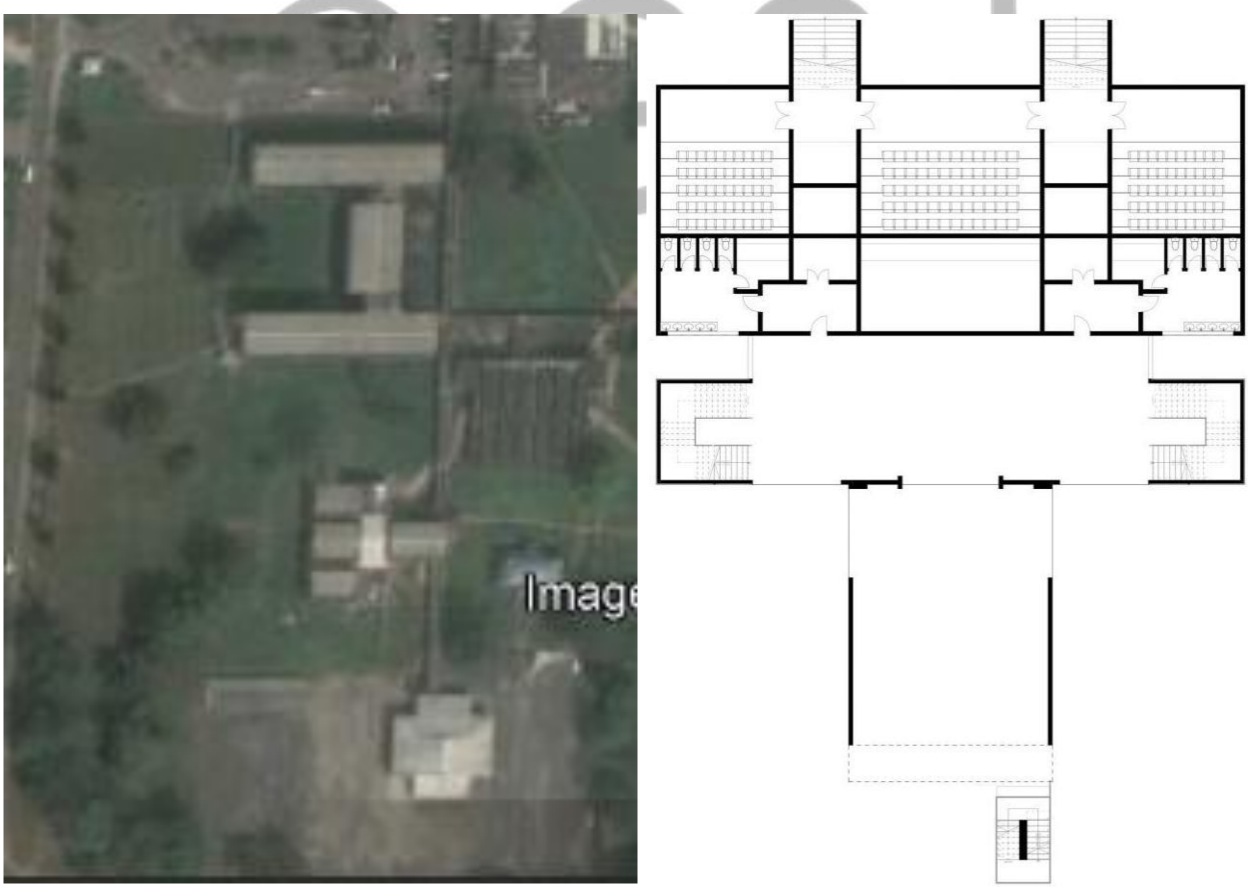

Plate 4.2: Site and Ground floor plan of the LT building, Rivers State University, Port Harcourt

Source: Author (2022)

Entry into the building is through the stairs from the lobby on the ground floor leading to another lobby on the first floor from which all 4 theatres can be accessed. There is another extension of stairs on the outside leading directly to the 135-seat theatre. Steps at the rear of the building give access to the 3 three other theatres.

