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Institute Campus

Rohini, Delhi, India

Dec, 2025

Institute Campus

Rohini, Delhi, India

BACHELOR OF ARCHITECTURE

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DEPARTMENT OF ARCHITECTURE AND PLANNING

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY, BHOPAL

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ARC 511 – Thesis Project

Institute Campus

Rohini, Delhi, India

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UNDER THE GUIDANCE OF

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DEPARTMENT OF ARCHITECTURE AND PLANNING

MAULANA AZAD NATIONAL INSTITUTE OF TECHNOLOGY, BHOPAL

CANDIDATE DECLARATION

The Thesis Project in the subject ARC 511, entitled "**Institute campus, Rohini, Delhi, India"**, is being submitted in partial fulfilment of the requirement for the award of degree of Bachelor of Architecture by the undersigned for evaluation.

The matter embodied in this project is a record of my own work. If, in future, it is found that the above statement is false, then I have no objection in withdrawal of Bachelor of Architecture Degree awarded to me by the Institute.

Date: 1st – 2nd Dec, 2025

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RECOMMENDATION

Based on the above declaration of the student, the undersigned recommends that the work submitted by the candidate may be considered for the final end term examination of the subject ARC-511, Thesis Project.

Date: 1st – 2nd Dec, 2025

Dr. Vinay Mohan Das
Thesis Guide

CERTIFICATION OF EXAMINATION

The Bachelor of Architecture Thesis Viva-Voce examination of Mr. Yashraj Borwal Scholar No.211110044, was held on 1/12/2025 to 2/12/25.

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ABSTRACT

The thesis proposes an institute campus design in **Rohini, Sector 3, Delhi**, developed as a climate-responsive and sustainable built environment in the composite climate of the region. The project integrates site-specific orientation, optimized building form, shaded circulation spines, and landscape strategies to reduce heat gain while enhancing natural ventilation and daylight penetration.

The campus layout organizes academic, administrative, and social functions around a hierarchy of courtyards and spill-out zones, encouraging interaction and outdoor learning while providing thermal comfort during most of the year. Building envelopes employ appropriate insulation, high-performance glazing where required, external shading devices, and material choices with low embodied energy to reduce operational energy and environmental impact. Provision for rooftop photovoltaic panels and efficient lighting and HVAC systems is incorporated with the long-term intent of moving towards a low-energy or near net-zero campus framework.

Passive design measures such as courtyards, buffer zones, appropriate facade treatment, and controlled openings are combined with rainwater management and green open spaces to improve thermal comfort and lower energy demand. The design aims to create a healthy, flexible academic setting that promotes social interaction, user comfort, and long-term environmental performance at the campus scale.

ACKNOWLEDGMENT

*In the first place, I would like to convey my profound gratitude to my Guide **Dr. Surabhi Mehrotra**, for her important support during the research. I have been greatly inspired by her unwavering support, vision, energy, sincerity, patience, enthusiasm, and vast knowledge. Being able to work and study under her direction was a huge honour and privilege.*

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1. DESIGN BRIEF

1.1 INTRODUCTION

The design of an Institute of Science & Technology in Rohini, Delhi, emerges from the need to create educational environments that not only meet the demands of rapidly evolving technological fields but also foster collaborative, inclusive, and sustainable communities. Rohini, a well-developed sub-city in North-West Delhi, is home to a diverse urban fabric and benefits from robust connectivity via the Delhi Metro and major road networks, making it an ideal site for a premier educational institution. Delhi itself is a hub of higher education and research, hosting a range of distinguished institutions like IIT Delhi, JNU, and Delhi University. However, there is a growing demand for specialized institutes focusing on advanced fields such as Artificial Intelligence, Database Management, and IT, which are increasingly critical in a technology-driven world. Addressing this gap, the Institute of Science & Technology will serve as a center for cutting-edge research and interdisciplinary collaboration. The institute's programmatic elements—comprising administrative functions, a library, dedicated academic blocks, and residential facilities—reflect a holistic approach to higher education. Contemporary academic campuses are no longer mere clusters of buildings but integrated communities fostering innovation, collaboration, and well-being. Residential facilities for both students and faculty members enhance the sense of community and promote continuous engagement. The phased development strategy ensures the institute can expand and evolve in response to academic and technological advancements. This background study establishes the foundation for designing a forward-thinking, resilient campus that can become a benchmark for 21st-century educational environments in India.

Rohini Campus Details	
Location	Sector-3, Rohini, DDA Phase-I Scheme, Delhi
Plot Area	7.3 hectares (18 acres)
Topography	Plain
Zone/Subzone	Zone H / Subzone H8
Ward	Ward 53, North Delhi Municipal Corporation (Rohini E)
Address	Institutional Area, Sector 3, Rohini, Delhi – 110085
Site Connectivity	1 km from Outer Ring Road; near Madhuban Chowk & Rohini East Metro Stations (Red Line)
Land Allotment Agency	Delhi Development Authority (DDA)
Development Agency	Public Works Department (PWD), Government of NCT of Delhi

1.2 AIM

The project aims to design an Institute of Science & Technology for undergraduate students, on a site of 18 acres in the institutional area of Rohini, Delhi. The project will focus on the integration of solar panels, to achieve energy self–sufficiency.

1.3 OBJECTIVE

- To conduct case studies and literature studies relating to the topic.
- To design different blocks on the site, catering to the different needs of the institute, the admin block, library block, the main academic block, and hostel blocks and faculty residential blocks for accommodating the students and the faculty members.

- To incorporate solar panels in academic block, to provide energy efficiency and reduce energy demands due to the extensive electricity use in the academic block.
- To contribute to the city's urban and cultural landscape by creating a landmark that reflects architectural excellence.
- To ensure a sustainable and eco-conscious development that responds to the site's environmental context.
- To integrate local cultural elements and materials into the design, reinforcing a sense of place and regional identity.
- To provide a seamless experience through thoughtful spatial planning and efficient circulation.

1.4 SCOPE

- To design a science and technology institute, having four computer-based departments.
- The institute will incorporate the use of rooftop solar panels to meet the intensive energy demand of the academic block, because of the use of air conditioners and computers.

1.5 LIMITATION

- The institute will only be designed for undergraduate students.
- The designing scope will only include designing hostels for students. The space for faculty housing will be given in the masterplan but will not be designed.

1.6 SITE LOCATION

- Location: Sector-3, Rohini, Delhi-110085
- Coordinates: 28.701037, 77.113076
- Access: 13.5m wide road, connected to Outer Ring Road

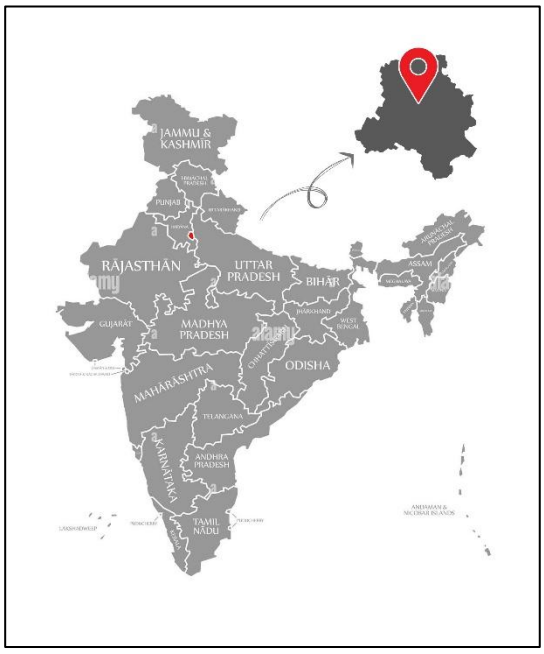


Figure 2: Delhi, India



Figure 1: Sector 3, Rohini, Delhi

1.7 PROJECT DETAILS

- Project Name: Ambedkar Univesity Delhi
- Site Area: 7.3 hectares
- Proposed Development: New Campus of Ambedkar University Delhi (AUD)
- Location: Sector-3, Rohini, Delhi-110085
- Funding: Government of NCT of Delhi
- Land Allotment: Delhi Development Authority
- Development Agency: Public Work Department
- Total Site Area: 7.3 hectares (73,000 sqm)
- Total Built-Up Area: 1,67,680 sqm
- Maximum Permissible FAR: 2.25
- Land Use Distribution:
    - Institutional: 70%
    - Residential: 30%
- Encumbrances: The site is free from all encumbrances, including overhead power lines.
- Site Division: The 7.3-hectare plot is divided by a 13.5-meter-wide public road almost in the center. The new campus will be developed taking this road into account, considering it will remain a public road accessible to the neighboring population and maintenance agencies.

Academic Schools	7 Schools: - Undergraduate Studies - Liberal Studies - Development Studies - Law, Governance & Citizenship - Business, Public Policy & Social Entrepreneurship - Education Studies - Human Studies & Culture & Creative Expressions
Research & Innovation Centres	9 Centres including: - Research Methods - Community Knowledge - Future Studies - South Asian Studies - Psycho Clinical Research - Early Childhood Education - Development Practice - Publishing - Women Studies - Innovation & Incubation Centre
Support & Public Facilities	Auditorium, Convention Centre, Seminar Halls, Library, Cafeterias, Guesthouse, Health Centre, Sports Facilities (Indoor/Outdoor), Display/Performance Areas, Crèche, Utility Centre

- Site Layout:

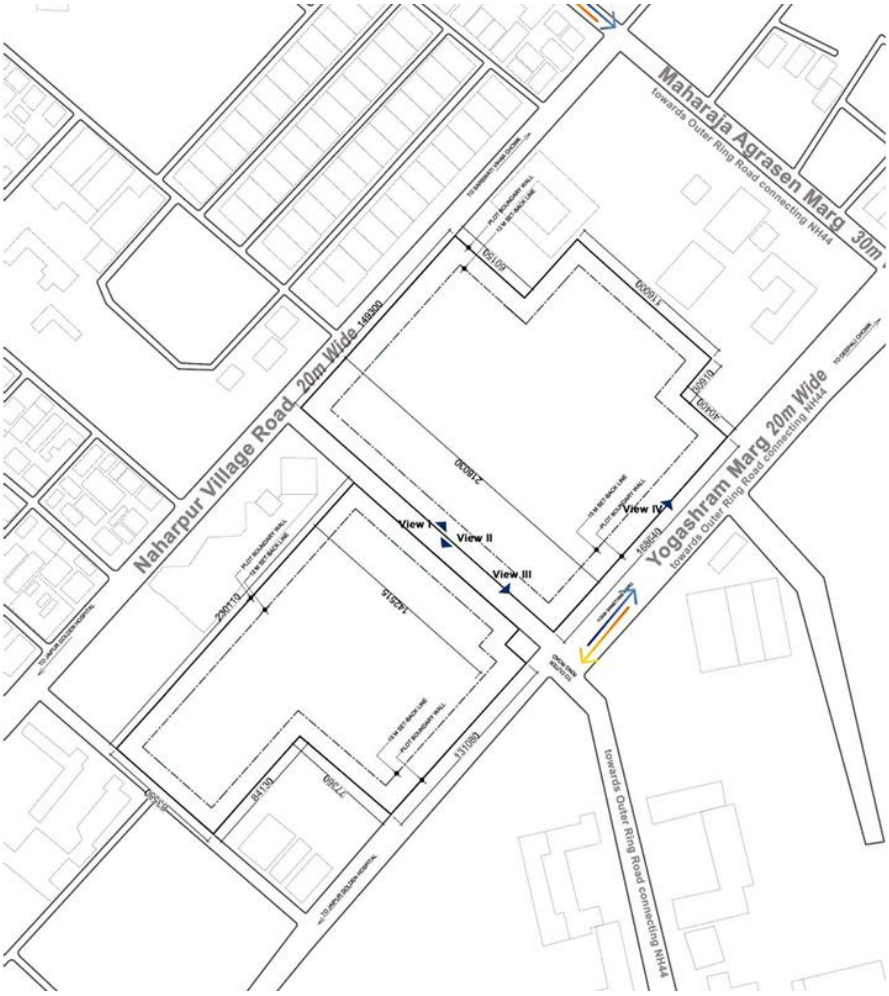


Figure 3: Site Layout

- Dimensions:

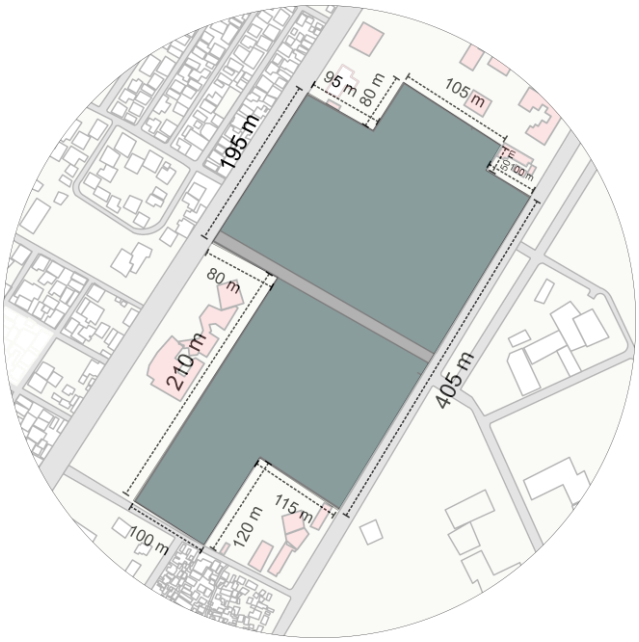


Figure 4: Site Dimensions

1.8 PROPOSING AGENCY

The **Public Works Department (PWD)** under the **Government of the National Capital Territory (NCT) of Delhi** is the proposing agency for the comprehensive consultancy services related to the development of the **New Campus of Ambedkar University Delhi (AUD)** at Sector-3, Rohini, Delhi-110085.

1.9 DETAILED LIST OF SPACES

1.9.1 Central Facilities (Campus-Level)

The Central Facilities are shared spaces designed for the entire campus community and include the Library & IT Complex, Auditorium/Convention Centre, Media Labs, Exhibition Centre, Student Centre, Cafeteria, Sports Centre, and the Administrative Block. These facilities will be used by all Schools and Centres of the university and are expected to function 24 hours a day, 7 days a week. Due to their significance and continuous usage, their placement within the campus must be carefully planned to ensure accessibility and convenience for all users.

Sl. No.	Facility	Proposed Area (sqm)
i.	Administrative Block	3,500
ii.	Library & IT Complex	10,500
iii.	Auditorium Complex (500 seats + seminar rooms)	4,000
iv.	Student Centre (reading, recreation, placement, indoor games)	1,000
v.	Exhibition Centre	500
vi.	Cafeteria	2,000
vii.	Utility Centre (shops, ATM, post office, etc.)	750
viii.	Faculty Centre/Club	500
ix.	Health Centre (OPD + 6 beds)	250
x.	Covered Parking Block	100
xi.	University Crèche (50 children)	250
xii.	Maintenance Office (includes services)	2,000
xiii.	Sports Centre (indoor/outdoor facilities)	1,000
xiv.	Basement Parking & Service Area (not in FAR)	31,680

1.9.2 Cluster-Level Facilities (For 2 Academic Clusters)

The Schools and Centres of the university serve as the core spaces for teaching, learning, and research activities. To promote academic synergy and optimize spatial efficiency, schools with epistemic (knowledge-based) congruity will be grouped into functional clusters.

Shared Infrastructure: Schools and Centres within a cluster will share common facilities, such as seminar halls, lounges, meeting rooms, and labs.

Non-Exclusive Instructional Spaces: Classrooms and instructional spaces will be centrally managed and not assigned exclusively to any individual school, promoting flexibility and efficient use.

Cross-School Interactions: Clustering encourages academic intermixing between students and faculty across disciplines, fostering a multidisciplinary learning environment.

Optimized Space Utilization: The cluster strategy ensures maximum use of shared resources, reducing redundancy and increasing sustainability.

- Faculty: Student Ratio (1:15)
- Admin Staff is 1/2 of total faculty strength

- Project staff is 8 per centre + 1/4th per faculty

Sl. No.	Facility	Area (sqm)
i.	Classrooms (for 60% of students)	10,000
ii.	Computer Labs/IT/Research Rooms	5,500
iii.	Committee Rooms (2 x 75 seats per cluster)	800
iv.	Faculty Rooms (100% faculty + 10% extra)	5,000
v.	Faculty/Staff Lounge	500
vi.	Staff Rooms	800
vii.	Utility Rooms (printing, copying, pantry)	800
viii.	Student Common Rooms (reading, recreation)	800
ix.	Security, Maintenance, Staff Support	800
x.	Workshops/Studios/Labs	22,500

1.9.3 School/Centre-Level Facilities (13 Schools/Centres)

Every School will have a Dean/Director's complex, Documentation Centre and Stores etc.

Sl. No.	Facility	Area (sqm)
i.	Dean/Director's Office Complex	550 per unit
ii.	Documentation Centre	300 per unit
iii.	Store (Supplies and Stationery)	150 per unit

1.9.4 Residential Facilities

The "Residential Zone" of the Rohini Campus will cover approximately "25% of the total plot area". It has been carefully planned to accommodate:

- Student Hostels (for both girls and boys, with a mix of single and double occupancy),
- Faculty Hostels, and
- Residential units for faculty and staff.

The housing layout is envisioned to promote a non-hierarchical and inclusive community, encouraging intermixing of faculty and staff residences with shared community resources.

Common Facilities Proposed within the Residential Zone:

- Community Centre
- Guest House
- Faculty Transit Accommodation
- Convenience Centre
- Maintenance Office
- Electrical Substation

Breakdown of Residential Typologies:

- Faculty Housing – 50% of the total residential capacity
- Staff Housing – 30% of the total residential capacity
- Student Hostels – 25% of the total residential capacity

Gender Ratio: Girls: Boys = 2: 1
Programme Ratio: Postgraduate (PG): Undergraduate (UG) = 1: 1
PG Students – Single occupancy rooms

UG Students – Double occupancy rooms

Sl. No.	Facility	Rooms/Units
i.	Faculty/Staff Housing	112 units
ii.	Girls Hostel	200 UG (Double), 200 PG (Single)
iii.	Boys Hostel	100 UG (Double), 100 PG (Single)

Residential Zone Common Facilities

Sl. No.	Facility	Area (sqm)
i.	Community Centre	1,500
ii.	Guest House (10 rooms)	750
iii.	Faculty Transit Accommodation (20 rooms)	1,500
iv.	Convenience Centre (shops, ATM, etc.)	500

1.9.5 Summary of Built-Up Area Allocation

Category	Built-Up Area (sqm)
Institutional Area	90,000
Residential Area	46,000
Basement/Parking/Services	31,680
Total (Phase I)	167,680

1.10 SITE SURROUNDING

The proposed site for the new campus of **Ambedkar University Delhi (AUD)** is located in **Sector-3, Rohini, Delhi-110085**, within the urban fabric of North-West Delhi. The site occupies a **total area of 7.3 hectares (73,000 sq.m)** and is strategically positioned to leverage the advantages of a well-developed metropolitan neighborhood.

- The site lies within the **Rohini sub-city**, one of Delhi's most prominent and planned residential areas developed by DDA.
- It benefits from **proximity to major arterial roads**, making it easily accessible from other parts of Delhi and the NCR region.
- The site is surrounded by **residential neighborhoods, commercial hubs, educational institutions**, and public amenities, ensuring a vibrant urban edge.
- Excellent **public transport access**, particularly due to its close proximity to the **Rohini East and Rohini West Metro Stations** (Delhi Metro's Red Line).
- Connected to **Outer Ring Road** and **NH-44**, enabling smooth vehicular movement and ease of commuting for students, faculty, and staff.
- Local roads adjacent to the site support last-mile connectivity and ease of entry into the campus.

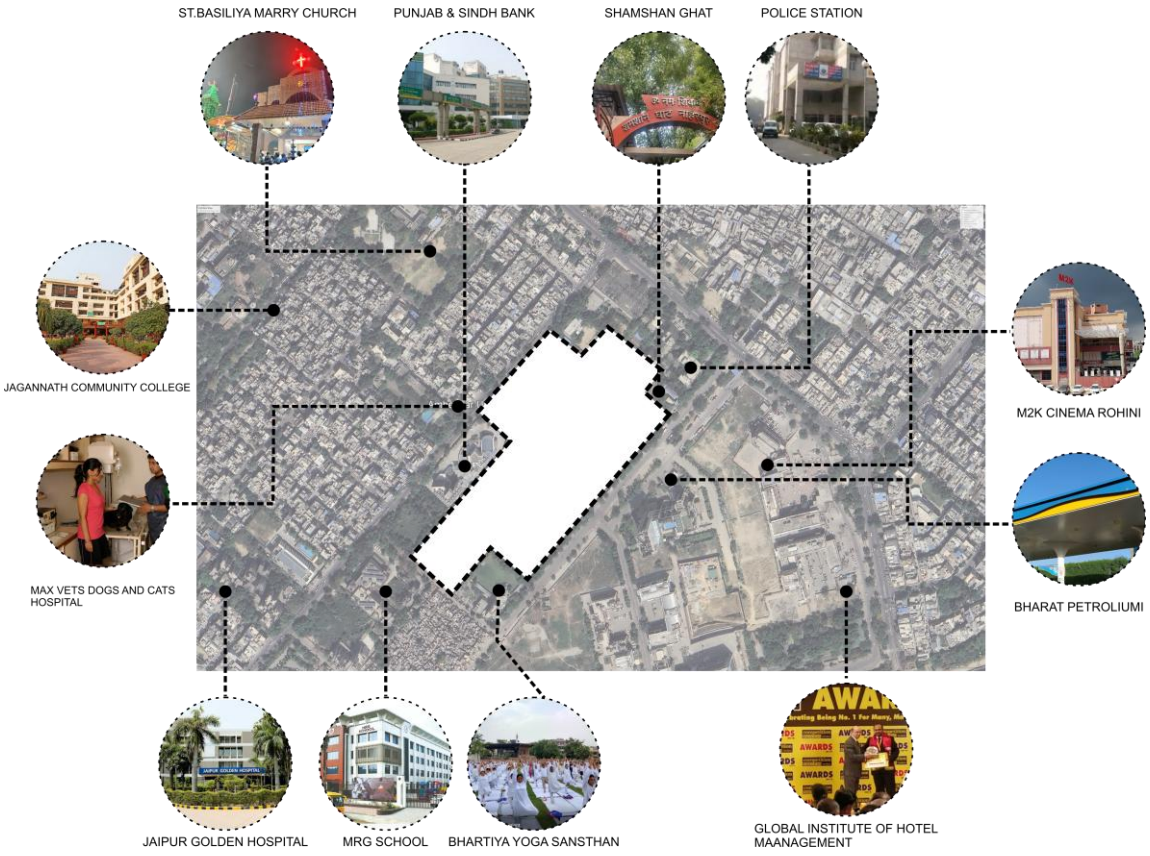


Figure 5: Site Surroundings

1.11 SITE CONNECTIVITY

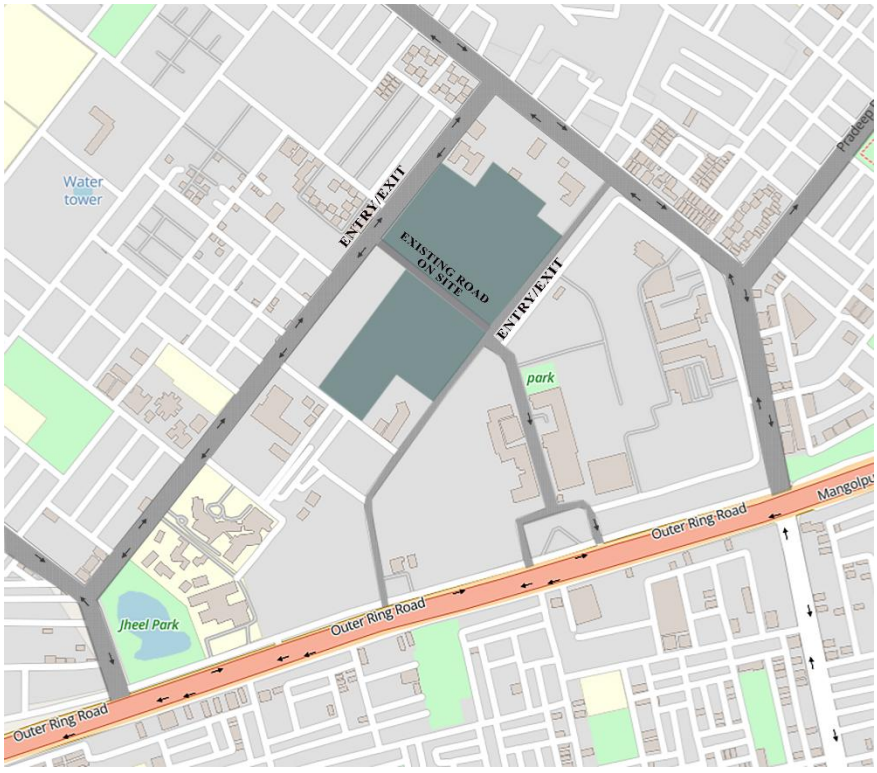


Figure 6: Site Connectivity

1.12 ZONING REGULATION

- The site has been earmarked as **"Institutional Land"** under MPD-2021.

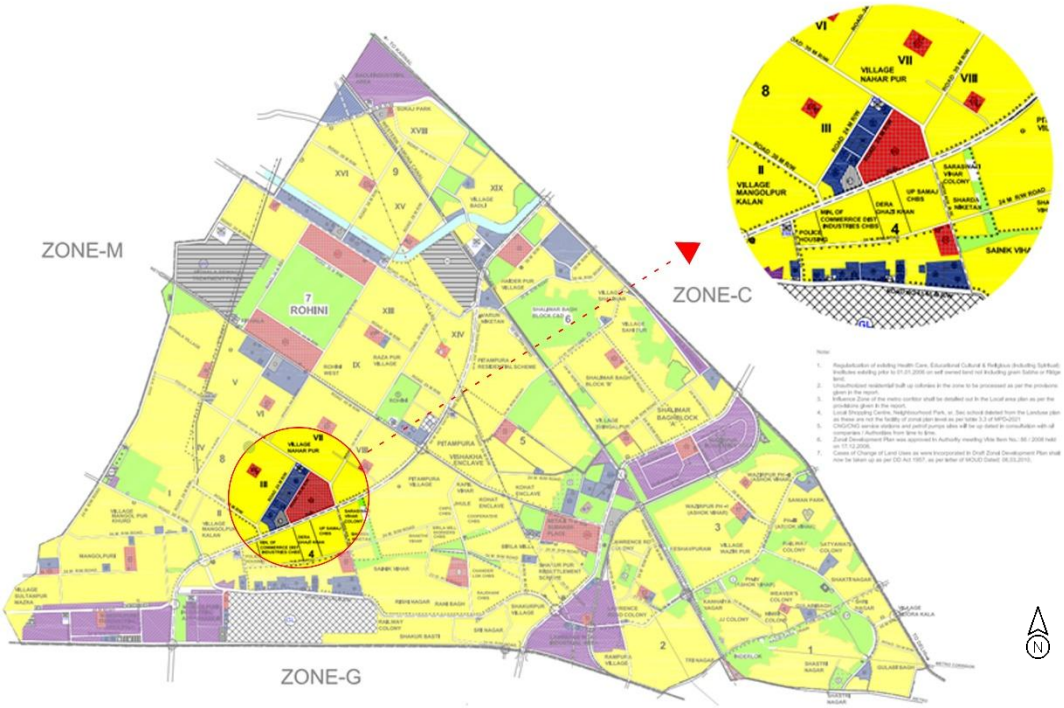


Figure 7: Zonal Development Plan of Zone-H

- The project must comply with all relevant building bye-laws, height restrictions, ground coverage, floor area ratio (FAR), and setback regulations applicable to Rohini developments.

- Any construction on the site must comply with applicable institutional development norms and standards, including those set by statutory and planning authorities such as the Delhi Development Authority (DDA) and Public Works Department (PWD), and must align with environmental and sustainability benchmarks like GRIHA or LEED certifications.

1.13 SETBACK REGULATION

As per the guidelines outlined in the **Master Plan for Delhi 2021 (MPD-2021)** and applicable building bye-laws for institutional developments, the following setback norms apply to large institutional plots within Delhi, including the proposed **Ambedkar University Delhi campus** at **Sector-3, Rohini**:

The total site area of the campus is approximately **73,000 square meters**, placing it in the category of **plots larger than 10,000 sqm**. Therefore, the mandatory minimum setbacks are:

- Front Setback: 15 meters
- Rear Setback: 12 meters
- Side Setbacks (each side): 12 meters

1.14 CLIENT'S BRIEF

Client's Brief		
S. No.	**Infrastructure**	**Proposed Area / No. of Students**
1	School of Undergraduate Studies	1000 Students
2	School of Liberal Studies	660 Students
3	Centre for Law and Governance	140 Students
4	School of Business, Public Policy and Social Entrepreneurship	565 Students
5	School of Educational Studies	510 Students
6	School of Human Studies	580 Students
7	School of Culture and Creative Expressions	20 Students
8	Administrative Block	3500 sq.m.
9	Student Centre	1000 sq.m.
10	Sports Centre	1000 sq.m.
11	Auditorium Complex	4000 sq.m.
12	Residential Complex	25% of Plot Area
13	Future Expansion	—

1.15 IDENTIFICATION OF USER GROUPS

The design of a university campus must be rooted in a deep understanding of its users—the people who will shape, occupy, and experience its spaces daily. At Ambedkar University Delhi (AUD), the proposed Rohini campus will serve a diverse and interconnected community, each with distinct spatial, social, and psychological needs. Identifying these user groups is essential to ensure that the campus responds meaningfully to patterns of use, behaviour, and interaction.

The primary user groups include undergraduate, postgraduate, and research students, who will form the academic core of the campus. Faculty members—both full-time and visiting—will engage in teaching, mentoring, and research, requiring a blend of private and collaborative workspaces. Non-teaching administrative staff and project personnel support the university's daily functioning and require efficient and accessible work environments.

Supporting services such as maintenance staff, security personnel, and utility workers are integral to the operation of the campus and must be provided with dignified and well-located service zones. The residential population, including students, faculty, and their families, introduces a layer of community living, while the presence of a crèche highlights the need for child-friendly environments.

In addition, the campus anticipates frequent engagement with external visitors—guest faculty, parents, researchers, and members of the local community—through seminars, exhibitions, performances, and public outreach. Vendors and retail workers also form a critical group, facilitating everyday campus life through food kiosks, convenience centres, and service outlets.

Comprehensive User Groups for AUD Rohini Campus	
User Group	**Description / Role**
Undergraduate Students	Primary user group; use academic clusters, hostels, student centres, and recreation spaces.
Postgraduate & Research Students	Engage in advanced studies and research; use labs, seminar rooms, studios, and specialized centres.
Faculty Members	Teaching and mentoring roles; require offices, lounges, housing, and academic collaboration spaces.
Administrative (Non-Teaching) Staff	Support university operations (HR, finance, planning, admissions, etc.); housed in the **Administrative Block**.
Project/Research Staff	Affiliated with research centres; need flexible office, IT infrastructure, and collaborative workspaces.
Maintenance & Utility Staff	Handle day-to-day operations like plumbing, electrical, horticulture, housekeeping, etc.; supported by a dedicated **Maintenance Office** and service zones.
Security Staff	Ensure safety and campus access control; positioned across entry gates, service roads, and student housing.
Visitors	May include parents, collaborators, speakers, contractors, etc.; access auditorium, exhibition areas, guest house, utility centre.
Guest Faculty & Transit Academics	Use the **Guest House** and **Faculty Transit Accommodation**; engage in teaching or collaborative events.
Children (Crèche Users)	Children of faculty, staff, or students; supported by the on-site **University Crèche** facility.
Community/Public Interface	Engage through open exhibitions, performances, or community outreach programmes; foster campus-community interaction.
Vendors / Retail Workers	Operate food kiosks, utility shops, banks, ATMs etc. within the **Convenience/Utility Centre**.
Sports & Cultural Participants	Use **indoor/outdoor sports facilities**, auditoriums, and performance spaces; includes students and outside invitees.

1.14 DESIGN BRIEF

Site: The site designated for the Ambedkar University Delhi (AUD) campus is located in Sector-3, Rohini, Delhi-110085, with a total area of approximately 7.3 hectares (73,000 sqm). The plot shape and boundary dimensions are as per the site plan issued by the Public Works Department (PWD), GNCTD, and are demarcated on-site.

Land Use: The land use is classified as Institutional, in accordance with the Master Plan for Delhi 2021. Development on the site is limited to educational and residential uses for the purpose of establishing a public university. Permissible built forms include academic buildings, administrative blocks, libraries, hostels, faculty and staff housing, recreational facilities, and support infrastructure. No commercial or industrial activities are permitted on the premises.

Division of Functions: The site will be divided functionally into the following zones: Academic/Institutional Zone, Campus-Level Common Facilities, and Residential Zone**.**

Specific clusters will be developed for:

- Central academic functions (classrooms, library, labs, workshops)
- Administrative offices
- Student life (auditorium, cafeteria, student centre, sports)
- Residential (hostels, faculty/staff housing, guest accommodation)
- Service and support areas, parking, and utility infrastructure will be planned integrally.

Site Coverage and FAR: As per DDA norms, the permissible Floor Area Ratio (FAR) is 225.

- Based on the site area of 73,000 sqm, the maximum permissible built-up area is approximately

164,250 sqm.

- The planned built-up area for Phase I **is** 167,680 sqm, including basements and non-FAR counted service areas.
- Ground coverage will follow norms of 30–35% for institutional blocks and 35–40% for residential components.

Plinth: The minimum plinth height shall be maintained as per PWD and DDA regulations, typically 450 mm to 600 mm, based on site drainage and flood risk assessment.

Parking Provision: Parking will be provided as per DDA norms:

- 1 ECS per 100 sqm of built-up area for institutional blocks.
- 1 ECS per residential unit.

Basement parking is planned for institutional and residential zones, along with surface parking for visitors and service vehicles.

Minimum 30% of built-up area will be allocated for parking and circulation, with integrated drop-off zones.

Basement: Provision for two levels of basement is planned for parking, utility services, HVAC systems, and storage. Basement layout will comply with fire safety, ventilation, and waterproofing standards.

Minimum Development Obligations (Project Deliverables): The campus must include:

- Minimum 90,000 sqm of institutional built-up space
- Minimum 46,000 sqm of residential facilities including hostels and housing
- Minimum 31,680 sqm of non-FAR basement and service space
- Key academic facilities: Library (10,500 sqm), Auditorium (4,000 sqm), Student Centre, and workshops/studios.
- Hostel capacity: Minimum 600 students (with gender and level-based split)
- Faculty/Staff Housing: Minimum 112 units + 20 transit rooms
- Crèche, Health Centre, Sports Facilities, and Utility Centres are mandatory

2. LITERATURE REVIEW

The proposed new campus for Ambedkar University Delhi (AUD) in Rohini, outlined in the Request for Proposal (RFP) from the Public Works Department (PWD) of Delhi, provides a clear plan for campus design that combines teaching goals, space use, and environmental care. This document is an important reference for understanding the challenges of planning and designing a higher education institution in a modern Indian city.

Ambedkar University aims to be a multi-campus institution based on the principles of equity, social justice, and interdisciplinary learning. The academic approach focuses on inclusiveness, open access to knowledge, and strong involvement in the humanities and social sciences. The campus is not just a place for education; it is designed to encourage open discussion, community involvement, and meaningful experiences for students, faculty, and society.

The site for the proposed development is in Sector-3, Rohini. It covers 7.3 hectares. Zoning rules set aside 70% of the land for institutional use and 30% for residential use. The design must follow the development control rules of the Master Plan of Delhi 2021. The total allowable built-up area is around 167,680 square meters. The proposal highlights the need to get approvals from several urban agencies, including DUAC, Delhi Jal Board, Delhi Fire Services, and the Central Pollution Control Board. The goal is to create a campus that meets local planning rules while also following global best practices in architecture and sustainability.

The program layout is organized into central, cluster-level, and school-specific zones. Central facilities include the library, IT complex, student center, auditorium, and administration block. These spaces will serve as 24/7 communal hubs for all campus users. Cluster-level planning is suggested for schools that focus on related themes, promoting collaboration and making the best use of resources. Each school will have its own identity with dedicated deans' offices, resource centers, and meeting spaces. The residential area, which takes up nearly one-fourth of the site, aims to encourage a communal way of living. It will combine faculty and student housing with shared amenities, like a community center, guest house, convenience stores, and play areas.

2.1 MODEL BUILDING BYELAWS (Delhi)-

A university campus is a dynamic and multifunctional environment conceived not only as a space for academic instruction, but as a collective framework for intellectual engagement, social integration, and cultural evolution. It is planned and designed to foster critical dialogue, interdisciplinary collaboration, and inclusive participation among diverse user groups, with the overarching goal of nurturing knowledge, innovation, and societal contribution.

2.1.1 Regulatory Standards for Public and Semi-public

3.10.1 General

Maximum ground coverage	30%
In hills	25%
Maximum floor area ratio	2.00
In hills	1.00
Maximum height	26 m.
In hills	15 m.

3.10.2 Government offices integrated office complex

Maximum ground coverage	30%
Maximum floor area ratio	2.00
In hills	1.00
Maximum height	37 m.
In hills	15 m.

Other Control:

i) The integrated office complex shall include Central Government Office, Local Government Office, Public Undertaking Offices and Courts.

ii) Basements up to the building envelope line to the maximum extent of plot area shall be allowed and if used for parking and services should not be counted in FAR.

Figure 8: Model Building Bye-laws, 2016, pg 42

2.1.2 Regulatory Standards for Colleges

Maximum ground coverage	35%
In hills	25%
Maximum floor area ratio	1.50
In hills	0.75
Maximum height	15 m.

Note:

1. In case of the above premises the total area of the plot shall be divided in
   i) School/college building area
   ii) Play field area
   iii) Parking area
   iv) Residential and hostel area

2. The maximum ground coverage and FAR shall be calculated only on the areas meant for building.

Table 3.9 Development Controls for Other Education Facilities

Sl. No	Category	Maximum		
		Ground Coverage	FAR	Height
1.	Play School, Coaching Centre, Computer Training Institute, Physical Education Centre etc.	N.A.	N.A.	N.A.
2	School for Mentally Challenged.	50%	1.20	18 mt.
3	School for*differently abled persons.	50 %	1.20	18 mt

Notes:

Pre-Primary Schools/Nursery Schools/Montessori Schools/Creche, Play Schools, may be permissible in residential use premises as per Mixed use policy.

Other Controls:

1. *In case of new schools, the front boundary wall shall be recessed by 6 mt. to accommodate visitors parking within setback area.*
2. *Playground shall be developed on pool basis in different areas at neighborhood level.*
3. *Practice of providing dedicated Nursery School plots in the layout plan discontinued as same is permissible in Mixed use.*
4. *In case of schools for mentally / *differently abled persons, 20% of the maximum Far can be utilized for residential use of essential staff and student accommodation.*

Figure 9: Model Building Bye-laws, 2016, pg 45

2.1.3 Regulatory Standards for Large Educational Campuses (Above 8 Hectares)

3.11.5 Education and Research Centre (large campus i.e. above 8 Ha.)

Large campuses of universities, medical and engineering colleges and other education and research institutes shall be covered under these regulations. The campus will be divided into three parts and the regulations shall apply, as given below:

i) Academic, including administration (45% of the total land area)

Maximum ground coverage	30%
In hills	20%
Maximum floor area ratio	1.20
In hills	0.80
Maximum height	37 m.
In hills	15 m.

Basement below the ground floor and to the maximum extent of ground coverage shall be allowed and if used for parking and services should not be counted in FAR.

ii) Residential (25% of total land area)

This will be developed at a density of 400 PPHa gross. The land shall be reserved for residential facilities @ 9.2 sqmt. per person. Sub-division regulations as given for group housing shall apply.

iii) Sports and Cultural Activities (15% of the total area)

Maximum ground coverage	10%
Maximum FAR	15

iv) *Parks and landscape* (15% of the total land area): Suitable landscape plan to be prepared for this area.

Figure 10: Model Building Bye-laws 2016, pg 45

2.1.4 Socio – Cultural Facilities

Sl.No	Category	Maximum			Other Controls
		Ground Coverage	FAR	Height	
1.	a. Multipurpose Community Hall. b. Banquet hall	30% 30%	1.20 1.20	26m 26m	1. Parking standard @3.0ECS/100sq m of floor area. 2. Other controls related to basements etc. are given at end of this chapter.
2.	a. Community Recreational Club. b. Recreational Club	30% 25%	1.20	26m	Parking standard @2ECS/100sq.m of floor area.
3.	Socio- cultural activities such as auditorium, music, dance & drama centre/mediation & spiritual centre etc.	35%	1.20	26m	1. Parking standard @ 2ECS/100sq.m of floor area. 2. A proper scheme for visitors parking and parking adequacy statement shall be prepared taking into consideration large number of visitors.
4.	Exhibition cum Fair Ground	20%	0.20	26m	Subject to statutory clearances.
5.	Science centre	30%	1.20	NR,	Parking standard @2ECS.
6.	International Convention Centre	30%	1.20	Subject to approval of AAI, Fire Department and other statutory bodies	Parking standard @2ECS.

Notes:

i.In case of community recreational clubs, 0.50 FAR shall be admissible on the area beyond 2000 sqm.

ii.In the open area apart from outdoor games/sport facilities, swimming pool would be permissible upto an area of 300sqm. Free from ground coverage.

iii.Basement within the ground envelope shall be allowed for parking, stilt floor for parking is permissible.

iv.30% of basement area for services, storage shall not be counted in FAR.

Figure 11: Model Building Bye-laws 2016, pg 48

2.1.5 Creche/Day Care Facilities

As per factories Act, 1948 a Creche/Day care facility has to be provided for any organization/establishment employing more than 15 women for their kids upto the age of 5.

a) The height of the rooms shall be not less than 3.6 metres from the floor to soffit and there shall not be less than 1.86 sqm of floor area / child to be accommodated and maintaining adequate ventilation by the circulation of fresh air.
b) There is a minimum of one toilet and one wash hand basin for every 10 children over the age of two years.
c) The minimum staffing ratios for care shall be 1:4 children.
d) Monitoring - There is a necessity of minimum two supervisor on continuous duty.

2.1.6 General Building Requirements and Services

2.1.6.1 Understanding Occupant Load Standards for Different Building Types

This part sets out the standard space requirements of various parts of a building (for all types of buildings – low/ high rise).

Table 4.1 Occupant Load

Sl.No.	Type of Occupancy	Occupant Load per 100 sq m. of Plinth or Covered Area
1	Residential	8.0
2	Educational	25.0
3	Institutional	6.60
4	Assembly with fixed or loose seats and dance floor without seating facilities including dining rooms	 166.6 66.6
5	Mercantile street floor and sales basement upper sale floor	 33.3 16.6
6	Business and industrial	10.0
7	Storage	3.3
8	Hazardous	10.0

* *The occupant load in dormitory portions of homes for the aged, orphanages or mental hospitals etc. where sleeping accommodation is provided shall be calculated at not less than 13.3 persons per 100 sq.m.*

** *The plinth or covered area shall include, in addition to the main assembly room or space, any occupied connecting room or space in the same storey or in the storeys above or below where entrance is common to such rooms and space and the area available for use by the occupants of the assembly place. No deduction shall be made in the plinth/covered area for corridors, closets and other sub-divisions; that area shall include all space serving the particular assembly occupancy.*

Figure 12: Model Building Bye-laws 2016, pg 51

2.1.7 Ramps

a) The ramp to basement and parking floors shall not be less than 7.2m wide for two way traffic and 4 m wide for one way traffic, provided with Gradient of 1:10 for cars and 1:15 for heavy vehicles. At curved portions of the ramp or for circular ramps the slope should not be more than 1:12.

b) Ramps may also be provided in the setbacks which can be sloped considering unhindered movement of fire engine and in no case the gradient shall be less than 1:10.

2.1.8 Provision of Podium for parking and landscaping

In case the buildings are to be constructed with stilt floor on individual plot for providing parking space and where basement could not be approached for parking, in such cases a podium may be constructed on ground floor in continuation of the stilt floor having access from the front for the parking after

leaving minimum 3m setback from the plot line. The terrace of podium may be used for plantation & landscaping. For low rise development, the maximum height permitted is 15mts. However where the stilt floor is to be constructed for parking the height may be increased to 17.5 mtr.

