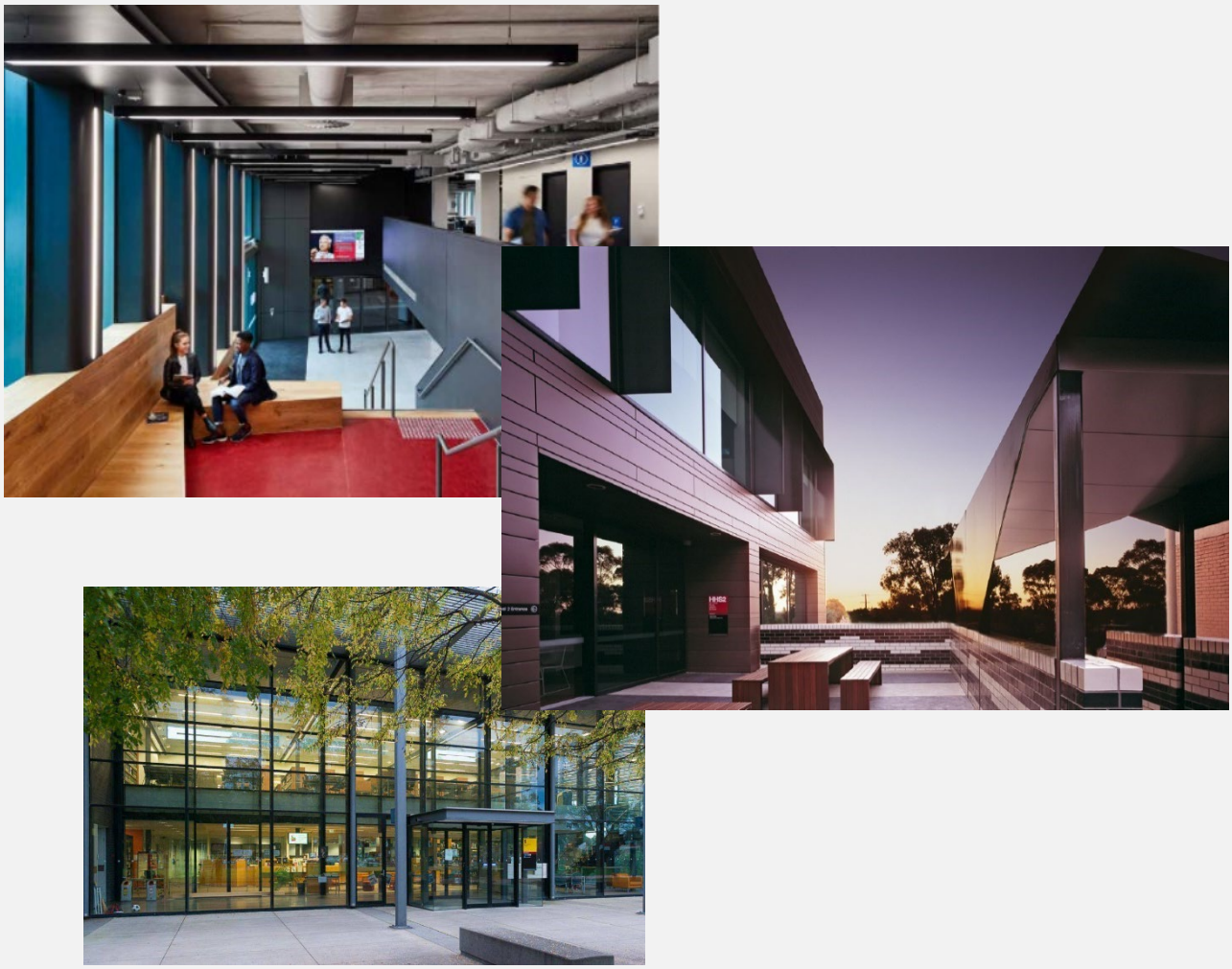
La Trobe University Design Standards

S003/V17.3, Date of Issue: 07 July 2025



Prepared by:

I&O Infrastructure & Operations

ENQUIRIES

I&O Service Desk T: 03 9479 8888

La Trobe University E: ioservicedesk@latrobe.edu.au

Victoria 3086 latrobe.edu.au/io

Welcome

Welcome to the La Trobe University (*LTU*), Infrastructure and Operations *Design Standards*. These standards *are to be* used by *consultants*, *contractors*, *LTU* stakeholders and user groups as they define the minimum standards *LTU* will accept when designing new spaces, refurbished spaces, structures, systems etc which *are to be* incorporated into Infrastructure and Operations *project*s.

The document has undergone a major revision in 2019 with the latest version aiming to be more user friendly, intuitive and definitive in its requirements. It has been divided into 7 sections - Sections 1 and 2 are relatively "generic" in nature, whilst Sections 3-7 are discipline specific.

This document requires review at least every two years (e.g. July 2024, 2026, 2028). This review must be signed off by the Executive Director Asset Transformation (on behalf of the design and construction team), Executive Director Net Zero (on behalf of the operations and maintenance team) and Pro Vice-Chancellor Learning & Teaching (on behalf of the learning and teaching team).

Table 1. Chronology of revisions

Section No.	Name	Outline
Section 1	Administration	Outlines the basic administration processes associated with the document contextualising it within the Infrastructure and Operations structure.
Section 2	General Items	Elements that are relative to all *campuses* e.g. high-level conceptual elements (Masterplans, Overlays) to functional elements (OH&S, & Sustainability.
Section 3	Structure/Civil	Structural elements including: • Loadings • Footings • Slabs • Columns etc; and • Associated materials
Section 4	Architectural	Architectural elements including: • External envelope • Internal fit out • Finishes & fixtures • Room types & associated functionality
Section 5	Services Engineers	Elements that are commonly associated with services infrastructure including • Mechanical • Electrical • BMCS • Security • Acoustic and vibration • Fire • Hydraulics • Lifts • Service tunnels and plant rooms
Section 6	Information Services / Audio Visual	Elements that are commonly associated with communications including: • Wi-Fi • Audio visual
Section 7	Landscaping	Matters relating to flora, fauna & external spaces.

Contents

Section 1.Administration

1.01 Purpose of The Design Standards

The *Design Standards* codify the application of La Trobe University (*LTU*) practice, procedures, *policy* and experience to all *building* works on several diverse matters, including:

- Architectural and engineering design requirements,
- Occupational Health and Safety (OH&S),
- Access for People with a Disability,
- Sustainability – inclusive of Green Star Communities commitment; and
- Space guidelines for staff.

The *Design Standards* support *LTU policy* documents & the key strategic vision and objectives of the University which are articulated within the current Strategic Plan & Customer Service Charter.

1.01.01. Primary Objectives of The Design Standards

In summary the primary objectives of the *Design Standards* are to:

- Increase the overall efficiency and effectiveness of the *Project* design, documentation, delivery process & design outputs to the advantage of *LTU* by standardising (where possible) key design elements that meet *LTU*'s operational requirements.
- Assist *LTU* to provide teaching, learning, research, administration and services that deliver on *LTU* objectives and policies while managing the cost of operating and maintaining facilities within acceptable limits. Each facility, whether new or refurbished should be developed to maximise long term benefit and sustainability of the university and in accord with the principles embodied in these *Design Standards*.
- Ensure that *LTU* preserves and utilises its corporate knowledge in relation to the delivery and management of its facilities.

Consideration should be given to:

- Variability and difference of people's backgrounds, capacities and physical abilities, differences in cultural interpretation of space and behaviour.
- The specific physical contextual qualities and characteristics of the *Project* site on *campuses*.
- The availability, layout and capacity of existing infrastructure services to the sites and adjacent areas.
- The Whole of Life cycle cost of the elements & equipment being delivered via the *Project*

The *Design Standards* are required to be read as a whole, understood & adhered to by all *Consultants* across all disciplines.

The *Design Standards* will apply to all new lessee work (new build & refurbishment).

The *Design Standards* will apply to all *LTU Campuses* unless noted otherwise.

The *Design Standards* are issued under the authority of the Executive Director Asset Transformation.

1.02 Revision History

This document is reviewed on an annual basis. A summary of the major revisions can be found in **Appendix 1**.

1.03 Glossary

Key terms, phrases and acronyms are used throughout this document. These have been written in *Italics* and are defined in a table in **Appendix 2**.

1.04 Reference Documents

The *Design Standards* utilise several key *reference documents*. The items listed in **Appendix 3** are *reference documents* **managed by La Trobe University**. These documents are hyperlinked and are in blue underlined text.

The items listed in **Appendix 4** are key *reference documents* that are **managed by external partners**. These documents are in grey text. *Consultants* and *contractors* are to utilise the most current version of each document.

1.05 Required Codes and Standard

The most stringent application of current Codes and Standards must be observed in complying with all safety matters in the University. Designated matters include but are not limited to the following:

- Egress, emergency lighting and exit signs
- Glass safety
- Fall safety
- Fire suppression systems
- Systems to store or reticulate toxic, flammable or smothering gasses
- Storage or reticulation of *hazardous materials*
- Compliance with Earthquake provisions of the Structural Code. *LTU* structures are designated Level 3 under AS1170.4 (2007) unless a higher rating is mandated by the Standard or *Brief*.

All Codes and Standards referred to and used *are to be* the current versions.

All parties will comply fully with current versions of all relevant Australian Standards and Codes.

Compliance for life safety matters will be to current codes and standards unless:

- In the opinion of the *Certifier*, the provisions in the design or the existing *building* provide an equivalent or adequate level of life safety.
- If an existing *building*, subject to review by the *Certifier*, the *building* did correctly comply with current life safety codes and standards within the previous seven years prior to the *Project*.

1.06 Guiding Principles and Criteria

Development of *LTU* infrastructure requires solutions that are:

- Fit for purpose,
- Promote quality design,
- Have appropriate flexibility, durability, maintainability and sustainability,
- Maintain long term goals; and
- Reduce recurrent costs, within *Project*s budgets.

1.06.01. Principles of The Design Standards

The *Design Standards* will avoid where possible the specification of single-select items and in all cases, *Consultant* documents will comply with *LTU's* Procurement *Policy*.

The *Design Standards* are to preserve contestability in the procurement of goods and services.

The exception will be where the University has selected a product which:

- demonstrably performs at minimum to University standards and provides a clear advantage to the University; or
- where its provision is so essential to the operation of systems, functions and infrastructure that to alter such a single-select item would be detrimental to the University.

The *Design Standards* will only go beyond the technical requirements of existing regulations, codes and standards where it can be demonstrated that applying a higher standard will

- yield life-cycle economies,
- contribute positively to a triple-bottom line assessment or
- advantage the University in some other measurable way, including the achievement of *Master Plan* objectives.

- support sustainability improvement or innovations in the built environment (e.g. prototyping or testing new methods, products or processes).

1.06.02. Guiding Principles for Design of New Work

- Minimise maintenance and maintenance processes of *building*, site and grounds maintenance as part of a total life cycle model of development.
- Build in flexibility for reuse, functional adaptation of space and the options for future extensions.
- Advance environmental sustainability and minimising long-term carbon impact and footprint.
- Optimise efficiency, functionality and usability and interaction of internal and external spaces.
- Deliver *project*s on budget and on time.
- In accord with *LTU* objectives of *Teaching and Learning*, and knowledge creation and its dissemination through innovative pedagogies, design of new and reconfigured learning environments should consider:
- Adaptability to a range of *pedagogies* - from *didactic* to active and on-line learning styles and technologies.
- Agile physical learning environments, furnished, equipped and designed to facilitate easy and timely adaptation rearrangement for different purposes.
- A response to faculty disciplinary, interdisciplinary and transdisciplinary requirements;
- Socially activated, enhancing and supporting informal and collaborative learning and research.
- Interrelationships and adjacencies among and between academic, ancillary, incidental and service spaces;
- Strategic use of enabling technologies.
- A balance of dedicated, specialised and multipurpose spaces; and
- Innovation in teaching, learning and research culture.

1.07 Compliance with The *Design Standards*

As per the *Consultant's Agreement* and standard *LTU* contracts, it is the responsibility of all *Consultants* (or if no *Consultant* is engaged, the *UPR*) to ensure that the intent and requirements of the *Design Standards* are implemented in documents and in instructions to *Contractors*.

When a *Consultant* is engaged, the version on the *Design Standards* displayed at that date on the *I&O* web page will be the *Design Standards* that are applicable to the *Project*. If amendments or revisions are made throughout the course of the *Project's* life, the *Consultant* is to review the amendments and advise the *University Project Representative (UPR)* what is required to accommodate the amendments. The *UPR* is to review and advise which amendments *are to be* incorporated into the *Project*.

1.07.01. Potential Departure from *Design Standards*

There may be times where the *Consultant* considers there is a potential:

- conflict or error within the *Design Standards*, or
- uncertainty in the application of the *Design Standards*, or
- conflict between the *Design Standards* and *reference documents*, standards and/or regulations outside the *Design Standards*, or
- alternative that may be required.

As per the *Consultant*'s *Agreement*, if there is a potential departure from the *Design Standards,* the *Consultant* is to follow the process outlined in that document.

The *Consultants* are not to assume that any deviations from the *Design Standards* will be supported and are to factor time taken to consider applications and contingencies in their design for when the deviations are not supported in their *project* programs.

I&O use the tabulated deviations when undertaking the annual reviews of the *Design Standards* to determine if any of the clauses require amending. This might be because a particular requirement is not being able to be regularly met or a more efficient/cost effective piece of equipment being specified by several *consultants*.

1.08 6 Star Green Star Communities Accreditation Overview

Green Star Communities accreditation aims to transform the built environment by encouraging practices that:

- Reduce the impact of climate change.
- Enhance the health and quality of life of inhabitants and the sustainability of the built environment.
- Restore and protect the planet's biodiversity and ecosystems.
- Ensure the ongoing optimum operational performance of *building*s.
- Contribute to market transformation and a sustainable economy.

LTU is a member of the Green Building Council of Australia. In December 2017 the Melbourne *Campus* in Bundoora achieved a 6-star Green Star Communities v1.1 rating setting minimum standards across a range of design and operational elements. For *LTU* to meet our ongoing commitments associated with the accreditation, *Consultants* must be aware of the credits available and how to implement them through the design or built form process for each *project*.

Further details regarding Green Star Communities can be found on the Green Building Council of Australia website.

Section 2. General Items

2.01 The University

La Trobe University is a public university and commenced operation in 1967 at the Bundoora *Campus*. It falls under the La Trobe University Act 2009 and now comprises owned and leased land and *buildings* throughout Victoria. These include *campuses* at:

- Melbourne (Bundoora),
- City *Campus* (Melbourne City Centre),
- Bouverie Centre,
- Bendigo,
- Albury-Wodonga,
- Shepparton,
- Mildura
- Sydney

*Building*s in Bundoora re typically forty to fifty years old, Bendigo typically thirty to forty years old. Albury-Wodonga *campus* was built in the 1990's, and Shepparton in 2013. The University also owns or leases various other property assets in Melbourne and through Victoria.

Image 1. David Myers *Building*, Melbourne (Bundoora)

Image 2. Albury Wodonga *Building*s

Melbourne (Bundoora) *Campus*

Melbourne (Bundoora) is the largest *Campus* and radiates out from the "Agora", a busy eating and retail core. Formal and bush *landscapes* permeate between the *building*s to the outer car parks, flowing into tracts of urban bushland. The *Campus* has a high temperature hot water system within a tunnel structure, linked to a co-generation facility, which, together with a natural gas supply, are utilised in heating, cooling, power and hot water supply. The moat and lake system at Bundoora receive rainwater catchment from the entire *Campus*, discharging into the Darebin Creek.

City *Campus*

The City *Campus* comprises levels 2 & 3 in 360 Collins St, Melbourne. The location provides work spaces for staff, meeting rooms and teaching spaces for a range of courses.

Regional *Campuses*

Bendigo is the largest of the regional *campuses*, including extensive residential facilities, on an undulating site.

Albury-Wodonga is next largest and together with Mildura; include research facilities serving the local regions.

Shepparton *Campus* comprises primarily of a contemporary *building* whilst

Mildura has several small *building*s through the town in addition to the main *Campus* at Benetook Ave.

Most *campuses* have extensive bushland environments interspersed throughout the various types of precincts.

Sydney *Campus*

The University leased space in the heart of Sydney's Central business district overlooking Hyde Park. These *Design Standards* **ARE NOT** applicable to the Sydney *Campus*.

2.02 Visions and Masterplans

La Trobe University builds, owns, operates and maintains nearly the majority of its *campus* facilities. It does so on behalf of current and future generations to deliver its mission, which is to:

"…serve the community of Victoria for the purposes of higher education, for the education, economic, social and cultural benefit of Victorians and for wider Australian and international communities." (La Trobe University Act 2009) Sub Heading Topic 2.2.1

To assist in the long-term planning for each *Campus*, *Visions* and *Master Plans* have been or are in the process of being developed.

Consultants and *contractors* are to familiarise themselves with the relevant documents to ensure that the design of the *project* and end product align with relative *campus* vision and associated *Master Plan*.

2.02.01. University City of The Future

In 2018, La Trobe University announced plans to transform its 235-hectare *campus* in Bundoora into a University City of the Future. This transformation will take place with a multi-stage development across sport, innovation, education, commercial and residential precincts. It will create a vibrant city where people, place, and culture converge, and lives are transformed. All *projects* for new or existing *building*s will help La Trobe achieve its vision.

2.02.02. Current Visions and Masterplans

The following links will direct the *consultants* and *contractors* to the relative document:

- Melbourne (Bundoora) *Vision* *(*)*
- Melbourne (Bundoora) *Campus* Masterplan
- Bendigo *Campus* vision
- Bendigo *Campus* Masterplan
- Albury-Wodonga Masterplan
- Shepparton *campus*

(*) Note – the University is currently updating its Vision which should be released in 2025. This will trigger a revision update to this document when complete.

The University is currently a working group member for the Shepparton/Mooroopna framework plan, managed by VPA. The Shepparton *campus* sits within a wider education precinct and the *campus* site is currently being reviewed in the context of the framework plan and how it integrates with other (existing and future) tenants of the precinct.

2.03 Town Planning

LTU is committed to working with local authorities and the local community to ensure that it is a good neighbour, a contributor to the community and will continue to play an important role in the local economies where its *campus*es are located.

LTU will ensure that the capacity of its *campus*es is adequate to provide for existing and future demand for space.

Refurbishments within the *campuses*-built environments generally do not require a Planning Permit.

2.03.01. *Campus* Specific

The *Campus*es at Bendigo, Mildura, Albury-Wodonga and Melbourne (Bundoora) are under planning Zones PUZ2, and as such are not required to obtain Planning Permits or shadow processes are undertaken to demonstrate informally compliance with town planning requirements. In certain instances, however, Planning Permits are sometimes obtained.

Shepparton *Campus* is zoned under Commercial 1 (C1) Zone, where Education is a permitted use. *Consultants* are to confirm Town Planning requirements with the *UPR* for new *building*s or extensions to the existing *building*.

2.04 Overlays

*LTU's campus*es are diverse due to locations, ages, *building* styles & fabrics and climate. Just as some require town planning permits and others do not, some are subject to overlays. *Consultants are to be* mindful of what opportunities and *risks* these overlays present.

LTU adopts the Code on the Ethics of Co-existence in Conserving Significant Places

2.04.01. Heritage Overlays

Heritage Items will be protected in *accordance* with the Victorian Heritage Act 2017, the Burra Charter 2013 or as directed by an *Authority*.

Where *Heritage* items are part of, or will be influenced by the *Project* design, recommendations/reports will be sought from *Consultants* with relevant Heritage expertise. The *UPR* will forward these reports to the *LTU Senior Manager Campus Planning* for confirmation on whether advice or applications to an external *Authority* for decision is required.

The *I&O* Heritage Management Guideline outlines heritage overlays and guides for University sites. This includes a reference to 29 Deakin Ave, Mildura.

2.04.02. The Terraces Melbourne (Bundoora)

A Heritage Plan has previously been approved for the Terraces, which included extensive landscaping around the *buildings*. It appears that the Heritage Plan may have lapsed, so proposed works to the exterior of the *buildings* and the *landscape* ill require a Heritage Permit, even if that element was previously been identified within the Heritage Plan.

This plan had an approved planting list for the area and to our current knowledge this is still enforceable. This list can also be accessed here

2.04.03. Cultural Heritage Management Plans (CHMP)

The Melbourne (Bundoora) *campus* has an overarching Cultural Heritage Management Plan (CHMP) within which can be seen registered Cultural Heritage Places (CHP) in the *campus*. The CHMP falls under the Aboriginal Heritage Act 2006 (Vic).

The CHMP needs to be checked for all proposed structures in the site. The document identifies *campus* CHP's, contains procedures for identifying ranges of 'disturbance' to the CHP's and provides consequent required action for these.

The Sports Park precinct has its own CHMP and can be assessed here.

The Nangak Tamboree precinct (formerly known as The Eco Corridor Precinct) has its own detailed CHMP and can be accessed here.

Proposed new structures to *campus*es other than Melbourne (Bundoora) need to follow the procedure outlined in *I&O's* Aboriginal Heritage Act - Compliance Procedure.

2.04.04. Wildfire

Bendigo *Campus* is under a Wildfire Management Overlay (WMO), which requires permits for developments of new *building*s or structures.

2.04.05. Vegetation

Removal of native vegetation may require a Permit. Removal of native vegetation within the Bundoora *Campus* requires a permit through Darebin City Council which may take some time to achieve approval. This needs to be factored into the *project's* Program.

Matted Flax Lilly - The *campus* contains species that are protected under the federal Environmental Protection and Biodiversity Protection (EPBC) Act. Environmental assessments will need to be undertaken and the presence of native vegetation and protected species identified. Standard vegetarian removal permit application processes can take two to six months. Management plans to deal with EPBC protected species may take up to two years.

2.04.06. Flooding

Designs are required to prevent flooding at floor level in a 1:100 year event (the 1% Annual Exceedance Probability (AEP)), including balconies and internal courtyards. Overland flow paths will be provided around *building*s to cope with a 1:100 year event. Ground floor *building* levels will be at least 300 mm above the calculated flood level ("freeboard") for a 1:100 year event. Designs are to adopt a 600 mm freeboard for new *building*s and site infrastructure, such as roads, within an identified floodplain.

Rainwater systems and their associated elements *are to be* designed to prevent the ingress of water into the interior of the *building* in a 1:100 year event.

A flood modeling exercise was conducted in 2017 and highlighted zones in the *campus* at *risk* of inundation during high rainfall events. This report can be found here.

2.04.07. Occupational Health and Safety and the Disability Discrimination Act

LTU is committed to promoting a healthy and safe environment and recognises its obligations under the *Occupational Health and Safety Act 2004* and *Occupational Health and Safety Regulations*. All *Consultants* must work to assist *LTU* to comply with the provisions of the Act.

New work on *campus* is to comply with the current revision of the Building Code of Australia (*BCA*) and Disability (Access to Premises — Buildings) Standards.

If necessary to discharge its responsibility to meet the current revision of the Disability Standards for Education, *LTU* may insist on higher standards through the *project brief* than set out in Disability (Access to Premises — Buildings) Standards.

All *Consultants*, *Contractors* and sub-*Contractors* will use best professional endeavours in order to ensure that their employees, agents and sub*contractors* comply at all times with *LTU*'s OHS policies and procedures. Refer *LTU Policy* Library (Health and Safety).

All *Consultants* and *Contractors* are to ensure that their works comply with the above to ensure that *LTU* comply with the *relevant Acts*/Standards/Policies.

Existing routes leading to an upgraded portion of an existing *building* will be brought into compliance with the current revision of the Disability (Access to Premises — *Buildings*) Standards as required by the *Building* Surveyor connected with the *Project* and incorporates into the design and *project* budget.

Temporary access during construction works is to comply with Disability (Access to Premises — *Buildings*) Standards. These works *are to be* incorporated into the *project* documentation and *project* budget.

Primary Routes and other access routes on *campus* favour Walkways over Ramps as defined in AS 1428.1. Design for Access and Mobility. Part 1: General Requirements for new *Building* Work.

In *Teaching and Learning* spaces, where there is no guidance in the *BCA*, at least 2 percent of space in any of these room types will be suitable for people using wheelchairs.

Teaching spaces for 30 or more students will be provided with hearing loops and loop amplifiers or IR Technology, suitable signage and front-end equipment. The technology to be used will depend on the nature of the space and is to be confirmed with Information Services.

Hearing augmentation will be provided to Meeting Rooms with a hearing loop, loop amplifier and front-end input for over 25 people unless other assistive devices are available. Meeting rooms used for public assembly, Council or Council Committee functions will have hearing loops, loop amplifiers and front-end inputs complying with *BCA* and AS 1428.1 requirements with appropriate *AV* to ensure that all people in the room can hear and all those entitled to can speak.

Main entrances to *buildings* will be provided with automatic doors, preferably bi-parting sliding doors.

Lift Access *is to be* provided to all *buildings* above one level, either with a lift within the *building*, or, at Melbourne (Bundoora), via the concourse walkway. Where lifts are provided in the *Building*, they should be accessible to and useable by disabled persons including those in wheelchairs, both at entrance level and all other levels normally used by the public.

Reception counters *are to be* no more than 1100 *AFL* and will have facilities for wheelchair usage for the public in accordance with Australian Standards.

2.04.08. Emergency Vehicle Access

Access for emergency and service vehicles is required in accordance with the relevant *Campus Master Plan*. Access will be in accordance with all relevant Authorities.

2.04.09. Asbestos, Hazardous Materials and Dangerous Goods

Consultants are to be aware that sites might contain h*azardous materials* and *Dangerous Goods* and allow in design, demolition and construction for any asbestos, *hazardous materials* or D*angerous Goods* so they do not cause a *hazard* in accordance with current Codes and Standards. (The *UPR* can access on behalf of the *Consultant*, the Division 5 Reports from ARCHIBUS). A visual aid has been provided on all *building*s with green stickers identifying that a *building* may contain *hazardous material*s whilst yellow stickers indicate a known presence of h*azardous material* in the *building*.

Designs are to cater for required storage and handling of materials or facilities that might cause a *hazard*, in a way that minimises exposure and that complies with the requirements of current Standards and Codes and requirements of *LTU*. (The *UPR* can access on behalf of the *Consultant*, a *Building*'s existing *Dangerous Goods* Manifest – G Drive/ Drawings)

No *LTU building* operation or the normal operation of an *LTU* facility is to contaminate the ground, pollute the air or pollute water beyond limits currently approved by the EPA.

Where the use of flammable liquid indoor storage is specified, it will be supplied and installed in accordance with AS 1940 and OH&S *Dangerous Goods* Legislative requirements. Attention is drawn to the provision in AS 1940 with respect to cabinet separation and ventilation, as well as ignition sources requirements.

2.05 Safety in Design

Safety in Design (SiD) is a process defined as the integration of *hazard* identification and *risk* assessment methods early in the design process to eliminate or minimise the *risk* of injury throughout the life of the *building*, including during construction, and during maintenance of the *building*. It encompasses all aspects of design including facilities, hardware systems, products, tooling, materials, energy controls, layout and configuration.

A systems approach to a SiD review should be considered that integrates a *risk* management process in each of the design phases, and encourages collaboration between client, designer and *Contractor*.

SiD reviews should include the identification and elimination or mitigation of design related *risk*s throughout the life of the *Project* including construction, operation and maintenance. A *Risk* Register may be used to identify the *risk* level associated with the identified design-related *hazard* prior to the inclusion of any mitigation controls, as well as any residual *risk*s that exist after the inclusion of any additional design control measures.

The purpose of *Safety in Design* Review is to:

- Ensure appropriate management of OHS design issues throughout the design process, to eliminate or, if this is not reasonably practicable, minimise *risk*s to health and safety throughout the life of the *building*/structure being designed.
- Control *hazards* and *risk*s with the range of work activities associated with the intended use of the *building*/structure as a workplace, any maintenance, repair, service and cleaning activities as well as the construction of the *building*.

2.05.01. Requirements

Consultants are to undertake a *Safety in Design* Review for *Projects* to meet the requirements of Victorian Law and to ensure that potential *hazards* in construction and operation are systematically reviewed in a written document. Key information about identified *hazards* and action taken or required to control *risks* should be recorded and transferred from the design phase to those involved in later stages of the lifecycle.

Communicating this information to other duty holders will make them aware of any residual *risks* and minimise the likelihood of safety features incorporated into the design being altered or removed by those engaged in subsequent work on or around the *building* or structure. Participants include *Architects*, designers, *engineers*, stakeholders, builders and users of the *building* or function.

Output from a SiD review will take a systematic approach to identifying *hazard*s, assessing *risk*s and recommending controls relating to the safe design of *buildings* and structures.

Minor works which involve refurbishments such as updates of joinery and finishes and maintenance of areas are not subject to a formal SiD review. The *UPR* will determine whether a *project* is exempt from a formal SiD process based on extent and nature of work. The design team should be aware of the guidelines, and any *hazards* identified in the design of minor works should be controlled and documented as part of the design documentation.

2.05.02. Participants

Participants to be consulted during a SiD review should include:

- Designers of *buildings*, structures and plant (*Architects*, interior designers, *engineers*, industrial designers and *Contractors*)
- People who use the *buildings* as a workplace.
- *If appointed*, people who will be constructing the *building*.
- People who will be maintaining the *building*.
- Relevant university stakeholders (i.e. OHS staff)

2.05.03. Situations Considered in a Safety in Design Review

Hazard identification should take place as early as possible in the concept development and design stages. It is important that the *hazard* identification is systematic and not limited to one- or two-people's experiences of situations. Activities and systems with *hazards* specific to the nature of the structure where the safety of these activities or systems is affected by the design of the structure *are to be* considered. The application of Crime Prevention through Environmental Design (CPTED) principles must be applied.

Risk Assessments undertaken during the design process *are to be* recorded by the design team. These assessments should include identification of *hazard* and crime *risks*:

- Identified *risks* and the action taken by the design team to mitigate the *risks* need to be documented during the design process.
- Identified *risks* related to the construction or maintenance of the *buildings* and facilities
- Management procedures that are required to control the *risks* associated with construction, maintenance or operations of the design.

For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 15.0** – Minimum Requirement Visibility & **Credit 15.1** – Design for Safety.

Building designs will provide safe and economical access for regular maintenance activities, including window cleaning and servicing of mechanical, waste and electrical systems.

2.06 Design for Maintainability

Buildings and *landscape* elements on *campus* should be designed to provide appropriate access and maintainability commensurate with a normal program of maintenance.

The design is to ensure that the cost of maintaining *LTU Campuses* is as low as reasonably achievable. The choice of materials and components *is to be* balanced against other considerations, including appearance and sustainability.

Provide clear access around new *buildings* perimeters to assist with access for the cleaning of the *building*'s external envelope.

All equipment, including mechanical plant and lighting *is to be* accessible from floor level minimising the use of ladders for maintenance activities.

Attention will be given to ease of cleaning of finishes and materials. Public spaces, such breakout spaces and their furniture are particular cases in point.

Building details and finishes *are to be* durable and suitable for use in a university environment. Notwithstanding the need to be creative and innovative in buildings and fit outs, designs need to be cognisant of maintenance and repair issues – extravagant numbers and diversity of materials and finishes is not encouraged from both an operational and sustainability perspective.

In the selection of equipment, systems, components and finishes Australian made products *are to be* given priority with overseas equivalents presented as options for *LTU* to provide a direction on. If the elements can be sourced locally (Northern Employment & Innovation Cluster or from within Victoria) that would be an even better outcome.

2.07 Design for Sustainability

The key objectives of creating a design that focuses on and respects best practice sustainability design principles are:

- To provide *buildings* that support and enhance the health, wellbeing and productivity of occupants through high indoor environment quality
- To provide facilities that enable *building* occupants to act sustainably.

A high-quality indoor environment will be provided through appropriate consideration of:

- Indoor environment quality
- Indoor air quality will consider:
- Ventilation supply – rates, control, distribution.
- Mould management – including control of humidity and access for cleaning of air supply and distribution systems.
- Indoor visual quality will consider:
- Daylight
- Glare control using shading and/or blinds
- External views
- High frequency ballasts
- Thermal Comfort
- *Building* insulation will improve on minimum *BCA* requirements by 20% to be calculated according to ABCB Climatic Region.

2.07.01. Anticipated Outputs and Benefits

The key outputs and benefits of implementing a best practice design include:

- Effective and efficient use of energy and a reduction in the demand for mains electricity and gas.
- Effective and efficient use of water and a reduction in the demand on mains water supply.
- Effective and efficient use of materials through intelligent design
- Effectively monitor and manage utility consumption and greenhouse gas emissions.
- To minimise general land fill waste and maximise recycling opportunities throughout construction due to intelligent design that considers material selection and construction methodology
- To respect and protect the ecological value of the local environment.
- The opportunity to trial, test and/or experience initiatives using new methods, processes or products, with regards to sustainability and the built environment.

For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 19.3** – Industry Capacity Development

It is anticipated that to successfully achieve the above, *Consultants* and *Contractors* will incorporate at minimum the following:

- Design activities and outputs that comply with *LTU's* Environmental Sustainability *Policy.*
- Mechanical and lighting systems designed to minimise energy consumption regardless of whether spaces are occupied or vacant e.g. zoned design systems.
- Water use from the mains *is to be* reduced as much as practicable through the appropriate design.
- Water harvesting from *buildings* and storage within tanks in locations approved by the *UPR*, is encouraged. Rain water *is to be* reused where possible, with appropriate systems, for toilet flushing, landscaping and other uses approved by the *UPR*.

- Utility usage *is to be* monitored to enable effective management through appropriate design.

Refer also to the Sustainability Plan for further information regarding goals and minimum requirements.