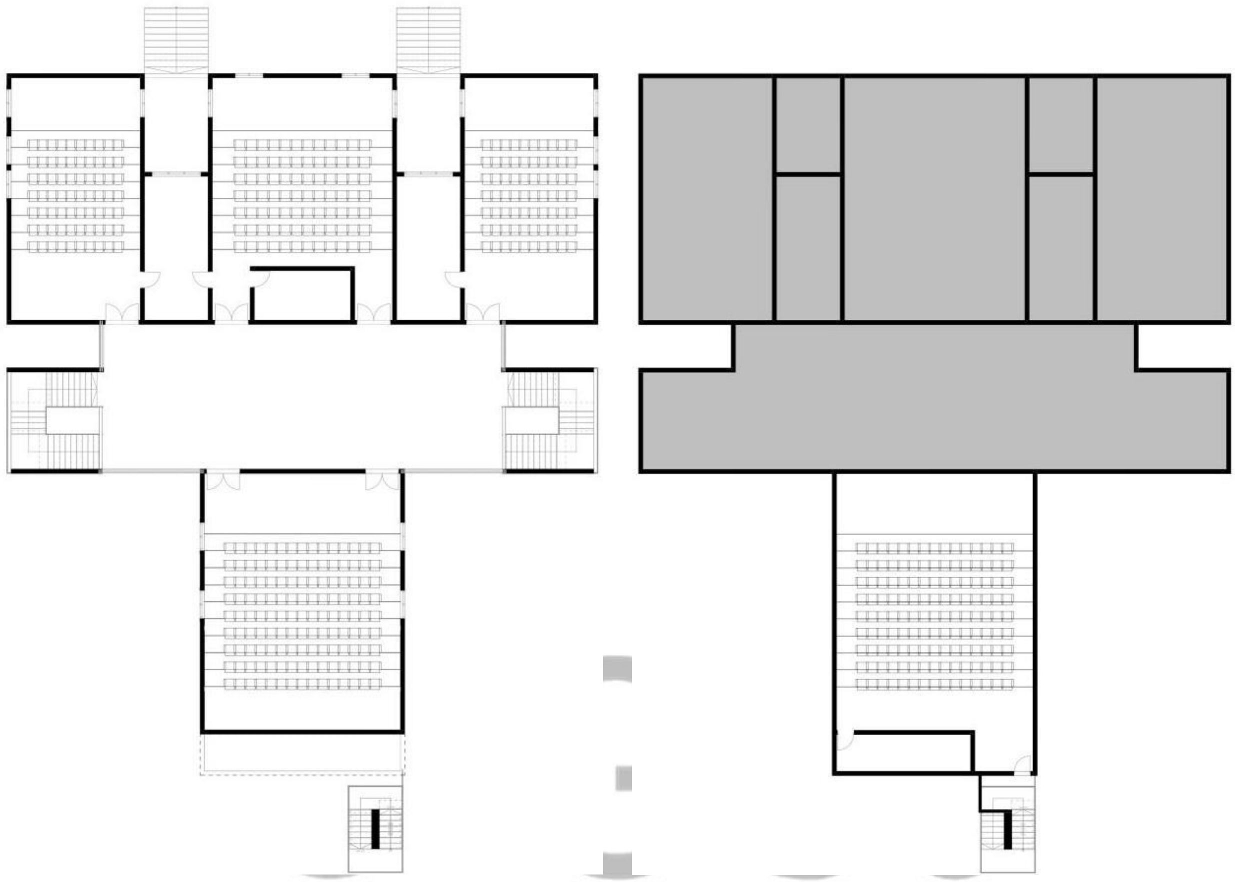

Plate 4.3: First and second floor plans of the LT building, Rivers State University, Port Harcourt

Source: Author (2022)

The foyers serve to regulate the movement flow on both floors. However considering the wait time between each session, the facility could make use of common/transition spaces to ease the transition between each session.

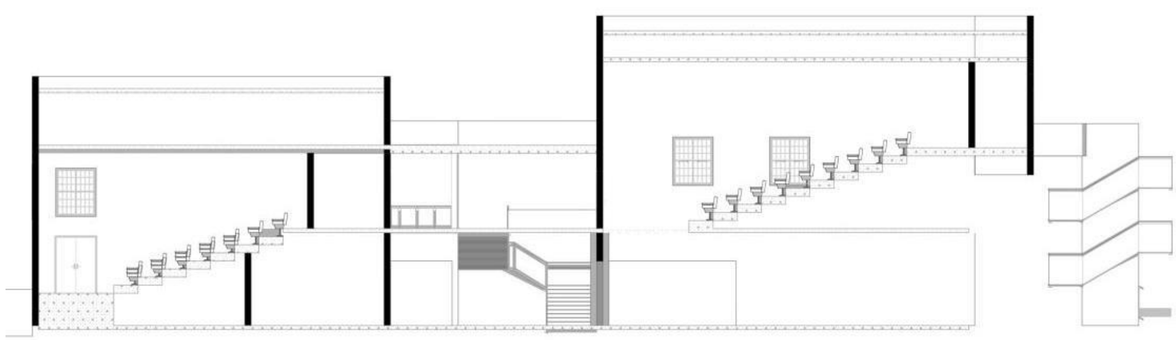

Plate 4.4: Section of the LT building, Rivers State University, Port Harcourt
Source: Author (2022)

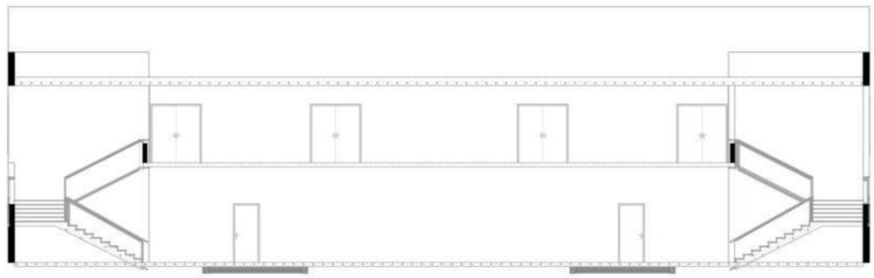

Plate 4.5: Section of the LT building, Rivers State University, Port Harcourt
Source: Author (2022)

Ramps, regardless of movement flow patterns are important and are needed to enable physically challenged individuals to gain entry to the access levels (first floor), especially if there is a seating gallery. A section of the seating area should be sloped with a few seats, at least 4 per cent, levelled and outlined for wheelchair users.

Plate 4.6: Rear view of the LT building, Rivers State University, Port Harcourt

Source: Author (2022)

5.0 INTERPRETATION AND DISCUSSION OF FINDINGS

Theatre buildings and other facilities that accommodate multiple users on different time schedules, experience high levels of rowdiness, as the users get stirred up at the end and beginning of every session, probably due to the eagerness to leave or join the next session. In an attempt to establish control over the configuration (mutual) and quality of circulation spaces (movement patterns), an approach based on the guiding principles of crowd control was used. This approach involved managing the gap between demand and supply through:

1 Controlling crowd inflow

2 Regulating the crowd at the venue

3 Controlling crowd outflow (NDMA 2014)

Doing so will require that the issues of passive crowd control be addressed. Issues such as:

1 Building size and capacity

2 Characteristics of building materials (combustibility, etc.)

3 Entrance to the building

4 Building layout

5 Walking distance

6 Ways and number of doors

7 Walkway and door dimensions (Sagun et al. 2008)

With the rise in student population, attributed to the growth of the university, study and learning places require a rethink and redesign in the way pedestrian traffic is controlled. Operating within the parameters of capacity planning is the way to go; requiring an understanding of crowd behaviour and/or psychology, as well as how crowds move in common and circulation spaces.