2.1.9 Water requirement and facilities

Sl. No.	Type of Occupancy	Consumption per head per day (in lt.)
1.	Residential	
	a) In living units	135
	b) Hostels	135
	c) Hotels with lodging accommodation (per bed)	180
	d) Hotels (5 star and above)	340
2.	Educational	
	a) Day schools	45
	b) Boarding Schools	135
3.	Institutional (Medical Hospitals)	
	a) No. of beds not exceeding 100	340
	b) No. of beds exceeding 100	450
	c) Medical quarters and hostels	135
4.	Assembly- Cinema theatres, auditoria, etc. (per seat accommodation)	15
5.	Government or Semi public business	45
6.	Segregated toilet facilities for Visitors in Public Buildings	
	a) Each use of toilet (including washing hands and floors)	7
	b) Flushing urinals	0.20
7.	Mercantile (Commercial)	
	a) Restaurants (per seat)	70
	b) Other business building	45
8.	Industrial	
	a) Factories where bath-rooms are to be provided	45
	b) Factories where bath-rooms are not to be provided	30
9.	Storage (including Warehouses)	30
10.	Hazardous	30
11.	Intermediate Stations (excluding mail and express stops).	45 (25)*
12.	Junction Station	70 (45)*
13.	Terminal Stations	45
14.	International and Domestic Airports	70

* The values in parenthesis are for such stations, where bathing facilities are not provided.

Note: *The number of persons for Sl. No. 11 to 14 shall be determined by the average number of passenger handled by the station daily with due consideration given to the staff and workers likely to use the facilities.*

Figure 13: Per Capita water requirement for various Occupancies/Uses (Model Building Bye-laws 2016, pg 70)

Table 4.7 Flushing Storage Capacities

Sl. No.	Classification of Building	Storage Capacity
1.	For tenements having common convenience	900 lt. net per w.c. seat
2.	For residential premises other than tenement having common conveniences	270 lt. net for one w.c. seat each and 180 lt. for each additional seat in the same flat.
3.	For factories and workshops	900 lt. per w.c. seat and 180 lt. per urinal.
4.	For cinemas, public assembly hall, etc.	900 lt. per w.c. seat and 350 lt. per urinal.

Table 4.8 Domestic Storage Capacities

Sl. No.	No. of Floors	Storage Capacity	Remarks
For premise occupied tenements with common conveniences:			
1.	Ground floor	Nil	Provided down take fittings are installed
2.	Floors 2, 3,4, 5 and upper floors	500 litre per tenement	
For premises occupied as flats or blocks			
1.	Ground floor	Nil	Provided down take fittings are installed
2.	Floors 2, 3, 4, 5 and upper floors	500 litre per tenement	

Note: *1. If the premises are situated at a place higher than the road level in front of the premises, storage at ground level shall be provided on the same lines as on floors.*

2. The above storage may be permitted to be installed provided that the total domestic storage calculated on the above basis is not less than the storage calculated on the number of down take fittings according to scale given below:

Down take taps	*70 l. each*
Showers	*135 l. each*
Bathtubs	*200 l. each*

Figure 14: Model Building Bye-laws 2016, pg 71

Table 4.11 Sanitation Requirements for Educational Occupancy

Sl. No.	Sanitary Unit	Boarding Institution		Other Educational Institution	
		For Boys	For Girls	For Boys	For Girls
1.	Water Closet (W.C.)	One for 8 boys or part thereof	One for 6 girls or part thereof	One for 40 boys or part thereof	One for 25 girls or part thereof
2.	Ablution Taps	One in each W.C.	One in each W.C.	One in each W.C.	One in each W.C.
3.	Urinals	One per every 25 pupils or part thereof	--	One per every 20 pupils or part thereof	--
4.	Wash Basins	One for every 8 pupils or part thereof	One for every 6 pupils or part thereof	One for every 60 pupils or part thereof	One for every 40 pupils or part thereof
5.	Baths	One for every 8 pupils or part thereof	One for every 6 pupils or part thereof	--	--
6.	Drinking Water Fountains	One for every 50 pupils or part thereof	One for every 50 pupils or part thereof	One for every 50 pupils or part thereof	One for every 50 pupils or part thereof
7.	Cleaner's Sink	One per Floor minimum	One per Floor minimum	One per Floor minimum	One per Floor minimum

Note:

1. *One water tap with draining arrangements shall be provided for every 50 persons or part thereof, in the vicinity of water closets and urinal.*
2. *For teaching staff, the schedule of sanitary units to be provided shall be the same as in case of office buildings (Table 5.10).*

Figure 15: Model Building Bye-laws 2016, pg 73

2.1.10 Minimum room size and height requirement for educational buildings

2.1.10.1 Height

The height of all rooms for human habitation shall not be less than 2.75 m measured from the surface of the floor to the lowest point of the ceiling (bottom of slab) provided that the minimum clear headway under any beam shall not be less than 2.4 m. In the case of pitched roof, the average height of rooms shall not be less than 2.75 m. The minimum clear head room under a beam, folded plates or eaves shall be 2.4 m. In the case of air-conditioned rooms, a height of not less than 2.4 m measured from the surface of the floor to the lowest point of air-conditioning duct or the false ceiling shall be provided.

2.1.10.2 Size

The area of habitable room shall not be less than 9.5 m2, where there is only one room with a minimum width of 2.4 m. Where there are two rooms, one of these shall not be less than 9.5 m2 and the other not less than 7.5 m2, with a minimum width of 2.1 m.

2.1.11 Bathroom and Water – Closets

2.1.11.1 Height

The height of a bathroom or water-closet measured from the surface of the floor to the lowest point in the ceiling (bottom of slab) shall not be less than 2.1 m.

2.1.11.2 Size

The area of a bathroom shall not be less than 1.8 m2 with a minimum width of 1.2 m. The floor area of water-closet shall be 1.1 m2 with a minimum width of 0.9 m. If bath and water-closet are combined, its floor area shall not be less than 2.8 m2 with a minimum width of 1.2 m.

2.1.11.3 Other Requirements

Every bathroom or water-closet shall:

a) be so situated that at least one of its walls shall open to external air;

b) not be directly over or under any room other than another water-closet, washing place, bath or terrace, unless it has a water-tight floor;

c) have the platform or seat made of water-tight non-absorbent material;

d) be enclosed by walls or partitions and the surface of every such wall or partition shall be finished with a smooth impervious material to a height of not less than 1 m above the floor of such a room;

e) be provided with an impervious floor covering, sloping towards the drain with a suitable grade and not towards VERANDAH or any other room; and

f) have a window or ventilator, opening to a shaft or open space, of area not less than 0.3 m2 with side not less than 0.3 m.

2.1.12 Basement Usage and Design Regulations

The following regulations govern the design, use, and construction of basements in accordance with the applicable Development Control Rules:

- Basements shall strictly not be used for residential purposes under any circumstances.

- Construction of basements shall be permitted only by the Competent Authority, subject to compliance with the designated **land use** and all relevant provisions specified in the Development Control Rules.
- Basements constructed **within the building envelope** and adhering to **maximum ground floor coverage norms** may be used for the following purposes only:
    a. **Storage** of household or other goods composed of ordinarily **non-combustible** materials.
    b. Use as **strong rooms, bank cellars**, and similar secure facilities.
    c. Installation of **air-conditioning equipment** and other mechanical systems or utilities that serve the building.
    d. Provision of **vehicular parking spaces**.
- All basements must meet the following structural and safety requirements:
    a. A **minimum height of 2.4 meters** shall be maintained from the basement floor to the underside of the roof slab or ceiling.
    b. **Adequate ventilation** must be provided in accordance with the occupancy type. If natural ventilation is insufficient, **mechanical ventilation systems** such as exhaust fans or blowers must be installed.
    c. The **ceiling height** above the average surrounding ground level shall be **not less than 0.9 meters and not more than 1.2 meters**.
    d. Proper **surface drainage systems** shall be installed to prevent rainwater or surface runoff from entering the basement.
    e. The **walls and floors** of the basement shall be **watertight** and designed to withstand soil pressure and moisture. Adequate **damp-proofing treatments** shall be incorporated.
    f. **Access to the basement** must be separate from the main and alternative staircases that serve the upper floors.
    g. Where staircases are continuous across multiple floors, they must be of the **enclosed type, effectively serving as a fire separation** between the basement and upper floors. Open ramps for basement access may be permitted within the building line, subject to drainage provisions mentioned in (d).
    h. **Exit provisions** from the basement must comply with **Part 4 – Fire and Life Safety** of the building code.

2.1.13 Septic Tanks

2.1.13.1 Design, Location, and Construction Standards

In accordance with the Model Building Bye-Laws, 2016 (TCPO) and NBC 2005 (Part 9: Plumbing Services), the construction and placement of septic tanks for sewage disposal must adhere strictly to the following guidelines to ensure public health, hygiene, and structural safety.

2.1.13.2 Location of Septic Tanks and Subsurface Absorption Systems

- Septic tanks must not be located closer than 18 meters from any source of drinking water (e.g., wells), ensuring protection from bacterial contamination of groundwater.
- The tank must be at least 6 meters away from the nearest habitable structure, or as far as possible within economic constraints, to prevent damage and odor nuisance (Model Bye-Laws, 2016, Clause 4.15.1).

2.1.13.3 Dimensional and Material Requirements

Minimum internal dimensions:

- Width: 750 mm
- Depth below water level: 1 meter
- Liquid holding capacity: 1 cubic meter
- The length of the septic tank should be 2 to 4 times its width.
- Tanks can be constructed from brickwork, stone masonry, concrete, or other approved materials (Clause 4.15.2a & b).

2.1.13.4 Effluent Disposal Regulations

- Effluent must not be discharged into open drains or water bodies without adequate treatment to avoid environmental pollution (Clause 4.15.2c).
- The minimum pipe diameter for outlets must be 100 mm, and the direction of flow in junctions should not exceed an angle of 45° from the main flow line (Clause 4.15.2d).

2.1.13.5 Drainage Gradient and Ventilation

- Gradient of dispersion trenches and under-drainage should lie between 1:300 and 1:400 (Clause 4.15.2e).
- Every septic tank must include a ventilation pipe (minimum diameter 50 mm) with a **mosquito-proof wire mesh cover.
- The pipe should extend:
- 2 m above ground level if tank is 15 m or more from any building.
- 2 m above the building roofline if tank is closer than 15 m (Clause 4.15.2f).

2.1.13.6 Seepage Pit Design (if used for Effluent Disposal)

Pits should have:

- Minimum cross-sectional dimension of 0.90 m
- Minimum depth of 1.00 m below inlet pipe
- Lining materials: Stone, brick, or concrete blocks with **dry joints, backed with **75 mm gravel.
- For large pits, top portion may be narrowed to minimize RCC slab size.
- Near trees or where unlined pits are used, pit should be filled with loose stones.
- Masonry ring to prevent surface flooding and anti-mosquito inlet pipe drop of 0.90 m should be provided (Clause 4.15.2g).

2.1.13.7 Dispersion Trench Alternative

Trench dimensions:

- Depth: 0.50 m – 1.00 m
- Width: 0.30 m – 1.00 m
- Length: Not more than 30 m
- Spacing between trenches: Minimum 1.8 m
- Trenches should be laid on a gentle gradient, lined with **150 mm to 250 mm of washed gravel, and contain **open-jointed earthenware or concrete pipes (diameter 75 mm to 100 mm) (Clause 4.15.2h).

2.1.14 Staircase/ Exit Requirements

4.17 Staircase/Exit Requirements

4.17.1 The minimum clear width, minimum tread width and maximum riser of staircases for buildings shall be as given as below (*see also* Part 4 'Fire and Life Safety of NBC 2005).

4.17.2 Minimum width

The minimum width of staircase shall be as follows:

A	Residential buildings (dwellings) NOTE — For row housing with 2 storeys, the min. width of shall be 0.75	1.0 m
B	Residential hotel buildings	1.5 m
C	Assembly buildings like auditoria, theatres and cinemas	2.0 m
D	Educational building	1.5 m
E	Institutional buildings	2.0 m
F	All other buildings	1.5 m

4.17.3 Minimum tread

The minimum width of tread without nosing shall be 250 mm for residential buildings. The minimum width of tread for other buildings shall be 300 mm.

4.17.4 Maximum riser

4.17.4.1 The maximum height of riser shall be 190 mm for residential buildings and 150 mm for other buildings and these shall be limited to 12 per flight.

4.17.4.2 The minimum head-room in a passage under the landing of a staircase shall be 2.2 m. The minimum clear head-room in any staircase shall be 2.2 m.

4.17.5 Exit Requirements

All aspects of exit requirements for corridors, doors, stair cases, ramps, etc in respect of widths, travel distance shall be as per Part 4 'Fire and Life Safety' of NBC,2005.

Figure 16: Model Building Bye-laws 2016, pg 57

2.1.14.1 Types of Exits

a) Permissible Exit Types:

Exits may be of horizontal or vertical type, and include:

- Doorways
- Corridors and passages
- Internal staircases
- External staircases
- Ramps to verandas
- Terraces with access to a street

Horizontal exits connecting to adjoining buildings on the same level

b) Not Considered as Exits:

These do not qualify as exit routes for fire safety purposes.

- Lifts,
- Escalators, and
- Revolving doors

2.1.14.2 Wheelchair Accessibility

At least one primary entrance to every building shall be accessible to individuals using wheelchairs and clearly marked with signage. That entrance should be located on a level that also provides elevator access for unhindered vertical movement.

2.1.14.3 Arrangement of Exits

When designing university or institutional campuses (like AUD Rohini), the arrangement of exits must follow these guidelines to ensure efficient and safe evacuation during emergencies:

a) Exit Placement and Travel Distance:

For all academic buildings, hostels, libraries, and auditoriums: The maximum walking distance from any point on a floor to the nearest exit must not exceed:

- 22.5 meters for residential (e.g., hostels) and educational/institutional buildings (e.g., classrooms, admin blocks).
- 30.0 meters for assembly spaces (e.g., auditoriums), office zones, cafeterias, or storage areas.
- Where more than one exit is required (e.g., in larger blocks or floors):
- Exits must be spaced as far apart as possible, creating multiple safe escape paths.
- Every part of the floor should have clear and direct access to at least one exit.

b) Distance from Remote Points:

For campus buildings with larger floor plates (like libraries or lecture halls):

- The distance from the most remote corner to an exit should not exceed half of the permitted maximums.
- For educational/institutional use: 11.25 meters
- For assembly/business/office use: 15.0 meters
- Exception: For buildings housing vulnerable populations (e.g., medical, or special needs blocks), the maximum travel distance from remote points must not exceed 6.0 meters.

2.1.15 Roof Drainage and Rainwater Management

(As per Model Building Bye-Laws, 2016, TCPO – Section 4.18)

The roof of a building must be designed and constructed to effectively drain rainwater using appropriately sized and adequately placed rainwater pipes. These pipes should be arranged, jointed, and fixed in a manner that ensures water is carried away from the building without causing dampness to any part of the walls, roof, or foundations—either of the building itself or adjacent structures.

2.1.15.1 Connection Requirements:

Rainwater pipes may be mandated by the Authority to connect to a drain, sewer, or a covered channel formed beneath the public footpath to lead water directly to the road gutter or any other approved outlet system.

2.1.15.2 Pipe Placement:

Rainwater pipes must be fixed to the exterior of the building's walls, either exposed or recessed within grooves formed in the walls. Any alternative method must be pre-approved by the Authority.

2.1.16.3 Rainwater Harvesting Recommendation:

It is recommended to conserve rainwater using appropriate Rain Water Harvesting (RWH) techniques, including roof water collection systems. Reference should be made to Part 9, Plumbing Services, Section 1 of the National Building Code (NBC) 2005, for further technical guidelines.

3. MASTER PLAN DELHI 2021

Sl. No.	Category	Maximum			Other Controls
		Ground Coverage	FAR	Height	
1 2 3	Vocational Training Centre (ITI/Polytechnic / Vocational/ Training Institute/ Management Institute/ Teacher Training Institutes etc.) / Research and Development centre. General College Professional College (Technical)	35%	[1][225]	37 m	1. [2][Upto 30% of max. permissible FAR can be used for hostel accommodation for the students.] 2. Parking standard @ 1.33 ECS / 100 sq m of floor area. The areas earmarked for parking if misused liable to be municipalized / taken over by the authority. 3. Other controls related to basements etc. are given in the Development Code chapter.

Sl. No.	Category	Maximum			Other Controls
		Ground Coverage	FAR	Height	
4	University Campus including International Education Centre (IEC) – Large campus (10 ha and above) will be divided into following four parts: a) Academic including Administration (45% of total land area)	30%	[1][225]	37 m	1. Parking standard @ 1.33 ECS / 100 sq m of floor area. 2. Other controls related to basements etc. are given in the Development Code chapter. 3. Landscape plan to be prepared.
	b) Residential (25% of total land area)	1. Regulations for group housing shall apply. 2. The land shall be reserved for facilities as per residential norms.			
	c) Sports and Cultural activities (15%)	10%	15	26 m	
	d) Parks and Landscape (15%)	N. A.			

4. DELHI DEVELOPMENT AUTHORITY

4.1 Environmental Conditions For Buildings And Constructions

(Category '3': 50000 to 150000 m2)

MEDIUM	S.N.	ENVIRONMENTAL CONDITIONS
Topography and Natural Drainage	1	The natural drain system should be maintained for ensuring unrestricted flow of water. No construction shall be allowed to obstruct the natural drainage through the site. No construction is allowed on wetland and water bodies. Check dams, bio- swales, landscape, and other sustainable urban drainage systems (SUDS) are allowed for maintaining the drainage pattern and to harvest rain water. Buildings shall be designed to follow the natural topography as much as possible. Minimum cutting and filling should be done.
Water conservation - Rain Water Harvesting, and Ground Water Recharge	2	A complete plan for rain water harvesting, water efficiency and conservation should be prepared. The local bye-law provisions on rain water harvesting should be followed. If local bye-law provisions are not available, adequate provision for storage and recharge should be followed as per the Ministry of Urban Development Model Building Bye- laws, 2016. A rain water harvesting plan needs to be designed where the recharge bores of minimum one recharge bore per 5,000 square meters of built up area and storage capacity of minimum one day of total fresh water requirement shall be provided. In areas where ground water recharge is not feasible, the rain water should be harvested and stored for reuse. The ground water shall not be withdrawn without approval from the Competent Authority. All recharge should be limited to shallow aquifer.
	2(a)	At least 20% of the open spaces as required by the local building bye-laws shall be pervious. Use of Grass pavers, paver blocks with at least 50% opening, landscape etc. would be considered as pervious surface.
	2(b)	Use of water efficient appliances should be promoted. Low flow fixtures or sensors be used to promote water conservation.
	2(c)	Separation of grey and black water should be done by the use of dual plumbing system. In case of single stack system separate recirculation lines for flushing by giving dual plumbing system be done.
Solid Waste Management	3	Solid waste: Separate wet and dry bins must be provided in each unit and at the ground level for facilitating segregation of waste. The provisions of the Solid Waste (Management) Rules 2016 and the e-waste (Management) Rules 2016, and the Plastics Waste (Management) Rules 2016 shall be followed.
	3(a)	All non-biodegradable waste shall be handed over to authorized recyclers for which a written tie up must be done with the authorized recyclers.
	3(b)	Organic waste composter/Vermiculture pit with a minimum capacity of 0.3 kg/person/day must be installed.
Sewage Treatment Plant	4	Onsite sewage treatment of capacity of treating 100% waste water to be installed. Treated waste water shall be reused on site for landscape, flushing, cooling tower, and other end-uses. Excess treated water shall be discharged as per CPCB norms. Natural treatment systems shall be promoted. Sludge from the onsite sewage treatment, including septic tanks, shall be collected, conveyed and disposed as per the Ministry of Urban Development, Central Public Health and Environmental Engineering Organisation (CPHEEO) Manual on Sewerage and Sewage Treatment Systems, 2013.
Energy	5	Compliance with the Energy Conservation Building Code (ECBC) of Bureau of Energy Efficiency shall be ensured. Buildings in the States which have notified their own ECBC, shall comply with the State ECBC. Outdoor and common area lighting shall be LED. Concept of passive solar design that minimize energy consumption in buildings by using design elements, such as building orientation, landscaping, efficient building envelope, appropriate fenestration, increased day lighting design and thermal mass etc. shall be incorporated in the building design. Wall, window, and roof u-values shall be as per ECBC specifications.
	5(a)	Solar, wind or other Renewable Energy shall be installed to meet electricity generation equivalent to 1% of the demand load or as per the state level/ local building bye-laws requirement, whichever is higher.

	5(b)	Solar water heating shall be provided to meet 20% of the hot water demand of the commercial and institutional building or as per the requirement of the local building bye-laws, whichever is higher. Residential buildings are also recommended to meet its hot water demand from solar water heaters, as far as possible.
	5(c)	Use of environment friendly materials in bricks, blocks and other construction materials, shall be required for at least 20% of the construction material quantity. These include flyash bricks, hollow bricks, AACs, Fly Ash Lime Gypsum blocks, Compressed earth blocks, and other environment friendly materials. Fly ash should be used as building material in the construction as per the provisions of the Fly Ash Notification of September, 1999 as amended from time to time.
Air Quality and Noise	6	Dust, smoke & other air pollution prevention measures shall be provided for the building as well as the site. These measures shall include screens for the building under construction, continuous dust/ wind breaking walls all around the site (at least 3meter height). Plastic/tarpaulin sheet covers shall be provided for vehicles bringing in sand, cement, murram and other construction materials prone to causing dust pollution at the site as well as taking out debris from the site. Wheel washing for the vehicles used be done. Sand, murram, loose soil, cement, stored on site shall be covered adequately so as to prevent dust pollution. Wet jet shall be provided for grinding and stone cutting. Unpaved surfaces and loose soil shall be adequately sprinkled with water to suppress dust. All construction and demolition debris shall be stored at the site (and not dumped on the roads or open spaces outside) before they are properly disposed. All demolition and construction waste shall be managed as per the provisions of the Construction and Demolition Waste Rules 2016. All workers working at the construction site and involved in loading, unloading, carriage of construction material and construction debris or working in any area with dust pollution shall be provided with dust mask. For indoor air quality the ventilation provisions as per National Building Code of India.
	6(a)	The location of the DG set and exhaust pipe height shall be as per the provisions of the CPCB norms.
Green Cover	7	A minimum of 1 tree for every 80 sq.mt. of land should be planted and maintained. The existing trees will be counted for this purpose. Preference should be given to planting native species.
	7(a)	Where the trees need to be cut, compensatory plantation in the ratio of 1:3 (i.e. planting of 3 trees for every 1 tree that is cut) shall be done and maintained.
Top Soil Preservation and Reuse	8	Topsoil should be stripped to a depth of 20 cm from the areas proposed for buildings, roads, paved areas, and external services. It should be stockpiled appropriately in designated areas and reapplied during plantation of the proposed vegetation on site.
Transport	9	A comprehensive mobility plan, as per MoUD best practices guidelines (URDPFI), shall be prepared to include motorized, non-motorized, public, and private networks. Road should be designed with due consideration for environment, and safety of users. The road system can be designed with the basic criteria. 1. Hierarchy of roads with proper segregation of vehicular and pedestrian traffic. 2. Traffic calming measures. 3. Proper design of entry and exit points. 4. Parking norms as per local regulation.
Environment Management Plan	10	An environmental management plan (EMP) shall be prepared and implemented to ensure compliance with the environmental conditions specified in item number 1 to 9 above. A dedicated Environment Monitoring Cell with defined functions and responsibility shall be put in place to implement the EMP. The environmental cell shall ensure that the environment infrastructure like Sewage Treatment Plant, Landscaping, Rain Water Harvesting, Energy efficiency and conservation, water efficiency and conservation, solid waste management, renewable energy etc. are kept operational and meet the required standards. The environmental cell shall also keep the record of environment monitoring and those related to the environment infrastructure.

viii) A maximum of 50% of interior exit stairways are permitted to egress through an atrium on the level of exit discharge.

ix) Since the design of each atrium varies in many aspects, hence drawings for use of kiosks in Atrium shall be referred to Delhi Fire Service for approval.

x) The atrium usage shall not be more than 25% of the atrium floor and subject to above mentioned conditions.

Figure 17: Unified Building Byelaws Delhi-2016

4.2 Sanitation Requirements

4.2.1 Educational Occupancy

Table 9.6: Sanitation Requirements for Educational Occupancy

S.No	Sanitary Unit	Boarding Institution		Other Educational Institution	
		For Boys	For Girls	For Boys	For Girls
1.	Water Closet (W.C.)	One for every 8 pupils or part thereof	One for every 6 pupils or part thereof	One for every 25 pupils or part thereof	One for every 15 pupils or part thereof
2.	Ablution Taps	One in each W.C.	One in each W.C.	One in each W.C.	One in each W.C.
3.	Urinals	One per every 25 pupils or part thereof	--	One per every 20 pupils or part thereof	--
4.	Wash Basins	One for every 8 pupils or part thereof	One for every 6 pupils or part thereof	One for every 40 pupils or part thereof	One for every40 pupils or part thereof
5.	Baths	One for every 8 pupils or part thereof	One for every 6 pupils or part thereof	--	--
6.	Drinking Water Fountains	One for every 50 pupils or part thereof	One for every 50 pupils or part thereof	One for every 50 pupils or part thereof	One for every 50 pupils or part thereof
7.	Cleaner's Sink	One per Floor minimum	One per Floor minimum	One per Floor minimum	One per Floor minimum

Table 9.11: Sanitation Requirements for Assembly Occupancy Buildings (Cinema, Theatres, Auditoria, etc.) Gender Ratio 50 Male:50 Female

Sl. No.	Sanitary Unit	For Staff		For Public	
		Male	Female	Male	Female
1.	Water Closet And Urinal	1WC+2 Urinals/150 2WC's+3Urinals/150-300 2WCs+4Urinals/301-450 3WCs+5Urinals/451-600 3WCs+7Urinals/601-900 1WC+1 Urinal for every 150 thereafter	3WCs/150 6WC's/151-300 9WCs/301-450 12WCs/451-600 14WCs/601-900 1WC every 100 thereafter	One WC for 15 persons. Two WCs for 16-35 persons. Urinal: Nil up to 6 persons 1 for 7-20 persons 2 for 21-45 persons.	One WC for 1-12 persons. Two WCs for 13-25 persons.
2.	Ablution Taps	One in each WC	One in each WC	One in each WC	One in each WC
3.	Wash Basins	One for every 200 persons or part thereof. For over 400 persons, add @ 1 per 250 persons or part thereof.	One for every 200 persons or part thereof. For over 200 persons, add @ 1 per 150 persons or part thereof.	One for 1-15 persons. Two for 16-35	One for 1-12 persons Two for 13-25 persons.
4.	Cleaner's Sink	One per floor, minimum.			
5.	Drinking Water Fountain	One per 100 persons or part thereof.			

Note: *For male-female calculation a ratio of 1: 1 shall be assumed.*

Figure 18: Unified Building Byelaws Delhi-2016

Table:-9.12: Sanitation Requirements for Assembly Occupancy Buildings (Art, Galleries, Libraries and Museums)

Sl. No.	Sanitary Unit	For Public		For Staff	
		Male	Female	Male	Female
1	Water Closet (WC)	One for 200 persons up to 400 persons. For over 200 persons, add @ 1 per 250 persons or part thereof.	One per 100 persons up to 200 persons. For over 200 persons add @ 1 per 150 persons or part thereof.	One for 15 persons. Two for 16-35 persons.	One for 1-12 persons. Two for 13-25 persons.
2	Ablution Taps	One in each WC	One in each WC	One in each WC	One in each WC
3	Urinals	One for 50 persons or part thereof	------	Nil up to 6 persons 1 for 7-20 persons 2 for 21-45 persons	-----
4	Wash Basins	One for every 200 persons or part thereof. For over 400 persons, add @ 1 per 250 persons or part thereof.	One for every 200 persons or part thereof. For over 200 persons, add @ 1 per 150 persons or part thereof.	. One for 1-15 persons. Two for 16-35	One for 1-12 persons Two for 13-25 persons.
5	Cleaner's Sink	One per floor, minimum.			

4.2.2 Administrative Building

Table 9.7 (contd.): Administrative Buildings

S.No	Sanitary Unit	For Males	For Females
1	Water Closet (W.C.)	One for every 25 persons or part thereof	One for every 15 persons or part thereof
2	Ablution Taps	One in each W.C.	One in each W.C.
3	Wash Basins	One for every 25 persons or part thereof	One for every 25 persons or part thereof
4	Baths with Shower	One on each floor	One on each floor
5	Bed pan washing sink	--	--
6	Cleaner's Sink	One per floor minimum	One per floor minimum
7	Kitchen sinks & dish Washers (where Kitchen is provided)	One for each floor	One for each floor
8	Urinals	Nil up to 6 persons 1 for 7-20 persons 2 for 21-45 persons 3 for 46-70 persons 4 for 71-100 persons From 101 to 200 persons add at the rate of 3%; for over 200 persons add at the rate of 2.5%	--

4.2.3 Residential building

Table 9.10: Sanitation requirements for residencs

S.No.	Sanitary Unit	Dwelling with individual conveniences	Dwelling without individual conveniences.
1	Bath Room	One provided with water tap	One for every two tenement
2	Water Closet (WC)	One	One for every two tenement
3	Sink (or Nahani) in the Floor	One	-------
	Water Tap	One	One with drainage arrangement in each tenement. One in common bath rooms and common water closet.

Note:

Where only one water closet is provided in a dwelling, the bath and water closet shall be separately accommodated.

4.3 Provisions for Green Buildings

4.3.1 Provisions and applicability for various plot sizes

Category of Plot Sizes (sq.m.)	Category of Plot Sizes (sq.m.)	Provisions for Green Building (as per Clause 10.2)
I	up to105	Optional usage of 2 (a), 2(b).
II	105 to 500	1(a), 2(a),2(b), 4(a)
	500 to 1,000	1(a), 1(c), 2(a),2(b), 4(a)
	1,000 to 3,000	1(a), 1(c), 1(d), 2(a),2(b), 3(b), 4(a)
III	Above 3,000	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3(a), 3(b), 4(a), 4(b)

Notes:

**The schemes/ projects formulated on the basis of provisions given in Master plan/ Zonal Development Plan will require approval as indicated:*

{Chapter 3 of these Bye-Laws, NBC (latest), ECBC 2007 or latest, BEE Star rating/ IGBC/ GRIHA Certification}

***EIA**- Environmental Impact Assessment Study Report, **ECC**- Environmental Clearance Certificate, **MoEF** – Ministry of Environment and Forest,**NBC** – National Building Code, **ECBC** – Energy Conservation Building Code, **BEE** – Bureau of Energy Efficiency, **LEED**– Leadership in Energy and Environment Design, **IGBC** – Indian Green Building Council, **GRIHA**– Green Rating for Integrated Habitat Assessment, **TERI** – The Energy and Resources Institute.*

The prevailing provisions of the above shall be applicable. However if there are any modification in the same, the modified provisions shall become automatically applicable.

10.2 **Provisions for Sanction:**

(As per Annexure – X)

1. Water Conservation and Management
   a. Rain Water Harvesting (by Recharge)
   b. Low Water Consumption Plumbing Fixtures
   c. Waste Water Recycle and Reuse
   d. Reduction of hardscape
2. Solar Energy Utilization
   a. Installation of Solar Photovoltaic Panels
   b. Installation of Solar Assisted Water Heating Systems
3. Energy Efficiency
   a. Low Energy Consumption Lighting Fixtures (Electrical Appliances – BEE Star and Energy Efficient Appliances)
   b. Energy Efficiency in HVAC systems
4. Waste Management
   a. Segregation of Waste
   b. Organic Waste Management

5. NATIONAL BUILDING CODES (NBC)

5.1 Educational building fire prevention

a) Buildings intended for educational occupancy shall not be used for storage of any hazardous material.

b) Gymnasiums, indoor stadiums and similar occupancies are permitted to have floors/ running tracks of wood, cinder, synthetic or the like.

5.1.1 Life safety provisions for educational buildings

6.2.2 *Life Safety*

a) Every room with a capacity of over 45 persons in area shall have at least two doorways. Exit doors shall be operated by panic bars except that doors leading from classrooms directly to the outside may be equipped with the same type of lock as is used on classroom doors leading to corridor, with no provision whatsoever for locking against egress from the classroom.

b) A building, which will have only the first floor and is accessible to not more than 20 pupils at any time, may be used for school purposes with the following exceptions:

1) Exterior walls or parts of walls which are less than 900 mm from adjacent property lines shall have no openings therein.

2) Classrooms may have only one exit not less than 900 mm wide.

d) Of the minimum exits as specified in **4.4.2.4.3.1**, the naturally ventilated exit staircases, may not require provision of fire door. However, fire door shall be provided for all other staircases and pressurized staircases.

6.2.3 *Additional Precautions*

a) Storage of volatile flammable liquids shall be prohibited and the handling of such liquids shall be restricted to science laboratories only.

b) All exterior openings in a boiler room or rooms containing central heating equipment,

5.1.2 Life safety provisions for Assembly buildings

6.4.2 *Life Safety*

6.4.2.1 The following shall be applicable:

a) Exit door width for assembly buildings shall not be less than 2.0 m.

b) Every place of assembly of sub-division D-1 shall have at least four separate exits as remote from each other as practicable.

c) Every place of assembly of sub-division D-2 shall have at least two separate exits as remote from each other as practicable and if of capacity over 600, at least three exits shall be provided with each exit not less than of 2.0 m width.

d) Clear aisles not less than 1.2 m in width shall be formed at right angles to the line of seating in such number and manner that no seat shall be more than seven seats away from an aisle. Rows of seats opening on to an aisle at one end only shall have not more than seven seats. Under the conditions, where all these aisles do not directly meet the exit doors, cross-aisles shall be provided parallel to the line of seating so as to provide direct access to the exit, provided that not less than one cross aisle for every 10 rows shall be required. The width of cross-aisles shall be minimum of 1 m. Steps shall not be placed in aisles to overcome differences in levels, unless the gradient exceeds 1 in 10.

5.2 Types of Exits

a) Permissible Exit Types:

Exits may be of horizontal or vertical type, and include:

- Doorways
- Corridors and passages
- Internal staircases
- External staircases
- Ramps to verandas
- Terraces with access to a street

Horizontal exits connecting to adjoining buildings on the same level

b) Not Considered as Exits:

These do not qualify as exit routes for fire safety purposes.
- Lifts,
- Escalators, and
- Revolving doors

5.2.1 Wheelchair Accessibility

At least one primary entrance to every building shall be accessible to individuals using wheelchairs and clearly marked with signage. That entrance should be located on a level that also provides elevator access for unhindered vertical movement.

5.2.2 Arrangement of Exits

When designing university or institutional campuses (like AUD Rohini), the arrangement of exits must follow these guidelines to ensure efficient and safe evacuation during emergencies:

a) Exit Placement and Travel Distance:

For all academic buildings, hostels, libraries, and auditoriums: The maximum walking distance from any point on a floor to the nearest exit must not exceed:

- 22.5 meters for residential (e.g., hostels) and educational/institutional buildings (e.g., classrooms, admin blocks).
- 30.0 meters for assembly spaces (e.g., auditoriums), office zones, cafeterias, or storage areas.
- Where more than one exit is required (e.g., in larger blocks or floors):
- Exits must be spaced as far apart as possible, creating multiple safe escape paths.
- Every part of the floor should have clear and direct access to at least one exit.

b) Distance from Remote Points:

For campus buildings with larger floor plates (like libraries or lecture halls):

- The distance from the most remote corner to an exit should not exceed half of the permitted maximums.
- For educational/institutional use: 11.25 meters
- For assembly/business/office use: 15.0 meters
- Exception: For buildings housing vulnerable populations (e.g., medical, or special needs blocks), the maximum travel distance from remote points must not exceed 6.0 meters.

5.3 Roof Drainage and Rainwater Management

(As per Model Building Bye-Laws, 2016, TCPO – Section 4.18)

The roof of a building must be designed and constructed to effectively drain rainwater using

appropriately sized and adequately placed rainwater pipes. These pipes should be arranged, jointed, and fixed in a manner that ensures water is carried away from the building without causing dampness to any part of the walls, roof, or foundations—either of the building itself or adjacent structures.

5.4 Campus Buildings as Per NBC 2016 And Delhi Bye-Laws

Parameter	Standard/Limit	Source	Remarks
FAR (General)	1.5 – 2.25	NBC 2016 – Part 3	
FAR (Delhi – Institutional)	2.25 (225%)	UBBL Delhi 2016 / MPD-2021	Confirmed in site RFP for AUD
Ground Coverage	30–35%	NBC 2016 – Part 3 / UBBL Delhi	Typical for institutional campuses
Setbacks	6 meters minimum	NBC 2016 / UBBL Delhi	For fire tender movement and ventilation
Basement (FAR Exemption)	Not included in FAR	NBC 2016 – Part 3	Allowed for parking/services only
Open Space (Recreational)	15–25% of site area	NBC 2016 – Part 3	Mandatory for campuses
Building Height	Subject to FAR + fire rules	NBC 2016 / Fire Dept.	No fixed height cap if fire NOC obtained

5.4.1 Comparative FAR for occupancies facing one public street of atleast 9mt width

(*Foreword*, *Clauses* 2.26, 9.2 *and* 9.2.1)

Sl No.	Occupancy Classification	Type of Construction			
		Type 1	Type 2	Type 3	Type 4
(1)	(2)	(3)	(4)	(5)	(6)
i)	Residential	UL	2.0	1.4	1.0
ii)	Educational	UL	2.0	1.4	1.0
iii)	Institutional	UL	1.5	1.0	0.8
iv)	Assembly	UL	1.0	0.7	0.5
v)	Business	UL	2.9	2.3	1.6
vi)	Mercantile	8.0	1.8	1.4	1.0
vii)	Industrial	7.5	1.9	1.6	1.3
viii)	Storage (*see* Note 4)	6.0	1.5	1.3	1.0
ix)	Hazardous (*see* Note 4)	2.8	1.1	0.9	NP

UL – Unlimited.
NP – Not Permitted.

5.4.2 Minimum requirement for fire-fighting installations

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
EDUCATIONAL BUILDINGS (B) (*see* Note 16)													
1)	Less than 15 m in height												
	i) Ground plus one or more storeys	R	R	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	10 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
2)	15 m and above but not exceeding 24 m in height	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	25 000	NR	900
3)	Above 24 m but not exceeding 30 m in height	R	R	R	NR	R	R (*see* Note 4)	R	NR	50 000	(5 000) (*see* Note 6)	(*see* Note 14)	NR

5.5 Standards for Building access width and open spaces

For all assembly buildings like, theatres, cinema houses, assembly halls, stadia; educational buildings; markets, hospitals; industrial buildings and other buildings which attract large crowd, the means of access shall not be less than the following:

Sl No.	*Width of Means of Access* m	*Length of Means of Access* m
i)	12.0	200
ii)	15.0	400
iii)	18.0	600
iv)	24.0	above 600

12.2.1.1 The requirements of **12.2.1** apply to residential, business and mercantile buildings. For educational and industrial buildings, the following minimum requirements apply :

a) Educational buildings : Ceiling height 3.6 m for all regions; in cold regions, 3 m

a) *Educational buildings* — Except for nursery schools, the open spaces around the building shall be not less than 6 m.

b) *Institutional buildings* — The open spaces around the building shall be not less than 6 m.

c) *Assembly buildings* — The open space at front shall be not less than 12 m and the other open spaces around the building shall be not less than 6 m.

NOTE — However, if assembly buildings are permitted in purely residential zones, the open spaces around the building shall be not less than 12 m.

5.6 Area division

2) University campus

Area:	10.00 ha to 60.00 ha
i) Residential (if included) area	25 percent of total land area
ii) Sports and cultural activities	15 percent of total land area
iii) Parks and landscape including green belt	15 percent of total land area

5.7 Auditorium Design

The auditorium is the heart of building, where the primary activity of experiencing and presenting performances take place. Audience seating is arranged to view the stage and the stage is a platform from which the performer can be communicate to the audience. The relationship between the two is very crucial for the success of convention centres. Mostly auditorium is designed to fulfil no of purposes. The objective of designer will be to use 100% usage of space. Auditorium should be designed in such a way that every member should be able to see and hear the performance of stage.

The three-dimensional volume of an auditorium is conditioned by the need for all members of the audience to be able to see the whole of the platform or stage: and to hear the actor, singer, musician, or speaker. Seating density, floor rake and seating layout are partly determined by this, partly to give the audience an appropriate level of comfort and essentially to ensure a means of escape in an emergency. Fire, within the time required by safety considerations and by legislation.

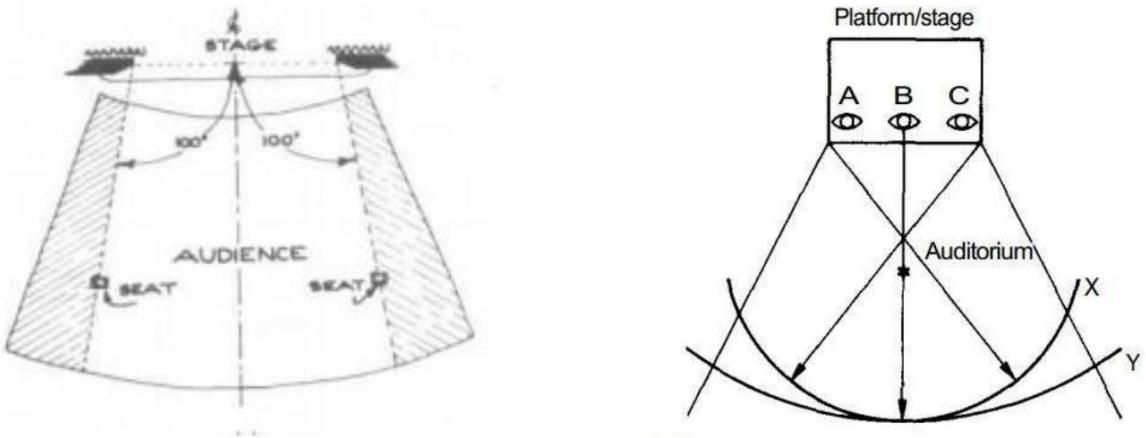


Figure 19: Auditorium View Direction

5.7.1 Audience Requirements

Every member of the audience should be able to see and hear clearly whatever is happening on every part of the stage or platform. The greater the encirclement of the audience of the platform or stage, the more people can be accommodated within the aural and visual limitations up to 180° encirclement. With a full encirclement, the distance from the platform or stage is restricted to six rows.

Proportions of the auditorium these are derived from the psychological awareness and angle of view of the spectator, or the requirement for a good view from all seats. Options are:

1. Good view, without moving head, but light eye movements of approx. 30°.
2. Good view with slight head movements and light eye movements of approx. 60°.
3. Max. Awareness angle without head movement approx. 110°, i.e., all actions in the field are 'in view'. Outside this field, there is uncertainty, because 'something' is out of view.
4. Full head and shoulder movement allows an angle of view of 360°.

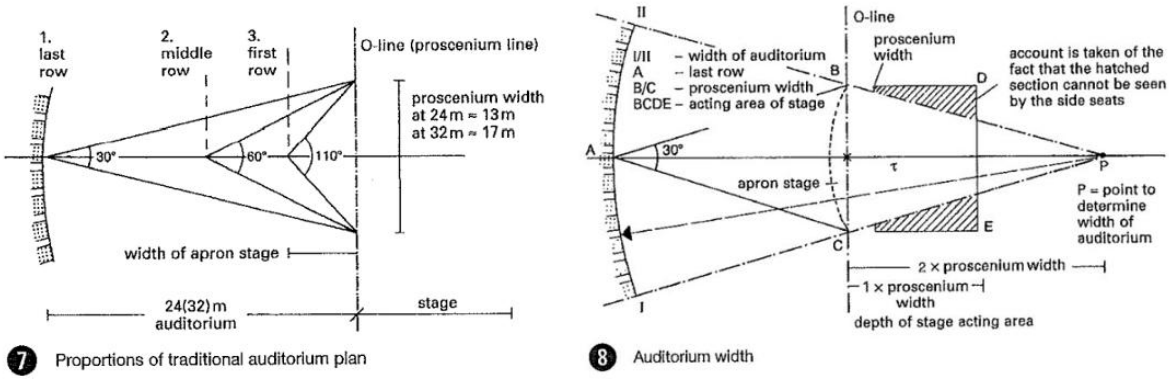


Figure 20: Neufert 4th Edition, pg 211

Proportions of the classic auditorium Opera, multi-purpose theatre, and traditional playhouse -7 0: distance of the furthest row from the start of the stage should not exceed: -

Playhouse, max. 24 m (max. distance for the recognition of facial expressions); Opera, 32 m (large movements are still recognisable).

Auditorium width is determined by the spectators at the side being able to see the stage adequately -8. The theatre situation is fundamentally one of the relationships between the performers and the audience. The audience wants to hear and see the show without distraction and in comfort and safety, as stated, but its ultimate objective in attending the show is to receive the utmost sensory stimulation toward the maximum emotional and intellectual experience.