*Project*s are to respect and protect the ecological value of the local environment through appropriate consideration of the following:

- Stormwater quantity and quality – Use Water Sensitive Urban Design approaches.
- Flora and fauna on the site – Tree retention and removal requirements
- Retain productive topsoil on the site or within the *campus*.
- Light pollution – Glare and zonal spill *is to be* considered

Designs of *buildings* will employ best practice for solar design, including:

- Facades with substantial glazing should not face east or west if possible, without effective external sun shading, screening or planting.
- Façade materials will have thermal properties to keep excess heat out during summer and insulate effectively in winter.
- Use of insulation and massing of *building* elements to help manage thermal gain and loss.
- Designers will apply the principles of sun angles throughout the day and year to implement best practice passive solar control.
- Roof area & associated roof sub structure designed in such a way to maximise the opportunity to utilise PV cell arrays for the collection of solar power for feeding into the *building* or the grid.
- Where possible, this includes:
- any roof plant should be centralised to ensure PV cell array capacity is maximised and any resulting shade is minimised
- minimise roof penetrations and potential water ingress issues with selection of suitable roof sheeting
- consideration of suitable roof orientation and pitch to maximise solar power generation and rainfall self-cleaning
- facilitation of suitable fall prevention systems and water points
- sufficient walkways to access key roof plant whilst minimising damage to roof fabric and solar panels.

LTU will conserve embodied energy in existing *buildings* and *Consultants* will consider conservation of embodied energy when making decisions to retain or demolish existing fabric.

2.07.02. Materials

The key objectives associated with materials are:

- To use materials that are fit-for-purpose, durable and easy to maintain, and of best environmental practice.
- To consider sustainable purchasing practices during material and equipment selection.

These objectives are likely to be actioned with the inclusion (at minimum) of the following initiatives:

- Review the feasibility of reusing existing structure and fabric.

- There *is to be* a focus substituting materials or products with others that contain less virgin material and more recycled content, increasing the reuse of existing materials, or avoiding through smart design, the use of materials/products with high virgin content where substitutes are not available.
- All engineered timber products (including particleboard, plywood, veneer, medium density fibreboard and decorative overlaid wood panels) to have a level of formaldehyde emissions equal to or less than E1 standard.
- Any PVC used in the *Project is to be* sourced from manufacture and suppliers that comply with the Vinyl Council of Australia's Best Environmental Practice accreditation.
- All paints, sealants and adhesives applied on site will be low in Volatile Organic Compounds and site are to comply with the VOC limits set by Green Building Council of Australia (GBCA).
- Refrigerants will have a low environmental impact.
- Insulation will not use any ozone depleting materials in its manufacture or composition.
- Reduce the Portland cement content of any concrete used by 30% compared to a standard practice reference concrete mix.
- Fabricated structural steelwork *is to be* supplied by a steel fabricator / steel *Contractor* accredited to the Environmental Sustainability Charter of the Australian Steel Institute and the reinforcing steel for the *Project* should be sourced from a steel maker using an energy-reducing process in manufacture, such as Polymer Injection Technology.
- Timber used in the *Project* should be either re-used or certified to FSC International or a PEFC-accredited certification scheme.

2.07.03. Environmental Protection Act

LTU is committed to environmental sustainability and recognises its obligations under the current Environment Protection Act. *LTU* will comply with the provisions of the Act.

2.07.04. 6 Star Green Star Communities

LTU is a member of the GBCA. In December 2017 its Melbourne *Campus* in Bundoora achieved a 6-star Green Star Communities v1.1 rating setting minimum standards across a range of design and operational elements.

Compliance with 6 Star Green Star Communities Accreditation is specific to the Bundoora *Campus* only.

To achieve compliance for each credit, there are certain minimum requirements that need to be adhered to and best practice guidelines which need to be followed.

For a specific list of the *LTU* credits that are applicable to the *Design Standards* and require compliance, refer to the table below.

Table 2. Green Star Communities Credits

HEADING	CATEGORY / CREDIT	CODE	CREDIT CRITERIA
Liveability	Healthy and Active Living	9.0	Minimum Requirement - Footpaths
Liveability	Healthy and Active Living	9.1	Active Lifestyle
Liveability	Sustainable Buildings	11.1	Certified Non-Residential Buildings
Liveability	Safe Places	15.0	Minimum Requirement - Visibility
Liveability	Safe Places	15.1	Design for Safety
Economic Prosperity	Education and Skills Development	19.3	Industry Capacity Development
Economic Prosperity	Digital Infrastructure	22.1	High-speed Broadband
Economic Prosperity	Digital Infrastructure	22.2	Wireless Local Area Network
Environment	Integrated Water Cycle	24A.1	Stormwater – Performance Pathway
Environment	Integrated Water Cycle	24A.2	Water Sensitive Urban Design – Performance Pathway
Environment	Greenhouse Gas Strategy	25A	Greenhouse Gas Strategy – Performance Pathway
Environment	Waste Management	30.1	Construction and Demolition Waste
Environment	Waste Management	30.2	Operational Waste
Environment	Heat Island Effect	31.1	Heat Island Effect
Environment	Light Pollution	32.1	Light Pollution

Where applicable to design, the requirement has been embedded into these *Design Standards* and/ or referenced back to the Green Star Communities Submission Guidelines. These guidelines should be read in conjunction with other *project* documentation that may provide details of further requirements e.g. *Project Brief*.

When using the *Design Standards* for the Bundoora *Campus* the *Consultant* / *Contractor* must also review the relevant section of the Green Star Communities Submission Guidelines. The table above outlines the specific Green Star Communities Credits which require compliance through the *Design Standards*.

Each new *building* within the Green Star Community may be eligible for pre-approved green star points known as 'crossclaim credits. Therefore, instead of a Green Star Building having to reapply to the GBCA for the applicable credits, GBCA will automatically grant relevant points that have already been obtained under the Community rating.

For a comprehensive list of all available credits under the Green Star Communities accreditation, refer to the Green Star Communities List of Credits

Greenhouse Gas Emissions reduction

The university has sustainability at its core and is committed to achieving carbon neutrality in the shortest possible timeframe. The university has committed to the La Trobe Net Zero program which is specifically designed to achieve carbon neutrality across all *campuses*. The University published the details of its targets for carbon neutrality during 2019. These targets and the core principals of sustainability should be included in all design solutions.

For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 25A** – Greenhouse Gas Strategy

The reduction in emissions is also consistent with the *LTU Environmental Sustainability Policy*.

Heat Island Effect

Reduction in Heat Island Effect through *building* and landscaping elements is achieved by implementing one or a combination of the following:

- Vegetation;
- Green roofs;
- Roofing materials, including shading structures, having the following SRI values:
  - i. For roof pitched <15°: a three-year SRI >64
  - ii. For roof pitched >15°: a three-year SRI >34

Only where three-year SRI for products is not available, use the following:

  - iii. For roof pitched <15°: an initial SRI > 82
  - iv. For roof pitched >15°: an initial SRI > 39
- Unshaded hardscaping elements with a three-year SRI> 34 or an initial SRI >39;
- Hardscaping elements shaded by overhanging vegetation or roof structures;
- Water bodies and/or water courses; and
- Areas directly to the south of vertical *building* elements, including green walls and areas shaded by these elements at the summer solstice.

For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 31.1** – Heat Island Effect.

Environmental Management Plan (EMP)

An Environmental Management Plan (EMP) may be required for *Projects* to meet the requirements of Victorian Law and to ensure that potential environmental *risks* in construction and operation are systematically reviewed and managed. Designs *are to be* undertaken bearing in mind constructability and potential negative impacts on the environment.

Green Star Certification requires *LTU* to have EMPs in place for *projects*. The reporting requirements *are to be* scaled based on *Project* type with the more onerous reporting on Major *Projects* as per the *LTU* templates, for each *project* type (Major *Project* > $2M, Capital *Project* >$300K, <$2M and Minor Works < $300K.

Larger *projects* naturally contain greater *risks* and by their very nature, generally generate a larger amount of waste than the other two types of *projects*. Consideration and mitigation strategies for *risks* are captured in a *Project* Specific *Risk* Management Matrix, with the environmental based items identified within the EMP for completeness.

The Waste Management component of an EMP needs to be in-line with Credit 30.1. For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 30.1** – Construction & Demolition Waste.

Refer also to the *LTU Environmental Sustainability Policy* for waste management requirements.

2.07.05. Certification of *Buildings* (All *Campus*es)

It is *LTU's* ambition to own and occupy *buildings* that demonstrate high environmental performance.

Where a *Project* is delivering a new facility, the new facility will have a minimum 5 Star Green Star Certification (or approved equivalent). Applications can be made to the *ED I&O* by exception where it can be demonstrated that formal Certification may not be required (e.g. a Certification tool may not exist for a particular type of *building*) however this process is by exception.

Where a new *building* is to have environmental certification, an appropriate rating tool will be applied, as approved by the *ED I&O*. The following list includes (but is not limited to) a variety of rating tools commonly used for *building* types that might be found in a University.

Table 3. Accreditation Tools

Rating Tool	Min Rating	General Description	Key Application
GBCA-Design & As Built	5 Stars	Design & As Built assesses the sustainability outcomes from the design and construction of new *building*s or major refurbishments, across nine holistic impact categories.	Applicable to a wide range of common *building* types in design stage and finished.
NABERS-Indoor Environment, Energy and Water tools	5 Stars	Measures and rates the environmental performance of *building*s within Australia, such as hotels, offices and shopping centres	Indoor spaces such as offices, and when completed
NABERS-Waste	4 Stars	Compares the waste generation and recycling performance of an office *building* or tenancy relative to similar premises in the market place.	Offices
LEED	TBD	Helps to utilize sustainability in the design and construction of a *building*.	Laboratories
BREEAM	TBD	Design and construction, and the adoption of green *building* technologies	Laboratories
Nathers (Houses)	7 Stars	Rates the energy efficiency of a home, based on its design	Dwellings
WELL *Building* Standard	TBD (of Gold, Silver and Platinum)	Performance-based system for measuring, certifying, and monitoring attributes of *building*s that impact occupant ***health and wellness***	Office *Buildings*

Where formal certification is required for a *Project*, this information will be captured in the *Project Brief*. *Consultants* for this *Project* would be deemed to have included this process within their fee submissions.

Where a *project* is not subject to a formal Environmental Certification process (e.g. refurbishment of an existing *building* in full or in part), it will be designed, configured, constructed, furnished and operated in ways that align with principles of relevant Environmental rating systems and best practice design principles. In so doing, designers will optimise between excellent environments and carbon impact, avoidance and reduction of materials, and reuse or recycling of energy, water, waste and other environmental resources.

Where formal certification is not being pursued, there may be occasions where a shadow process might be adopted by a *Project* if instructed by the *ED Asset Transformation.* In this case, in lieu of a formal certification process, the *consultants* may be required to undertake a similar certification process without submitting for formal accreditation. However, credits would be documented in a way that demonstrates how, if formally submitted, the credits would be achieved. Such a requirement would be captured in the *Project Brief*. *Consultants* for this *Project* would be deemed to have included this process within their fees.

For Melbourne (Bundoora) *campus*, a 'Credit Interpretation Request' (CIR) may be submitted to the GBCA, or correspondence with the GBCA may be undertaken for response to proposals for meeting Aims of Credits, for acceptance by GBCA.

For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 11.1** – Certified Non - Residential Buildings.

2.07.06. Waste and Recycling Management

Facilities for removal of waste and recycling from *buildings* will need to be provided to align with the *LTU* waste management systems. It is noted that at each of the University *campus*es there are designated collection points for final collection. Refer to the Waste and Recycling Bins System Guidelines. The Environmental Management Plan (EMP) includes a waste management component.

The Waste Management component of an EMP needs to be in-line with Green Star Communities Credit 30, which outlines specific requirements to be met, to reduce the environmental impacts on and off-site related to construction waste activities at the University.

- For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 30.2** – Operational Waste.

Discipline Specific Sections Preamble

This section deals with elements that are predominately covered off by a specific discipline or trade. We trust that the information you are seeking is easy to find and interpret and we look forward to feedback that may enhance the use of this document.

Sections 3-7 (inclusive) identify key design disciplines & the material/ topics they generally cover.

The order of disciplines reflected are as follows:

Table 4. Discipline Specific Sections

Section	Discipline	Covers	
Section 3	Structural/Civil *Engineer*	All matters structural	
Section 4	Architectural (including miscellaneous items)	All matters architectural	
Section 5	Services *Engineer*	Mechanical	Fire
		Electrical	Hydraulics
		BMCS	Lifts
		Security	Service tunnels & plant rooms
		Acoustic and vibration	
Section 6	Communications	Communications	
		Wi-Fi	
		Audio Visual	
Section 7	Landscaping	All matters landscaping	

Sections 3-7 include a sub clause “Performance Requirement” (where applicable) detailing the particular requirements for that clause’s element and its components.

Note: An element is usually described in one location, primarily under the key discipline. For example, a room’s typical layout requirement can be found under the room requirements section. However, for the mechanical requirements for this type of space, the *Consultant* would got to Mechanical section and find the sub heading room type’s where each specific room types mechanical requirements would be identified.

Section 3.Structure/Civil

3.01 Design Loadings

Compliance with the requirements of the *BCA* and its adopted standards will normally provide satisfactory performance for *LTU* purposes providing that a full assessment of the function of the *building* is provided by the *Principal Consultant* to the Structural *Engineer*.

Minimum floor live load for any floor at *LTU* is 5kPa.

- general live load: 4kPa
- partition allowance: 1kPa

Floors *are to be* designed for proposed use, allowing for heavily loaded areas such as compactus and other storage, libraries and machine rooms, and loadings from ceilings. Allowances for *campus* loadings *are to be* as per *Project Brief*.

The Design Team is to ascertain if any provision *is to be* made in the floor design to resist rhythmic loads, such as caused by dancing.

Where allowable vibration in laboratories is low, *Consultants* will confirm vibration criteria and ensure the structure and detailing accommodate all requirements. Refer also the Plant Rooms Section 5.06.06 Plant Rooms for requirements for plant vibration isolation.

Balustrades subject to crowd loadings will be designed and detailed appropriately. Consideration will be given to the mode of failure to ensure that failure at a single point will not result in the failure of the whole balustrade.

3.02 Floor Slab Design

Ensure that floor slabs remain dry and flat enough to meet service requirements.

Slab design should ensure that retrofit services penetrations up to 200 mm diameter core holes are possible without special provisions to reinforce the slab, to ensure *building* longevity. Designs using post-tensioning or pre-tensioned membranes will provide sufficient area for services penetrations between the tendons, and As Built documentation of the slab will be provided to show the location of tendons.

Structural grids and floor-to-floor height will be chosen to ensure that *buildings* can support a diversity of reuse options over the long-term. In general, new *LTU buildings* should have structural grids greater than 9 metres and floor-to-floor heights equal to or greater than 4200 mm. Ceiling heights of new *building* work connecting into existing is to marry in with the existing to enable a smooth transition for use, maintenance and efficiency of design.

3.03 Slabs with Waterproof Membranes

Slabs with accessible membranes will be watertight over the expected lifespan of the membrane with minimum of 25 years.

Inaccessible membranes *are to be* avoided.

Where membranes are inaccessible and necessary, use alternative waterproofing strategies, such as drained cavities or waterproofing admixtures to cement together with post-tensioning. If an inaccessible membrane is unavoidable and approved as an amendment to the *Design Standards*, it will have a minimum guaranteed life of 25 years and a projected life in service equal to the service life of the structure or covering material.

Consequences of membrane failure will be considered in design. Where the failure of a membrane or waterproofing detail will cause serious disruption to operations, an alternative method of waterproofing is required.

3.03.01. Performance Requirements

Vapor barriers will not be used in situations where liquid water may be present.

If liquid water is present, an approved membrane will be employed, or another form of approved waterproofing barrier.

If waterproof, concrete is specified using crystallising materials. The concrete must be post tensioned or other arrangements made to ensure that the concrete does not crack beyond the limits of the crystallising agent. All designs of this nature will be the subject of written certifications by the *Architect* and Structural *Engineer* where used structurally, or by qualified *Consultant* in other circumstances.

3.04 Durability

Ensure that unexposed structure will be serviceable for minimum 50 years without maintenance.

There are circumstances in which the provisions of the *BCA* and adopted standards will not suit the longevity, durability, maintenance, waterproofing or other requirements of *LTU*. In these cases, it will be the duty of the *Principal Consultant* to highlight possible failings to the *UPR* in writing.

3.05 Floor Penetrations

Floor penetrations *are to be* designed in such a way that prevents the transit of liquid, fire or noise between levels.

All floors required to maintain a fire separation will be constructed to the approval of required *Authorities*.

3.05.01. Performance Requirements

Floor penetrations in laboratories will be watertight and not allow the transit of liquids to the floor below should there be a spill in a laboratory or an ancillary space, including stores and corridors.

Any floor penetration required to be watertight will resist water at a head of 100 mm.

All floor penetrations and associated service pipes (particularly in laboratory areas), *are to be* fully sealed with a flexible material. All floor penetrations must include a sleeve.

3.06 Structural Steel

Structural steel members *are to be* appropriately protected against corrosion and fire damage.

Structural steel members internal to *buildings* in locations protected from condensation *are to be* prime painted or better.

Structural steel members exposed to extreme conditions *are to be* hot dip galvanised and painted with tar epoxy or equivalent, depending on the environment to be protected against.

Structural steel members external to *buildings* or in locations where they are not protected from condensation *are to be* hot dip galvanised to at least 450g per sqm.

Other than for purlins and girts which are detailed to allow for eventual replacement, cold rolled members are not be used to provide structures on a *campus* other than for a Class 1 or 10 *building*.

All structural steel *is to be* fire rated or protected as required by all Codes and Authorities.

Section 4.Architectural

4.01 Room Types and Requirements

These standards and guidelines do not preclude the adoption of more innovative and enhanced design responses for specialised pedagogies or where it can be demonstrated that the enhanced design responses improve learning outcomes, whilst being cost effective. Innovation involves change that is positive and improves educational outcomes.

In some specialised cases, spaces may be designed and/or adapted to encourage more experimental *Teaching and Learning*, engaging students and staff in multi-mode, more open ended and less time dependent pedagogies.

All *teaching and learning* spaces in the University must be designed to support the pedagogies to be used within the spaces, have technology that fully supports the pedagogies and that is easy to use. Spaces should be designed to maximise flexibility of use. For more information refer to the Space Allocation and Use *Policy*.

4.01.01. Objectives

Teaching rooms are to support all *LTU pedagogy*, and provide a safe, comfortable, stimulating and functional environment for all occupants.

Teaching spaces will be designed to accommodate approaches that include, but are not limited to:

- *Didactic* (lecturing and formal learning spaces)
- *active learning*,
- collaborative teaching modes
- individual
- social
- virtual
- specialist (including laboratories)
- informal
- flexibility
- indoor and outdoor learning.

Teaching and Learning spaces should be located so that, among related disciplines, the advantages of clustering and proximity, sharing of services, convenient access, timetabling, and other efficiencies are achieved.

Linking teaching spaces physically (built form) or sensory (visually, audibly) with outdoor *landscaped* areas can enhance *Teaching and Learning* ambiance and through clever design, facilitate extension of teaching into outdoor areas as informal learning.

Teaching and Learning spaces that are supporting *LTU* pedagogical innovation will require consultation with academic discipline groups to establish appropriate design responses.

Consistency across *campuses is to be* maintained.

4.01.02. Key Requirements

Flat floor teaching spaces *are to be* quickly and easily reconfigurable for multiple learning modes, even within a particular class, including *didactic*, group work, simulations and *Project* work.

Spaces should provide a practical and perceived sense of ease and stimulation to promote engagement for a variety of pedagogies.

The combined effect of location, shape, materiality, colour and lighting should produce spaces that stimulate learning.

Design responses should explore the adoption of an enlivened and creative palette of colours and finishes.

Teaching rooms may have varying levels of digital and interactive Audio Visual (*AV*) facilities for high-quality student-centered learning, such as a number of switchable screens around the room. *Consultants* are to confirm the level of *AV* to be provided for each teaching space, including liaison with Information Services staff.

Teaching rooms are to have suitable and adaptable lighting and acoustic performance to fully support all *AV* facilities, and to allow all occupants to see and hear at a high standard.

Graduate teaching spaces are to provide for specialist pedagogies, including oral defense, moot spaces, tailored workshop and laboratory and object-oriented learning spaces as required.

4.01.03. Performance Requirements

Didactic spaces *are to be* designed to promote t student audience participation and peer interaction.

For more informal seminar, workshop, group interactive and discursive type settings, design for flexible and adaptable furniture and equipment arrangement.

Where the *pedagogy* requires, rooms will be sized to allow the lecturer to move around while interacting with students when room is at full capacity.

Floor plan and layouts will be designed to maximise eye contact and sight lines between students, staff and visual aids.

Where required, windows are to have blinds to support lighting conditions that enable clear projection.

Breakout space outside/ adjacent to teaching spaces is encouraged. These are considered part of the learning environment for students, making more seamless connections between formal and informal learning. Seating areas, including tables with access to power, informal 'lounge' areas and standing/milling areas should be considered as part of the foyer and similar spaces.

New sloped floor lecture theatres are to have a structural flat floor with framed tiers determined by sight lines and layout.

4.01.04. Specialised Learning Areas

Areas with specialist facilities will receive specialist input from the user departments and any other relevant areas.

Requirements of professional accreditation and relevant *LTU* bodies (such as ethical committees) *are to be* documented and met.

4.01.05. Point of Delivery

Lecturers may deliver classes roaming the room, utilising Wi-Fi and a portable device for presentation of material away from the lectern, or at the lectern. All teaching rooms are to provide for presentation of material from and away from the lectern using a portable device where the *Project Brief* requires it. This could be from the lecturer or students.

Lecterns for the standard teaching rooms will be as per standard models in the Standard Lecterns document. Note lecterns will require power and data, for equipment for the top and in the rack. Refer *Information Services* Digital Workplace Technology Standards for details of racks, power and data requirements. Refer to Room Types described following for positions of lecterns.

Lecture theatres and larger rooms are to have lecterns as per *Project Brief*.

4.02 Flat Floor Teaching Spaces

'Flat Floor Teaching Spaces' includes…

- Collaborative,
- *Didactic*,
- Seminar,
- Studios
- Tutorial rooms

…on a flat floor.

Flat Floor rooms have a variety of uses and have become the general teaching spaces of the University, generally negating rigid name types. There is a transition within the University to Collaborative pedagogies, but other forms, including *Didactic*, with fixed or movable seats (with tablets) may still be required.

Note the term "collaborative" here is used to include other pedagogical descriptions such as "*Active Learning"* and "Enquiry Based Learning" (EBL) that can use rooms set up for group work as described.

4.02.01. Collaborative Learning Spaces

Collaborative spaces provide facilities for group and *project* work involving interaction between students around movable tables, as well as teaching focused on the teacher (including "*didactic*"). The Collaborative rooms *are to be* flexible in layout of furniture and the teacher *is to be* able to move freely around.

The rooms will generally be set up with white boards for each student group and may have *AV* screens for each group. There will be at least one central video display device. The exact nature of the device will be dependent on the size and architecture of the room and *is to be* resolved with *Information Services*. The rooms will be equipped with Wi-Fi adequate to service 'Bring Your Own Devices' (BYOD) for the capacity of the room.

Requirements for Collaborative Teaching Rooms

- Sightlines relate all students to all screens and main Projection image.
- Whiteboards *are to be* provided for each table group, and between the *AV* screens if they are provided. Maximum whiteboard surface should be provided.
- In new *buildings,* include windows to provide a visual connection to spaces beyond the room.
- Include internal glazed panels to provide a visual link to the adjacent internal spaces (e.g. to foyer and entry corridor.
- At least one central video display device. The exact nature of the device will be dependent on the size and architecture of the room and *is to be* resolved with *Information Services*. Note maximum distances from main projected image to furthest viewing position in default layout should be as per Information Services *AV* Standards.
- A whiteboard *is to be* provide for lecturer. To be as large as possible and have unobstructed sight lines for the students.
- Lectern *is to be* near main Projection image.
- Lecturer's chair is to suit height of lectern.
- Room *is to be* carpeted with carpet tiles.
- Wi-Fi structured for Bring Your Own Device (BYOD) *is to be* provided.
- Chairs *are to be* on castors and be swivel.
- Tables *are to be* flip-top and on lockable castors.
- Lighting *is to be* zoned to assist viewing of Projection.

4.02.02. Room Layout and Capacities

Indicative default layouts used for various collaborative *pedagogy* are shown below, which also show the standard table configuration of two movable tables together, referred to as a "cluster".

Long narrow collaborative rooms *are to be* avoided.

Room shapes and sizes will vary, according to existing conditions or shapes designed for new rooms.

Capacity of rooms are dependent on several factors including but not limited to:

- the shape of the room;
- *LTU* Space Standards (e.g. spatial allowance per student per *pedagogy*);
- Location of *AV* screens to walls (if used);
- particular pedagogical requirements, minimum clearances between table units, and tables with other items and walls in the rooms; and
- Compliance with *BCA* egress requirements.

Although movable, default configurations shown below are used for determining room size.

The advertised capacity will be the same as the number of chairs provided for the room.

4.02.03. Minimum Clearances to Tables in Teaching Rooms

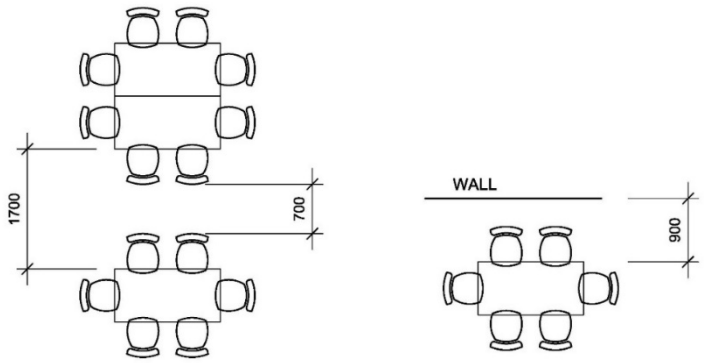


Fig 1. Clearance between chairs and walls

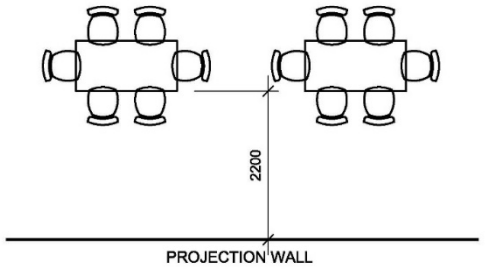


Fig 2. Clearance between table and projection wall

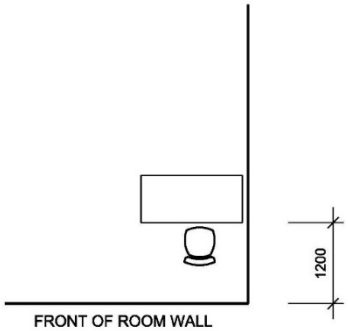


Fig 3. Clearance with long lectern

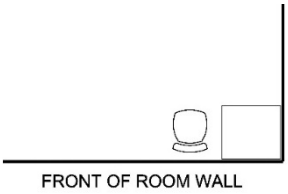


Fig 4. Clearance with small lectern

4.02.04. Room Type A – Collaborative with NO AV to Clusters

The below figures are indicative layouts only illustrating rooms with standard collaborative configurations.

Note Lighting zones for projection shown dashed wb= whiteboard

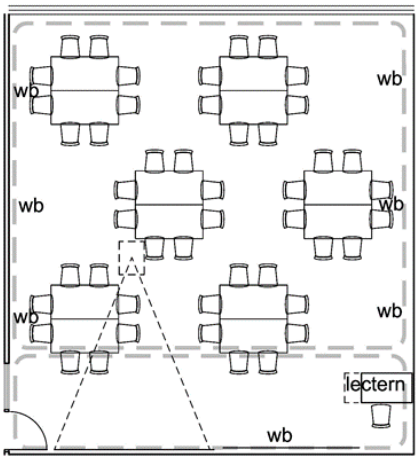


Fig 5. Six clusters per room space standard:

- 1.8 to 2.2 sq. m per student
- Guide size: 10.4 x 9.6 m

The design number of students is 8 per cluster. This room type may have less tables and a lower capacity

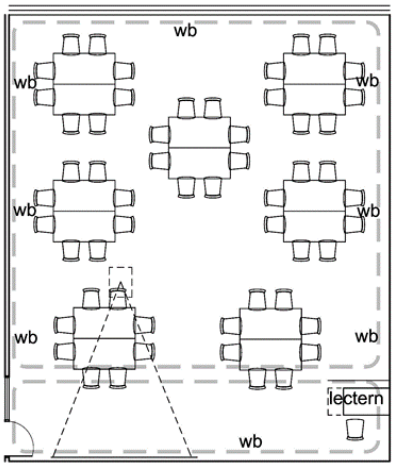


Fig 6. Seven clusters per room space standard:

- 2.0 to 2.3 sq. m per student
- Guide size: 11.6m x 9.9 m

This design number of students is 8 per cluster.

Projection (or central *AV* screens) may be to any wall. Two projectors may be used if required. Tables of 1600 mm x 800 mm are standard for this layout if space permits.

Rooms required to have over seven clusters, whilst subject to principles within *Design Standards*, would be a bespoke design.

Key Facilities

- Projector(s) to screen(s) or wall or large *AV* screen
- Wi-Fi for Bring Your Own Device (BYOD) to be provided. Liaise with Information Services.
- Maximum whiteboards *are to be* applied to walls.
- Lectern (Model A)
- Zoned lighting
- Augmented hearing facilities as required.

4.02.05. Room Type B – Collaborative WITH AV to Clusters

The below figures are indicative layouts for rooms with standard collaborative configurations with *AV* screens per cluster.

Fig 7. Note Lighting zones for projection shown dashed wb= whiteboard

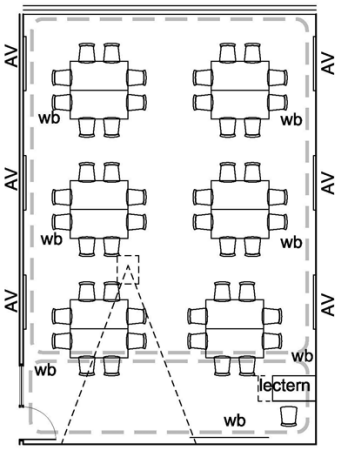


Fig 8. Six clusters per room space standard:

- 1.8 to 2.2 sq. m per student
- Guide size: 11.9 x 8.1m

The design number of students is 8 per cluster. To maximise *campus* utilisation accommodating specialized use of screens and demand for collaborative rooms

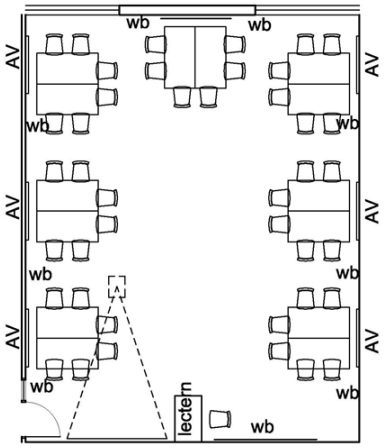


Fig 9. Seven clusters per room space standard:

- 2.2 to 2.5 sq. m per student
- Guide size: 11.1 x 8.7m

The design number of students is 6 per cluster. Room is optimized for use of *AV* screens in groupwork.

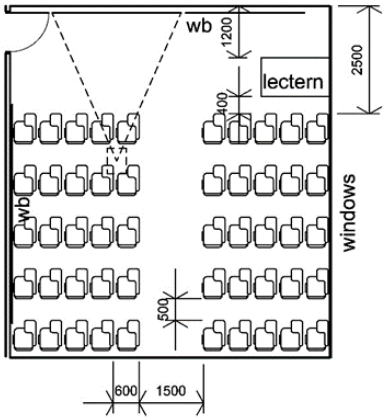
Projection (or front of room *AV* screen) may be omitted where each cluster has an *AV* screen *and* is required in the *Project Brief*. Projection (or central *AV* screens) may be to any wall. Two projectors/screens may be used if required. Tables of 1600 mm x 800 mm are standard for this layout if space permits. The standard *AV* configuration for this Room type includes independent switching of each cluster *AV* screen. Rooms required to have over seven clusters whilst subject to principles within *Design Standards* would be a bespoke design.

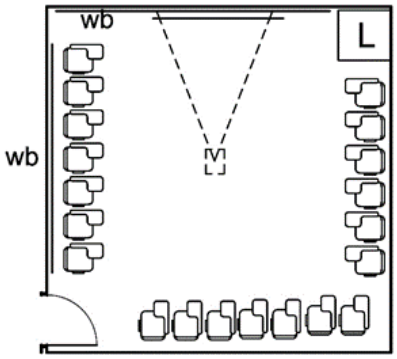
Key Facilities

- Projector(s) to screen(s) or wall or large *AV* screen
- Wi-Fi for Bring Your Own Device (BYOD) to be provided. Liaise with Information Services.
- Maximum whiteboards *are to be* applied to walls.
- Lectern (Model A)
- Zoned lighting
- Augmented hearing facilities as required.

4.02.06. Room Type C – Loose Chairs and Tablets

This mode utilises loose chairs with tablets. The chairs *are to be* on castors. The layouts below are indicative for the two main types. The variation is in capacity in which the smaller has more opportunity for configuration. Note that use of a pull-down screen for projection enables extended use of a white board when screen is up.





- (Example layout only. Configurations in smaller rooms vary considerably

Fig 10. Loose chairs – large rooms

Capacity: nominally greater than 20

Primarily configured for *didactic* teaching with some but minimal interaction between students. Note there are similar configurations within La Trobe with fixed seating. Such seating is unlikely to be assigned to new or refurbished spaces

Space standard: 1.0 – 1.4 sq. m. / student

Guide sizes:

- 25 students – 5.4 m x 2.2 m
- 40 students – 5.4m x 8.4m
- 70 students - 8.5m x 8.8m

Fig 11. Close chairs – small rooms:

Capacity: Nominally 20 or less

Varies from *didactic* teaching to group work as the room is more easily configurable

Space standard:1.5 – 2.0 sq. m. / student

Guide size:

Typically would be up to approx. 35 sq. m (for 20)

Key Facilities:

- Projector to screen or wall
- Whiteboard for lecturer
- Wi-Fi for BYOD
- Lectern (Model A for large rooms, Model C for small rooms)
- Zoned lighting
- Augmented hearing facilities as required.

4.02.07. Room Type D – *Didactic* Narrow Tables

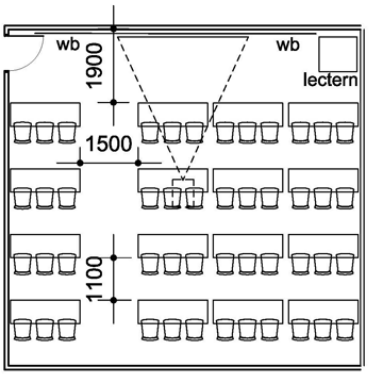


Fig 12. *Didactic* narrow tables

Space standard: 1.2 – 1.8 sq.m. /student

Guide sizes:

- 48 students – 8.7 x 9.1 (1.65 sq.m /student)
- 60 students – 10.4 m x 9.1 m (1.58 sq.m /student

There are many rooms currently with narrow tables (no castors), which are set up for *didactic* teaching. The above figure illustrates a typical room with these tables, although the existing length of the tables varies from room to room and within the room. The size of lectern and facilities within *is to be* confirmed in *Project Brief*. The tables take up more space per student than chairs with tablets. Chairs *are to be* swivel. Tables are nominally 600 mm deep.

Key Facilities

- Projector to screen or wall
- Whiteboard for lecturer
- Wi-Fi for BYOD
- Lectern (Model C)
- Zoned lighting
- Augmented hearing facilities as required

4.02.08. Room Type E – Boardroom Configuration

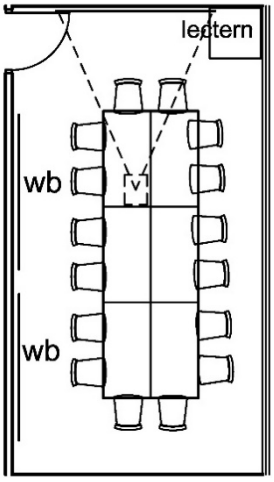


Fig 13. Boardroom Configuration

Used for small groups for tutorials or small learning spaces that involve *didactic* and/or group work. Furniture would be moveable chairs and movable 1500 x 750 flip-top tables.

Key Facilities:

- Projector to screen or wall
- Wi-Fi for BYOD
- Lectern (Model C)
- Zoned lighting if possible for Projection
- Whiteboards

Space Utilisation:

1.6 – 2.0 sq. m. / student

4.03 Lecture Theatres

There are currently two types of Lecture theatre currently used at *LTU*.

Factors to consider for all lecture theatres include:

- Configuration is to provide sufficient access, circulation and clear sight-lines.
- Designs are to provide quality, attractive vibrant environments to support and promote planned activities.
- Provide visual links via glazing is to the outside of the *building* and to the adjacent internal spaces.
- Generous foyer space *is to be* provided for adequate 'break out' space and waiting space that will avoid crush situations.

4.03.01. Interactive Theatres

This style presents as a lecture theatre in the first instance, as it enables the attendees to assemble in small groups during the lecture period. Interactive Lecture theatres have wide tiers with two rows of movable seats that swivel, the front row being able to turn around to interact with the rear row with a shared desk between. Traditional *didactic* teaching is also possible with all students facing the front. Multi directional *AV* screens may be required to cater for all sightlines.

A spatial allowance of 1.7 – 2.0 sq. m. per student should be allowed for new Interactive theatres.

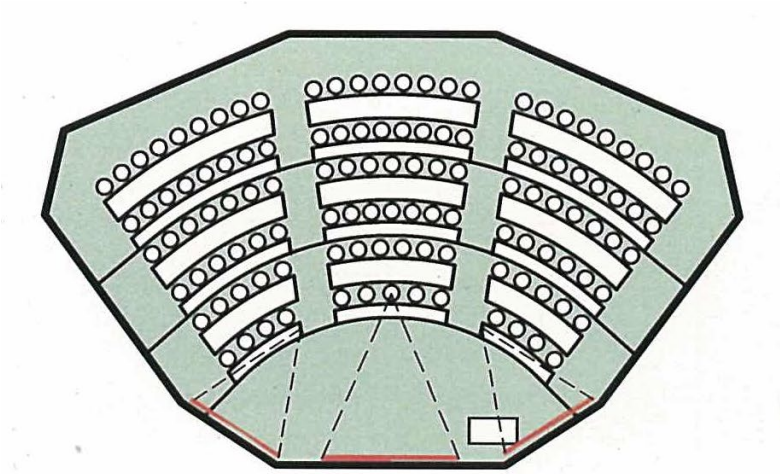
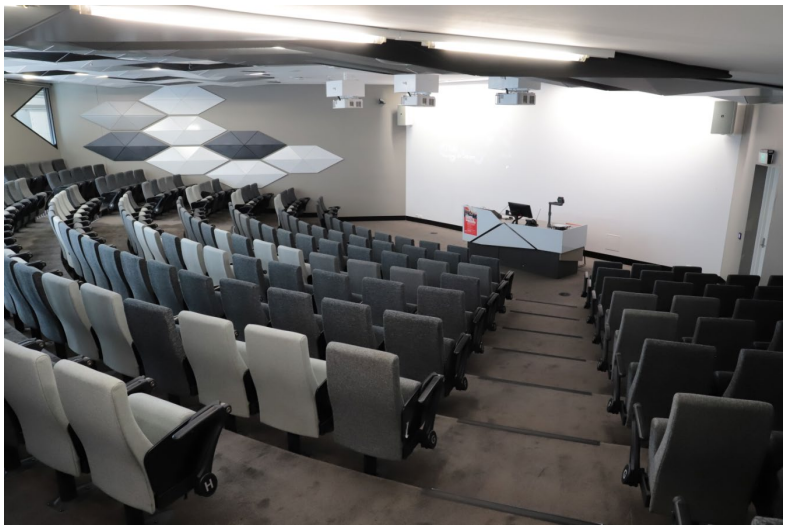


Fig 14. Interactive Theatre



4.03.02. Traditional Lecture Theatres

Typically works with this form would be for refurbishment. A Lecture Theatre is defined as a sloped or tiered floor with fixed seating that has provision for a laptop/notepad. Used for *didactic* teaching.

Factors for prime consideration include:

- Lecturer/student engagement
- Ease of access to seats for students
- Use of *AV* throughout auditorium to enable ease of viewing Projected material. Multiple electronic screens may be provided as necessary for good viewing. Aisles to be to the side to enable prime viewing area at front for seats.
- Spatial allowance of 1.1 to 1.3 sq. m./ student should be allowed for new theatres

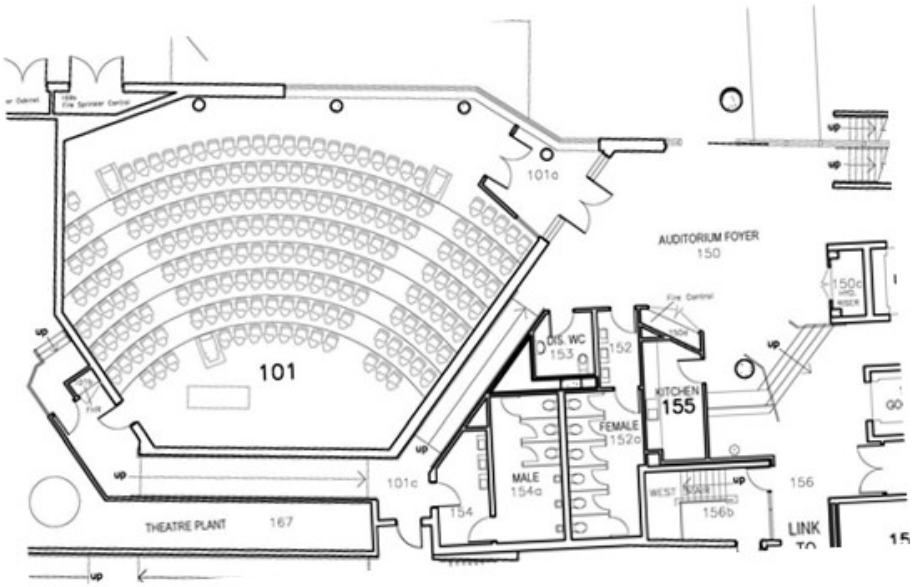


Fig 15. Traditional Lecture Theatre

4.03.03. Other Types of Lecture Theatre

Other types of Lecture Theatre may be considered according to the *Project Brief*.

4.04 Wet and Dry Laboratories

4.04.01. Teaching Laboratories

Teaching laboratories, depending on the disciplines they support, will be either dry or wet spaces. *Consultants* will work to specific *Briefs* based on the functions to be accommodated –

Dry labs include –

- physical sciences,
- computing,
- electronic and
- robotics

Wet Labs include -

- biology,
- chemistry,
- biomedical
- anatomy and
- some engineering and materials science.

All labs will be designed with flexibility in mind to cater for changes in technologies and pedagogues supporting the sciences.

Labs will be designed with links (access/ egress & visual) to *ancillary* spaces in mind - apparatus, observation, preparation and storage spaces.

Penetrations in laboratory *buildings* will be sealed tight or bunded to a height of 100 mm to prevent spilled liquids from transiting to a floor below.

Designs for laboratories are to comply with all applicable legislation, standards and codes of practice, particularly the *safety in design* related aspects.

4.04.02. Dry Teaching Laboratories (Minimum Requirements)

Dry Teaching Laboratories are general purpose spaces for practical *Teaching and Learning* of various sciences, including; Electronics, Mechatronics, Engineering, Computer Engineering, Physics and Robotics. This section does not cover the requirements of Computer "Laboratories" which can be accessed at Section 4.05 Computer Laboratories.

Dry labs generally have no plumbing requirement, but in some cases may require a single plumbed service point for general use, preferably located adjacent to access entry doors.

Dry Lab Capacities: allow 2.8 sq.m per student (unless advised to the contrary in *Project Brief*)

General Requirements for Dry Labs

- Direct adjacency to preparation and apparatus rooms and safe stores.
- Room configuration to suit *pedagogy*, whether *didactic* demonstration or active laboratory problem solving with flexible and adaptable lab table or bench layout.
- Provision of electrical services to island tables and benches *is to be* achieved where possible with shallow ducts on floors and with tapered infills for floor finishes to ducts. Alternately dropper ducts from the ceiling may be used.
- Lab work tables, benches to be of robust and inert material.
- Suitable and adjustable table and bench heights and/or stool and chair heights accessible for disabled staff and students.
- Sufficient storage, shelf space and cupboards for exhibits, samples, tools and partially completed *Projects*.
- Magnetic or glass white boards, pin boards, smart boards as required.

- Projection screens, lecterns or other points of delivery, flexible instruction stations as required.
- Blinds provided to external windows for brown-out as required.
- Accessible, non-combustible, ceiling grid for services.
- Observation window panels viewing in, out and between lab spaces and prep rooms.
- Teaching labs will generally have several *AV* screens (e.g. one per bench run). *Consultants* are to liaise closely with *Information Services* for requirements for these facilities

4.04.03. Wet Teaching Laboratories (Minimum Requirements)

Wet Labs may involve the use of *hazardous material*s and organisms and flammable substances that will require appropriate containment.

Fume cupboards, emergency washing, and other safety equipment may also be required.

Specific Design Requirements for Wet Labs

- Most wet laboratories will require Physical Containment Level 1 PC1 minimum under AS and the Gene Technology Regulator OGTR.
- For more advanced labs the standards for PC2/3/4 may also apply.
- If there is a potential requirement for PC2 or more in the future and if budget permits it is recommended to undertake futureproofing in the design and construction to minimise impact on operations when upgrade is physically required. Elements include:
    - coved vinyl skirtings,
    - sealing of benches,
    - appropriately sized mechanical plant
    - structural elements and other “covered up” areas behind walls in ceilings in the PC1 works so that PC2 works are “superficial” e.g. changing of filters etc.)
- Where required, Wet Labs should be suitable for registration under the OGTR and DAFF such that the faculty/ university can satisfy these regulators.
- Flexible arm fume extraction systems are not recommended.

Lab Layout and Capacities: allow 2.8sq.m per student (confirm in *Project Brief*).

General Requirements for Wet Labs

- Adjacency to apparatus, preparation and safe stores.
- Room configuration to suit layout of lab benches and related ancillary and research work spaces.
- Bench work surfaces to be generally chemically resistant.
- Services combined and aligned vertically for efficient deployment.
- Wet activities as required, including biological and chemical agents.
- General teaching benches to be of chemical resistant laminate, and as approved by User Group. Provide sinks and services outlets according to *Brief*. Generally, there will be sinks with integral drainers of high-grade stainless steel at the end of bench runs. Benches are to have laminate to the underside. Bullnose leading edge.
- Suitable bench heights, with access for disabled staff and students. Adjustable, where possible, *are to be* considered.
- Under and over bench shelving and storage for chemicals, apparatus and equipment.
- Adjustable ergonomic lab stools and chairs with wet and chemical resistant impervious material (e.g. vinyl or rubber).

- Minimum of one single sided fume cupboard per wet lab. The final number and arrangement of fume cupboards will be as per *Project Brief*.

Door entry mats or shoe bath facilities as required by lab PC rating.

- Magnetic or glass white boards, pin boards, smart boards as required.
- Projection screens, lecterns or other points of delivery, flexible equipment stations, as required.
- Blinds provided to external windows for brown-out as required.
- Splash back behind basins.
- Floor finish for industrial wet and corrosion resistance, with integral coving.
- Accessible, non-combustible, sealed ceiling grid for services
- Observation window panels viewing in, out and between lab spaces, prep rooms etc.
- Safety showers are not to have floor grates and waste, but safety eye washes are to have bowl and waste.

4.04.04. Research Laboratories (General Principles)

Research laboratories may be open plan, generic and flexible or highly specialised, contained spaces, depending on the disciplines involved and the nature of the research programs, especially where environmental control, *hazardous material* or security requirements determine.

Consultants will work to specific *Briefs* and in consultation with research directors and laboratory managers concerning the functions to be accommodated.

Produce designs for laboratories that comply with all applicable legislation, standards and codes of practice, particularly the *safety in design* related aspects.

General Lab Requirements

- All labs will be designed with adaptability in mind, to cater for changes in research programs, research teams and research technologies and equipment.
- Labs may require specific adjacent research offices for senior researchers and work station areas for the general team of researchers, post-doctoral fellows, research assistants and research students.
- In some cases, research teams will require wet labs to be associated with more generic knowledge socialisation and innovation spaces.
- The final number and arrangement of fume cupboards will be as per *Project Brief*.
- Labs will be designed in conjunction with apparatus and instrument, preparation and safe storage spaces, cold and freezer rooms, dark rooms and other support facilities.
- According to research programs certain labs may require mutual adjacency and containment for functional research
- Flexible arm fume extraction systems are not recommended.

Research Lab Capacities and Layout (Wet and Dry Labs)

A lab planning grid of 3.3m with a lab module of 90-100 m2 with adjacent lab support modules and work areas will facilitate efficient and effective planning is the typical module for Research Labs for *LTU*. If the *Project Brief* deviates from this module it *is to be* reviewed in close consultation with the University.

General Research Lab Requirements

- Ceiling heights and structures to accommodate flexible areas and accessible services and reticulation.
- For open plan lab layouts, modules should be arranged to maximise functional requirements of particular research groups but also for multi-group sharing of space, services and support facilities.

- Lab benching should also be modularised to fit the *building* grid. Module dimensions of 1800mm or 2400mm long x 700-750mm wide, 900-925mm high, with 900mm high where possible are a base benchmark with bench top appropriate for the research function. Note that *Dangerous Goods* cabinets are sometimes required to go under benches.
- For smaller specialised labs, bench layouts using the basic lab planning module as standard although highly specialised research may require other design solutions.
- Ancillary lab rooms adjacent to main lab space off a ghost corridor or open circulation space linking lab modules.
- Maximum visibility between the laboratory and non-laboratory environment glazed walls or panels.
- Exhaust at each end of open plan lab floors and configuring of air-handling on each open plan floor to allow floor isolation for future lab planning.

4.04.05. Wet Research Laboratories

Wet Labs may involve the use of *hazardous materials* and organisms and flammable substances that will require appropriate containment. Decisions about the level of openness or containment and closure best made in conjunction with research teams.

Fume cupboards, emergency washing, and other safety equipment *are to be* provided.

Specific Design Requirements for Wet Labs

- Where required, Research Wet Labs should be suitable for registration under the OGTR and DAFF such that the faculty/ university can satisfy these regulators.
- Research wet labs will be constructed to be minimum of PC2 ready. This will involve use of coved vinyl floor finish, enabling for air control in the future and sealing of surfaces to benches, including having laminate to underside on bench top.
- If there is a potential requirement for PC3 or more in the future and if budget permits, it is recommended to undertake futureproofing in the design and construction to minimise impact on operations when upgrade is physically required.

General Requirements for Wet Research Labs

- Adjacency to apparatus, preparation and safe stores.
- Room configuration to suit layout of lab benches and related ancillary and research work spaces.
- Services combined and aligned vertically for efficient deployment.
- Wet activities as required, including biological and chemical agents.
- Generally, benches to be of chemical resistant laminate. Provide sinks and services outlets according to *Brief*. Benches are to have laminate to the underside. Bullnose leading edge.
- Suitable bench heights, with access for disabled staff and students.
- Under and over bench shelving and storage for chemicals, apparatus and equipment.
- Adjustable ergonomic lab stools and chairs with wet and chemical resistant impervious materials (e.g. vinyl and rubber).
- Minimum of one single sided fume cupboard per wet lab. The final number and arrangement of fume cupboards will be as per *Project Brief*.
- Door entry mats or shoe bath facilities as required by lab PC rating.
- Magnetic or glass white boards, pin boards, smart boards as required.
- Blinds provided to external windows for brown-out as required.
- Splash back above benches and behind basins.
- Floor finish for industrial wet and corrosion resistance with integral coving.
- Accessible, non-combustible, sealed ceiling grid for services

- Observation window panels viewing in, out and between lab spaces, prep rooms etc.
- Safety showers are not to have floor grates and waste, but safety eye washes are to have bowl and waste

4.04.06. Dry Research Laboratories

Dry Research Labs will generally require:

- Direct adjacency to preparation and apparatus rooms and safe stores.
- Lab configuration to suit the research function, whether fixed laboratory problem solving or a combination of fixed and adaptable lab bench layout.
- Provision of required services mainly power and data sources for computers, 3d printers and a variety of equipment and instruments.
- Lab work tables, benches to be of robust and inert material appropriate to dry but potentially abrasive research.
- Suitable and adjustable table and bench heights and/or stool and chair heights accessible for wheel chair use to be available where possible.
- Sufficient storage, shelf space and cupboards for exhibits, samples, tools and partially completed *Projects*.
- Magnetic or glass white boards, pin boards, smart boards as required and Projection screens.
- Blinds to external windows for brown-out as required.
- Accessible, non-combustible, ceiling grid for services.
- Observation glazed panels viewing in, out and between lab spaces and prep rooms.

4.04.07. LTIBC (La Trobe Institutional Biosafety Committee) & Animal Ethics Committee

LTU is a Gene Technology Regulator accredited organisation and has an Institutional Biosafety Committee (IBC) – the La Trobe Institutional Biosafety Committee (LTIBC). The LTIBC performs quality assurance and helps the University meet requirements for this field of research and monitors internally and externally certified facilities according to relevant legislation.

The *UPR* is to ensure that the LTIBC is contacted at the commencement of a *project* that involves the development of any research facility to determine the Committees level of involvement and what sign offs are required throughout the *Project*s process.

Where facilities are being designed to accommodate research & teaching involving non-human vertebrates & higher order vertebrates *LTU's* Animal Ethics Committee must be contacted and involved throughout the *project*. The Committee will advise the touchpoints where approvals and inspections must be undertaken.

4.05 Computer Laboratories

*Consultant*s and designers are to liaise closely with *Information Services* to establish detail of all equipment for fixed joinery, tables and other facilities.

4.05.01. Computer Labs and Collaborative Teaching Facilities with Computers

Layouts of computer labs generally need to afford the teacher easy and comprehensive view of the screens. Facilities may integrate fixed computer positions with a flexible collaborative area in the room. Teachers *are to be* able to move to all students easily.

Where power is provided to student positions, fixed benches and island tables with university computers are to have as a minimum, for each student position, one double GPO, and data outlet, immediately below the work surface. Access holes *are to be* provided for cables to top surface. For each position provide on or above work surface one double GPO and USB power slot per position for student use. On work surface to island tables one DGPO may be shared between two students. Freestanding tables with incoming power or data cables *are to be* fixed to the floor.

Cable management on and within furniture must provide a safe and tidy system with ease of access for maintenance and adjustment. This includes cables from table sockets to computers and other equipment on the work surfaces, as well as cables supplying table sockets from sources. Cable runs should be managed by using velcro at 500mm max centres.

Computer Labs will have, per each permanent computer position, one 'Kensington Grommet Hole Security Anchor Point", or equivalent, fixed to work surface, to back of work area, to enable computer to have maximum flexibility in position on work surface and to minimise interference with available space. The Anchor Point enables a security wire to be fixed to work surface.

Computer Joinery Services

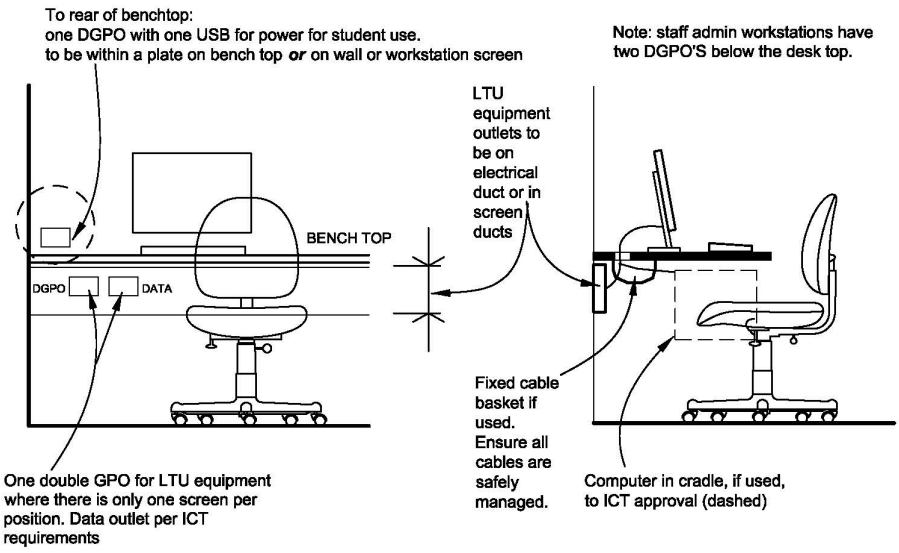


Fig 16. Computer Table Requirements

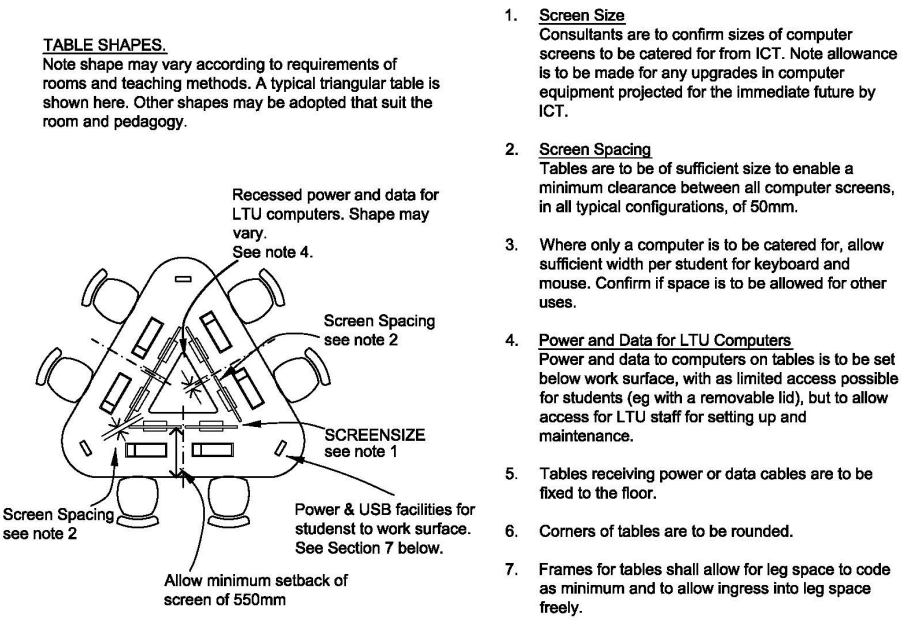


Fig 17. Computer table requirements

Computer Table Clearances

Table shape may vary. Triangular tables are shown below for illustrative purposes.

Tables may be at varying positions and angles according to teaching methods, room sizes and shape, and *AV* requirements.

Illustration is provided as a guide for minimum clearances.

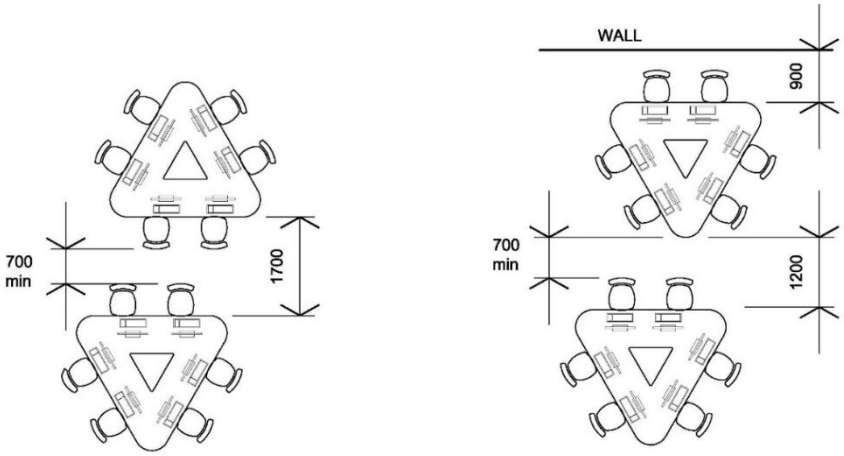


Fig 18. Computer table clearances

4.06 Informal Learning Spaces

4.06.01. Pods

"Pods", a form of Group Study Areas, are spaces for six to eight students to work and focus together, typically in a space with access from one end, a central table and with an *AV* screen at the other end that the students can access. The spaces are currently utilised within or adjoining:

- informal learning;
- breakout areas; &
- the library study areas.

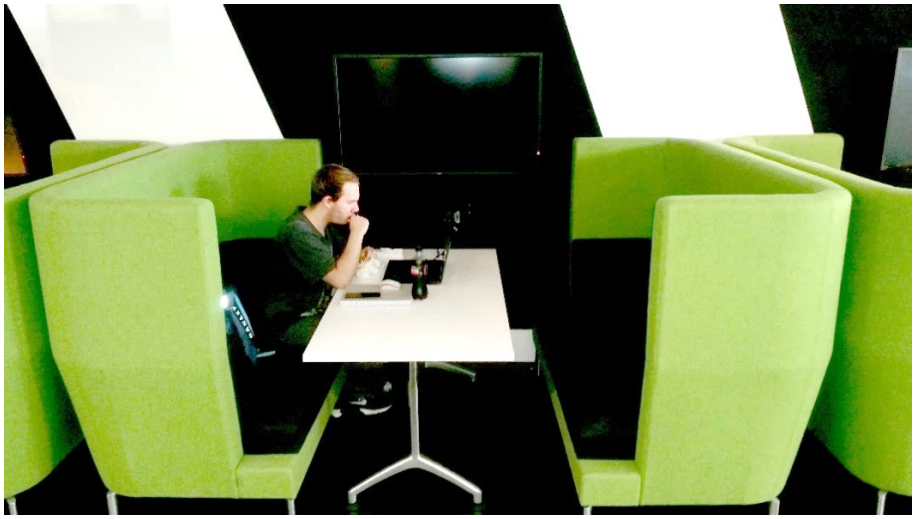


Image 3. PODs

4.06.02. Informal Learning Spaces

Informal Learning Spaces are typically spaces with facilities for students to study unsupervised singly or in groups in spontaneous or planned work. Spaces are to provide for learning and social interaction. The spaces should provide a friendly atmosphere allowing students to feel comfortable meeting with their peers, enhancing their wellbeing, a sense of community and belonging. The areas may be in various sizes, from small “eddy spaces” from only one or a few students, to areas catering for larger numbers in various group sizes. It includes student common rooms. Priority should be given to fixed furniture.

Typically, the spaces should include:

- Wi-Fi
- Power to recharge lap tops;
- Comfortable tables and chairs;
- Soft and comfortable furnishings;
- Milling areas;
- Enlivened creative environments;
- A variety of facilities (e.g. vending machines, computer charging lockers);
- Be located close to toilet facilities &

Where feasible, accommodate a small kitchenette that accommodates:

- a sink,
- hot and cold water
- bench space that can also accommodate a small microwave

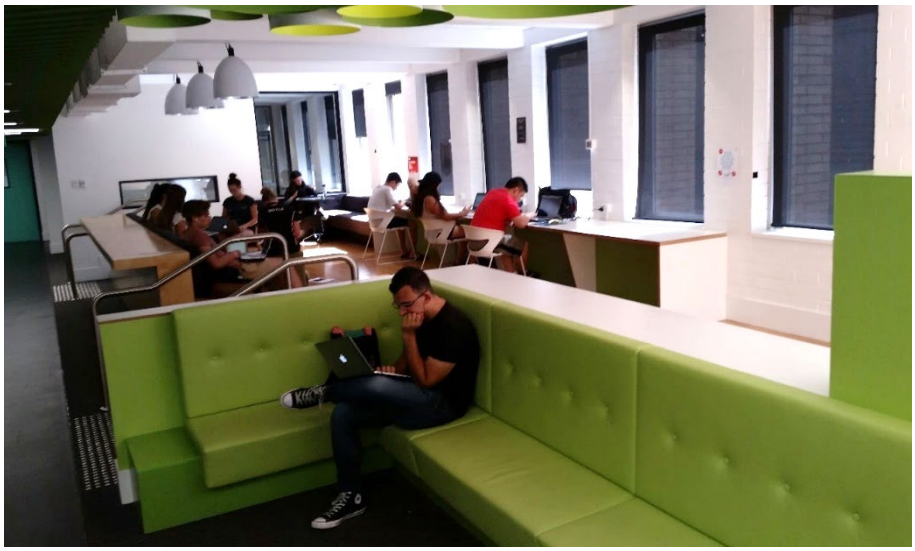


Image 4. Informal Learning Spaces

4.07 Higher Degree by Research Students and Post Graduates

Design of these workspaces are to encourage efficient and effective working techniques consistent with *LTU* policies.

Higher Degree by Research (HDR) and Postgraduates are to have sufficient space and suitable facilities to achieve their tasks and to meet *LTU*'s obligations under relevant OH&S legislation.

Study space *is to be* supported by adequate shared facilities including meeting rooms, amenity spaces, utility/resource rooms, storage, waste and recycling storage and disposal areas.

4.07.01. Performance Requirements

Finishes and colours on the walls of these types of spaces *are to be* light toned.

Desks and tables in these types of spaces are to have surfaces with medium tone colours to minimise potential glare issues

Access *is to be* provided to a kitchenette or tea room. This may be close to PG/HDR rooms or within the actual spaces. In general, no student should have to travel beyond the level of their *building* to access this facility.

Adequate shelf storage *is to be* provided - more than one shelf per workstation is typically required. The *Consultant* is to ascertain if any special storage requirements, such as secure storage, is required.

Spaces are to provide access to natural light and exterior views where possible.

Minimum spacing between front edges of facing workstations or desks will generally be 1500mm minimum in existing cellular offices (stagger seat positions if possible) and 1800mm minimum in other areas.

Unless a particular need is established and approved by the *Director, Project Design & Delivery,* desks *are to be* 1500mm wide.

Power *is to be* provided, per position, two double GPOs (Switched Socket Outlet), and data outlet, immediately below the work surface. Access *is to be* provided for cables to top surface. For each position also provide on or above work surface one double GPO and USB power slot per position for student use.

HDR and Post Graduate desk/workstation areas are to have motion sensors connected to lighting.

4.08 Staff Office Space

Design of workspaces are to encourage efficient and effective working techniques consistent with *LTU* policies.

Staff are to have sufficient space and suitable facilities to achieve their tasks and to meet *LTU*'s obligations under relevant OH&S Legislation.

Office spaces *are to be* supported by adequate shared facilities including meeting rooms, amenity spaces, utility/resource rooms, storage and waste and recycling storage and disposal areas.

Planning of spaces *are to be* to the *LTU Space Allocation and Use Policy*.

4.08.01. Performance Requirements

Planning of staff office space and positioning of workstations and desks are to provide access to natural light and where possible, exterior views.

Spaces *are to be* designed to minimise glare to computer screens from windows and light fittings.

Finishes and colours on the walls of Open offices and cellular offices *are to be* light toned.

Desks and tables in open offices and cellular offices are to have surfaces with medium tone colours to minimise potential glare issues

Open offices, Resource/photocopier spaces and Printer rooms are to have motion sensors connected to lighting.

A kitchenette or tea point *is to be* provided close to office space but the arrangement of facilities within a *building* will be at the discretion of the *UPR* or *Governance Body*.

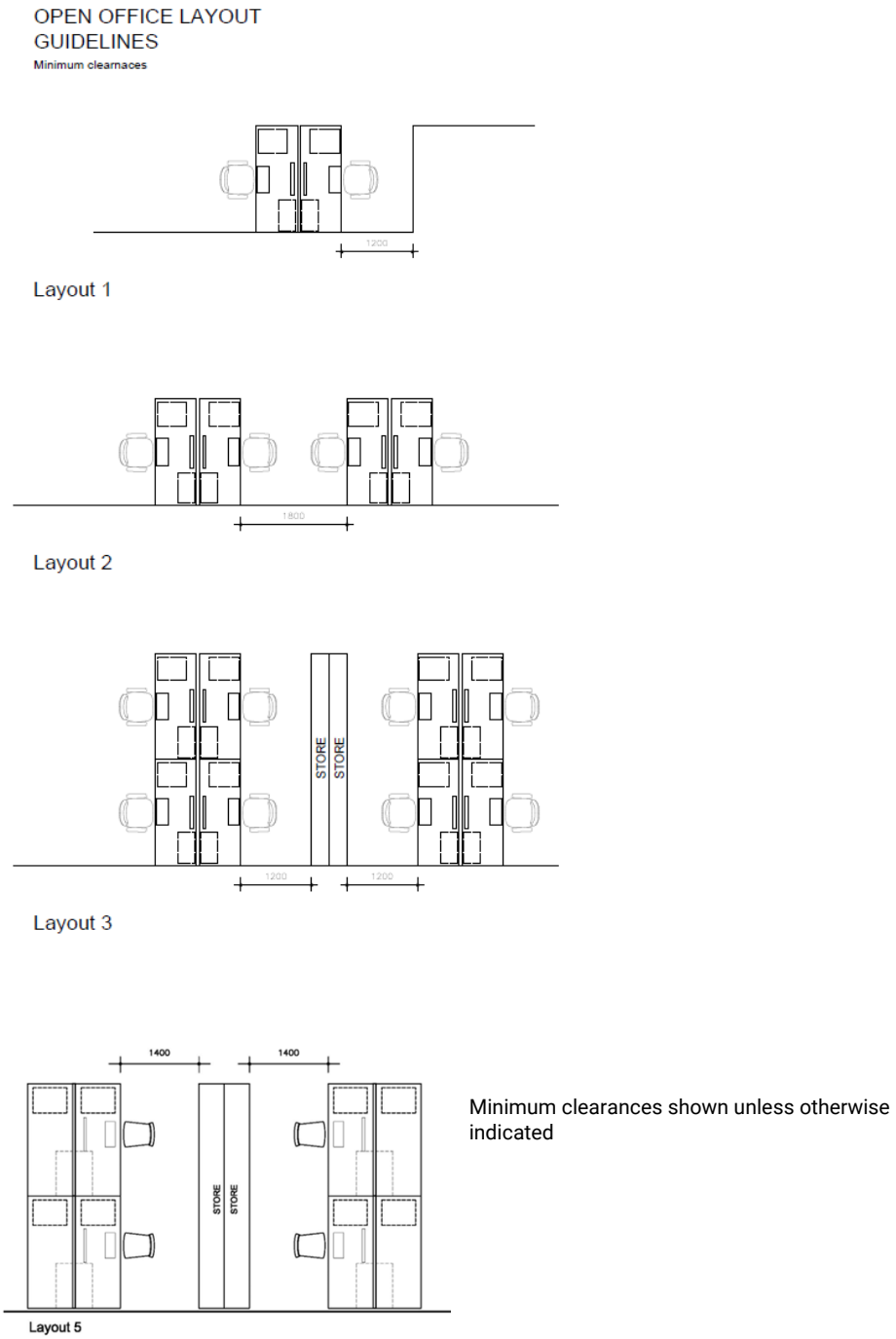
In accordance with the *LTU Space Use and Allocation Policy* the following is to apply when determining whether a *Project* needs to provide a tea point or kitchenette:

- One tea-point (5m2 up to 30 EFT).
- One kitchenette/break-room over 30 EFT (1m2 per person) Space *is to be* provided for bins and receptacles for paper recycling and other office goods (e.g. toner cartridges). Refer also Waste and Recycling Bins Systems Guidelines.

Further details regarding Kitchens can be found at Section 4.10 Kitchen and Kitchenettes.

Cellular offices may have a whiteboard for general discussion purposes of 1200 w x 900 h, with a ledge and duster. A larger whiteboard may be provided for special uses when approved by the *UPR*.

4.08.02. Open Office Layout Guidelines



Minimum clearances shown unless otherwise indicated

Fig 19. Open office clearances

4.09 Meeting Rooms

Meeting rooms provide an effective environment for discussion and presentations with adequate acoustic privacy to protect confidentiality and minimise disturbance to surrounding spaces.

Meeting rooms will comply with the *Information Services* Digital Workplace Technology Standards

Video conferencing *is to be* provided at the minimal rate of one facility per *building*. If more than one is required, this will be a Design Standard Variation and justification will be required (benefit of installation v's cost of the unit and installation)

Meeting rooms are to comply with the LTU Space Allocation and Use Policy.

4.09.01. Performance Requirements

Finishes and colours on the walls of meeting rooms *are to be* light toned and low contrast to provide high quality images on camera.

Meeting rooms will be designed to hold comfort conditions when they are at maximum capacity.

Desks and tables in meeting rooms are to have surfaces with medium tone colours.

Protection to wall finishes to damage caused by chair backs to be provided where appropriate.

Electronic room booking panels will be provided adjacent to the door of meeting rooms. Refer to Room Booking Panel Installation Guide for installation details. Cabling *is to be* concealed. If this is not physically possible, the location of the cabling *is to be* co-ordinated in design and in construction with the *UPR*.

Motion sensors *are to be* connected to lighting in meeting rooms.

4.10 Kitchen and Kitchenettes

Kitchen and kitchenettes are to provide food preparation areas which are easy to maintain, protected from vermin and comply with relevant Codes and Standards.

Ensure that people using kitchens are safe from scalding and electrocution *hazards*.

These requirements apply to facilities for both students and staff.

4.10.01. Performance Requirements

Kitchens and kitchenettes *are to be* provided with the following:

- Boiling water/ Chilled water facility. Note that "on wall" boiling water units above sinks are not permitted – they *are to be* Zip or Whelan Thermal Tap (under bench).
- Single or double bowl sink with hot and cold water and a one or two drainers drainer.
- Fridge.
- Dishwasher.
- Microwave (set approx. at eye level, or just below).
- Waste and recycling bins *are to be* provided within all kitchens and kitchenettes in accordance with Waste and Recycling Bin Systems Guidelines.

A kitchen and kitchenette are to provide sufficient bench space for multiple users.

The design of the kitchen and kitchenettes is to consider the flow path of food preparation, heating of food, washing and drying of dishes and waste as part of its functional layout

Kitchens are to have motion sensors connected to lighting.

Where facilities are used to prepare food commercially for the public, they must comply with Food Standards Code.

Design of kitchenettes for self-prepared food **are not** required to comply with the Food Standards Code. Eliminate crevices that can accumulate food scraps and crumbs and minimise voids that can harbour vermin and insects.

All benches and splashbacks must be scrub-able.

Adequate space must be provided for the provision of waste and recycling bins.

4.11 Toilet and Showers

Toilet numbers *are to be* adequate for the particular functions served and be in accordance with *BCA* requirements.

Toilets *are to be* provided for each floor of a *building* unless permitted by Authorities and *Certifier* and *are to be* within close proximity to main teaching area groupings.

Toilets also include DDA Toilet, Ambulant Toilet, Gender Neutral & Changing Rooms

The entrance to toilets will be from secondary or primary circulation routes, and are not be immediately visible from workstations, teaching seats or learning seats.

Toilet cubicles or fixtures are not to be seen from the entrance to toilet suites, including with all air lock doors open.

Where toilets are permanently mechanically ventilated, an air lock is not required provided that the conditions of these *Design Standards* are able to still be met.

A baby-change table and suitable facilities for baby changing may be provided in access toilets, but where a baby change table is provided the location and design of the baby-change table will not impinge on the area of the access toilet and access requirements.

4.11.01. Performance Requirements

Toilets to be easy to clean and maintain.

Choice of materials and fittings *are to be* in response to the expected level of use. High use toilets *are to be* designed with materials and fittings that can deal with the required number of users. Low use toilets can adopt materials and fittings appropriate to their level of use.

High Use, Medium Use and Low Use toilets defined as follows:

- High Use toilets - those adjacent to more than 500 teaching seats or concentrations of food and beverage outlets.
- Medium Use toilets - cater for staff and students, such as areas with significant numbers for research.
- Low Use toilets - generally only used by staff.

The following will be provided for all toilets:

- A mirror will be positioned behind each basin, with frames protecting exposed edges.
- Hot and cold water to basins.
- A threaded hose tap for cleaning (includes male, female and accessible toilets).
- Clothes hook and WC paper dispenser in every WC cubicle with provision for the fitment of a standard sharps bin.
- Female WC cubicles will have sufficient space to allow the placement of a sanitary napkin disposal unit to be serviced by an outside operator.
- A shelf near the basins to allow users to place hand carried objects off the floor.
- Electric hand dryers are standard for hand drying to all types of toilets – see below for use of paper towel dispensers.

Flusher valves *are to be* used instead of cisterns where there is a flusher system in the *building* (Zurn dual flush).

Concealed flusher valves and cisterns, where used, are to have adequately sized access panels to allow all maintenance.

Toilet seats are to have lids, and pans *are to be* floor mounted. Fixings for seats *are to be* accessible in installed suites.

Urinals are not to be waterless. They *are to be* trough and a grate to stand on in high use areas e.g. student areas, or wall hung. Soft touch flushometers *are to be* used where flushometers are used.

In a high use toilet, taps *are to be* automatic.

Where used, waste paper bins will be sized and in accordance with the Waste and Recycling Bin Systems Guideline.

Toilet paper roll holders to be Tork® Twin Mini Jumbo Toilet Roll Dispenser - 555500 (white or black depending on the design and palette)

Disabled (Access) and Ambulant toilets will have toilet paper holders to standard household dispensers to meet the DDA compliance.

Where used paper towel roll dispensers *are to be* Tork® Mini Jumbo Toilet Roll Universal

Soap holders *are to be* plastic and located over the basin.

- In high profile areas such as in chancellery or amenities servicing prominent offices the Tork Foam Dispenser – Intuition (Sensor White) Model No. 561600 *is to be* used
- In high traffic or student areas the Tork Foam Dispenser (push Button) Model No. 561500 *is to be* used

Wall and floor finishes in toilets will be impervious and scrub-able using chlorine-based cleaning agents without damage to the material.

Vanity benches will not be provided in high use toilets.

Floor finishes in toilets *are to be* coved up a minimum of 100mm above floor level (*AFL*) in the same material as the floor.

Floor finishes are to meet required slip resistance criteria when wet.

Provision of air locks to entrances are required for new *buildings* and major refurbishments and is the preferred design solution in other refurbishments. Consider sight lines if both doors are open if an air lock is not provided. Minimum cubicle size 1550mm x 920mm. Women's and accessible toilets will include space for free standing sanitary disposal bins, 350mm x 250mm.

In new *buildings* or complete *building* refurbishments, and where possible in partial refurbishments, a Floor Waste *is to be* provided in all toilets.

4.11.02. Hand Drying Facilities

Auto electric dryers *are to be* quiet and energy efficient and installed in all toilets, disabled accessible toilets, sick and baby change rooms. Paper towel dispensers to toilet and shower facilities *are to be* provided in Access toilets and showers, sick and baby change rooms only. The ZIP Silent Dry hand dryer (Order Code 20041) *is to be* specified.

Where paper towel dispensers are used, at Bundoora *campus*, paper towel roll dispensers *are to be* used, and at regional *campuses*, wide interleaf system *is to be* used. Refer to the Waste and Recycling Bin Systems Guidelines for waste and recycling receptacles for waste paper.

4.11.03. Shower Cubicles

In new *buildings* and major refurbishments of *buildings,* a unisex shower facility *is to be* provided accessible from a main corridor located on Level One (Ground Floor).

A suitable dry area *is to be* provided in showers to allow for dressing. This area to be provided with a drained bench or seat and a minimum of 3 No. clothes hooks. A glazed screen not a shower curtain, *is to be* provided to isolate the shower area from the dressing area.

Shower cubicles *are to be* provided with a shelf for soap and shampoo containers, recessed where possible.

A soap dispenser *is to be* provided.

4.11.04. Partitions to WC Cubicles

When laminated board is used for cubicle walls, the minimum thickness *is to be* 18mm. If fixings *are to be* made into board, 32mm board *is to be* used. Construction is to provide a structure that is robust and does not wobble.

HMR board *is to be* used.

Gap at bottom *is to be* 150 to 200mm.

Provide head rail over door.

4.11.05. Gender Neutral Toilets

Gender neutral designated facilities will be provided as below for LGBQTI (Lesbian, Gay, Bisexual, Queer, Transsexual and /or Intersex) people.

New access toilets for the disabled in publicly accessible areas will have Gender Neutral Toilet signs places below the required Access signs. The signs will be as in the Signage Style Guide.

Where an existing *building* is undergoing a full refurbishment that has a Usable Floor Area (*UFA*) of greater than or equal to 4,000 sq. m. in its new configuration, a Gender-Neutral Toilet will be included within the redesign in addition to the Unisex (Access) toilets required by the *BCA*.

Where a new *building* is being built that has a *UFA* of greater than or equal to 4,000 sq. m. in its configuration, a Gender-Neutral Toilet will be included within the redesign in addition to the Unisex (Access) toilets required by the *BCA*.

Sole Gender-Neutral Toilets (i.e. spaces that are not Unisex [Access] toilets) will only have a sign to the outside stating "Gender Neutral Toilets". Refer to the Signage Style Guide.

Sole Gender-Neutral Toilets *are to be* a single compartment space opening off a corridor or public space. There will be a lock to the door that is activated from inside, but that can be opened from outside in case of emergency. The door is to have a closer. The spaces are to have sanitary napkin disposal units within. Facilities within the room will be as per the standard requirements for toilets.

4.11.06. Changing Places Toilets

Where used, Changing Places toilets *are to be* designed for children and adults. Reference is made to 'Changing Places Information Guide and Technical Standard' for further reference details. Changing Places toilets *are to be* separate rooms to Access toilets as per AS 1428 and regular toilets.

In order to be classified as a Changing Places toilet and use the Changing Places logo, facilities must undergo Changing Places Accreditation by an Accredited Access *Consultant* who has completed Changing Places Accreditation training. Accreditation *is to be* co-ordinated through the *UPR*.

Changing Places rooms must include:

- A height adjustable adult sized changing bench.
- A constant charging ceiling track hoist system.
- A centrally located peninsula toilet.
- Specific Circulation spaces – Refer reference in clause 01.
- Automatic door with a clear opening of 950mm at a minimum.
- Other fixtures and fittings as detailed in the design specifications

4.12 Cleaners Facilities

Facilities will be provided to make it economical and convenient to clean and service *buildings*.

Provide minimum of one cleaners' room in each *building*, and in larger *buildings* one per floor. Provide cleaners' cupboards to each level of multi-level *buildings* where there is no opportunity for a cleaner's room.

Locate cleaners' rooms and cupboards adjacent to wet areas or amenities within *buildings*, at an access level of a *building*. 24-hour access for cleaning staff is required.

4.12.01. Performance Requirements

The minimum area of a Cleaners Room will be 8 sq. m *UFA*

A cleaners' cupboard will contain a cleaners' sink, space for bins as required, and storage shelves and be minimum of 2m long, 1m deep and 2.4m high.

Cleaners Rooms will contain:

- stainless steel cleaners sink with grate and with hot and cold running water.
- storage for bucket, brooms, toilet requisites, equipment and vacuum cleaners, trolleys and wheelie bins.
- shelf storage
- coat hooks 1350mm above floor level.

4.13 Sick Rooms and Baby Care Rooms

LTU will provide sufficient sick rooms and baby care rooms within *campus* planning requirements.

Sick rooms and baby care rooms are not to be combined but can be planned adjacent to one another.

A sick room or baby care room *is to be* adjacent to a suitable WC or a dedicated WC can be provided ensuite. If a WC is provided, the WC facilities requirements apply to that space.

An easily accessible Emergency Call button *is to be* provided in a Sick Room.

4.13.01. Performance Requirements

The minimum area for each is 8 sq.m *UFA* with a minimum length of walls 2400. Suitable furniture *is to be* provided.

A basin with hot and cold water will be provided to each type of room, with related facilities as noted previously in this section.

A fold down baby change table *is to be* provided to the Baby Change Room.

Provision of an external window with a shade or curtain is desirable.

Finishes *are to be* waterproof and easy to clean and maintain.

4.14 Communication Rooms

To provide an environment that fully supports operation of Communication Rooms and equipment within that space.

4.14.01. Performance Requirements

Requirements for Information Services infrastructure, racks and associated equipment will conform to *LTU*'s

- Information Services Communications Brief and
- Information Services Data Cabling Standards

The *Building* Distributor room (BD) *is to be* provided on the ground floor (Level 1) of the *building* and will act as the main communications distribution room for the *building*. All *campus* lead-in cabling to the *building* will terminate in the BD and all backbone riser cabling serving the *building* will originate from the BD.

A Floor Distributor room (FD) will be provided on each level of the *building*. All backbone riser cabling will terminate in the FD and all horizontal cabling to the floor will originate from the FD on that level. Accordingly, FDs will be provided on each floor so no data run on the floor is greater than 85m from a FD. **All FD and the BD *are to be* vertically aligned within the *building*** to minimise deviations in vertical cable paths between the levels.

The BD and FD will be minimum 2-hour fire rated construction and be sealed slab-to-slab to prevent dust ingress and concrete dust within the room. The room construction will be acoustically treated to minimise the noise transmitted to the adjacent work areas. Raised floors and ceilings are not permitted in the BD.

Access to the BD will be clear and unobstructed through to the *building* entrance and/or loading bay.

Access to the FD will be clear and unobstructed through to the level entrance.

No services (inclusive of stormwater & sewer pipe runs), other than those serving the BD and FD, are permitted to enter the BD room without approval from *LTU* Information Services.

All access doors to the BD will be monitored for both entrance and exit.

Unless otherwise advised by Information Services, the BD is required to accommodate a minimum of two 45RU (PANDUIT R4P) racks with associated Vertical Cable managers. Each equipment rack will be earthed from a single point. A rack-mount UPS *is to be* installed at the bottom of each equipment rack. The UPS Type and model will be as advised by *LTU*.

Each FD is required to accommodate a minimum of one (1) 45RU (PANDUIT R4P) equipment rack including 2x Vertical Cable managers. Each equipment rack will be earthed from a single point. A rack-mount UPS *is to be* installed at the bottom of each equipment rack. The UPS Type and model will be as advised by *LTU*.

Each equipment rack in BD and FD rooms will require 2x 15Amp captive outlets per rack. (Type: Clipsal Combination Switched Socket Outlet 56C315 15 Amp flat pins or equivalent). The outlet will be suspended or overhead mounted to remove tripping *hazards*. 1x DGPO 10A connections are also to be provided within the BD. Exact location of the DGPO will be as advised by *LTU*. 2x Data points will also be provided within the room (final location to be nominated by Information Services – during design phase).

At least 1m clearance is required around the perimeter of the equipment racks. Clearance to the front of the rack will be 1200mm. It may be permissible to locate one side of a rack adjacent to a wall to allow for wall mounted cable tray. Exact rack locations & BD & FD room layouts *are to be* confirmed and approved by Information Services as soon as possible in the Design Phase and no later than at completion of Schematic Design.

Dedicated overhead cable support systems (cable tray/basket) will be provided for all optical fibre and copper cabling.

The BDFD will typically require air conditioning due to the higher equipment loads. The air conditioning system will be independent of other air conditioning systems within the *building* and comply with the requirements with the main Mechanical Services.

An environmental monitoring system (compatible with existing *LTU* systems) *is to be* provided for temperature and humidity control.

A smoke detector system *is to be* provided, sprinklers are not permitted.

Heat extraction *is to be* provided within the BD in case of failure of the air conditioning. This extraction method *is to be* connected to a UPS (so in the event of power loss, the UPS can control the extraction fan, to allow egress of hot air from the room.) Power supply to the air conditioning for the BD room will be on an independent system.

4.14.02. Security

Access into the BD & FD rooms *is to be* via swipe access in accordance with the *LTU* standard Gallagher access controllers. Access to the room should be via a public area (rather than a teaching area). Personal Computing devices for *BMCS* or other control systems will not be permitted to reside in any of the BD or FD rooms.

4.14.03. Cleaning

Prior to handover to the University the BD and FD Rooms will be professionally cleaned to ensure the area is free from dust and debris prior to University installing their equipment. The rooms *are to be* inspected and signed off by *Information Services*.

4.15 Communication Risers

A dedicated communications riser will be provided for the reticulation of all backbone riser cabling extending from ground level to the roof top plant space.

Separate cable tray (optical fibre, copper, MATV) will be fixed and not restrict access to the room or the equipment racks.

4.16 Corridors

Size is to accommodate anticipated volumes of pedestrian movements and adjacent room functionality. Particular attention should be addressed to corridor space forming breakout areas to teaching rooms and which open out to informal learning areafsos.

4.16.01. Minimum Widths:

- Main spine corridors between *buildings*: 2700mm is optimal, 2400mm is minimum.
- Primary corridors in *buildings* (main corridor linking rooms on a level): 1800mm
- Secondary internal corridors linking groups of rooms in a section of a level: 1500mm

If greater than 100m in length, provide rest stops and seating.

Protrusions and/or objects: avoid or recess.

Wheelchairs: widths and passing places to comply with DDA Gradients: to be less than 1:20.

Protection to surfaces:

- Provide where damage is likely to occur i.e. where trolleys are regularly in use.

4.17 Room Numbering

I&O have a standard room numbering system and protocol that *consultants* and *contractors* are required to follow. The standardisation of room numbering assists *I&O* in their day to day operatons. Refer to **Appendix 5** for details and requirements.

4.18 Handover Documents

In previous versions of this document there was a section titled “Handover Documents”. The processes, roles and responsibilities have now been incorporated into *consultants* and *contractors* contract documents.

4.19 Building Fabric

Façade materials will be chosen for appearance, durability maintainability and sustainability.

Façades will contribute to *LTU* Planning and Sustainability objectives.

Design of *building* façades are to take into consideration directions and requirements as identified in relevant *Master Plans* and *Project Briefs*.

Design of *building* façades will control exterior noise to achieve acoustic targets.

Façades are to control heat transfer to achieve thermal comfort for occupants in conjunction with the mechanical systems provided.

Façades are to also contribute to *ESD* design requirements.

The external façade *is to be* designed to prevent unauthorised access to the roof areas.

4.19.01. Performance Requirements

Envelopes and finishes are to provide satisfactory service for at least 50 years with normal maintenance.

Façade materials *are to be* warranted to be durable and waterproof by the manufacturer for at least 25 years and will be installed and detailed to ensure that the manufacturer will provide the warranty.

Buildings designated as naturally ventilated under the *BCA* *are to be* designed to facilitate and control air movement without the ingress of rain when windows are open. Where windows are likely to be open of a night time e.g. Student Accommodation facilities, as part of an integrated night purge system etc. flyscreens are to be installed. Flyscreens are generally not to be installed on manually openable windows for office and administration facilities.

The placement of protruding *building* services and equipment on *building* facades *is to be* avoided or shielded from view. All services within *buildings* *are to be* accessible as required for maintenance.

Clear access paths used by equipment for maintenance of facades (e.g. boom access for window cleaning) *is to be* integrated into the design.

4.20 Brickwork

Brickwork, when used as a façade material, *is to be* designed to resist water ingress appropriate to the location and climate. The use of cavity brickwork at elevation or in unprotected locations is unlikely to be acceptable for waterproofing without special detailing which *is to be* approved by the *UPR*.

4.20.01. Performance Requirements

When working with existing brickwork, contract documentation is to identify that the *Contractor* is required to establish the brick type in walls. Drilling and fixing into wire cut bricks may require special provisions to avoid splitting the bricks.

New work within existing brickwork is to match the existing.

New brickwork adjacent to existing is to comfortably sit with the existing.

Existing *building* brickwork at Melbourne (Bundoora) is comprised of “standard” and “modular” bricks.

“Modular” bricks are generally wire cut, 290mm in length (300mm for a module including the mortar joint), 90mm wide x 68mm high (for a 78mm high brick and mortar joint). Coursing for new brick work should be documented to match existing.

The use of wire cut bricks with large voids is discouraged due to poor performance over time in supporting fixings for services or architectural elements such as awnings or blinds.

4.21 Composite Panels

Wall Cladding cannot consist of either aluminium composite panels (ACP) with a polyethylene core or expanded polystyrene (EPS) cladding.

4.21.01. Performance Requirements

Metalwork *is to be* constructed and sealed in a manner that preserves the inherent longevity of the material. Stainless steel gutters, for example, should be welded instead of relying on sealants.

4.22 Thermal Insulation

When a *building* is being fully refurbished, façade performance of existing *buildings* *is to be* upgraded to align with the requirements of Section J at minimum and exceed the requirements of Section J of the current *BCA* by 20 percent where practicable.

4.22.01. Performance Requirements

No thermal insulating material *is to be* placed in a position or in a construction where its performance will be significantly affected by moisture due to condensation or leakage.

All insulation materials *are to be* protected by appropriate vapour barriers on the appropriate side of the construction.

The installation of cool rooms or climate-controlled chambers will not give rise to condensation inside *buildings*.

4.24 Metalwork

Metalwork *is to be* protected from corrosion appropriate to its environment and is to have a service life comparable with the assembly that it supports or is part of.

Do not create opportunities for bi metallic corrosion (galvanic reaction) by using higher potential metals above lower potential metals.

4.25 Roofs

Roofs *are to be* durable and watertight.

If the roof is visible from other *buildings,* ensure its appearance is acceptable.

Roofs and rainwater goods to be designed to provide a watertight assembly in a 1:100 - year event.

The use of flat roofs with membranes is discouraged. If a flat roof is unavoidable, a solution using post tensioned concrete with a suitable admixture should be considered.

4.25.01. Performance Requirements

Gutters *are to be* accessible for cleaning in accordance with safe design principles. Any gutters located 3 storeys or more above ground level *are to be* accessed via the roof.

Eaves gutters are not to flood into a *building*.

Box gutters are not permitted. If a box gutter were to be approved as a deviation to the standard it must have a fall greater than 1 in 200. Incorporate gutter sumps, overflows and design to be trafficable.

Internal downpipes are not permitted. If internal downpipes were to be approved as a deviation to the standard, they will be of stainless steel or uPVC, installed oversized with no sharp bends. Downpipes will be accessible with inspection openings at change of direction and at base.

The minimum fall for a new metal deck roof on a steel or concrete structure *is to be* 3 degrees with optimum of 5 degrees.

The minimum fall for a metal deck roof on a timber structure *is to be* 5 degrees.

The minimum fall of a tile roof with weather checks to the tile *is to be* 17.5 degrees or greater if specified by the manufacturer.

The minimum fall of a tile roof without weather checks to the tile will be 25 degrees or greater if specified by the manufacturer.

The minimum fall to a membrane roof is 1:100.

Membrane roofs will be laid according to the written instructions of the manufacturer and be installed in so that they will be warranted by the manufacturer for a minimum period of 15 years.

Drains to roofs will be fitted with a leak proof flange and be detailed

In full *building* refurbishments,

- Increase the roof pitch to 5 degrees, if the existing roof is less than this.
- Increase the depth and/or the width of any box gutters.
- Increase the depth and frequency of pop outs.

In partial *building* refurbishment that may impact the roof it is the University's preference to align the roof works with the full *building* refurbishment requirements. A review and audit *are to be* undertaken of:

- Existing gutters and roof conditions
- Pop out locations, sizes and frequency
- Rain water heads dimensions and locations to determine how this can be achieved.

Skylights may be considered where appropriate and to negate the need for internal lighting being on during the day. They will need to:

- Have internal light sensors installed linked to the surrounding internal lighting to dim when the natural lighting levels provide light. Overall levels *are to be* to code.
- Be installed to manufacturer's specification.
- Have safety measures as required by University and relevant Standards, including Prevention of Falls in General Construction.
- Be capable of being shaded in summer.

Where works are undertaken to greater than 10% of roof gutters, new or replaced gutters *are to be* fitted with an appropriate gutter guard to prevent the accumulation of leaves and other debris. Detail of gutter guard and method of installation *is to be* approved by *FAS* v/a the *UPR*.

4.25.02. Solar Generating Facilities On Roofs

A thorough investigation of existing roof spaces and shading *are to be* undertaken as to the suitability when photovoltaic panels are being considered for the roof or when works are planned for a roof.

Where possible, any existing *building* should not be shaded by adjacent new construction between the hours of 10 am – 2 pm on the winter solstice.

New *building* roofs *are to be* designed to:

- Structurally support PV panels
- Maximise the opportunity to generate maximum power via the PV panels due to orientation, pitch etc

4.25.03. Roof Access

Building design should incorporate parapets or guardrails at edges to maximise roof safety.

Roofs of one storey above ground, or one storey above a level that has stair access may be accessible by a ladder.

Roofs of *buildings* of two storeys or more *are to be* accessed via an internal ladder or stair, or a combination of both

Stairs may be nevertheless provided to all roofs.

Permanent access to roof level will be provided and *is to be* internally positioned. For multi-level *buildings*, the roof access *is to be* from a stairwell or roof top plant room with full door access. Where a full door access is not possible, a permanent, lockable ladder system *is to be* employed complying with the relevant Australian Standards. If this fixed ladder point is to a roof edge, then a 1.1m high handrail *is to be* fixed 2m along each direction along the roof away from the access point. Alternatively, a 1.1m high handrail / continuation of the fixed ladder can lead away from the roof edge to a distance of 2m with a flat walkway platform.

Where roof access to ventilation and lighting equipment is over sheet metal, glass or other material that may be damaged or collapse under the point contact of a person, walkways *are to be* designed and installed to the service positions of these areas. Walkways must be constructed using aluminium for the frame, handrail with expanded metal or aluminium decking. The area under the walkway must be accessible for cleaning.

Where permanent access to a roof is provided, access on the roof is to comply with AS1657 - Fixed Platforms, Walkways, Stairways and Ladders – Design Construction and Installation.

4.25.04. Plant

All plant located on a roof/roof platform must be at least 3m from an edge unless a 1.1m high handrail is fitted.

Plant must be located in a position where it will not be visible from the ground. Plant that is overly prominent *is to be* screened. Screens *are to be* adequately framed and secured. Typical screening material is a large expanded aluminium mesh or perforated metal (round holes), powder coated a light colour, to approximate height of plant.

All new facilities are to incorporate a plant platform sized to incorporate all current and foreseen future plant.

Access to plant on a roof must allow for all maintenance requirements.

New plant being installed on an existing roof will require a platform unless the cumulative *area* is less than 1 square metre.

4.26 Bird Roosting Places

LTU buildings are to be designed to minimise opportunities for birds to roost and cause a nuisance.

Where bird roosting is likely to cause a nuisance, suitable control measures *are to be* designed and implemented

4.26.01. Performance Requirements

The design is to manage the *risk* of roosting of nuisance birds such as pigeons, especially over doorways, eaves, top of pillars, window sills, sun shading devices etc.

Ledges which may support bird perching should be carefully considered and appropriate steps taken to ensure that birds will not roost in these areas.

Areas identified as potential roosting areas must have clear access points from the ground or adjacent levels incorporated into the design so that safe access to the roosting point can be achieved by *FAS Contractors* undertaking maintenance.

4.27 Doors and Doorways

Transit of doors or door operation is not to pose an avoidable *hazard*.

Doors on *Primary Routes* are not become a barrier for people with a disability.

Maintenance of doors, particularly fire doors, *is to be* minimised.

Slamming doors due to drafts and differential air pressures can pose a severe *hazard* and appropriate control of doors *are to be* provided to prevent this occurrence. Doors in a naturally ventilated *building are to be* fitted with closers. However, the use of closers is not to create entrapment *hazards*.

Provide door closers to entrance doors, external doors, internal doors from general office space to public corridors, lecture theatre doors and doors to all teaching spaces, plant rooms, toilets, air-locks and fire doors.

High traffic doors are not be fire doors. Where a deviation to the standards have been approved, fire doors located in high traffic locations *are to be* held back on electromagnetic latches during normal hours of operation. A separate door set will be provided to contain noise and retain control of the indoor environment including a viewing panel.

Building entrance and high traffic doors *are to be* automatically operated wherever possible. Main entrances to *buildings* and high-traffic doors internally *are to be* provided with automatic operation, preferably bi-parting sliding glass doors.

External access doors are vulnerable to weather effects and may also be required to pause in open position, particularly for wheelchair users. Weather protection, such as canopies, *is to be* provided, or doors will be recessed into the *building* sufficient to provide protection from weather when opened. External doors will be designed to resist the effects of weather.

All external doors *are to be* fully waterproof and can be either:

- Metal framed and glazed.
- Unframed glass where sufficient protection is provided from the weather.
- Framed and sheeted with marine ply.
- Sheeted with metal or an approved laminate or
- Made entirely of metal or other weatherproof materials approved by *UPR*.

Floors of entrance door recesses will slope away from *building* (i.e., provide provision to prevent rain surface water ingress).

Doors are not open directly into a primary or secondary path of travel. If a door is required to do so to meet fire egress or other Code requirements, an appropriate recess or protection will be provided.

Use inward opening swing doors where there is sufficient space; alternatively use sliding doors in confined spaces. All external doors to be lockable.

Double doors may be required to larger plant rooms to enable installation of large pieces of equipment.

4.27.01. Performance Requirements

Closers to non-fire doors are to meet AS1428.1 force requirements.

Handles to doors *are to be* lever type suitable for single action egress.

Electrically operated doors *are to be* controlled by key operated switch located in an adjacent wall.

Automatic door controllers *are to be* suitable for the installation of the University access control system.

Manually operated external doors *are to be* fitted with a lockset which after hours allows exit from the *building* but automatically prevents entry when the closer has closed the door.

High traffic doors and entry doors that are not glazed are to have viewing panels provided. Where there are double doors, a glazing panel *is to be* installed in at least one door leaf. The size of the panel will ensure visibility for everyone, including wheelchair users.

All teaching, learning, research and meeting rooms that are fitted with doors of solid material *are to be* fitted with a viewing panel, nominally 200mm wide and 1300mm high-top at 1700mm. Clear glazing thickness 10mm minimum, laminated. The size of the panel is to ensure visibility for everyone, including wheelchair users. Where 1½ doors are used, the view panel will be in the larger door leaf. A prismatic observation lens may be accepted as an alternative to a viewing panel or sidelight if approved by the *UPR*.

Rooms with more than 30 seats are to have a minimum of 1½ door width at main entrance with a minimum clearance of 850mm on the active side. Provide panic bolts to top and bottom of non-active door leaf only.

Provide entrance matting to doors at the entrances to *buildings*. Entrance matting to be aluminium, and limit ingress of dirt, water, mud, ice and be of a light weight to enable easy removal and cleaning by one person. Mat recesses *are to be* adequately drained if exposed to weather.

Mat recesses to extend a minimum of 2m perpendicular to the face of the door.

Toilet cubicle doors will be in hold open position. Hinges will allow for the ability to remove shut doors (cubicle occupied) in an emergency situation where the occupant becomes incapacitated.

Provide stainless steel push, pull and kick plates, on all toilet entrance doors.

4.28 Windows

Windows are to provide a comfortable amenity and a sense of connection and openness.

Operational spaces within *LTU* should be able to be viewed from circulation spaces. This applies particularly to *Teaching and Learning* spaces.

New window design and existing *is to be* used in conjunction with lighting control systems to supplement artificial lighting wherever possible.

4.28.01. Performance Requirements

Windows are not to be traversable by people.

Security at Level One for windows *is to be* addressed within other constraints of the rooms.

Internal and external windows *are to be* easily cleanable from both sides.

4.29 Glazing

All glass on *campus* will be safe in service.

The thermal performance of glazed facades will be in response to *BCA* Section J requirements or if being accredited, in accordance with the Credit requirements, whichever is the higher requirement

The acoustic performance of external and internal facades is to achieve *LTU* acoustic objectives with normal activity occurring outside the window. For teaching rooms, normal activity will include maintenance activities, including lawn mowing but not tree lopping.

Double-glazing *is to be* used where this will contribute to energy efficiency. This is particularly important for *campus*es in regional Victoria.

4.29.01. Performance Requirements

All new glass on *LTU campus*es, including mirrors, will be safety glass, either appropriate toughened or laminated glass.

Existing glass in *building* refurbishments *is to be* replaced with safety glass. Where a deviation from the standards has been approved because this is not physically possible, consider a film of sufficient thickness to retain the glass in the event of breakage.

4.30 Stairs, Walkways and Ramps

Ramps and stairs *are to be* safe and comfortable in use.

Walkways are preferred to ramps in accordance with Australian Standards

Stairs and ramps *are to be* provided with handrails on both sides in all circumstances.

Stairways *are to be* of sufficient size and accessibility to facilitate transport of ambulatory personnel and equipment.

4.30.01. Performance Requirements

Detail nosings to provide clear visual delineation between trends. Provide non-slip, screw-fixed aluminium nosings with 30% tonal contrast to stairs with carpet or vinyl finish. Do not specify rolled carpet on nosings.

Balustrades are to comply with current Codes and Standards to prevent children from falling through them and climbing on them. Horizontal rails on balustrades are not permitted where this would allow children to climb.

Vertical elements of balustrades will not be more than 80 mm apart.

4.31 Termite and Pest Control

LTU buildings and landscape elements using timber *are to be* appropriately protected against termite attack where failure will have adverse structural or appearance consequences.

The design of *buildings* will always minimise issues caused by pests.

Termite Control measures *are to be* provided in all *LTU buildings* that use timber for structural purposes or have significant components of timber in finishes.

A *building* without timber elements is not required by *LTU* to be provided with termite control.

Sub-floor cavities and roof cavities will be effectively sealed against vermin and birds.

4.31.01. Performance Requirements

Pest control measures relying on chemicals will use methods that do not create *hazards* to humans or non-target species.

4.32 Internal Walls Finishes and Linings

Fire indices for all finishes will comply with requirements under the *BCA*.

Stainless steel used externally will be equivalent in performance to 316 grade material minimums. Stainless steel used internally (non-fittings) will be equivalent in performance to 304 grade material minimums. In both situations, the material is not to rust or tarnish in normal service.

Examples of recyclable finishes include timber (both veneer on timber-based substrate and solid), metals or alloys without PTFE or similar coatings and linoleum.

Examples of durable finishes include stone, brick, properly detailed concrete, ceramic tiles, zinc, copper and lead.

4.33 Walls

Walls are to have adequate structural performance for the situation they are employed in.

Partition walls constructed in plasterboard and studs to use a minimum 13mm plasterboard.

Partition walls are provided in office spaces, *are to be* capable of supporting shelving attached to the studs.

4.33.01. Performance Requirements

Do not use MDF in wet areas. Use high moisture resistant (HMR) particle board or other approved moisture resistant material.

A hardwearing protective capping to all external angles from floor to ceiling *is to be* installed to walls in high traffic corridors. Acceptable materials include, steel, aluminium, preformed plastic or rubber. Width of capping to be minimum 50mm.

4.33.02. Typical Cellular Office Wall Construction

Acoustic requirements for Class 2 cellular offices to be met without taking walls to the soffit of the slab above in order to preserve flexibility for future fit out works.

Plasterboard walls of 13 mm thick Gyprock Soundchek or equivalent both sides on conventional steel studs and track filled with high density Noise Control Batts compressed to fit tightly between studs, track and noggings (acceptable alternative is one layer 13mm standard plasterboard one side and two layers 13mm plasterboard the other, with high density Noise Control Batts compressed to fit tightly between studs).
Ceiling panels equivalent in mass to 13 mm plasterboard or be backed with 10 mm plasterboard, Gyprock, Soundchek or equivalent, within 1200 mm of bounding walls.

Plasterboard joints to fall on studs or noggings and be taped and set to eliminate holes and acoustic weak points.

Plasterboard is to terminate as close to the ceiling as practicable. If a decorative head section is used, a heavy weight low profile track with a minimum housing recess for plasterboard of 15 mm *is to be* used.

Top track or the head section to be firmly secured to the ceiling grid at no more than 150 intervals and sealed with a high-density compressible foam or similar to give no gaps between the track and ceiling grid. Walls are to occur at the grid and are not traverse ceiling tiles.

Firmly secure the bottom track to the floor at no more than 150 mm intervals. If secured on a hard surface or if the floor is not level, seal with a high-density compressible foam or similar to give no gaps between the track and floor.

Plasterboard is to extend to the floor and to any bounding walls.

Office doors, where solid, to be solid core minimum 25 thick with minimum 13 mm rebates to frames.

Door grilles and undercut doors are not to be used. Return air to be provided via ceiling plenum, in a ceiling shunt with a minimum Rw of 35 dBA, or by other means.

Frames to glass walls to be of a low-profile type with minimum voids.

Glass to open office work areas and corridors to be 10.38 mm min thickness.

Glass to fins between offices or similar will be minimum 10.38 mm thick.

4.34 Ceilings

Ceilings are to provide suitable support for all likely services and ceiling mounted fittings, and are not sag, collapse or fail in normal service.

Ceilings are to give ready access to concealed services.

If services are exposed, they *are to be* designed to facilitate cleaning and maintenance.

Two-way ceiling grids to be provided where normal servicing or replacement of equipment above the ceiling may result in the collapse of a one-way system. Design of ceiling systems are acoustic performance within the space as well as acoustic separation of spaces, specialist lab and research requirements, and appearance.

Teaching spaces, offices, labs and circulation are to have modular, drop in panel ceiling systems utilising a suspended metal grid. Rooms without ceilings with exposed services are acceptable with approval of *UPR*.

4.34.01. Performance Requirements

Ceiling access hatches where required must be secured to prevent unauthorised access and designed in such a way to ensure that hatches cannot swing open and injure people on the floor below. A minimum of two fixings will be provided to secure ceiling hatches shut where there is a *risk* of a hatch swinging open in a manner dangerous to people below.

Drop in tiles *are to be* typically 600mm x 1200mm. 600mm x 600mm is acceptable.

4.35 Interior Finishes

Finishes *are to be* consistent with the architectural design of the *building* and provide durability and maintainability.

Applied finishes that wear quickly are not permitted.

Finishes *are to be* capable of being recycled or refinished rather than being scrapped at the end of their service lives.

Finishes *are to be* durable or recyclable, and suitable for the level of anticipated wear.

Finishes *are to be* appropriately durable to suit their level of use. Teaching rooms, learning spaces, access routes and so on all experience heavy use by students that, experience shows, are not delicate *building* users.

4.35.01. Floor Finishes General

Floor finishes *are to be* selected according to the density and frequency of traffic. The following *are to be* considered when selecting floor finishes.

- Creative solutions with graphic expression within floor coverings is encouraged where appropriate (e.g. public areas).
- To achieve a good standard of comfort suitable to the use of the space.
- To have a high degree of life and interest, and to sit well with the overall finishes and colour scheme.
- To wear well. High traffic areas (such as main corridors through *buildings*) are to have a resilient flooring instead of carpet.
- To have a retention of appearance over anticipated life cycle.
- To reduce stains and soiling being seen
- To be easily cleaned.
- To be safe.
- To be designed to minimise impact noise.
- To be designed to reduce foot noise where pertinent.
- Electrostatic resistance (anti-static) where required (e.g. comms rooms and some labs).

Floor finishes *are to be* selected according to the density and frequency of traffic. The following *are to be* considered when selecting floor finishes.

4.36 Carpet

4.36.01. References

Key *Australian Standards* particularly relevant to carpet are as follows:

Preparation	to AS/NZS 2455.1 or AS/NZS 2455.2 as appropriate
Underlay	to AS/NZS 2455.1
Fire resistance	to AS 1530.3
Laying	to AS/*NZS 2455*.1 or AS/*NZS 2455*.2 as appropriate
Wear and abrasion	to AS 2001.
Electrical resistance	within the range of surface resistance specified in ***AS 4155.6***

4.36.02. Carpet Tiles

Carpet tiles *are to be* used in lieu of broadloom carpet, with the following exceptions:

- In stepped teaching spaces, and where using carpet on stairs.
- Broadloom carpet may be considered in high profile areas.

Carpet Tiles will be:

- Heavy duty.
- Preferably Solution Dyed Nylon.

4.36.03. Broadloom Carpet

Broadloom carpet will be extra heavy-duty commercial grade with minimum wool content of 80%. Carpet will be minimum weight of 40 oz/sq.m.

Carpet type and underlay must not produce a compression greater than 6mm under normal use.

TVOC emissions from carpet will not exceed: 0.5 mg/ m² per hour.

Carpet is to avoid heavily textured finishes where there is large pile height and variation, to avoid uneven wear and allow ease of cleaning.

4.36.04. Underlay

Quality heavy duty soft underlay *is to be* used for broadloom carpet such as animal fibre/jute or heavy-duty vulcanised rubber with backing of reinforcing.

4.36.05. Preparation

Suitably prepare substrates to receive all types of carpet or underlay as follows:

- Strip, clean and level substrate as required.
- Provide hard underlay if required.

4.37 Vinyl to Floor

Floor surfaces will provide non-slip serviceable attractive finishes appropriate for use in varying situations of wear.

Staff rooms, student common spaces, tea rooms and similar wet areas are to have hard surfaces (sheet vinyl or approved equivalent). Vinyl in lunchrooms may be restricted to a panel in the vicinity of sinks, dishwasher, fridge and other wet bench areas etc.

Finishes of higher durability should also be considered for wet and dry laboratory spaces.

Anti-static vinyl/marmoleum *is to be* considered for wet and dry and electronic laboratories and IT/Comms Rooms.

Fire indices and performance are to comply with the relevant Australian Standard.

4.37.01. Performance Requirements

Non-slip vinyl with an R10 rating to be used on the floor of all wet areas including kitchens.

Heavy wear areas or wet areas may require higher level specification, or alternative finish.

Skirtings to vinyl floors will be 150mm high feather edge vinyl skirting.

Wet laboratories will have sealed coved vinyl skirtings.

4.38 Painting

Painted surfaces will provide serviceable attractive finishes with

Paint used will be high quality, long lasting and durable. Finishes of higher durability should also be considered as alternatives.

Painted products and surface preparation are to comply with Australian Standards

4.38.01. Performance Requirements

Rooms without special requirements identified *are to be* painted with minimum specifications:

- **Walls: New walls**: Apply one coat sealer/undercoat and two coats low-sheen acrylic finish.
- **Timber doors and trim:** Apply one coat sealer/undercoat and two coats ‘enamel’ or ‘aqua enamel’ gloss or semi-gloss finish coat. Note that surfaces with an existing enamel finish will need to be recoated with enamel. A thorough sanding and preparation is also required. All painting with enamel *is to be* specified to be undertaken out of hours, preferably on a weekend to allow dissipation of odour

- **Ceiling**: Apply flat acrylic. New to receive one coat sealer/undercoat and two coats flat acrylic finish. For repainting, prepare as required and apply one or two coats of flat acrylic to achieve full depth of colour.

All repainting to receive preparation plus two finishing coats, or more if required, to achieve full depth of colour.

Heavy wear areas or wet areas may require higher level paint specification, or alternative finish.

Anti-Graffiti application will be applied to brick, concrete and other surfaces as directed by the *UPR*.

4.39 Colour and Finishes Schedule

Utilisation of colours to provide an environment that is vibrant and maintainable.

To embody *LTU* branding according to University requirements and *policy*.

Where colours outside of the *LTU* branding palette are proposed to be used, these *are to be* presented a Design Standard Deviation for approval.

4.39.01. Performance Requirements

The *Principal Consultant* is required to submit to the *UPR* a colour scheme and sample board for approval of all applied finishes, including recommendations for floor furnishings, carpet, upholstery, curtains and blinds. This schedule *is to be* submitted in sufficient time for confirmation of finishes and colours by completion of the Design Development Stage at the latest.

It is required that the *Principal Consultant* limits their choices to standard readily available materials, which will be clearly identified on the sample board. The approved sample board will remain the property of the *University*.

4.40 Environmental Branding Guidelines

The University has a set of colours for depiction of the *LTU* brand in *building* works. These typically would be used only as highlights in key areas. The document Environmental Branding Guidelines defines these colours and provides a guide to their use.

Where colours outside of the *LTU* branding palette are proposed to be used, these *are to be* presented as a Design Standard Deviation for approval.

4.41 Furniture Fittings and Equipment

4.41.01. Furniture

Loose furniture will be fit for purpose, safe in operation and ergonomically sound.

Furniture will be loose and not fixed to walls wherever possible.

A Furniture panel has recently been established by *LTU*. *Consultants* are to request details of supplies from *UPR* when selecting furniture to determine where selections can align with discounted models.

All new furniture needs to meet or exceed the Australian Industry Fire Index standard requirements.

The whole of life cycle for furniture will be considered when purchased. Furniture that is sustainably constructed and easily disassembled for recycling is preferred.

Recycled furniture will be considered prior to purchasing new furniture.

4.41.02. Performance Requirements

Furniture supplied *is to be* fit for purpose and of a robust, sturdy construction and material. Fixings, connectors and connections between elements of an assembled unit need to be safe and of a hard-wearing material. Furniture is to conform to all codes above for strength and durability.

The product needs to be easily disassembled and the components recyclable.

Manufacture *is to be* preferably Australian.

Furniture should be able to be cleaned easily.

4.41.03. Consideration of Furniture Procurement

Procurement of loose furniture is to adhere to the following criteria

- All items are to have a minimum of 5-year warranty, preferably 10 years.
- Total VOC limit should be 0.5 mg/item/hr.as per ISO 17025.
- For all loose furniture items:
- The product is certified for its environmental merit by a third party, recognised by the Green Building Council of Australia (GBCA) under its Product Certification Scheme.
- OR
- The products are sourced from suppliers that have all of the following:
- Environmental Management System: The product's manufacturer must have an ISO 14001 certified EMS.
- Product stewardship: The product's manufacturer must have a contractual arrangement to take back the items at the end of their service life for re-use, recycling or re-processing.
- At least 90% by mass of the product will readily be able to be disassembled
- OR
- The products may have been previously used.

4.41.04. Teaching Facilities General Requirements

Teaching spaces will utilise furniture enabling maximum flexibility of use of space, such as moveable and nestable/stackable.

Wet Teaching Laboratory layouts vary with science *pedagogy* - from fixed, serviced perimeter benches to flexible island tables.

Generally, a table, lectern or flexible equipment station will be provided for the lecturer.

Seats for lecterns will be at a height to enable correct ergonomic sitting at the lectern.

For Wet Laboratories lecturers may require a fully serviced demonstration station.

La Trobe University Financial Procurement have recently appointed a furniture supplier panel that have met minimum prerequisite requirements and provide furniture at agreed rates. That have been discounted for La Trobe *consultants* and *contractors* are to review supply lists and adopt as an initial. Design response variance from this process is via a *Design Standards Variance* submission.

4.42 Workstations

4.42.01. Systems Furniture Workstations

These are workstations of modular or systems components that are easily assembled and dissembled as needs change. Requirements for Workstations are as follows.

- To be flexible, freestanding movable systems.

Standard Sizes

- Staff:
- Rectangular, 1800 to 2100 mm long, 700 to 800mm deep. Assigned hot desks to be minimum of 1500 x 700mm.
- Post Graduates
- Rectangular, 1500mm (min) to 1600 (optimum), 700 to 800mm deep.
- Standard desk height to be 720mm.
- Work surface to be constructed of laminated board, 25mm minimum thick with laminate finish to both sides. Gloss finish not permitted. Workstations that *are to be* used with Mac mice are not to have light laminate finishes. Supports and any framing under the bench *are to be* provided as necessary to provide a strong work bench

- without movement, wobble or bowing, to support a computer screen pedestal (if required), and to allow free leg room. Maximum deflection of all workstations to be as prescribed in Codes AS 4442 and AS 4443. Metal framing *is to be* powder coated.
- To have 2mm high impact ABS edge strips to exposed edges. There will be no sharp edges.
- To be adjustable onsite for true horizontal install.
- To have baskets or trays beneath for cables, that are easily accessible, such as two vertically, or one with 200 min clearance above to all obtrusions.
- Workstations are not to be fitted with adjustable keyboard panels unless a specific need is demonstrated and approved by the *UPR*.
- Modesty panels *are to be* provided to stand alone workstations (not backing another workstation or a wall), adjacent to a full height window, external or internal, or where required.

4.42.02. Shelves

Standard Workstations

- Shelves will be fixed to the work top, with 270 min clearance under. Lever arch files *are to be* able to be accommodated on the shelves.
- When attached to screens, a shelf facility is to have 320 mm minimum clear under when to the side of a computer screen. The shelf may have 600 mm clear under to clear computer screens, in which case will be full width of workstation screen, and the screen will be high enough to accommodate shelf support. Lever arch files *are to be* able to be accommodated on the shelves. Shelves used with workstations are not to be fixed to walls. Shelves not full width *are to be* maximum width whilst allowing computer screen to be comfortably accommodated and to be adjustable on desk top.

Post Graduates

- When attached to screens, a shelf facility *is to be* provided, to allow 600 mm minimum clear under lowest shelf. Two shelves horizontally *are to be* accommodated. Lever arch files *are to be* able to be accommodated on the shelves. Shelves and screens are not to be fixed to walls. Shelves *are to be* maximum width whilst allowing computer screen to be comfortably accommodated under and to be adjustable on desk top.

4.42.03. Dividing Screens to System Furniture Workstation

Standard workstation dividing screens are to adhere to the following:

- All components of the workstation structure, including screens, *are to be* thoroughly integrated to provide a strong, stable, unit.
- Frames to screens, where used, *are to be* powder coated metal.
- Screens are to have standard fabric finish, preferably with genuine pinboard. Maximise pin able surface to be over screen face.
- Preferred heights:
- For general staff functions is 1200 - 1250mm from finished floor level.
- For Post Graduates is 1600 - 1650mm from finished floor level.

4.42.04. Fitments

Hampers (Hutches), if used, *are to be* screen mounted, compatible with the system and screens must be capable of withstanding imposed loads. Metal (powder coated) *is to be* provided where used. Provide tambour shutter or hold open device to provide safe enclosing of hamper. Locks to be provided as required and agreed with client.

Screens *are to be* able to have rail systems to accommodate additional shelves such as paper and stationary shelves. These shelves *are to be* provided according to *project* requirements. These *are to be* an integral part of workstation/screen system, preferably powder coated metal.

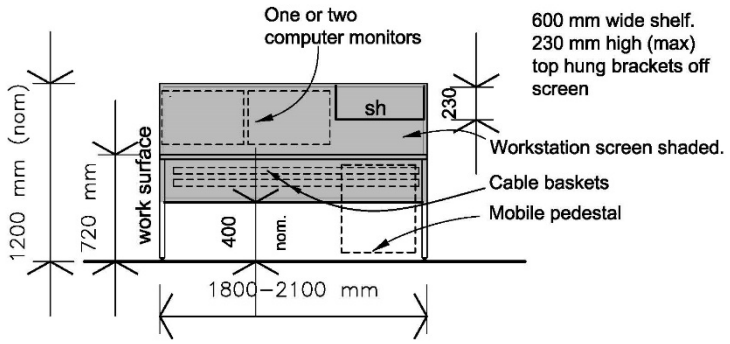
4.42.06. Standard Workstations

The configurations below are defaults for use through Administration and Post Grad/HDR areas. Variations to these may be provided where needs are demonstrated to the *Project UPR* for other arrangements, but which must still conform to the requirements of the *Design Standards* elsewhere.

Variable factors to consider in determining design include:

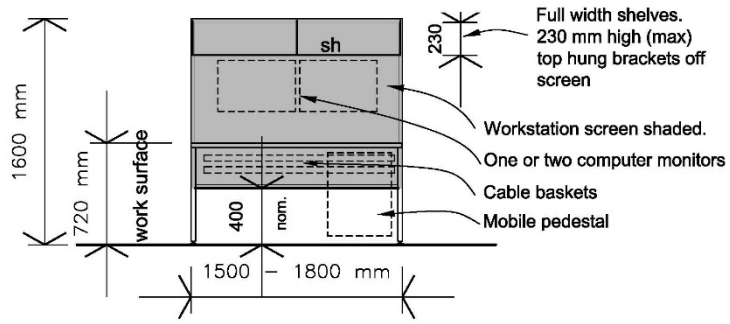
- The use: Administration or Post Grad/HDR.
- How many workstations *are to be* variable height.
- If one or two monitors *are to be* provided.
- The amount of shelf space that *is to be* provided.
- If "Vari-desks" *are to be* used.

Option 1 – Standard workstation – ADMINISTRATION



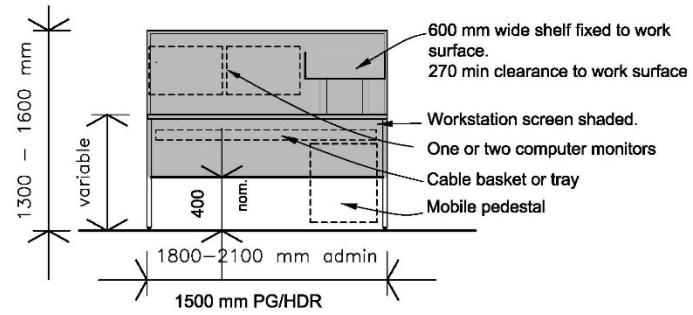
- Fixed height work surface
- Generally, 1500 mm wide for PG/HDR, 1800, wide for administration

Option 2 – Standard workstation – ADMINISTRATION or POSTGRADUATE/HDR



- Fixed height work surface
- Generally 1500 mm wide for PG/HDR, 1800, wide for administration

Option 3 – Standard workstation – ADMINISTRATION or POSTGRADUATE / HDR



- Variable height work surface may be mirrored.

Fig 20. Workstation types

4.42.07. Sit / Stand Workstations

Provision for work stations adjustable from sitting to standing heights may be considered can be achieved by the installation of a Varidesk (model Proplus 30 for single screen, model Proplus for dual screen). In this way workstations screen height is not impacted by the use of the Varidesk.

At times it might be appropriate for a staff member to request an electronic sit stand desk. The screen height needs to remain at the same height through the area, when adjustable height work surfaces are used. Adequate power facilities will need to be provided for mechanical adjustment. A request by a staff member for one of these desks over and above a Varidesk must be accompanied by an application to and subsequent sign off by a team member from Health, Safety & Environment, Human Resources.

4.43 Desk

Desks in this document are typically standalone units in cellular offices without dividing screens or panelised structure, with work surfaces, and that *are to be* able to support computer monitors if required. The following will be observed:

- Knee and leg space under are required, in all directions from the sitting positions, to allow free leg movement without obstruction.
- Desks *are to be* sized to accommodate all tasks, including use of computers and monitors. Standard size is 800 deep and x 1800-2100 long (staff) and 1500-1800mm long (post graduates). Desks may have attached drawers as required.
- Standard height to be 720mm.
- Modesty panels *are to be* integrated where required.
- Desks are not to be fitted with adjustable keyboard panels.
- Returns may be provided to desks in cellular offices (staff) only

4.44 Mobile Pedestals

- Mobile pedestals will be fit for purpose, for general administration, hot desks, postgraduates or other uses.
- Mobile pedestals will generally be fitted with two narrow drawers at the top, and one large draw at the bottom, capable of taking hanging files, or personal belongings.
- Generally, all drawers *are to be* lockable, keyed alike within each unit, with units being keyed differently. Alternative locking arrangements as agreed with the *UPR* can be adopted.
- Ensure carcase has non-tilt feature, when drawers fully loaded and opened, and of strong and robust construction.
- Ensure handle / drawer pull design will not cause injury to user.

4.45 Seating

4.45.01. Chairs

Samples *are to be* provided where required. Where possible, consultation with users *is to be* undertaken.

Fabrics

- Generally: to be commercial upholstery grade, selected for appearance, stain, fire resistance and durability. Tight weave fabrics are recommended and must be recommended by the manufacturer for the intended purpose.
- Abrasion Test: Minimum of 50,000 rubs, Martindale test.
  Protective Treatments: “Scotchguard” or similar approved may be applied.

4.45.02. Task Chairs

- To have adequate padding and be large enough for all intended users.
- To be ergonomically designed with adjustable back (height and tilt), tilt seat and have seat height adjustment (gas lift).
- To have five-star base with castors and swivel.
- To be fully upholstered or include a quality durable mesh back (including lumbar support).

- Arms (optional), *are to be* fully adjustable in administration areas, and are to not interfere with ergonomics of sitting at work surfaces.
- Note footrests may need to be provided in administration areas in certain cases for smaller people.

4.45.03. Teaching Chairs

Student Chairs-General

- May be task chairs, with legs or with other solid bases.
- To have minimum of `medium height' back. Generally speaking, a medium height back chair supports below the shoulder blades with emphasis on the lumbar region. Small back chairs finish near the lumbar region.
- Preference for chairs to collaborative spaces is to have 5-star swivel bases, although other types as below are acceptable (e.g. if nesting is a requirement).

- Solid Base
- Generally, to have fixed bases such as sleds or with legs. Legs *are to be* greater than 16mm in diameter steel tube.
- Castors may be considered for legs, but to be robust and hard wearing.
- To be able to be stacked or nested. Where stacking of chairs is to occur, supply of mobile storage cradle should be considered for ease of moving. These will be as supplied or recommended by chair manufacturer.
- Chairs may be upholstered, semi upholstered or of a 'hard' finish, but will be shaped for a high level of comfort and support.

4.45.04. Lecture Theatre Seating

To lecture theatres with sloping or tiered floors.

General

- Lecture theatre seating systems are to have a 10-year minimum warranty.
- Seats to be fully tilt up mounted.
- Fixed seating *is to be* preferably staggered with respect to the seats in adjacent rows.
- Tilt up seat and tablet folding action to make no distinct sound.
- Finger traps to be eliminated wherever possible.
- Armrests to be ergonomically designed and conform to Australian Standards.
- Seat and back to be ergonomically designed & conform to Australian standards.
- Positioning of seats in relation to tier risers is to avoid any *hazard* and to minimise gaps between the seat back and riser.
- Seat centre to centre minimum to be 550mm.

Seat Back

- Seat back: To be fully upholstered to front and sides, with minimum 75mm polyurethane foam and fabric over moulded inner support with adequate lumber supported ergonomically designed.
- Back of seats to have moulded plastic hard shell cover.

Seats

- To be tilt-up, fully upholstered and have minimum 75mm polyurethane with fabric over moulded inner support.

Writing Tablets

- To be approximately A3 size, durable, robust and suitable for supporting laptop computers and full-sized conference binders without noticeable flex. To be supported by means of a solid steel non-deformable swivel joint on armrests. To be ergonomically designed for left- and right-hand users.

4.45.05. Visitors Chairs

- Generally, to be cantilevered or sled. Legs are acceptable where they are of heavy-duty design (greater than 16mm dim steel tube). Arms optional.

  To be of robust construction, and co-ordinated with adjacent furniture.

4.45.06. High Chairs

- Uses include working at counters, high teaching tables and lab benches.
- Chairs may be on castors and swivel if appropriate. Chairs for vinyl or linoleum to be designed to minimise unwanted movement, such as using rubber castors or other mechanisms.
- Chairs must not tilt with general use or moving around when on castors.
- Provide a foot rest, preferably a ring.
- Seat and back must be ergonomically designed.
- Arms are optional and are to not interfere with ergonomics of sitting at work surfaces.

4.45.07. Common Room Chairs

- May be of hard finishes, soft finishes, or a combination.
- To be easily cleanable.

  Informal and 'lounge' furniture may be used.

4.45.08. Seminar/Meeting Chairs

- To be robust and easy to move. Arms optional.
- May have fixed legs/sleds or be swivel with full ergonomic design as above.

  To be padded and provide a high comfort level for extended sessions.

4.45.09. Waiting / Reception Chairs and Furniture

- Waiting and reception furniture may be selected with design and character reflective of the profile of their area.

4.46 Tables

Sharp edges *are to be* minimised and use within rooms *is to be* as flexible as possible. Generally, there will be no laminate edging. Tables may be of various sizes and shapes according to use.

4.46.01. Teaching Tables

Tables for teaching will be fit for purpose.

- Ergonomically designed
- Consider teaching methods, integration with technology, room size and shape.
- Be easily movable to provide for flexible room layouts.

4.46.02. Flip Top Tables

The outline below is for new tables generally for standard collaborative (or flexible learning) teaching. Note additional provisions may apply to the more elaborate collaborative rooms.

- Nominally rectangular 1500 x 750 or 1600 x 800mm (optimum). To seat 5 typically, although 6 will be possible with the structure discussed below. Height to be 720 mm. To form a square when placed next to each other. Size per room may vary and *is to be* assessed and selected in relation to main layouts possible in the intended rooms. Specific uses, such as if they will only be used end to end (this is not encouraged, but there are instances where this is accepted), should be established
- Flip Top tables will conform to the following requirements.
- To have castors (lockable).

- To have tilt tops, and to nest together when tops are vertical. To be easily converted horizontal to vertical but be solidly secured when in the horizontal position.
- Leg structure at the ends to be inset approx. 250-300mm from end edge of table to allow sitting at the ends.
- To have 2mm ABS high impact edging to all edges.
- Work surface *is to be* laminated board, nominally 25mm thick, with laminate to both sides. Gloss finish is not permitted. Tables that *are to be* used with Mac mice are not to have light colour finishes (whites, "Parchment").
- *Consultants* are to liaise closely with *Information Services* to establish detail of all equipment for design of tables and other facilities.

4.46.03. Collaborative Tables with Computers

- Work surface to be constructed of laminated board, 25 mm minimum thick, with laminate finish to both sides. Gloss finish not permitted. Workstations that *are to be* used with Mac mice are not to have light laminate finishes (whites, "Parchment"). Client Departments *are to be* consulted for any additional requirements for space on work surface (e.g. note pads).
- In existing *buildings*, the running of cables to free standing tables will, where possible, avoid supply through the floor structure. Vertical supply to tables will be in purpose designed 'Umbilical ducts. Tables with power or data being run to them will be fixed to the floor.
- Ensure worktop surfaces are compatible with mice being used, in particular with Macs with wired mice. These need to avoid the very light colours (whites).

4.46.04. Meeting Room Tables

- Tables for meeting rooms can be with or without castors but should be able to be easily moved where appropriate to the design of the room.

4.47 Whiteboards

- As a minimum, a whiteboard *is to be* provided at or near the wall of the teaching room receiving projection. A minimum of two whiteboards *are to be* provided to larger rooms (60m2 or over). More should be provided for collaborative teaching spaces, with a whiteboard surface available for each main table area.
- Boards *are to be* positioned so writing can be seen from all areas of the teaching room.
- Generally, boards *are to be* fixed horizontally, a maximum of 900mm from the floor. Typically, whiteboards *are to be* 1200mm high with a ledge for markers. Larger writing surfaces, such as extending across a section of the wall or to the floor are acceptable.
- All laboratories will have white boards, pin boards, or magnetic boards. Smart boards and related interactive digital data technologies may be required, in particular labs.

4.48 Informal Areas

These areas typically:

- Include casual use.
- Are for informal and social learning and interaction, for self-directed learning.
- Include breakout space to formal learning areas.
- Range from individual use to facilities supporting group interaction, and with the spaces ideally supporting a variety of uses and technologies.

Furniture Requirements

- Easily movable.
- Provide motivation to students for involvement in activities within the spaces.
- Suit a variety of types of group sizes and types of interaction.
- Suit the types and ranges of technologies in the spaces.
- Suit flexible use of spaces.
- Be easily cleanable.
- Be strong enough to withstand the modes of use.

4.49 Storage

Units *are to be* standardised as much as possible within an area.

Shelves in all types to be adjustable where possible or specified and must have no discernible deflection when fully loaded with paper-based store. Supports to adjustable shelves to be metal to metal: spigots fitting directly into particle board are not acceptable.

Doors to storage units *are to be* lockable, unless agreed with Client.

At Workstations and Desks

- Storage units can be provided adjacent or near workstations. Metal carcass, Tambour type units or cupboards with sliding doors. Doors to be lockable. Provide type of storage shelf as required. E.g. shelf, hanging files etc.
- Height would be considered as to amount of storage required and to the relationship with workstation screens and other furniture, but not be higher than workstation screens.

Tall Shelf Units

- Standard tall shelf units (typically for general office storage) *are to be* fixed to walls. Top of unit to 2100 mm max. (top of unit not to be used for storage). Metal carcass, Tambour type units with adjustable metal shelving.

Compactus

- The capacity of the floor design load for the compactus fully loaded *is to be* confirmed prior to installing in an existing *building*, or specifically designed for in a new *building*.
- Rails are not to be exposed as trip *hazard*. Ramp floor up to rails if they are exposed.
- Bays *are to be* able to be moved safely and freely by one person. Safe operating procedures and methods *are to be* observed in use of a compactus. Mechanisms for moving bays *are to be* fit for purpose in terms of size and loadings. For example, large heavily loaded units should have wheel mechanisms for moving bays. Refer to "Officewise - A Guide to Health and Safety in the Office" (Worksafe).
- Where safety of users is at *risk* with operation of bay movement, appropriate safety devices such as sensor and locking mechanisms (for bays) *are to be* considered.
- Display appropriate signage to ensure correct operation for the installation and warn against closing the compactus on workers working within.
- Compactus may be lockable where required and approved by the *UPR*

4.49.01. Waste Receptacles

Internal bin and recycling bin and enclosures will be according to the Waste and Recycling Bins System Guidelines.

4.50 Blinds

Blinds (generally internal) will be used for control of light and solar penetration where required. Typical areas requiring blinds include teaching areas, research laboratories and administration areas.

Roller blinds are the preferred type (mesh and blockout acceptable depending on requirements).

4.50.01. Performance Requirements

- The degree of blockout will be co-ordinated by the *UPR* and *Consultants* in conjunction with any Projection and lighting system requirements.
- Certain conditions such as in various laboratories may require full blackout. This will achieve full light rejection using full blockout blinds, pelmets and enclosing tracks as required.
- Motorised blinds can be considered where the amount of glazing (width or height or both) may be required. If motorised blind systems are installed in teaching areas, their controls should be incorporated into the *AV* control system. Time for motorised blind closure should not exceed 20 seconds.

4.51 Fittings and Fixtures

In general, fittings and fixtures *are to be* easily cleaned and maintained. Purchase of fittings and fixtures are to consider on going supply of parts and support base.

4.51.01. Performance Requirements

- Fixtures and tapware will conform to the WELS (Water Efficiency Labelling Standards) and the following maximum flow rates:
- Showers: 7.5 litres/minute, or 3 stars, whichever is the more stringent.
- Hand Basin Taps: 4.5 litres/minute, or 6 stars, whichever is the more stringent.
- Sink Taps: 6.0 litres/minute, or 4 stars, whichever is the more stringent.
- Toilets: Dual Flush 3/4.5 litres.
- Urinals: Low water use (<1.0L/flush) with sensor or timed flushing in heavy use areas. Waterless urinals are not permitted.
- Provision *is to be* made for all required vandal resistant features to fixtures and tapware.
- Flusher valves of the dual flush, soft touch type will be provided for water closets. Cistern flush systems are not be used where a flusher system exists or can be incorporated in the design, unless otherwise indicated in the *Project Brief*. Flusher valves *are to be* 'Zurn'.
- Flusher valves will be used for urinal flushing. Cistern flush systems are not be used unless otherwise indicated in the *Project Brief*.
- Taps *are to be* standard jumper valve or ceramic disc with quarter turn isolation stops. Jumper valves *are to be* 'Aqualoc' where possible
- Tapware selection must consider the available water pressure. For example, care must be taken with mixer tap selection as some existing *buildings* have low pressure hot water systems.
- In high use toilets, taps *are to be* automatic.

4.52 Door Hardware, Locks and Keying

LTU hardware and locking systems are self-maintained and will conform to *LTU* requirements.

Door locking will be configured in such a way that there is no possibility of people being locked inside *buildings* once they are made secure.

External doors and openings will be designed to be effective against intrusion.

The *Principal Consultant* is responsible for co-ordinating door furniture, locks, and Access Control System in accordance to the *Design Standards*.

All electronic access systems installed must have a "key override" capability on the University keying system to allow access. This key is restricted to I & O and Security emergency personnel to ensure that the electronic access system lock is not by passed and the integrity of the room is not breached.

4.52.01. Performance Requirements

- Automatic door mechanisms must be readily available, have readily available parts, be strong in construction and have options that suit the Gallagher access system.
- Glass doors must be of strong construction, and potential finger jambs be avoided in the design.
- Doors to fire hose/reel cabinets will be painted and sign written to comply with the Commonwealth Fire Board Specifications and AS1319 - other adjacent signage *is to be* in consultation with *I&O FAS*. All fire doors to be fitted with lock and cylinder to code 003, where required.
- In general, glass doors will be aluminium framed, although frameless are acceptable in prominent locations (e.g. entrances).
- All office and shower doors will be fitted with coat hooks.
- All doors will be fitted with at least two equally spaced heavy-duty door hinges. For doors over 2030mm, min of three equally spaced hinges will be fitted.
- Doors are to have lever handles. Backsets to door handles *is to be* a minimum of 50 mm. This is from the centre of the spindle of the handle to the face of the door stop. Note that this might require a wider stile to the door at the handle.

4.52.02. Melbourne (Bundoora) *Campus*

General

- New master keyed cylinders are to be the University's Bilock System registered as 5E142
- Door Locks *are to be* Lockwood 3572 Mortise Lock.
- Door furniture *are to be* Lockwood 1800 series.
- Padlocks *are to be* Lockwood 334B/45/shank size to suit.
- Digital locks *are to be* Lockwood 3572 with key override cylinder.
- Deadlocks *are to be* Lockwood 002 Deadlatch (lever type handle).
- Cabinet Locks *are to be* Focus with L + F key system.
- Door closers *are to be* Dorma or similar.
- Window winders *are to be* Whitco – short chain (150mm opening).

For Refurbishments

- Large area refurbishments that have Lockwood 500 series locks *are to be* changed to Lockwood 3572 Mortise locks.
- 20305 + 20201 series plates are to hide the hole left in the door after 500 series are removed.
- In major refurbishments, if the door closers are not as specified in this Design Standard, they *are to be* changed to closers as specified in this Design Standard to suit the door.
- If replacing double hung windows with new, contact *UPR* for details.

Master Keys

Master keying on all *Project*s for property maintenance and services areas will be Bilock Series as follows:

- Plant Rooms: Bilock System 5E142 : Series 1D
- Bollards and Gates: Bilock System 5E142 : Series 2A
- Switchboards: Bilock System 5E142 : Series 1B
- Roof Access: Bilock System 5E142 : Series 1A
- Service Tunnels: Bilock System 5E142 : Series 1F
- Communications Room: Bilock System 5E142 : Series 1M
- Cleaner's Cupboard: Bilock System 5E142 : Series 1C
- All external entrance doors must be fitted with the "Gallagher" access system compatible with the University's La Trobe Card, and Abloy lock. The system will be supplied and installed by La Trobe University's approved *Contractor*.
- Refer to the University Security Services Brief for details of electric strikes electric mortice locks and Magnetic locks.
- Access controlled doors with electronic or magnetic locks must be fitted with emergency egress facility and key override cylinder: Bilock System 5E142 : Series GGM1
- The University will provide special lock cylinders for high-tension electrical substations where applicable. Contact the *I&O* Engineering & Compliance Manager through the *UPR* for details.
- All external and internal fire hose/reel cabinet construction will be in accordance with Australian Standard AS 2441-2005 (most recent upgrade/amendment).

- No new floor springs *are to be* fitted to new or existing doors. Doors requiring work in areas receiving works are to have floor springs removed, floor made good, and a closer fitted to suit.

4.52.03. Regional *Campus*es

All service shafts, plant rooms and switchboards are on restricted key profiles. Liaise with the Regional *Project* Manager for keying details.

4.53 Wall Stripping

Stripping on shelving is to provide safe storage and safe usage.

4.53.01. Performance Requirements

Minimum requirements are as follows,

- Stripping *is to be* at 600mm max centres with the top shelf at 1800mm maximum height. Shelves *are to be* maximum depth of 250mm and minimum thickness of 18mm with timber/particle board/MDF products.
- Shelving *is to be* installed at a true horizontal line.
- Provide secure fixings into studs, structural members or masonry walls at all fixing holes in stripping.

4.54 Drinking Fountains – Internal

Internal drink fountains *are to be* built in and refrigerated. In general, there will be one drink fountain per floor, and near common areas.

Working and serviceable parts should be fully accessible for all maintenance. Units fitted within a wall should have an access panel providing adequate access.

Drinking fountains will have power, cold water and sewer connections.

Drinking fountains will cater for wheel chair use.

4.55 Vending Machines

All vending machines will be located such that they do not detract from the appearance or amenity of *LTU buildings*.

Vending machines *are to be* used indoors and located near areas of high student use, including informal learning spaces.

4.55.01. Performance Requirements

- Vending machines may be noisy in operation and emit considerable amounts of heat. Locate them in a way that controls visual, acoustic and thermal issues associated with their function.
- Vending machines *are to be* provided with power and data lines as required. Data lines *are to be* run through the University network as arranged with *Information Services*. The *UPR* is to confirm arrangements for supply and installation of any vending machines.
- Vending machines will not be placed in corridors where the predominant width of the corridor is reduced.
- An internal space will be provided to accommodate vending machines and drinking fountains within each *building*, in public areas easily accessible by students e.g. in corridors and foyers and near informal leaning areas. Levels 1 and or 2 will be levels considered for vending machines. These are areas are to also incorporate recycling and waste management facilities. Final locations of the vending machines *are to be* co-ordinated by the *UPR* with the Procurement Category Manager, Finance

4.56 Art Works

The University is in a very privileged position to display local, national and international works of art from within its extensive collection. *Project*s provide an opportunity to crate spaces to display the Artwork in its many guises e.g. paintings, sculpture, memorabilia, collections, etc.

As part of the design of a space consideration *is to be* given to:

- Maximising opportunities to display components of the University's extensive art collection.
- Create environments that are conducive to those that are optimum conditions for displaying a variety of artwork in its many forms.

Consideration of elements beyond the physical display space is to include but are not limited to the following:

- Lighting (natural, artificial, orientation, task, impact on materials, etc)
- Thermal comfort (heat, cool, humidity)
- Security (passive and active surveillance, physical containment, physical barrier that prevents but permits visual connection).

Where artwork already exists in an area designated as a *project* space, the *UPR* is to liaise with the La Trobe Art Institute to determine whether it should be re-used or replaced.

4.57 Signage

Signage is to provide functional information on locations and way finding for all persons on *campus*, including:

- Cycling and pedestrian infrastructure, speed limits, directional instructions and/or other information to enable safe use of the infrastructure and promote an active lifestyle.
- To ensure that signage promotes the *LTU* Brand.
- To improve rather than detract from the *campus* environment.
- For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 9.1** – Active Lifestyle.

Signage to *buildings* on *Primary Routes* will be lit, either inherently or passively sufficiently to ensure legibility.

4.57.01. Performance Requirements

Signage will conform to the Signage Style Guide.

Refer to Environmental Branding Guidelines for details of required branding.

4.57.02. Room Signage System

Primary Room Signage

Primary door signs (D1) and (D2) are an Aluminum frame with paper inserts and clear acrylic cover. Frames are available through the *UPR*.

Secondary Room Signage

Secondary door signs (D3), are a small plate with vinyl lettering-refer to the Signage Style Guide for detail. Cupboards with existing secondary numbering will only be re-signed with agreement of the *UPR*.

Teaching Facilities

Signage to outside teaching spaces should observe the Signage Style Guide additional high-level signage may be required for visibility if the line of sight is obstructed or likely to be obstructed at peak times.

For Wet Labs safety messages for required Eyewear, Footwear Emergency Stop, Chemical and other *Hazards are to be* located at appropriate points for universal vision.

Exit signs are required to all egress points.

4.58 External Works

External works are to provide best practice urban design in development of external areas, recognising particular requirements of various environments, adjacent to *buildings*, in spaces between *buildings* and in separate external environments.

To preserve and enhance bio-diversity in *campus* environment and to complement existing neighbouring habitats.

- *Primary Routes* will comply with the requirements of Disability (Access to Premises — Buildings) Standards (current).
- Consideration of relationships between *buildings* and external environments. This includes:

  - design for the elements: sun, wind, rain
  - spatial scale and relationships
  - pedestrian and vehicular flow
  - visual character of differing areas

- Pedestrian crossings *are to be* designed in accordance with Australian Standards and DDA requirements.

4.58.01. Performance Requirements

- Primary and *secondary routes are to be* illuminated to *LTU* requirements.
- Kerbs should not present barriers to pedestrians, prams or cyclist movement paths.

4.59 Accessible Parking

- Provide accessible set down locations close to the main entrances of *buildings*, major pedestrian routes, and undercover wherever possible, to Australian Standards.
- Travel paths to *building* entrances needs to be Disability Discrimination Act (DDA) compliant continuous paths of travel.
- Accessible set down point facilities will be maintained through refurbishments when sections of the *building* are still in use.
- Accessible set down points will be adequately lit for night use.

4.60 Drink Fountains - External

Drinking fountains will be provided throughout the core of *LTU campuses* at sites approved by *I&O FAS* Sub Heading Topic 3.2.2

Drinking fountains will be disabled compliant. They will cater for wheel chair use.

4.60.01. Performance Requirements

- The area around the base of the drinking fountain is to match adjacent ground surface
- External drinking fountains to have cold water and sewer connections.
- All drinking fountains will have bottle filling taps in addition to a bubblier, and cartridge filter.

4.61 Bicycle Provisions

Provide sufficient bicycle parking space and bicycle facilities to meet demand.

Encourage people to ride to the *campus* rather than use cars.

- Bicycle storage will be provided with secure storage facilities and unsecured with hoops in various places throughout the *campuses*.
- Storage provisions will minimise damage to bicycles and provide easy access for all users.
- Storage will be distributed around the *campus* for convenience and will not be provided on a *building*-by-*building* basis.

4.61.01. Performance Requirements

- Bicycle hoops will be located under shelter and provided within close proximity from each *building*.
- Stand-alone secure bicycle facilities will include or have immediate access to adequate lockers and showers for users.
- Bike enclosures to be provided around *campuses* according to *campus* planning requirements. These are to:
  - Be covered with open metal mesh to outside
  - Be provided with card swipe access.
  - Change facilities and showers and lockers.

4.62 Concourse Area Through *Buildings*

Ensure that the functional requirements of the concourse area do not clash with the functional requirements of the *building.*

Where a concourse *area* runs through a *building,* it must not adversely affect climate control to habitable areas of the *building*.

4.62.01. Performance Requirements

The treatment of concourse areas that will pass through a *building* (new or refurbishment) should be discussed with the University to ensure that a satisfactory sense of flow is maintained and that the relationships between the new and existing is satisfactory. Security control of these areas in relation to individual departments on each level within the *buildings* will also be subject to detailed discussion with the *University*.

4.63 Waste and Recycling Bins

Waste and recycling bins *are to be* in accordance with the *Waste and Recycling Bin System Guidelines*.

Job specific bins surrounds may be used following approval by the *UPR*.

Ensure easy access to bins

Manufacture is preferably Australian

Section 5.Services Engineers

5.01 Mechanical Services

5.01.01. General Design Considerations

Mechanical Services will be designed:

- to suit the intended application, location and climate condition.
- to maximise energy efficiency and minimise associated greenhouse gas emissions from the operation of the mechanical heating, ventilation, and air conditioning (HVAC) plant.
- with modularity and flexibility for change.
- to enhance indoor air quality.
- to minimise operational and maintenance costs.
- to respond to the *buildings* usage pattern, in accordance with the current *NCC/BCA* Volume 1 - *NCC* 2014, Section E, E2 Smoke *Hazard* Management, Deemed-to-Satisfy provisions including referenced standard AS/NZS 1668.1. In addition, miscellaneous systems not required to operate in fire mode will also shut down upon receipt of a general fire alarm signal from the fire indicator panel.
- in accordance with the current *NCC/BCA* Volume 1 - *NCC* 2014 Section J, J5.2 Air-conditioning and ventilation systems, Deemed-to-Satisfy provisions as a minimum; and more stringent energy efficient requirements for particular items as described herein.

All plant and equipment will be:

- of high quality and be constructed from high quality materials.
- designed for the environment in which it will be installed.
- corrosion resistant.
- fully weatherproof where installed outdoors.
- compliant with minimum energy performance standards (MEPS).
- compliant with all required codes and standards applicable to the item, its environment and its intended application. environmental performance will be as per *Project Brief*.
- fit for purpose for the application and environment in which they are installed.
- provided with safe and convenient access for maintenance.
- readily maintainable with minimum disassembly required for routine cleaning and maintenance activities.
- supported locally (within Victoria) with respect to service and spare parts.
- complete in all respects to allow full functioning of the item or system.
- compatible with all other items with which it must operate with or interface to.
- accept a standard Australian electrical supply as available via the *Local Authority*.

Whilst this design *Brief* further specifies the Mechanical Services systems to be installed, *LTU* will consider alternative configurations of plant on a case by case basis. The following system selection table *is to be* followed as a general guide for new *buildings* or major refurbishments. Refer to the specific *Project Brief* for details.

Table 5. Mechanical Systems High Level Summary

Under 2,000m²	Over 2,000m² - 5,000m²	Over 5,000m²
Air-conditioning Type		
• Variable refrigerant volume system • Ground source heat pumps • Roof top packaged units • Packaged units with integrated heat recovery • Ducted split system units (air cooled) Water cooled direct expansion fan coil units + condenser water loop with VSD on pumps	• Variable refrigerant volume system • Ground source heat pumps • Variable air volume terminals with air handling units + central thermal plant* • Mixed mode ventilation (mechanical mode as per above options)	• Variable air volume terminals with air handling units + central thermal plant • Chilled beam + radiant heating (if required) + central thermal plant • Underfloor air distribution + central thermal plant Mixed mode ventilation (mechanical mode as per above options)
Ventilation systems – as per relevant Australian Standard		
• Toilet exhaust • Tearoom exhaust	• Toilet exhaust • Tearoom exhaust	• Toilet exhaust • Tearoom exhaust Enclosed car parks - vehicle exhaust **AND** if over 20 vehicle spaces be controlled by an atmospheric contaminant monitoring system
Supplementary systems		
		• As per PCA Grade A, i.e. • General exhaust (min 0.1l/s/m² NLA) • Supplementary toilet exhaust (min 0.1 l/s/m² NLA) • Supplementary outside air (min 0.3 l/s/m² NLA) Tenant supplementary loop (min >=20W/m² NLA)
Controls		
Proprietary controller and DDC controller interfaced with *BMCS*	DDC or *BMCS*	BMCS

For Melbourne (Bundoora) *Campus* central plant options may or may not include connection to the high temperature hot water (HTHW) system. Refer to the specific *Project Brief* for details.

Teaching rooms and meeting rooms will where possible be serviced from independent mechanical systems, or managed zones to allow systems serving different areas to be shut down or operate at varying levels, when the rooms are unoccupied.

5.01.02. Performance Criteria and Design Parameters

For heating and air conditioning the following criteria will apply unless otherwise stated in the *Project Brief*.

5.01.03. Temperatures

General Air-Conditioned Areas

- Relative humidity: No specific humidity control. Anticipated 40 - 60% relative humidity by virtue of cooling coil performance.

Set points for temperature control will be adjustable over the following range using thermal comfort controls in accordance with relevant *Australian Standards*:

- 22°C deg +/- 2°C.

An adjustable dead band of at least 2°C will be provided across the set points.

The systems will be capable of maintaining the above internal conditions within the design parameters noted below.

The above set points will apply to offices, laboratories (unless there are specific requirements within laboratory spaces), classrooms, lecture theatres, etc. unless otherwise stated in the *Project Brief*.

The above conditions will be maintained during normal hours of operation for the following "comfort" conditions as per Table 1A from the AIRAH Application Manual DA9, "Air Conditioning Load Estimation and Psychometrics"

For critical process facilities the below ambient temperature values will be substituted with the "Critical process" values as per Table 1A from the AIRAH Application Manual DA9, "Air Conditioning Load Estimation and Psychometrics"

Ambient Conditions

Table 6. Ambient Conditions

	Melbourne (Bundoora & City *Campuses*)	Albury-Wodonga (Wodonga)	Bendigo	Mildura	Shepparton
Summer (Dry Bulb / Wet Bulb)	34.3°C /20.5°C	36.5°C / 21.6°C	35.3°C / 21.2°C	39.5°C / 21.4°C	36.4°C / 22.0°C
Winter (Dry Bulb)	3.5°C	0.1°C	0.7°C	0.8°C	-0.3°C

Heat rejection plant and equipment will be selected to continuously operate at the nominated capacity based on the above design conditions with an increase of +10 °CDB for air-cooled plant and +1.5 °CWB for evaporative based heat rejection.

5.01.04. Internal Heat Load Design Parameters

Table 7. Population Density

Area	Area (m²) per person
General office areas	10.0 or as per the seating plan, whichever is the higher density
Undergraduate study areas	4.5 or as per the seating plan, whichever is the higher density
Laboratories	3.5 or as per the seating plan, whichever is the higher density
Lecture Theatres	1.5 or as per the seating plan, whichever is the higher density
Libraries	5.0 or as per the seating plan, whichever is the higher density

Other areas: As per the seating plan or default figures as per AS1668.2-2012, whichever is higher density.

Ventilation (Outdoor Air):

- All areas: No less than the minimum values as a per AS1668.2-2012

  NB: Some *Projects*, particularly Green Star *Projects* may stipulate greater requirements than the minimum vales under AS1668.2. Refer to the specific *Project Brief* for requirements.

Lighting and Power

- Lighting Load: As per the lighting design density including an allowance for ballast losses plus 2W/m² allowance for fit out modifications.
- Equipment load (offices): 15W/m²
- Equipment load (other areas): Refer *Project Brief*

For new *buildings* or major refurbishments, the version of AS1668.2-2012 referenced in the current edition of the *BCA* as incorporated into the National Construction Code (*NCC*) will apply. For partial refurbishments within existing *buildings* the version of AS1668.2 referenced in the *BCA* applicable at the time of the *building*'s original construction will generally apply.

5.01.05. Plant Shut Down and Response Times

Mechanical plant or zonal control will, where possible, be connected to occupancy sensors, which may also be connected to the lighting or security system, to implement plant shut down or reversion (set back) to an 'idle state'. The time till such states are triggered will be programmable, but typically be 15 min with no occupancy sensor triggering.

Consideration must be given to the plant and equipment response time so that the thermal comfort criteria is achieved within a reasonable period. Particular attention will be given to the following:

- Start-up response time from the “off” state to the scheduled start time e.g. the target internal temperature should be achieved no more than one hour after the plant start time.
- Transient response time from idle state to occupied state e.g. where occupancy controls are used for temperature set back (or plant shut down) the target internal temperature should be re-established within 10 minutes.

5.01.06. Energy Efficiency

Mechanical services plant will comply with the deemed to satisfy provisions of the *BCA* Section J Energy Efficiency as a minimum, and improvements on the *BCA* benchmarks reproduced below:

Table 8. Improvements on *BCA* Benchmarks

Description	Improvement	Proposed work (*GFA*)
Maximum pump power	10% improvement	Over 5,000m²
Minimum thermal efficiency of a water heater	10% improvement	Over 2,000m²
Minimum energy efficiency ratio for packaged air conditioning equipment	10% improvement	Any
Minimum energy efficiency ratio for chillers<2000kWr for integrated part load value Water cooled Air cooled or evaporatively cooled	90% improvement 50% improvement	Between 2,000m² and 5,000m²
Minimum energy efficiency ratio for chillers>2000kWr capacity for integrated part load value Water cooled Air cooled or evaporatively cooled	50% improvement 25% improvement	Over 5,000m²
Minimum energy efficiency ratio for motors	10% improvement	Any

Comply with minimum energy performance standards (MEMPS) as applicable.

Refer also to the *Project Brief* for specific *Project* requirements.

5.01.07. Economy Cycle

Mechanical services plant will comply with the deemed to satisfy provisions of the *BCA* Section J Economy cycle as a minimum, and improvements on the *BCA* benchmarks in climates zone 4 to 8 when the air-conditioning system is more than 35kWr.

5.01.08. CO2 Monitoring or Energy Reclaim System

Mechanical services plant will comply with the deemed to satisfy provisions of the *BCA* Section J5.3 as a minimum, and improvements on the *BCA* benchmarks in other than climates zone2, where the number of square metres per person not more than 1 and the airflow rate is more than 1000l/s.

5.01.09. Teaching Facilities General Requirements

Motion activated zoned lighting and zoned indoor air handling units (where applicable) along with timing devices for *AV* equipment to be provided.

Where air conditioning is not provided to *Teaching and Learning* spaces, or where an existing space that has no air conditioning is being refurbished, ceiling fans should be installed.

5.01.10. Laboratory Requirements

Natural ventilation should be considered as a redundancy provision.

Supply air to suit *building* system generally with positive and negative pressure requirements to be considered, in particular laboratory environments.

Standard exhaust systems required for fume cupboards, including due regard for flume stacks and adjacent *buildings*.

Where air conditioning is required, provide laboratory heating, cooling to retain temperature and humidity within acceptable laboratory environmental range. Set localised controls for temperature and humidity (less than 60 percent) at set points in labs. Other conditioning to be as set by *BMCS*

5.01.11. Higher Degree by Research Students, Postgraduate and Staff Office Spaces

Thermal performance is to comply with Workplace Thermal Comfort Guidelines.

5.01.12. Air Handling Systems

Air handling systems will incorporate:

- Fully modulating economy cycle operation to allow 100 per cent outside air intake, when outside air conditions are acceptable.
- After-hours operation on a floor by floor or maximum of 1000m2 NLA basis, whichever is less. The operation of the after-hours system will include a minimum amount of equipment (pumps, fans, and the like) to provide comfort conditions.
- Incorporate after-hours operation of individual floors or zones not exceeding 1000m2 (NLA).
- Outside air intake(s) that are well away from cooling towers and public areas and have adequate security measures in place.
- Minimum outdoor air provision as per relevant Australian Standards. Alternatively, use of CO2 (carbon dioxide) or air quality sensing equipment to control outside air intake reduce the outdoor air quantity based on demand.
- Variable speed drives and high efficiency motors for fan motors

5.01.13. Packaged Air Conditioning

Variable Refrigerant Volume System

- Each system will consist of a series of fan coil units connected to a central condensing plant under a global control system to maximise system efficiency and heat recovery where applicable.
- Where fan coil units are connected to a common condenser the pipework and controls will be configured so that each zone is capable of independent heating and cooling at the same time.
- The system will be complete in all respects, insulated and installed to maximise efficiency, control noise and prevent condensation or leakage on external surfaces.
- Utilise non-ozone depleting refrigerant that is not subject to phase-out provisions.
- VRV system shall consist of 3-pipe configuration to obtain effective operations.

Rooftop Packaged Units

- Comply with minimum energy performance standards (MEMPS).
- Economy cycle to be provided for all units of more than 35kW nominal cooling capacity.
- Minimum of two steps of cooling or continuously variable capacity control.
- The system will be complete in all respects, insulated and installed to maximise efficiency, control noise and prevent condensation or leakage on external surfaces.
- Utilise non-ozone depleting refrigerant that is not subject to any phase-out provisions.

Ducted Split System (Packaged) Units

- Comply with minimum energy performance standards (MEMPS).
- Economy cycle to be provided for all units of more than 35kW nominal cooling capacity.
- Minimum of two steps of cooling or continuously variable capacity control.
- The system will be complete in all respects, insulated and installed to maximise efficiency, control noise and prevent condensation or leakage on external surfaces.
- Utilise non-ozone depleting refrigerant that is not subject to any phase-out provisions.

Split System (Non-Ducted) Units

- Comply with Minimum Energy Performance Standards (MEMPS). For clarity MEMPS specify the minimum level of energy performance that the unit must meet or exceed before they can be offered for sale or used for commercial purposes
- Provide continuously variable capacity control.
- The system will be complete in all respects, insulated and installed to maximise efficiency, control noise and prevent condensation or leakage on external surfaces.
- Utilise non-ozone depleting refrigerant that is not subject to any phase-out provisions.
- Incorporate integrated input/output card or add on controller to interface with the *building* monitoring and control system as applicable. Functions to include on/off control and general fault alarm output.

Water Source Heat Pumps / Water Cooled Package Units

- Comply with minimum energy performance standards (MEMPS).
- Automatic shut off valve to isolate condenser water to unit when not in use.
- Variable speed drives to be provided to all primary and secondary pumps.
- Heat rejection from the condenser water loop will be via one of the following means (in order of preference):
- Hybrid evaporative cooler: or
- Cooling tower with heat exchanger between the primary condenser water loop and secondary condenser water loop; or
- Fluid cooler with internal heat exchanger.
- Cooling towers and fluid coolers are not to be used for any *campus* other than Bundoora. In addition, cooling towers with open condenser water loop to the package units will not be used for any *campus* other than Bundoora.
- Heat injection where required will be via natural gas fired boiler or via heat exchangers from the HTHW system (Bundoora). If natural gas or HTHW are not available, then an LPG fired boiler will be used.

Ground Source Heat Pump

- Comply with minimum energy performance standards (MEMPS).
- Automatic shut off valve to isolate condenser water to unit when not in use.
- Variable speed drives to be provided to all primary and secondary pumps.
- Heat rejection from the condenser water loop will be into the ground water condenser water loop. Direct refrigerant heat rejection ground loops will not be used.

5.01.14. Air Filters

- Any individual mechanical supply air ventilation system incorporating heating/cooling coils or humidifiers, or both, will incorporate an air filter rated in accordance with the relevant standard. Such filters will be positioned before supply air fans and any coils or humidifiers and both the outdoor and recycle air will be filtered as applicable.
- NOTE: This requirement does not preclude the use of additional filters in other parts of the air handling system.
- Filter modules will be readily accessible and removable and will be securely held in position. Frames will be mounted so as to provide an adequate seal and prevent air from bypassing the filter media. The entire filter assembly will be adequately supported to prevent distortion of frames or media under all anticipated loadings.

Panel Type

- 25mm thick panel filters will be of the disposable dry media type. Filters will be designed to handle the specified total air quantities for each system with a face velocity not exceeding 1.7m/s, a maximum clean resistance to air flow of 62.5 Pa and minimum AS 1324 No. 1 dust minimum efficiency of 24%.
- 50mm thick panel filters will be of the disposable dry media type, of "Farr 30/30" or approved equivalent manufacture. Filters will be designed to handle the specified total air quantities for each system with a face velocity not exceeding 2.54m/s, a maximum clean resistance to air flow of 70 Pa and minimum AS 1324 No. 1 dust minimum efficiency of 24%.

Deep Bed Type

- Disposable media type of filters will have a minimum efficiency of 60% when tested to AS 1324 with No. 1 Test Dust. The filters will have a dust holding capacity of not less than 400g for a final resistance of 250Pa for test dust No. 4.
- At the design maximum air flow the effective face velocity will not exceed 2.5m/s and the clean resistance will not exceed 50 Pa.
- 300 deep pocket filters will only be accepted where 660 deep pockets cannot be accommodated due to space restrictions.
- Filter banks will be provided with direct reading manometers to indicate air pressure drop through filters with a range of 0 to 250 Pa.

Deep Bed Type ('Four Peak')

- Disposable media type filters when tested to AS 1324.2 with No. 1 Test Dust the filters will have a minimum performance of 43%.
- Disposable media type of filters when tested to AS 1324.2 with No. 4 Test Dust the filters will have a dust holding capacity of not less than 956g for a final resistance of 250Pa with an average resistance efficiency of not less than 94.6%.
- Filter Rating F5 - At the design maximum air flow the effective face velocity will not exceed 2.5m/s and the initial (clean) resistance will not exceed 43 Pascals throwaway type filters.

5.01.15. Condenser Water Systems

Cooling Towers

- Cooling towers will comply with the requirements of the relevant local Statutory *Authority* and *Australian Standards* requirements.
- Cooling Towers will not be used for any *campus* other than Bundoora.
- All cooling towers will be constructed of corrosion inhibiting materials suited to the application complete with fan, water distribution system, removable corrugated honeycomb fill, tower basin, sump, controls, valves and fittings.
- All metal fixings and components *are to be* minimum 316 grade stainless steel.
- Cooling tower casings *are to be* complete with all access doors or panels required to provide access to all internal parts.
- Fan motors will be located external to the cooling tower drift/plume discharge stream, or if located in the cooling tower discharge, be of minimum IP55 rating and corrosion resistant with immersion proof cable glands (IP68).
- Cooling Tower water supply should be piped from recycled water where possible.

Pipework configuration

- Condenser systems for chillers must include temperature and flow control mechanisms via variable speed drives for condenser water pump motors or modulating bypass valve located as close as practical to the chiller.
- Condenser water systems for water sourced heat pumps and water-cooled package units will be of closed loop configuration utilising a fluid cooler, or primary/secondary pumping loops with heat exchanger.

5.01.16. Chilled Water Plant

For new *buildings* where chilled water is required, dedicated chilled plant for the subject *building is to be* provided unless otherwise stated in the *Project Brief*.

For refurbishments in existing *buildings* refer to the *Project Brief* for chilled water plant requirements.

Dedicated primary and secondary chilled water circuit pumps *are to be* installed, when a chilled water system is designed with primary and secondary circuits.

Chillers – Vapour Compression

Chillers – Water Cooled:

- Chillers under 2,000kWr nominal cooling capacity will be centrifugal chilled water machines of the packaged, water-cooled, oil free, electrically driven type operating with non-ozone depleting refrigerant not subject to phase-out provisions.
- Chillers over 2,000kWr nominal cooling capacity may be variable speed centrifugal type, or screw (helical) type, electrically driven, operating with non-ozone depleting refrigerant not subject to phase-out provisions.
- Water cooled chillers may be used for the Melbourne (Bundoora) *Campus* only. Water cooled chillers are not to be used for the regional *campus*es.
- Refer to the Energy Efficiency sub section (5.01.06) for minimum integrated part load value requirements.

Chillers – Air Cooled and Evaporatively Cooled

- For nominal cooling capacities under 1,000kWr nominal capacity, evaporatively cooled chillers or air-cooled chillers may be considered. Evaporative or air-cooled chillers *are to be* used for the regional *campus*es.
- Evaporative cooled chillers will be centrifugal chilled water machines will be of the packaged, water-cooled, oil free, electrically driven type operating with no-ozone depleting refrigerant not subject to phase-out provisions.

Chillers – Absorption

- Absorption chillers should be considered as a preference at Melbourne (Bundoora) *Campus*. Existing *buildings* already connected to the [Melbourne *Campus*] high temperature hot water (HTHW) system are particularly suitable, but other *buildings* can also be considered with the power availability. In such cases the system will be combined with electric vapour compression type chillers to optimise base load and part load cooling demands.
- Absorption chillers will be of the two-stage type, utilising high temperature hot water from the central plant [Melbourne *Campus* only].

Chiller Plant Control System:

- The chiller plant control will be provided by the manufacturer's standalone microprocessor-based chiller control panel which will monitor and control the chiller(s) and associated plant.
- The chiller plant control system in conjunction with the *BMCS* will perform the following control functions/strategies:
    - chiller plant system scheduling
    - chiller sequencing
    - chiller load control and cop optimization
    - cooling tower fan speed and temperature optimisation
    - chilled water reset optimisation
    - colour graphic based chiller plant status screens
    - system and chiller diagnostic messages
    - system and chiller reports
    - primary flow control for chillers, pumps and bypass valves
    - critical valve or pressure reset strategy
    - high level interface to the site *Building* management and control system.

5.01.17. Heating Hot Water

Heating plant will utilise natural gas fired where available, or LPG where natural gas is not available.

For the Melbourne (Bundoora) *Campus* only, existing *buildings* already connected to the high temperature hot water (HTHW) system, may use the HTHW system as the primary heating source.

Heating plant will be sized to maintain specified space conditions in the absence of internal loads and to accommodate morning warm-up requirements.

The *building* will obtain operating temperature (i.e. warm-up period) within a maximum of one hour.

- Where central heating plant is installed with a combined heating capacity over 500kW, a minimum of two boilers will be provided.

Heating plant will be sized to maintain specified space conditions to enable the *building* to achieve operating temperature (i.e. warm-up period) within a maximum of one hour.

Units are to include the following:

- Fully factory assembled units, with all Authority certifications for the proposed application
- Controls are to include modulating control of the gas valve based on discharge air temperature sensing

Direct Electric Heating (Office Areas)

- The maximum electric heating capacity permitted if reticulated gas is not available at the allotment boundary is as per *NCC/BCA* Table J5.4c
- Note that natural gas networks are available to each regional *campus* except Bendigo.
- When using HTHW as the primary heating source, Shell and Tube Heat Exchanges *are to be* used instead of Plate Heat Exchanges.

5.01.18. Pumps

Pumps for chilled water, heating hot water, or condenser water systems will be selected for the required pressure and flow and operating environment.

Pump motors *are to be* of the high efficiency type as per AS/NZS 1359.5.

Variable speed drives *are to be* provided for chilled water, heating hot water, or condenser water pump motors for commissioning purposes.

5.01.19. VSDS

VSD specification *is to be* provided and unit selected with an in-built filter system to reduce harmonic issues. Any VSD, must not be operating at frequencies exceeding 40Hz.

5.01.20. Specialised Exhaust Systems

Exhaust systems required for specific purposes will comply with the relevant Australian Standard.

5.01.21. Laboratory and Medical Gas Systems

Gas systems required for specific purposes will comply with the relevant Australian Standard.

5.01.22. Mechanical Services Switchboards

Mechanical services switchboards (MSSBs) will comply with all the relevant requirements of the relevant *Australian Standards,* especially for low-voltage switchgear, control gear assemblies; and Wiring Rules.

Mechanical services switchboards serving connected loads over 100kVA will be fitted with multi-function energy power meter capable of measuring voltage, current, maximum demand kW (current and maximum recorded) kWh, kVA, kVAr, and power factor. Refer to Section 5.03.04 Metering for further details.

Mechanical services switchboards will be capable of being opened and inspected, with resets possible, without exposure to live electrical parts. This should be provided by a hinged transparent panel.

Mechanical services switchboards *are to be* storm grey in colour.

Indicator lights in mechanical services switchboards *are to be* LED type.

Mechanical switchboards *are to be* provided with circuit legend and labelling.

Mechanical services switchboards *are to be* installed with LED *GFA* indicator light/relay and connected to the relevant FIP. This will operate according to the relevant fire matrix.

5.01.23. Mechanical Electrical Works

Power to mechanical equipment will be provided from closest mechanical services switchboard MSSB. MSSB location will be advised by *LTU* during design phase. Spare capacity will be determined by the design team.

The above clause is to overcome the overloading of electrical distribution board and in line with the energy metering strategy for the University.

5.01.24. Ductwork

Ductwork systems (flexible and rigid ductwork) to comply with the requirements of the relevant *Australian Standards*:

Ductwork insulation to comply with *BCA* Section J Deemed to satisfy requirements.

Consideration will be given to increasing ductwork sizes in the risers and main ductwork branches to reduce fan power requirements.

5.01.25. Pipework

All pipework materials will be new and will comply with current editions of the Australian Standards, or equivalent British Association codes where the former are not available.

Pipe materials for the following applications will be:

- HTHW Piping - Seamless steel piping to A.S.T.M. A53 Grade "B" suitable for working pressure of 2200 KPa and temperature of 193ºC.
- Chilled Water Piping - Copper piping to AS 1432 Type B hard drawn.
- LTHW Piping - Copper piping to AS 1432 Type B hard drawn or Acrylonitrile butadiene styrene (ABS) or stainless steel.
- Condenser Water Piping - Copper piping to AS 1432 Type A hard drawn.
- Natural Gas - Copper piping to AS 1432 Type A hard drawn.
- Pneumatic Piping - Copper piping to AS 1432 Type A hard drawn.
- Mains Cold Water - Copper piping to AS 1432 Type B hard drawn or REHAU PE-Xa cross linked polyethylene pipe.
- Domestic Hot Water Piping - Copper piping to AS 1432 Type B hard drawn.
- Recirculated Cooling Water, Chilled Drinking Water, Vents, Drains, Wastes, etc. - Copper piping to AS 1432 Type B hard drawn / uPVC type

Alternative piping materials may be considered for underground services, mechanical protection and corrosion protection. *UPR* will substantiate reasons for suggesting alternative material.

All joints in steel lines where possible will be butt welded. Where welded joints are impractical and at connections to fittings or equipment, flanged joints will be used.

All bends, tees and elbows will be of manufactured type and not pulled on site. Bends will be standard long radius type.

All joints in copper lines will be silver soldered. Where soldered joints are impractical and at connections to fittings or equipment, flanges will be used

Pipework insulation to comply with *BCA* Section J Deemed to satisfy requirements.

Table 9. Piping Identification Symbols

The following piping identification symbols will be used in plant rooms, pipe ducts, etc:

Description	Code	Colour
High temperature hot water	HTHW	BS5252 Code 10 C31 "Cream"
Heating hot water	HHW	AS1345 Code G21 "Green"
Domestic hot water	DHW	AS1345 Code G21 "Green"
Chilled water	CHW	AS1345 Code B41 "Bluebell"
Condenser water	Cond.W	BS5252 Code 00A05 "Goosewing"
Recirculated cooling water	RCW	AS1345 Code B41 "Bluebell"
Cold water	CW	AS1345 Code G21 "Green"

5.01.26. High Temp Hot Water System

The High Temperature Hot Water system is only **at Melbourne (Bundoora) *Campus*.**

Where applicable, modifications or additions to the high pressure (temperature) pipework systems will be computer designed and results of stress analysis submitted to the University for approval. Final pipework design will be carried out by a suitably qualified specialist in high pressure pipework applications.

Twenty percent (20%) of high-pressure welds will be radiographed and results submitted to the University. Hydrostatic pressure tests will be 1.5 times the working pressure.

HTHW Installation Specification

- Maximum working temperature 180ºC
- Maximum working pressure 1860 kPa

All pipe joints other than at welded flanged joints or valves, bellows, strainers or pipe work that requires disassembly for maintenance purposes, will be welded. No screwed joints will be allowed without written approval by *LTU*.

During major refits and new-builds thermal metering should be installed to capture thermal energy consumption related to total HTHW use at the *building* level. All thermal energy meters *are to be* connected to and be compatible with the *LTU* cloud hosted energy monitoring system where fitted.

During Design, *Project Consultants* should liaise with AZZO for system connection requirements and further hardware specifications when installing metering.

Table 10. Thermal Monitoring Meter Performance Specifications

*Preference should be given to non-intrusive metering solutions

Metric	*Building* Level
Measurement Method	Magnetic (flow) Resistance (temperature)
Measured value acquisition	Contiguous
Accuracy	0.4% +/-1mm/s (flow) ± 0.5 °C (temperature)
Connection	Threaded or flanged (flow) Threaded (temperature)
Protocols	Modbus or Pulse output
Measurement Variables	Volume (m3/h) Temperature (degC)
Cold water	AS1345 Code G21 “Green”

Commissioning Procedure for HTHW System at Bundoora

The following commissioning process has been detailed so that the design *consultant* can incorporate this into the design documentation and contract documentation:

- Prior to operation of new or modified sections of the system, the affected sections of the system will be flushed to remove any scale or debris and all dirt boxes cleaned and refitted.
- The piping will be fully charged with water and all air vented from the system. Charging water will be from mains supply suitably protected by “Back Flow Devices” and checked for cleanliness before connecting.
- The connection of new sections to the operating system will be coordinated between *Consultant* and the *UPR*, after commissioning of a new section has been completed.
- The actual “livening” of the new section will be done by *LTU* staff.
- The temperature in the new section will to be raised by 100oC per hour to allow for gradual expansion of the system. All bellows, anchors, and supports will be regularly monitored during this period (approximately 16 hours).
- The new section will be monitored for 4 hours at the system operating condition and approved by *LTU* before being left unattended.
- At all times the branch isolating valves on the existing high temperature hot water system *are to be* operated by staff of *LTU* only.

5.01.27. Commissioning

The following commissioning process has been detailed so that the Design *Consultant* can incorporate this into the design documentation and contract documentation

- For new *buildings* and major refurbishments, the commissioning of the mechanical services *is to be* performed in accordance with the following:
- ASHRAE Guideline 1; or
- CIBSE Commissioning Codes; or
- AIRAH application manuals

- DA 27 *Building* Commissioning; and
- DA 28 *Building* Management and Control Systems (*BMCS*).
- All new air and water systems will be commissioned, balanced and tested at the completion of the installation and be carried out by NEBB (National Environmental Balancing Bureau) certified operators using NATA (National Apparatus Testing *Authority*) calibrated and checked instruments using recognised and reliable test methods.
- Commissioning data will be included in the Operation and Maintenance Manual for the *Project*.

5.02 Building Monitoring and Control Systems

5.02.01. Overview

La Trobe University has adopted the Tridium Niagara N4 product suite as the BMS for managing the University's HVAC, Fire, lighting, energy systems and auxiliary assets. All new mechanical equipment and controls will be compatible with the campus wide Niagara system as per the requirements of this section. BMS to be comply with La Trobe Building Management System Standards or latest.

The *BMCS* controls mechanical plant and equipment only. The BMCS monitors selected electrical points/metering, lighting systems, specific gas supply systems etc.

5.02.02. Proprietary Controllers (Split Systems and Package Units)

Packaged air conditioning units and split ducted air conditioning units will be provided with proprietary controller interface via interface card with DDC controllers, BACnet communication (preferred, if not BAC net communication available then modus communication is acceptable alternative) and connection to the *BMCS*. Provide local wall mounted room temperature sensors for each zone and locate the controllers within a mechanical services switchboard or cabinet not accessible by room users.

Alternatively, and subject to *Project* and equipment quantity, BACnet gateway will be provided to allow for High Level Interface HLI to the *BMCS*.

Splits systems and package units controls strategies will incorporate the Direct Digital Control abilities as a minimum as articulated below.

5.02.03. Direct Digital Control

Controllers will be capable of communication with Niagara Building Management system via BACnet open protocol systems as applicable to the *building*.

DDC Controllers

- Universal inputs and universal/configurable outputs.
- 23-bit microprocessor.
- BACnet automatic discovery function.
- Writable flash memory.
- Real time clock.
- BACnet IP or MSTP capability
- BTL listed and certified.

Direct Digital Control (DDC) Systems Controllers

- on / off control
- 365/366-day time switch
- public holiday schedule
- out of hours operation via manual override (2 hours adjustable push button) or when the space motion detector is activated (where applicable).
- plant scheduling and setback
- temperature set point adjustments for each zone
- economy cycle (where fitted)
- automatic reset after power failure
- data logging storage to equivalent to minimum 4 weeks at 15-minute intervals (fan status, zone temperature, outside air temperature, compressor start/stop, unit fault, etc).
- no less than 20% spare memory available once programmed
- spare input/output points – no less than 20% per panel/per type

5.02.04. Building Maintenance Control System (*BMCS*)

BMCS will provide comprehensive control and monitoring for the mechanical services and equipment interfaces. Any system offered will also be capable of integration with existing site *BMCS* system for overall monitoring and global control functions.

The *BMCS* will utilise BACnet native controls for Niagara. Remote intelligent controllers communicating over the *LTU* Information Services network *are to be* provided. The field controllers will be networked to a BMCS and be accessible via remote desktop services.

Each controller will be capable of providing control functions without reliance on other controllers or *BMCS* front end. Malfunctions or power loss of the *BMCS* front end will not cause degradation of operation of the field controllers. Similarly, failure of a controller will not prevent other controllers from communicating with one another

The system will include proven reliable systems and components which have been in commercial or industrial use for two years prior to installation or developed from a mature product range in use for the same period. Hardware will be suitable for the environment in which it *is to be* installed. Field equipment will be capable of continuous operation in ambient temperatures of minus 10–45°C and humidity of 10–95% RH.

The system will have the ability for the following minimum list of functions to be programmed:

- optimal stop/start
- duty cycling
- time of day scheduling harass
- holiday scheduling
- out of hours operation via manual override (2 hours adjustable push button)
- restart scheduling, following fire shut down or power failure
- maximum demand limiting/ load shedding
- load shedding prior to generator start up (if applicable)
- analogue alarm limits with appropriate adjustable time delays
- digital alarm limits, depending on defined priority
- energy summation
- energy calculations
- early morning warm up algorithm
- night purge
- supply air temperature algorithm
- temperature set back
- chiller/boiler/ahu temperature reset algorithm
- room temperature reset algorithm
- control mode selection i.e. P, PI or PID
- over cycling protection
- hours run summation
- run time diagnostics
- plant and equipment strategies:

- Variable air volume air handling control.
- Variable volume boxes
- Chiller plant
- Boiler plant
- Packaged equipment
- Economy cycles
- Ventilation and exhaust systems
- Chilled beams
- Low temperature air supply systems
- Miscellaneous systems

Data Storage Requirements

Information will be 'backed up' in data memory for historical records over a minimum six months period

Data stored will be capable of being copied to a USB memory stick within the system in a format that can be accessed for viewing or printing

Remote monitoring

***BMCS* Graphics**

Provide user programmable dynamic colour graphics based on a standardised set of graphics agreed with the University as per La Trobe Building Automation Standards.

Graphic slides to be organised around a hierarchical entry menu and will include but not be limited to:

- site plan
- floor plans for each *building*
- system plans for each engineering system, e.g. chilled water, power supply, etc. with correctly drawn schematic pipework layout
- equipment such as AHU, FCU, ventilation fans summary pages.

Chiller Parameters

- On/off status
- Chilled water set-point
- Chilled water supply (leaving) temperature
- Chilled water return (entering) temperature
- Condenser water entering and leaving temperatures
- Electrical load
- Fault status
- Chilled water bypass valve position

Boiler Parameters

- On/off status
- Heating hot water set-point
- Heating hot water supply (leaving) temperature
- Heating hot water return (entering) temperature
- Condenser water entering and leaving temperatures
- Fault status
- Bypass valve position

Cooling Tower Parameters

- On/off status
- Condenser water supply (leaving) temperature
- Condenser water return (entering) temperature
- Fan speed
- Fault status
- Chilled water bypass valve position

Air Handling Unit / Fan Coil Unit Parameters

- Control zone temperature
- Maximum, minimum and average temperatures for serviced zones - Supply air temperature set-point
- Supply air temperature set-point
- Supply humidity set-point (if applicable)
- Supply air humidity (if applicable)
- Humidification/dehumidification control signal (if applicable)
- Chilled water valve position (%)
- Hot water valve position (%)
- Return air temperature
- Outside air temperature
- Maximum, minimum, average and control zone CO2 level (if applicable)
- Outside air damper position %
- Return air damper position %
- Relief air damper position %

Terminal Units Summary (VAV Box, Chilled Beam, Etc.) Summary

- Floor layout with ductwork schematic showing location of terminal units and sensors
- Temperature at each sensor
- Terminal unit temperature set-point
- Terminal unit status: Heating/cooling; heating %, cooling %;
- Terminal fan status; for VAVs: achieving/not achieving flow set-point
- Clear indication of which AHU serves each duct/terminal unit

Terminal Units (VAV Box, Chilled Beams, Etc.)

- Zone set-point
- Zone temperature deviation from set-point
- Status: heating / cooling (%)
- Minimum flow (l/s)
- Maximum flow (l/s)
- Flow set-point (l/s)
- Current Flow (l/s)
- Terminal fan operation (on/off, %) as applicable
- Terminal reheat operation (on/off, %) as applicable
- Damper position (%) as applicable
- VAV Box, chilled beam, etc. identifier
- Parent AHU identifier

General

- Set-point alteration
- Override start and stop plant
- All points report
- Acknowledgement of alarms alteration of temperature
- Time scheduling
- Other control scheduling
- Access will be password priority controllable
- Start/stop commands
- Equipment status
- VSD speed in percentage and/or frequency (hz)
- Damper and motorized valve position
- Differential pressures
- Flow rates
- Tank levels
- Changeover status
- Alarm status.
- Standard colours to be used indicate difference liquid lines (i.e. chilled water – Blue, condenser water – Green, HT hot water, - Red, etc).
- Reflect new *building* names on points and time schedules
- Animation *shall be* activated on all equipment
- New graphic template to be added on new installations
- Accurate outside air sensing *shall be* connected to new installations

User Requirements

The system will be capable of allowing a minimum of three users to log on to the system simultaneously to allow local or remote access and system interrogation.

Reporting and Alarms

- Reporting capabilities will also include out-of-hours use reporting and energy usage reporting.
- In the event of server failure, it will be possible to retrieve 14 days of energy logging from field controllers.
- Include high level interface connections to systems such as FM messaging system, security, FIP, chiller control, tri-generation, lifts and help desk, etc. to enable seamless response to alarms and appropriate secure reporting to the Help Desk.
- SMS messages for alarm conditions at nominated connected points to are to go to nominated telephone numbers.
- Email messages for alarm conditions at nominated points are to go to nominated recipients' messages to client devices.

5.03 Electrical Services

5.03.01. Performance Requirements

The services will be designed:

- To suit the intended application, location and climate condition
- To maximise energy efficiency and minimise associated greenhouse gas emissions.
- With modularity and flexibility for change;
- To minimise operational and maintenance costs;
- To respond to the *buildings* usage pattern;
- In accordance with *NCC/BCA* Volume 1 - *NCC* 2014 (or subsequent versions), Section J, Part J6 artificial lighting & power, deemed-to-satisfy provisions as a minimum. More stringent energy efficient requirements for particular items are also required and are described herein.
- All plant and equipment will be supported locally with respect to service and spare parts.

Power Supply

- Lighting: Full Load of lighting installation plus 20%.
- General Power (Offices): 50VA/sqm.
- General Power (Other areas): 30VA/sqm (To be confirmed based on equipment loads).
- Base *Building* Equipment Loads: Full connected load plus 25%.

Standby Power Supply

- Not typically required – However are used in the following instances:
- Generators: *Information Services* data centres, high temperature freezers, low temperature freezers, constant temperature rooms, security control room, animal holding areas, etc.
- UPS: *Information Services* comms rooms, some service desks critical research facilities, animal holding areas, etc.
- Refer to the *Project Brief* for specific requirements. *Brief is to be* vetted and approved by *FAS* Department in *I&O*.

UPS Power Supply

- General: 100% of communications equipment loads for 15min.
- Generators: *Information Services* data centres, high temperature freezers, low temperature freezers, constant temperature rooms, security control room, animal holding areas, etc.
- UPS: *Information Services* comms rooms, some service desks, etc.
- UPS units that serve communications system equipment will be 19-inch rack mounted type when sized at 5kVA or less. Minimum battery autonomy time 15mins.
- UPS systems greater than 5kVA will be floor mounted & provided with maintenance bypass switch arrangement complete with solenoid interlock to achieve 'make-before-break' changeover.
- Refer to *Project Brief* for specific requirements. *Brief is to be* vetted and approved by Director Facilities, Asset and Services – Infrastructure and Operations & where applicable *Information Services*.

Lighting Illuminance

- General: Minimum maintained illuminance levels to be in accordance with the recommendations contained in AS1680.2 Parts 1, 2, and 3. Maximum maintained illuminance levels will not exceed 50% of minimum levels.
- Administration areas: Lighting design will achieve 19 Unified Glare Ratio (UGR) or better with 0.5 uniformity or better at the working plane.
- Average maintained illuminance levels for internal spaces will comply with lux levels as stated within relevant parts of AS1680.

Labelling

- Each GPO and Light switch will be labelled to clearly state the originating switchboard and associated circuit breaker number.
- Switchboards will be labelled to describe where power originates from.
- Purpose built cupboards accommodating electrical equipment will be provided with labels. For example; main switchboard, meters, switchboard, communications etc.
- Labelling to be in accordance with Australian Standards

Energy Efficiency

- Electrical services plant will comply with the deemed to satisfy provisions of the *BCA*
- Section J Energy Efficiency as a minimum, and with the more stringent requirements for illuminating the following spaces. Note the additional requirements may not be able to relate to small works and maintenance.

Table 11. Maximum Illumination Power Lighting Density (W/m2)

Space	NCC/BCA	*LTU*
Auditorium	10	9
Board room and conference room	10	9
Carpark – general	6	5
Carpark – entry zone (first 20m of travel)	25	23
Control room, switch room, and the like	9	8
Corridors	8	7
Dormitory of a Class 3 *building* used for sleeping only	6	5
Dormitory of a Class 3 *building* used for sleeping and study	9	8
Entry lobby from outside the *building*	15	14
Kitchen and food preparation *area*	8	7
Laboratory – artificially lit to an ambient level of 400 lx or more	12	11
Library – stack and shelving *area*	12	11
Library – reading room and general areas	10	9
Lounge *area* for communal use in a Class 3 *building*	10	9
Office – artificially lit to an ambient level of 200 lx or more. 320 lx min at work surface.	9	8
Plant room	5	5
Restaurant, café, bar, hotel lounge and a space for the serving and consumption of food or drinks	18	16
Retail space whose purpose is the sale of objects	22	20
General purpose learning areas and tutorial rooms	8	7
Storage with shelving no higher than 75% of the height of the aisle lighting	8	7
Storage with shelving higher than 75% of the height of the aisle lighting	10	9
Service *area*, cleaner's room and the like	5	5
Toilet, locker room, staff room, rest room and the like	6	5

- For enclosed spaces with a Room Aspect Ratio of less than 1.5, the maximum illumination power density may be increased by as per the *NCC/BCA* adjustment factors.

Wall Ducting

- Wall ducts are to generally be extruded aluminium with drop in cover plates
- Ducting is to provide required compartmentalisation and separation between power cables and other service cables.
- Ducts are to provide for required radius for data cabling systems.
- Covers to ducts *are to be* screwed in place with minimum of two Phillips head screws, flathead, countersunk, nominally either end of each cover plate.
- Refer also to the *Project Brief* for specific *Project* requirements.

Teaching Facilities General Requirements

- Motion activated zoned lighting and zoned indoor air handling units (where applicable) along with timing devices for *AV* equipment to be provided. Lighting should have the capacity for automated shut-off when spaces are not in use. Use recessed and flush mounted LED low glare and shadow free fittings, sealed according to lab PC rating where required.
- Task lighting and *project* lighting as required by lab specialists.
- For Lecture Theatres, power outlets *are to be* provided to seating system. These *are to be* easily accessible from the seat and to be a three-pin socket and USB power outlets. A minimum of half the seats in the room should be provided for.

Workstation General Requirements

- Power for workstations is not to be hard wired to walls. "Soft Cabling" systems are required with adequate cable management. For staff generally, per position, provide two double GPO's per position beneath the work surface and one double GPO with USB power outlet above the work surface (in power rail or drop in box). Power and data cables *are to be* separated to code. Soft wiring is required to all movable furniture.
- Cable management on and within furniture must provide a safe and tidy system with ease of access for maintenance and adjustment. Cable trays or baskets will be provided below work surfaces. Cable management includes cables from sockets to computers and other equipment on the work surfaces, as well as cables into sockets from sources such as walls. Cabling *is to be* minimised on work surfaces.
- Power and data may be fed to furniture from the floor, walls and ceiling with purpose designed 'umbilical' ducts, poles and other ducts that are fully compatible with the furniture and *building* finishes.
- One computer monitor is generally used in a standard configuration to administration workstations. Two can be provided where the requirement can be demonstrated to the *UPR*.
- For adjustable standing workstations a separate GPO to *LTU* power requirements *is to be* provided. Provision of electrical cables needs to be carefully managed to accommodate the work surface movement.

5.03.02. Solar Electricity Generation

There are four scenarios where solar installations *are to be* considered on roofs:

- Scenario 1 – Where works are undertaken to maintain or replace roofs
- Scenario 2 – Where works are undertaken on roofs where existing solar panels are installed
- Scenario 3 – Where major refits or new builds are undertaken
- Scenario 4 – Where a solar PV system is proposed to be installed on an existing roof

Scenario 1 - Where works are undertaken to maintain or replace roofs

- **Current & Future Roof Mounted Equipment:** Consider current and future installation of additional plant, solar panels/inverters/switchboards, rainwater tanks/water points, roof gardens, fall prevention systems, walkways etc. Consolidate new or existing plant and machinery where possible. Additional plant location to maximise available unshaded roof area for solar panel installation.
- **Materials:** Metal sheet profiles should be such that they allow non-penetrative fixings for solar panels to be clipped fixed (Lysaght Kliplock roof profile or similar preferred). Drilled fixings for solar panels that encourage water ingress must not be avoided. Any room tiles specified must also allow for non-penetrative fixing of any solar brackets and any drilled fixings are not allowed.
- **Wiring:** Consider future installation of solar PV systems and allow for additional switchboard capacity, spare MCB and MCCB for future solar connection and adequate space in the switchboard for additional cabling.

Scenario 2 – Where works are undertaken on roofs where existing solar panels are installed

- New roof mounted plant and equipment will be located on the southern side of any existing solar PV array to minimise shade and any associated loss of solar generation.
- Where new items of plant are installed that will cast shade on the array between 10 am and 2 pm, the *Contractor* is responsible for engaging a La Trobe University approved *consultant* to quantify any shading effects, provide alternative array designs or recommend panel level DC optimisers/AC micro inverters across the array.

Scenario 3 – Where major refits or new builds are undertaken

- Where major refits or new builds are undertaken, onsite solar photovoltaic systems should be installed to minimise grid-sourced electricity consumption and associated greenhouse gas emissions. *LTU* have preferred *Consultants* in this space who *are to be* engaged to assess the existing infrastructure and design a suitable system. Enquire with the *Project*'s *UPR* for details. Refer to Solar PV Specification along with specific system design specifications when engaging solar PV supply and installation *Contractors*.

Scenario 4 – Where a solar PV system is proposed to be installed on an existing roof

- Where a solar PV system is proposed to be installed on an existing roof, a Clean Energy Council accredited solar PV design *Consultant* should be engaged to assess the existing infrastructure and design a suitable system. *LTU* have preferred *Consultants* in this space, enquire with *UPR*. Refer to Solar PV Specification along with specific system design specifications when engaging solar PV supply and installation *Contractors*.

5.03.03. Power Supply

Melbourne (Bundoora) Overview

- The electrical infrastructure has two separate incoming feeds, one from the Jenny Graves high voltage (HV) switch room through two high voltage (HV) ring mains. The other incoming HV feed comes from College Drive kiosk. The incoming feeds step down to low voltage (LV) throughout the site at transformers to supply power to the *buildings* and amenities. A map of the distribution of power can be obtained upon request from the *UPR*.

General

- Electrical supply *is to be* metered at the low voltage (400/230V) point of supply.
- Base *building* services *are to be* metered separately to tenant/occupant metering.
- High voltage cables and main low voltage cabling will be located within dedicated risers' trenches and shielded if required to ensure electromagnetic fields do not interfere with other equipment or tenant systems.
- Power correction equipment *is to be* provided for new *buildings* and major refurbishments of existing *buildings*. The power factor correction equipment will achieve minimum 0.95 and be located within or adjacent to the main switch room. Refer to the *Project Brief* for requirements.
- Harmonic Filters will be provided to limit harmonic distortion. Locate filters close to known non-linear loads sources.
- Surge Protection devices will be fitted to all new main switchboards and distribution boards serving communication rack mounted equipment.

5.03.04. Metering

It is *LTU policy* to separately meter whole of *building* electricity use, main mechanical board electricity use, floor level light and power circuits and tenancy electricity use.

Floor level light and power circuits should only be metered if the *Project Brief* includes replacement of main switchboard. The requirement for the replacement of main switchboard and metering will be determined as a result of the refurbishment and recommended by the *consultant* for the *project*. This will be checked and signed off by *FAS* as it would impact on our infrastructure.

Refer also to the *Project Brief* for specific *Project* requirements.

All meters *are to be* connected to and be compatible with the *LTU* cloud hosted energy monitoring system (Schneider PME) in a manner so that data is readily available for *LTU* upon request

During Design, *Project Consultants* should liaise with AZZO Pty Ltd for systems integration and connection requirements and hardware specifications when installing metering.

Table 12. Specific Electrical Meter Selection

Metered Service	Meter type
All whole *building* incoming feeds	to be metered by AZZO-LTR-8000 meters
Lecture Theatre only *buildings*	to be metered by AZZO-LTR-5330 meters
All Mechanical Services feeds	to be metered by AZZO-LTR-5560 meters
Light & Power circuits	to be metered by AZZO-LTR-3255 meters
All Tenancies >100A	to be metered by Power of Choice meters – please contact La Trobe directly to confirm requirements given changing electrical legislation
All Tenancies <100A	to be metered by Power of Choice meters – please contact La Trobe directly to confirm requirements given changing electrical legislation

Azzo Pty Ltd should be contacted for clarification on metering requirements beyond the above specified circuits.

Metering Performance Specifications

The following are general meter performance specifications. Final meter selection to be confirmed in liaison with AZZO Pty Ltd during the design stage so as to confirm the network requirements to connect meters to *LTU* PME monitoring system.

Table 13. General Meter Performance Specifications??

Metric	*Building* Level
Measurement Method	True RMS measurement
Measured value acquisition	Contiguous
Accuracy (Voltage and Current)	• Class 1 to IEC62053-22. • Class 0.2s to IEC61557-12 and IEC62053-22 for all Mains and Mechanical Services metering. All other metering to be class 0.5s to IEC61557-12 and IEC62053-22.
Connection	RS485 Interface, TCP/IP optional
Protocols	Modbus and BACNet compatibility options. ION and Modbus RTU or TCP
Measurement Variables	• VL-L • VL-N • VL-Lmin • VL-Lmax • A • An • Amaxdmd • VA • Var • Wdmd • Wmaxdmd • PF • hz • kWh± • kvarh±
Harmonic distortion measurement	THDi & THDv, THD to 15th individual Harmonic
Real time clock with battery backup	Yes
Miscellaneous functions	Disturbance Direction Detection Waveform Capture for Main incomer or Precinct level metering only
Display	LCD Display
Integrated memory storage	Yes – Two parameters for 30 days at 15 mins intervals

5.03.05. Main Switchboards

Main switchboards (MSB) will be designed to Form 3b segregation for <=1600A, Form 2 segregation <=800A, Form 1 segregation <=400A. MSB Air Circuit Breakers (ACB's) should be Masterpact MTZ type ACB units and be installed with all necessary communications modules/firmware to allow native Modbus TCP for transmission of measurement variables and breaker status.

Surge protection will be provided on all new main switchboards.

All Busbars will be arranged to withstand a short circuit at any point and all switchgear will be arranged to withstand any external fault. The time value of the rated short-time withstand current will be 1 second.

Main switchboards located outdoors must be constructed from stainless steel or aluminium to withstand corrosion. IP 42 protection is required for main switchboards located within a *building*. External Main Switchboards will be IP 56.

Gland plates will be provided to facilitate incoming and outgoing sub main cabling.

The switchboard manufacturer will perform temperature rise calculations to AS60890. All busbars will be sized & derated accordingly to deliver the required ampere rating. The switchboard compartment design will ensure equipment (circuit breakers, isolators, fuses etc,) are capable of functioning within their rated temperature ranges at specified currents for calculated temperature rises, considering ambient air temperatures.

Provide "traffolyte" labels on the main switchboard to identify incoming and outgoing circuits, capacity of CFS unit & rating of installed fuse cartridge, or capacity of circuit breaker and adjusted trip setting for circuit breakers 100A and above.

Power Factor

All specified equipment will achieve 0.95 power factor or better. Where required, whole installation (i.e. power factor correction unit installed at switchboard) power factor correction equipment will be designed to maintain a minimum corrected power factor of 0.95. System faults and performance will be monitored with PME. Liaise with *FAS* for detail of existing PME.

High Voltage/Medium Voltage Circuit Breaker Protection devices should be Schneider Easergy P3 type relays- with native hi-level Ethernet communications for real-time system information, predictive maintenance analytics and easy integration into AZZO PME and SCADA solutions

- Embedded virtual injection testing
- Built in Arc flash protection
- Programmable logic and protection stages

RMU - To be Easergy T300 with installed PT/VT modules for incoming and outgoing isolators for monitoring over native hi-level ethernet of real-time variables and status.

HV/MV Protection devices (Circuit Breakers & RMU's) to be integrated into AZZO Energy Management System setup and commissioned as advised by AZZO. Ancillary communications devices required for connection to AZZO remote cloud network to be procured from AZZO as advised.

HV/LV Transformer – Provision of hinged and lockable doors to the LV and HV Termination boxes for ease of access.

5.03.06. Distribution Switchboards

All distribution switchboards will be metal clad, fully enclosed.

- Lockable ("CL-001" keyed)
- Hinged escutcheon
- Protection rating: IP 52 or better
- 160 Amp minimum main switch size
- Earth and Neutral bars, circuit identification and schedule cards supplied

In areas likely to accommodate workstations, distribution switchboards will provide sufficient circuits to service a workstation density of 1 per 10 sqm with 6 GPO's (SSO's) per workstation.

Distribution switchboards will be configured to provide separate sections for lighting circuits, power circuits and mechanical services circuits. Each switchboard section will include spare pole capacity/space for the following outgoing future circuits: 100% spare capacity for 24 circuits or less, 50% spare capacity for 25-48 circuits, 25% spare capacity for >48 circuits.

Where required distribution switchboards will be configured to support the essential / non-essential configuration.

Miniature circuit breakers (MCB) will be DIN rail mounted type. Duplex circuit breakers are not permitted.

Residual current device (RCD) protection will be provided via combined MCB/RCD units installed at the distribution boards.

Distribution switchboards will be of storm grey colour exterior.

A review of existing switchboards serving proposed works will be undertaken to confirm capability of all anticipated loadings from altered and new areas. Note that new and altered mechanical works are not to be powered from lighting or general switchboards.

5.03.07. Socket Outlets

General Power Outlets (GPOs), also called Switched Socket Outlets (SSO), required for internal spaces will be Clipsal 200 series or approved equal. No more than 16 single GPO's or 8 x double GPO's will be assigned to a 20A final sub-circuit.

Approximately one DGPO (Switched Socket Outlet) per three students should be placed around the perimeter of collaborative rooms. Provide USB charging slots within each outlet plate. The use of "charging lockers" in an accessible public location is an option for consideration.

In teaching laboratories:

- Provide DGPO points to wall, perimeter and island lab benches, min 10A circuits.
- Provide dedicated power lines as required - to refrigerators, freezers, special laboratory apparatus.
- Provide override and emergency stop buttons as required.

Recessed Floor boxes will feature stainless steel trim and hinged lid, located in areas of reduced traffic.

GPO's to walls, unless for a specific purpose, will be at either 500 mm above floor level or in a skirting duct.

Where hand driers are required, install an isolating switch for the GPO. GPO *is to be* at 1300mm above floor level nominal height.

Provide Cleaner GPO's at 15m through the facility at nominal 500mm above floor level.

Colours of sockets *are to be* as per Australian Standards

5.03.08. General Lighting and Controls

All external lighting should meet the following requirement - 95% (by number) of all external public lighting luminaries within the *project* site boundary should have an Upward Light Output Ratio (ULOR) less than 5% relative to their installed mounting orientation.

Upward Light Output Ratio (ULOR) is the ratio of the luminous flux emitted by a luminaire above the horizontal to that emitted by the lamp, as defined in AS/NZS 1158.0:2005.

- For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 32.1** – Light Pollution.

The University now utilises LED Lighting systems for both internal and external applications. Applications for any other type of system must be via a Variation to *Design Standards* form.

Internal Lighting will comply with the following criteria:

- minimum light output ratio: 0.8
- colour rendering index (Ra): no less than 80
- colour temperature: 4000K ("cool white")
- min maintained system efficacy: 80 lumens per watt
- minimum lamp life (hours): 50,000 LED at L70

Low voltage halogen lamps will not be used.

Lighting control to teaching spaces, appropriate meeting rooms, and other assembly spaces *is to be* provided via a fully integrated and programmable lighting control system that can also incorporate occupancy sensors. The system must be accessible tablet device capable of

altering all system parameters (dimming settings, time schedules, delay times, zoning, etc.). The proposed system *is to be* reviewed and approved by a *FAS* representative.

Lighting to teaching areas, office areas, kitchens, resource/photocopier rooms and printer rooms, and meeting rooms will be controlled by automatic occupancy sensors and automatic dimming systems for daylight compensation to minimise artificial lighting output when daylighting is available. Note the sensors may also be connected to the mechanical or security system as well. Manual override switching with pre-set auto-off function *is to be* provided.

Perimeter areas to external windows and interior areas will be zoned separately in open plan areas. Switching zone maximum sizes *are to be* the lesser of 100sqm or the smallest zone appropriate to the functional requirements of the space.

Occupancy sensors will be configured to ensure that lighting in vacant areas, offices, corridors and meeting rooms are switched off automatically at any time of day after 15 minutes (adjustable) of inactivity.

Where Occupancy sensors are placed within enclosed rooms – strategically position sensors on ceiling or on walls to avoid movement being incorrectly detected in adjoining corridors, when room door is left open.

In corridors, toilets and amenity areas Occupancy sensors will control lighting.

Teaching Rooms will have zoned lighting, to allow for reduced or no lighting adjacent Projection images. They should have the capacity for automated shut-off when spaces are not in use.

Fire stairs will be provided with LED fittings complete with integral microwave (motion) sensor. Permanent background dimmed lighting is required at all times and full lighting activated for a set time when the space is occupied.

Luminaires fitted to external walls, *landscape* areas, toilets, amenities will be vandal resistant type rated to minimum IK 10.

Wherever possible, internal lighting will be accessible from floor level, and will have a maximum height set by use of ladders.

5.03.09. Exit and Emergency Lighting

Self-contained LED emergency and exit lighting will be provided throughout the *buildings* in accordance with Australian Standard AS 2293. In addition, emergency lighting will be installed in communications rooms, main switch rooms and plant rooms.

Exit signs will be un-switched remaining permanently on. Exit sign legends will be white on green. The exits signs will be maintained and self-contained complete with running man pictograph.

The emergency lighting will be able to operate for 2 hours via self-contained batteries and fitted with Lithium-ion batteries

Central testing and monitoring systems to be provided for new *buildings*, major refurbishments of existing *buildings* and where existing central systems are already in place.

Monitored exit and emergency lighting systems will be Legrand “Axiom” wireless communications type or approved equivalent, connected to an area controller located in communication rooms or cupboards.

All *buildings* that contain Axiom monitored exit and emergency lighting systems will be linked back to the University centralised monitored system at *I&O* Office. The link will be connected to the main loop, but if this is impracticable, an electronic link via Lantronix units will be established.

5.03.10. Phones

Emergency Phones

Emergency phones *are to be* provided on an as needs basis. Refer to Director *FAS* for approval of final locations.

Phone Cabling

Phone cable (e.g. via VOIP) and outlet and any access to beneath the work surface are to enable a phone to be positioned on either side of the computer monitor.

5.03.11. External Lighting

As a minimum, the external lighting design will comply with AS4282 'Control of the Obtrusive Effects of Outdoor Lighting'; and comply with the minimum requirements of AS1158 Lighting for Roads and Public Spaces for illuminance levels unless otherwise stated within these *Design Standards* or the *Project Brief*. Particular consideration should be given to any *Project* specific light spill requirements resulting from the presence of nocturnal fauna.

All lighting located within close proximity of the Wildlife Sanctuary on the Melbourne *Campus* must be provided through full cut-off fixtures to direct light down, reducing light pollution and negative impacts on nocturnal flora.

External lighting luminaires will primarily comprise LED lamps. All external luminaires will be weatherproof to IP56 standard and be vandal resistant type. Fixtures should minimise light pollution using the above codes.

External lighting to be linked to daylight sensor, time switch or *BMCS* controls (where installed).

Poles for mounting of luminaires will be galvanised metal and painted or powder coated to required colour to manufacturer's strict specifications.

Option 1 for individual or small scale installations: External lighting will be controlled via PE cell, 7-day time switch combination. Bypass switch will enable testing of external lighting during daylight hours.

Option 2 for large scale installations: External lighting will be controlled via DALI Lighting Network (either Hardwired to each Public Light Pole and Luminaire or using Wireless 'Smart City' Lighting Controls). Therefore luminaires must be supplied complete with DALI dimming ballast labelled terminal and connected to the existing DALI lighting control network. All pole based lighting must be wired to a NEMA 7 Lighting control system.

Building entry point lighting will be controlled using a combination of occupancy and daylight controls.

5.03.12. Lightning Protection

In general, *LTU* does not provide lightning protection to its *buildings*. Nevertheless, a lightning *risk is to be* assessed in accordance with AS1768 and where the *Risk* Assessment value is above 13, a system for lightning protection including surge diversion *is to be* provided.

5.03.13. Inground Pits

Where required pits will be heavy duty sealed gatic type and include space conduits/draw wires for future use. Pits will be located at each change of direction and at every 50 metres for straight run.

Pits will be adequately drained.

Pit load table with defined classes are outlined below for reference.

Type	Class	Typical use	Nominal wheel loading (kg)	Serviceability design load (kN)	Ultimate limit state design (kN)
	A	Areas accessible strictly by pedestrians. Not suited to vehicles. Purpose – residential backyards. Walkways not accessible by vehicles.	330kg	6.7kN	10kN
	B	Private and shared residential property. Suitable for vehicles accessing driveways and footways. Low speed only. Purpose – residential driveways. Unit sites. Parklands. Residential car parks.	2,670kg	53kN	80kN
	C	Residential roads and car parks trafficable to vehicles. Purpose – areas with slow moving traffic and minor roads.	5,000kg	100kN	150kN
	D	Major roads including freeway and motorway shoulders. Warehouses and loading docks. Purpose – major roads.	8,000kg	160kN	240kN
	E	Freeway and motorway carriageways. Suitable for all heavy vehicles. Purpose – freeways and motorways.	13,700kg	267kN	400kN
	F	Docks, wharfs and airport service and taxiways. Purpose – heavy and high traffic volumes.	20,000kg	400kN	600kN
	G	Docks, wharfs and airway runways. Purpose – heavy and high traffic volumes.	30,000kg	600kN	900kN

5.05 Security

5.05.01. Electronic Security Systems

Requirements For Access Control Systems, Intruder Alert And Alarm Monitoring; And CCTV Are Specified In The Approved Security Products Schedule.

5.05.02. Electrical Coordination

Refer to the Security Services Brief for specific requirements.

5.05.03. Card Swipe Access

All teaching rooms with a projector and/or resident computers are to have swipe access control, integrated into the security system. All laboratories are to similarly have swipe access control. Doors with swipe access control are to have mechanical lock override.

5.05.04. Door Hardware, Locks & Keying

Provide CCTV, access control, intruder protection as appropriate to the lab function, security of lab materials and apparatus, ongoing experiments as appropriate.

5.06 Acoustics and Vibration

Provide a suitable acoustic environment for Teaching, Research and Administration to avoid noise causing a nuisance to neighbours of *LTU Campuses*.

- Ensure that background noise and vibration levels in *Teaching and Learning* spaces are as low as reasonably achievable so that all students in the room can participate in classroom activities without speech reinforcement or hearing support.
- Room acoustics in teaching rooms will deliver acceptable voice clarity for a trained speaker without sound reinforcement wherever possible.
- Cellular and open plan office environments will provide suitable acoustic conditions to support the work being carried out and to minimise noise disturbance.
- Plant noise and music noise to external areas of the *campus* will be kept as low as reasonably achievable and will not cause a nuisance on or off the *campus*. Noise to comply with State Environment Protection *Policy* (Control of Noise from Commerce, Industry and Trade) No. N-1 (SEPP N-1) and State Environment Protection *Policy* (Control of Music Noise from Public Premises) No. N-2 (SEPP N-2).
- Noise from plant and machinery must be controlled to ensure that no employee at the workplace is exposed to noise that exceeds the noise exposure standard according to the Victorian Occupational Health and Safety Regulations.
- Green star IEQ requirements for acoustics (new *buildings* only).
- Vibration levels must comply with the maximum vibration levels for human comfort defined in ISO 10137 Bases for design of structures - Serviceability of *buildings* and walkways against vibrations. Specific requirements for laboratories or sensitive equipment will be outlined in the *Project* Brief and ISO 2631 Mechanical vibration and shock – Evaluation of human exposure to whole body vibration.

5.06.01. Performance Requirements

Office Requirements (Class 2)

Acoustic requirements for Class 2 cellular offices will be met where possible without taking walls to the soffit of the slab above in order to preserve flexibility for future fit out works.

Room Privacy Classes for Room Types

- CLASS 1: Senior Management, High profile Teaching Areas (e.g. lecture theatres with *AV*), Meeting Rooms requiring good acoustic privacy or separation, Conference/Function Rooms, Libraries.
- CLASS 2: Academic Offices, Flat floor teaching areas including collaborative type teaching areas, general meeting rooms and laboratories.
- CLASS 3: General and Open Offices, Amenity Areas.

Acoustic Design of Teaching Areas

Teaching or meeting rooms larger than 85 sqm *UFA* or that are accommodating audio or video conference equipment may need to be designed to meet the required criteria by an acoustic *engineer*. All *AV* or VC systems will be in accordance with Information Services Communications Brief and *Information Services* Digital Workplace Technology Standards and will be approved by Information Services.

Privacy and Noise Transmission

Design of acoustic separation between spaces must consider all *building* elements and possible paths for sound transmission. Hence, whilst partitions are generally the major elements to consider between rooms, consideration must also be given to sound transmission via flanking paths. The figures below are Noise Reduction figures generally based on field sound reduction (DnTw). It should be noted that selections of constructions based on laboratory sound reduction (Rw), (as is often provided in product literature) would need to be higher than the DnTw values specified in Table 13 to allow for actual in-field installations.

- Note STC (sound transmission class) and FSTC (field sound transmission class) have been superseded by Rw and DnTw respectively.

5.06.02. Minimum Weighted Sound Reduction Values

Table 14. Noise Reduction Levels

Privacy Classification	Sound reduction through walls and ceilings (includes operable walls)	Sound reduction through walls loss containing doors*	Sound reduction specification for doors only **	Subjective impression of sound reduction through walls and ceilings
Class 1	D_{nTw} 45	D_{nTw} 40	Rw 35	High degree of privacy. Voices in next room may be just audible but unintelligible.
Class 2	D_{nTw} 40	DnTw30	Rw 30	Good degree of privacy. Voices sometimes audible but conversation normally unintelligible.
Class 3	D_{nTw} 35	D_{nTw}25	NA	Voices audible and specific - conversation intelligible unless persons speaking in subdued voices. Although privacy is not good the reduction in office noise is well worthwhile.

* Typically includes glazing in walls to corridors and open areas.

** For the purpose of this Specification the sound reduction of the door is included as a laboratory performance and includes the door leaf and frame.

The following tolerances are applicable to the performance criteria

Sound insulation ±2Db

5.06.03. Ambient Sound Levels

In general, it is required that the level of ambient sound, as from air conditioning and ventilating and other mechanical equipment, should be neither so high that it is objectionable nor so low that the resulting quiet causes intruding speech and other activity noise to be objectionable. The design objective figures given in the table below are not intended as absolute maxima and minima but are preferred values.

The following tolerances are applicable to the performance criteria (this may be approved by the *UPR* if necessary to meet other requirements).

- *Building* services noise ±2dB

Table 15. Ambient Sound Levels

Type of Space	Recommended Ambient Sound Level Design	Subjective Impression
Lecture theatres	30-35dB L_{Aeq}, depending on the nature of the function.	Barely audible and very unobtrusive.
Classrooms, Meeting Rooms	35-45dB L_{Aeq}	Audible, but noticeable only in Tutorial Rooms absence of activity noise.
Offices of all Classes	40-45dB L_{Aeq}	Audible, but noticeable only in offices when there is little activity noise.

Where sound levels increase due to conversion from heating and ventilation to full air-conditioning, the design objectives will apply to the new design.

Ambient sound should be free from distinctive characteristics such as tones or fluctuations.

5.06.04. Reverberation Control

The control of reverberation in spaces is generally carried out either for noise control purposes or to create a specific acoustic environment. In areas such as libraries and offices, reverberation time should be minimized to control ambient noise levels. In teaching areas speech intelligibility is the most important criterion, for which an optimum reverberation time should be selected depending on the usage and volume of the space. It is advised that an acoustic *consultant* be used for the appropriate selection of reverberation time for teaching areas and specialist spaces such as music and television studios, auditoria or concert halls. In spaces such as these, speech projection and music quality may be dependent not only upon the amount of absorption, but also upon its appropriate location and room geometry.

The following tolerances are applicable to the performance criteria (this may be approved by the *UPR* if necessary to meet other requirements).

- Reverberation time ±0.1s

The following guidance is provided for reverberation time for typical spaces. Reference will be made to AS2107 for spaces not listed below, or for specific Curve references.

Table 16. Recommended Reverberation Times

Space	Recommended reverberation times, seconds
Lecture theatre with *AV*	Refer AS2107 Curve 1 Appendix A
Senior Management	0.6-0.8s
Meeting room	0.6 to 0.7
Conference/Function Rm	0.6 to 0.7
Libraries	<0.6
Academic office	0.6-0.8s
Flat floor fixed seating	Refer AS2107 Curve 3 Appendix A
Laboratories	0.5-0.8
Flat Floor Teaching Rooms	<0.6
Retail	Minimise as far as practicable
Toilets	NA
Group(open) office	0.4-0.7
Informal learning	Refer AS2107 Curve 3 Appendix A
Staff lounge	<0.6

5.06.05. Toilets

Where internal walls supporting basins and cisterns are adjacent to occupied areas they should be isolated from other walls to minimize structural noise transmission. Doors to the cubicles and toilet areas should have rubber stops to minimize impact noise. Toilet seats should also have rubber stops to minimize impact noise. Partitions between toilets and adjacent Class 1 or 2 spaces should be as for Class 1. Ensuites should have isolated walls supporting showers, fittings and toilets. Attention should be paid to ensure hand dryer noise is not heard to adjacent toilets or to Usable areas outside.

Relief Air from Toilet Suites

Acoustic relief ducts in ceilings *are to be* used where possible in lieu of grilles in doors to suites without airlocks, opening to commonly used passageway and adjacent spaces.

5.06.06. Plant Rooms

The class of insulation to be used for plant rooms will depend on the type of plant in the rooms, the location of the rooms in the *building* and the nature of adjacent rooms. Special consideration will be given to sound insulation of plant rooms and discuss proposals with the University at an early stage of documentation. Other specialist areas within a particular *Brief* will be identified and specified as necessary in the documentation stage. Plant rooms will be designed to eliminate as much plant noise as possible affecting surrounding spaces through *building* fabric and air borne sound.

Precautions will also be taken to minimise vibrations from plant. Ensure sources of vibration associated with plant or machinery are isolated to prevent or reduce transmission causing any disturbance to areas outside the plant rooms, including minimum ambient sound levels described above.

Vibration of plant and equipment from Plant Rooms and equipment generally will not exceed levels set out in AS10137 Bases for design of structures - Serviceability of *buildings* and

walkways against vibrations and ISO 2631 Mechanical vibration and shock – Evaluation of human exposure to whole body vibration.

5.06.07. Emergency Smoke and Fire Services

Emergency smoke and fire systems will comply with the noise requirements specified in Australian Standard 1668.1. The use of ventilation and air- conditioning in *buildings* Part 1: Fire and Smoke Control in Multi-compartment *Buildings*:

The noise level due to the operation of smoke control systems (including smoke spill fans and air pressurization fans) will not exceed 65dBA in occupied spaces or 5dBA above the ambient noise levels to a maximum level of 80dBA. Noise levels in fire-isolated exits will not exceed 80dBA.

5.06.08. Hydraulic Services

Noise generated by any hydraulic services such as water supply pipes or waste pipes must comply with the following:

- Where the noise source is continuous or semi-continuous, the LAeq must not exceed the services noise levels shown in Table 2.
- Where the noise source is intermittent, the Lmax must not exceed the services noise level shown in Table 2 by more than 5 Db.

5.06.09. Animal Facilities

There are various facilities at Melbourne (Bundoora) and Bendigo *Campuses* that house animals for teaching and research, such as La Trobe Animal Research and Teaching Facility (LARTF) at Bundoora that are very sensitive to both noise and vibrations. *Consultants* are to pay particular attention to limit noisy and high vibration construction processes within or close to these areas, and for the usage noise levels in final designs to be within working limits of the facilities. These should be captured within the *Project brief*. Close liaison is required with managers of the areas.

5.06.10. Audiometric Facilities

There are facilities within the University, such as in Health Sciences at Bundoora, that house Audiometric teaching, research and clinics. *Consultants* are to pay particular attention to construction and final usage noise levels in surrounding areas in relation to required levels within these facilities. Close liaison is required with managers of the areas.

5.06.11. Teaching Areas

Teaching rooms supporting lecture recording or video conferencing may be required to perform at higher standards than specified in the *Design Standards*. The *Principal Consultant* is to assess if advice of an Acoustic *Engineer* is required.

Attention will be applied to reverberation in teaching environments to cater for the room's *pedagogies*, in particular, to reduce the noise levels in rooms with group work.

5.07 Fire Protection

5.07.01. Performance Requirements

- Fire services are to conform in every respect to the requirements of applicable *building* permits, fire engineering designs, codes and standards; and to ensure health and safety of all occupants.
- Fire services installation is to comply with *BCA*, the *NCC* and associated *building* regulations and Australian Standards.
- Fire services installation is to comply with Water *Authority* and Fire Brigade requirements as applicable.
- The *UPR* is responsible for coordinating meetings between the required *Consultants* and *LTU FAS* personnel to discuss the scope of works and specific detailed requirements with *LTU* Infrastructure and Operations Group
- Fire services to comply with current engineered documents, *building* permits and the Australian Standards (current Standards) where applicable.
- Where new *buildings* are planned or where sprinklers *are to be* retrofitted into existing *buildings*, the *Project Architect* will inform *LTU's Risk* Unit through the *UPR*.
- All new major university *buildings* will be protected by automatic fire sprinklers where required by the *BCA* or Fire Safety *engineer*. *Buildings* containing high value commodities should be given special consideration as part of a *risk* analysis.

- Where *building* layout and design cannot meet the Deemed to Satisfy provisions of the *BCA* a registered Fire Safety *Engineer* may utilize the performance provisions of the current *BCA* to provide alternate solutions. These solutions will be reviewed and approved by the relevant *Building* Surveyor and the *MFB* or *CFA*
- *Buildings* that contain very high value equipment, such as Electron Microscopes will be protected by Pre-Action Sprinkler systems, linked to VESDA detection and point type detectors. These will be configured as a double interlocked arrangement to minimised water damage *risk*.
- Capture and reuse of fire system test water *is to be* provided where safe and suitable. Refer *Building* Commission Practice Note 2007-61.
- All plant and equipment will be supported locally with respect to service and spare parts.
- Refer also to the *Project Brief* for specific *Project* requirements.
- Each *building* may be flexible for a variety of educational uses and therefore each fire safety strategy must consider realistic levels of expected fire *hazard* and occupancy levels.
- The *BCA* provides for fire safety engineering assessment against specific performance requirements to meet the *Building* Regulations. Fire Safety engineered design *is to be* adopted where appropriate to optimize and effectively integrate the University's accommodation requirements within both new and existing *buildings*.
- Comprehensive tests will be carried out for both new and altered systems by the *Contractor* prior to a qualified independent *Certifier* and services *Consultant's* testing the system to ensure that the whole of the system complies with all appropriate Australia Standards. Any deficiency in a system which is added to or altered should be highlighted.

5.07.02. Fire Detection

- Fire detection and alarm systems for all works will be installed where required to the *BCA/NCC*.
- Smoke and heat detection systems *are to be* provided in accordance with Standards and Codes. Install smoke detectors where possible. Where smoke detectors are likely to falsely activate due to room conditions - utilise heat detectors. i.e. kitchens, breakout spaces, plant rooms, wet areas etc.
- Automatic fire detection systems will be fully addressable and networked back to the Main Fire Indicator Panel. These systems will include smoke and heat detection systems, air sampling systems or other specific systems and will be provided to meet regulatory requirements or particular asset protection requirements of the University.
- For all alterations to the fire detection systems at Melbourne (Bundoora), Bendigo, Wodonga, Mildura and Shepparton *campuses*, the fire *Contractor* is to make arrangements for the update of the University fire network floor plan drawing managed by Wormalds. Fire network floor plan drawing to be updated by an independent network *contractor* recommended by *I&O FAS* to update links to the system to incorporate the new works. Queries for these matters can be directed to the Essential Safety Measures Advisor, *I&O*, *LTU*, on 03 9479 2393.
- The systems will be of current technology and all components compatibility tested and compliant as a total system.
- The Evacuation Diagrams will be drawn so that when it is mounted on the wall it is correctly oriented with respect to the *building*.
- All new and *building* refurbishments will include a review and adjustment if required of the *building* Cause and Effect Matrix, which will be completed showing the sequence operation of these systems and be provided with the system installation manual for new works when installed. Queries for the location and update of the Cause and Effect Matrix can be directed to the Essential Safety Measures Advisor, *I&O, LTU*, on 03 9479 2393.
- Provision of Manual call points and Break glass alarms must be to code and as agreed with *LTU*. Manual call points *are to be* provided at the fire indicator panel only unless additional points are required for the specific *Project*. For example, provide additional manual call points if deemed required by a fire engineered solution.

- Automatic signalling equipment (ASE) to the Tyco ADT or similar.
- Very early warning digital smoke detection alarm (VESDA) systems will be installed in new computer server rooms. Refer to the *Project Brief* for details of computer server rooms.

Melbourne (Bundoora) *Campus* Only

- Provide fire rated hard line link from the *building* fire indicator panel to the Master Main Fire Indicator Panel located in the Central Control Gatehouse.

5.07.03. Fire Panels

For new *buildings*, *buildings* receiving a total refit and for existing *buildings* receiving a major upgrade of the Fire Indicator Panel, the Fire Indicator Panel will be designed to have spare capacity for at least 25% additional alarm groups.

All new Fire Panels will be compatible to ensure a full high-level interface is into this existing system.

Fire Alarm panels and field devices are:

- to be fully addressable and
- conform to (AS4428-1 1999) and
- be Certified and
- CSIRO approved and compatible with the existing Vigilant standard colour graphics and loop system.

New fire panels must comply with AS1670-1 and will be mounted a minimum of 50 mm above a floor.

Main Fire Indicator Panels, Sub Fire Indicator Panels and Mimic Panels will be located in accordance with the *BCA* and *MFB* or *CFA*.

An A3 sized laminated plan detailing the layout of all field devices will be mounted adjacent to each Fire Indicator Panel showing "as installed" condition drawing for the fire detection/protection system of the *building*.

Where the FIP is mounted externally, the "As-Built" drawings will be housed in a weatherproof "003" keyed lockable cabinet, having signage "Fire Detection Drawings" in 25mm text.

Oral communication facilities will be provided between the Main Fire Indicator Master-Panel and all Main Fire Indicator Sub-Panels.

Fire indicator panels will be of Vigilant manufacture, MX series.

Fire indicator panels will incorporate LED indicator lights for each zone in addition to their integrated liquid crystal display.

All Fire Indicator Panels will have an interface card suitable for the University monitoring system and will have a data connection within close proximity connecting in to the University network.

5.07.04. Fire Detectors

Remote indicators will be provided for all ceiling space fire detectors.

For new *buildings* and *buildings* receiving a total refit, system design will incorporate capacity for an additional 10% detector heads per 1000sqm.

All detectors will indicate a continuous steady light in an alarm condition. This includes situations where the existing detectors *are to be* connected to a new fire indicator panel. All concealed detectors will be installed in conjunction with a remote indicator which will indicate a continuous steady light in an alarm condition.

Existing switch rooms that are protected by thermal detection will be replaced to smoke detection.

Heat detectors installed in areas not generally occupied and not visible from open areas will be provided with a flashing indicator mounted external to that *area*.

5.07.05. Occupant Warning Systems / Ewis

The *Consultant* in conjunction with the *Project Building surveyor* and the Fire Safety *Engineer* will specify either a *Building* Occupant Warning System (OWS) or an Emergency Warning Intercommunication Systems (EWIS). *Consultants* will note that there might be special requirements for some areas such as Animal Houses and Research laboratories, or as described in *Project briefs,* where sounders are not suitable & strobes or other systems will be installed as an alternative.

The Fire Alarm System will also incorporate an emergency warning and Communication system to AS2202-2; including warden inter communication points and public address facilities, or a single zone tone fire warning system to AS2220 tones along with auto position and PA facility with microphone.

The type of EWIS selected will be Quintrix QE-90 or equivalent as approved by the Director, Facilities, Asset and Services.

Notwithstanding the following requirements, the whole of the EWIS must meet the appropriate Australian Standard and regulatory requirements.

5.07.06. Performance Requirements

New *buildings* and refits of *buildings* are to have an EWIS installed. Substantial refurbishments are to have an EWIS or OWS installed. Bells are acceptable as a minimum OWS where the existing system is bells, the *building* works are only of a very minor nature (e.g. one or two rooms being refurbished) and the *Project Brief* requires it or is accepted by the *Building* Surveyor. The extent of work to occupant warning systems outside the works area will be according to the *Project Brief* or as approved by the *Building* Surveyor.

Where an EWIS is not installed, a warning system to AS-1670.1 must be provided. The warning system must be a monitored system with ceiling or wall mount speakers.

The system will be installed throughout *buildings* of the University *Campuses*, where nominated by the relevant *Building* Surveyor.

Sound systems and intercom systems for emergency purposes will be installed for all works where required by the *BCA/NCC*. The systems will be of current technology and all components compatibility tested and compliant as a total system.

All EWIS will forego ALERT tone and go straight to the EVACUATION tone.

The evacuation message will be “EVACUATE VIA THE NEAREST EXIT”.

Emergency Warning Systems are to incorporate warning strobes lights in areas where they are required, and the typical background noise might interfere with the performance or perception of the Occupant Warning System panel.

System will comply with AS 1428.4.

For new *buildings*, *buildings* receiving a total refit and for existing *buildings* receiving a major upgrade of the Master Evacuation Control Panel, the Master Evacuation Control Panel *is to be* designed to have spare capacity for at least 25% additional alarm groups.

For new *buildings* and *buildings* receiving a total refit, system design is to incorporate capacity for an additional 10% speakers and warning devices per 1000sqm.

Master evacuation control panels will be of Vigilant QE90 manufacture and *are to be* compatible with the fire indicator panel.

Where existing systems are extended, new equipment added will be compatible. Additions will be identical and will be of the same manufacturer.

Sound pressure level in any area served by the whole system at any point less than 2 meters above floor level will not be less than 10db (A) above the maximum ambient noise level and will be in the range of 75db (A) to 95db(A).

For *buildings* requiring automatic tone generators only, these will be compatible with the fire indicator panel.

The EWIS will be interfaced to the FIP and will activate on receipt of an alarm from the FIP or a *GFA*.

The EWIS will be installed to act as a standard PA system. Early consultation with *LTU* Infrastructure and Operations Group is required for the application to establish zones etc.

The EWIS will be positioned adjacent to, or directly in the line of sight of the *Building* Fire Panel in accordance with Australian Standards.

All lock cylinders will be keyed to CL 003 locks.

Warden Intercommunication Phones will be installed at approved locations on each *building* level. All attempts should be made to have WIP's placed within hose reel cabinets adjacent to exits within *buildings*. When WIP's are located in these *area's* signage must be provided to identify their location.

Amplifier capacity and loadings will be checked for correct operating parameters.

Batteries will not be wired in multiple banks unless a separate charger and monitoring circuitry is provided for each bank. Batteries will be of the same make and model and of the same vintage where more than one battery is installed.

Warning Devices

- Speakers will be selected with a frequency range to allow the Alert, Action and Speech signal to be clearly propagated.
- The use of Horn type speakers will be limited to plant rooms and areas having high ambient noise levels only
- It is expected that in a typical floor area, a number of speakers are strategically located to provide the required sound pressure levels as described above.
- While complying with the current edition of all Australian Standard, special attention *is to be* paid to sound proof rooms where the sound pressure level generated by audible warning signals is less than 10db (a) above maximum normal ambient sound, or where the normal occupants may be expected to have hearing difficulties.
- Where practical, visual warning devices should be installed for the hearing impaired or in noisy environments.
- Each Visual alarm device will automatically operate when the alert and evacuation message as generated by the specific zone alarm from the EWIS panel.
- The system will comply with AS 1428.2 Design for access and mobility - Enhanced and additional requirements - *Buildings* and facilities.

Smoke *Hazard* Management

- Where the *BCA* nominates that Smoke *Hazard* compartmentation and smoke control is required, the system will be designed, installed and commissioned in accordance with Australian Standard, AS 1668.1.
- All active equipment including Dampers and associated In-Duct smoke detector will be fully accessible to enable easy access for regular maintenance and testing.
- Where dampers are built into services risers these will be accessible via removable panels and not built out.
- Equipment will be installed by a competent person as defined in the *Building* Act to ensure the installation is performed to a high standard. Evidence of the installers experience will be provided to *LTU* Infrastructure and Operations Group prior to commencement of works.
- All In Duct sampling units will be of the photoelectric type and be mounted within a dust & air tight clear enclosure. The detector head will be analogue addressable and be assigned a dedicated device descriptor nominating the AHU, R/A, S/A and location.
- All controls of Motors and fans will have specific toggle switches located either on the Fire Indicator Panel or a Fire Fans Control Panel.
- Any interface between the Fire Alarm System and Air Conditioning – shutdown/smoke fans, etc., will be completely documented and in particular the responsibilities to run wire/terminate/provide equipment etc. clearly defined.

- All smoke control systems will have colour schematic drawings indicating each smoke zone and each fan control function. These drawings will permanently mount adjacent to the FIP/FFCP for fire brigade information.
- It is not acceptable for the fire alarm to simply be confirmed at each MSSB. The mechanical services trade will confirm that each required damper and fan operated as intended.
- The results of the testing will be measured against any fire safety engineering report.

Smoke Doors

- Smoke doors *are to be* installed in the *building* where specified. Each smoke door will be fitted with an approved magnetic door holder compatible with the Fire Indicator Panel, and a "Press to release" door switch.

Passive Fire Protection

- The installer must hold a license registered with the *Building* Control Commission in the appropriate category for the installation of fire compartmentation systems, i.e. