

NATIONAL UNIVERSITY OF SINGAPORE

SPACE . PLANNING . GUIDELINES

CONFIDENTIAL

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1. INTRODUCTION

Space, like time and money, is a resource that should not be taken for granted. Our current use of space will not allow us to grow with the spatial scarcity that is becoming more apparent. This forces us to face the current challenges of meeting the increasing space demands.

This paper outlines the definitions and guidelines for the use of space in NUS for all new, upcoming expansions and upgrading works, learning from the strategies and methodologies of our international counterpart institutions. We will address and define the terms used for lecture facilities, laboratories, offices and conference rooms, to form a guiding principal for planning. As the needs of NUS change, these guidelines may need to be adapted accordingly.

Guiding Principles:

- ❖ Space is owned by the University and is allocated to Faculties, research groups or individuals with demonstrated needs. Needs are based on current programs and not on historical bearings.
- ❖ Faculties, research groups and departments are responsible to ensure allocated space is used efficiently with measurable utilization rates.
- ❖ Faculties, research groups and departments are encouraged to carry out internal space audits and review to update how the space is being used. The University will undertake annual space audits of space allocation and utilization.
- ❖ Faculties, research groups and departments are responsible to administer all common or shared facilities using the University Facility Booking System instead of other means (i.e. Individual calendars or operating platform and manual booking).
- ❖ Utilisation of University spaces which includes teaching, laboratories, office and meeting facilities will be audited based on the following methodology:

Frequency %	Occupancy %	Utilisation %
(A) = Number of Hrs Utilised / Number of hrs available	(B) = Capacity / Available Capacity	Average of (A) x (B)

Good targets of Frequency % rates is observed at 75% and above.

- ❖ Co-sharing of common use spaces such as teaching facilities, computer rooms, study areas, research core facilities and meeting rooms need to be considered during space allocation and physical planning stage.
- ❖ Flexibility is to be considered in building multi-purpose spaces that are easily reconfigurable. Adopting open space planning for offices and laboratories will encourage flexibility, collaboration and facilitate expansion needs.
- ❖ Large storage spaces are discouraged. Offsite storage, compactors or electronic archival need to be considered before additional storage space is requested.

1.1 Intent & Objectives of Space Planning Guidelines

It is intended that the Space Planning Guidelines will support the University in efficient and fair space planning. The guidelines will apply university-wide and aim to achieve the following goals:

- ❖ **Impartiality** – ensure that space is allocated, renovated and built in an equitable manner across the campus.
- ❖ **Consistency** – ensure consistent practices in space allocation, renovation and construction.
- ❖ **Efficiency** – ensure space is well utilized and efficiently planned for all intended purposes.
- ❖ **Flexibility** – ensure that spaces are planned to meet current and future needs such as allowing for future modifications.

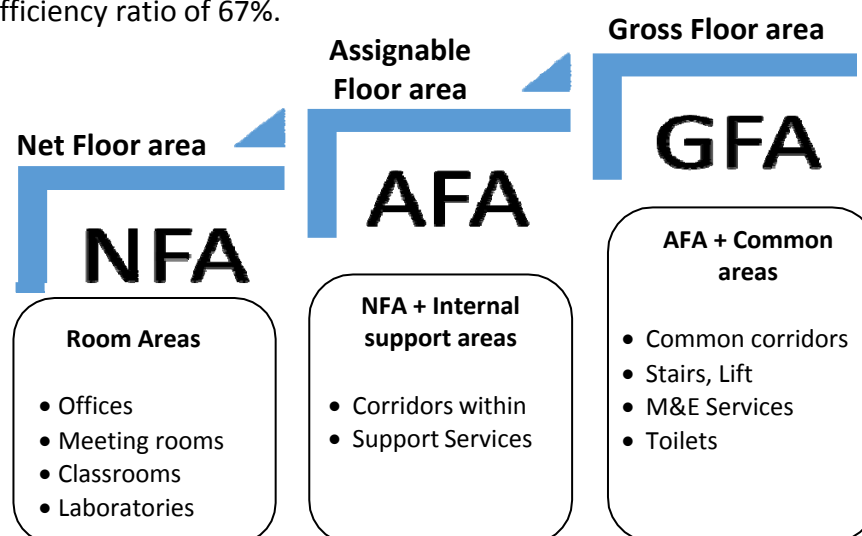
In making space standards transparent, we hope to:

- ❖ Minimise contentions over space allocation
- ❖ Benchmark space usage for all departments or faculties
- ❖ Maximise use of existing accommodation
- ❖ Reduce the need for new or additional space
- ❖ Match more effectively required space with availability

When existing spaces are being renovated and for all new capital projects, these guidelines will serve as a planning reference.

1.2 Definition of Terms

Building efficiency is guided by a space factor of 1.5 from NFA to GFA to achieve a building efficiency ratio of 67%.



1.2.1 Gross Floor Area (GFA)

GFA is defined under the URA guidelines as **measuring all sheltered floor areas of a building and unsheltered areas for commercial uses for purposes of plot ratio control and development charge**. GFA is measured as the total area of sheltered floor space, including the thickness but excluding voids. Refer to URA website for GFA definition and GFA exclusions.



Figure1
Gross Floor Area (GFA). The hatched areas delineate the GFA of a building.

1.2.2 Assignable Floor Area (AFA)

AFA refers to the area within a building, **available for the occupant for specific uses**. What will not be assigned in the AFA are common building circulation and service areas such as external corridors, restrooms, elevators and stairs.



Figure2
Assignable Floor Area (AFA). The hatched areas delineate the AFA of a building.

1.2.3 Net Floor Area (NFA)

NFA refers to the area inside a specific room or rooms.



Figure 3
Net Floor Area (NFA). The hatched areas delineate the NFA of a building.

2. ROOM DEFINITIONS

2.1 Teaching Facilities

2.1.1 Auditoriums > 100 persons

Auditoriums are principally used for public performances (music, drama and dance) that generally include a performance stage, backroom, tiered seating, a control room and audio-visual devices. Such facilities are sometimes used as lecture halls.

2.1.2 Lecture Theatres > 100 persons

Lecture theatres are similar to auditoriums with tiered seating, but are designed for instructional purposes that includes an instructor's platform or podium at the front and may offer flexible seating design, such as fixed or mobile seats and a choice of fixed benches or tablet arms.



2.1.3 Seminar Rooms > 30 persons

Seminar rooms are designed for mid-size group teaching equipped with audio-visual aids to facilitate formal presentations. Seats may be on level or gentle tiered floor.



2.1.4 Tutorial Rooms < 30 persons

Tutorial rooms are designed for small group teaching which are less formal and are generally equipped with simpler audio-visual devices.

2.1.5 Active Learning Rooms > 30 persons

Active learning rooms are seminar rooms designed as a customizable learning space with reconfigurable seating and ample writing surfaces for group discussions. Level flooring is essential to allow multiple layout configurations with of 5 to 6 tables of 6 persons for comfortable interactions.



2.1.5 Global Learning Rooms > 60 persons

Global learning rooms are fitted with of video conferencing and recording capabilities, equipped with microphones and cameras to allow long distant lectures to take place.



2.2 Laboratories

A laboratory is defined as a room for the testing, analysis and examination of articles.¹ A well-organised and coordinated laboratory layout should be designed to provide an efficient and safe working environment. Laboratories are classified under **teaching** or **research**, **Wet** or **Dry** laboratories. These are further categorised by discipline. Laboratories dealing with biological material are further classified by their bio-safety levels (BSL1, BSL2, BSL3 and BSL4).

Open Laboratories promote collaboration and minimise future modification works. **Laboratories should be designed to accommodate changes in use without significant infrastructural modification.** This flexibility should be adopted with consideration of site and building constraints. It is recommended to consult certified laboratory planners in the design of laboratory spaces. Consideration must be made to floor loading and ceiling heights with a well-planned access for regular equipment maintenance, dirty and clean corridors. Laboratories are energy intensive and energy efficient technologies shall be considered during the design process to minimise energy use.

2.2.1 Teaching Laboratories

Teaching laboratories are used for group instruction in scheduled classes and are often planned with core facilities to serve the needs of a particular discipline. The right sizing of teaching laboratory is approximately 5m² per student/researcher. The space provision is dependent on specialised equipment and teaching needs. Requirements for teaching laboratories are based on:

- a) Academic program needs
- b) Frequency of use
- c) Diversity of users
- d) Optimum modular sizes

2.2.2 Research Laboratories

Most laboratories are planned with laboratory, core facility and office support zones. Offices support are write-up spaces, meeting and break rooms. The laboratory zone are where the main experiments are carried out and is equipped with key components such as chemical fume cupboards, biological safety cabinets and laboratory benches. Adjacent to laboratories are core facility zones used to store core or common equipment.

¹ The definition is extracted from MOM definition in the workplace safety and health act.

2.2.3 Wet Laboratories

Wet laboratories are equipped with benches, sinks and chemical fume cupboards for work with a variety of bio-chemical solutions. Services such as piped filtered water, laboratories vents, compressed air, eyewash, safety showers and natural gases are required for experiments to take place.

❖ With core facilities

Biology and chemistry involve core facilities with tissue culture and cell manipulation. Core facilities are shared between investigators, example: Cold / Warm rooms | Equipment rooms | Fume cupboards rooms | Tissue / cell culture rooms | Dark rooms | Microscope rooms | Autoclave rooms | Instrument rooms | Clean rooms | Wash areas | Computer rooms | Laboratory storages.

❖ Without core facilities

General laboratories dressed with basic equipment sufficient to conduct smaller scale experiments and workshops.

2.2.4 Dry Laboratories

Dry laboratories are usually engaged in work involving electronics computational, small scale modelling, makerspace and instruments that require fewer piped services. These maybe analytical laboratories housing highly calibrated electronic apparatus that are sensitive to humidity, dust and temperature, vibration, clean power and filtered chilled water.

❖ With core facilities

Laboratories or workshops housing large or specialised machine, for instance Nuclear Magnetic Resonance (NMR) apparatus in quantum physics research. Core facilities are shared between investigators, example: Equipment rooms | Instrument rooms | Clean rooms | Computer rooms | Laboratory storages

❖ Without core facilities

Workshops with less machines and experiments are performed on a smaller scale. Drawing studios curriculum such as in architecture, industrial design and civil engineering.

Computer laboratories, which are multidisciplinary and engaged in technology based programmes or research.

2.3 Academic & Administrative Office

Relative to the variety of functional titles and job grades, there is a need to establish efficient guidelines to provide equitable and consistent space allocation to university staff. Based on their positions, members are entitled to work spaces or varying floor area with rooms or office system panels.

Refer to Space Norms for Academic & Administrative Offices.

2.4 Conference or Meeting Rooms

Conference and meeting rooms are made available to study groups, boards and clubs for discussion and collaboration. The rooms are typically equipped with tables, chairs and audio-visual systems catering to specific departments or organisational units. Conference and meeting rooms are classified by their capacity. Conference rooms are larger venues with 30 persons and above while meeting rooms hold below 30 persons.