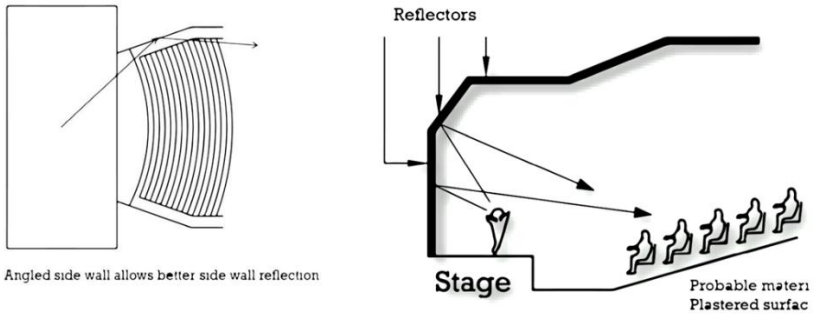
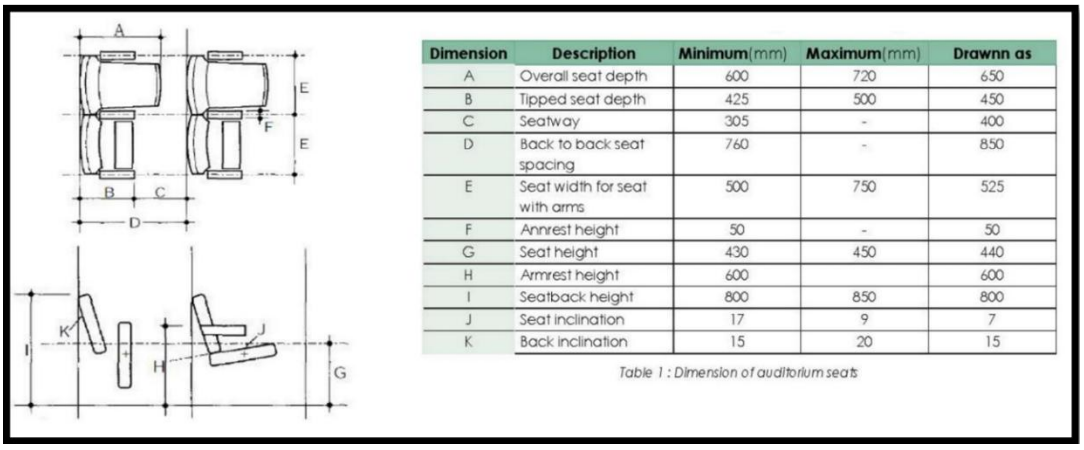


Figure 21: Auditorium Design Concept



Dimension	Description	Minimum(mm)	Maximum(mm)	Drawnn as
A	Overall seat depth	600	720	650
B	Tipped seat depth	425	500	450
C	Seatway	305	-	400
D	Back to back seat spacing	760	-	850
E	Seat width for seat with arms	500	750	525
F	Annrest height	50	-	50
G	Seat height	430	450	440
H	Armrest height	600		600
I	Seatback height	800	850	800
J	Seat inclination	17	9	7
K	Back inclination	15	20	15

Table 1 : Dimension of auditorium seats

Figure 22: Dimension of Auditorium Seat

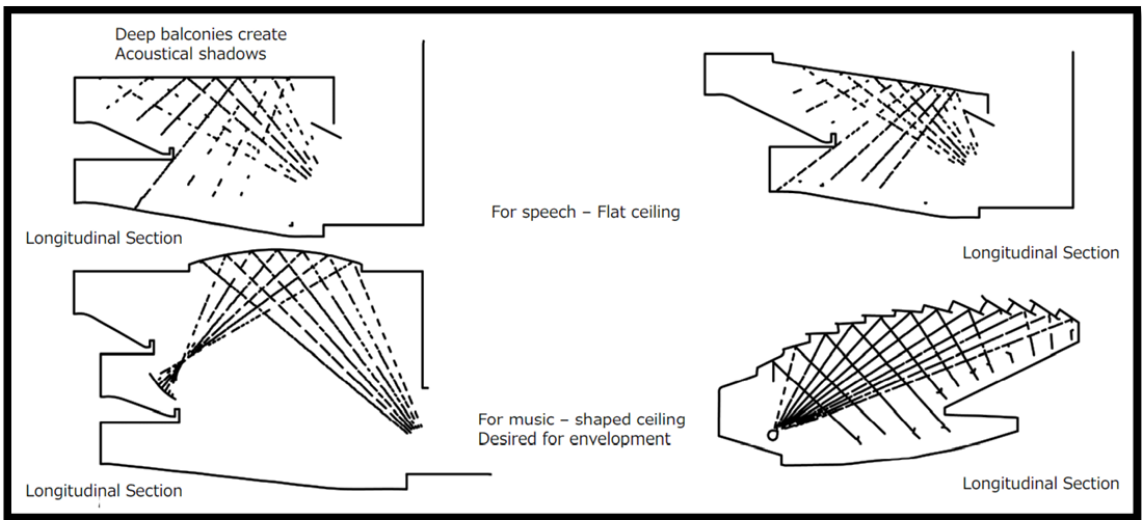


Figure 23: Auditorium Design Types

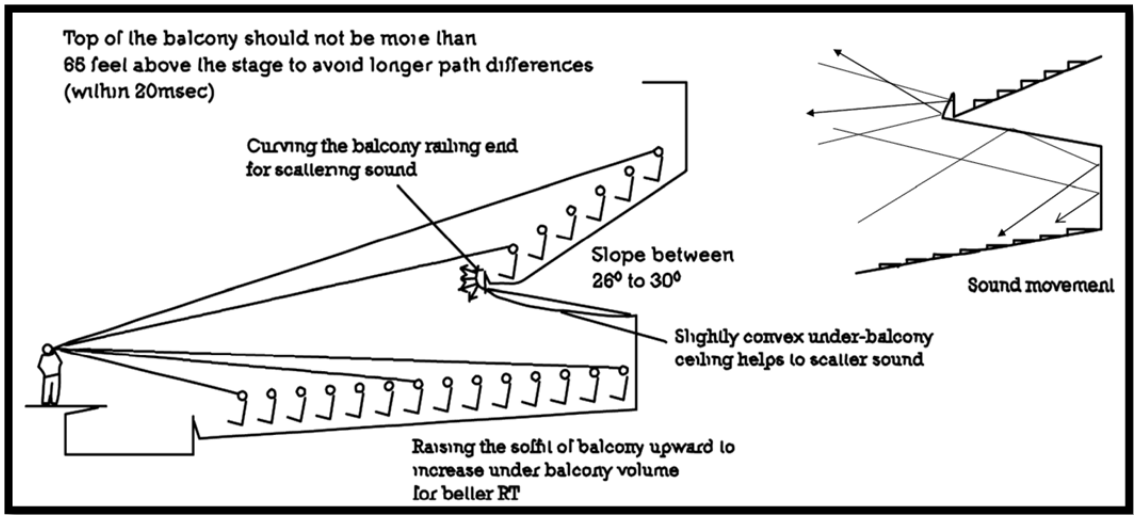


Figure 24: Design of Auditorium Balcony

5.7.2 Seating

With traditional seating, the maximum number is 22 if there are gangways at both ends of the row, and 11 for gangways at one end. Rows with more than 22 seats are permitted if the audience is not thereby imperiled.

- minimum Dimension of seating with arms =500mm Without arms =450mm
- Seat height = 430-450 mm
- Angle of inclination= 7-9 degree with horizontal Back Height = 800-850mm
- Angle of inclination = 15-20 degree
- Seat Depth= 600-720 mm, reduced to 425-500mm when the seat is tipped Other Factors affecting seating is,
- Acoustics: Upholstery to satisfy the acoustic requirements, usually the level of absorbency when unoccupied
- Ventilation & heating: Air supply or extract under a seat
- Upholstery: Thickness of padding should provide comfort & avoid fatigue, material of padding and finish must satisfy fire regulations

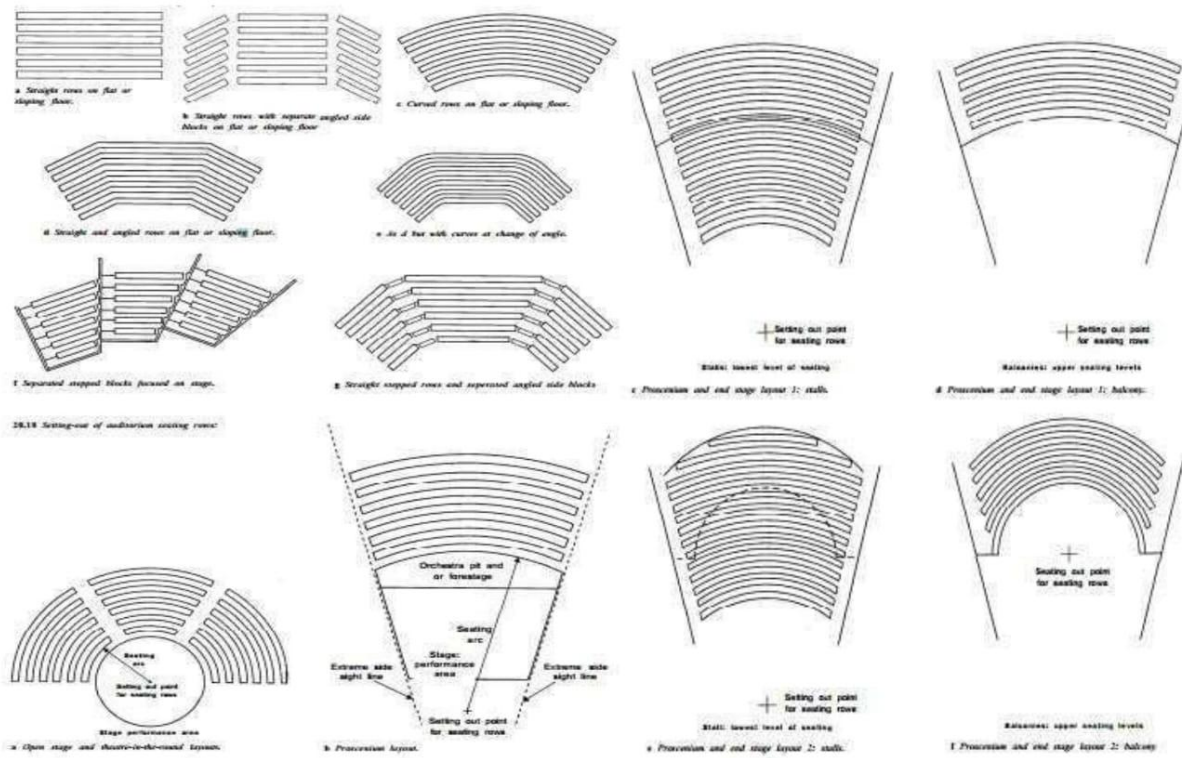


Figure 25: Seating Arrangements for Auditorium

Seating geometry

Seating is usually laid out in straight or curved rows focused toward the platform or stage. Further forms are the angled row, straight row with the curved change of direction, and straight rows within emphasised blocks of seats.

Seating density

Seats with arms and tippable seat can occupy a space as small as 500 mm wide with a how-to-row dimension of 760 mm: but can be as large as 750 mm wide by 1400 mm. The area per seat therefore varies between 0.38 m² and 3.05 m².

Row to row spacing

Spacing is controlled by the clearway between the leading edge of the seat and the rear of the back of the seat in front. For traditional seating, the minimum clearway for people to pass along the row is 300 mm and this dimension increases with the number of seats in a row. For continental seating the clearway is not less than 400 mm and not more than 500 mm

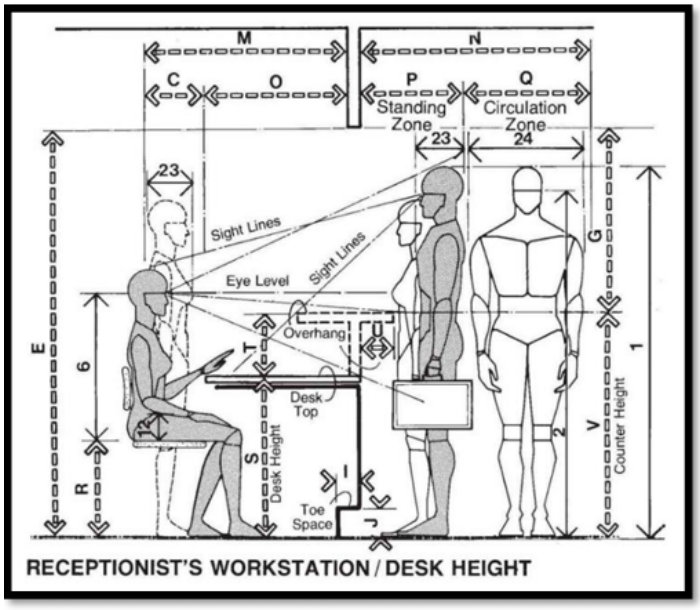
Gangways

As gangways are essential to escape routes, their widths are determined by the number of seats served. The minimum is 1100 mm. They can be ramped up to 10%. If the seating rake is steeper, gangways must-have steps extending the full width and these must have consistent treads and risers in each run.

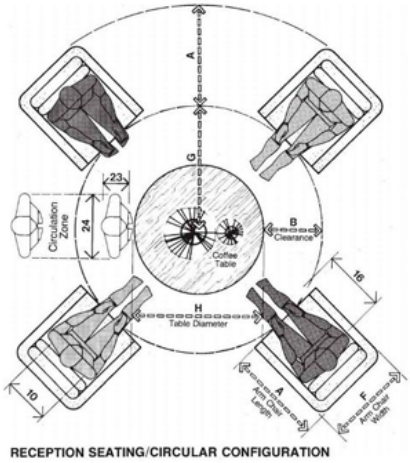
5.8 Reception And Waiting

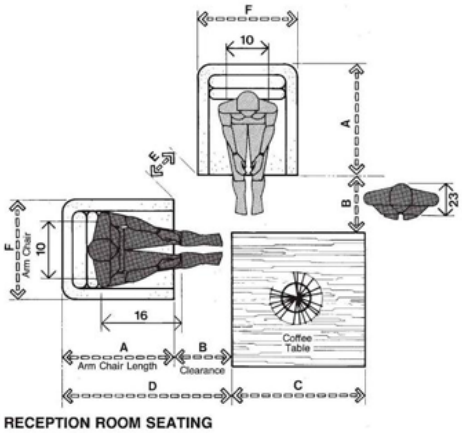
Reception and waiting areas should ensure efficient flow, comfort, and accessibility. Standards typically include:

- Space Allocation: Sufficient space for queuing and seating to avoid congestion.
- Accessibility: Compliance with ADA (or local equivalent) for barrier-free access.
- Lighting: Adequate natural and artificial lighting for comfort and ambiance.
- Acoustics: Sound-absorbing materials to reduce noise.
- Signage: Clear, visible signs for navigation.
- Furniture: Ergonomic and durable seating.
- Technology: Integration of digital screens for information and entertainment.



	in	cm
A	40–48	101.6–121.9
B	24 min.	61.0 min.
C	18	45.7
D	22–30	55.9–76.2
E	78 min.	198.1 min.
F	24–27	61.0–68.6
G	36–39	91.4–99.1
H	8–9	20.3–22.9
I	2–4	5.1–10.2
J	4	10.2
K	44–48	111.8–121.9
L	34 min.	86.4 min.
M	44–48	111.8–121.9
N	54	137.2
O	26–30	66.0–76.2
P	24	61.0
Q	30	76.2
R	15–18	38.1–45.7
S	29–30	73.7–76.2
T	10–12	25.4–30.5
U	6–9	15.2–22.9
V	39–42	99.1–106.7





	in	cm
A	28–32	71.1–81.3
B	15–18	38.1–45.7
C	30–48	76.2–121.9
D	43–50	109.2–127.0
E	9–12	22.9–30.5
F	28–36	71.1–91.4
G	33–42	83.8–106.7
H	36–48	91.4–121.9

Figure 26: Auditorium Reception Design

5.9 Conference Room

A conference hall or conference room is a room provided for singular events such as business conferences and meetings. Sometimes other rooms are modified for large conferences such as arenas or concert halls. Conference rooms can be winning dowels for security purposes.

5.9.1 Types of Seating

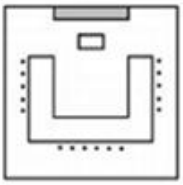
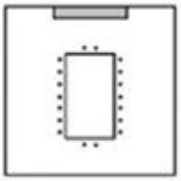
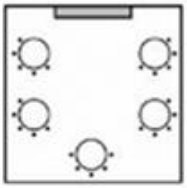
	Type	Description	Layout
1.	U shaped	• Seating around three sides of the room. • It is good for presentations from front. • Presentation space in the middle of the room. • Can be used for up to 50 persons. • Per seat area is 3.25m².	
2.	Boardroom style	• Centrally located table. • Classic layout ideal for debate and discussion. • Seating capacity 5-30 persons. • Per seat area is 3.71m².	
3.	Cabaret style	• All delegates facing front-center on round tables. • Large space in the middle of the room. • Ideal for small-group work. • Per seat area is 1.57m².	
4.	Theater style	• Used for product launches, presentations, displays. • Used to present to large numbers of delegates. • Can be used for 100-250 persons. • Per seat area is 0.83 m².	

Figure 27: Conference Seating Types

5.9.2 Space Standards

Type	Dimension
A	1210-1520
B	100-150
C	510-610
D	150-255
E	460-610
F	790-910

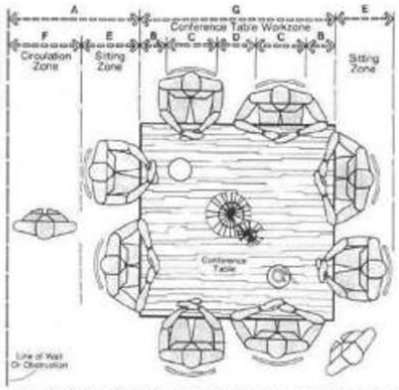
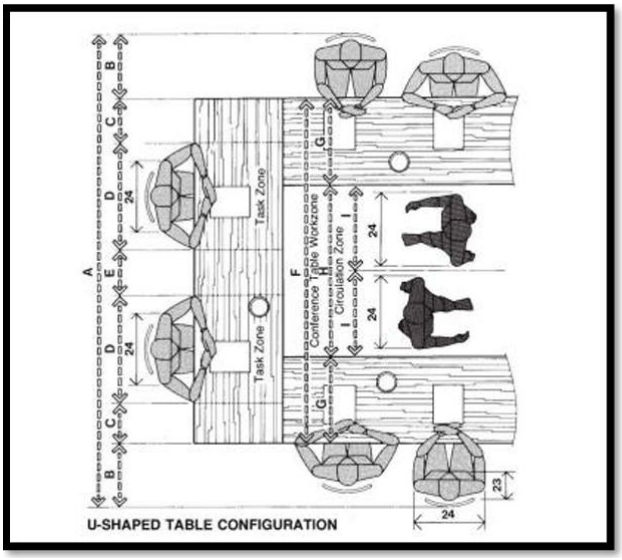


Figure 22: Seating standards for a conference table

Figure 28: Seating Standards for a conference table

5.9.3 The basic dimensions of a U-shaped conference table are given below:



	in	cm
A	138-180	350.5-457.2
B	18-24	45.7-61.0
C	12-21	30.5-53.3
D	32-36	81.3-91.4
E	14-18	35.6-45.7
F	108-132	274.3-335.3
G	24-36	61.0-91.4
H	60	152.4
I	30	76.2
J	72	182.9
K	24-28	61.0-71.1
L	3-6	7.6-15.2
M	12-16	30.5-40.6

Figure 29: U-shaped Conference Table Standards

5.10 Barrier-Free Norms

A wheelchair user's movement pivots around his or her shoulders. Therefore, the range of reach is limited, approximately 630 mm for an adult male. While sitting in a wheelchair, the height of the eyes from the floor is about 1190 mm for an adult male.

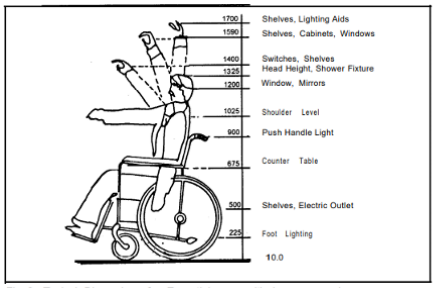


Fig.-9. Typical Dimensions for Essential uses with in easy reach

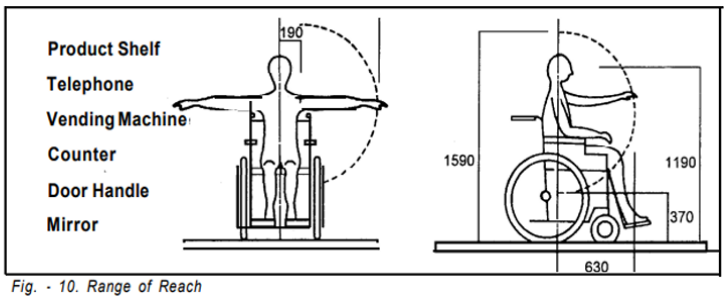
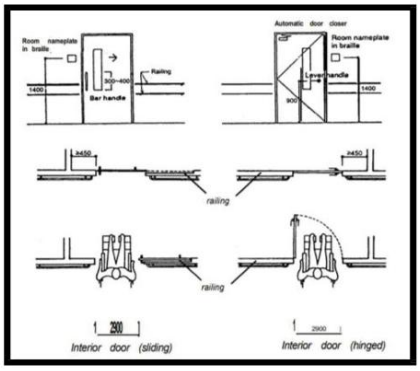
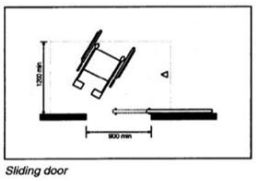


Fig. - 10. Range of Reach

Figure 30: Wheelchair user's movement

5.10.1 Entrance/Exit Doors





Sliding door

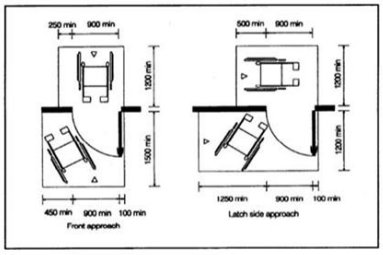


Figure 31: Auditorium Entrance/Exit Door

Minimum clear opening of the entrance door shall be 900 mm. and it shall not be provided with a step that obstructs the passage of a wheel chair user. Threshold shall not be raised more than 12 mm.

5.10.2 Auditorium

- Applies to wheelchair spaces in auditoria, assembly halls, theatres, and similar facilities.
- Accessible seating space should be provided in a variety of locations to give persons with physical disabilities a choice.

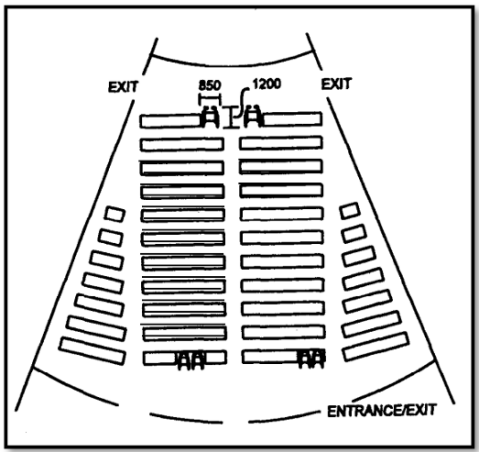


Figure 33: Auditorium Exit/Entrance Plan

Step width	600	800	1000
A	605-620	805-820	1005-1020
B	1170-1220	1320-1420	1570-1620
C	1280	1480	1680
Transportation capacity/hr	5000-6000	7000-8000	8000-10000

Plan view of guest seating arrangement

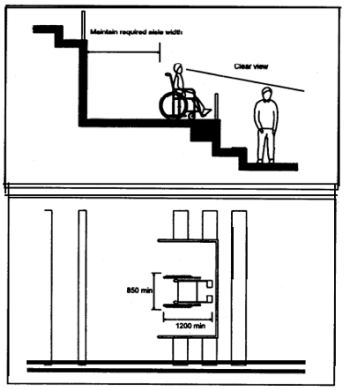


Figure 32: Plan View of guest seating arrangement

5.11 Vertical Circulation

5.11.1 Elevators

Location:

Passenger lifts should be within a reasonable walking distance from the furthest part of the floor areas served (say, 70 m maximum) and, where they are the only or main lifts near an entrance. The location of goods and service lifts will depend on their function, but they should not open into passenger lift lobbies or public areas.

Planning a passenger lift:

Cul-de-sac or recessed lobbies, are essential to get the maximum performance from lift groups. Clearly, having called for lift service the waiting passengers should not have to walk further than necessary to the responding lift car, and should not be obstructed by passers-by.

- Provision of the lifts shall be made for all multi-storeyed building having a height of 15.0 m. and above.
- All the floors shall be accessible for 24 hrs. by the lift. The lift provided in the buildings shall not be considered as a means of escape in case of emergency.
- Grounding switch at ground floor level to enable the fire service to ground the lift car in case of emergency shall also be provided.
- The lift machine room shall be separate and no other machinery be installed in it.

5.11.2 Lift Enclosure/Lift:

General requirements shall be as follows:

- Walls of lift enclosures shall have a fire rating of two hours. Lift shafts shall have a vent at the top of area not less than 0.2 2 sq m
- Lift motor room shall be located preferably on top of the shaft and separated from the shaft by the floor of the room.
- Landing door in lift enclosures shall have a fire resistance of not less than one hour. The number of lifts in one lift bank shall not exceed four. A wall of two hours fire rating shall separate individual shafts in a bank
- Lift car door shall have a fire resistance rating of 1 hour
- For buildings 15.0 m and above in height, collapsible gates shall not be permitted for lifts and solid doors with fire resistance of at least one hour shall be provided.

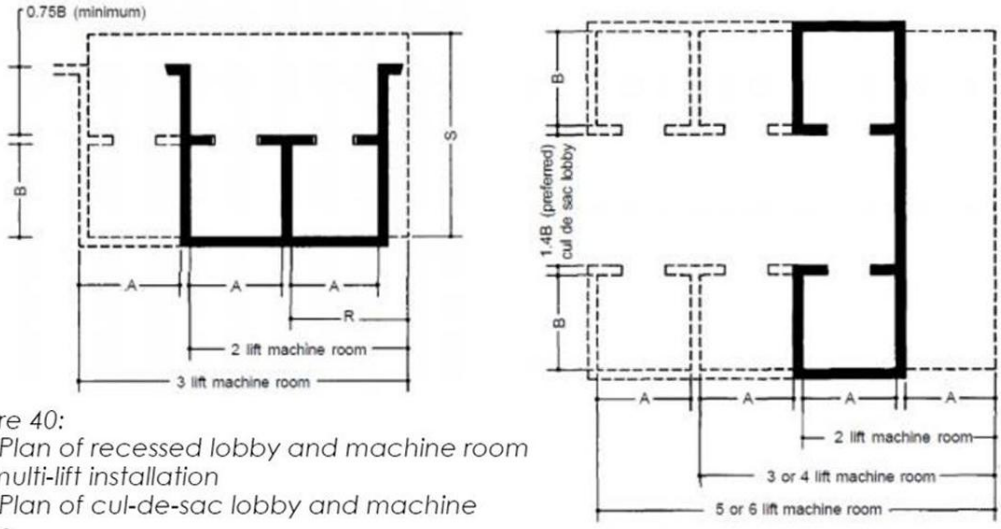


Figure 40:
(a.) Plan of recessed lobby and machine room for multi-lift installation
(b.) Plan of cul-de-sac lobby and machine room

Figure 34: Lift Details

- **Selecting the size of an elevator:**

Type	Capacity/ load	Shaft size	Car size	Door	Pit
	persons/kg	mm	mm	mm	mm
General purpose passenger traffic (speed : 1m/s)	13/1000	2400*2300	1600*1400	1100	1800
	16/1250	2600*2300	1950*1400	1100	1900
	21/1600	2600*2600	1950*1750	1100	1900
Intensive passenger electric traction (speed : 2.5 m/s)	13/1000	2400*2300	1600*1400	1100	2800
	16/1250	2600*2300	1950*1400	1100	2800
	21/1600	2600*2600	1950*1750	1100	2800
General-purpose goods lifts, electric traction (speed : 0.5/0.63/1 m/s)	13/1000	2100*2100	1400*1800	1400	1500
Heavy-duty goods, electric traction	26/2000	2600*2900	1700*2000	1700	1500-1800
	26/2000	2900*2500	2000*2100	1800	1500-1800

Figure 35: Lift Standards

5.11.3 Ramps

These are used to allow wheeled vehicles such as trolleys, wheelchairs and buggies to change levels.

- A ramp when provided should not have a slope greater than 1 in 20 or maximum af I in 12 for short distance up to 9000 mm.
- Each ramp shall have at least 1800 mm of straight clearance at the bottom
- At least one entrance usable by individuals in wheelchairs shall be on a level that would make the elevators accessible.
- Width of a ramp: It is determined according to type and intensity of use. One-way travel requires a minimum width of 900 mm clear, whereas two-way travel needs 1500 mm. Where turns occur at landings adequate space for manoeuvring wheel chairs must be provided.

Internal staircase:

All assembly buildings having area more than 500 m on each floor shall have a minimum of two staircases.

- The minimum width for a staircase in an assembly building shall be 1500mm. The formula for most staircases of twice the rise plus the going lies between 600 and 630mm will give a suitable relationship.
- The rise should not exceed 190 mm, and the going should not be less than 250 mm.
- The top of the handrail should be between 900 and 1000 mm above the pitch line.
- The minimum headroom in a passage under the landing of a staircase and under the staircase shall be 2.2 m.

5.12 Vehicular Ramps

- Ramps of slope of not more than 1 in 10 may be substituted for and shall comply with all the applicable requirements of all required stairways as to enclosure capacity and limiting dimensions. Larger slopes shall be provided for special uses but in no case greater than 1 in 8. For all slopes exceeding 1 in 10 and where the use is such as to involve danger of slipping, the ramp shall be surfaced with approved non-slipping material
- The minimum width of the ramps in the Hospitals shall be 2.4 m. and, in the basement, using car parking shall be 6.0 m
- Handrails shall be provided on both sides of the ramp.
- Ramp shall lead directly to outside open space at ground level or courtyards of safe place.
- For building above 24.0 m in height, access to ramps from any floor of the building shall be through smoke fire check door.
- In case of nursing homes, hospitals, etc. area exceeding 300 sq m at each floor one of the exit facilities shall be a ramp of not less than 2.4 m. in width.
- Prevent the installation of steep ramps.
- Prevent the installation of steep ramps.
- Make sure the grade of a ramp is a moderate rise of 10 mm to each 120 mm of travel.
- Provide a flat surface 1500 mm or more in length at the top and bottom of the ramp for a wheelchair to pause and prevent it from going out of control.

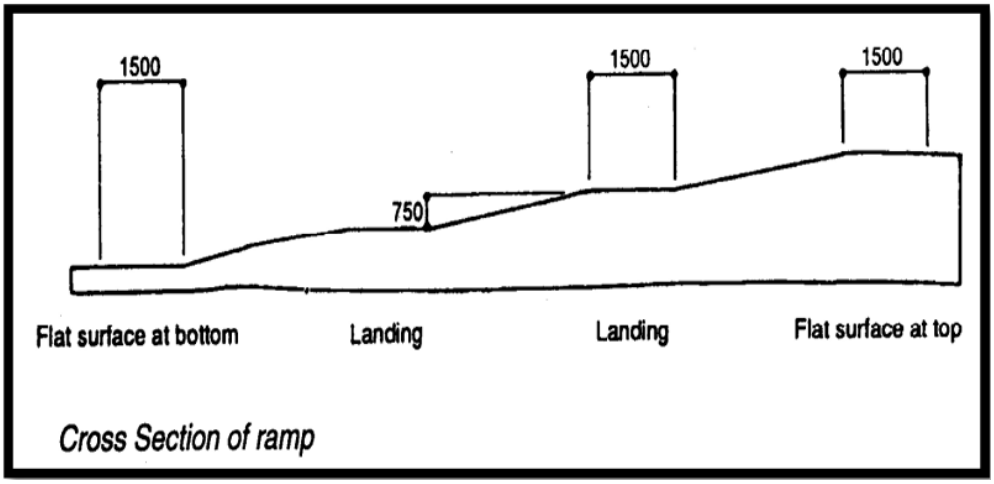


Figure 36: Cross Section of Ramp

Ramp systems:

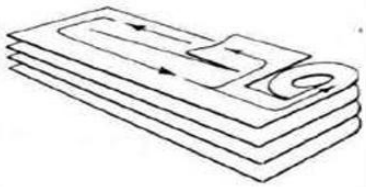
Type	Description	Layout
Clearway ramp systems	• Interfloor travel path completely separated from potentially conflicting parking–unparking movements. • Provide safest movement with least delay • Preferred for self park design	
Adjacent ramp systems	• Part or all of ramp travel is performed on access aisles • Requires less area per parking stall • Twofold use of travel paths • More susceptible to traffic movement delays	

Figure 37: Ramp Systems

Ramp Design:

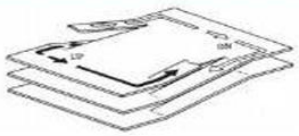
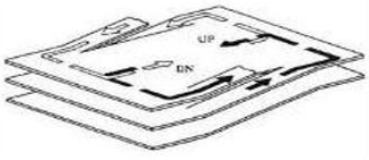
Type	Description	Layout
Opposed ramp design	• Vehicles rotate in the same direction • Up and down ramps in opposite direction • Required ramp surfaces to be opposed	
Parallel ramp design	• Up and down ramp slope in the same direction • Ramp surfaces are parallel • Vehicles must rotate in opposite direction • Cheaper to construct	

Figure 38: Ramp Design

5.13 Parking

5.13.1 Surface Parking

Parking stalls should be built to accommodate the larger cars frequently used, although not necessarily

the very largest. Parking spaces may be parallel, perpendicular, or angled (30, 45, or 60 degree) to the driving lane, or aisle as per ECS for surface car parking as per DDA is 23 m².

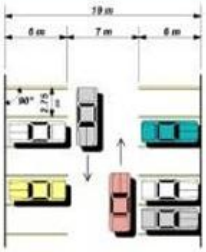
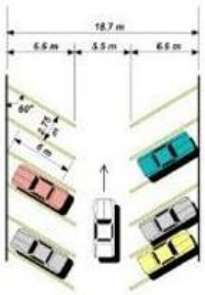
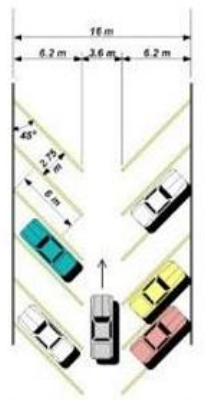
Type	Description	Layout	Advantage/Disadvantages
Perpendicular	• Effective in low turnover rate or long term parking areas. • Most efficient and economical since it accommodates the most vehicles per linear meter.		**Advantages:** • Works well with either one- or two-way aisles • Handles the most vehicles per square meter of pavement **Disadvantages:** • Requires widest area • Two-way traffic can create visibility problems
Angled - 60 degree	• This parking area configuration is ideal for a fast turnover rate or predominantly short term use. • This is often offset by difficulties of inefficient circulation patterns and one-way aisles.		**Advantages:** • Easy maneuvering in and out of parking spaces • Good visibility • Lends itself to either one-or two-way aisles **Disadvantages:** • Requires more pavement per vehicle than perpendicular configuration
Angled - 45 degree	• The 45 degree angled parking configuration displays similar benefits and limitations as the 60 degree.		**Advantages:** • Reduced width requirements for layout. • Easy maneuvering in and out of parking spaces. • Good visibility to the rear **Disadvantages:** • Doesn't work well with two-way aisles • Requires more pavement per vehicle than perpendicular parking configuration.

Figure 39: Surface Parking Types

5.13.2 Basement Parking

- Every basement shall be in every part at least 2.4 m in height from the floor to the underside of the roof slab or ceiling.
- Adequate ventilation shall be provided for the basement.
- The access to the basement shall be separate from the main and alternative staircase providing access and exit from higher floors.
- Area per ECS for basement car parking as per DDA is 32 m².

For car, minimum parking space to be 3m x 6m when individual parking space is required and 2.75m x 5m when common parking space is required Space for two-wheeler and bicycle to not be less than 1.25 m2 and 1.00 m2, respectively.

Table 9 Norms for Off-Street Parking Spaces

(*Clause* A-1)

Sl No.	Occupancy	One Car Parking Space for Every				
		Population Less than 50 000	Population Between 50 000 and 200 000	Population Between 200 000 and 1 000 000	Population Between 1 000 000 and 5 000 000	Population Above 5 000 000
iv)	a) Assembly halls, cinema theatres	120 seats	80 seats	25 seats	15 seats	10 seats

Figure 40: Off-Street Parking

Designated parking for physically handicapped

The minimum size of the parking space for a car shall be 3.9m x 5.4m

If two parking spaces share a transfer are: 6.3 m

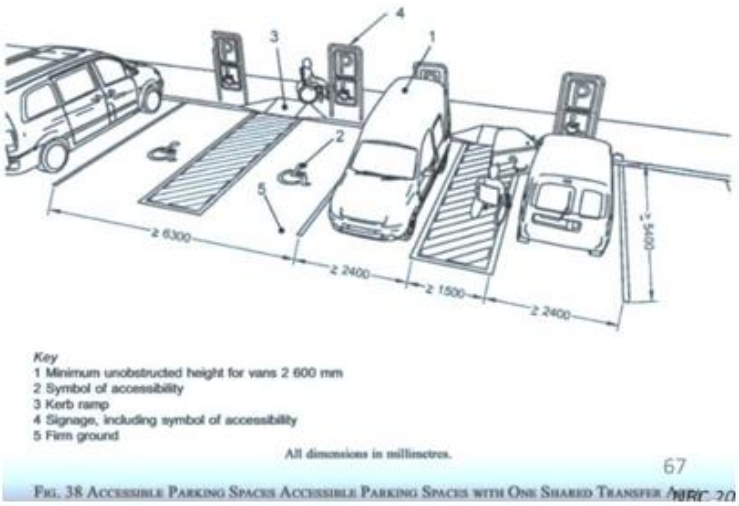


Figure 41: Handicap Parking

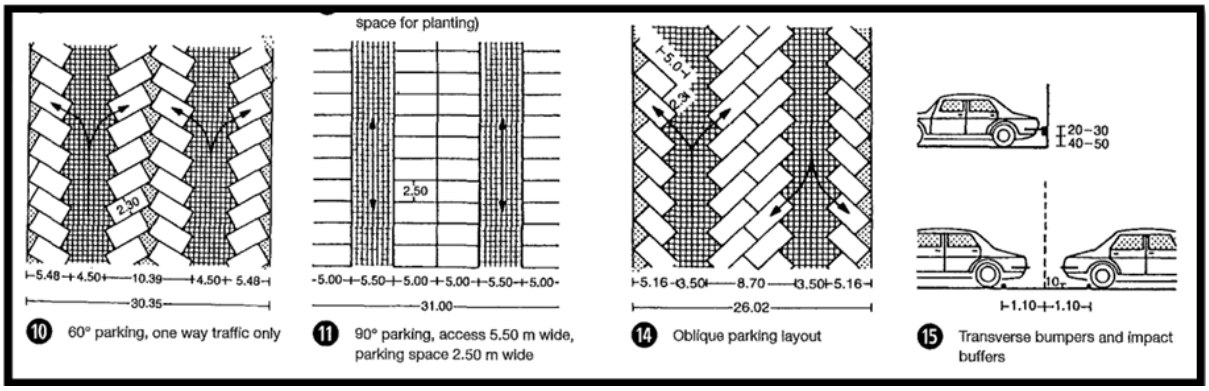


Figure 42: Surface Parking Arrangements

5.13.3 Parking for Handicapped People

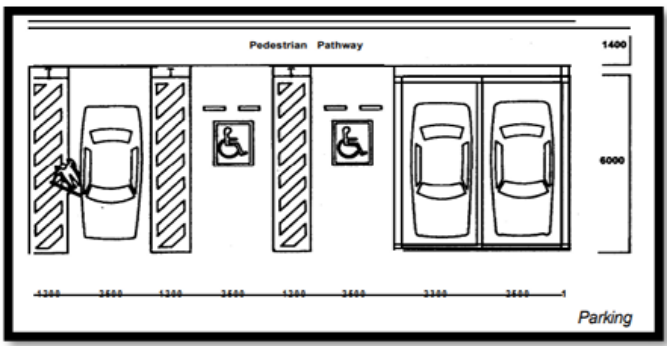


Figure 43: Parking for Handicapped People

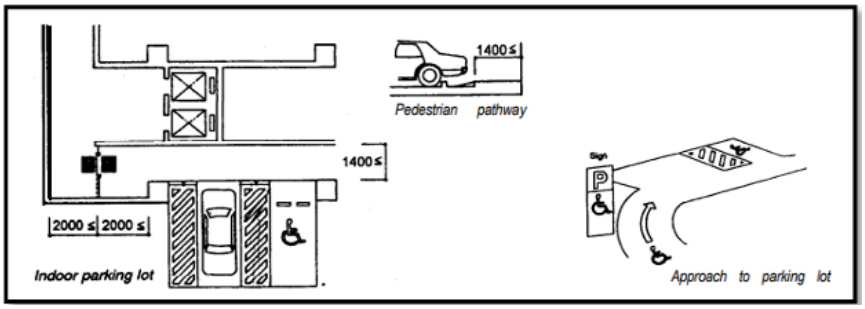


Figure 44: Parking Details

For parking of vehicles of handicapped people, the following provisions shall be made:

a) Surface parking for two care spaces shall be provided near entrance for the physically handicapped persons with maximum travel distance of 30 M from building entrance.
b) The width of parking bay shall be minimum 3.60 Meter.
c) The information stating that the space is reserved for wheel chair users shall be conspicuously displayed.
d) Guiding floor materials shall be provided or a device which guides visually impaired persons with audible signals or other devices which serves the same purpose shall be provided.

5.14 Signage

Signage is an important part of our everyday Inco. From identifying a street name, to branding a specific store, to navigating through a museum, signage is any kind of visual graphic that displays information to a particular audience. Certain signs stand out from others based on the colours, typography, shape, and graphics utilized. In addition to printed scrips, there are an increasing number of digital signs today.



Figure 45: Signage

5.15 Fire Fighting

9.3.12. **Fire Dampers**

a. These shall be located in conditioned air ducts and return air ducts/ passages at the following points:

   i. At the fire separation wall.

   ii. Where ducts/passages enter the central vertical shaft.

   iii. Where the ducts pass though floors.

   iv. At the inlet of supply air duct and the return air duct of each compartment on every floor.

b. The dampers shall operate automatically and shall simultaneously switch off the air-handling fans. Manual operation facilities shall also be provided. (Note: For blowers, where extraction system and duct accumulators are used, dampers shall be provided).

c. Fire/smoke dampers (for smoke extraction shafts) for buildings more than 24 m in height.

   i. For apartment houses in non-ventilated lobbies / corridors operated by fusible link / smoke detectors and with manual control.

   ii. For other buildings on operation of smoke detection system and with manual control.

d. Automatic fire dampers shall be so arranged as to close by gravity in the direction of air movement and to remain tightly closed on operation of a fusible link / smoke detector.

Note: *The use of type of detectors shall be to the satisfaction of Delhi Fire Service.*

Figure 46: Fire Dampers (Unified Building Bye-laws Delhi 2016)

2.11 Dry Riser — An arrangement of firefighting within the building by means of vertical rising mains not less than 100 mm internal diameter with landing valves on each floor/landing which is normally dry but is capable of being charged with water usually by pumping from fire service appliances.