5.1 DESIGN CONCEPT

According to Sagun et al. (2008), certain variables need to be considered when dealing with passive crowd control. In addition, Lecture theatres should be arranged to enable the movement of large numbers of students into and out of the Lecture theatres. Lobbies should be large enough to allow the gathering of students without interfering with the normal traffic flow in and out of the facility (Classroom and Lecture Hall Design Division N-14 2003). Accessibility for physically challenged persons, fire safety and easy access to fire escapes are also important factors to consider when designing lecture theatres.

Taking account of the two-way nature of traffic flow in most theatres and its potential to cause congestion during entry and exit between classes, a one-way traffic flow seemed to be the best way to eliminate the collision between the large inflows and outflows and vice versa NDMA India (2014). This required the development of a concept (The Mainstream Flow) that serves that purpose without disrupting the regular flow and functioning of the facility.

5.2 THE MAINSTREAM FLOW

“ THE MAINSTREAM FLOW" is a derived concept from the flow of a river(mainstream) which receives water from smaller rivers (tributaries) and also gives off water to form smaller rivers (distributaries) as it continues down to the ocean.

For the intended design, the mainstream becomes the original/main circulation path that connects to the lecture theatres, while the tributaries are the traffic that spills out from the lecture theatres onto the mainstream, and the distributaries become those that move from the mainstream into the theatres. This back-and-forth movement will be controlled by a simple mechanism not often used in this manner; THE CRASH BARS

Figure 5.1: Crash bars on doors

Source: https://www.dndhardware.com/

5.2.1. CRASH BAR

This consists of a spring-loaded bar fixed horizontally to a door that swings in one direction; depressing the bar unlatches the door — on entry and exit, working as part of the derived concept; "The Mainstream Flow".

5.4.1 CONCEPT ANALYSIS

Using a prototype 400-seat lecture theatre the author was able to simulate the one-way movement flow within; the students will enter from the doors behind on both the ground and terraced floor and exit from the sides enclosed by booths (noise and sound)