3. SPACE NORMS

3.1 Teaching Facilities

Facility	NFA (m ²) per person
Auditorium	1.5
Lecture Theatre	1.5
Seminar Room	2
Active learning/Global Room	2.5
Tutorial Room	2

3.2 Laboratories

Facility per Research Group (approx. 5-7 researchers)	NFA (m ²)	NFA (m ²) per person
Dry Laboratories (without core facilities)	40	~ 6
Wet / Dry Laboratories (with core facilities)	80	~ 12
Dry Laboratories - Computer lab		2.3

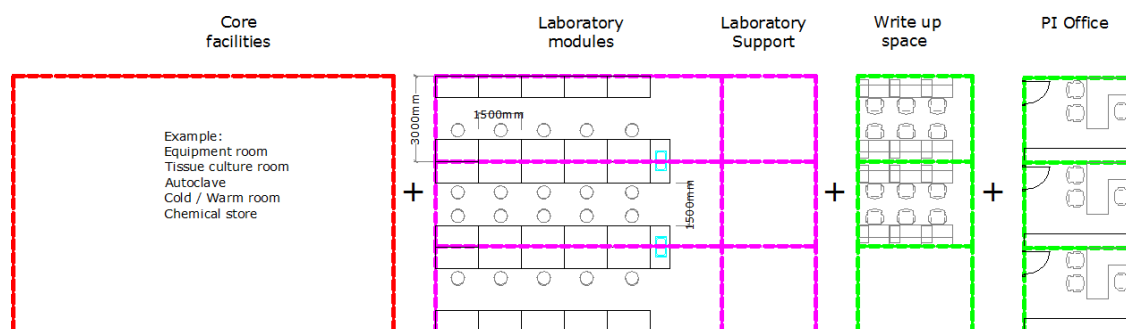


Figure 4 Example of Laboratory modules for illustration purposes

Example Research or PI group of 5-7 researchers		
Facility	Lab <u>without</u> core facilities	Lab <u>with</u> core facilities
Laboratory modules + Laboratory Support	40 m ²	40 m ²
Laboratory shared Core facilities Core facilities are generally 40 to 50 % of main lab spaces. For open labs, the ratio of lab vs core lab is 60/40.	-	40 m ²
Laboratory write up space (2m ² /pax)	12 m ²	12 m ²
PI office (12m ² /pax)	12 m ²	12 m ²
TOTAL approximate NFA	64 m ²	104 m ²
TOTAL approximate GFA	96 m ² ~ 100 m ²	156 m ² ~ 160 m ²

3.3 Academic & Administrative Offices, Conference or Meeting Rooms				
With Room				
Category	NFA (m ²)	Staff Title		
		Admin	Faculty /RIs	Residences
Office Type 1	24	Senior Vice President Vice President Vice Provost Assoc Provost		Rector
Office Type 2	12	Secretary or PA to Type 1		
Office Type 3	24		Dean	
	20	Senior Director Director	Deputy Dean Vice Dean Assoc Dean Director (RIs)	Master Director
Office Type 4	16		Assistant Dean Head of Department Deputy Head Prof / Assoc Prof /Assistant Prof	
Office Type 5	12	Deputy Director Snr Assoc Director Assoc Director	(Acad): Snr Lecturer (Research): (PI) Prof Assoc Prof Res Asst Prof ^Chairman (with an adjoining meeting room)	Warden
Cubicle or system panel (1.2m ht)				
Cubicle Type 1	5	Secretary or PA to Dean or Director		
Cubicle Type 2	5	Snr Manager Manager Assistant Manager Senior Executive Executive Management Assistant Officer Specialist Associate Operation Associate	(Acad): Lecturer Instructor Teaching Assistant (Research): Snr Res Fellow Res Fellow Post-doctoral Fellow Res Associate Res Assistant Engineer Laboratory Technologist	Hot desking (shared) Grad tutor
Cubicle Type 3	2		Full time research student	Hot desking (shared) Resident Fellow Non-resident Fellow Junior Common Room Committee members Residential Assistants Student Mentors
Conference or Meeting Room	2	-		

* Any deviation from the norms will require wavier submission for approval.

^ Allocation of Chairman's room will require respective DP's approval before planning and construction.

For Second offices or allocation for visiting staff, please refer to 4.3.3 and 4.3.4.

4. SPACE PLANNING

4.1 Teaching Facilities

4.1.1 Intent

Teaching facilities are designed to adopt flexible layouts to encourage student interaction and collaboration. Learning spaces should be remodelled to suit current teaching methodology with enhance technology. Learning is multi-faceted and interactive. Therefore, creating learning spaces require consideration to spatial, psychological, physiological and behavioural patterns of students today.

4.1.2 Design Criteria

- Create multi-functional spaces that can double for teaching and collaboration.
- Cluster teaching spaces with acoustic considerations between rooms.
- Locate along major circulation artery to allow convenient egress.
- Design sufficient circulation and communal spaces as **“learning streets”** that aids social learning and collaboration. Corridors are social arteries where meetings can be spontaneous. Provide spaces for interaction, event, buffet space and study space.
- Provide study corners with sufficient power points (recommended 4 persons : 1 twin power points) and writeable surfaces is essential.
- Optimise the use of building spaces with more transparency and connection with the outdoors and landscape spaces for a more conducive environment.



Auditorium / Lecture Theatre

- Design to suit teaching capacity and methodology, providing opportunities for breakout and discussions.
- Maintain clear sight lines to presentation screens, display materials and lecturer.
- Acoustic considerations are important.
- Consider chairs with swivel for discussions.

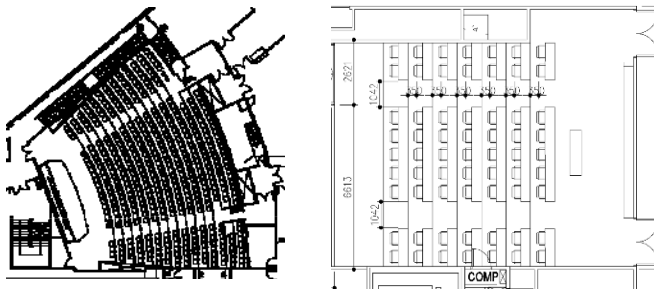


Figure 5 Example layouts of Auditoriums / Lecture Theatre

Seminar / Tutorial room

- Design to accommodate various layout configurations with movable furniture to suit collaborative teaching.
- Provide power and data points to suit different layouts.
- Maintain clear sight lines to screens and lecturer.
- Acoustic considerations are important.
- Consider operable walls to allow flexible room configurations.
- Allow storage of furniture in close proximity.
- Filing cabinets within the room is not necessary unless requested by user.

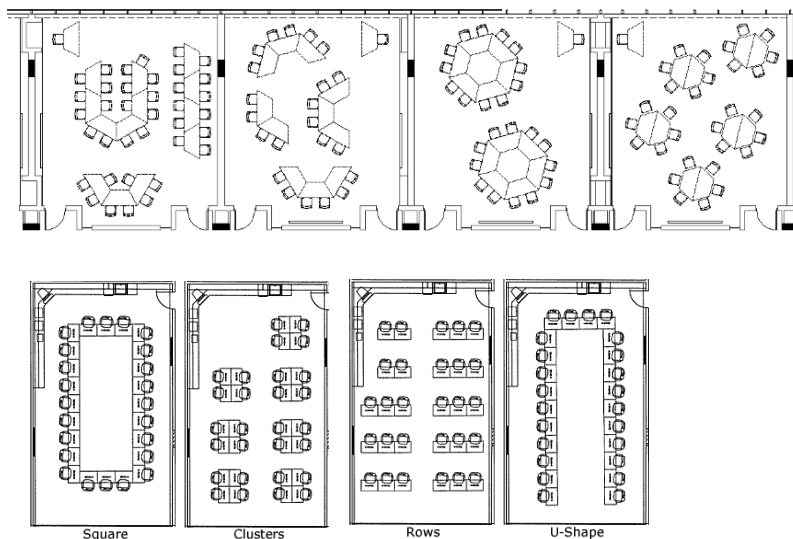


Figure 6 Example layouts of Seminar / Tutorial room

❖ **Access:** Introduce card access control to monitor access. Allow for CCTV cameras at main entrances. Door access is recommended to be from the front and back of the classroom.

❖ **Floor:** [Auditorium / Lecture Theatre](#)
Install heavy duty roll or carpet tiles with acoustic backing, include skirting.
[Seminar / Tutorial room](#)
Install vinyl or heavy duty carpet tiles with acoustic backing, include skirting.

❖ **Wall:** Install double layer partitions, slab to slab with insulation.
[Auditorium / Lecture Theatre](#)

- Install acoustic fabric or timber panels with acoustic considerations.
- Install double layer partitions, slab to slab with insulation.

[Seminar / Tutorial room](#)

- Emulsion Paint is acceptable for smaller teaching facilities, however acoustic (e.g. fabric panelling) should be considered.
- Install double layer partitions, slab to slab with insulation.
- Consider operable walls for flexibility of space usage.
- Install whiteboards or writable paint surface for group discussions.
- Where large movement of furniture is expected (i.e. multipurpose rooms), install walls with washable paint, guard rails or panelling to avoid scuffing.

Blinds:

- Install day and black out blinds to windows.
- Manual blinds are acceptable for most venues unless for auditorium / lecture theatre with high ceiling, motorised blinds should be considered.

❖ **Ceiling:** Design ceilings that are easily accessible for maintenance with acoustic treatment.
[Auditorium / Lecture Theatre](#)
Install plaster ceiling or acoustic timber panels for larger teaching facilities.
[Seminar / Tutorial room](#)
Install acoustic ceiling tiles for smaller teaching facilities such as in seminar or tutorial rooms. Recommended ceiling height is 3m.

❖ **Visibility:** Install doors with vision panels or introduce glass panels to enclosed rooms. Vision panels should not be blocked or fully frosted.

❖ **Furniture:** Auditorium / Lecture Theatre

Provide mobile or fixed tiered seating with tablet. If space permits, install chairs with swivel to facilitate group discussion.



Seating should be comfortable to suit long lectures with sufficient leg room of minimum 350mm to allow students to walk between. Select seat with recessed legroom and allow a slight controlled tilt mechanism for ergonomic comfort instead of rigid back seats. All seats should be individually numbered, visible from the aisle.



Seminar / Tutorial room

Chairs:

Provide mobile, stackable and durable seating with ergonomics. Mesh or PU backing can be considered. For collaborative learning, consider chairs with tablets and casters.



Tables:

Provide mobile, foldable tables. Surfaces should be durable to avoid scratches and be easily maintained. Hexagonal tables for flexible reconfigurations with group of 6 is recommended.

Whiteboard:

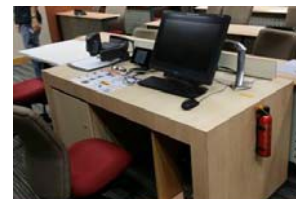
Provide wall-to-wall whiteboard with pen tray. Ensure whiteboard space is accessible when projector screens are down to enable delivering of shared instructional information. Introduce portable whiteboards with clips at the top for flipcharts to facilitate group discussions.



Console:

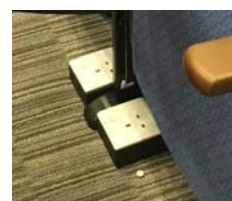
Lecturer's console should cater space for:

- L1800 x W620 x H800mm desk to fit a visualizer and 22" electronic writing tablet screen (on monitor arm) with CPU and space for lecturer's laptop. Power and data points should be neatly recessed in cable tray.
- **Minimum 3 twin power and 2 data points** at lecturer's console.
- Pull out drawer for paper, whiteboard marker and eraser.
- Lockable audiovisual rack with sufficient ventilation
- Pull out CPU tray.
- Modesty panel.
- Lockable heavy-duty rollers.
- Small fire extinguisher.



❖ M&E:

Cater power points strategically around the room to facilitate the need to plug in laptops and adapt to layout configurations. Power points are recommended on the walls, however, heavy-duty floor socket outlet boxes (SOBs) are also acceptable. If furniture is fixed, power and data points can be mounted on recessed cable trays or below desk. Recommended to provide **3 seat : 1 twin power point**. Wireless network is necessary with sufficient coverage.



❖ **Lighting:**

General:

- Lighting should be diffused / indirect to avoid glare.
- Lighting circuit should be controlled in rows parallel to the screen.
- Provide lighting with motion sensor for energy saving.
- Provide recessed lights above whiteboards on a separate circuit to allow clear visibility when main lights are switched off.
- Install LED lighting for energy saving.
- 2-way controls at the door and at lecturer's console.



Auditorium / Lecture Theatre



Install dimmable lighting with scene setting. Steps should be lit as a safety consideration with clearly lit signage and seat numbering.