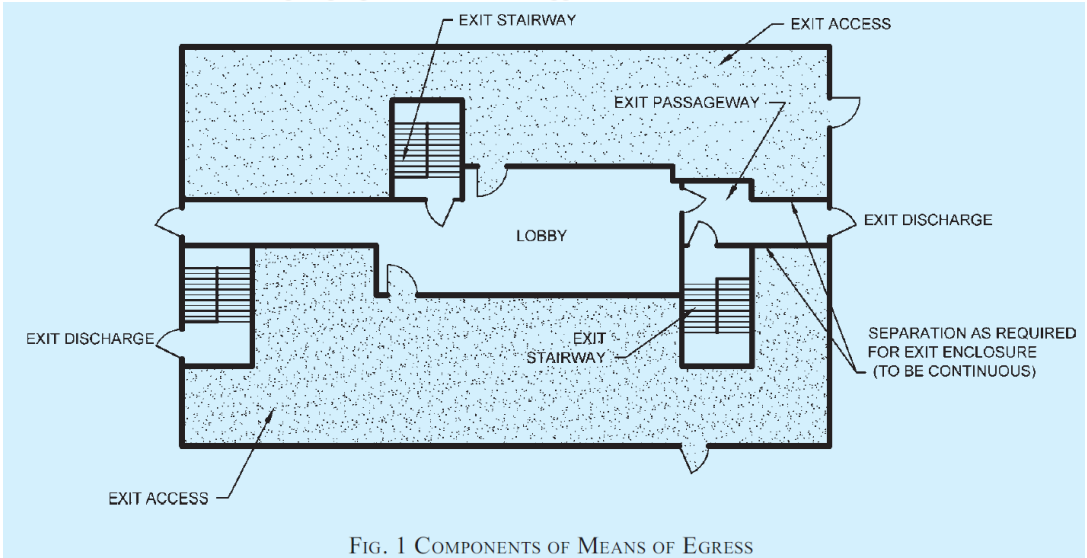


FIG. 1 COMPONENTS OF MEANS OF EGRESS

Figure 47Components of Means of Egress (NBC India 2016)

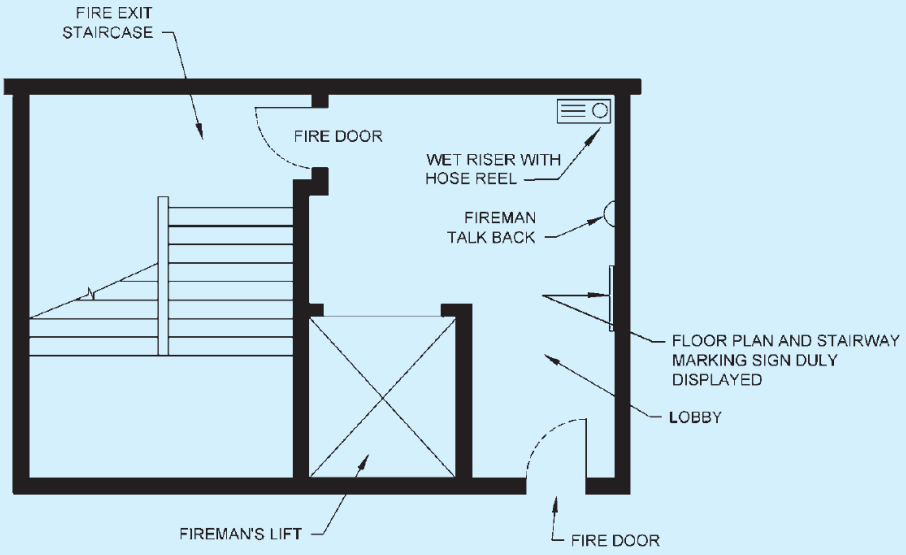
9.3.13. **Fire Tower**

a. Fire towers are escape routes for multistoried buildings and these shall be considered as the safest route for escape. Their number, location and size shall depend on the building concerned, and its associated escape routes. A fire lift, internal hydrant, hose reel etc. shall be providedin the fire tower.

b. In high rise buildings with over 8 stories or 24.0 m in height, at least 50% required means of egress shall preferably be a fire tower(s).

c. The fire towers shall be constructed of walls with a two hour fire resistance rating without openings other than the exit doorways, with platforms, landings and balconies having the same fire-resistance rating.

d. The area of the lobby shall be subject to a minimum of 6.0 sq.m area and such that no side of the lobby is less than 2.0 m.



(LAYOUT TO BE PLANNED AS PER PROJECT BASIS MEETING ALL THE REQUIRED DETAILS)

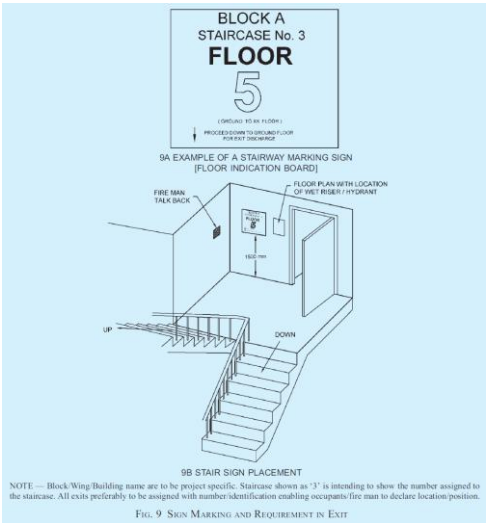
NOTES

1 Where such lobbies and staircase in the firefighting shaft are naturally ventilated/cross-ventilated, the shaft may not be enclosed and fire door need not be provided.

2 For all enclosed firefighting shaft, the shaft's lobby should have floor plan duly displayed for the information of fire fighters.

FIG. 2 TYPICAL FIRE FIGHTING SHAFT

Figure 48: Typical Fire Fighting Shaft (NBC India 2016)



NOTE — Block/Wing/Building name are to be project specific. Staircase shown as '3' is intending to show the number assigned to the staircase. All exits preferably to be assigned with number/identification enabling occupants/fire man to declare location/position.

FIG. 9 SIGN MARKING AND REQUIREMENT IN EXIT

Figure 49: Sign Marking and Requirement in Exit

2.64 Water Based Systems

2.64.1 *Hydrant System* — A distribution system having a network of piping installed underground/above-ground around and/or through inside of a building with internal and/or external hydrants fitted with landing valves at regular intervals according to the occupancy. The distribution system is connected to water supply system for firefighting.

2.64.2 *Automatic Sprinkler System* — A system of water pipes fitted with sprinkler heads at suitable intervals and heights and designed to actuate automatically, control and extinguish a fire by the discharge of water.

2.64.3 *Automatic Water Spray Systems* — A special fixed pipe system connected to a reliable source of fire protection water supply and equipped with water spray nozzles for specific water discharge and distribution over the surface or area to be protected. The piping system is connected to the water supply through an automatically actuated deluge valve which initiates flow of water. Automatic actuation is achieved by operation of automatic detecting equipment installed along with water spray nozzles. There are two types of systems namely high velocity and medium velocity systems.

2.64.4 *Water Mist Systems* — A distribution system connected to a pumping and water supply system that is equipped with nozzles capable of delivering water mist to the part/entire enclosure or area, intended to control, suppress, or extinguish fire and is capable of meeting the specified performance requirements.

2.64.5 *Foam Protection System* — Firefighting systems where foam is made by mechanically mixing air with a solution consisting of fresh water to which a foaming agent (liquid concentrate) has been added. Firefighting foam is a stable aggregation of small bubbles of density lower than oil or water, and shows tenacious qualities for covering horizontal surfaces. There are three types of foam applications that is, low, medium and high expansion foams depending upon the application.

2.65 Wet Riser — An arrangement for firefighting within the building by means of vertical rising mains not less than 100 mm nominal diameter with landing valves on each floor/landing for firefighting purposes and permanently charged with water from a pressurized supply.

NOTE — For definition of other terms, reference shall be made to accepted standards [4(3)].

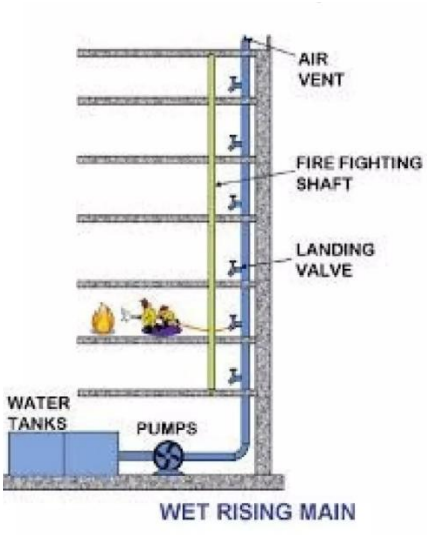


Figure 50: Water Based Fire Hydrants (NBC India 2016)

Table 7 — (*Continued*)

Sl No.	Type of Building Occupancy	Type of Installation								Water Supply (litre)		Pump Capacity (litre/min)	
		Fire Exting-uisher	First Aid Hose Reel	Wet Riser	Down Comer	Yard Hydrant	Automatic Sprinkler System	Manually Operated Electronic Fire Alarm Systems (*see* Note 1)	Automatic Detection and Alarm System (*see* Note 2)	Under-ground Static Water Storage Tank Combined Capacity for Wet Riser, Yard Hydrant and Sprinklers per Set of Pumps	Terrace Tank over Respective Tower Terrace	Pump Near Underground Static Water Storage Tank (Fire Pump) with Minimum Pressure of 3.5 kg/cm^2 at Remotest Location	At the Terrace Tank Level with Minimum Pressure of 3.5 kg/cm^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
2)	15 m and above but not exceeding 30 m	R	R	R	NR	R	R	R	R	150 000	20 000	(*see* Note 11)	NR
3)	Above 30 m in height	R	R	R	NR	R	R	R	R	200 000	20 000	(*see* Note 11)	NR
e)	**Hotels (A-6)**	R	R	R	NR	R	R	R	R	250 000	20 000	(*see* Note 12)	NR
EDUCATIONAL BUILDINGS (B) (*see* Note 16)													
1)	Less than 15 m in height												
	i) Ground plus one or more storeys	R	R	NR	NR	NR	R (*see* Note 4)	NR	NR	NR	10 000 (5 000) (*see* Note 6)	NR	450 (450) (*see* Note 6)
2)	15 m and above but not exceeding 24 m in height	R	R	NR	R	NR	R (*see* Note 4)	R	NR	NR	25 000	NR	900
3)	Above 24 m but not exceeding 30 m in height	R	R	R	NR	R	R (*see* Note 4)	R	NR	50 000	(5 000) (*see* Note 6)	(*see* Note 14)	NR
INSTITUTIONAL BUILDINGS (C) (*see* Note 16)													
a)	**Hospitals, Sanatoria and Nursing Homes (C-1)**												
1)	Less than 15 m in height with plot area up to 1 000 m^2												
	i) Up to ground plus one storey, with no beds	R	NR	NR	NR	NR	R (*see* Note 4)	R	NR	NR	(5 000) (*see* Note 6)	NR	(450) (*see* Note 6)

R – Required
NR – Not Required

NOTES

1 MOEFA System shall also include talk-back system and public address system for the occupancies given in the table for (d) (1) (iii) under A-5, (a) (1) (iv) and (a) (2) under C-1, and (a) (2) under D-1 to D-5, in all buildings 15 m and above in height, except for A-3 and A-4 occupancies where these shall be provided for buildings of height 24 m and above. These shall also be provided in car parking areas more than 300 m^2 and in multi-level car parking irrespective of their areas.

2 Automatic detection and alarm system is not required to be provided in car parking area. Such detection system shall however be required in other areas of car parking such as electrical rooms, cabins and other areas.

3 Buildings above 15 m in height are not to be permitted for occupancies A-1 and A-2.

4 Required to be installed in basement, if area of basement exceeds 200 m^2.

5 Required to be provided if basement area exceeds 200 m^2.

Table 7 — (*Concluded*)

6 Additional value given in parenthesis shall be added if basement area exceeds 200 m^2.

7 Required to be provided for buildings with more than two storeys (Ground + One).

8 Required to be provided for buildings with height above 15 m and above.

9 Sprinklers shall be fed water from both underground static water storage tank and terrace tank.

10 Provide required number of sets of pumps each consisting of one electric and one diesel pump (stand by) of capacity 2 280 litre/min and one electric pump of capacity 180 litre/min (*see* Fig. 11) (*see also* notes 22 and 23).

11 Provide required number of sets of pumps each consisting of two electric and one diesel pump (stand by) of capacity 2 280 litre/min and two electric pump of capacity 180 litre/min (*see* Fig. 12) (*see also* Notes 22 and 23).

12 Provide required number of sets of pumps each consisting of two electric and one diesel pump (stand by) of capacity 2 850 litre/min and two electric pump of capacity 180 litre/min (*see* Fig. 12) (*see also* Notes 22 and 23).

13 Lower levels in high rise buildings 60 m or above in height are likely to experience high pressure and therefore, it is recommended to consider multi-stage, multi-outlet pumps (creating pressure zones) or variable frequency drive pumps or any other equivalent arrangement.

14 Provide required number of sets of pumps each consisting of one electric and one diesel pump (stand by) of capacity 1 620 litre/min and one electric pump of capacity 180 litre/min (*see* Fig. 11) (*see also* Notes 22 and 23).

15 Required to be provided for buildings with more than one storey.

16 Buildings above 30 m in height not to be permitted for Group B, Group C, Group D and Group F occupancies.

17 The requirements given in this table for Group G Industrial Buildings are for small scale industry units. For other industries the requirements will have to be worked out on the basis of relevant Indian Standards and also in consultation with the local fire authorities.

18 Buildings above 18 m in height not to be permitted for G-1 and G-2 occupancies.

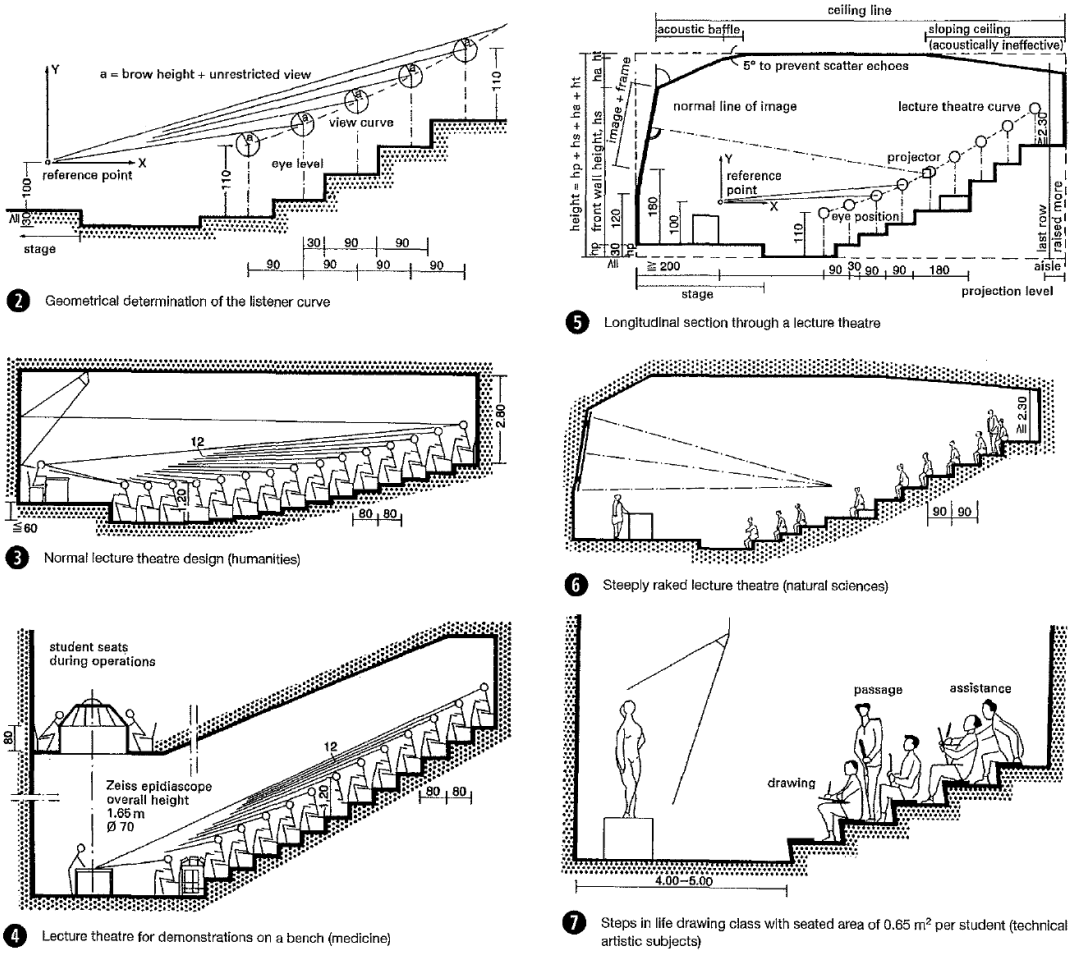
19 Buildings above 15 m in height not to be permitted for G-3 occupancies.

20 Buildings above 15 m in height not to be permitted for Group H and Group J occupancies. However, buildings above 45 m in height shall not be permitted for multi-level car parking (MLCP) occupancy.

Figure 51: Fire and Life Safety (NBC India 2016)

5.16 Spatial Arrangement

5.16.1 Lecture Theatres



2 Geometrical determination of the listener curve

5 Longitudinal section through a lecture theatre

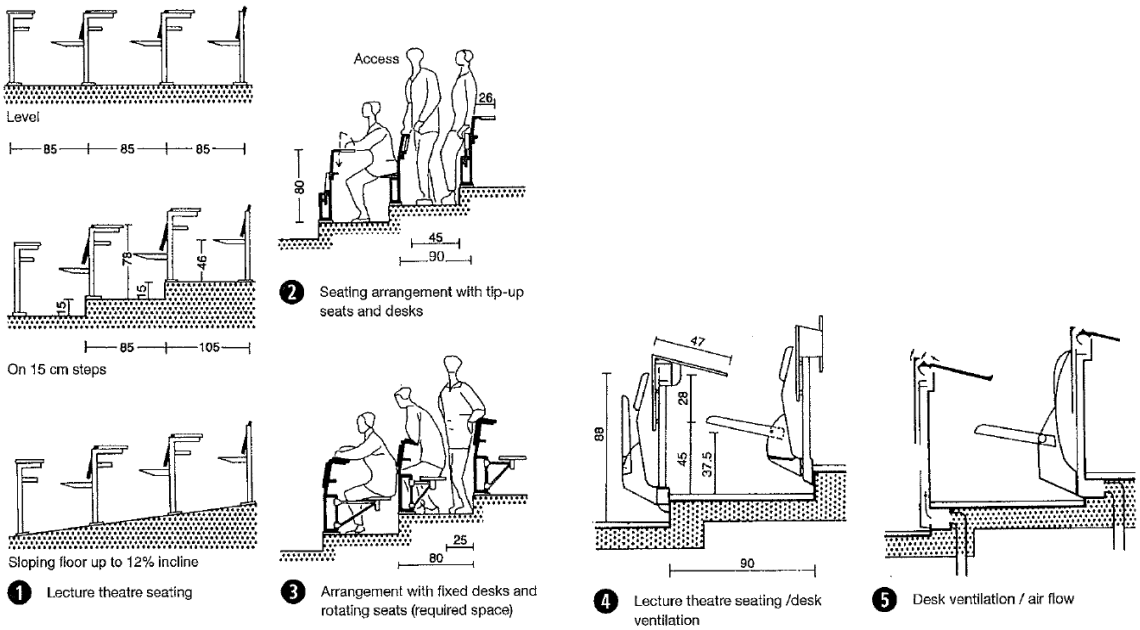
3 Normal lecture theatre design (humanities)

6 Steeply raked lecture theatre (natural sciences)

4 Lecture theatre for demonstrations on a bench (medicine)

7 Steps in life drawing class with seated area of 0.65 m² per student (technical artistic subjects)

Figure 52: Neufert, 1936



1 Lecture theatre seating

2 Seating arrangement with tip-up seats and desks

3 Arrangement with fixed desks and rotating seats (required space)

4 Lecture theatre seating /desk ventilation

5 Desk ventilation / air flow

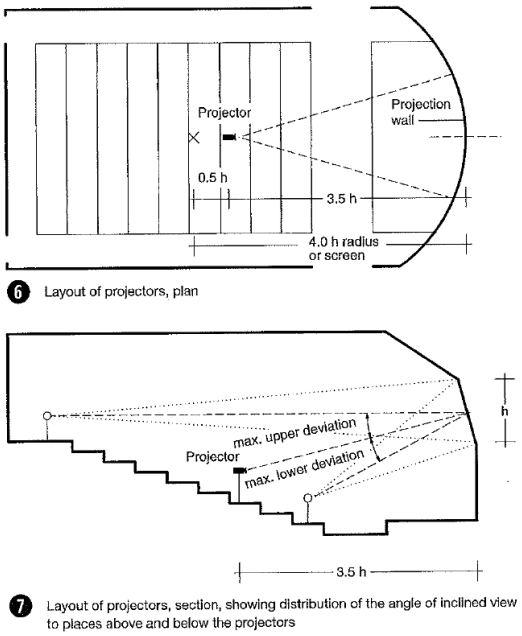


Figure 53: Neufert, 1936

5.16.2 Laboratories

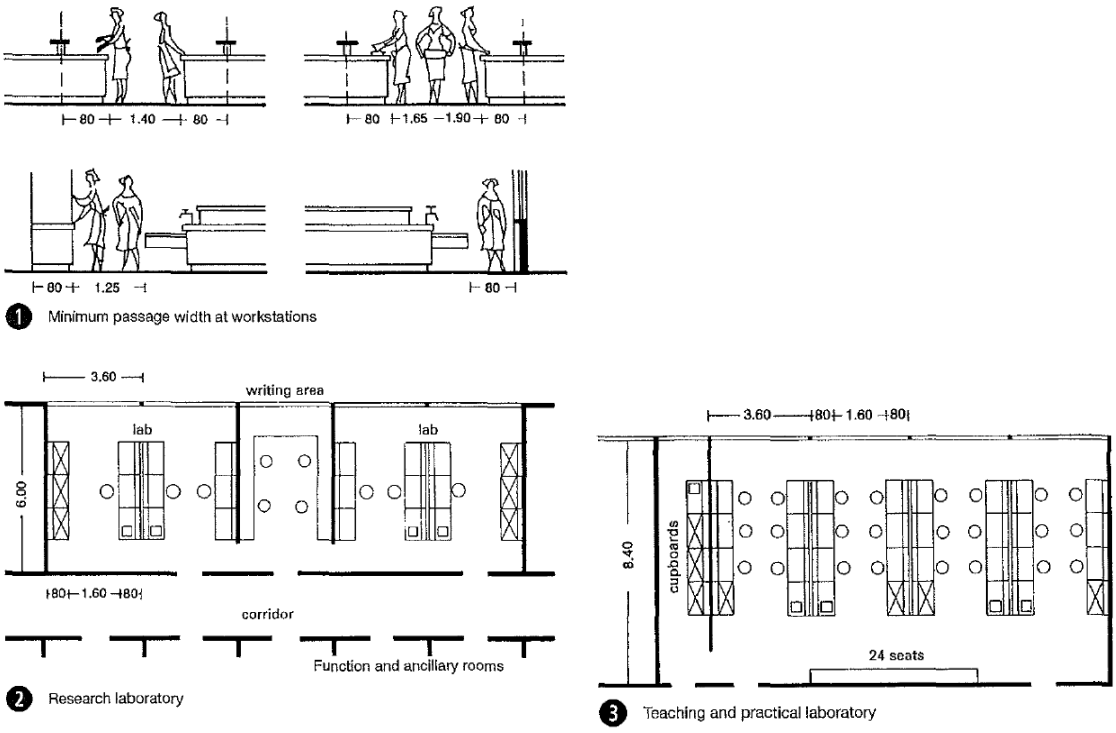
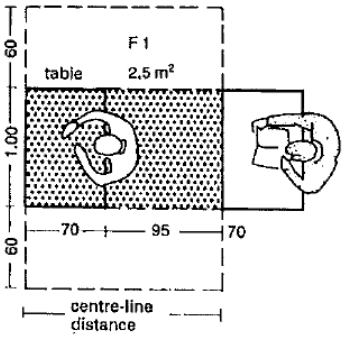
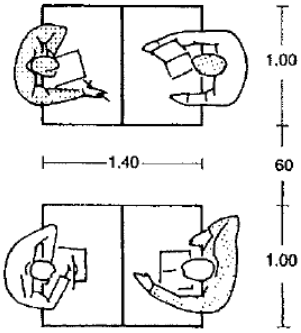


Figure 54: Neufert, 1936

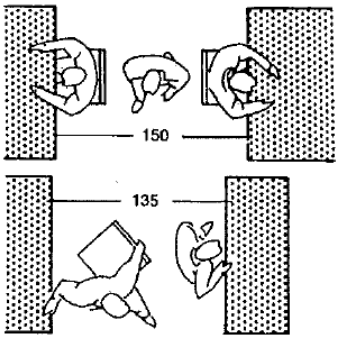
5.16.3 Library



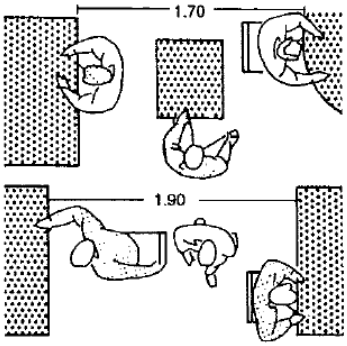
1 Space for a single workplace → 3



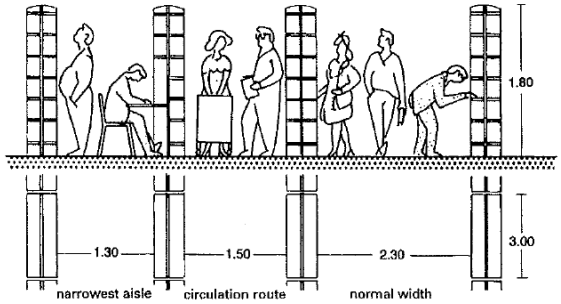
2 Minimum spacing between tables



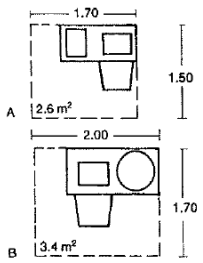
4 Minimum free room in reading area → 5



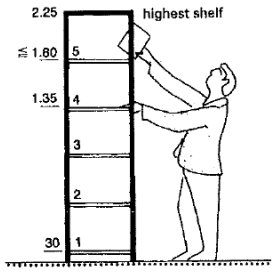
5 Transporting books between sitting and standing library users → 4



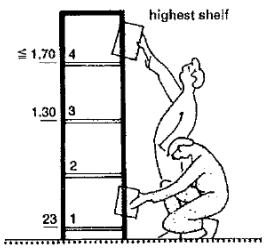
7 Minimum spacing



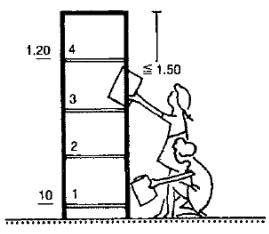
8 Microfiche reader workplace



9 Shelf unit, five shelves



10 Shelf height for schoolchildren



11 Shelf unit, four shelves – small children

5.17 Dimensions for Sports Facility

Playing Areas

Sport	Competitive sport				Leisure sport				Net	Goal / basket (m)
	Playing area dimensions (m)	Free space around sides (m)	Free space around ends (m)	Total area (m)	Playing area dimensions (m)	Free space around sides (m)	Free space around ends (m)	Total area (m)	Height (m)	W = width H = height
Football	45–90 × 90–120	1	2	46–91 × 92–122	68 × 105	1	2	69 × 107	—	W = 7.32 H = 2.44
Football, FIFA requirements	45–90 × 90–120	2	3.5	47–92 × 93.5–123.5	68 × 105	2	3.5	70 × 108.5	—	W = 7.32 H = 2.44
Rugby	68.4 × 100	2	12–23	70.4 × 123	68.4 × 100	2	12–23	70.4 × 123	—	W = 5.60 H = 3.00
Handball	55–65 × 90–110	1	2	56–66 × 92–112	60 × 90	1	2	61 × 92	—	W = 3.00 H = 2.00
Indoor handball	18–22 × 38–44	1	2	19–23 × 40–46	20 × 40	1	2	21 × 42	—	W = 3.00 H = 2.00
Hockey (field hockey)	—	—	—	—	55 × 91.4	2	4	57 × 95.4	—	W = 3.66 H = 2.14
Netball	25 × 60	1	2	26 × 62	25 × 60	1	2	26 × 62	—	net H = 2.50
Softball/ rounders	25 × 50–70	10	10	35 × 60–80	—	—	—	—	—	pole H = 1.50
Indoor cycle polo	9–11 × 12–14	0.5	0.5–1	9.5–11.5 × 13–15	—	—	—	—	—	W = 2.00 H = 2.00
Volleyball	9 × 18	2	3	11 × 21	9 × 18	2	3	11 × 21	2.43	—
Prellball	8 × 16	2	4	10 × 20	8 × 16	2	4	10 × 20	—	—
Schleuderball	—	—	—	—	15 × 100	8	30	23 × 130	—	—
Fistball	—	—	—	—	20 × 50	6	8	26 × 58	2.00	—
Basketball	15 × 28	1	1	—	—	—	—	—	—	3.05
Streetball	13–15 × 24–28	1 2	1 2	14–16 × 26–30	—	—	—	—	—	3.05

Figure 55: Playing Area Dimension, Neufert, 1936

Type of sport	Usable playing area (net)				Additional unobstructed zone at the:		Unobstructed playing area with standard dimensions (gross)		Clear hall height[1]
	Permissible dimensions:		Standard dimensions:						
	length (m)	width (m)	length (m)	width (m)	sides (m)	ends (m)	length (m)	width (m)	(m)
Badminton	13.4	6.1	13.4	6.1	1.5	2.0	17.4	9.1	9[2]
Basketball	24–28	13–15	28	15	1[3]	1[3]	30	17	7
Boxing	4.9–6.1	4.9–6.1	6.1	6.1	0.5	0.5	7.1	7.1	4
Fistball	40	20	40	20	0.5	2	44	21	(7)
Football	30–50	15–25	40	20	0.5	2	44	21	(5.5)
Weight lifting	4	4	4	4	3	3	10	10	4
Netball	40	20	40	20	1[4]	2	44	22	7[5]
Hockey	36–44	18–22	40	20	0.5	2	44	21	(5.5)
Judo	9–10	9–10	10	10	2	2	14	14	(4)
Netball	28	15	28	15	1	1	30	17	(5.5)
Sports acrobatics	12	12	12	12	1	1	14	14	(5.5)
Gymnastics	52	27	52	27	—	—	52	27	8
Cycle football/ polo/gymnastics	12–14	9–11	14	11	1	2	18	13	(4)
Rhythmic gymnastics	13[6]	13[6]	13[6]	13[6]	1	1	15	15	8[2]
Wrestling	9–12	9–12	12	12	2	2	14	14	(4)
Roller hockey	34–40	17–20	40	20	—	—	40	20	(4)
Roller acrobatics/ dancing	40	20	40	20	—	—	40	20	(4)
Sports dancing	15–16	12–14	16	14	—	—	16	14	(4)
Tennis	23.77	10.97	23.77	10.97	3.65	6.4	36.57	18.27	(7)
Table tennis	2.74	1.525	2.74	1.525	5.63	2.74	14	7	4
Trampolining	4.57	2.74	4.57	2.74	4	4	12.57	10.74	7
Volleyball	18	9	18	9	5	8	34	19	12.5[2]

[1] nos in brackets: recommended; [2] for national events, 7 m is sufficient; [3] for spectator stands bordering the playing area, ideally 2 m; [4] additional space requirement for timers' table and reserves' bench (poss. in sports equipment room); [5] in a 3.3 m wide zone around the playing area (net), a uniform reduction to 5.5 m is permissible; [6] for national competitions 12 m.

1 Playing area dimensions for competitive sports use

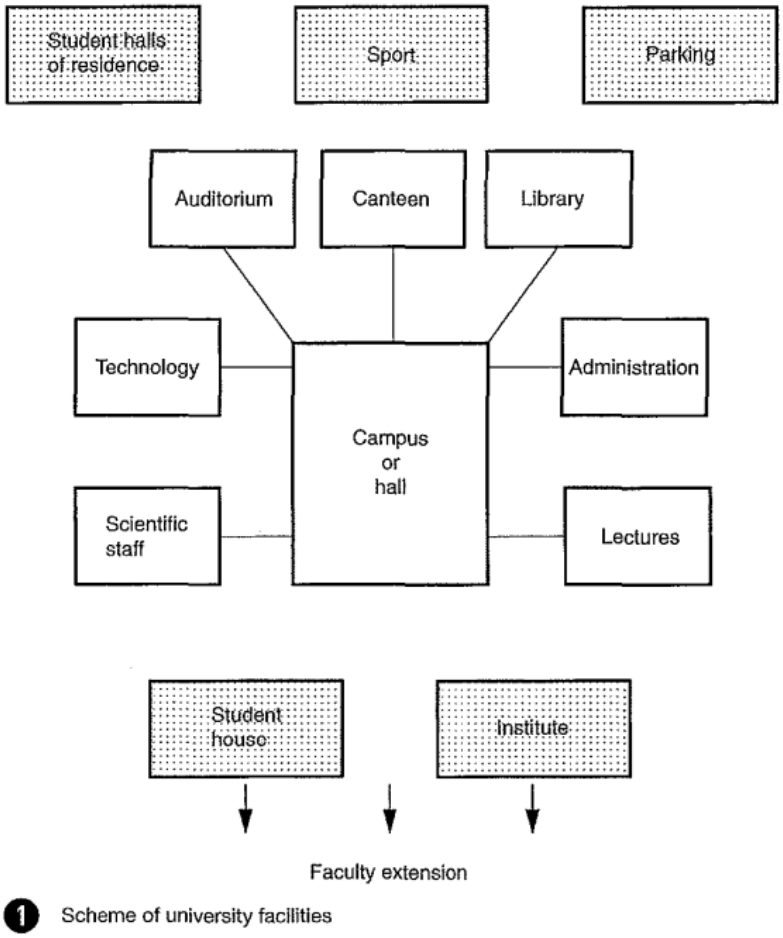


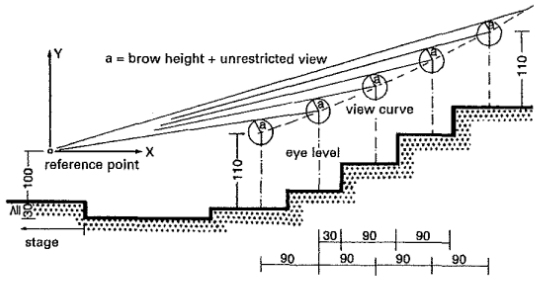
Figure 56: Scheme of Univesity Facilities

5.18 Lecture Theatres

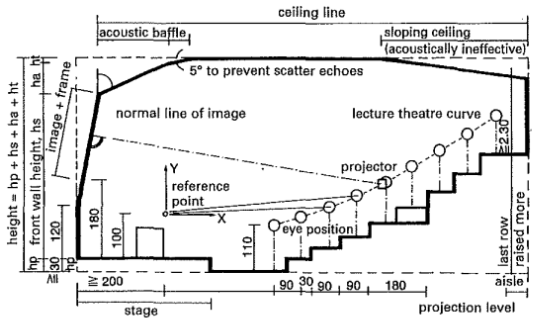
Central university facilities include: great hall, event hall, administration, deanery and student union. Also prominent are libraries, canteens, sports facilities, car parks and student residences (~ p. 167}.

Basic space requirements for all subjects Lecture theatre for basic and special lectures, seminar and tutorial rooms (partially with PC workplaces) for detailed instruction of the course material, specialised libraries, rooms for scientific assistants, conference and examination rooms.

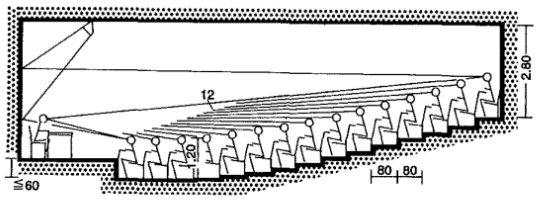
Space requirements for specific subjects: Humanities: lecture theatre with seating raked (rising) at a low pitch ~ 3. No particular requirements for blackboards or projection. Technical and artistic subjects: e.g. architecture, art, music: drawing, studio, workshop, practice and meeting rooms of all types. Technical and natural science subjects: e.g. physics, mechanical engineering, electrical engineering: drawing rooms, laboratories, workshops. Natural science and medical theory subjects: e.g. chemistry, biology, anatomy, physiology, health care, pathology: laboratories with associated practical rooms, scientific workshops, animal keeping and experiment rooms. Medical demonstration ('anatomy') theatres with steeply raked seating ~ 4. Natural science lecture theatres with experiment benches and steeply raked seating ~ 6).



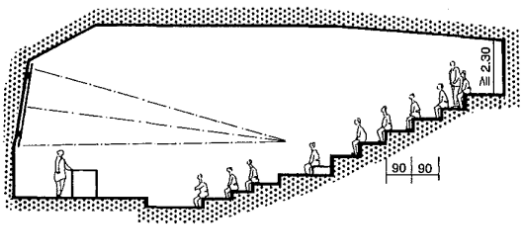
2 Geometrical determination of the listener curve



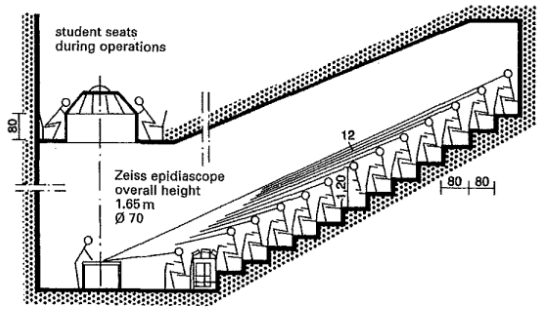
5 Longitudinal section through a lecture theatre



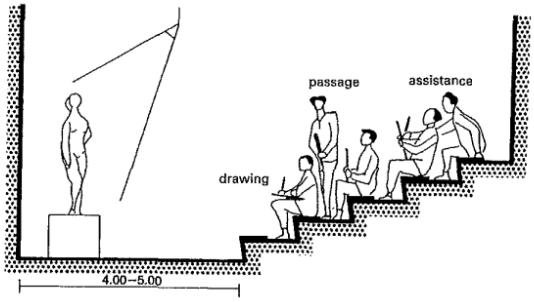
3 Normal lecture theatre design (humanities)



6 Steeply raked lecture theatre (natural sciences)



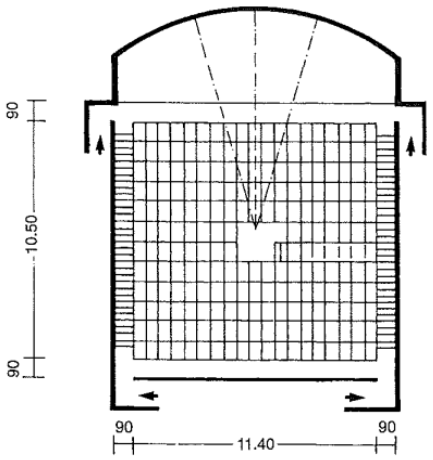
4 Lecture theatre for demonstrations on a bench (medicine)



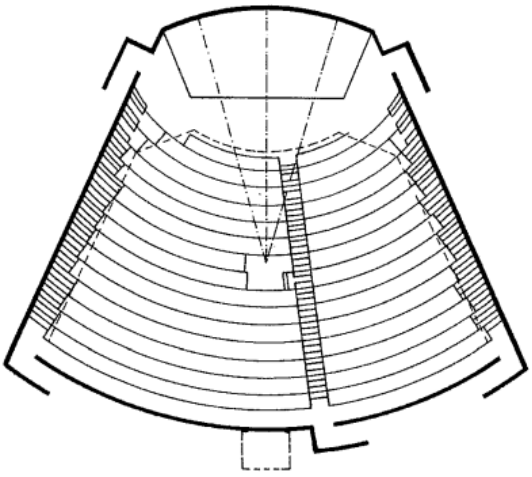
7 Steps in life drawing class with seated area of 0.65 m² per student (technical artistic subjects)

Larger lecture theatres for central lectures are preferably accommodated in auditorium buildings, and smaller lecture theatres for specialist lectures in institute or seminar buildings. Access to the lecture theatre is best separated from the research facilities, with the shortest possible route from outside to the back of the lecture theatre (in the case of raked seating, entrances behind the uppermost row, or in larger lecture theatres also at the side at middle height (3)

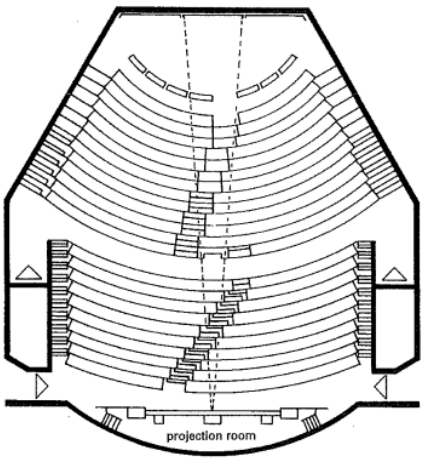
Lecturers enter the lecture theatre at the front, from the preparation room, and experimental apparatus can be rolled into the theatre. Common lecture theatre sizes are 100, 150, 200, 300, 400, 600, 800 seats. Lecture theatres with up to 200 seats, ceiling height approx. 3.5 m can be integrated into an institute building; larger theatres should ideally have their own building. Experiment benches should be easily changeable, on wheels and suitable for laboratory work. Media connections are required.