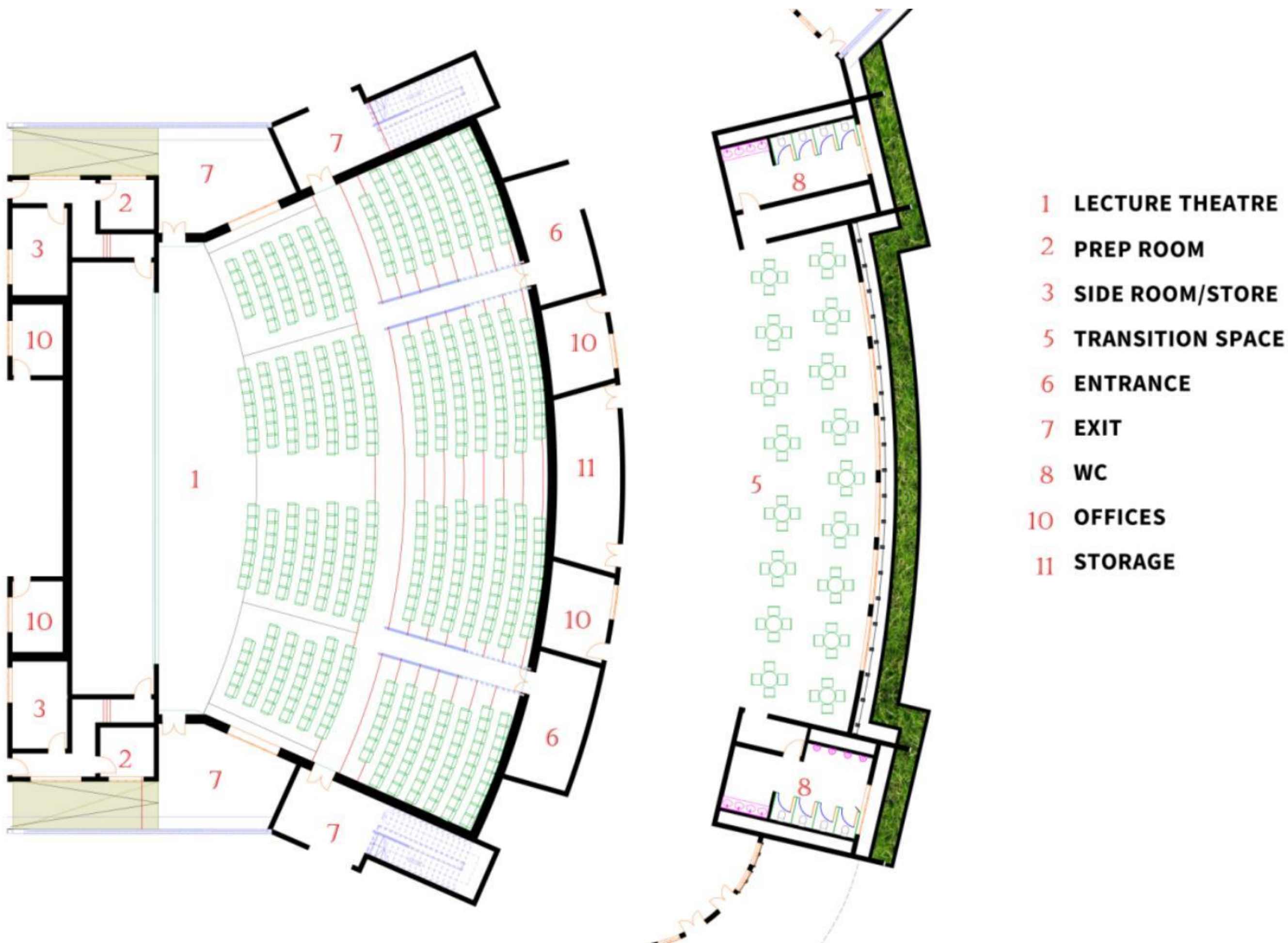

Plate 5.1: Ground Floor Plan Of a Prototype 400 Seat Lecture Theatre

Source: Author (2022)

The entrance to the theatres is behind on a levelled floor, while the exits are located on the midsection of the theatre (on the same floor) and from there it slopes down to another exit at the front of the theatre. This is intended to facilitate easy and quick entry and exit for both able-bodied and physically challenged individuals without having any contact with the newcomers.