Seminar / Tutorial room

A simplified system can be adopted with different switches controlling different lighting circuits parallel to the screen.

Maximise natural lighting and visibility to green spaces where possible.

- ❖ **Equipment:** Rooms should be equipped with teaching aids to suit the desired teaching methodology. Provide neat cable management for all equipment with future expandability. Equipment should be placed on sleep mode when not in use. Visual displays should be using the latest connectors (HDMI, DVI, Display ports) and have a suitable high lumens. Dual screen can be considered for larger rooms

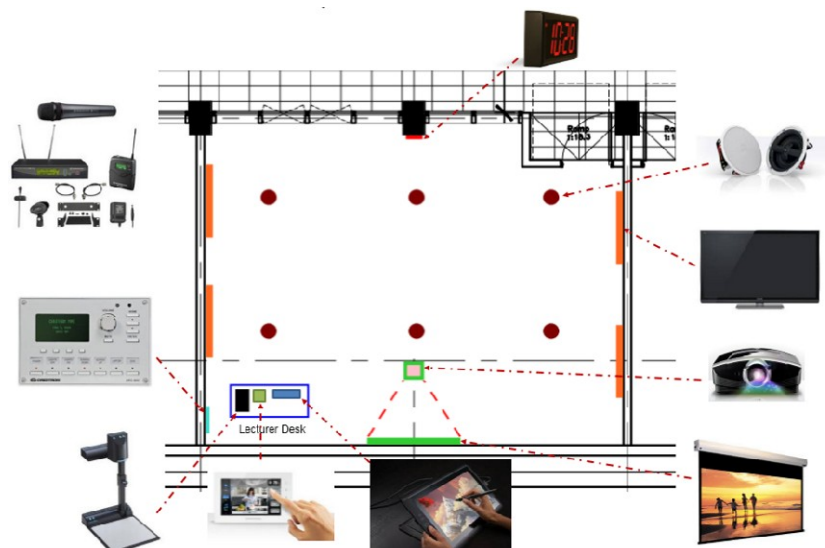


Figure 7

Example of equipment placement in a typical teaching facility

Equipment	LTs	Seminar/ Tutorial	Active learning		Global Learning
			(Basic)	(Enhance)	
Audio visual rack (w/ control system, switcher, amplifier) located within console.	✓	✓	✓	✓	✓
Wireless microphone Worn around the neck, rechargeable	✓	✓	✓	✓	✓
CPU with DCD/CD player Performance enhanced with Solid State Drive (SSD) or HDMI for connection to a digital control panel and projector.	✓	✓	✓	✓	✓
22" Electronic writing tablet Replaces the computer monitor with annotating function, on monitor arm. 	✓		✓	✓	✓
Speakers Ceiling speakers is ideal and neat. Front throw speakers may affect the voice of the speaker.	✓	✓	✓	✓	✓
Visualizer For display to projector.	✓	✓	✓	✓	✓
Whiteboards Wall to wall to maximize writing.	✓	✓	✓	✓	✓
LED Projector and motorised screen Dual screens are recommended, if teaching requires use of multiple devices.	✓	✓	✓	✓	✓
Wireless presenter (WP) - Require router and data point. - Require to download driver. - Presentation lag due to wireless buffering.	Optional				
Push button control panel (Limited for design expansion) - Toggling to display to projector, on /off - Lighting / Volume control 		✓	✓		
5" Touch panel (in place of push button control) - Toggling to display to projector , on /off - Lighting / Volume control - Graphic user interface 	✓		✓		✓

Equipment	LTs	Seminar/ Tutorial	Active learning		Global Learning
			(Basic)	(Enhance)	
10" Touch panel for collaborative learning <i>(in place of push button control)</i> - Toggling to display to projector , on /off - Lighting / Volume control - Graphic user interface - Collaboration mode to switch between screens 				✓	
47-55" LCD Confidence screen <i>(Installed at rear)</i>	✓		✓	✓	✓
42" collaborative LCD screens <i>(6 persons : 1 screen)</i> 				✓	
Microphone at student desk <i>(2 persons : 1 microphone)</i> Allow audio to be amplified and captured, recorded if necessary. 					✓
Video system for video conferencing <i>(w/ video switcher and conferencing codec)</i>					✓
Audio system for video conferencing <i>(Integrated into video conferencing system)</i>					✓
HD camera for webcast recording 	✓				✓
Synchronised clock <i>(Installed at rear. Require ceiling mounted data point)</i>	✓	✓	✓	✓	✓

❖ **Sustainability:** Provide lighting, air-conditioning and mechanical ventilation (ACMV) system tied to the building management system (BMS) and facility booking system. Where booking of rooms are linked to the building controls (i.e. lighting, ACMV, card access).

- Lighting controls can also be on motion sensor with energy efficient light fittings.
- Equipment should be powered down in an energy saving sleep mode when not in use or be provided with a master switch control.
- Provide separate meters for each building/floor for active management of electrical consumption.
- Consider using green materials which:
 - a) Are regionally sourced
 - b) Contain recycled materials
 - c) Are recyclable or reusable or easily renewable
- For a list of green products, please refer to:
 - a) Singapore Environment Council's "Green label scheme"
 - b) NEA "Mandatory Energy Labelling Scheme"
 - c) PUB "Water Labelling Scheme"

❖ **Utilisation:** Utilisation should be optimised where all teaching facilities are entered in the University booking system to facilitate booking, timetabling and tracking of utilisation.

- Users should avoid double booking venues and release unused slots when timetable is confirmed.
- Planning of timetabling should be evenly spaced and not only take up the more favoured slots.
- Good utilisation is referred with frequency rate as 75% and above.

4.2 Laboratories

4.2.1 Intent

Laboratories are designed to provide a safe environment for experiments and observations to be carried out. Open laboratories with flexible design considerations will minimise research disruption during reconfiguration. Adopt a modular planning grid to cater for potential increase or reduction of research size.

4.2.2 Design Criteria

Laboratories, where possible should be **generic**, catering the same basic amenities for multi-disciplinary use. 8 to 12 research groups are expected to work effectively and best optimise open laboratories and shared core facilities. An open effective laboratory floor would range from 2,300 m² to 2,800m². Centralise storage and inert gas yards for each lab or building cluster. Consider separate dirty corridor and back-of-house delivery routes for chemical and waste disposals.

Open Laboratories

- Allows visibility, facilitating collaboration and teamwork.
- Allows greater flexibility to accommodate research programs growth or reduction.
- Increases natural lighting and fresh air circulation.
- Increases density, optimising use of shared core facilities.
- Reduces the cost of research.



Shared core facilities should be located along common corridor spaces. Examples of core facilities include cold / warm rooms, preparation rooms, computer rooms etc.

Mobile casework is recommended to allow maximum flexibility. Fixed casework can be considered at the perimeter of the laboratory.

Zoning laboratory spaces with consideration of activity can ease operations. Centralise hazardous zones for fume cupboards, fixed equipment and sinks to free up usable space. By creating equipment zones, changes can be accommodated in a cost-effective way.

Flexible engineering services

- Introduce modular mechanical, electrical and plumbing (MEP) & heating, ventilating, and air conditioning (HVAC) systems design.
- Consider increase structural loading or ceiling heights for future enhancement.
- Provide engineering systems that can easily add or remove for easy maintenance and adaptable to future changes.
- Integrated common vertical risers or ducts that can be sized for future growth.
- Provide overhead cable trunking or raised floor, suitable for dry computer laboratories where services can be easily connected.

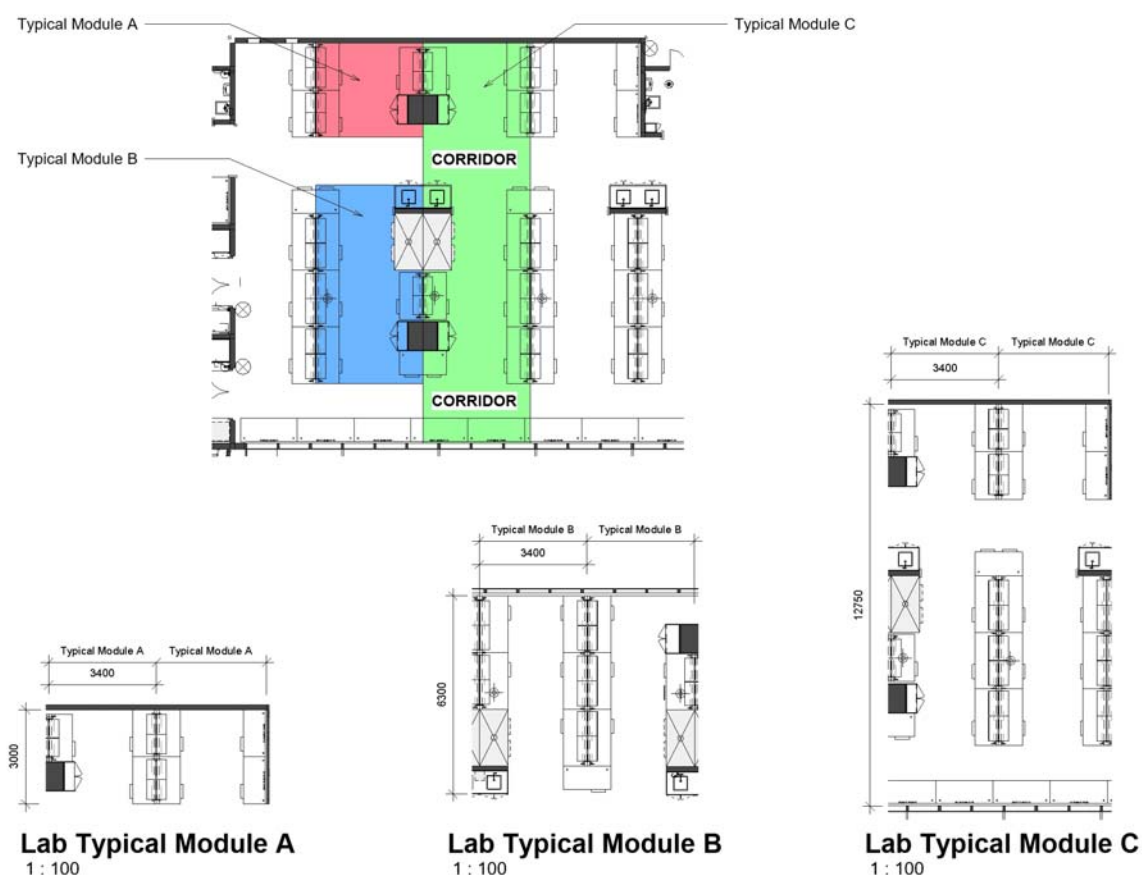


Figure 8 Typical laboratory module

STANDARD DRY LAB MODULE	STANDARD WET LAB MODULE
LAB BENCH Modular system Overhead Shelf REAGENT DROPPER (RD) N2, Compressed Air, Vacuum Twin power pt + 1 Data	LAB BENCH Modular system Overhead Shelf REAGENT DROPPER (RD) N2, Compressed Air, Vacuum Twin power pt + 1 Data
	OTHERS Fume cupboard / General exhaust Chemical Storage Lab sink

❖ **Access:** Introduce CCTV cameras and card access control to monitor access. Biometric access control can be considered for higher security.

❖ **Floor:** Install resilient surfaces that are chemical resistance and durable, e.g. vinyl or trowel epoxy with a minimum 100mm height skirting. Install raised floor for areas with high usage of M&E services such as in a computer laboratory.

❖ **Wall:** Install double layer partitions, slab to slab with insulation to meet BSL requirements.

- Install emulsion or polyurethane (PU) enamel paint
- Provide corner guards and guardrails to avoid damaging the wall surfaces where necessary.



Allow wall space for information display such as course information, past and recent research discoveries.

❖ **Ceiling:** Install mineral fibreboard of minimum 13mm thick 600 x 600mm grid ceiling tiles or exposed ceiling with acoustical liners. False ceiling would be necessary for infectious and radioisotope laboratory spaces. Recommended ceiling height is 3m.