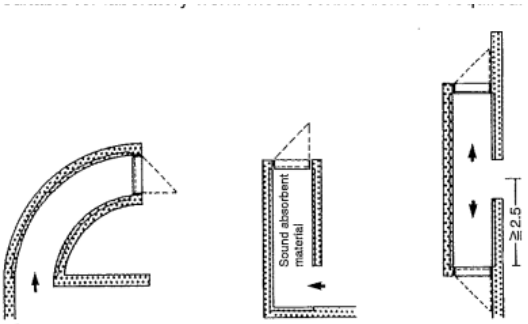
1 Rectangular lecture theatre with 200 seats



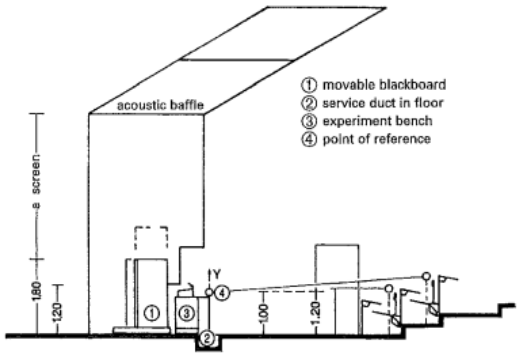
2 Trapezoidal lecture theatre with 400 seats



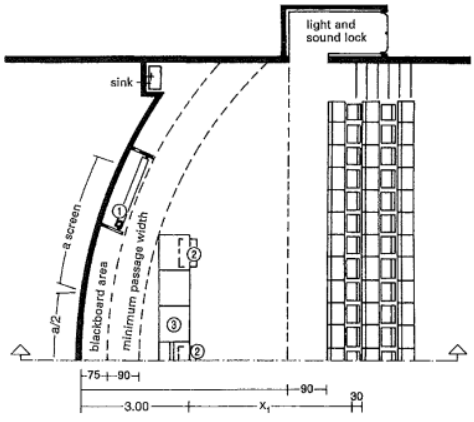
3 Lecture theatre with 800 seats



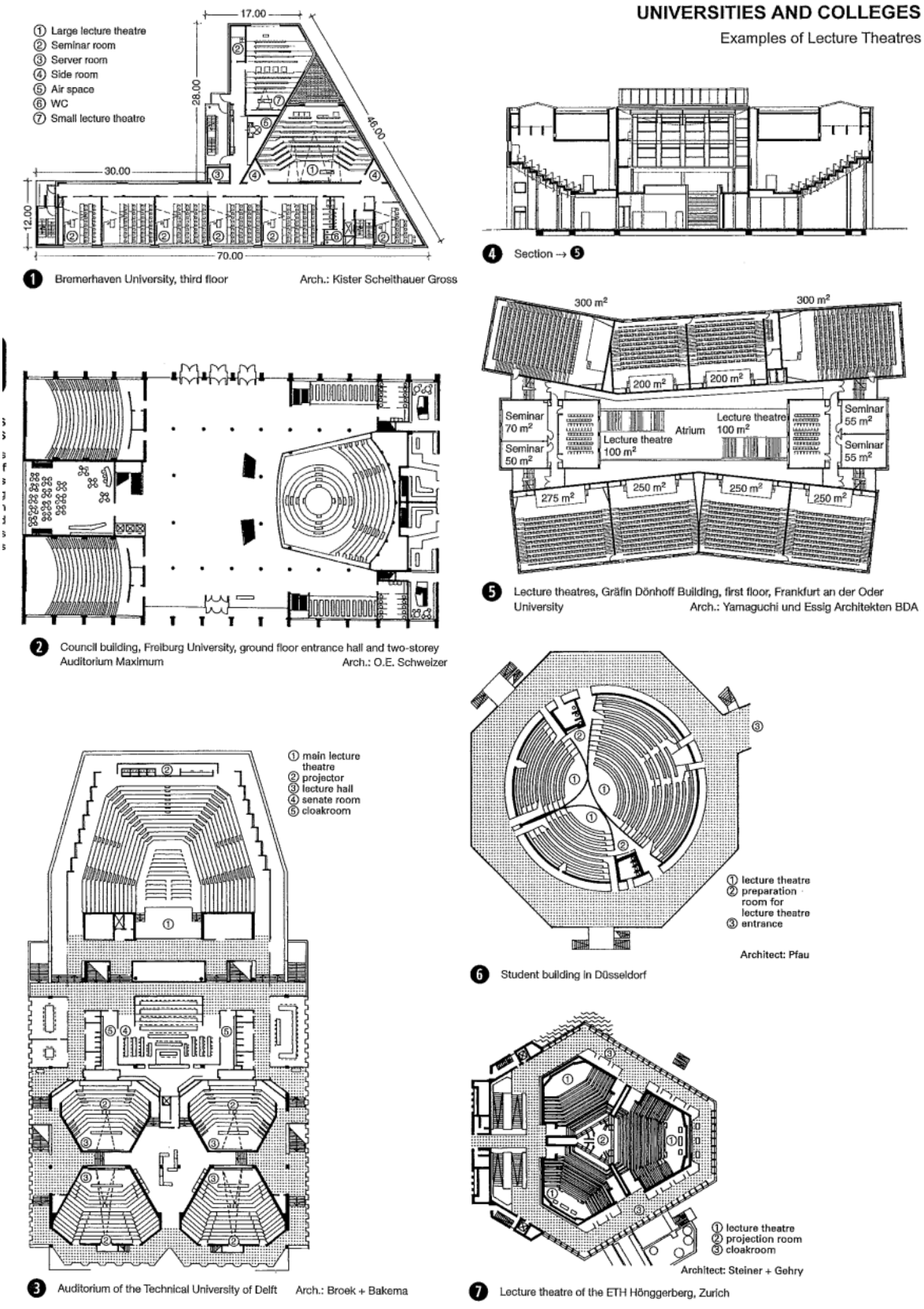
4 Floor plans for light and sound booths



5 Longitudinal section → 6



6 Plan of podium area



❶ Bremerhaven University, third floor Arch.: Kister Scheithauer Gross

❷ Council building, Freiburg University, ground floor entrance hall and two-storey Auditorium Maximum Arch.: O.E. Schweizer

❸ Auditorium of the Technical University of Delft Arch.: Broek + Bakema

❹ Section → ❺

❺ Lecture theatres, Gräfin Dönhoff Building, first floor, Frankfurt an der Oder University Arch.: Yamaguchi und Essig Architekten BDA

❻ Student building in Düsseldorf

❼ Lecture theatre of the ETH Hönggerberg, Zurich

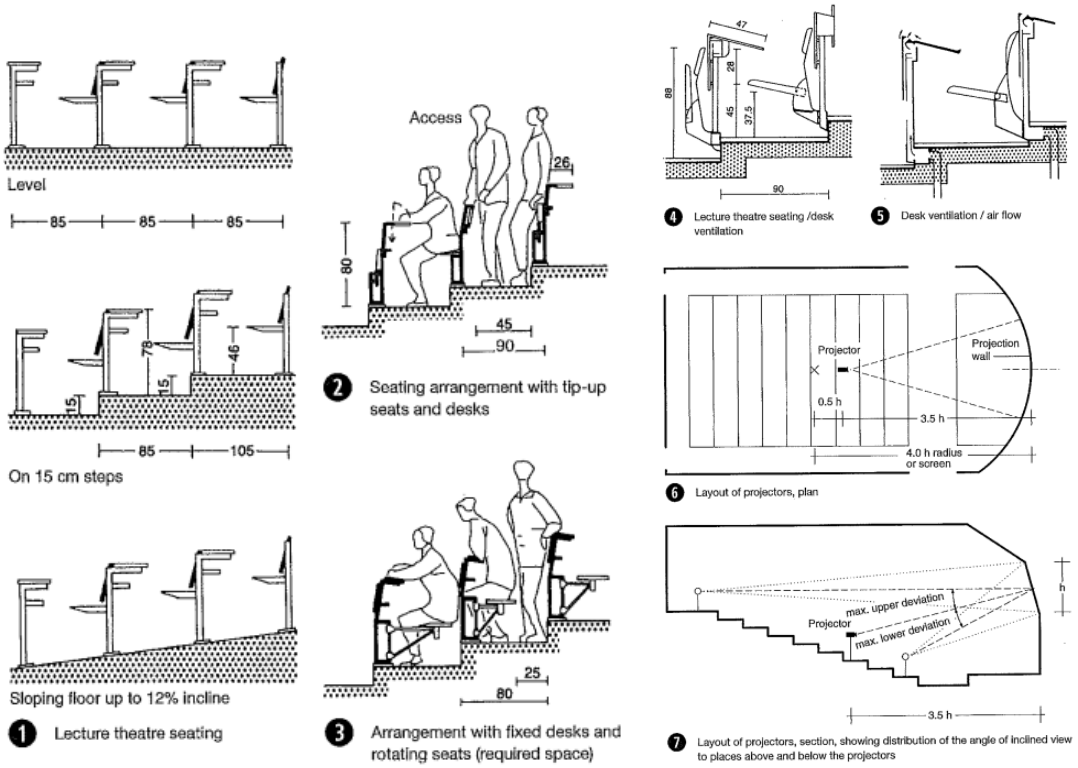
Figure 57: Lecture Theatres

5.18.1 Seating and Projections

Lecture theatre seating

Combined units with tip-up or slewing seat, backrest and desk (with shelf or hook for case or bag), mostly fixed mounting ~ 1 - 3. Arrangement is according to subject, number of students and type of tuition: from light (slide shows, electro-acoustic facilities) to heavy. Some lecture theatres (surgery, internal medicine, physics) have raked (rising) rows of seating ~ 1. The space requirement per student depends on type of seating, desk depth and floor pitch. Per student (including all walking areas in larger lecture theatres in a cramped situation), the space requirement is 1.10 m2, in smaller lecture theatres and in a normal situation 0.80-0.95 m2

Projection, boards, acoustics, lighting: Projection screens and black-/whiteboards can be designed as segmented surfaces, or fixed to a straight back wall. Wall boards in many sections, mostly vertically sliding, manual or mechanical, can be dropped down below the projection area. Wheeled boards or screens are also possible. Speech should reach the listener as uniformly as possible, with no disturbing echo. Suspended ceilings will aid reflection and absorption. Rear walls should be clad with sound-absorbing material, other walls flat. Light intensity in windowless lecture theatres: 600 lx.



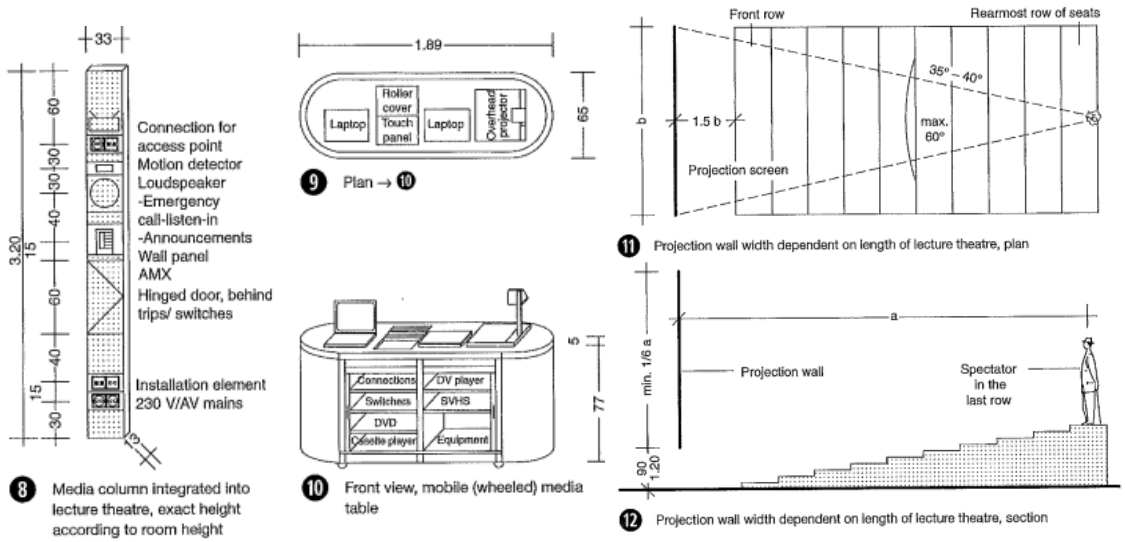


Figure 58: Lecture Theatre Seating

5.19 Seminar and Service Rooms

The design of lecture theatres and seminar rooms has to comply with the places of assembly regulations. It should also be ensured that wheelchair users have sufficient space in lecture theatres in line with standards.

5.19.1 Service rooms for lecture theatres.

Every lecture theatre should have a directly accessible side room. This has no fixed function and can be used as a storage room. Sufficient preparation area should be provided next to all lecture theatres featuring experiments, positioned at the same level and with a short route to the podium. Guideline for the min. size: for rectangular plan lecture theatre, approx. 0.2-0.25 m2 /seat.

trapezoidal plan 0.15-0.18 m2/seat; natural science and pre-clinical subjects 0.2-0.3 m2/seat. Areas for storage and staff rooms are necessary for the proper operation of a lecture theatre building: a room for technical staff to maintain the facilities; for cleaning staff; storeroom for replacement parts, light bulbs, fluorescent tubes, black-/whiteboard, clothing etc. Min. size per room 15 m2; space required for all side rooms min. 50-60 m2.

5.19.2 Computer room

The size of the computer room is related to the number and size of the computer desks, which depends on the size of the displays.

5.19.3 General tuition rooms

Seminar rooms, usual sizes: 20, 40, 50, 60 seats; mobile double tables, width 1.20 m, depth 0.60 m, space required per student 1.90-2.00 m. Variable arrangement of the tables for tutorial and group work. If there is free ventilation from only one external wall, the depth of the room should not exceed 2.5 x clear ceiling height.

- Offices for scientific personnel - 5
- professor 20-24 m2
- scientific assistant 15 m2
- assistant 20 m2
- secretary 15 m2 (double occupation 20 m2)

- Cloakroom and WC facilities
- Rough estimate for both together: 0.15-0.16 m2/seat
- Faculty and open-access libraries (-7 Libraries pp. 247 ff.)
- Storage for 30 000-200 000 vols on open-access shelves.
- Book storage space -6)
- Bookcases with 6-7 shelves, 2 m high (reaching height)
- Distance between bookcases 1.50-1.60 m
- Space required 1.0-1.2 m2/200 vols
- Reading places -7
- Width 0.9-1.0 m/depth 0.8 m
- Space required 2.4-2.5 m2 per place
- Entrance control, with storage for cases/bags; catalogue, copier room

5.20 Laboratories

Laboratories differ according to use and subject. According to use:

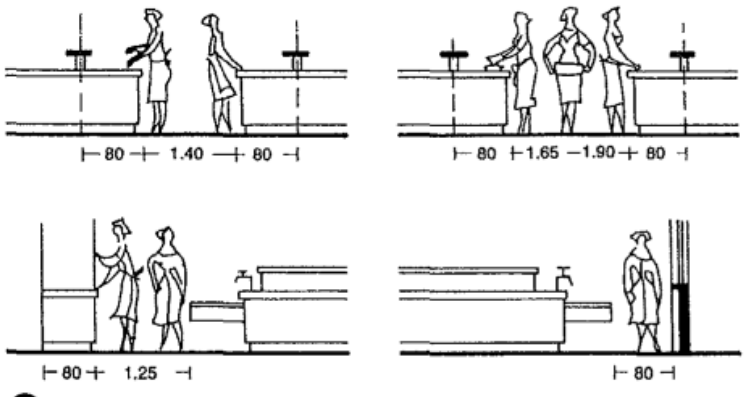
Tuition-related practical laboratories with a large number of workstations collected together and mostly with simple basic equipment - 3

Research-related laboratories, mostly in smaller rooms with special equipment and additional practical spaces like weighing and measurement rooms, centrifuge and autoclave rooms, rinsing kitchens, air-conditioned and cold storage rooms with constant temperature, photographic/dark rooms etc. -2

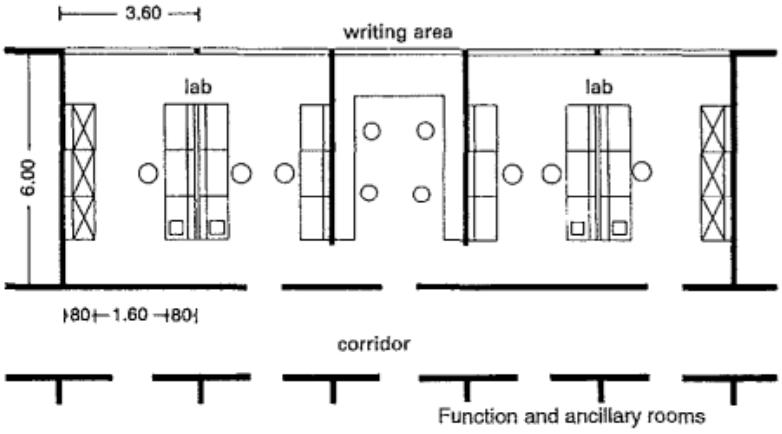
According to subject: Chemistry and biology laboratories have permanently installed laboratory benches. Rooms have a high rate of air exchange and frequently additional fume cupboards with air extraction - p. 204 -7 for work producing gas and smoke. Fume cupboards are often installed in their own rooms ('stink rooms').

Physics laboratories mostly have mobile benches and sophisticated electrical equipment in cable ducts in the wall or suspended from the ceiling. Low rate of air exchange -7 p. 204. There are special laboratories for specific requirements, e.g. isotope laboratories for work on radioactive substances in various safety classes.

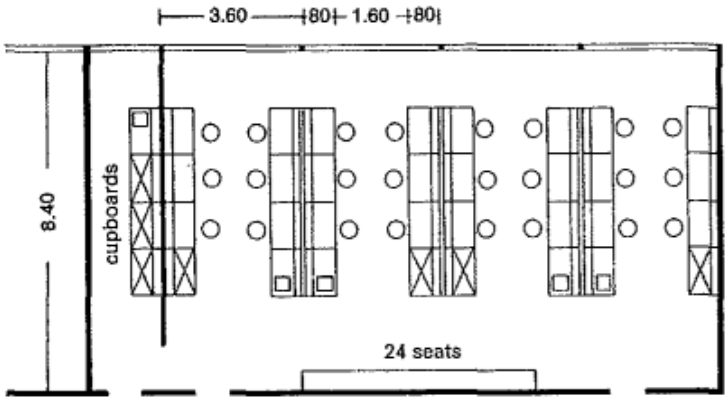
Clean room laboratories are used for work requiring especially dust-free filtered air, e.g. in microelectronics or for particularly dangerous substances, whose release into the surrounding rooms should be prevented by special air circulation and filtering (microbiology, gene technology) -4.



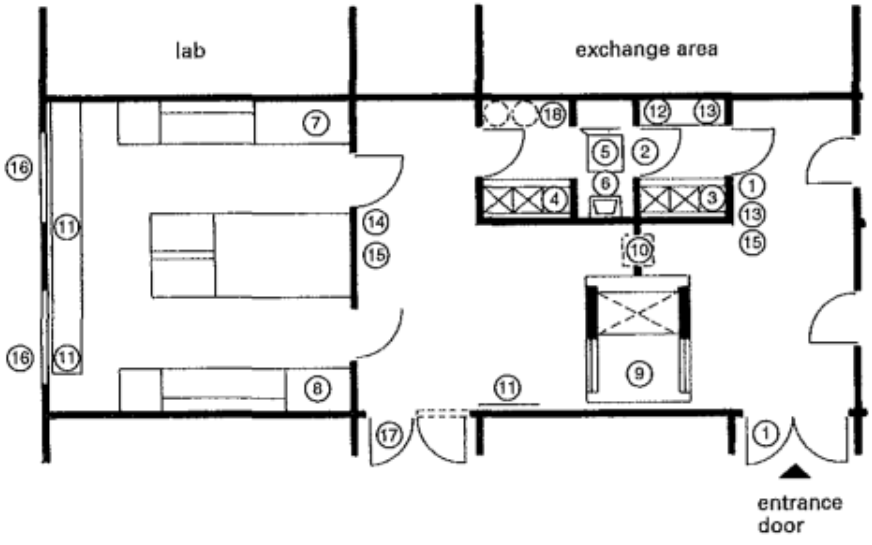
1 Minimum passage width at workstations



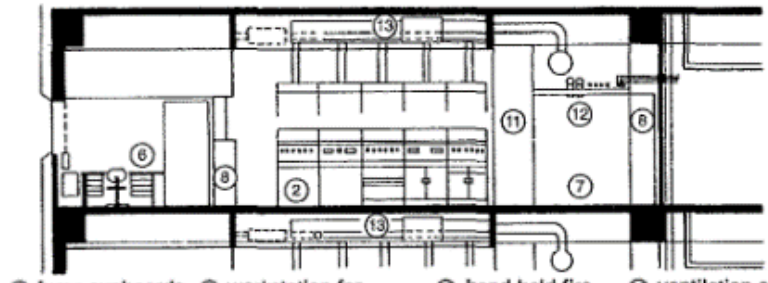
2 Research laboratory



3 Teaching and practical laboratory

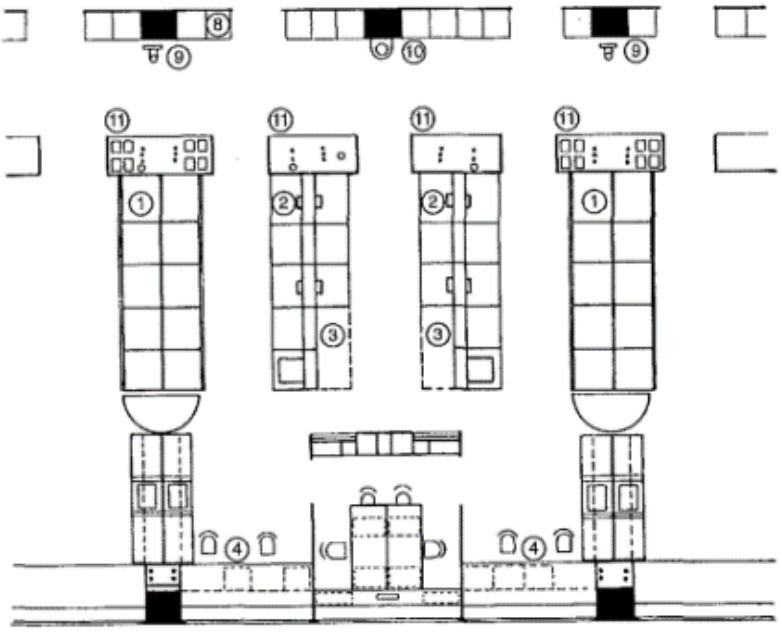


4 Clean room laboratory, example



① fume cupboards
② workbenches
③ reserves
④ dry work places
⑤ weighing tables
⑥ workstation for chemist
⑦ corridor
⑧ materials cupboards
⑨ eye douche
⑩ hand-held fire extinguisher
⑪ vertical energy supply
⑫ overhead pipes
⑬ ventilation and environmental control system

5 Section, BASF plastics laboratory Arch.: Suter u. Suter



6 Plan → **5**

Lab safety level 3
① warning sign
② double-door safety lobby, self-closing doors
③ outdoor clothing
④ protective clothing
⑤ floor trough (pos. disinfectant mat) in front of shower
⑥ hand wash basin with disinfectant dispenser
⑦ workbench (clean bench) with separate special filter
⑧ extractor
⑨ autoclave (in lab or building)
⑪ flat panel radiator (7.5 cm from wall)
⑫ control and monitoring cupboard: electricity box, emergency mains off-switch, error board
⑬ pressure difference display readable from inside and out with acoustic alarm
⑭ emergency telephone, telephone
⑮ two-way intercom, electric door-opener
⑯ windows: gas-tight, non-combustible, leaded
⑰ pass-door: fireproof

Lab safety level 4
② three-chamber safety lobby. Doors self-closing and gas-tight
⑤ personal shower (L-3 system can be upgraded*). Collect and disinfect waste water
⑦ gas-tight, enclosed workbench, separate air supply and extraction, additional special filter
⑨ autoclave with lockable doors on both sides, disinfect condensation
⑩ flood lock
⑱ autoclavable container for used protective clothing

*) Only required if upgrading to L-4 lab.

Figure 59: Lab Standards

Cold laboratories are used for tasks requiring extreme temperature conditions, photographic work and

as darkrooms. Workrooms without equipment installed also belong in the close laboratory area: Study cubicles; social/rest rooms for laboratory staff; central rooms for general storage, chemical stores and issue, with particular safety measures; isotope stores with decay containers etc. Animal laboratories are a special case, with rooms for keeping the animals, which have special equipment appropriate to the species and require their own air circulation.

Laboratory workstations The determining design unit for the laboratory workstation is the laboratory bench, permanently installed or mobile, whose dimensions together with the associated work and passage areas define the laboratory axis, which forms the basic spatial unit ~1 - 3.

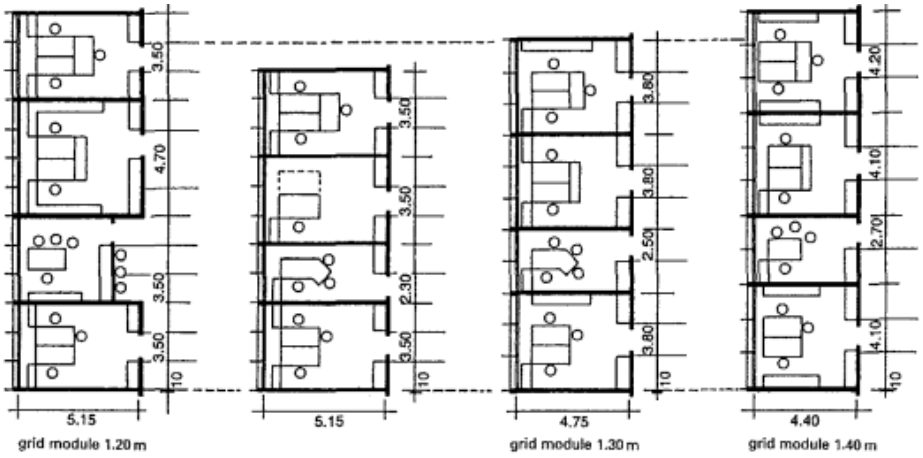
Standard dimensions for the normal working bench: 120 em width in practical laboratories, several times that in research laboratories, 80 em depth work surface including socket strip.

Benches and fume cupboards are mostly in the form of a building block system: element widths 120 em, fume cupboards 120 and 180.

The socket strip is an independent element with all electricity supply systems. Benches and low-level cupboards are placed in front of it.

Steel tubing supports the construction of laboratory benches, whose work surfaces are of artificial stone panels without joints, seldom tiled, and chemically resistant plastic panels. Low-level cupboards are of wood or plastic-coated chipboard. Supply services are fed from above out of the ceiling cavity or from below through the floor structure.

5.21 Office Building



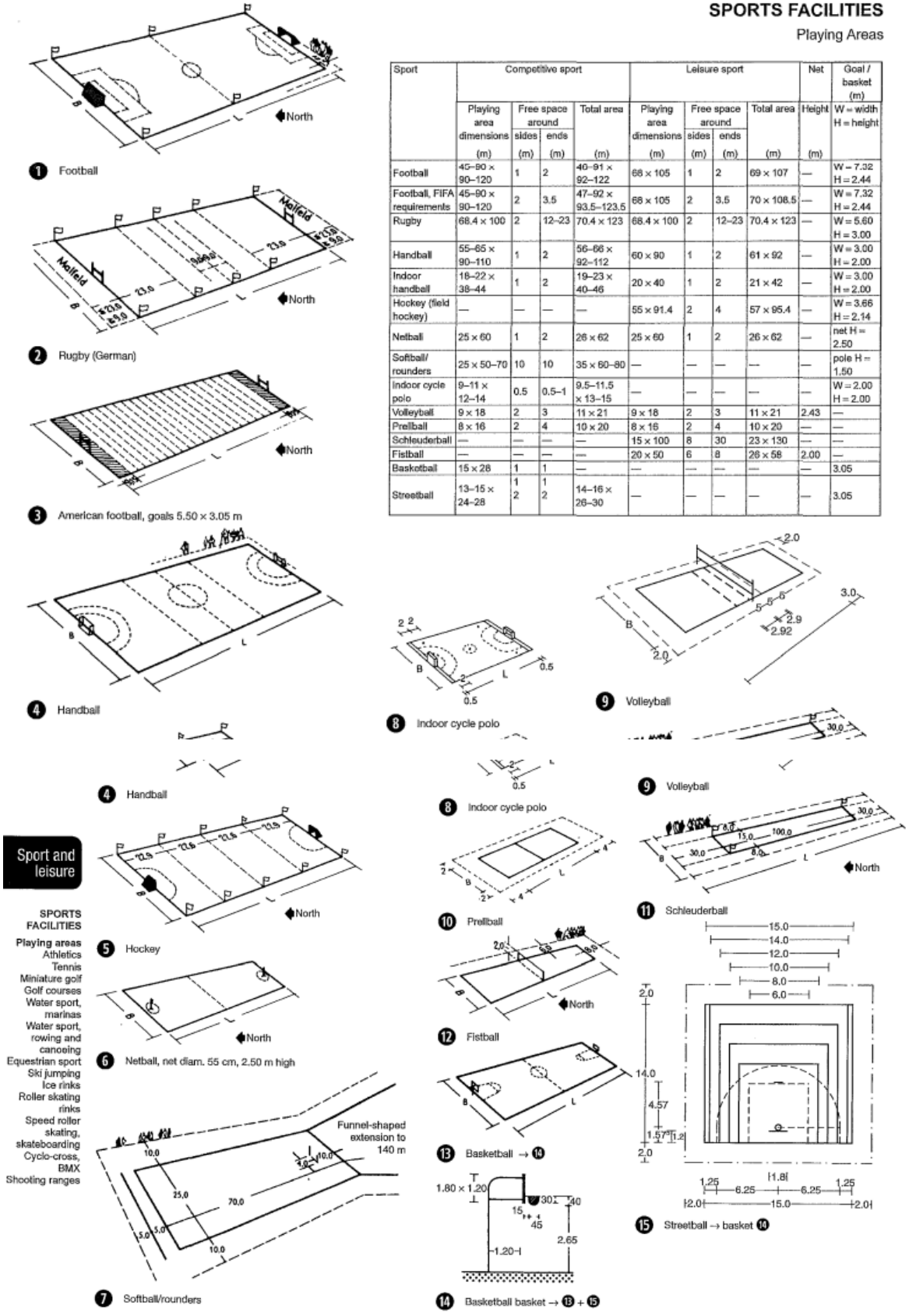
❸ Possible uses for various window axis dimensions

Figure 60: Office Building Standards

Open-plan office: A form of office developed in the 1960s and 1970s of the last century. Large-scale office landscapes with 100 or more workstations are made possible by artificial lighting and ventilation; they stand for free communication and openness. Economical cubic structures, however, have the disadvantage of high maintenance costs. This form is not very popular among users → ❸.

Group office: The experience with the open-plan layout led to the development of group offices with approx. 4–16 workstations; each office is used by a single team or department. This arrangement is preferred above all for creative, design or coordination and development activities with high internal communication needs. → ❷

5.22 Sports Facilities

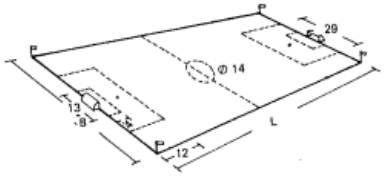


Sport	Competitive sport				Leisure sport				Net	Goal / basket (m)
	Playing area dimensions (m)	Free space around sides (m)	Free space around ends (m)	Total area (m)	Playing area dimensions (m)	Free space around sides (m)	Free space around ends (m)	Total area (m)	Height (m)	W = width H = height
Football	45–90 × 90–120	1	2	46–91 × 92–122	68 × 105	1	2	69 × 107	—	W = 7.32 H = 2.44
Football, FIFA requirements	45–90 × 90–120	2	3.5	47–92 × 93.5–123.5	68 × 105	2	3.5	70 × 108.5	—	W = 7.32 H = 2.44
Rugby	68.4 × 100	2	12–23	70.4 × 123	68.4 × 100	2	12–23	70.4 × 123	—	W = 5.60 H = 3.00
Handball	55–65 × 90–110	1	2	56–66 × 92–112	60 × 90	1	2	61 × 92	—	W = 3.00 H = 2.00
Indoor handball	18–22 × 38–44	1	2	19–23 × 40–46	20 × 40	1	2	21 × 42	—	W = 3.00 H = 2.00
Hockey (field hockey)	—	—	—	—	55 × 91.4	2	4	57 × 95.4	—	W = 3.66 H = 2.14
Netball	25 × 60	1	2	26 × 62	25 × 60	1	2	26 × 62	—	net H = 2.50
Softball/ rounders	25 × 50–70	10	10	35 × 60–80	—	—	—	—	—	pole H = 1.50
Indoor cycle polo	9–11 × 12–14	0.5	0.5–1	9.5–11.5 × 13–15	—	—	—	—	—	W = 2.00 H = 2.00
Volleyball	9 × 18	2	3	11 × 21	9 × 18	2	3	11 × 21	2.43	—
Prellball	8 × 16	2	4	10 × 20	8 × 16	2	4	10 × 20	—	—
Schleuderball	—	—	—	—	15 × 100	8	30	23 × 130	—	—
Fistball	—	—	—	—	20 × 50	6	8	26 × 58	2.00	—
Basketball	15 × 28	1	1	—	—	—	—	—	—	3.05
Streetball	13–15 × 24–28	1 2	1 2	14–16 × 26–30	—	—	—	—	—	3.05

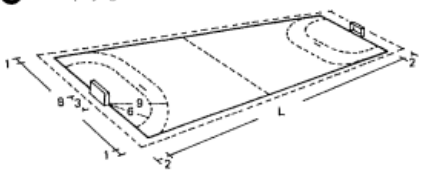
Figure 61: Sports Facility Standards

SPORTS FACILITIES

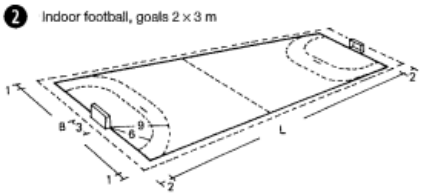
Playing Areas



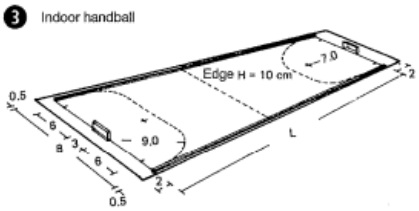
❶ Small playing field for school football



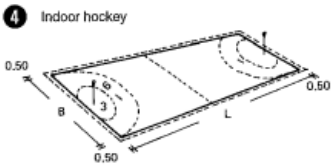
❷ Indoor football, goals 2 × 3 m



❸ Indoor handball

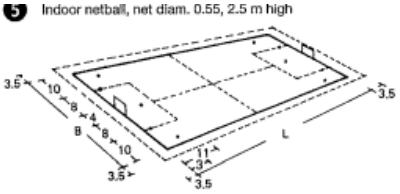


❹ Indoor hockey

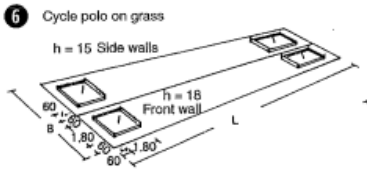


❺ Indoor netball, net diam. 0.55, 2.5 m high

❺ Indoor netball, net diam. 0.55, 2.5 m high



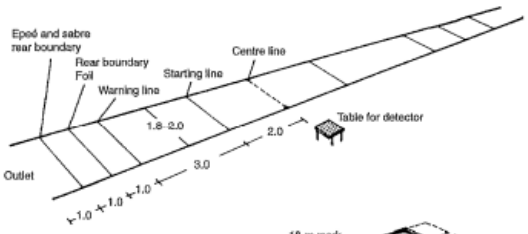
❻ Cycle polo on grass



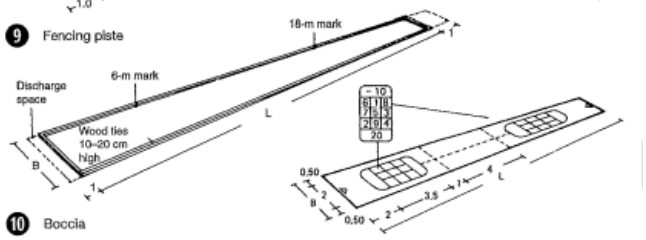
❼ Horseshoe throwing

Playing area size (m)						
Game	max.		min.		Standard dimensions[1]	
	L	W	L	W	L	W
❶ School football	70	40	40	20	44	22
❷ Indoor football	50	25	40	20	44	22
❸ Indoor handball	—	—	—	—	44	22
❹ Indoor hockey	40	20	36	18	44	22
❺ Indoor netball	60	25	64	27	—	—
❻ Cycle polo on grass	—	—	—	—	60	40
❼ Horseshoe throwing	15	3	12	3	—	—
❽ Croquet	—	—	—	—	20	4
❾ Fencing piste	24	2	13	1.80	—	—
❿ Boccia	—	—	—	—	24	3
⓫ Shuffleboard	—	—	—	—	17	3
⓬ Tennikoit	12.20	5.50	—	—	18.20	11.50
⓭ Baseball	—	—	—	—	18.29	18.29

[1] including safety margin



❾ Fencing piste

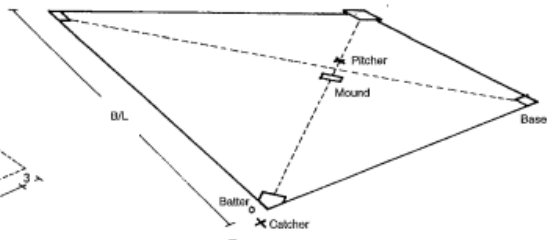


❿ Boccia

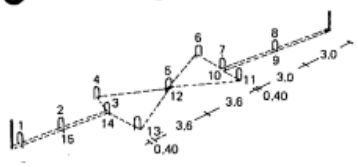
⓫ Shuffleboard

❿ Boccia

⓫ Shuffleboard



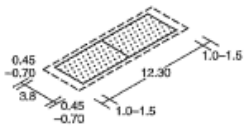
⓭ Baseball



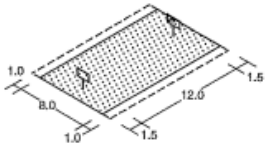
⓬ Tennikoit

❽ Croquet lawns

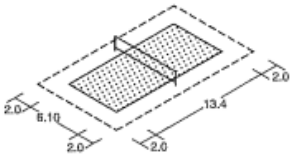
Figure 62: Sports Facility Standards



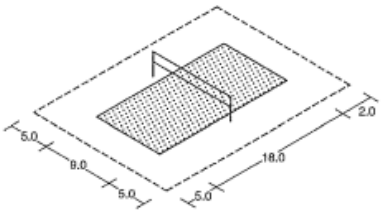
1 Beachminton



2 Beach basketball



3 Beach badminton (competitive)

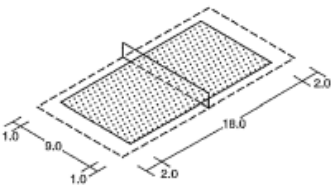


4 Beach volleyball (competitive)

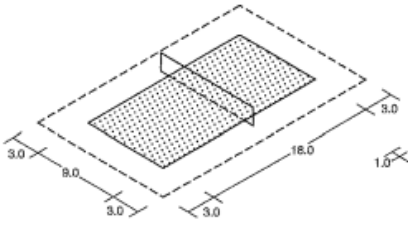
Beach sport type	Competitive sport				Leisure sport				Net	Goal/basket	Sports hall
	Size of playing area (m)	Free space around sides (m)	Free space around ends (m)	Total area (m)	Size of playing area (m)	Free space around sides (m)	Free space around ends (m)	Total area (m)	Height (m)	W = width H = height (C) = competition (m)	Clear height (m)
Volleyball	18.00 × 9.00	5.00	5.00	28.00 × 19.00	18.00 × 9.00	3.00	3.50	25.00 × 1500	2.24 F 2.43 M	—	reg >5.50 nat >7.00 int >12.50
Football ("professional")	36.00 × 28.00	1.00	2.00	40.00 × 30.00	—	—	—	—	—	W=7.32 (C) H=2.44 (C)	—
("amateur")	31.00 × 25.00	1.00	2.00	35.00 × 27.00	—	—	—	—	—	W=5.00 (C) H=2.00 (C)	—
	—	—	—	—	27.00 × 12.00	1.50	1.50	30.00 × 15.00		W=3.00 H=2.00	—
Football tennis	—	—	—	—	18.00× 9.00	1.00	2.00	22.00 × 11.00	1.30	—	—
Sepak takraw	18.00 × 9.00	2.00	2.00	22.00 × 13.00	12.00 × 6.00	2.00	2.00	16.00 × 10.00	1.10	—	—
Handball	27.00 × 12.00	3.00	3.00	33.00 × 18.00	27.00 × 12.00	1.50	1.50	30.00 × 15.00	—	W=3.00 H=2.00	—
Badminton	13.40 × 6.10	2.00	2.00	17.40 × 10.10	13.40 × 6.10	1.50 exceptionally. 0.30	2.00 exceptionally 1.30	16.40 × 10.10	1.55	—	reg >7.00 nat >7.00 int >9.00
Beachminton	12.30 × 3.80	0.45 0.70	1.00 1.50	14.30 × 4.70 15.30 × 5.20	12.80 × 3.80	0.30	0.35	13.00 4.40	1.28	—	reg >5.20 nat >6.50 Int >9.00
Basketball	12.00 (basket spacing)	—	—	—	15.00 × 8.00	1.00	—	15.00 × 10.00	—	12.00 (basket spacing)	—
Tennis (single court)	18.00 × 9.00 18.00 × 6.00	3.00 3.00	3.00 3.00	24.00 × 15.00 24.00 × 12.00	18.00 × 9.00 18.00 × 6.00	300 300	3.00 3.00	24.00 × 15.00 24.00 × 12.00	1.50 1.50	—	reg >7.00[1] nat >9.00 int >9.00
TAMbeach (single court)	24.00 × 11.00 24.00 × 7.50	1.00 1.00	2.00 2.00	28.00 × 13.00 28.00 × 9.50	18.00 × 9.00 18.00 × 6.00	1.00 1.00	2.00 2.00	22.00 × 11.00 22.00 × 8.00	2.10 to 2.15	—	—

[1] Regional leisure sport can take place from a hall height of 5.50 m

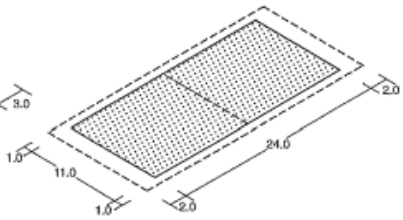
7 Dimensions of beach playing areas



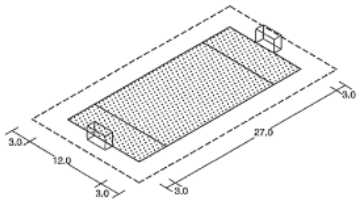
5 Beach football tennis



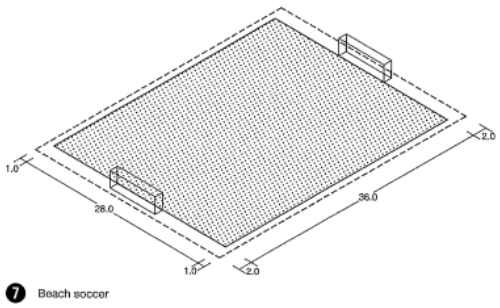
8 Beach tennis (doubles)



9 TAMbeach (competitive)



6 Beach handball (competitive)



7 Beach soccer

Figure 63: Sports Facility Standards

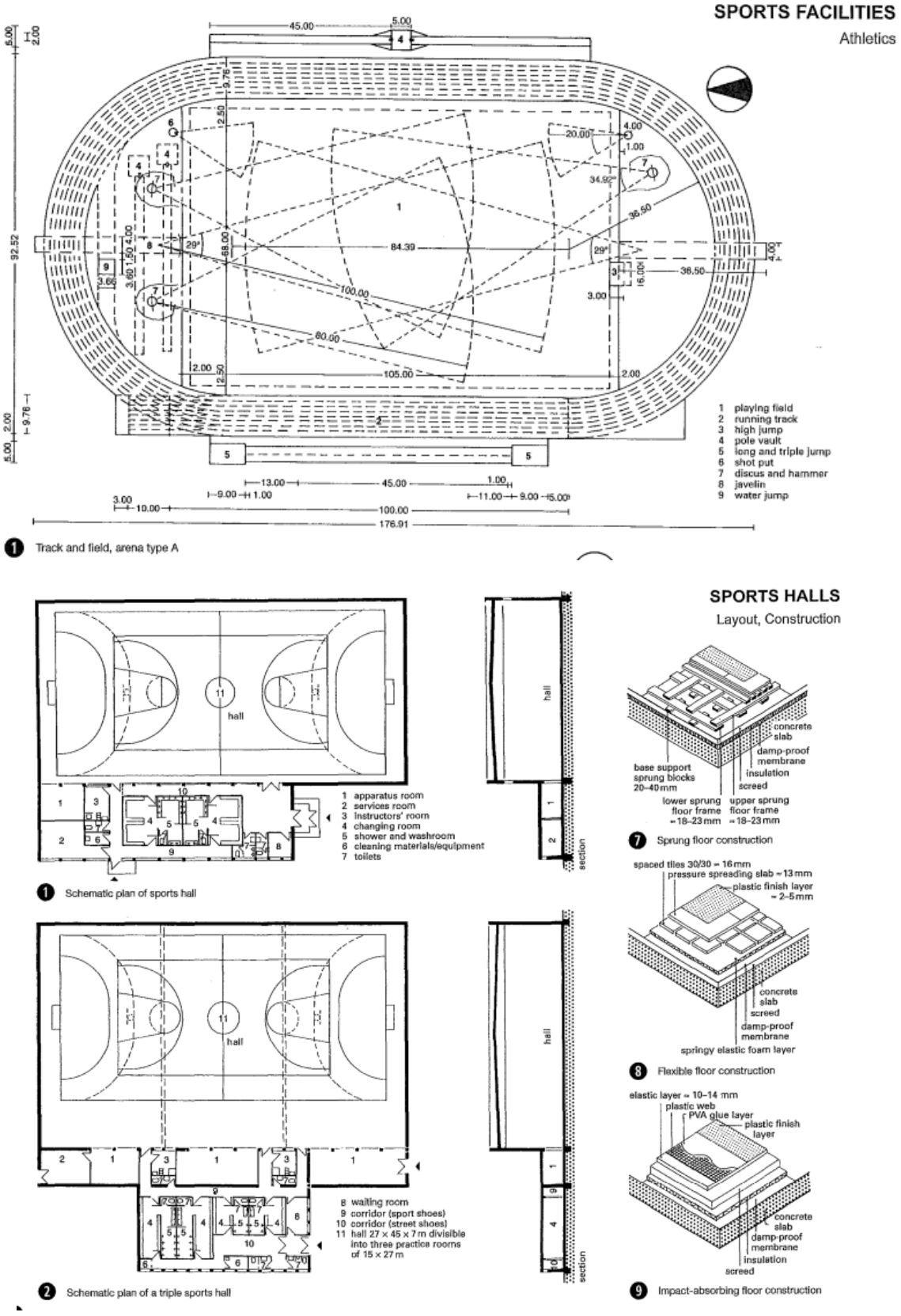
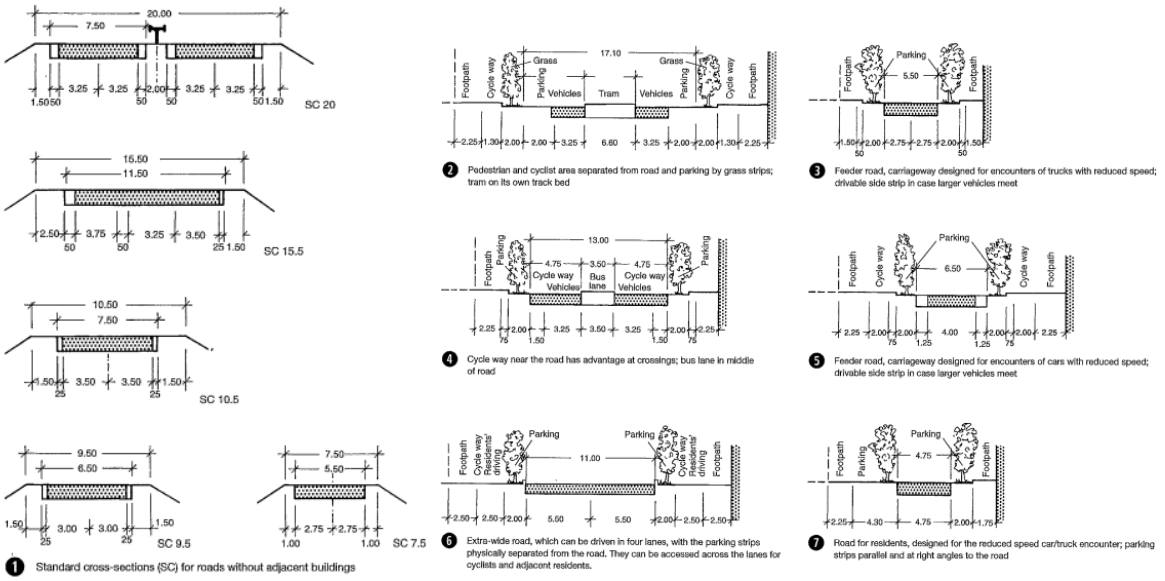


Figure 64: Sports Facility Standards

5.23 Inter Urban Road



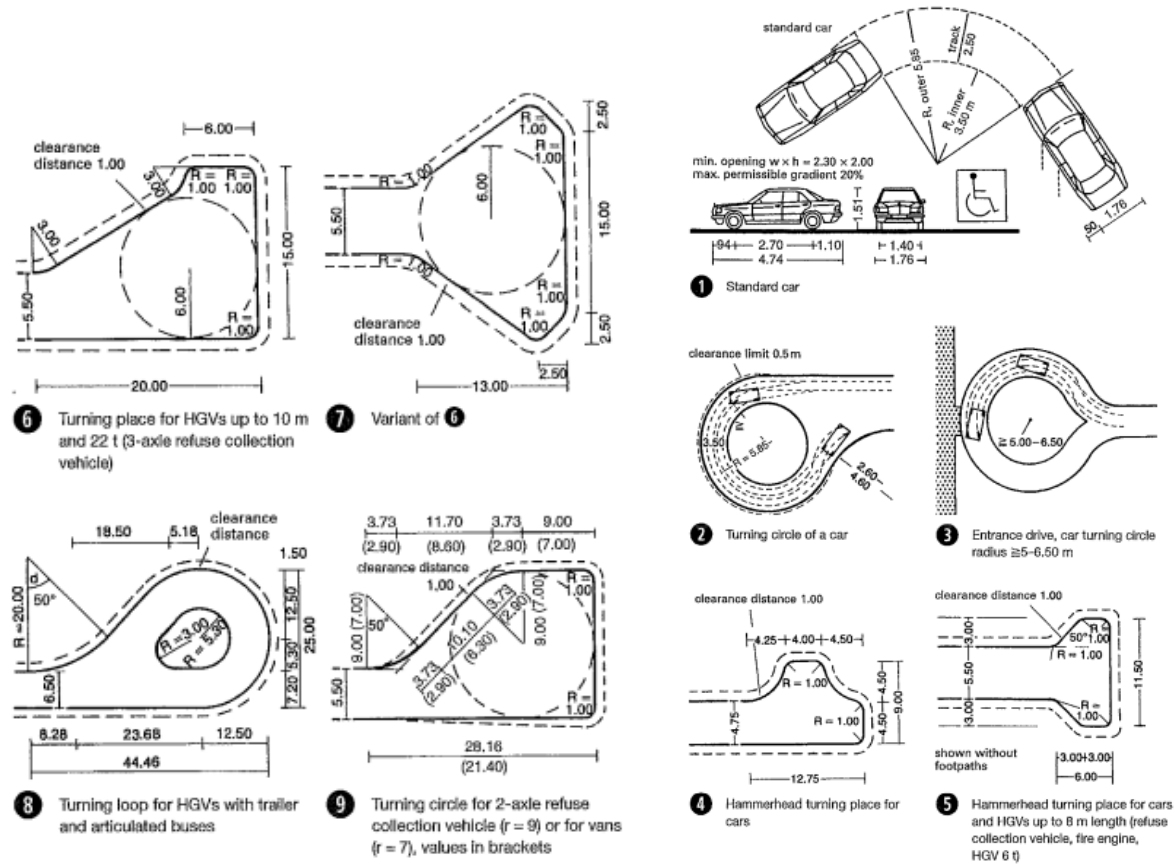


Figure 65: Road and Turning Standards

5.24 Bus Staions

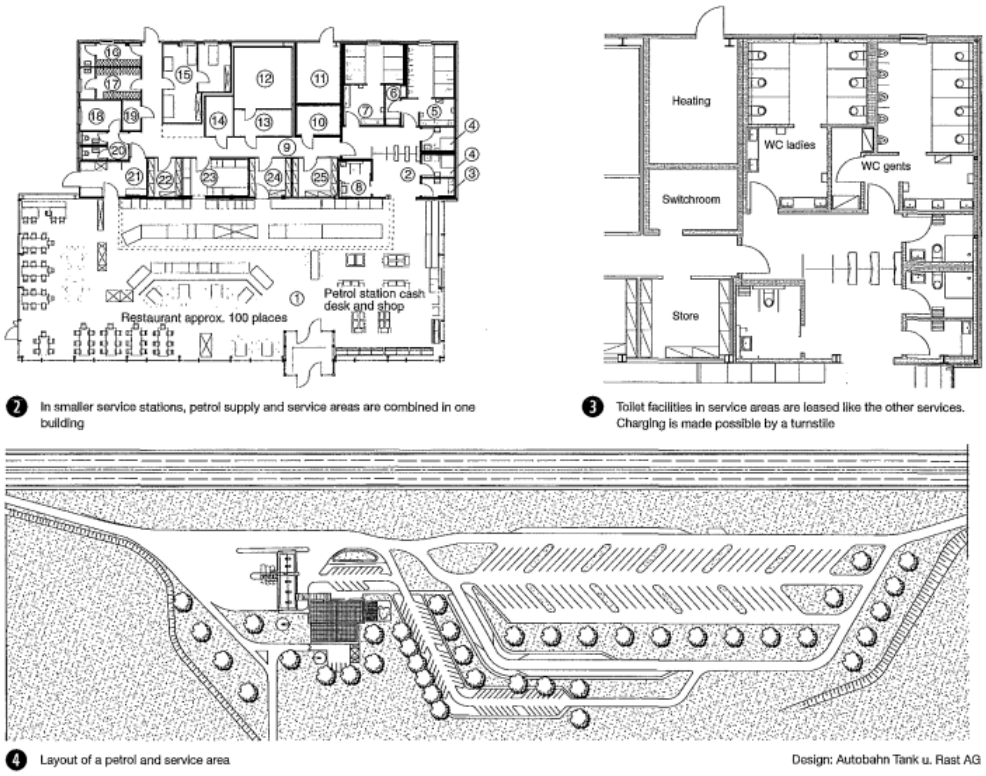


Figure 66: Bus Station Standards

5.25 Boundary Walls

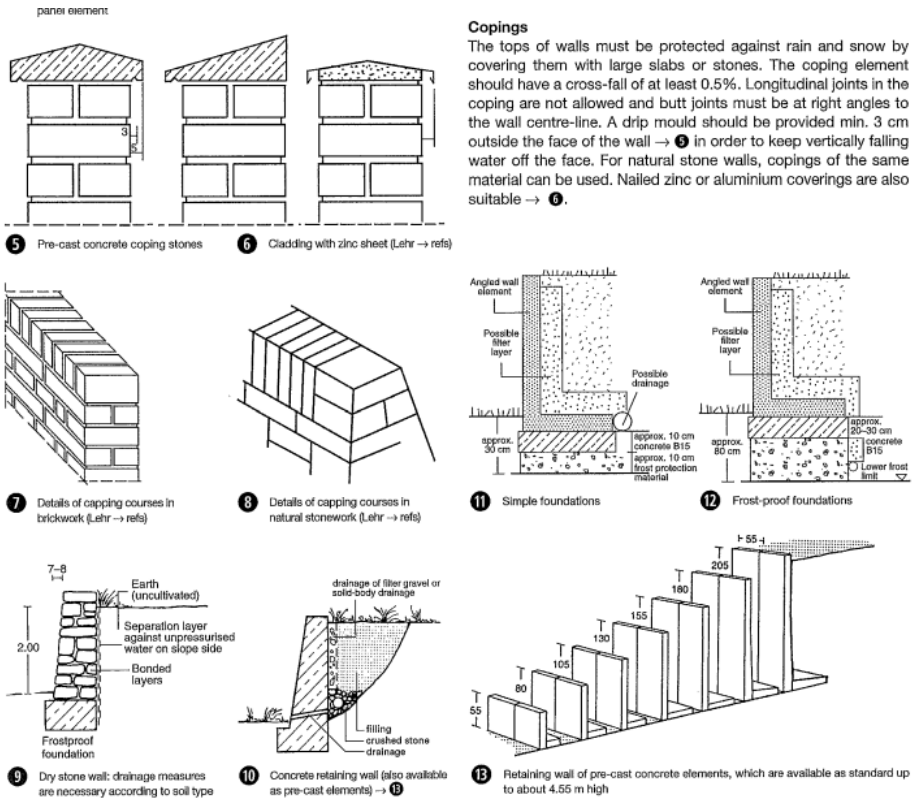
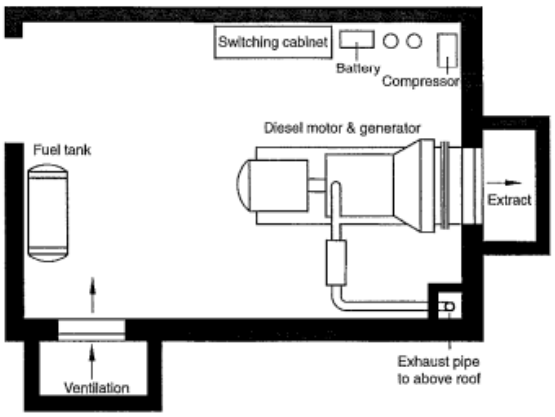


Figure 67: Boundary Walls

5.26 Emergency Power Rooms



❶ Room for diesel emergency generator set with separate air supply and extraction

Emergency power supply systems (diesel generator sets)
Emergency power units are combustion motors (usually diesel) which are coupled to generators to produce electricity. They are used for a limited time in case of a power cut (and are thus not for constant power supply) and supply emergency and safety lighting, lifts and other critical usages (e.g. in operating theatres in hospitals, server rooms and industrial processes etc.). They consist of a diesel motor and a generator mounted on a base frame (e.g. steel) on a foundation with elastic supports between machine set and frame, and a starter and battery → ❶.

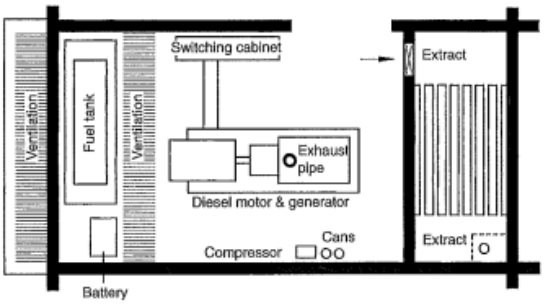
There are mobile (container generator sets) and permanently installed diesel generator sets including switching gear. The performance range is between 5 and 2000 kVA (kilovolt amp) according to specification.

The design starts with the determination of:
– motor power
– sound insulation
– exhaust system

Generator capacity (kVa)	20–60	100–200	250–500	650–1500
Room size (m)	5.0–4.0	6.0–4.5	7.5–5.0	10.5–5.5
Room height (m)	3.0	3.5	4.0	4.0
Door width (m)	2.0–1.5	2.0–1.5	2.2–2.0	2.2–2.0

❷ Dimensions of emergency generator rooms

Emergency power rooms
The required dimensions, height and openings of the room for a generator set vary according to the power and configuration of the motor → ❸. Air supply and extraction can be through forced ventilation (shaft) → ❶. It is also possible to run the extract air together with the exhaust of the diesel motor up a vertical shaft to exit above the roof → ❸ – ❹. In this case, sufficient sound insulation should be provided with a silencer in the ductwork → ❸ – ❹. The manufacturers of the motors give information about the required quantity of air and thus the size of the supply and extract ducts.



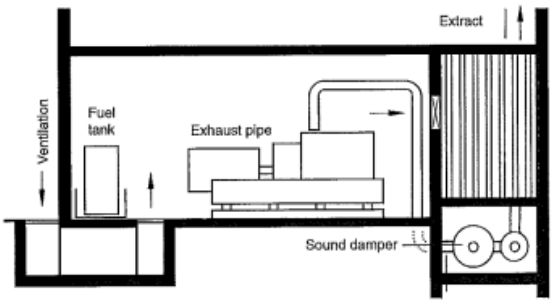
❸ Room for diesel emergency power generator with separate air supply and extraction

On account of the high noise level involved in running a generator set for testing and maintenance, it is recommended not to place it near inhabited rooms which should be particularly quiet (e.g. the care rooms of a hospital). Measures should also be undertaken to keep the noise level as low as possible. Another measure is to position the frame, on which the generator and motor are mounted, on spring dampers to reduce the sound transmission into the structure.

Uninterruptible power supply (UPS) systems
There is normally a gap of at most 15 seconds between the power cut and the switching to emergency power. UPS systems are used to continue power supply without interruption during this time. Static UPS systems are bridging battery power devices, whose batteries are constantly charged from the mains.

According to equipment and requirements, a UPS system should be able to protect the connected consumer from the following risks: power cuts, voltage fluctuations, voltage peaks, low voltage, excessive voltage, lightning effects/switching peaks, interference voltage and frequency fluctuations.

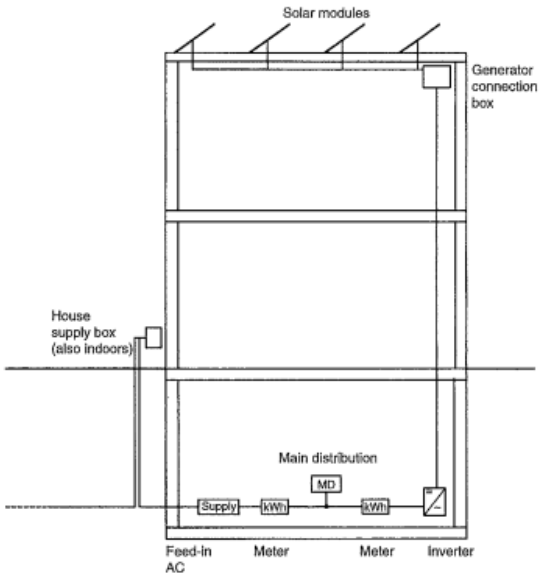
While UPS systems are designed to cope with a power cut of at most 30–60 minutes, diesel-powered emergency generators can supply power during much longer interruptions.



❹ Section → ❸

Figure 68: Emergency Power Rooms

5.27 Solar Energy Panels



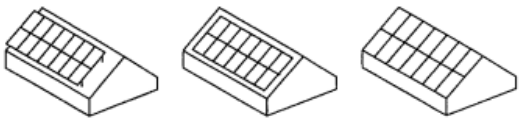
❷ Principle of a grid-connected photovoltaic system (Bohne → refs)

Most systems are connected to the grid for more cost-effective operation: the electricity coming from the solar modules is fed into the grid, which requires a separate feed-in meter.

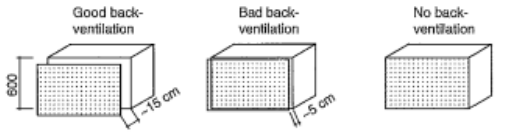
Large photovoltaic installations should be operated with changing tilt and alignment (tracking), with separate solar generators and grid feed-in equipment to achieve the optimum yield. Grid-connected systems work completely automatically without maintenance and have a lifetime of at least 20 years. Solar-generated electricity fed into the public grid is paid for over a guaranteed period as regulated in the Renewable Energy Law (EEG).

Photovoltaic elements can be integrated into the building envelope in various ways or mounted subsequently. They are designed for use in the open air and can be used as an independent part of a façade or roof. Solar cells are UV-resistant and weatherproof.

They can play an important architectural role and also fulfil other functions: sound, visual, sun and weather protection. Solar cells are mostly built on roofs, for which there are various possibilities: mounted on the roof (independently, mostly for later installation), integrated into the roof covering or forming the roof itself. The installation of photovoltaic modules in façades is also possible, in which case they should be back-ventilated in order to avoid reduction of yield → ❸ + ❹.



❸ Possible roof-related arrangements of photovoltaic elements



❹ Photovoltaic elements on a façade with possible yield reductions (Bohne → refs)

Figure 69: Solar Energy Panels

5.28 Green Building Requirements

10.1 **Provisions and Applicability**

These provisions for green buildings are applicable on all plots more than 105 sq. m in size The green building provisions on various plot sizes are indicated in the table below:

Table 10.1-Provisions and applicability for various plot sizes (all use premises)

Category of Plot Sizes (sq.m.)	Category of Plot Sizes (sq.m.)	Provisions for Green Building (as per Clause 10.2)
I	up to105	Optional usage of 2 (a), 2(b).
II	105 to 500	1(a), 2(a),2(b), 4(a)
	500 to 1,000	1(a), 1(c), 2(a),2(b), 4(a)
	1,000 to 3,000	1(a), 1(c), 1(d), 2(a),2(b), 3(b), 4(a)
III	Above 3,000	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3(a), 3(b), 4(a), 4(b)

Notes:

**The schemes/ projects formulated on the basis of provisions given in Master plan/ Zonal Development Plan will require approval as indicated:*

{Chapter 3 of these Bye-Laws, NBC (latest), ECBC 2007 or latest, BEE Star rating/ IGBC/ GRIHA Certification}

***EIA**- Environmental Impact Assessment Study Report, **ECC**- Environmental Clearance Certificate, **MoEF** – Ministry of Environment and Forest,**NBC** – National Building Code, **ECBC** – Energy Conservation Building Code, **BEE** – Bureau of Energy Efficiency, **LEED**– Leadership in Energy and Environment Design, **IGBC** – Indian Green Building Council, **GRIHA**– Green Rating for Integrated Habitat Assessment, **TERI** – The Energy and Resources Institute.*

The prevailing provisions of the above shall be applicable. However if there are any modification in the same, the modified provisions shall become automatically applicable.

Figure 70: Unified Building Byelaws Delhi-2016

1. Water conservation and management
    a. Rainwater Harvesting (by Recharge)
    b. Low Water Consumption Plumbing Fixtures
    c. Wastewater Recycle and Reuse
    d. Reduction of hardscape
2. Solar Energy Utilization
    a. Installation of Solar Photovoltaic Panels
    b. Installation of Solar Assisted Water Heating Systems
3. Energy Efficiency
    a. Low Energy Consumption Lighting Fixtures (Electrical Appliances – BEE Star and Energy Efficient Appliances)
    b. Energy Efficiency in HVAC systems
4. Waste Management
    a. Segregation of Waste
    b. Organic Waste Management

5.28.1 GRIHA Rating System

GRIHA v.2019			
Section	**Criterion No.**	**Criterion Name**	**Maximum Points**
1. Sustainable Site Planning	1	Green Infrastructure	5
	2	Low Impact Design	5
	3	Design to Mitigate UHIE	2
2. Construction Management	4	Air and Soil Pollution Control	1
	5	Top Soil Preservation	1
	6	Construction Management Practices	2
3. Energy Efficiency	7	Energy Optimization	12
	8	Renewable Energy Utilization	5
	9	Low ODP and GWP Materials	1
4. Occupant Comfort	10	Visual Comfort	4
	11	Thermal and Acoustic Comfort	2
	12	Maintaining Good IAQ	6
5. Water Management	13	Water Demand Reduction	3
	14	Wastewater Treatment	3
	15	Rainwater Management	5
	16	Water Quality and Self-Sufficiency	5
6. Solid Waste Management	17	Waste Management-Post Occupancy	4
	18	Organic Waste Treatment On-Site	2
7. Sustainable Building Materials	19	Utilization of Alternative Materials in Building	5
	20	Reduction in GWP through Life Cycle Assessment	5
	21	Alternative Materials for External Site Development	2
8. Life Cycle Costing	22	Life Cycle Cost Analysis	5
9. Socio-Economic Strategies	23	Safety and Sanitation for Construction Workers	1
	24	Universal Accessibility	2
	25	Dedicated Facilities for Service Staff	2
	26	Positive Social Impact	3
10. Performance Metering and Monitoring	27	Commissioning for Final Rating	7
	28	Smart Metering and Monitoring	0
	29	Operation and Maintenance Protocol	0
Total Points			100
11. Innovation	30	Innovation	5
Grand Total Points			100 + 5

Figure 71: https://www.grihaindia.org

5.28.1.1 IGBC Green Campus

Checklist

IGBC Green Campus Rating System		New Campuses	Existing Campuses
Site Planning and Management		**25**	**25**
SPM MR 1	Green Features in the Campus Buildings	Required	Required
SPM MR 2	Soil Erosion Control	Required	Required
SPM Credit 1	Enhanced Green Features in the Campus Buildings	12	12
SPM Credit 2	Basic Amenities	1	1
SPM Credit 3	Site Preservation	2	NA
SPM Credit 4	Green Cover	4	4
SPM Credit 5	Heat Island Reduction, Roof & Non-roof	4	6
SPM Credit 6	Outdoor Light Pollution Reduction	1	1
SPM Credit 7	Universal Design	1	1
Sustainable Transportation		**7**	**7**
ST Credit 1	Pedestrian Network	2	2
ST Credit 2	Bicycle Network	2	2
ST Credit 3	Access to Sustainable Transportation	3	3
Water Conservation		**19**	**20**
WC MR 1	Rainwater Harvesting	Required	Required
WC Credit 1	Enhanced Rainwater Harvesting	6	6
WC Credit 2	Sustainable Landscape	2	2
WC Credit 3	Management of Irrigation Systems	2	2
WC Credit 4	Wastewater Treatment and Reuse	5	6
WC Credit 5	Optimise Water Use for Construction	1	NA
WC Credit 6	Water Performance Monitoring	3	4
Energy Efficiency		**21**	**24**
EE Credit 1	Eco-friendly refrigerants	1	2
EE Credit 2	Enhanced Energy Efficiency	7	8
EE Credit 3	Green Power	10	10
EE Credit 4	Energy Performance Monitoring	3	4
Material and Resource Management		**12**	**8**
MRM MR 1	Segregation of Waste, Post-occupancy	Required	Required
MRM Credit 1	Sustainable Building Materials	4	NA
MRM Credit 2	Use of Green Products & Equipment	3	3
MRM Credit 3	Handling of Waste Materials, During Construction	1	NA
MRM Credit 4	Dry Waste Management, Post-occupancy	NA	1
MRM Credit 5	Organic Waste Management, Post-occupancy	4	4
Health & Well-being		**8**	**6**
HWB MR 1	Tobacco Smoke Control	Required	Required
HWB Credit 1	Daylighting	2	3
HWB Credit 2	Control Indoor and Outdoor Pollutants	1	1
HWB Credit 3	Low VOC Materials	2	NA
HWB Credit 4	Health & Well-being Facilities	2	2
HWB Credit 5	Basic Facilities for Construction Workforce	1	NA
Sustainable Operation & Maintenance		**1**	**3**
SOM Credit 1	Green Audit	NA	2
SOM Credit 2	Green Education	1	1
Innovation in Design		**7**	**7**
ID Credit 1	Innovation in Design Process	4	4
ID Credit 2	GHG Inventorization and Mitigation Measures	2	2
ID Credit 3	IGBC Accredited Professional	1	1
-	**Total**	**100**	**100**

Figure 72: https://igbcinigbcgreencampus

The threshold criteria for certification levels are as under:

Certification Level	New Campus & Existing Campus	Recognition
Certified	50 – 59	Best Practices
Silver	60 – 69	Outstanding Performance
Gold	70 – 79	National Excellence
Platinum	80 – 100	Global Leadership

IGBC Green Campus Rating System – Version 1.0

5.28.1.2 LEED Rating

LEED Rating System Criteria (LEED v4 – Building Design and Construction)

Credit Category	Description
1. Integrative Process	Encourages early analysis of energy and water systems to support informed design decisions.
2. Location and Transportation	Focuses on site selection to minimize transportation impacts (e.g., access to public transit, bicycle facilities, walkability, reduced vehicle use).
3. Sustainable Sites	Promotes responsible site development: open spaces, rainwater management, heat island reduction, and light pollution control.
4. Water Efficiency	Encourages water-saving fixtures, efficient landscaping, and reduction in potable water use for irrigation.
5. Energy and Atmosphere	Optimizes energy performance, encourages renewable energy use, commissioning of building systems, and monitoring-based commissioning.
6. Materials and Resources	Focuses on sustainable materials, waste reduction, life-cycle impacts, reuse, recycling, and sourcing of materials.
7. Indoor Environmental Quality	Addresses daylight, ventilation, acoustic comfort, thermal control, and use of low-emitting materials to support occupant health and productivity.
8. Innovation	Awards points for creative sustainable strategies beyond the established credits, including education and exemplary performance.
9. Regional Priority	Grants additional points for addressing geographically specific environmental priorities, as determined by the LEED system's regional credits map.

LEED Certification Levels

Points Earned (Out of 110)	Certification Level
40–49	LEED Certified
50–59	LEED Silver
60–79	LEED Gold
80+	LEED Platinum

Figure 73: httpswwwusgbcorgleed

5.28.1.3 BEE Rating System

The **Bureau of Energy Efficiency (BEE)** is a statutory body under the Ministry of Power, Government of India, responsible for promoting energy efficiency in buildings, appliances, and industrial operations.

For buildings, BEE has introduced the **Energy Performance Index (EPI)-based Star Rating System**, which evaluates the energy performance of commercial and institutional buildings, including universities.

Criteria	Details
Applicable Building Types	Office buildings, Hotels, Hospitals, IT parks, Retail malls, and Institutional buildings
Basis of Rating	Energy Performance Index (EPI): kWh/sqm/year – actual energy consumption per square metre
Climate Zones	India is divided into 5 climate zones: Composite, Hot & Dry, Warm & Humid, Temperate, Cold
Rating Scale	1 Star to 5 Star, based on the building's EPI compared to benchmark for its climate zone
Pre-requisites	- Centralized HVAC system (for applicable categories) - At least 12 months of energy data
Data Considered	Actual electricity bills (including diesel/generator backup), floor area, operating hours

Published by: International Organization for Standardization (ISO)
Scope: Environmental Management Systems (EMS)
Purpose: Helps organizations improve their environmental performance through efficient resource use and waste reduction.

Key standards in the ISO 14000 family:

Standard	Title
ISO 14001:2015	Environmental Management Systems – Requirements with guidance for use
ISO 14004	General guidelines on principles, systems, and support techniques
ISO 14006	Guidelines for incorporating ecodesign
ISO 14031	Environmental performance evaluation

5.28.1.4 Life Cycle Assessment (LCA) Framework

LCA (Life Cycle Assessment) is a systematic methodology used to assess the **environmental impacts associated with all stages of a product's or building's life cycle**—from raw material extraction to disposal. It is widely used in green building certification systems (like LEED, GRIHA, IGBC) to evaluate the **ecological footprint** of materials, systems, and entire buildings.

Purpose of LCA in Campus Design

- For a university campus like **AUD Rohini**, LCA helps in:
- Choosing **low-impact building materials**.
- Evaluating **construction methods and energy systems**.
- Reducing **embodied carbon**.
- Supporting **eco-labelling, EPDs (Environmental Product Declarations)** and compliance with **green building norms**.

LCA Phase	Description
1. Goal and Scope Definition	Define the purpose of the study, the system boundaries (e.g., building materials only vs. full construction and use), and the functional unit (e.g., 1 sqm built area).
2. Inventory Analysis (LCI)	Collect data on inputs (materials, energy, water) and outputs (emissions, waste, by-products) for each life cycle stage.
3. Impact Assessment (LCIA)	Translate inventory data into environmental impact categories such as:
	- **Global warming potential (GWP)** (CO_2 emissions) - **Ozone depletion** - **Acidification** - **Resource depletion** - **Water use**
4. Interpretation	Analyze results, identify hotspots, and recommend design improvements (e.g., switching materials, reducing transport).

LCA Stages in a Building's Life Cycle

Stage	Includes
1. Raw Material Extraction	Mining, harvesting, and transportation of raw materials (e.g., stone, cement, steel, wood).
2. Manufacturing	Energy, water, and emissions used in producing construction materials and components.
3. Construction	On-site energy, machinery use, material transport, waste generation.
4. Operation & Maintenance	Energy/water use, HVAC systems, repairs, retrofitting.
5. End-of-Life	Demolition, recycling, landfill, transportation of waste.

Applicable Green Building Norms and Sustainability Frameworks for Ambedkar University Delhi

In line with the vision of developing a sustainable and environmentally responsible campus, it is imperative to refer to relevant green building standards and frameworks. The selection has been made based on the institutional typology, climatic responsiveness, national compliance mandates, and long-term environmental goals of the university. The following norms are recommended:

1. GRIHA (Green Rating for Integrated Habitat Assessment)

Recommended as the primary framework

GRIHA is India's nationally accepted rating system, developed specifically for climate-responsive and resource-efficient buildings. It aligns well with public institutional projects such as AUD. GRIHA encourages passive architectural design, low-impact construction, and promotes self-sufficiency in energy and water usage.

Relevance to AUD:

- Climate-responsive design integration
- Solar passive strategies and renewable energy incorporation
- Efficient waste and water management
- Lifecycle cost reduction through sustainable materials
- Mandated in various government projects

2. IGBC (Indian Green Building Council) – Green Campus Rating

The IGBC Green Campus Rating System is designed for educational campuses with multiple buildings and integrated outdoor environments. It promotes environmentally responsible planning, resource efficiency, and user well-being.

Relevance to AUD:

- Suitable for large, multi-use university campuses
- Emphasizes pedestrian and bicycle-friendly planning
- Focus on ecological preservation and student well-being
- Integrates green landscaping, shaded pathways, and low-carbon mobility

3. BEE (Bureau of Energy Efficiency) Norms

The BEE's Energy Conservation Building Code (ECBC) and appliance star rating standards are essential for ensuring energy efficiency in institutional buildings.

Relevance to AUD:

- Mandatory for large public and institutional buildings
- Guides envelope design, HVAC systems, lighting, and equipment selection
- Supports energy modeling and compliance evaluation
- Enables reduced operational costs through high-efficiency systems

4. ISO 14001:2015 – Environmental Management Systems (EMS)

While not a design-stage requirement, ISO 14001 provides a comprehensive framework for managing the environmental impact of ongoing campus operations. It facilitates environmental policy implementation, performance tracking, and continual improvement.

Relevance to AUD:

- Useful for post-occupancy sustainability governance
- Enables systematic tracking of environmental performance
- Promotes policy-based integration of environmental goals in administration

5. LCA (Life Cycle Assessment) Framework

Life Cycle Assessment offers a scientific approach for evaluating the environmental impact of building materials and systems over their entire lifespan—from raw material extraction to disposal.

Relevance to AUD:

- Informs material selection and procurement strategy
- Encourages low-carbon, locally sourced, and recyclable materials
- Supports carbon footprint reduction and sustainable construction practices

6. LEED (Leadership in Energy and Environmental Design) ***(Optional/Reference Use)***

LEED is a globally recognized certification system. While not essential for a public institution like AUD, it can be referred to for benchmarking best practices or in case of international funding or collaboration.

Relevance to AUD:

- Offers alignment with international sustainability benchmarks
- Can be used for comparative learning and performance evaluation

3. SITE INVENTORY

3.1 Location

The Site is located in Sector 3, Rohini, Delhi 110085. Rohini is predominantly a residential area planned for 8,50,000 population. This Scheme was planned in 1980. Rohini sub-city is divided into more than 50 Sectors of which 'Sector 3' is the biggest Sector. Sector 3 is divided into three parts:- Residential area, Institutional area, and Commercial area.



Figure 74: Rohini, Delhi

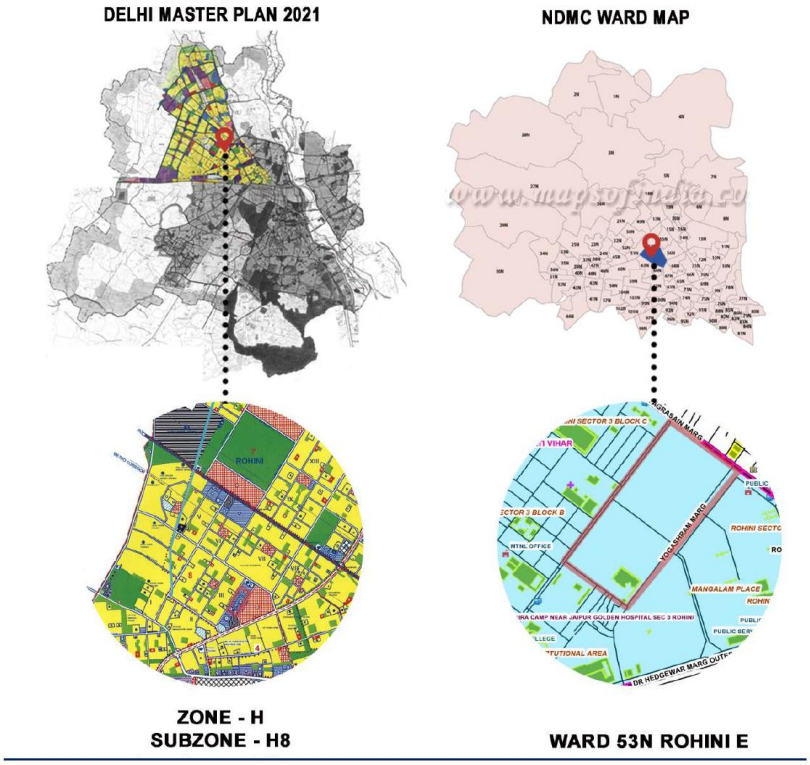
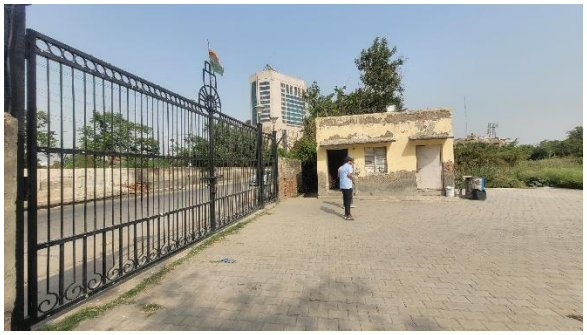


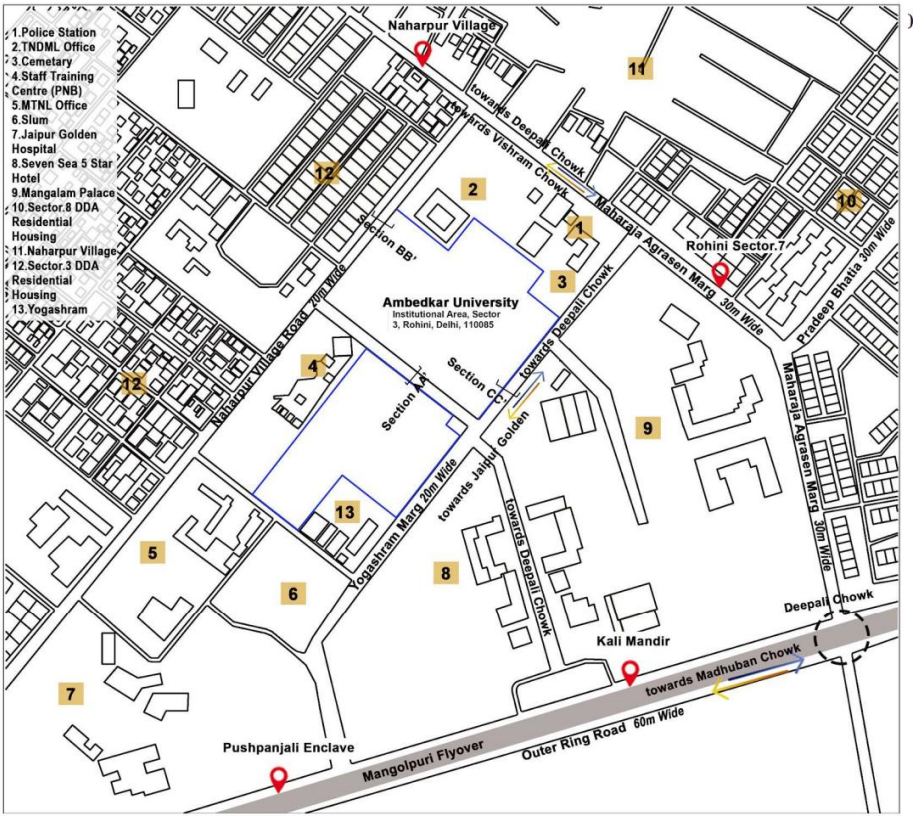
Figure 75: Zone-H, Delhi Master Plan 2021



3.2 Accessibility & Urban Context

1. The site is well connected to - Outer Ring road – 0.6 km
2. Metro station – Rohini East - 2.4 km , Rohini West - 3.1 km , Pitampura - 3.1 km
3. New Delhi Railway Station – 15 km
4. IGI International Airport - 19.6km
5. Bus stands nearby are Pushpanjali Enclave Bus Stand, Kali Mandir Bus Stand,
6. Naharpur Village Bus Stand, Rohini Sector -7 Bus Stand.





Map: Site Location Map with context and connectivity.

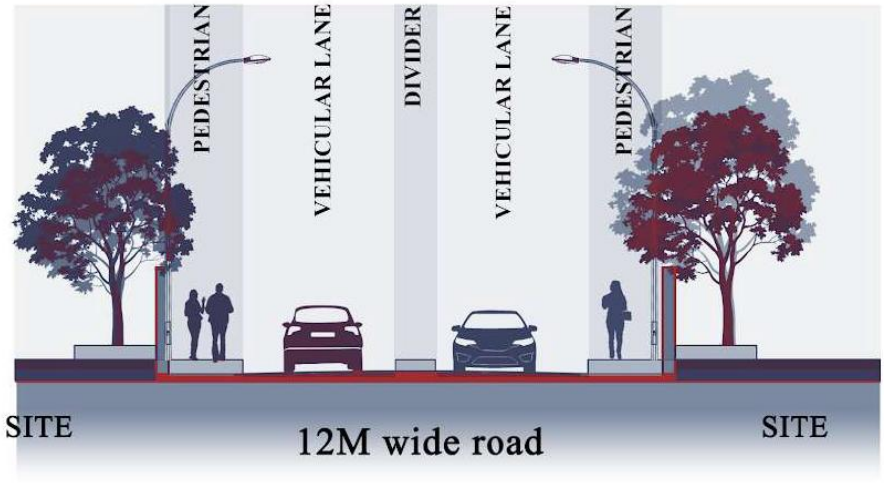


Figure 76: Section AA

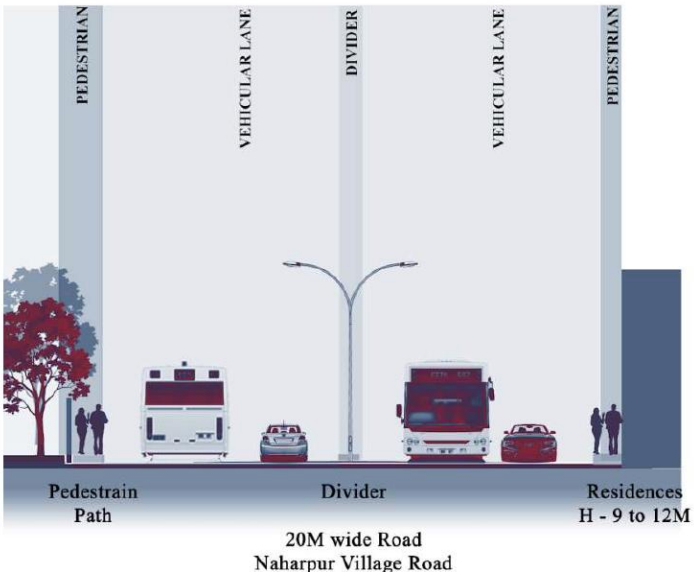


Figure 77: Section BB

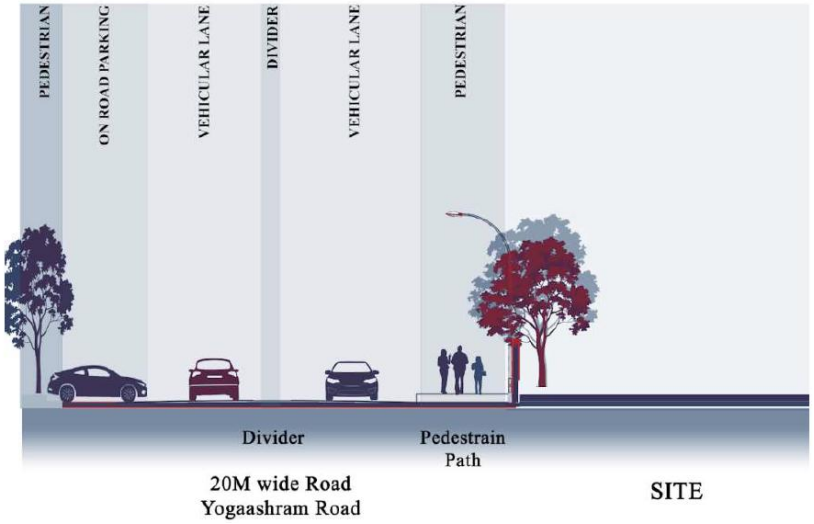


Figure 78: Section CC

Yogashram Marg is 20 m wide road and segregates the institutional and commercial areas. The road has parking lanes for the commercial area and wide footpaths along the institutional boundary. Naharpur road is 20m wide and segregates the residential and institutional areas.

3.3 Site Constraints

Road passing through Ambedkar University has a fish market on it presently which leads to unwanted foul smell for the existing surroundings and the passing by.



Figure 79: Photo of Road Passing through Site

3.4 Topography

- Coordinates 28.6969° N, 77.1104° E
- Maximum elevation: 251 m
- Minimum elevation: 206 m
- Average elevation: 217 m

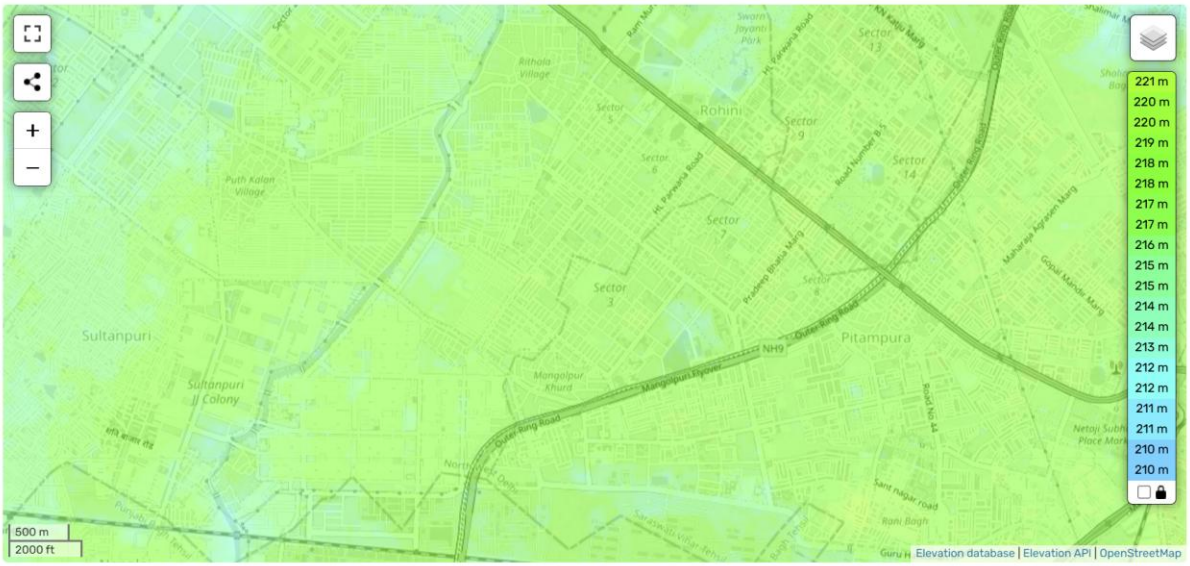


Figure 80: Site Topography

There are no existing trees on the site. The site is full of wild shrubs and grass. The topography of the site is flat. There are no levels on the site which makes it an ideal site.

3.5 Climatology

A monsoon influenced humid subtropical with high variation between summer and winter temperatures and precipitation.

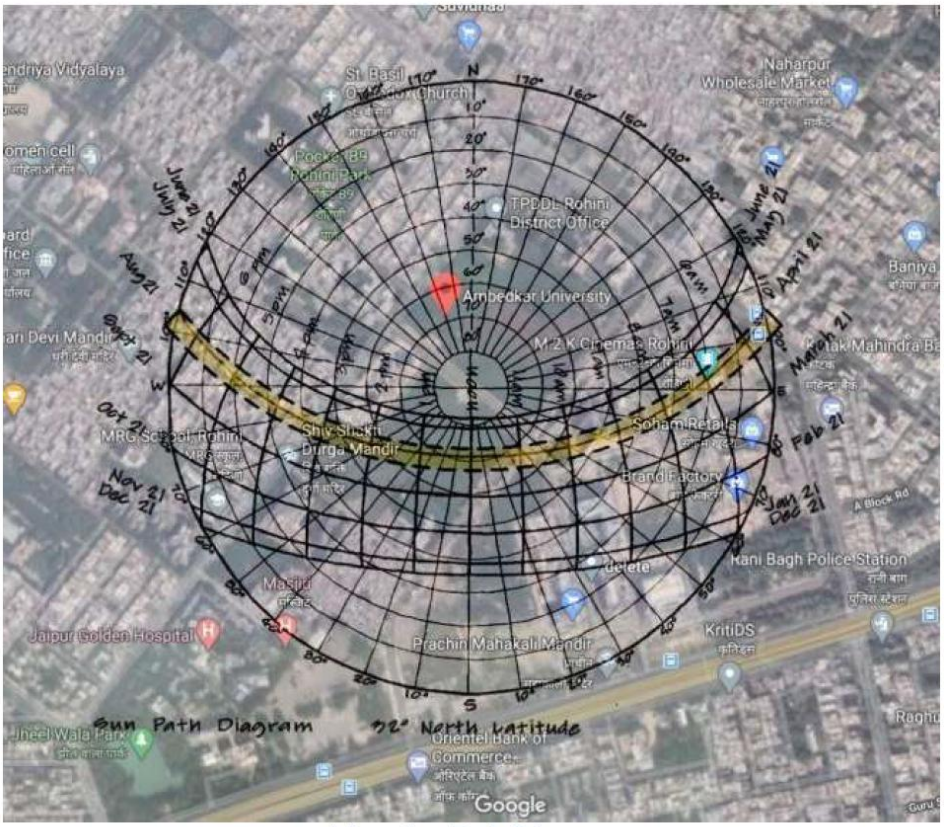
Season	Months	Temperature	Humidity	Precipitation
Summer	April – June	Hot	Very low - Normal	Low
Monsoon	July - September	Pleasant	High – Very high	Heavy
Autumn	October - November	Warm	Very low – Low	Very Low
Winter	December - January	Cold	Low	Low
Spring	February - March	Warm	Very low – Low	Good

Figure 81: Temperature, Humidity and Precipitation

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	13.5 °C (56.3) °F	16.9 °C (62.4) °F	22.5 °C (72.6) °F	29.2 °C (84.5) °F	32.7 °C (90.9) °F	33 °C (91.3) °F	29.9 °C (85.8) °F	28.7 °C (83.7) °F	27.8 °C (82.1) °F	25.4 °C (77.7) °F	20.5 °C (69) °F	15.4 °C (59.7) °F
Min. Temperature °C (°F)	7.7 °C (45.8) °F	10.6 °C (51) °F	15.2 °C (59.4) °F	21 °C (69.8) °F	25.3 °C (77.6) °F	27.6 °C (81.6) °F	26.6 °C (79.9) °F	25.8 °C (78.5) °F	23.9 °C (75.1) °F	19.2 °C (66.5) °F	14.2 °C (57.5) °F	9.3 °C (48.7) °F
Max. Temperature °C (°F)	20 °C (68) °F	23.5 °C (74.4) °F	29.8 °C (85.7) °F	36.7 °C (98.1) °F	39.6 °C (103.3) °F	38.2 °C (100.8) °F	33.7 °C (92.6) °F	32.3 °C (90.1) °F	32.2 °C (90) °F	31.8 °C (89.3) °F	27.4 °C (81.3) °F	22.2 °C (72) °F
Precipitation / Rainfall mm (in)	23 (0.9)	33 (1.3)	20 (0.8)	14 (0.6)	20 (0.8)	74 (2.9)	208 (8.2)	183 (7.2)	99 (3.9)	13 (0.5)	5 (0.2)	8 (0.3)
Humidity(%)	67%	60%	47%	29%	32%	46%	71%	77%	71%	55%	54%	61%
Rainy days (d)	2	3	3	3	4	7	15	15	8	2	1	1

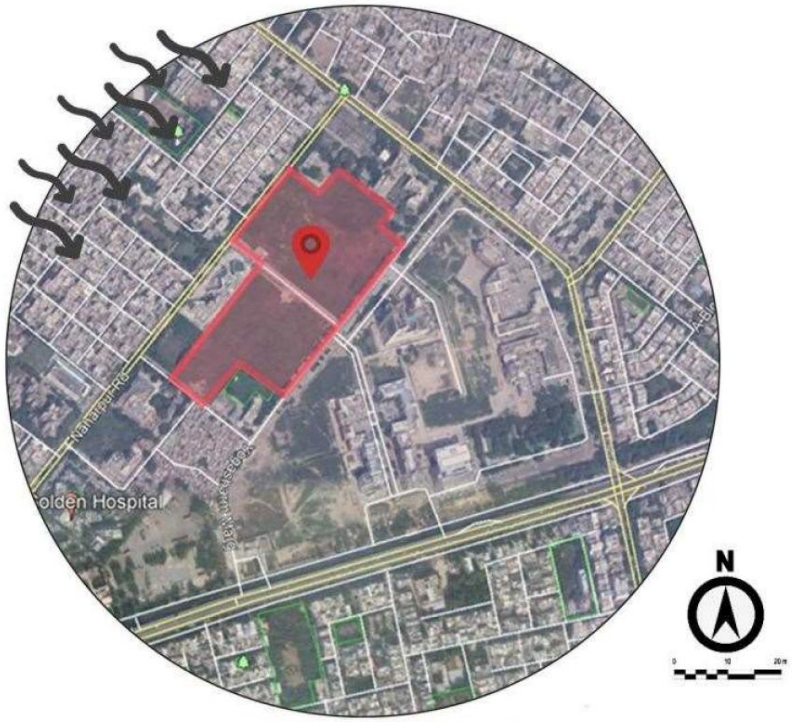
Figure 82: Temperature

3.6 Analysis



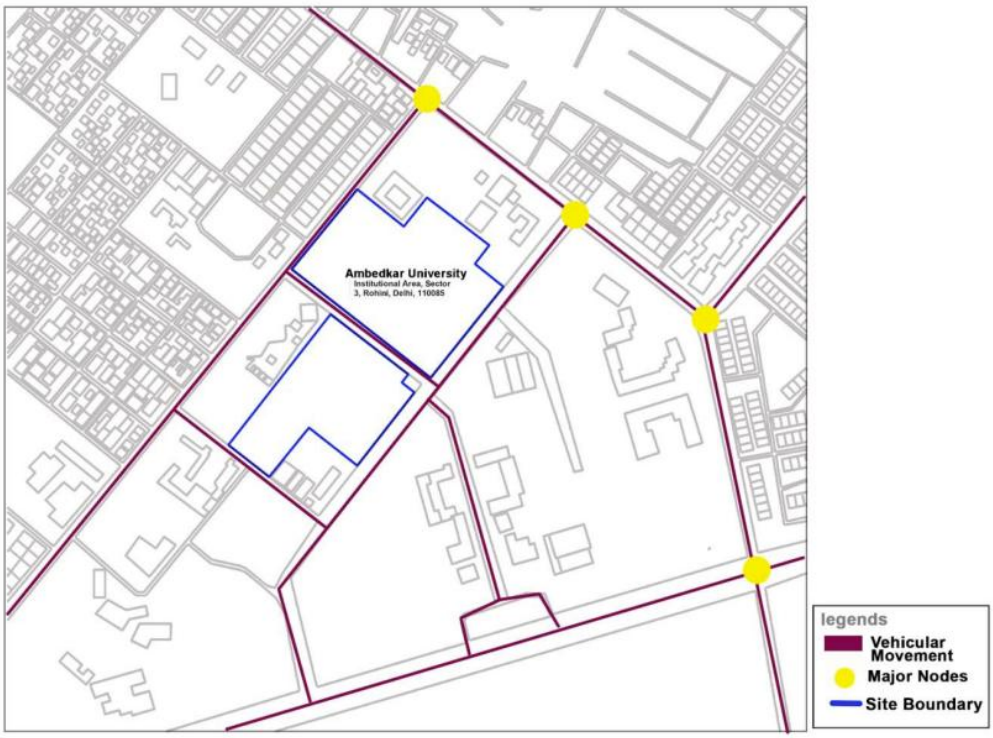
Map: Sun Path Diagram

Figure 83: Sun Path



Map: NW Wind Direction

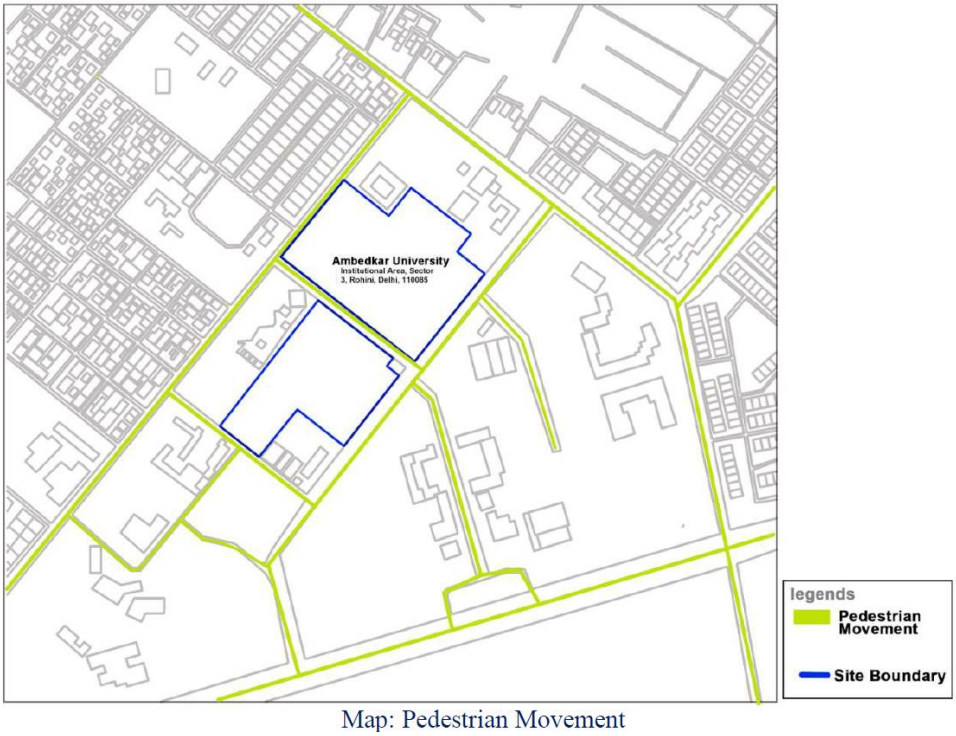
Figure 84: Wind Direction



Map: Vehicular Movement

Figure 85: Vehicular Movement

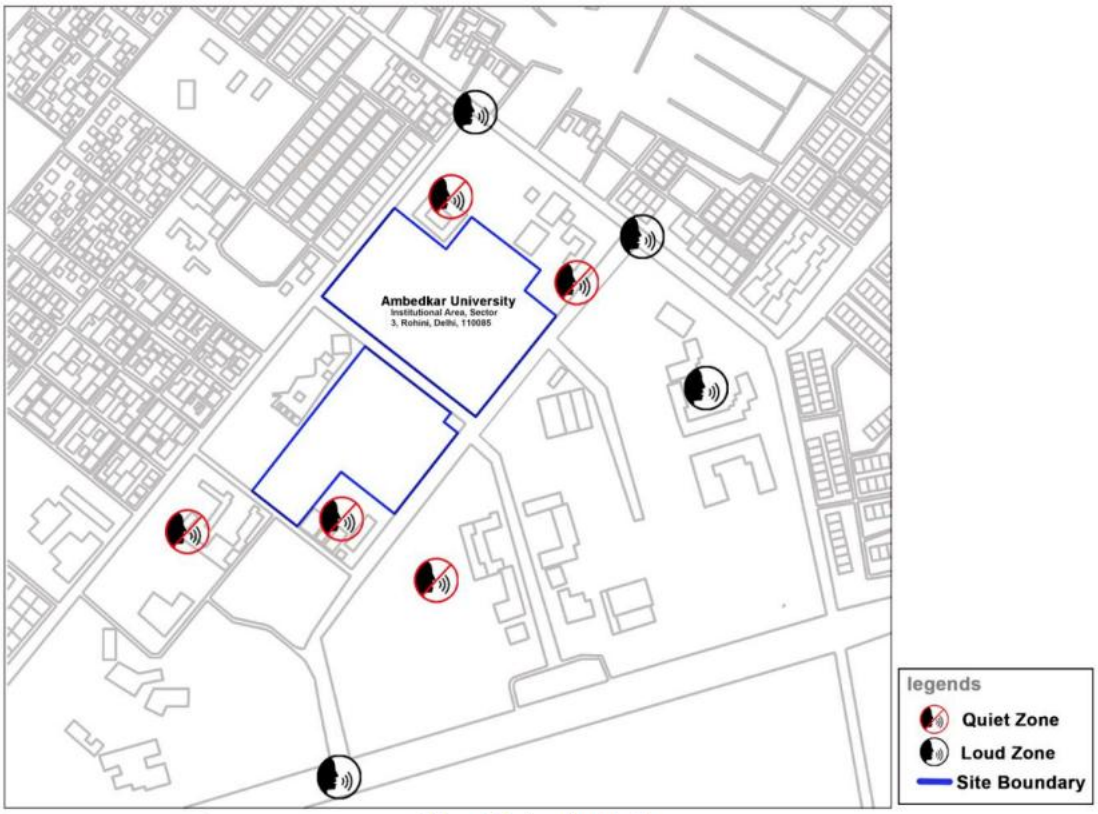
The major vehicular movement is along the Outer Ring Road as well as the commercial area nearby the Ambedkar University. Naharpur Road is majorly used by the Police Staff as well as Jaipur Golden Hospital users (Doctors, Staff or Patients/Visitors) along with the local residents of Sector – 3. Traffic light also has its impact in ensuring smooth traffic movement.



Map: Pedestrian Movement

Figure 86: Pedestrian Movement

Pedestrian movement is along the both sides of the site, local residents are the major users. Street hawkers also participate on these pedestrian walkways.



Map: Noise Analysis

Figure 87: Noise Analysis

Most of the noise is observed along the nodes connecting the Outer Ring Road.

Services on the Site

- Electricity Supply Conditions: TATA Power Delhi Distribution Limited and BSES ensure that there is a regular and continuous supply of electricity throughout the day.
- Sewage Discharge Conditions: The sewerage collected through drains from the different localities is treated. Supplementary Drain carries only the treated water from Rohini and Rithala STP before it falls into the Yamuna River.
- Stormwater Management: As such, there is no provision of stormwater management nearby our site and its surroundings. The collected rainwater is linked with Badli Bawana Nahar which is a major source of freshwater in Rohini.
- Water Supply Conditions: Delhi Jal Board ensures that there is a regular and continuous supply of water throughout the day.

Conclusions from the site study

Inferences

- Parking: The parking should not be too far or not visible to the visitor entering the site.
- Noisy and quiet zone: Noisy areas like entrance, parking and auditorium are also clubbed together to stop noise spread to the whole site.

- Site context and analysis: Existing site features and surroundings are most responsible for the planning of the site and buildings. This way the quality of the design is enhanced.
- Climatic Factors: Buildings are oriented to achieve the best out of the climatic factors of the site. Most of the spaces should be designed to extract daylight and natural ventilation.
- The classrooms should be such oriented that the daylight enters from the right of the blackboard/whiteboard. Library should have north diffused light.

3.7 Physical Requirements

Institutional Buildings

Administrative Block/ Office Complex

1. Vice-Chancellor's Office

1. VICE-CHANCELLOR'S OFFICE					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Chancellor's Room	1	1	With attached Toilet	20m2	
Special Assistant's Room	1	1	With attached Toilet	10m2	
Personal Secretary	1	1		5m2	
Assistant's Secretary	1	1		5m2	
Meeting Room	1	10	With attached Toilet	27m2	2.7m2/person

2. Pro Vice-Chancellor's Office

2. PRO VICE-CHANCELLOR'S OFFICE					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Pro Chancellor's Room	1	1	With attached Toilet	20m2	
Personal Secretary	1	1		5m2	
Meeting Room	1	10		27m2	2.7m2/person

3. Registrar's Office

3. REGISTRAR'S OFFICE					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Registrar's Room	1	1	With attached Toilet	20m2	
Assistant Register's Room	1	1		10m2	
Database Manager	1	1		5m2	
Supporting Officers	1	5	With attached	25m2	5m2/per

			Toilet		son
Student Record Room	1				
Document Processing Room	1				
Reception	1	2		10m2	5m2/per son
Waiting Area	1	10	With attached Toilet	20m2	2m2/per son
Kitchen/Pantry	1	2		7m2	
Store Room	1				

4. Account's Office

4. ACCOUNT'S OFFICE					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFER ENCE
Director Account Officer's Room	1	1	With attached Toilet	20m2	
Chief Account Officer's Room	1	1		10m2	
Supporting Officers	1	5	With attached Toilet	25m2	5m2/per son
Student Record Room	1				
Document Processing Room	1				
Reception	1	2		10m2	5m2/per son
Waiting Area	1	10	With attached Toilet	20m2	2m2/per son
Kitchen/Pantry	1	2		7m2	
Store Room	1				

5. Controller of Examination

5. CONTROLLER OF EXAMINATION					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFER ENCE
Head Controller's Room	1	1	With attached Toilet	20m2	
Personal Secretary	1	1		5m2	

Assistant Head Controller's Room	1			10m2	
Supporting Officers		5	With attached Toilet	25m2	5m2/person
Student Record Room	1				
Document Processing Room	1				
Reception	1				
Waiting Area	1	10	With attached Toilet	20m2	2m2/person
Kitchen/Pantry	1	2		7m2	
Store Room	1				

6. Library

Common Facilities

6. LIBRARY **(TOTAL AREA - 10500 SQM)**					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Librarian's Office	1	1	With attached Toilet	20m2	
Assistant Librarian's Office	1	1		10m2	
Lobby	1	50	With attached Toilet	100m2	2m2/person
Checkout Counter	1	4		11m2	2.6m2/person
Reference Desk	1	1		2.6m2	2.6m2/person
Book Stacks	2lakh Books			1000m2	1.0-1.2m2/200books
Reference Computer Terminals	4	4		11m2	2.6m2/person
Card Catalog	2	2		5.4m2	2.7m2/person
Lounge Seating	1	100		200m2	2m2/person
Table Seating		500		1200m2	2.4m2/person

Research Computer Terminals	4	50/unit		520m2	2.6m2/person
Audio Lab	2	75/unit		195m2	2.6m2/person
Duplication Centre	1				
Books Store Room	1				
Housekeeping Locker Area	2		With attached Toilet		1m2/person

7. Cafeteria

7. CAFETERIA **(TOTAL AREA - 2000 SQM)**					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Vegetable Preparation Counter				28m2	0.08m2/seat
Meat Preparation Counter				25m2	0.07m2/seat
Hot food Preparation				84m2	0.24m2/seat
Bakeshop				35m2	0.10m2/seat
Cold Food Storage				91m2	0.26m2/seat
Food Storage				91m2	0.26m2/seat
Dish Washing Area				39m2	0.11m2/seat
Pot Washing area				32m2	0.09m2/seat
Trash				70m2	0.20m2/seat
Employee Locker Area			With attached Toilet		1m2/person
Employee Dining Area					1.6m2/seat
Public Dining Area	1	350	With attached Toilet	560m2	1.6m2/seat
Service Lines					

8. Auditorium

8. AUDITORIUM (MASTER PLAN) **(TOTAL AREA - 4000 SQM)**
FUNCTION
Lobby
Seating (500People)
Stage
Projection Room
Equipment Storage Room
Green Rooms
Housekeeping Locker Area

9. Student Centre

9. STUDENT CENTRE (350 Students) **(TOTAL AREA - 1000 SQM)**					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Lobby	1	50	With attached Toilet	100m2	2m2/person
Reading Room	1	100		240m2	2.4m2/person
Recreational Rooms	1				
Indoor Sports	1				
Student Locker Area	2	50/unit	With attached Toilet	100m2	1m2/person
Housekeeping Locker Area	2		With attached Toilet		1m2/person

10. Utility Centre

10. UTILITY CENTRE **(TOTAL AREA - 750 SQM)**			
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS
Food Courts	1		With attached Toilet

Bank+ATM	1		
Post Office	1		
Book & Stationery Store			
Housekeeping Locker Area	2		With attached Toilet

11. FACULTY CENTRE (100person Capacity) **(TOTAL AREA - 500 SQM)**					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Meeting Halls (informal gathering)	2	25/unit	With attached Toilet	135m2	2.7m2/person
Dining Halls		75		120m2	1.6m2/seat
Indoor Sports					
Faculty Locker Area	2	50/unit	With attached Toilet	100m2	1m2/person
Housekeeping Locker Area	2		With attached Toilet		1m2/person

12. HEALTH CENTRE (6 BEDDED) (MASTER PLAN) **(TOTAL AREA - 250 SQM)**
FUNCTION
Waiting Area
Reception
Payee Window
Physician Office
Examination Room
Nurse Work Area
Supply Room
Medication Storage
Medical Record Storage
6 bedded Patient Area
Housekeeping Locker Area

13. SPORTS CENTRE (Indoor & Outdoor) **(TOTAL AREA - 1000 SQM)**			
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS
Swimming Pool	1		
Football Field	1		
Cricket Field	1		
Athletics Track	1		
Student Locker Area	6		With attached Toilet

14. MAINTENANCE OFFICE **(TOTAL AREA - 2000 SQM)**
FUNCTION
Electric Substation
AC Plant
Horticulture
Plumbing
Water Supply
Fire Fighting

Academic/Training/Resource Complex

15. DEAN'S OFFICE (for each school) **(TOTAL AREA - 550 SQM)**					
FUNCTION	NO. OF UNIT	NO. OF USER	REMARKS	AREA	REFERENCE
Dean's Office	1	1	With attached Toilet	20m2	
Personal Secretary	1	1		5m2	
Supporting officers		5	With attached Toilet	25m2	5m2/person
Meeting Room	1	10		27m2	2.7m2/person
Visitor's Lounge	1	10	With attached	20m2	2m2/person

			Toilet		
Kitchen/Pantry	1	2		7m2	
Student Record Room	1				

3.8 Intangible Considerations

- Bring the community into the planning process through an integrated design process.
- Provide an interior environment that is visually comfortable and stimulating by integrating natural and artificial lighting, eliminating glare, and incorporating colors that stimulate or soothe, depending on the space function.
- Use a day lighting analysis tool to integrate lighting systems, controls, and materials that reflect or absorb light.
- Outdoor Circulation Building Orientation and Entrances17- Structure should be sited and designed to support, enhance and activate common outdoor space.
- Incorporation of exterior circulation elements and gathering spaces is encouraged, including:
    - Freestanding Arcades
    - Arcades connected to buildings
    - Courtyards/Plazas
    - Roof terraces
    - Exterior circulation at multiple levels of a building
    - Linkages to existing buildings, including covered walkways and bridges

- Relationship of Interior to Exterior at Ground Floor Building- Primary entrances (typically adjacent to streets and quadrangles) should be carefully located; pedestrian circulation around and potentially through the building should also be considered
- The relationship of the building to the campus open space network and useable open space is critical; facades of buildings fronting on major open spaces.
- Typical ways to designate entries include:
    - Incorporation of a canopy or other feature to mark the entry.
    - Articulation of entries as a vertical element.
    - Orientation of building entries toward the major axis or primary open space.
    - Horizontal articulation of entries with arcade elements.
    - Transparent and open ground floors are to be provided to increase the interaction
    - between inside and outside.
- The ground floors of new buildings should be designed according to the following:
    - Ground floor spaces should house active uses, for instance, classrooms and class laboratories.
    - Multiple entries should be incorporated to activate ground floor facades
    - A hierarchy of building entries (primary, secondary, service etc.) should be reflected in the design of the façade.

● Massing and Articulation-

- Divide large buildings into smaller components to reduce the overall scale.
- Incorporate smaller-scale elements on lower levels to provide a human scale.

- Minimize blank walls at the ground floor and encourage active uses and ample fenestration.
- Reduce building mass to mediate scale and provide transitions to open spaces and adjacent buildings.
- Express the structural frame clearly to reduce the apparent scale of the building.
- Express circulation elements as separate components.

● Building Materials and Color Palette-

- Ensuring long-term durability and ease of maintenance.
- Providing textural variety.
- Minimizing vandalism.

4. CASE STUDY (LIVE)

1. National Institute of Fashion Technology, Delhi

1. Institutional Overview

- **Established:** 1986 by the Ministry of Textiles, Government of India
- **Architects:** Gautam Bhatia followed by Stein Doshi & Bhalla
- **Location & Area:** Hauz Khas, Delhi; approximately 3 acres (11,650 sqm) WikipediaScribd

2. Master Plan & Spatial Organization

- Designed to resemble a **traditional Indian village square**, featuring a **central sunken courtyard ("Kund")**, open amphitheatre, terraces, bridges, and interconnected walkways Scribdwww.slideshare.net.
- **Zoning strategy:**
    - Academic blocks on one side,
    - Administration and amenities centrally located,
    - Hostel block at the rear
- Circulation separates **pedestrians inside** (around the courtyard) from **vehicular traffic** (basement parking).





Figure 88: NIFT Delhi, Layout (httpswwwbehancenet)

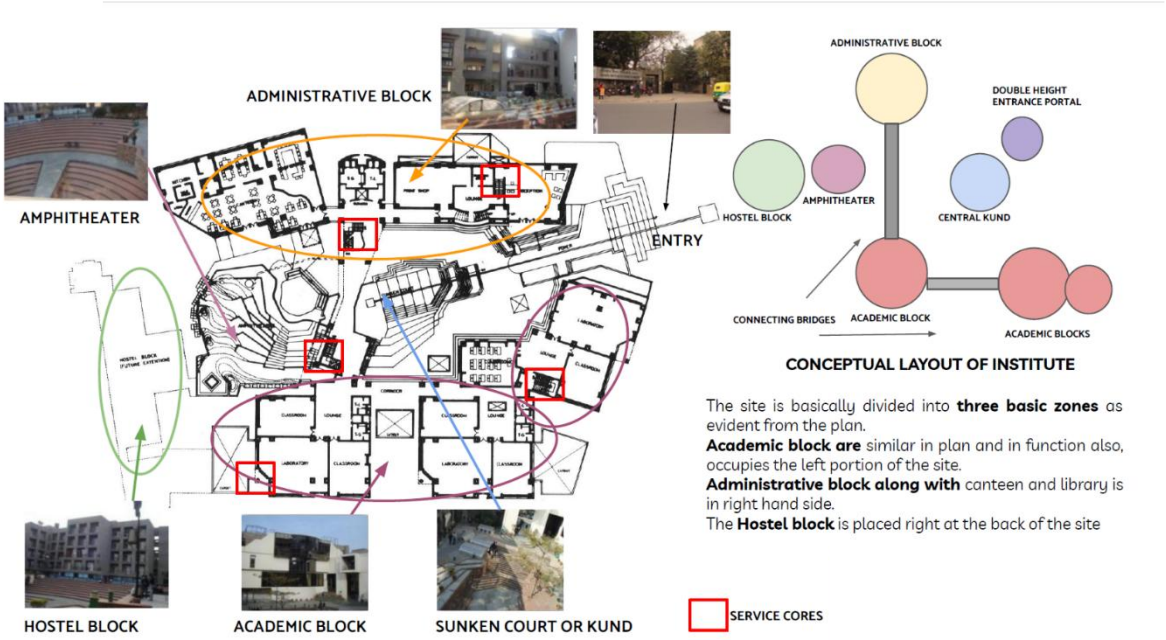
Orientation

The building layout is oriented along the **Northwest–Southeast (NW–SE) axis**, optimizing exposure to **sunlight and prevailing breezes**. This alignment supports passive design strategies by enabling effective solar access and natural ventilation.

Key design considerations include:

- **Building blocks follow the site geometry**, with peripheral lines aligned parallel to site boundaries.
- **Internal courtyards and block placements** are shaped around visual axes and pedestrian movement.
- Despite environmental considerations, **certain openings for light and ventilation were compromised for aesthetic goals**, potentially impacting comfort.
- **Windows in academic blocks face NW and SE**, which can result in excessive **daytime heat gain and glare**, especially during summer months.

Zoning



Ground Floor Details



Administrative Block

Ground Coverage=2892 Sq Mts. (25%)



Labs In The Way Due To Insufficient Space



The front court separated from amphitheatre by terraced academic wing becomes culturally appr.
and climatically comfortable outdoor space





The irregular lines of the plot bind the irregularly growing blocks. different blocks acquire different shapes and forms depending upon the functions they are accommodating.
Permeability of the blocks, due to accessibility from all the sides makes the site totally traversed.
The building blocks are concentrated around the sunken court thus generating activity and creating lively environment.

ACADEMIC BLOCK

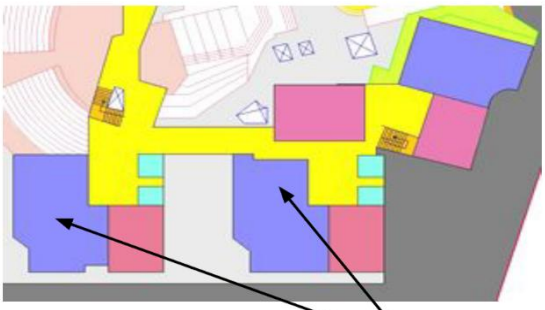
The whole complex forms a vibrant composition with a double height entrance to the reception
the academic blocks are connected through different systems of circulation overlooking the central court.

Double height reception with a large glazed waiting hall and this reception is overlooked through the exhibition area

Academic facilities have been provided in the areas joined together in the form of a cluster the cluster comprises of lobby lecture rooms laboratories and toilets.



The exterior covers the activity happening inside giving privacy



LABORATORIES

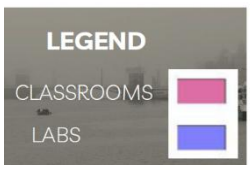


Fashion design demands extravagant gaps to handle sprawling fabric and numerous accessories they require larger tables, space for mannequins so there is a complaint of space due to increase in number of students.



LECTURE ROOMS

Space in between the labs and toilets acts as lounge/lobby - an interaction space which is quite large enough so actual space is being used by the faculty members.



Amphitheatre

It is mainly designed to accumulate the persons for fashion shows as it helps the students to keep a contact with the changing friends. The nift amphitheatre is too much a topic of controversy and criticism. it has not been constructed as it was designed. it was supposed to have the stage floating in the water body below. But the direction of the stage has also been changed, without taking into consideration the orientation of the sun, i.e. seating of the audience and stage exchanged their seats during construction. Total seating capacity is for 300 students, which is not large enough for large gatherings. it creates an inwardly bazar, livened up by designed displays and movements of students as well as visitors through entire space.



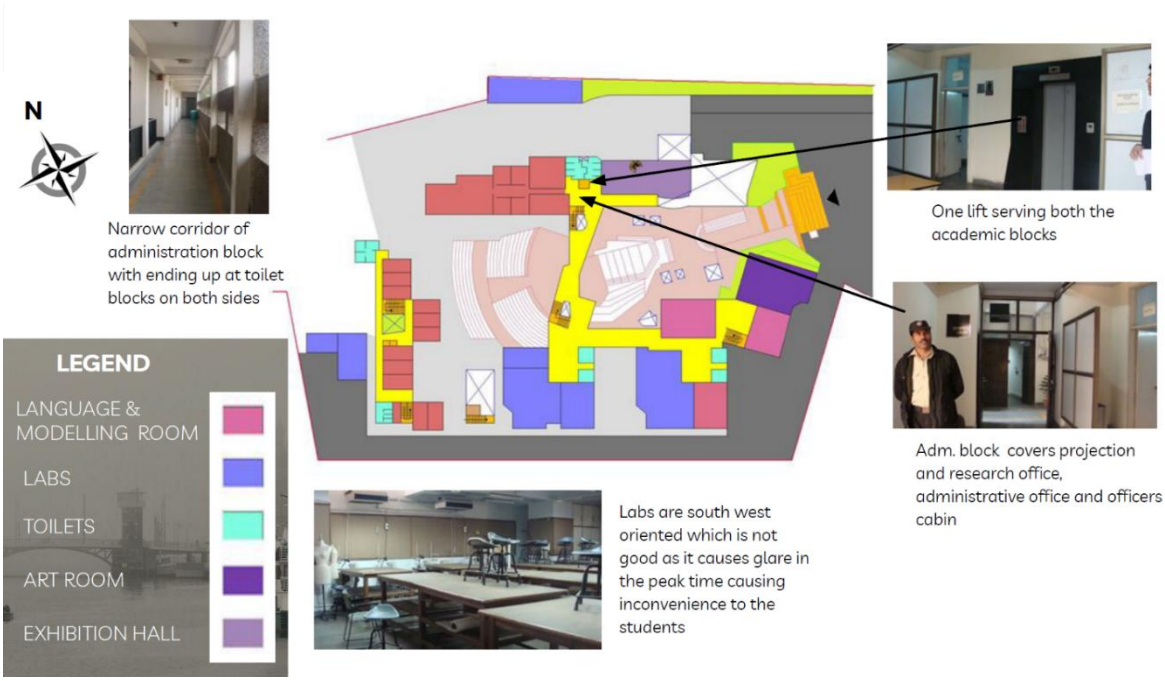




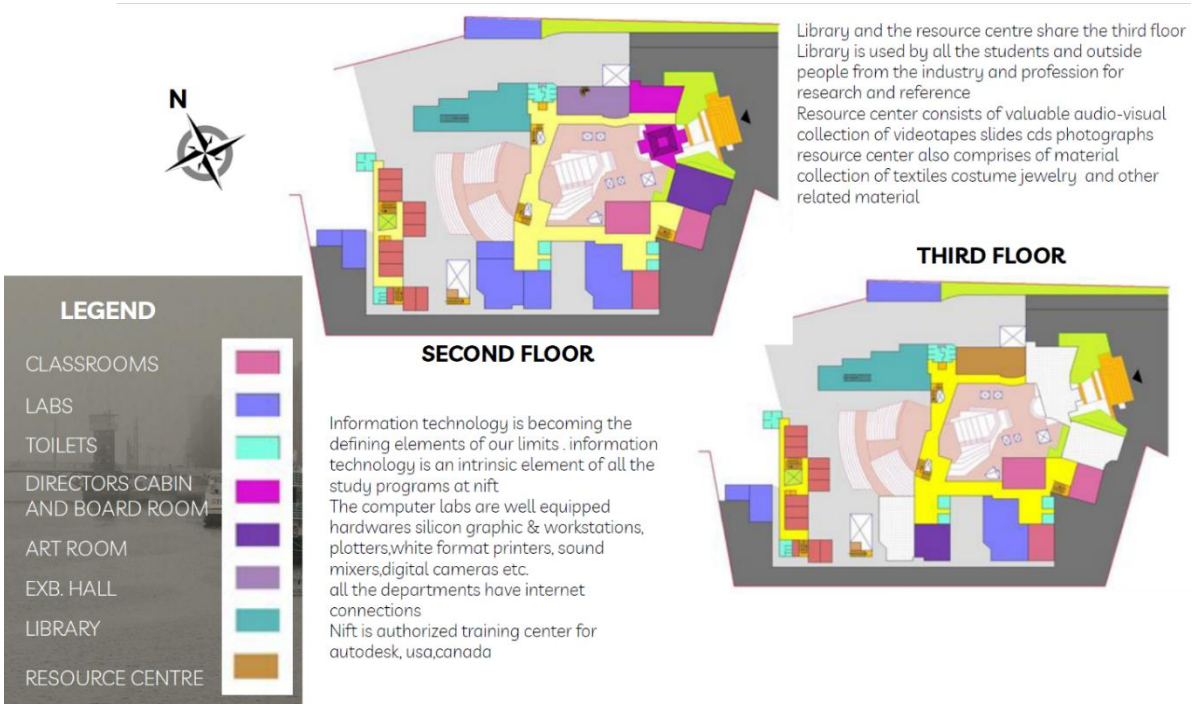


Basement is well lighted by using the skylights covered by fibre sheet which can be seen in central court.

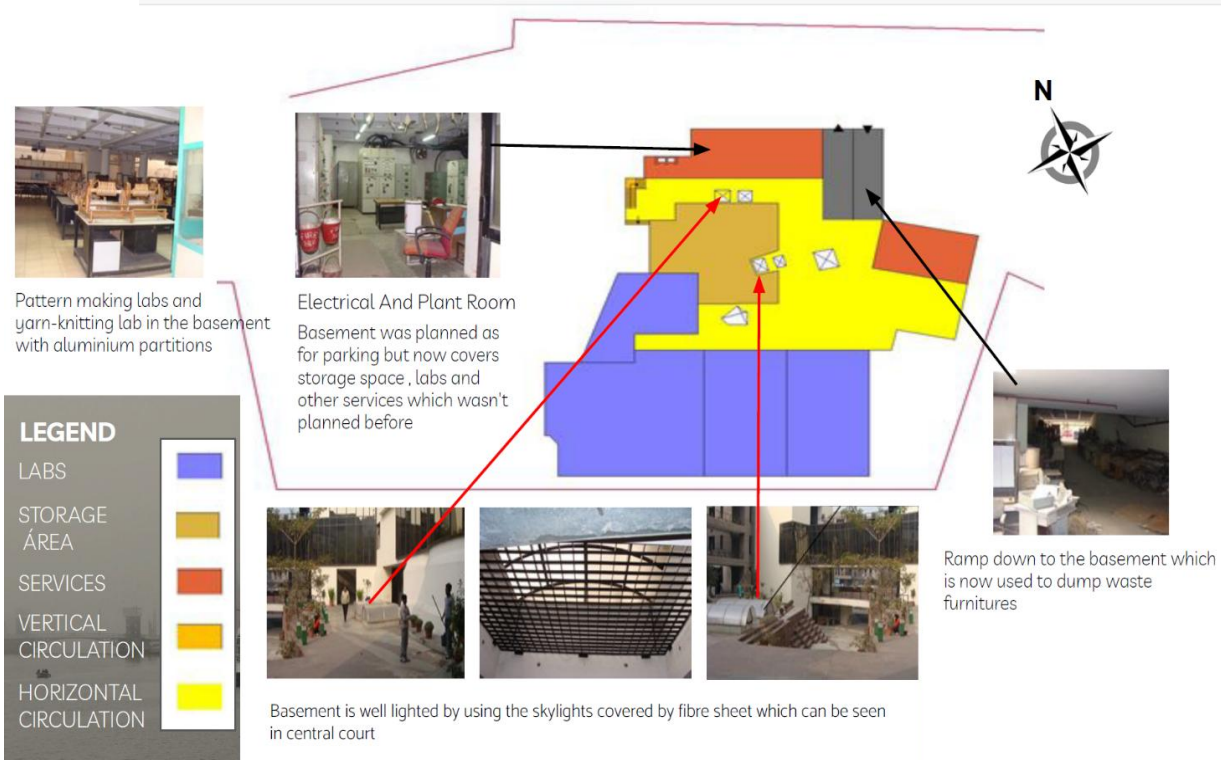
First Floor Details



Second and Third Floor Details



Basement Details



Material Palette

1. Structural System

- Reinforced concrete (RCC) frame with brick walls provides structural stability and flexibility in layout

2. Exterior Cladding & Façade

- The plinth and parts of the wall feature random rubble stone masonry, which blends with Delhi's heritage context.
- The façade is finished in grey-coloured grit aggregate with jagged grooves, creating a dynamic interplay of texture and light.
- Reflected/float glass and steel-framed screened glazing are used selectively to emphasize transparency and modernism in administrative zones.

3. Fenestration

- The project incorporates architectural jharokhas—traditional projecting windows reinterpreted in glass and steel—to create a fusion of modern expression and climatic responsiveness, though glazing to the NW–SE direction has received criticism for glare and heat gain.









4. Floor Finishes

- A variety of finishes demarcate different functional areas:
    - Reception: Black granite and white marble checkerboards
    - Corridors: Kota green and Jaisalmer yellow stone
    - Classrooms & Labs: Plain cement finish
    - Exhibition Halls: Chip flooring
    - Open plaza and amphitheatre: Rough natural stone

5. Roofing

- Waffle slab system (1.7 m × 1.7 m modules) provides column-free interiors (~6.85 sqm) and thermal insulation through thicker roof depth

SPECIFICATION	NO.	AREA IN SQ.M	TOTAL AREA IN SQ.M
COMPUTER LAB			
AUDIOVISUAL ROOM FOR 50 PEOPLE	1	175	175
LIBRARY FOR 40,000 BOOKS	1	300	300
AUDITORIUM FOR 300 PEOPLE	1	450	450
RESIDENTIAL FACILITIES			
DORMITORY- DOUBLE ROOM	50	17.5	875
COMMON ROOMS & RECREATIONAL	1	150	150
STAFF ACCOMODATION			
CARETAKERS APARTMENT	1	85	85
STAFF QUARTERS	4	100	400
CLASSROOM – FOR 30 STUDENTS			
FASHION DESIGNING	3	20	60
GARMENT MANUFACTURING TECHNOLOGY	3	20	60
APPAREL MARKETING & MERCHANT	3	20	60

SPECIFICATION	NO.	AREA IN SQ.M	TOTAL AREA IN SQ.M
LABORATORIES			
PATTERN MAKING LAB	2	160	320
MACHINE LAB	4	160	640
ART ROOM G.M.T	2	160	320
SEMINAR ROOM 30 PEOPLE	1	120	120
DYEING WORKSHOP	1	125	125
PHOTOGRAPHY STUDIO + DARK ROOM	1	100	100
STORAGE SPACE	1	6	6
LOCKER SPACE	1	8	8
ENTRANCE HALL/ WAITING/ RECEPTION	1	100	100
EXHIBITION HALL	1	200	200
BUSINESS OFFICE	1	35	35

SPECIFICATION	NO.	AREA IN SQ.M	TOTAL AREA IN SQ.M
ADMINISTRATION			
EXECUTIVE DIRECTORS OFFICE + TOILET	1	100	100
OFFICERS CABIN	9	25	225
CONFERENCE ROOM 20 PEOPLE	1	132	132
REGISTRATION OFFICE	1	25	25
CASHIER	1		
ADMISSION OFFICE	1	50	50
PROJECT & RESEARCH	1	80	80
PANTRY	1	62	62
STAFF ROOM	1	100	100
BOARD ROOM 22 PEOPLE	1	125	125
STORE/ RECORD ROOM	1	12	12
FACULTY ROOM 22 PEOPLE	1	132	132
SITE AREA- 11,650 SQ.M			
TOTAL BUILT AREA- 13,570			
INTAKES- 300 STUDENTS			

Inferences

1. Climatic Orientation and Passive Design Strategies

NIFT buildings are aligned along the Northwest–Southeast axis, allowing optimal exposure to natural daylight and prevailing wind patterns. For AUD, a similar approach should be adopted by orienting buildings to minimize heat gain and maximize ventilation. Incorporating shading devices, recessed openings, and climate-responsive fenestration will enhance user comfort throughout the year, especially in Delhi's semi-arid conditions.

2. Campus Spine and Connectivity

The NIFT campus is structured around a prominent pedestrian spine that connects key academic zones. This organizational principle fosters spatial clarity and intuitive movement. In the AUD campus, a central north-south pedestrian corridor can function as the primary artery, linking academic blocks, library, administration, and student facilities while reinforcing visual and functional coherence.

3. Academic and Learning Spaces

The academic blocks at NIFT feature modular layouts and ample daylighting, enhancing flexibility and energy efficiency. For AUD, it is recommended to adopt similar modularity in classrooms, studios, and seminar spaces to accommodate evolving pedagogical needs. Open-plan studios with operable partitions and natural lighting should be prioritized to support transdisciplinary learning.

4. Integration of Landscape and Built Environment

NIFT effectively utilizes landscaped courtyards as interactive and transitional spaces. These green pockets not only improve microclimatic conditions but also serve as informal learning zones. For AUD, landscape courtyards interspersed across academic and residential zones can support peer interaction,

recreational use, and introspection, aligning with the vision of a holistic learning environment.

5. Material Palette and Sustainability

The material usage at NIFT comprises exposed concrete, grit finishes, and local stone, contributing to both aesthetic coherence and thermal regulation. AUD should adopt a sustainable material palette with low embodied energy, including fly ash bricks, lime plaster, and indigenous stones. Use of local materials will also ensure contextual appropriateness and ease of maintenance.

6. Functional Zoning

NIFT demonstrates clear zoning between academic, administrative, recreational, and residential components, minimizing functional overlap and promoting operational efficiency. This principle is critical for the AUD campus, where clear demarcation of public, semi-public, and private zones will facilitate better user experience and security.

2. CEPT University, Ahmedabad

Location:
CEPT University is situated within the Kasturbhai Lalbhai Campus on University Road, Navrangpura, Ahmedabad, Gujarat – 380009.
The site lies at geographical coordinates: 23°02′15″N, 72°32′59″E.
The terrain demonstrates a slight general slope towards the northwestern corner, allowing for natural surface drainage and strategic campus planning.

Connectivity:
The campus is well-connected through multiple modes of public and private transportation:

- Ahmedabad Airport: Approx. 11 km
- Ahmedabad Railway Station: Approx. 4 km
- Municipal Bus Stand: Within 300 meters
- Bus Rapid Transit (BRT) Corridor: Just 1.1 km away

These connections provide ease of access for students, faculty, staff, and visitors, supporting regional and intercity mobility.

Nearby Landmarks and Institutional Context:
The CEPT campus is located within a dense academic and institutional zone, surrounded by prestigious institutions and cultural landmarks:

- Indian Institute of Management (IIM), Ahmedabad – 3.1 km
- University of Gujarat – 1.1 km
- Amrit School of Management – 230 m
- School of Engineering and Applied Sciences – Located to the east
- M.G. Science Institute and L.M. College of Pharmacy – Located to the south
- Amadavad ni Gufa (cultural landmark and gallery) – In close proximity



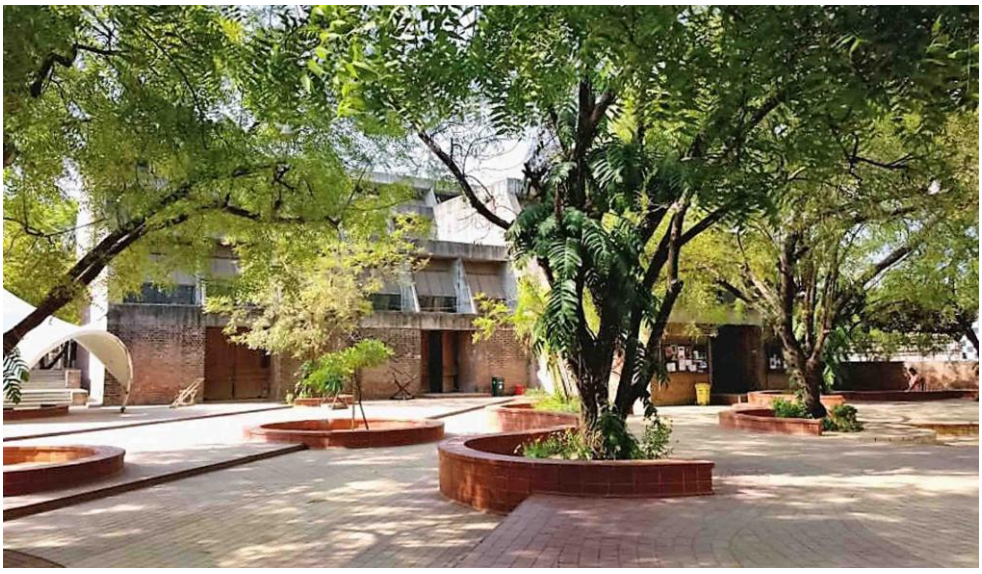
Ahmedabad experiences a **Hot and Semi-Arid Climate**, classified just below the threshold for a tropical savanna climate. The city witnesses three distinct seasons: **Summer**, **Rainy (Monsoon)**, and **Winter**.

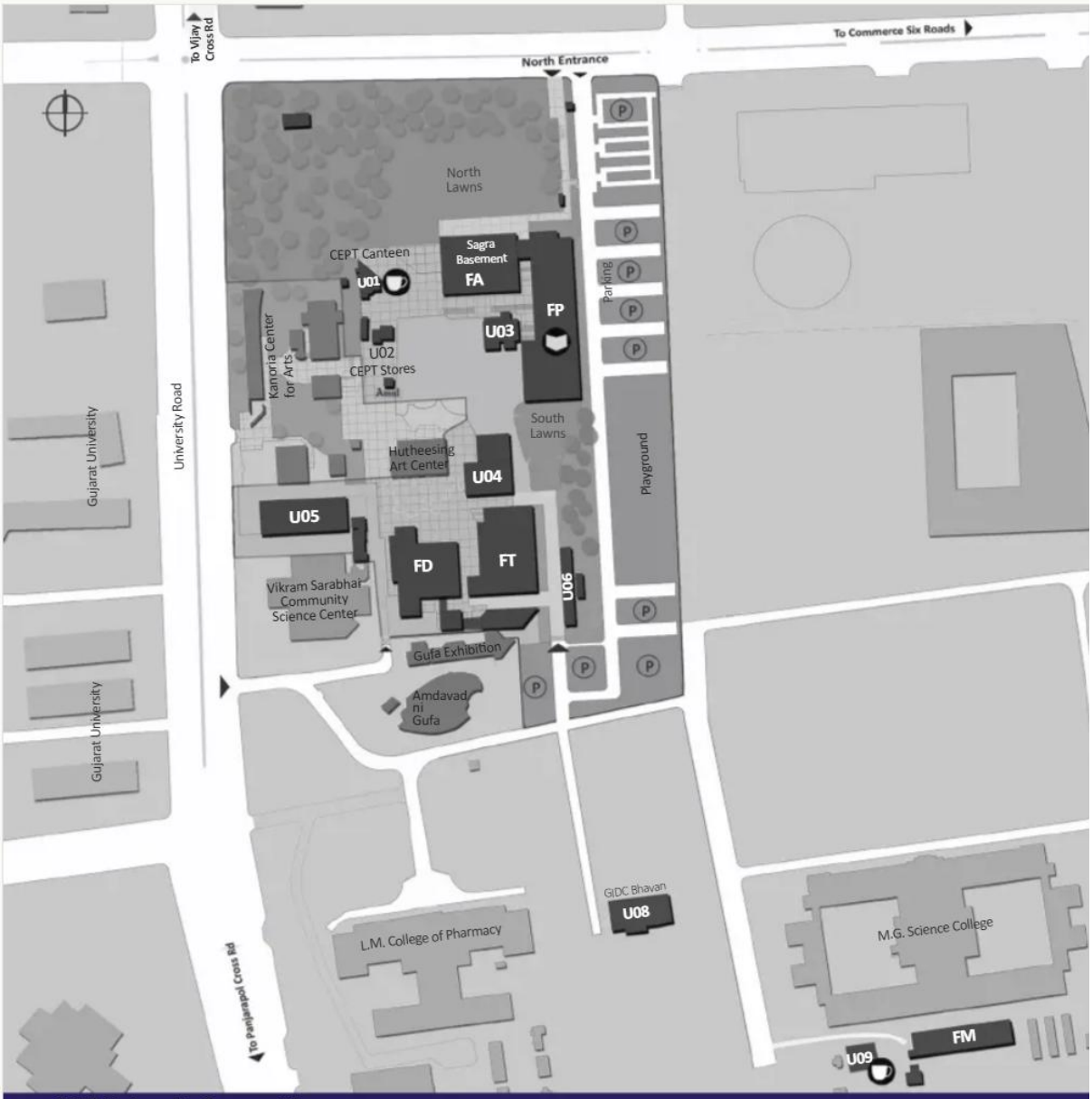
- The climate remains extremely dry for most of the year, with the exception of the monsoon period.
- Summer lasts from March to June, during which temperatures peak.
- The average maximum summer temperature is approximately 42°C.
- The average minimum temperature during this period is about 24°C.
- The southwest monsoon brings a humid climate from mid-June to mid-September, offering relief from the intense summer heat.
- During winter (November to February), the average maximum temperature is around 30°C, and the average minimum drops to approximately 13°C.
- Cold northerly winds contribute to a mild chill in January.
- The average annual rainfall is 800 mm, with maximum precipitation occurring in August, typically spread over 15 days.

Response to climate

To mitigate excessive heat buildup on campus, CEPT University employs a scattered planning approach. This strategy incorporates small landscape patches and intermediate open spaces—such as jury courts, interaction areas, and passages—between building blocks.

- These intermediate open zones act as thermal buffers, facilitating cross ventilation and dissipating heat.
- Openings in the north ensure cooler inflow of air, while larger projections on the south façade provide shading, reducing solar gain.
- This planning not only improves thermal comfort but also enhances social interaction and flexible spatial usage.





CEPT University Campus Map

Key (This list includes the common facilities on the campus.):

FD (Faculty of Design)
- Center for Advanced Research in Building Science & Energy (CARBSE)

FM (Faculty of Management)
- Center for Urban Equity (CUE) - FM 102
- Computer Tutorial Lab - FM 202,3
- Performance Assessment System (PAS) Project Center - FM 107
- CEPT Research & Development Foundation (CRDF) - FM 201
- Faculty of Technology (FT) Project Office Center - FM 103
- Crèche - FM 106
- CEPT Cafeteria - U09

FP (Faculty of Planning)
- Administration Area - FP 223
- Auditorium - FP 103
- CEPT Computer Lab - FA 101
- Library - FP 201

FT (Faculty of Technology)
- Geomatics Computer Lab - FT 111

U01: CEPT Canteen

U02: Amul Parlor
- Stationary
- Print Shop (Siddhi)

U03: Workshop

U04 (NBO Block): University Labs

U05: Fab Lab
- Metal & Wood Workshop
- Design Innovation & Craft Resource Center (DICRC)

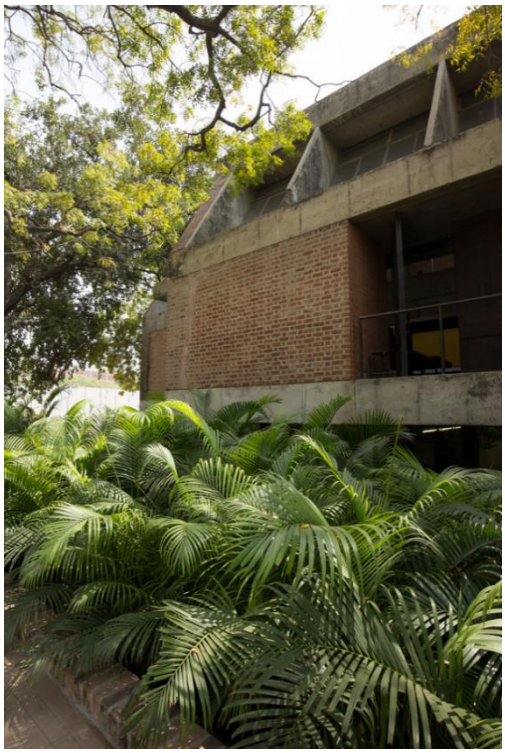
U06 (University Staff Office: USO)
- Help Desk
- Student Services Office (SSO)
- UG, PG, Doctoral, Diploma & Certificate and Exchange Offices
- Outreach Services Office (OSO)



To further reduce heat gain, buildings at CEPT are designed with major openings oriented towards the north. This orientation takes advantage of the diffused and soft natural light from the north, which minimizes thermal ingress while enhancing indoor daylight quality.

- Inclined windows are strategically designed to maximize the penetration of natural light without glare.
- This approach ensures well-lit interiors while reducing the reliance on artificial lighting, thus promoting energy efficiency.





These passive design strategies contribute significantly to creating a climatically responsive campus suitable for the hot and semi-arid climate of Ahmedabad.

To mitigate heat gain and improve indoor thermal comfort, **large projections are strategically placed on the south-facing façades** of the buildings at CEPT University. These overhangs:

- **Shade the building envelope** during the hottest parts of the day when solar intensity from the south is highest.
- **Minimize direct solar radiation** from entering indoor spaces, effectively reducing internal heat buildup.

This passive shading measure is especially critical in Ahmedabad's **hot and semi-arid climate**, where solar protection on southern sides significantly enhances energy performance and user comfort.

Design Philosophy Implemented

CEPT University encourages student and faculty engagement by incorporating numerous informal seating areas throughout the campus. These are strategically positioned within courtyards and plazas, creating flexible zones for discussion, reflection, and collaboration.

Additionally, the play of levels is used as a design strategy to integrate seating at varying heights and platforms. This spatial layering not only activates transitional areas but also contributes to the dynamic character of the built environment, fostering spontaneous interactions and a sense of community within the academic setting.



The studio interiors at CEPT University are **strategically connected to the exteriors through balconies**, fostering a strong visual and spatial connection with the outdoors. The openness also encourages **fluid interactions between indoor academic activities and the external campus environment**, promoting creativity and collaborative learning.



BALCONIES OF STUDIOS (INSIDE)



BALCONIES OF STUDIOS





CONNECTION BETWEEN DEPARTMENTS

BRIDGES CONNECTING FA AND FP

OPEN SPACES -> INTERCONNECTIVITY OF SPACES

INTERMEDIATE OPEN TO SKY SPACES

ARCHITECTURE DEPARTMENT SOUTH VIEW

Landscaping



PALM PLANTS

- The campus is full of neem trees, which were planted over the years since the initial phase to make the hot Ahmedabad climate cooler.
- The trees provide a perpetual changing pattern of light and shade.



NEEM TREES TO PROVIDE SHADE AS WELL AS TO ABSORB HEAT



Inferences

- **Climatic Responsiveness**

The campus effectively addresses Ahmedabad's hot and dry climate through shaded walkways, open courtyards, and passive ventilation, creating comfortable microclimates throughout the site.

- **Open and Non-Hierarchical Planning**

CEPT's layout avoids rigid zoning and hierarchy, instead promoting fluid movement and informal interactions among students, faculty, and visitors across disciplines.

- **Flexible Learning Environments**

Studios and classrooms are designed to be adaptive and reconfigurable, supporting changing academic needs, project-based learning, and collaborative activities.

- **Seamless Indoor-Outdoor Integration**

The design blurs boundaries between built spaces and nature, using semi-open corridors, landscaped courtyards, and spill-out areas that foster interaction and visual openness.

- **Material Expression and Honesty**

The use of exposed brick, concrete, and locally sourced materials reflects a raw and honest architectural expression while celebrating regional craftsmanship and sustainability.

- **Human-Centric Scale and Comfort**

Built forms respect human proportions, offering shaded seating areas, visual porosity, and comfortable circulation paths that encourage people to linger, meet, and engage.

- **Landscape as a Core Element**

Green spaces are not just decorative but integral to the spatial experience, offering visual relief, improving microclimate, and encouraging relaxation and interaction.

- **Minimal Boundary and Urban Connectivity**

The campus minimizes physical barriers and walls, maintaining visual and pedestrian links with the surrounding urban fabric, making it an accessible and integrated part of the city.

- **Multi-Functional Communal Spaces**

Central plazas, open-air theatres, and informal gathering zones serve multiple functions—academic, cultural, and social—enhancing campus vibrancy.

- **Sustainable and Passive Design Strategies**

Buildings are oriented and detailed to maximize natural light and ventilation, reduce energy usage, and support long-term environmental sustainability.

5. CASE STUDY (DESK APPRAISAL)

1. Azim Premji University, Bengaluru, India

Phase I - Completed
Phase II - Ongoing

Located on the outskirts of Bengaluru, the adopted design sets out to redefine the educational landscape of the country and is an integral component of a national strategy for improving primary education in India.

The architectural marvel is spread across a 36-hectare site with modules ranging from Academic and Residential Buildings to Recreational spaces, all synergetically designed to articulate a kinetic experience that enhances curiosity in the young inhabitants. The planning of the campus adopts a mix of linear and organic compositions. Its spatial layout evokes a sense of stately emotion and follows a formal segregation of spaces, which aids in the holistic inclusion of various segments of design such as its landscapes, interiors, structural, utilities and services.



1. Institutional Vision & Academic Alignment

- Founded in **2010** by the Azim Premji Foundation with a mission toward **equity, social justice, and sustainability** Designyatra+12Wikipedia+12MasterEdu+12.
- Offers undergraduate and postgraduate programs in **development, education, law and policy, humanities, economics**, akin to AUD's schools WikipediaMasterEdu.

2. Campus Layout & Spatial Organisation

- Spread across approximately **36 hectares (90 acres)** at Sarjapur-Attibele Road, Bengaluru Designyatra+7Azim Premji University+7Wikipedia+7.
- Designed by **CCBA (Christopher Benninger Associates)** with an emphasis on a **pedestrian-focused central spine**, separating vehicular traffic to the periphery for enhanced safety and walkability RTF | Rethinking The Future+3CCBA Designs+3Designyatra+3.

- Academic buildings arranged in modular clusters, connected through **arcades and courtyard-based plazas**, supporting informal interaction and wayfinding Wikipedia+13CCBA Designs+13Wikipedia+13.

3. Building Typologies & Residences

- Facilities include a **Welcome Centre**, academic blocks, laboratories, library, auditorium, seminar halls, and large-scale **Universal Hostels** (40-storey towers accommodating ~3,000 students each) Wheree+7Surfaces Reporter+7Wikipedia+7.
- Built space: ~2.6 million sq.ft by the end of Phase I; projected full capacity ~20,000 students, with ~16,000 living on campus

1. Building Typologies

Typology	Function & Design Approach
Academic Blocks	Modular clusters for classrooms, labs, seminar rooms, and faculty spaces; connected by arcades.
Library	Central academic resource with open-plan reading zones, archives, and digital support spaces.
Auditorium & Seminar Halls	Multiple formats for events (small discussion rooms to large halls); shared by schools.
Welcome Centre	Orientation, information desk, and visitor lobby; serves as the threshold to the campus.
Administrative Block	Contains registrar office, finance, academic affairs, and HR cells.
Recreational Spaces	Indoor sports hall, music/art studios, fitness rooms, and open-air amphitheatre.
Food Courts & Cafeterias	Clustered near hostel zones and academic areas; designed as informal gathering nodes.

2. Residences / Hostels

Feature	Description
Universal Hostels	High-rise, mixed-use towers (~40 floors) accommodating ~3,000 students each.
Room Types	Mix of single, double, and accessible rooms; attached toilets; well-lit with cross ventilation.
Shared Facilities	Study lounges, TV/common rooms, kitchenettes, laundry zones, and vending areas.
Safety & Access	RFID entry, CCTV, 24/7 warden presence, gender-sensitive policies, dedicated accessible rooms.
Recreational Integration	Landscaped terraces and balconies, visual connection to courtyards and social spaces.
Proximity to Academics	Designed within walking distance of core academic and food zones.

4. Landscape & Public Realm

- Designed to integrate **water bodies**, green corridors, courtyards, and an **open-air amphitheater** as spatial and climatic anchors RTF | Rethinking The Future.
- Pedestrian spine runs alongside a **rainwater harvesting tank**, visually aligned with the amphitheater for scenic and functional coherence DesignyatraCCBA Designs.

5. Sustainability & Ecological Design

- Emphasis on **rainwater harvesting, groundwater recharge, organic waste composting, native landscaping**, and **energy-efficient passive design** Azim Premji UniversityAzim Premji University.
- Use of **local materials**, solar hot water systems in hostels, and limited air conditioning to high-demand zones such as library and conference halls Azim Premji University.

6. User Experience & Community Engagement

- Central social arenas like plazas and courtyards foster **interdisciplinary exchange and spontaneous learning** RTF | Rethinking The Future.
- Programs like open libraries, public festivals, and climate-awareness initiatives—extending to the local neighborhood community Surfaces Reporter.

7. Inclusion & Accessibility

1. Universal Design in Physical Infrastructure

- **Barrier-Free Access**:
    - All buildings on the Bengaluru campus are designed with **ramp access**, **wide corridors**, **elevators**, and **tactile flooring** to ensure **mobility for wheelchair users and the visually impaired**.
    - Classrooms, hostels, toilets, and libraries are **designed with accessible fixtures and layouts**, enabling independent navigation by users with physical disabilities.
- **Accessible Hostels**:
    - Residential towers have accessible floors and rooms, fitted with **grab bars**, **anti-skid flooring**, and **low-height utilities**.
    - Elevators serve every level and are equipped with **braille signage** and **auditory floor indicators**.

2. Academic Accessibility

- **Inclusive Teaching Practices**:
    - Faculty receive orientation in **inclusive pedagogy**, ensuring classes are sensitive to **learning disabilities**, **language barriers**, and **mental health conditions**.
    - Use of **captioned videos**, **screen readers**, and **digital learning platforms** ensures that content is available in **multiple accessible formats**.

- **Assistive Technologies**:
    - The library and digital infrastructure offer tools such as **text-to-speech software**, **DAISY books**, and **customized learning workstations** for visually impaired users.

3. Social & Psychological Inclusivity

- **Gender-Neutral Spaces**:
    - Some restrooms and residential spaces are **gender-neutral**, creating safe environments for **transgender and non-binary students**.
- **Well-being Support**:
    - APU has a **dedicated counselling cell**, peer mentoring systems, and safe reporting mechanisms for harassment or emotional distress.
    - Events and workshops on **diversity, inclusion, and identity** are embedded into campus life.
- **Diversity in Admissions**:
    - Offers need-based scholarships and bridges for students from **marginalized backgrounds**, including **rural, first-generation learners** and **tribal communities**.
    - Encourages applications from students with disabilities by providing **custom support** during admissions and assessment.





ACADEMIC BUILDING

YEAR 2010 : AZIM PREMJI UNIVERSITY, BANGALORE



UNIVERSAL HOSTEL

YEAR 2010 : AZIM PREMJI UNIVERSITY, BANGALORE

Classroom Layout & Interior – Azim Premji University (APU)

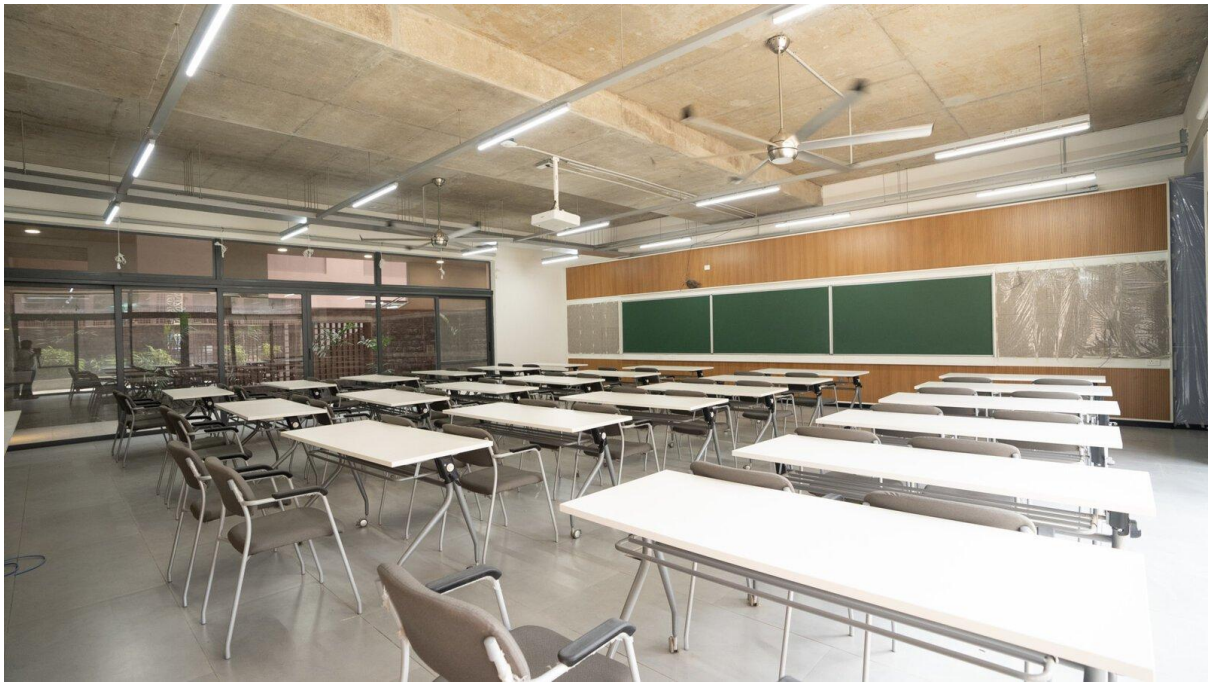
Classroom Features

- **Flexible Furniture**: Lightweight chairs and tables allow reconfiguration for group discussions, seminars, or lecture formats.
- **Natural Light & Ventilation**: Large windows provide abundant daylight, reducing reliance on artificial lighting and promoting ventilation Azim Premji University+14Azim Premji University+14Shiksha+14.
- **Tech-Enabled Spaces**: Smart boards/projectors, Wi-Fi access, and well-planned acoustics support interactive pedagogy and multimedia presentations .

Spatial Configuration

Based on architectural descriptions and campus plans:

- **Academic blocks** are arranged in **curved modules** around internal plazas and arcades. Classrooms are clustered along these paths for easy access and visual connectivity Wikipedia+7Abirpothi+7libraryarchives.azimpremjiuniversity.edu.in+7.
- Seminar halls with capacities of around **250–500 seats** are embedded within academic blocks, adjoining open courtyards and common areas CCBA Designs+11Abirpothi+11Wikipedia+11.
- The **Welcome Centre** and lecture clusters serve as focal nodes along a central pedestrian spine, enhancing wayfinding and campus coherence







Azim Premji University – Laboratory Infrastructure

1. Academic & Discipline-Based Labs

- **Physics Department**: Hosts six lab spaces including two teaching labs, an electronics & instrumentation lab, a projects lab, a machining workshop, and an advanced instruments lab Reddit+13Azim Premji University+13Reddit+13.
- **Geography Laboratory**: Designed for experiential learning using real soil, rock, and tectonic models. Includes tactile exhibits, interactive maps, and sustainable construction methods for models Azim Premji University+1Azim Premji University+1.
- **Environment, Climate Change & Sustainability Labs**: Equip students with analytical and field tools—GIS, remote sensing, microbiology, water and air testing instruments, weather stations, and climate sensors—facilitating multidisciplinary scientific research Azim Premji University.

2. Core Features

- **Hands-On Pedagogy**: Programs emphasize building instrumentation and experimental rig development within labs, encouraging practical skill-building Azim Premji University+1Azim Premji University+1.
- **Ethical & Sustainable Practices**: Geography labs promote use of sustainable, recycled materials for models and teaching aids Reddit+9Azim Premji University+9Wikipedia+9.
- **Community & Education Engagement**: Labs host workshops for professionals, NGOs, school educators and local residents around water, air quality, and climate interventions Azim Premji UniversityAzim Premji University.

3. Spatial Configuration & Integration

- Labs are **clustered adjacent to academic blocks**, ensuring accessibility and visual connection to courtyards and communal areas Azim Premji University+11Wikipedia+11Reddit+11.
- Field labs and weather stations are integrated into campus landscape, enabling outdoor class experiences Azim Premji University.

4. Facilities & Services

- Computer and Mapping Labs available for data analysis and cartographic work Shiksha.
- Central research programs like the **Census Data Research Workstation** provide high-performance computing infrastructure for quantitative research Business Today+1economictimes.indiatimes.com+1.

Azim Premji University Library

1. Scale & Capacity

- The library occupies approximately **43,837 ft² (4,074 sqm)** on the main Bengaluru campus Jamia Millia Islamia+10Wikipedia+10Azim Premji University+10.
- Houses an extensive physical and digital collection, including over **104,000 books**, nearly **2,000 reference titles**, **3,610 audio-visual resources**, and curated archives such as the Schoolbooks Archive The New Indian Express+3Azim Premji University+3Azim Premji University+3.

2. Collections & Access

- Provides access to 6,900+ online journals, 14,000+ e-magazines and newspapers, around 14,000 e-books, and subject-specific databases via tools like **JGate**, OPAC, and a centralized discovery platform Azim Premji University+2Azim Premji University+2Azim Premji University+2.
- Supports inter-library loan through partnerships with DELNET, IIM Bangalore, and ISEC Bengaluru, among others Shiksha+4Azim Premji University+4Azim Premji University+4.

3. Technology & User Experience

- Fully automated with **RFID-enabled self-check kiosks**, enabling self-service borrowing and returns during library hours without staff intervention Azim Premji University+2Azim Premji University+2Azim Premji University+2.
- Offers web-based training on literature search, database usage, information retrieval, and subject guides tailored by discipline Azim Premji University+1Azim Premji Foundation+1.

4. Spatial Layout & Design

- The layout features a **day-lit reading hall** with shelves organized for intuitive browsing, soft seating clusters, and ample circulation space Jamia Millia Islamia.

- Situated near academic blocks and communal spaces, enabling seamless transitions between quiet study, group discussion, and campus social areas Wikipedia.

5. Special Collections & Archives

- Hosts unique holdings such as:
    - **Schoolbooks Archive**: Over 5,700 historic textbooks across languages and regions, augmented by a digital repository reddit.com+6Azim Premji University+6Azim Premji University+6The New Indian Express+1Wikipedia+1.
    - **Pushpa Mittra Bhargava Archive**: Rare documents, manuscripts, historical essays, and artifacts from the renowned scientist's collection Azim Premji University+1Azim Premji University+1.









Inferences

1. Integrated Zoning with Nature: The campus follows a nature-first zoning strategy, integrating academic, residential, and administrative zones with minimal ecological disruption.

2. Academic Core in Central Spine: Academic blocks are arranged along a central pedestrian spine, ensuring accessibility, orientation clarity, and visual connectivity across departments.

3. Functional Clustering: are clustered: academic, residential (hostels), faculty housing, admin, and recreation are placed in distinct but interlinked zones, improving circulation and noise control.

4. Green Buffers as Transitions: zones act as buffers between different building zones (e.g., between classrooms and residences), softening transitions and enhancing microclimate.

5. Porous Built Form: The design avoids rigid boundaries by creating semi-open courtyards, verandahs, and shaded walkways, blending indoor and outdoor spaces for a breathable campus fabric.

6. Low-Rise Horizontal Layout: Like many sustainable campuses, APU favors a low-rise, spread-out layout suited to the site's topography, reducing visual bulk and enhancing approachability.

7. Zoning for Passive Design: Orientation and zoning consider climatic factors: buildings are placed to maximize daylight, cross ventilation, and minimize heat gain.

8. Pedestrian-Focused Circulation: Internal roads are minimized, with zoning that prioritizes walking and cycling, reducing vehicular intrusion and promoting sustainability

9. Scalable Master Planning: The master plan allows for phased growth, with clear zones earmarked for future academic or residential expansion without disturbing current functions.

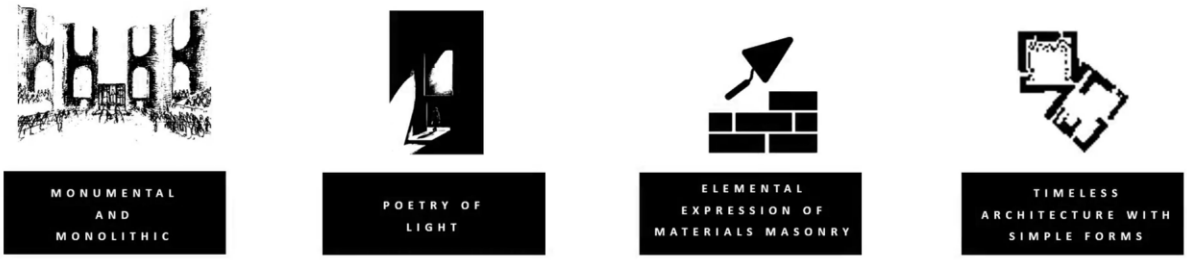
10. Architectural Language Unity: Despite zoning variety, a consistent material palette (local stone, exposed concrete, earthy colors) and sustainable design principles maintain architectural unity.

2. IIM Ahmedabad

- Year of Completion- 1961
- Architects- Louis I Kahn, BV Doshi
- Site Area- 66 ac (old) + 40 ac (new)
- No. of Students- 1500+
- No. of Staff- 300+
- No. of Faculties- 100+

The institute offers post graduation diploma programme in management, a fellowship programme and a number of executive training programme.





Parameter	Description
1. Site Analysis:	
- Location and Context	Geographical location: Ahmedabad, Gujarat, India. Climate: Dry and hot climate. Surroundings: Serene and spacious setting conducive to learning.
- Topography	Relatively flat terrain facilitating easy movement and construction.
- Existing Infrastructure	Well-maintained buildings and infrastructure, preserving architectural heritage.
- Vegetation and Ecosystems	Lush greenery, gardens, and natural elements promoting sustainability and eco-friendliness.

2. Program and Functional Requirements:	
- Academic Spaces	- State-of-the-art classrooms, libraries, and research facilities tailored to management education.
- Administrative Spaces	- Well-equipped offices and meeting rooms supporting administrative functions.
- Recreational and Cultural Facilities	- Sports centers, theaters, and cultural spaces enhancing the student experience.
- Residential Spaces	- On-campus dormitories and faculty housing fostering a close-knit community.
- Transportation and Parking	- Adequate parking and transportation options ensuring accessibility for all.

3. Sustainability and Environmental Considerations:	
- Energy Efficiency	- Incorporation of energy-efficient design elements and utilization of renewable energy sources.
- Water Management	- Efficient management of water resources, including stormwater and wastewater treatment.
- Sustainable Materials	- Use of eco-friendly construction materials in alignment with sustainability goals.
- Green Spaces	- Landscaping and outdoor spaces promoting biodiversity and sustainability.
- Transportation Alternatives	- Promotion of walking, biking, and public transportation to reduce car dependence.

4. Accessibility and Universal Design:	
- ADA Compliance	- Ensuring accessibility for individuals with disabilities through ADA compliance.
- Inclusivity	- Design fostering inclusivity and accommodation for people of all abilities.
- Pedestrian Paths	- Accessible walkways, ramps, and crossings facilitating easy navigation.

IIM is situated on a 66 acre site to the west side of the city of Ahmedabad.

The institute was conceived as an integrated campus to house the different kinds of activities and to provide an environment conducive to creative work.

Just 10 kms from ahmedabad airport

7 kms drive from ahmedabad railway station nearby bus stop is less than 10 mins walk.

- well connected to the major roads of city.
- good accessibilty to public transport
- multiple entries to campus divides the crowd.



Approaching road to campus

Flyover road

Road inside the campus

WIND ANALYSIS

wind is blowing from SW to NE

ORIENTATION

The diagonal layout had the advantage of the building being oriented towards the south-west breeze. The orientation also helps to cut out the west sun reducing glare.



OLD CAMPUS

NEW CAMPUS

Old campus is segregated from the new campus by the road in between

The functions are different, the programmes are different

Hierarchy of Spaces



ACADEMICS

STUDENT DORMITORIES

FACULTY HOUSING

CAFE

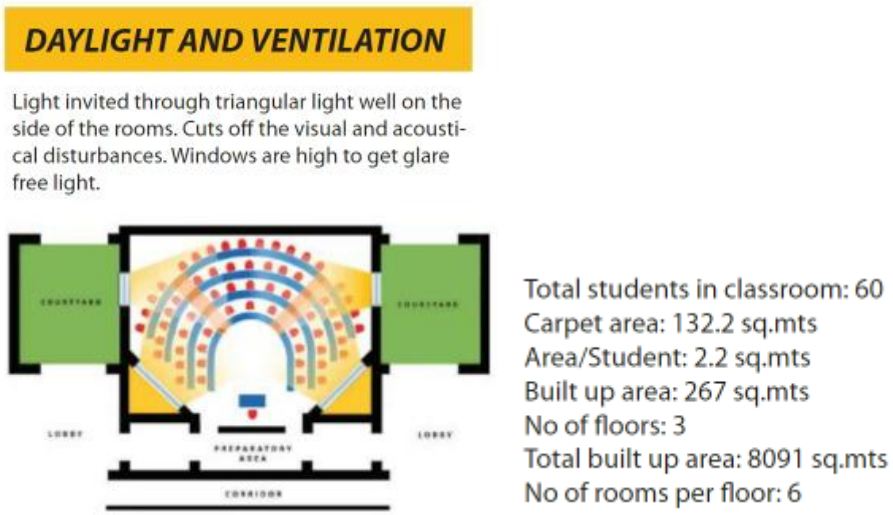
PUBLIC

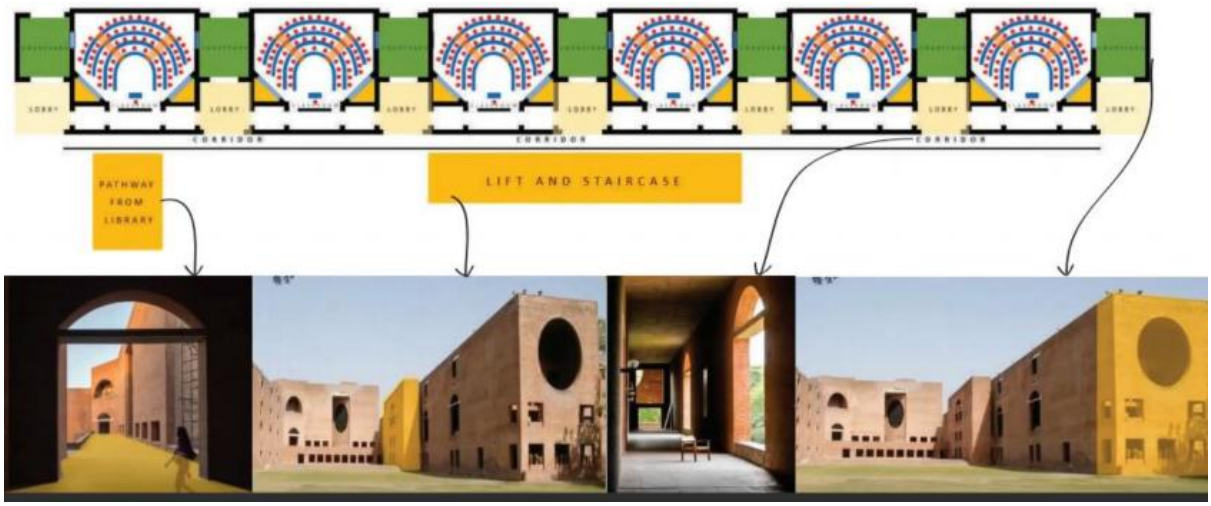
PRIVATE



- Separate entries for institutional and residential complexes.
- Separate service entry.
- Academic and social activities have been integrated with students and staff living.
- The institutional building has been taken as the focal building.
- The auditorium is located near the main entrance for easy access for visitors.
- Residential areas have been planned in a hierarchical pattern
- The canteen and auditorium do not integrate well due to being a later addition
- School building and students' dorm have been placed diagonally to take advantage of winds from southwest.

Classroom (academic block)

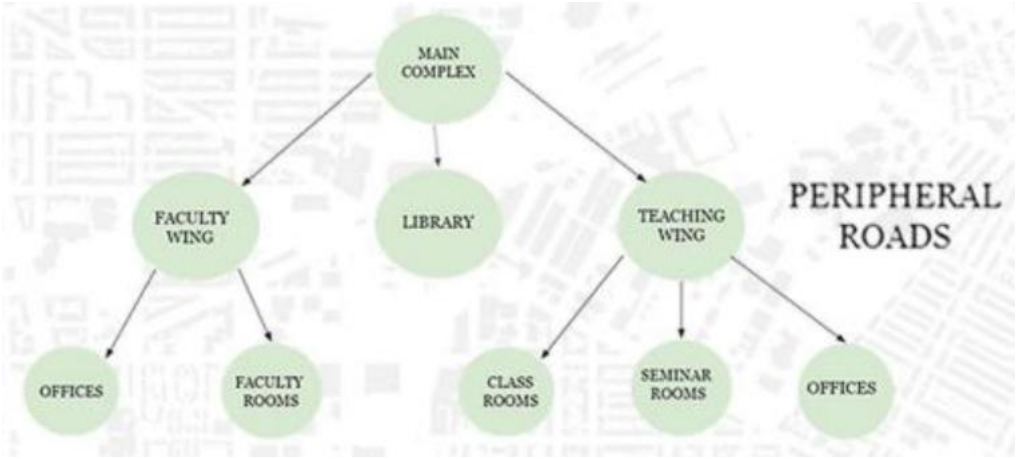




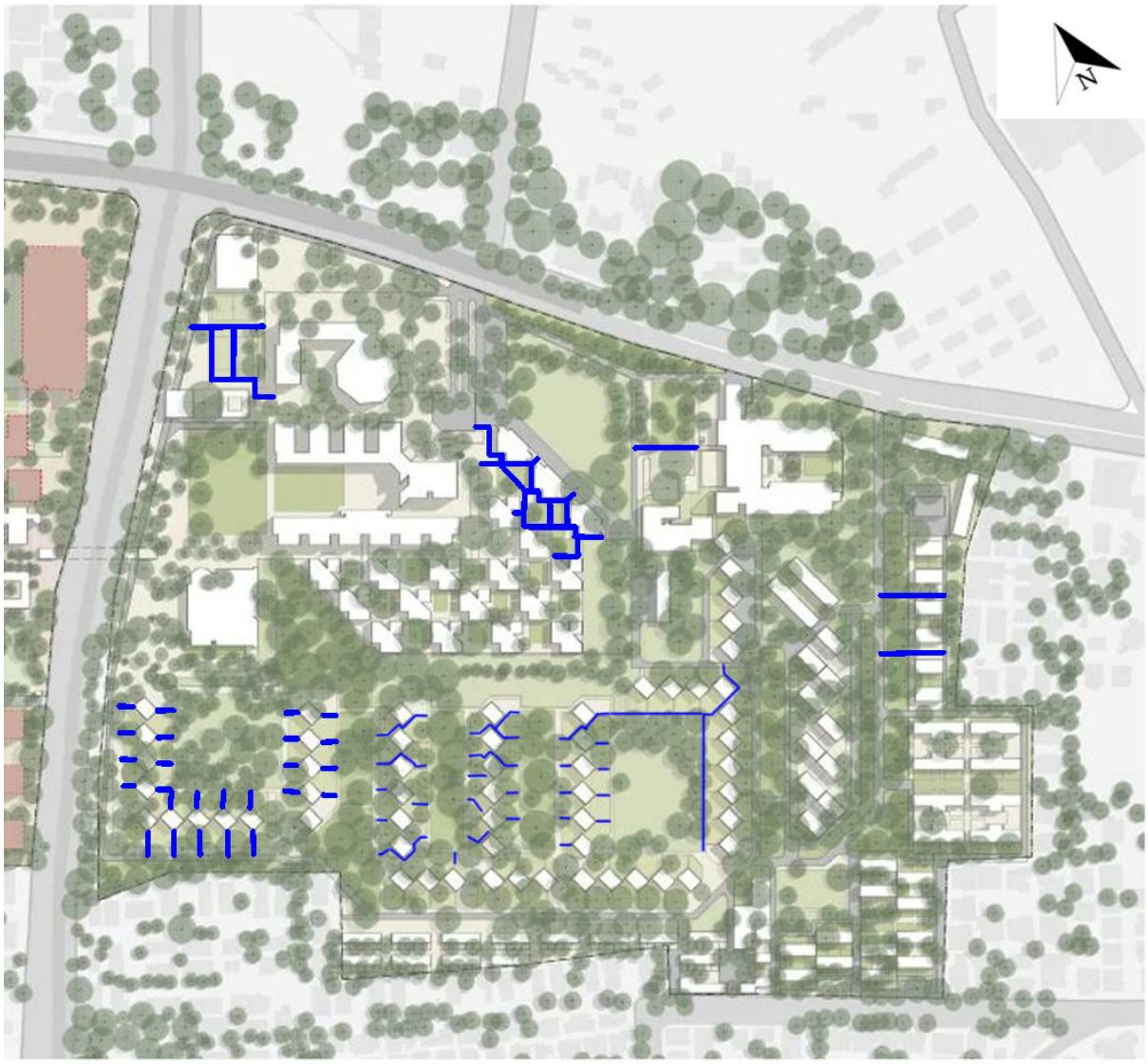
Circulation (Peripheral Road)



- Separate accesses are provided for the institutional and residential complexes
- All the activities are placed within walkable distance



Circulation (Internal Road)



Circulation (Small Internal Road)



Parking

Parking area has been provided near the main entrance to the complex to minimize disturbances in the academic area.

Parking lots are distributed evenly along the site, based on the accessibility.





Inferences

1. Clear Functional Zoning: The campus follows a well-defined zoning system, separating academic blocks, hostels, faculty housing, and service areas for efficient campus flow and reduced conflict between functions.

2. Academic Core Placement: The academic zone is centrally located, acting as the heart of the campus, symbolizing the institution's intellectual focus and making it easily accessible from all other zones.

3. Symmetry and Axis: Louis Kahn used a strong visual and spatial axis to organize blocks, giving the campus a sense of formal discipline and clarity in movement and hierarchy.

4. Interconnected Circulation: Covered corridors and interlinked pathways connect buildings, ensuring fluid circulation while protecting users from sun and rain — critical in a hot, dry climate.

5. Residential-Academic Buffering: The hostels are slightly offset from the academic zone, providing privacy and quiet while still maintaining walkable proximity for students.

6. Void-to-Built Relationship: Strategic zoning of built spaces around courtyards creates a balance of openness and enclosure, fostering interaction and climate-responsive design.

7. Hierarchy of Spaces: Zoning creates layers of public, semi-public, and private areas, from open plazas to secluded study rooms — a key principle in campus planning.

8. Vertical vs. Horizontal Zoning: The design favors horizontal spread over vertical stacking, emphasizing grounded, accessible forms suited for a low-rise, open-campus experience.

9. Integration of Services: Services like kitchens, staff areas, and utilities are discreetly zoned, maintaining the visual and spatial purity of academic and residential blocks.