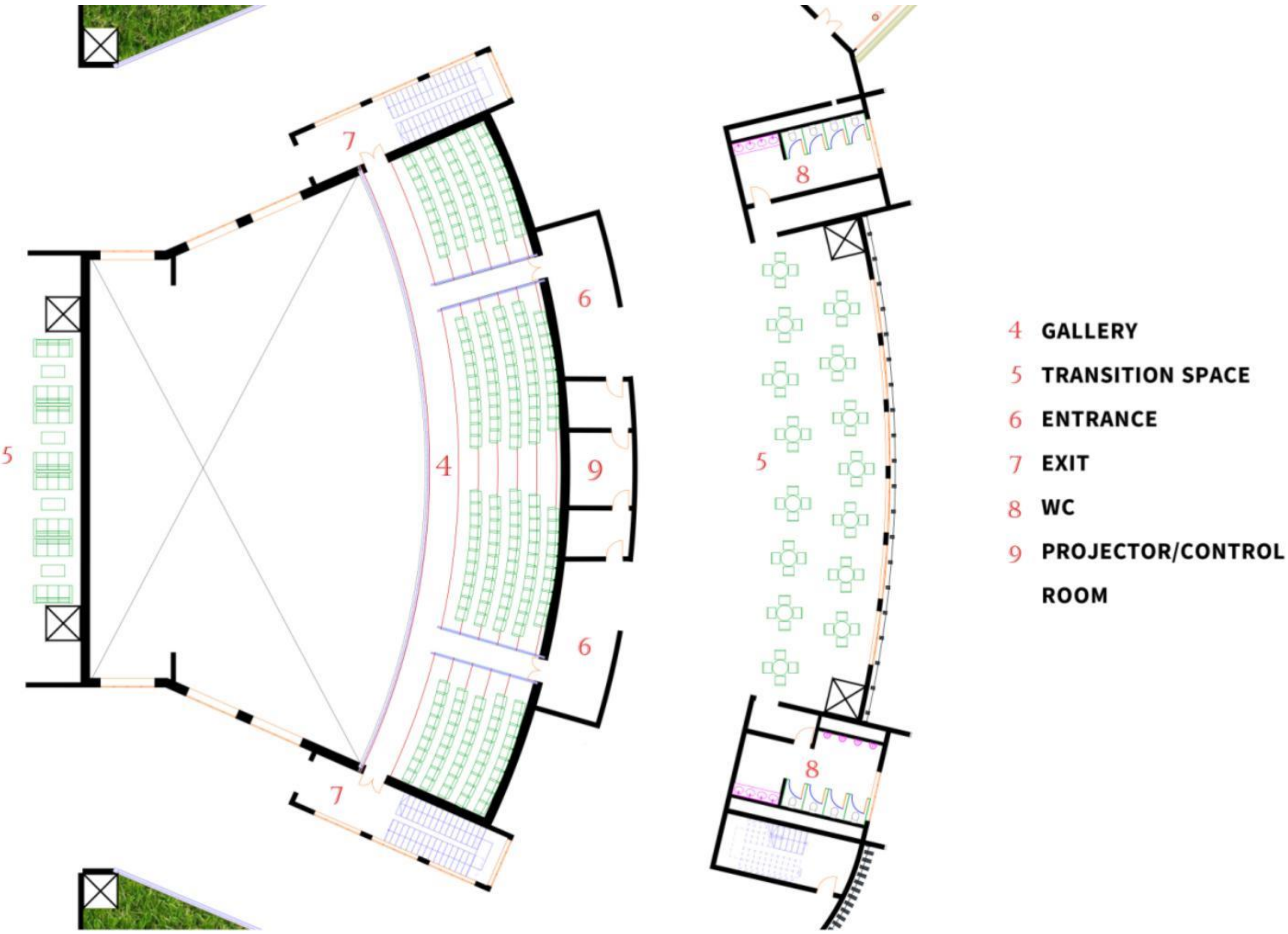

Plate 5.2: First Floor Plan Of a Prototype 400-Seat Lecture Theatre

Source: Author (2022)

The same concept applies to the first floor, with the entrance at the back of the theatre and exits on both sides with a stairway that leads to the ground floor.