❖ **Lighting:** Install evenly distributed LEDs or fluorescents that are energy efficient. Lighting can be suspended parallel to benching to minimise shadows or install integrated up lighting to support ambient lighting. Maximise natural lighting where possible.

❖ **Visibility:** Install doors with vision panels or introduce glass panels to enclosed rooms. Vision panels should not be blocked or fully frosted.

Position vision panels appropriately with consideration of wall space for equipment.



- ❖ **Furniture:** Laboratory benches with adjustable shelves (max weight 25kg per shelf) and stools should have easy maintenance. Provide **modular** and **mobile** storage units or tables, where possible. Mobile carts can come with glides or castors, height adjustability with anti-tipping counterweights and integrated wire management.



MODULAR, ULTRA MOBILE AND LOOSE BENCHING, UNDER BENCH STORAGE, REMOVABLE AND ADJUSTABLE SHELVING.



MULTI PURPOSE REAGENT SHELVES AND SERVICES DROPPER SYSTEM. RETICULATION FROM ABOVE TO ALLOW FLEXIBILITY



CARE IN POSITIONING SINKS AND FUME CUPBOARDS TO CONSOLIDATE SERVICES. THIS ALLOW TO MAXIMISE THE FLEXIBILITY IN THE CENTRE OF THE MODULE



FUMECUPBOARD CENTRALISED TO CONCENTRATE HAZARDOUS WORK AND EFFICIENCY. BRINGING TOGETHER DG STORAGE



SAFETY STATION WITH SAFETY SHOWER, EYE WASH AND HAND BASIN AT THE ENTRANCE OF THE LAB



DEFINED CIRCULATION PATHS BETWEEN FUNCTIONAL SPACES. MAXIMISING TRANSPARENCY TO ENHANCE SUPERVISION

Write-up desks should be separately located but within proximity to laboratories. If possible, install clear observation panels to view into the laboratory space and allow access to natural light. Student carrels should function as hot desk spaces with a ratio of (3 students : 1 desk) to optimise space usage. Provide lockers along corridors can facilitate personal storage.



❖ **M&E:**

In the central open laboratory, services should be reticulated on ceiling suspended service droppers. Where laboratory benches are against the walls, there can be overhead storage. Services should be wall mounted.

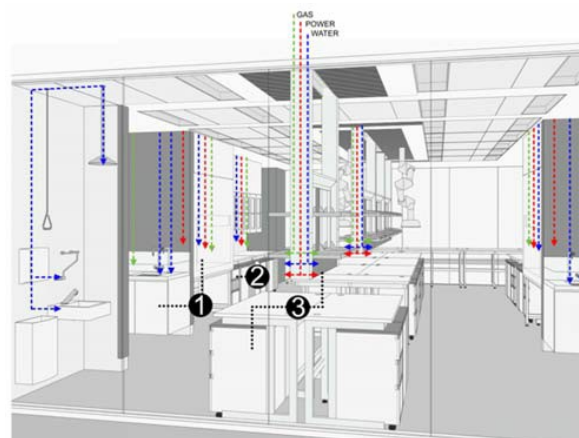
- Install 'Reagent Droppers' that are modular and demountable with easy services connection located above ceiling, sized to suit the table, with nitrogen, compressed air and vacuum.
- Integrate vertical risers for ductwork sized to allow future growth.
- Consider safety provisions such as sprinkler, fire extinguisher, gas detector, detector display panel and Audio/visual strobe alarm.
- Compartmentalise fume cupboard or placement of heat-emitting equipment.

Mechanical:

- Specifications and operation of the ACMV system should be in accordance with the Singapore Standard Code of Practice for Mechanical Ventilation and Air-conditioning in Buildings (SSCP13).
- Install individually controlled connections for HVAC, utilities and safety devices with efficient control of temperature and humidity.
- Consider dust control methods.

Electrical:

- Install **2 twin power points with 1 Data** per module
- Cater emergency or standby power, depending on laboratory use.
- To differentiate normal power source and E-source power points.
- To obtain user required plug load requirements.
- Include sufficient coverage for wireless network and mobile phones.



CENTRALISED ACCESS AND MONITORING POINTS



GAS PLUMBING RETICULATED 'TOP DOWN' WITH MINIMAL PENETRATION IMPACT TO FLOOR PLATE



COMBINING FUME CUPBOARDS AND SINKS TO CENTRALISE SERVICES WITHIN THE PARTITION WALL



OVER HEAD STORAGE AND SERVICES ON THE WALL. DUCTS ALLOW TO LOCATE THE POWER SUPPLY WHERE NEEDED



GAS, WATER AND POWER RETICULATED ON SERVICE DROPPERS. ALLOW TO FREE THE BENCH SPACE

- ❖ **Equipment:** Teaching laboratories should include teaching aids such as a computer, projector, projector screen, document visualizer/camera and non-reflective whiteboard to best suit current teaching methodology.

Shared equipment should be placed in **common core laboratory support areas** to facilitate co-sharing and reduce inventory. The Faculty should advocate co-sharing of equipment and equipment renewal when research leases are discontinued. Plan laboratories with equipment zones and fume cupboards along walls.

Doors to be minimum 2.4m clear height with 1½ leaf to accommodate most deliveries. (Further consultation with users are necessary).

- ❖ **Sustainability:** Laboratories consume between 5 to 10 times more energy than an office space. Apply sustainable designs and practices to achieve energy conservation without jeopardizing laboratory safety.

Provide separate meters for each building/floor for active management of electrical consumption. Individual metering for specific high energy usage lab cluster or user will be necessary for monitoring.

Apply sustainable designs and practices which include:

- Minimum required ventilation rate
- Fume cupboard density and sash management
- Ventilation airflow efficiency
- Temperature and humidity set points
- Heating and cooling system efficiency
- Process or plug load design
- Lighting design and solar orientation
- Water management

Apply sustainable practices with consideration of the following:

- Purchase green labelled or energy-star labelled equipment
- Right sizing of mechanical and electrical equipment to decrease peak energy load.
- Improve ventilation system by using variable exhaust system can reduce the number of air changes with the required fan-system efficiency and right sizing.
- Prevent standby power by switching off all electrical equipment that is not in use.
- Cater for paper recycling collection point in each lab.
- Reduce the need for harmful waste disposal to minimise the need for special waste removal systems.

Consider using green materials which:

- a) Are regionally sourced
- b) Contain recycled materials
- c) Are recyclable or reusable or easily renewable

For a list of green products, please refer to:

- a) Singapore Environment Council's "Green label scheme"
- b) NEA "Mandatory Energy Labelling Scheme"
- c) PUB "Water Labelling Scheme"

❖ **Utilisation:** **Teaching laboratories**

Utilisation should be optimised where all teaching laboratories are entered in the University booking system to facilitate booking, timetabling and tracking of utilisation.

- Users should avoid double booking venues and release unused slots when timetable is confirmed.
- Planning of timetabling should be evenly spaced and not only take up the more favoured slots.
- Good utilisation of teaching laboratory should provide for minimum 2 turns of classes with possible 3 turns. The capital and operational cost of laboratories are high thus increased man-power to assist in laboratory turning over will be a better consideration.

Research laboratories

- Space allocation is evaluated by the number of PIs and researchers.
- Number of lab benches can be assigned in open or modular laboratories spaces depending on the needs of the research.
- Space allocated should be based on a term use period and be continually measured based on the research activity, grants and criticality of the research to the University.
- Obsolete equipment from past research should be removed when research is terminated to optimise space usage.

❖ **Safety:**

For health and safety detail requirements, please refer to Office of Safety, Health and Environment (OSHE) guide on [Laboratory Design Standard](#) and [Ergonomic guidelines](#).

4.3 Academic & Administrative Offices

4.3.1 Intent

Office spaces are designed to provide a collaborative environment with quiet spaces for individual work. Limit the number of built zones and high panels. An open office environment is encouraged with panels no higher than 1.2m. Create quiet rooms for 1-2 persons for private calls or discussions, where deemed appropriate in relation to having an open office plan. Introduce hot desking spaces to provide flexibility for mobile and visiting staffs.

4.3.2 Design Criteria

Create flexible spaces that can be easily reconfigurable to cater for expansion and multiple space use to optimize space use.

- Install **modular workstations** with maximum of 1.2m height panels.
- Install a **grid system of power or data network** to allow the nearest point to be tapped on or consider raised floor system for greater flexibility, depending on space use and budget.
- Consider **modular built zones** to allow flexibility for change of use between an office and a meeting room.
- Avoid unnecessary built walls; instead use filing cabinets to divide spaces, which will give a certain level of privacy while allowing future reconfiguration.
- Limit number of enclosed meeting rooms. Introduce informal open discussion areas.
- Consider **shared desk system** for temporary or term staff who can be assigned with a personal mobile filing unit.

❖ **Access:** Introduce CCTV cameras and card access control to monitor access.

❖ **Floor:** Install vinyl with skirting to offices and general office. Vinyl flooring is hardwearing, durable and has better indoor air quality. Carpet tiles with skirting for type 1, 2, 3 offices can be considered.

❖ **Wall:** Install double layer partitions, slab to slab with insulation and doors with drop seals for private offices that require acoustic considerations.

- Install emulsion paint.
- Install day blinds at windows to cut down potential glare.
- Install writable surfaces in office and general office.

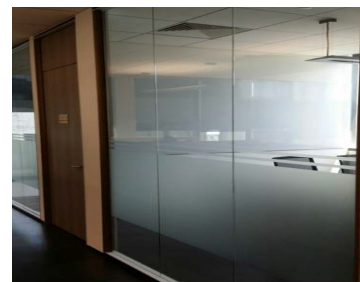
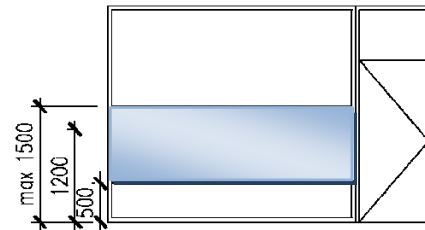
❖ **Ceiling:** Install mineral fibre grid ceiling tiles. Ceiling tiles should have acoustical considerations. Profiles should allow easy accessibility to facilitate maintenance. Recommended ceiling height is 3m.

❖ **Lighting:** Install evenly distributed LEDs or fluorescents that are energy efficient fixtures. Consider overhead direct or indirect lighting that can effectively illuminate the work surface. Install daylight sensors to reduce utilisation of artificial lighting on sunny days. Maximise natural lighting where possible. LED task lights are encouraged to allow customise lighting to suit each individual.

Avoid high cabinets abutting windows. Natural light should be shared by all staff in an open plan to enhance the general quality of the space and help save energy. Building design should also consider glare control into the workspace by providing external louvers or sun shading devices.

❖ **Visibility:** Install vision panels. **Glass panels should not be blocked or fully frosted.** Greater visibility is encouraged to foster an open office concept to facilitate greater interaction. **Every office or room should have a vision or glass panel** with the purpose of allowing light into the room and having shared light spilling to the common spaces. **Office rooms should not be fitted with internal blinds** with the exception of meeting rooms.

Recommended frosting:
500mm clear at the bottom
1200 - 1500mm height



- ❖ **Furniture:** Refer to Singapore standard “Code of Practice for Office Ergonomics, SS514” published by Spring Singapore and OSHE’s [Ergonomic Guidelines](#).
- Position tables perpendicular to the window to avoid direct sun’s glare.
 - Install magnetic whiteboard and pin board.
 - Install coat hooks for office rooms (where required)

Table ergonomics requirements:

- Distance between adjacent users should be minimum 1.2m apart.
- Sufficient leg room under the table.
- Ample and non-reflective work surface.
- Table height should be 700-750mm.

System furniture:

Consider reconfigurable modular components with thinner system panels for space savings. Avoid sharp corners for desks. Panels can integrate whiteboards and accessory rails to include file holder, penholder, Nameplate etc.



Office room:

Consider typical desk furniture for ease of future procurement. Custom furniture can be considered for built-in cabinets.

Chairs ergonomics requirements:

- Stability with five castors and able to swivel
- Seat height adjustability
- Lumbar support with adjustable tension
- Height adjustable arm rest
- Seat pan adjustability (where possible)

Type of chairs should no longer represent hierarchy and where possible **standardisation** of chairs should be introduced throughout for ease of inventory. Select breathable padded seating such as fabric as it retains less body heat compared to polyvinyl chloride (PVC).

Director chair: Mid or high back with arm rest, on castors. Director chair can be the same as other staff chairs with the option of changing its finishes. (e.g. fabric to leather seat)

Staff chair: Mid back with arm rest, on castors

Visitor chair: Similar to selected staff chairs but without arm rest, on castors.

Filing:

Consider digitised archival. Limit the amount of individual filing at workstations with maximum 1.2m height. Utilise wall space to fit high filing that can effectively divide spaces as an alternative to building walls.



Consider compactors or business savers for savers. Mobile storage units can be used for temporary staff who do not require a permanent desk space.



Business savers



Mobile Storage

❖ M&E:

Provide **2 twin and 1 data point** to each desk. Include sufficient coverage for wireless network and mobile phones. Zone lighting controls with colour coding for ease of defining the zones.

❖ Equipment:

Flat screen monitors can be installed on monitor arms for space saving considerations, freeing up more desk space.



❖ Sustainability: To implement:

- Cater strategic locations where trash and recycle bins are provided together to encourage recycling.
- Set air-condition temperature at 25 degrees.
- Install energy efficient lighting, e.g. LED lighting.
- Pantry equipment used should be energy efficient.
- Use materials that are made from recycled waste or fast generation products where viable.
- Provide separate meters for each building/floor for active management of electrical consumption.

Consider using green materials which:

- a) Are regionally sourced
- b) Contain recycled materials
- c) Are recyclable or reusable or easily renewable

For a list of green products, please refer to:

- a) Singapore Environment Council's "Green label scheme"
- b) NEA "Mandatory Energy Labelling Scheme"
- c) PUB "Water Labelling Scheme"

❖ **Utilisation:** Office rooms and cubicles are viewed as 100% used, however its allocation should be based on space norms and for full time staff. Studies found that utilisation at desk usually ranges 40 to 50% as staff are at meetings, training or on leave. As such, touchdown or hotdesking spaces can be tailored to accommodate peak demand.

- **Second offices and cubicles are discouraged within the campus and would require the approval from senior management and subject to space resources.**
- Visiting staff can be allocated a room/cubicle based on a ratio of 1 : 3 visiting staff.
- Temporary or adjunct staff should be allocated in hot desking.

❖ **Indoor
air quality:**

Poor indoor air quality can lead to loss in productivity and comfort problems.

Guidelines to achieve good indoor air quality include:

- Efficient location of cooling towers and fresh air inlet.
- Adequate natural ventilation or otherwise enhance mechanical ventilation to purge indoor air.
- ACMV design to limit spread of potential contaminants.
- Use building materials that do not contain or emit chemicals, bacteria or fungi and able to withstand the intended use.
- Locate filtered outdoor air intake away from polluted areas like car parks, loading bays and refuse chutes.
- Design to allow cleaning and maintenance of ACMV, windows and surfaces in contact with air supply to the room.
- Maintain cleanliness during and after construction to ACMV systems.
- Specifications and operation of the ACMV system should be in accordance with the Singapore Standard Code of Practice for Mechanical Ventilation and Air-conditioning in Buildings (SSCP13).
- Effective isolation of ACMV is necessary during partial renovation works.
- Regular inspection and maintenance is necessary to check airflow, temperature and humidity.

4.3.3 Second Offices

Requests will have to be submitted to SPM with justifications.

Second offices are discouraged within the campus and requires the approval from senior management, subject to space resources. Exception cases includes:

- When a staff holds a role in leadership and has a joint appointment in administration and academic positions.
- When a staff has their primary role office in a separate building of a distance away.

The second office is required to be of shared occupancy and must be smaller than their entitled size. However, staff are encouraged to hot desk in an open office plan to increase communication and utilisation of space.

4.3.4 Visiting staff

Visiting professors may be assigned in shared offices (2 - 4 desks in a room) or hot desking cubicles, co-shared of with a ratio of estimated (1:3 visiting staff), depending on frequency.



Figure 9 Example plan of a typical shared office.

4.3.5 Suggested Layouts

University staffs are allocated work spaces relative to their functional titles. The example layouts here are meant to provide diagrammatic ideas for space planning. Window should be optimised to allow lighting to be shared with more staff members.

❖ Office Type 1 & 2

Office type 1 and 2 are adjacent to each other. Type 2 houses the secretary or PA of the VP and the rooms should be attached with preferred direct access.

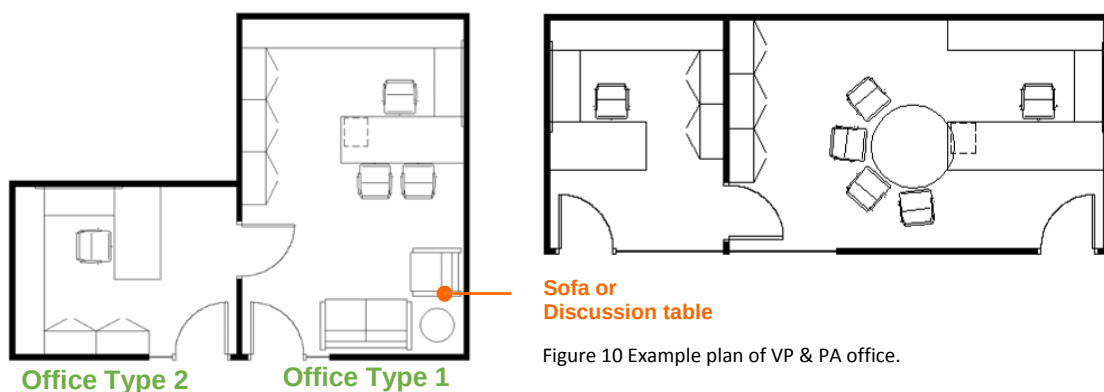


Figure 10 Example plan of VP & PA office.

❖ Office Type 3 & Cubicle Type 1

Type 3 consists of an office with a secretary's cubicle, preferably located adjacent. Any panels exceeding 1.2m height must be installed in clear glass or acrylic. Cubicle Type 1 are allowed up to 1.5m height panels if necessary.

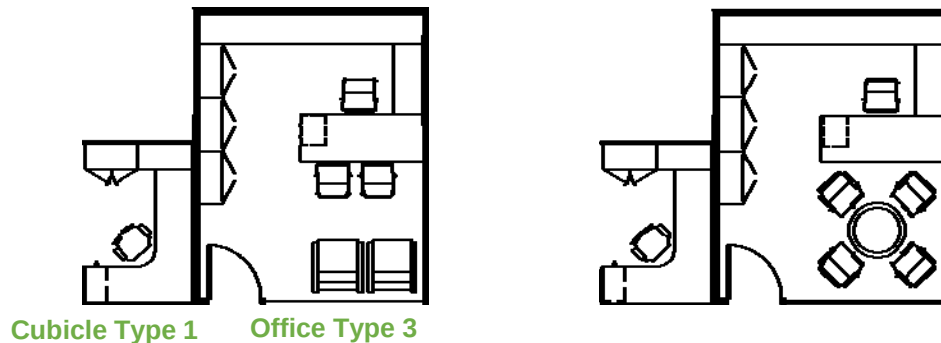


Figure 11 Example plan of a Dean or Director Office & Secretary.

❖ Office Type 4 & 5

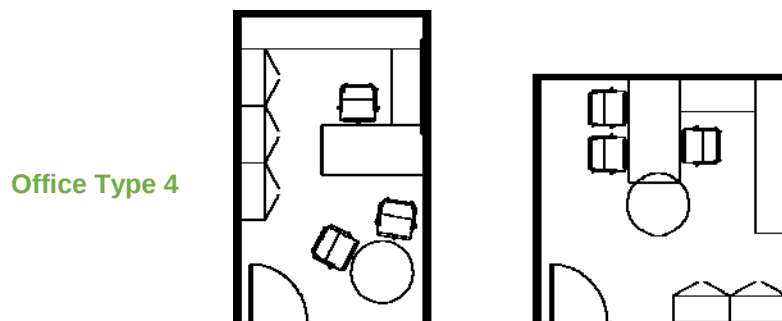


Figure 12 Example plan of a typical Faculty Staff's office.

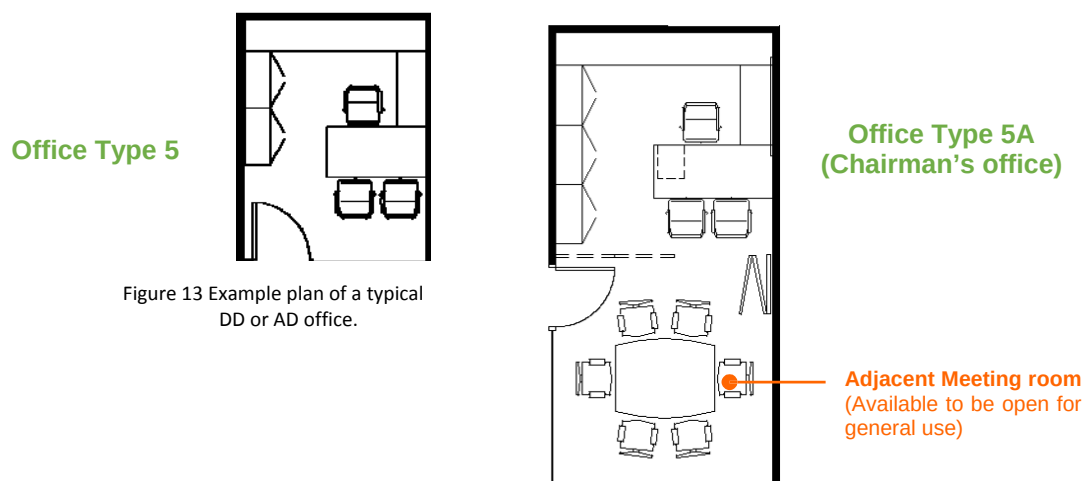


Figure 13 Example plan of a typical DD or AD office.

Figure 14 Example plan of a typical Chairman's office.

Office type 5A is representative of a Chairman's office where by the size of a typical DD or AD office is assigned with a dividing door that opens up to a meeting. Alternatively, when closed, the meeting or lounge room can function independently.

❖ Cubicle Type 2

Each staff is entitled 5m² in an open office plan. Use generic panels to maintain consistency and future flexibility. **Cubicle can be as 3 to 4m² allowing more communal and interaction spaces within the office.**

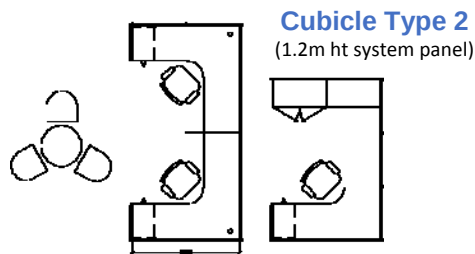
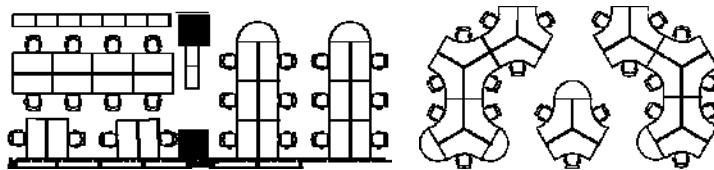


Figure 15 Example plan of a typical cubicle.



❖ Cubicle Type 3

A typical full-time graduate student desk length is 1.2 to 1.5m. The number of work desks should provide for part-time students and fluctuations. Shared work desk is encouraged to a ratio of 1:3.

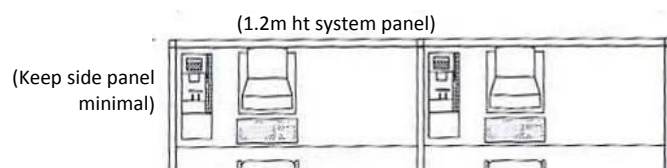


Figure 16 Example plan of a typical research work desk / hot desk.



❖ Quiet rooms

Quiet rooms are typically for 1-2 persons, for private calls or discussions. Such rooms are applied to open office plans to allow a certain level of privacy for the staff. **The rooms can double as enclosed touchdown spaces, nursing or prayer rooms.**

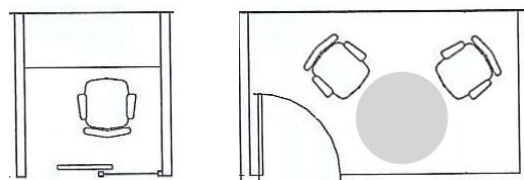


Figure 17 Example plan of a typical quiet room.



❖ Touchdown or Hot desking spaces

Touchdown spaces are encouraged for mobile or temporary staff. Such spaces allow for flexibility in headcount increase and can be located next to breakout spaces to allow for more interaction. Central storage units or locker spaces can be assigned for mobile staff.

4.4 Conference or Meeting Rooms

Classification of conference and meeting rooms is dependent on capacity. **Conference rooms are larger venues for > 30 persons while meeting rooms hold < 30 persons.**

4.4.1 Intent

Meeting spaces should facilitate and promote effective group discussion and interaction. Procuring the right technology for the room is critical to suit the indented presentation method.

- **Locate all conference or meeting rooms at common circulation and accessible areas, out of departmental assigned boundaries.**
- **All conference or meeting rooms should be registered in the University Facility Booking System and co-shared with occupants in the building.** Faculties and individual administrative departments are responsible in ensuring utilisation of meeting spaces are optimal.
- Ensure number and size of rooms are justifiable, depending on the meeting capacity, departmental size and discipline. Meeting spaces tend to be over planned with the wrong sizing and quantity which will lead to reduced utilisation therefore careful planning is required.
- Ratio of meeting room to staff is dependent on the office environment. An estimate can be taken with **1m²/full time staff**, allocated as meeting facilities.

4.4.2 Design Criteria

- Design modular built zones/rooms to allow flexibility for change of use between an office and a meeting room.
- Consider operable walls between rooms for added flexibility to convert into larger venues if required.
- Select modular tables for reconfigurable furniture layouts.
- Allow sufficient circulation to accomodate additional side chairs.
- Consider open informal 4 persons meeting spaces to limit the number of built rooms.

❖ **Access:** For rooms at common areas, provide card access control to monitor access.

❖ **Floor:** Install heavy-duty carpet tiles.

❖ **Wall:** Install double layer partitions, slab to slab with insulation.

- Install emulsion paint.
- Install non-reflective magnetic whiteboard or writable surfaces.
- Consider fabric wrapped acoustic panels / pinboards.
- Consider operable walls for flexibility of space usage.
- Install day and black out blinds at windows.

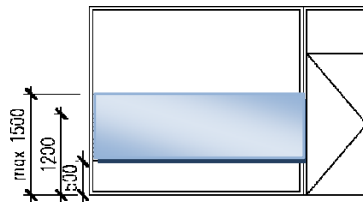
❖ **Ceiling:** Install acoustic ceiling tiles or gypsum board ceiling for feature profiles.

❖ **Lighting:** Install controlled lighting with dimming for larger conference rooms and a simplified split circuit system for smaller meeting rooms. Lighting control sequence should be done parallel to the whiteboard to control the lights during presentation.

Consider indirect lighting as well as maximising natural lighting where possible. Install energy efficient lighting (e.g. T5 with high frequency ballasts or LED lights).

❖ **Visibility:** Install glass panels beside doors and/or vision panels on the doors. Glass panels should not be blocked or fully frosted.

Recommended frosting:
500mm clear at the bottom
1200 - 1500mm height



❖ **Furniture:** **Meeting tables:**

Consider modular components for easily configurability. For higher profile meeting spaces, customised tables may be necessary. Maintain clearance of 1m around room and min 1m from screen.



Meeting Chairs:

- a) Stability with five castors and able to swivel
- b) Mid back without arms
- c) Seat height adjustability
- d) Lumber support

Credenza:

Provide a counter as a coffee point with minimal storage for pens, paper. AV equipment (if required) should be stored in a well ventilated cabinet which can be part of the credenza.

Miscellaneous:

Display case, Water cooler, Clock, phone point, Trash bins (if necessary)

- ❖ **M&E:** Cater sufficient power or data points for equipment, located in accessible cable flip trays or floor box. Cater power points at strategic points around the room to facilitate the need to plug in laptops.
- ❖ **Equipment:** AV requirement will depend on user requirement and room size. Basic requirement includes a projector screen and ceiling mounted projector.
- ❖ **Sustainability:** Use energy efficient light fittings. Equipment should be powered down in an energy saving sleep mode when not in use or be provided with a master switch control.
- ❖ **Utilisation:** Utilisation should be optimised where all meeting facilities are entered in the University facility booking system (FBS) to facilitate booking.
 - Users should avoid double booking venues and release unused slots.
 - Good utilisation is referred with frequency rate as 75% and above.

4.4.3 Suggested Layouts

The circular layout is more passive focusing on group conversations and discussions while the trapezoid layout caters for presentations and video conferences.

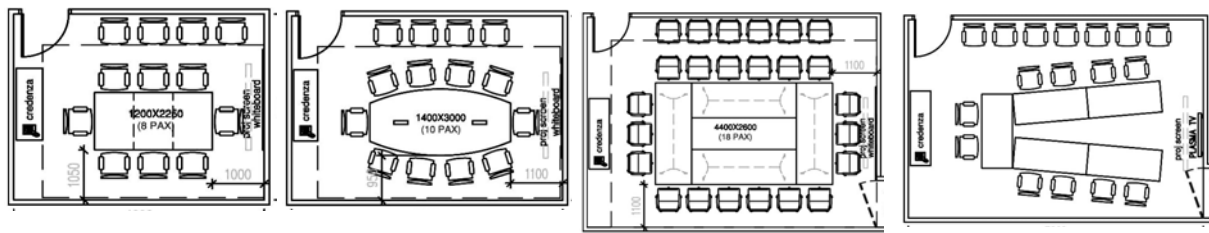


Figure 18 Example plan of a meeting room.

4.5 Lobbies or Receptions

4.5.1 Intent

Consider aesthetics with appropriate use of furniture, finishes, signage and artwork to welcome and direct visitors. Both spaces often influence a visitor's first impression and require a balance of aesthetics, security and operational considerations. Introduce higher volumes of space where possible, with well-defined circulation routes.



Avoid having two or more reception areas for a single department. Size should be justifiable depending on visitor peak loads and frequency of use. **For departments where there is no necessity to receive guest, a reception is not necessary. Instead, provide a privacy screen wall with a phone extension to request for assistance.**

4.5.2 Design Criteria

The function of lobbies or receptions will vary depending on the location and purpose. However, consideration of the following is necessary.

- Install clear directional signage.
- Provide informal meetings or discussions areas.
- Design space to accommodate peak loads.
- Consider HVAC system requirements if the spaces require 24h operation.
- Create clean and clutter free spaces where bulky equipment is centrally stored.
- Consider mail collection and delivery. Mailrooms should be accessed from the external in case of potentially contaminated mail.
- Provide umbrella stand, newspaper, magazine stand or TV (optional).
- Provide display areas / notice boards (if required).
- Provide coffee point or water dispenser (if required).
- Provide phone points/data points for payment devices (if required).
- Plan restroom facilities within proximity.

Manned lobbies with a reception

A receptionist would be station at the counter as a permanent work desk.

- Locate reception desks with a clear view of the entrance.
- Design counter with sufficient lockable storage and neat cable management for a clean work surface.

Unmanned lobbies

- Provide a phone point and directory.

- ❖ **Access:** **Design informal discussions areas and meeting rooms next to lobbies or receptions to allow ease in sharing of common facilities.**
 - Consider concrete planter boxes or bollards at building driveways, to prevent any vehicle from crashing into buildings.
 - Consider locations for deliveries, with adequate space for larger vehicles and shelter.
 - Consider landscape to allow subtle transitional barriers between spaces.
 - Install CCTV cameras at public areas, entrances, receptions, exits, lift lobbies and walkways. Landscape and lighting should be considered when installing any cameras.
 - Consider visitor accessibility and access control.
 - Introduce emergency one-way exit doors.
 - Provide sufficient lighting at strategic locations like pathways, alleys, etc.
 - Consider space for security posts (if needed).
- ❖ **Floor:** Install durable finishes to accommodate high pedestrian traffic, such as stone or tiles, at lobbies and heavy-duty carpet tiles or vinyl at receptions.
- ❖ **Wall:** Install durable finishes to accommodate high pedestrian traffic. Install glass panels to create an open and welcoming space.
- ❖ **Ceiling:** Install plaster ceilings or acoustic ceiling tiles.
- ❖ **Lighting:** Install energy efficient fixtures with accent lighting to enhance general ambience. Maximise natural lighting where possible.
- ❖ **Furniture:** Select durable finishes and fabrics.
- ❖ **M&E:** Provide sufficient power or data points for equipment at reception and general power for facilities and housekeeping.
- ❖ **Sustainability:** Maximise natural light and greenery into the space where possible. Provide trash and recycle bins.
- ❖ **Utilisation:** Lobbies and receptions should only be created if the need is justified, such as to provide for an anticipated crowd, space for events or student study area. Reception desk should be manned if requested. Alternatively, a counter against the wall will suffice.

4.6 Corridors

4.6.1 Intent

Design corridors to encourage communication and interaction. Plan meeting rooms, informal breakout and touchdown spaces beside main circulation arteries, where is easily accessible to visitor and staff. Allow as much natural light and greenery into the space as possible.

4.6.2 Design Criteria

- Double loaded corridors are more efficient.
- Introduce wall features or graphics to feature events and informational data.
- Plan corridor widths within optimal widths to meet traffic flow.
- Design optimal wind flow for natural ventilated corridors.
- Locate service corridors away from noise sensitive areas such as meeting rooms or main entries.
- Introduce lighting motion sensors for efficiency.

Recommended corridor widths:

Heavy traffic public areas: 6 m

(Depending on traffic movement)

Main circulation in buildings: 2-3 m

Between rooms and workstations: 1.2 m

Between cubicles or workstations: 1 m



4.7 Print and Mail stations

4.7.1 Intent

Print and mail stations can be co-located with breakout, pantry areas at accessible centralised areas to encourage shared copy points. **Personal printing facilities are discouraged** as sensitive documents can be printed with password lock.



4.7.2 Design Criteria

- Design equipment benches for storage and neat cable management.
- Integrate pigeon slots to common copy rooms, for mail and storage of paper or binders.
- Integrate trash and recycle bins where possible.
- Design print rooms to cater for high frequency printing (e.g. Exam scripts), with proper acoustics to minimize noise transmission and avoid adjacency to meeting or executive office rooms.
- Large mailrooms should be accessed externally in case of potential contamination.

4.8 Breakouts or coffee stations

4.8.1 Intent

Breakouts or coffee stations should provide a space where people can gather, interact and relax. Locate breakouts or coffee stations at easily accessible centralised areas but must not be within any laboratory area. Cater casual seating to allow informal discussion over coffee to encourage team bonding.



4.8.2 Design Criteria

- Install finishes that are hardwearing and resilient to food or coffee stains.
- Select a range of seating at breakout areas (e.g. lounge chairs, café type seating, high stools in touchdown areas).
- Projector screens can be integrated to allow multiple usage of a breakout space as a meeting or training space.
- Design wall space for notice boards and white boards for informal discussion.
- Provide wireless internet access as a touch down workspace.
- Design carpentry units to allow sufficient counter and storage space to accommodate and integrate all equipment (e.g. microwave oven, coffee machine, water dispenser, refrigerator, sinks, dish rack etc).
- Sustainability features:
 - Provide trash and recycle bins (for recycling paper, cans and plastic bottles) as an integrated feature to the overall design.
 - Position the refrigerator away from any heat source. Keep your refrigerator around 3°C and freezer at -18°C. Use dryer instead of paper towel for your wet hands.
 - Introduce lighting motion sensors for efficiency.

4.9 Support spaces

4.9.1 Store

- Large storage spaces within offices are discouraged. Consider offsite storage, compactors or electronic archival before requesting for additional storage space.
- Maximise storage with high cabinets against walls.
- Storage use should be consolidated if a room is required to avoid multiple store rooms to suit different purposes.

4.9.2 Toilets

- Cluster toilets in a vertical stack for better way-finding and service maintenance.
- Bathroom facilities are not a norm. If required, needs should be highlighted.
- Toilets should be well-ventilated and not directly facing main circulation corridors.
- Where possible, design toilets without main doors for better ventilation, movement and hygiene. Review visual sightlines into the toilets.
- Introduce lighting motion sensors for efficiency.
- Provide the basic amenities:
 - Toilet with manual dual water saving flush system. Auto flush for handicap toilets
 - Hand held bidet for minimum of 1 toilet per cluster. Provide additional floor drain to for ease of cleaning.
 - Presto taps is preferred. A mix of presto and auto sensor taps can be suggested for high traffic toilets.
 - Dry ledge space at sink and within toilet cubicles.
 - Sensor hand dryer is preferred.
 - Manual soap dispenser (typically provided by the cleaning company).
 - Location for bins (typically provided by the cleaning company).
 - Ceiling fan for better air circulation if clear ceiling height of 2.5 m can be achieved. Alternatively, wall mounted fan can be also installed.
 - Mop sink of (W400 x D300mm) to be provided at every cluster of toilets.
 - Clothes hook with ledge to be provided for every toilet cubicle.
 - Floor trap to be located at the corner, not along main circulation.
 - One lockable bib tap to be provided for washing at each toilet.
- Provide one **cleaner's store** to each toilet cluster per floor.
(i.e. if there are 2 toilet clusters on the same floor, minimum one cleaner's store is required)
 - Minimum room size: (W1000 x D1000mm).
 - If space allows, provide wall shelves, raised 600mm above floor.
- Provide one **cleaner's rest area** (approx. 8 - 10m²) for each or a cluster of buildings.
 - Room to be naturally ventilated with lighting and twin power points at countertop.
 - Provide door with vision panel.

5. RESIDENTIAL

5.1 Housing Types

The University experience embraces living spaces as part of the community spirit. Campus housing cultivates a sense of belonging, which fosters learning and social interaction. A mix of social, sports and recreational spaces with educational spaces should be planned to effectively facilitate residential life purposed housing.

There are greater room type options, ranging from double and single rooms with communal bathrooms in traditional halls to single rooms with attached bathrooms and 6-rooms apartment units in the residences and residential colleges. Graduate student housing consists of studio apartments designed for married couples and 4-Rooms Apartment Units for singles.

5.1.1 Undergraduate Student Housing

There are three main types of undergraduate student accommodation on campus:

❖ Halls of Residence

The 6 Halls of Residences offer a communal and vibrant living experience with co-curricular activities, rich culture and history. Students living in Halls are engaged in a wide range of team building, sports, cultural and community activities within the Hall, typically organized by Hall student leaders to encourage residents' participation.

Each Hall typically houses 500 students, managed by a team of live-in senior staff members forming a Senior Common Room Committee (SCRC) comprising of a Master and 5 Residential Fellows. Residents are represented by elected members that form the Junior Common Room Committee (JCRC), serving to promote the Hall's community and cultural life.

Each Hall consist of single or double rooms that are typically grouped by gender with common bathroom, lounge, pantry and laundry spaces. Resident Fellow's apartments with 2 to 3 bedrooms are typically located at each block.

Common facilities in each Hall consist of a multi-purpose hall (for events, sports and performances), a dining hall (supported by a full catering kitchen), squash/tennis courts or multi-sports courts , specific-uses rooms, e.g. gymnasium, music room, reading room, study room, etc.

❖ Residences

Students staying in the Residences are encouraged to participate in activities organized by their preferred clubs and societies. It offers students independent living while experiencing close interaction among residents.

Resident Advisors (an academic or administrative staff) oversees groups of appointed student Resident Assistants (senior students) in each of the Residence at a recommended ratio of 1: 5: 250 students. These members reside and serve to promote the social and community life among the residents.

11 to 15 single rooms are grouped per floor with a common kitchen and bathroom/toilet facilities. Resident Advisor apartments are designed for a small family with 2 to 3 bedrooms.

Common facilities include lounges, reading, study or discussion rooms, gymnasiums, open basketball courts to multi-purpose hall, function rooms and seminar rooms.

❖ Residential Colleges

Residential Colleges offer living and learning options for students, focusing on academic and personal achievement through leadership development and interaction. Students are encouraged to take on active roles in sharing their interests with other students that may relate academically or to sports and culture.

Faculty staff and students are given opportunities to interact more directly within the same residential compound, enhancing the learning experience. Each college houses around 600 students, managed by a College Master and Fellows with a recommended ratio of 1:120 students. Master and Fellow live within the college in family units with 2 to 3 bedrooms. Rooms are a combination of single occupancy on corridors and 6-bedroom apartment units with shared living and bathroom facilities.

Common facilities include a multi-purpose hall, dining hall, which may be shared between two colleges, study and recreational rooms. In addition, there are teaching spaces such as seminar rooms, multi-purpose rooms and supporting office spaces within the college to support academic learning.

5.1.2 Graduate Student Housing

Graduate students are typically more matured, independent and self-directed in their studies and research. As such, they are likely to be more concerned with privacy and individual study spaces.

Studios or 1-bedroom apartments designed for married couples should be self-sufficient with living and study space and a small cooking/pantry facilities with adjoining bathroom.

4-bedroom apartments should have a common living/dining space, pantry and communal toilet/shower. Study space is included in the individual room space.

Supporting common spaces include social lounges, multi-purpose seminar rooms and open spaces such as roof gardens should provide a space for casual interactions.

5.1.3 Staff Housing

Staff housing are catered for faculty and administrative staff who hold senior positions or have arranged appointments from aboard. Staff members are likely to reside with their accompanying family members. As such, units are layout in an apartment style living with self-contained facilities such as living, dining, kitchen, bedrooms and adjoining toilets in each unit.

Supporting facilities, such as security, recreational spaces, function rooms, children playgrounds should be included in the compound. Proximity to retail/commercial spaces e.g. convenience and grocery store, pre-school childcare facilities should be considered.

5.2 Housing Facilities

When planning for residential housing, one should consider creating personal and interactive spaces. Each residential block should be fitted with the basic amenities with convenient access to common facilities.

5.2.1 Lobby

Visibility and accessibility to visitors is most important. Proximity to vehicular drop-off would be helpful to new arriving students with luggage. Covered drop off points and bicycle parking should be considered at entrances. Provision of bus bays is also recommended. Barrier free accessibility should be considered with ease of luggage transportation.

5.2.2 Main Reception

Location of the front desk for the maintenance/operation office should be easy to find and in view at the lobby. There should be waiting areas to accommodate peak admission crowds. One option is to locate the community lounge in proximity to the office, the lounge can then be used as an alternate more comfortable waiting area for visitors when needed. There should be writable surfaces, magazine racks and notice boards at waiting/lounge area. There should be clear way-finding signage and directional map to orientate a new visitor. Wifi provision should be provided at all common areas.

5.2.3 Maintenance/Operation/Master's Office

Requirements are similar to a regular administrative office. However, additional consideration is needed for locating the key press, medical supply aid and centralized monitoring systems (e.g. BMS, CCTV, fire safety panel, digital card/lock programming PCs and hardware etc.) The office should be at proximity to the mail room with space within the office to sort mails and parcel articles for the residents. Fire alarm panel should be located where convenient to the first respondent.

Locate a sick bay and possibly an isolation room that can be shared between adjacent residential halls/colleges. Rooms should preferably be located on ground floor with wheelchair accessibility consideration.

Isolation room should be fitted with toilet/shower facilities and adjacent to the pantry to minimise cross infection cases. Rooms should have air-conditioning with network and phone access to allow students to continue their studies and remain contactable while being quarantined.

5.2.4 Main Lounge

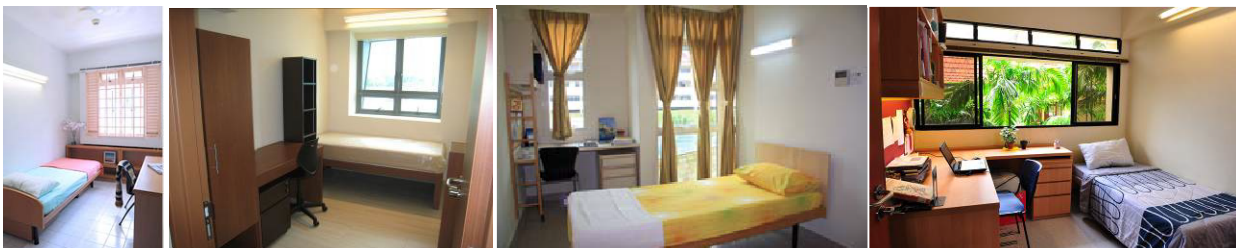
The main lounge consists of a common space accommodating 80 to 100 persons. Main lounges should be located next to entrances to allow mass check in and out exercises. Provide writable surfaces, magazine/book racks, notice boards, TV/projector screens and sufficient Wifi and data points strategically located for check in stations and payment devices. The lounge should allow for possible conversion to a seminar room when required.

5.2.5 Residential Space

Rooms are categorised by room types according to the internal layout and occupancy. Universal design should be considered with some handicap friendly rooms located on ground floors.

Each room is fitted out with:

- A single size bed or beds depending on occupancy.
- Writing table of minimum 1.5m length with mobile pedestal and bookshelf.
- Wardrobe with sufficient storage for clothes and luggage.
- Task chair on castors.
- Pin up board / writable surface.
- Consider location of personal shoe rack.
- Provision of roller blinds.
- Ceiling fan (for non air-conditioned and air-conditioned units).
- Air-condition rooms with individual metering (pay as you use meters).
- Provide separate meters for each building/floor for active management of electrical consumption.
- Provide ventilation louvers when rooms are closed during vacation.
- Power and data points at desk with central Wifi provision.



5.2.6 Basic Amenities

Each residential floor or block should include:

❖ Kitchen / pantry equipped with:

- Refrigerator | Hot/cold water dispenser | Microwave oven
- Toaster oven | Hot plates (depending on use)

❖ Common lounge, Study room, Computer room, Library

Located on each floor / intermediate floors adjacent to the foyer and are fitted out with:

- Modular soft seating and study tables
- Television | Common access computers | Magazine rack
- Power and data points with central Wifi provision.



❖ Laundry facilities equipped with:

- Washing machines and dryers (coin or card operated) | Ironing facilities
- Sink with drainer | Sheltered drying yard with adequate ventilation.
- Data, Wifi access with telco provision for cash card machines.

❖ Bathroom facilities fitted with:

- Fully tiled shower and toilets located on each floor or adjoining for suites with water heaters.



❖ Common facilities include: *(Common facilities may differ from each residence)*

Dining hall

- Incorporate acoustic treatments with appropriate sound absorption and reverberation control when used as a large space and for formal dinner events.
- Introduce audio-visual systems and lighting controls to suit different events with consideration of viewing angles.
- Design a well-ventilated space with provision for air-condition.
- Separate the dining hall from the servery and kitchen to allow the hall to be used as a study space during exam periods.
- Orientate mechanical exhaust systems away from living spaces to prevent noise and smell contamination.
- Loading bays and bin centres should be easily accessible to the kitchen but discreet.

Multi-purpose rooms / hall

- Allow a central workshop space for building of floats/exhibition panels with accessible delivery access and washing points.

Sports and recreational rooms

- Multipurpose courts | music room | dance studio | gymnasium
- Seminar rooms / function room
- Barbeque facilities | Vending machines

5.2.7 Back of House

There should be consideration for:

❖ Storage rooms:

Luggage store: Locate common stores for luggage and bulky items.

Linen store: Locate a central store for linen. Linen store can be distributed in the Residence if sizable.

Cleaning store: Locate a central store for supplies and materials to be collected from a Cleaner's closet space and distributed in the building to facilitate ease of maintenance.

Activity store: Locate a common store for activity equipment that involve props for sports and recreational, orientation and seminar functions.

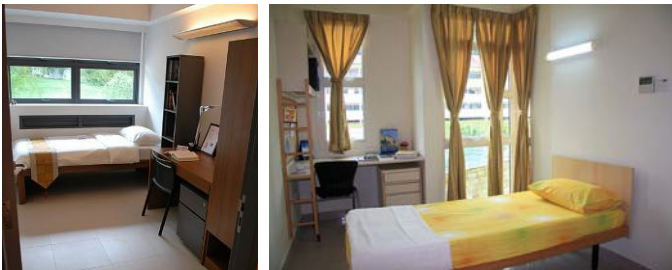
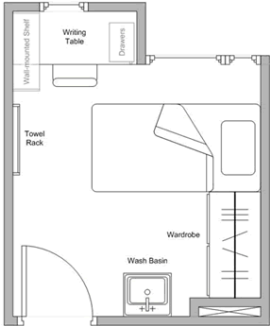
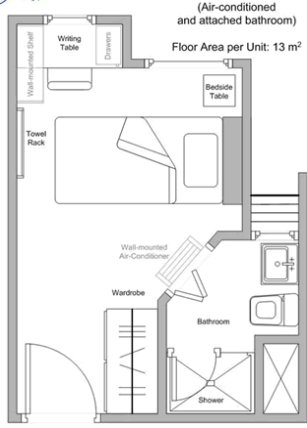
Cleaner's rest: Location discrete rest areas for cleaners to rest and have their meals.

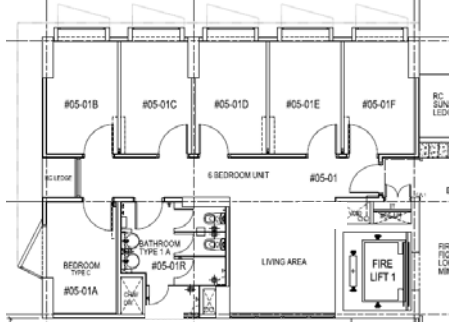
❖ Refuse disposal:

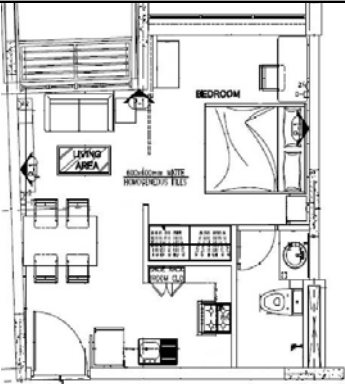
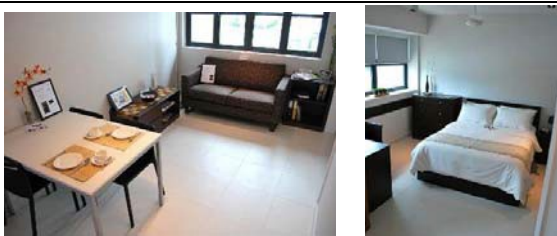
Consider the method of refuse disposal:

- Categorise the different waste types.
- Consider a double chute system to categorise waste and recycling.
- Consider the frequency of waste collection.
- Consider the collection method and its transportation route.
e.g. By garbage bags, chutes, trolley
- Consider its disposal method and location.
e.g. By compactors, bin points

5.3 Room Types and Space Norms

Category	Floor Area (m ²)	Example image / layout
Single occupancy		
Room Type 1	8 m² Width of room should be approximately 2.5m	 Figure 19 Layout plan of a typical Single Occupancy room 
Room Type 1A	9 m²	 Figure 20 Layout plan of a typical Single Occupancy room with wash basin
Room Type 1B	13 m²	 Figure 21 Layout plan of a typical Single Occupancy room with adjoining bathroom

Category	Floor Area (m ²)	Example image / layout
Double occupancy		
Room Type 2	15m ²	 Figure 22 Layout plan of a typical Double Occupancy room 
4 -6 suite occupancy		
Room Type 3	4 person suite 60 m² 6 person suite 90 m²	 Figure 23 Layout plan of a typical 4 Occupancy Suite  Figure 24 Layout plan of a typical 6 Occupancy Suites 

Category	Floor Area (m ²)	Example image / layout
Graduate / Married apartments		
Room Type 4	30 m²	 Figure 25 Layout plan of a typical Graduate / Married apartment 
Guest rooms		
Room Type 5	Typical room	Typical room with adjoining bathroom facilities. The room is fitted out with: - Twin or queen size bed (depending on occupancy) - Wardrobe with safe deposit box - Writing desk - Television, drink console with fridge - Telephone and Internet connection - Bed linen and towels
Master / Fellow / Staff Apartments		
Room Type 6	2 bedroom (~ 85m²) 3 bedroom (~ 100m²)	- Living and Dining space - Pantry / Kitchen space - Laundry / Utility area - Common bathroom - Master bedroom with adjoining bathroom <i>(For a 2 bedroom apartment, there is typically one master and one common bathroom.)</i> - Second bedroom or Study room

5.4 Space Planning

5.4.1 Intent

Residential living on campus provides learning communities to cater for a well-rounded living and learning experience especially for all freshman and overseas students. Residential living on campus should provide comfortable, clean and safe facilities that will meet the needs of the student community.

5.4.2 Design Criteria

❖ **Flexibility:** Provide flexible furniture for easy reconfiguration of room layout.

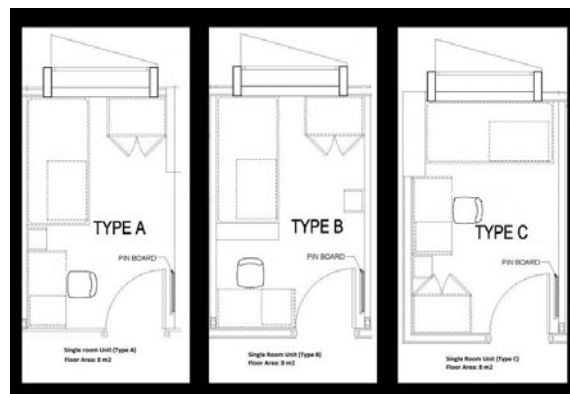
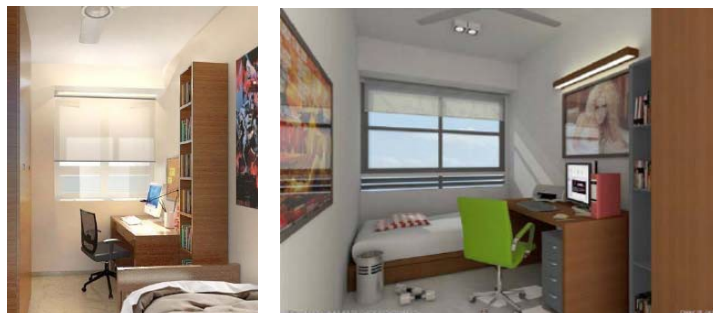


Figure 26 Flexible layout arrangement for rooms.



❖ **Access:** Consider friendly measures to monitor and control access around and within residential living areas with measures to deter break-ins and vandalism.

- Consider shrubs and planters surrounding the compound.
- Design control points to secure spaces, introducing CCTV cameras and card access control to monitor access and deter crime.
- Install grilles or top hung windows to prevent access to low-level residential units while allowing the necessary ventilation.
- Plan delivery access with provision of adequate space for larger vehicles.
- Consider emergency routes. Location of fire protection system requires design integration with the building infrastructure.

- Avoid features such as trash bins or mailboxes that can hide devices in non-secured areas.
- Provide security lightings at strategic locations like pathways, alleys, etc.
- Consider space for security posts (if needed).

❖ **Floor:** Install durable materials such as vinyl or tiles.

❖ **Wall:** Install durable finishes that are easy to maintain.

- Install double layer partitions, slab to slab for spaces that require acoustic considerations.
- Install day blinds to cut down potential glare.

❖ **Ceiling:** Install ceiling tiles. Plaster ceilings may be considered for lounges. Consider ceiling profiles that allow easy accessibility to facilitate maintenance.

❖ **Lighting:** Install evenly energy efficient fixtures (e.g. T5 with high frequency ballasts or LED lights). Consider overhead direct or indirect lighting that can effectively illuminate the room. Maximise natural lighting where possible.

❖ **Visibility:** For common areas, install glass panels to create an open and welcoming space. Visibility will help in overall security of the space. For individual rooms, install peepholes on doors.

❖ **M&E:** Provide **2 twin power + 1 data points** at desk with **1 single power** for miscellaneous housekeeping within a room. Power points in rooms should allow for flexible furniture arrangement.
Provide wireless internet access at all areas.

❖ **Sustainability:** To implement:

- Provide strategic recycling areas on each floor.
- Common pantries and print areas should be equipped with recycling of paper, plastics and aluminium cans.
- Install energy efficient lighting.
- Position or orientate rooms to allow as much natural lighting in.
- Design naturally ventilated rooms with fans (where possible).
- Set air-condition temperature at 25 degrees for air-conditioned areas.
- Install convenient bicycle stands to encourage cycling around campus.
- Install WEL fixtures and products, where applicable.

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REVISION TABLE

No.	Version	Date	Revised pages	Description
01	1	June 2009		
02	1.1	January 2010	12, 21, 22, 24	• Change of Space norms for standard cubicles to 5m² • Inclusion of Indoor air quality requirements
03	1.2	January 2011	12	• Change of Space norms for Research Assistant Professor to 12m²
04	2	January 2012	Entire document	• Update general guidelines of entire document • Inclusion of Residential guidelines
05	2.1	April 2014	14, 17, 28, 37, 40, 48 66, 67	• 3.3 Space norms - Academic & Administrative Offices, Conference or Meeting Rooms • 4.1.2 Update to Teaching facilities - Furniture • 4.3.2 Update to Acad & Admin office – Visibility • 4.3.5 Suggested layouts for Cubicle type3 • 4.4.2 Update to Conference & Meeting room – Visibility • 4.6.2 Corridors Design Criteria – corridor widths • Remove Part 6: Planning Approval Policy (former pg 66,67)
06	3	October 2015	Entire document	• Update general guidelines of entire document. • Chapter 1: Inclusion of utilisation methodology • Chapter 2: Inclusion of Active and Global learning rooms guidelines recommended design for seating in LTs • Chapter 3: Updated space norms • Chapter 4: Included 'General' and 'Utilisation' in Design Criteria Updated system furniture height requirements Updated glass frosting guidelines Provide guidelines to meeting rooms provision • Included 4.9: Support spaces • Chapter 5: Minor edits to text based on OHS/OSA comments
07	3.1	Aug 2017	5, 34, 40 32,33	• Removed URL internet links • Updated Laboratory design criteria
08	4	Jun 2018		• 1.3 Summary of Terms • 4.1 Removed sectional views • Chapter 4.2: Laboratories • Updated entire document