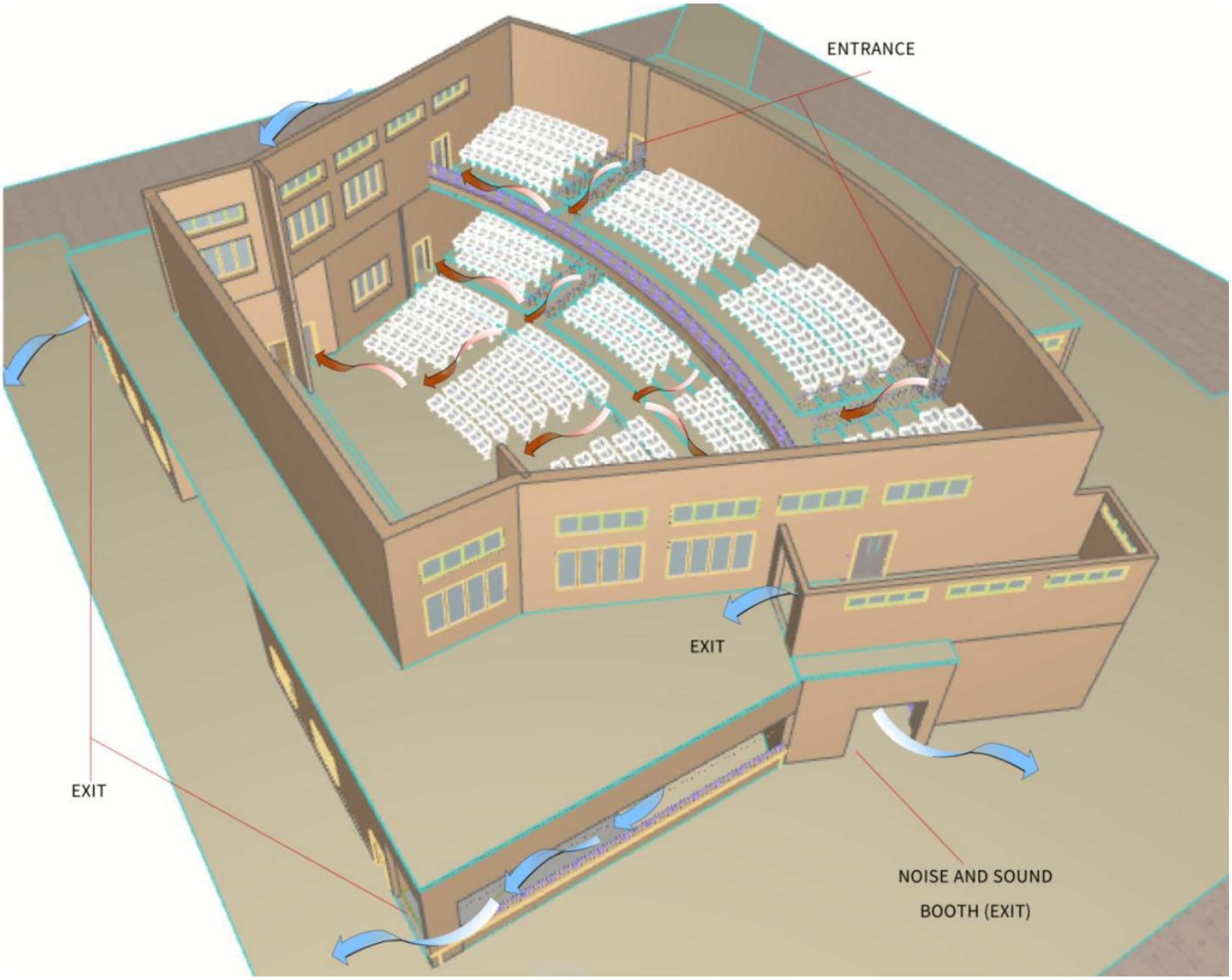

Plate 5.3: Concept Analysis in a Prototype 400-Seat Lecture Theatre

Source: Author (2022)

The model simulates the movement flow in the lecture theatre, showing the crowd inflow and circulation in red and the outflow in blue.

6.0 CONCLUSION AND RECOMMENDATION

The purpose of this paper is to explore, through research and design, ways in which problems in a particular building typology could be solved. The problem of collision between two different movement flow patterns in buildings accommodating multiple users on different time schedules, particularly theatres can now be solved based on the guiding principles of crowd control, which is managing the gap between demand and supply through:

1 controlling crowd inflow; by eliminating the use of entrance doors as exits through the aid of crash bars fixed horizontally on the side of the doors that open into the theatres only.

2 regulating the crowd at the venue; by providing enough space for movement, waiting for the start of a new session, and facilities to ease the wait time were all crucial aspects of the design.

3 controlling crowd outflow; by using the same function as the crash bars on exit doors to eliminate their use as entrance into the theatres. And also reducing the evacuation time to give way to the incoming users by providing side exits on different sections of the theatres (the midsection and at the front of the theatre).

As an added function for the improvement of the indoor air quality in the theatres passively, wind catchers were incorporated into the design.

The implication of this is a better-functioning facility without crowd control issues. Where there is success in a building typology with a broader spectrum will effectively mean that buildings of a similar nature will have a framework on which their designs will be based.

The problem of a collision between two movement flow patterns in theatres was solved by zoning off the entrances and exits into a one-way movement flow pattern by using crash bars fixed only on the side of the doors that either open into or out of the theatres. As the author would say, "No design is foolproof" Therefore, considering a situation where this function has been tampered with, through either dogging of the doors or by whatever mischievous means to bridge this control function would mean a failure in design. Therefore, more research needs to be done towards a more efficient and effective way of countering a bridge in the control of circulation/movement pattern flow in theatres.

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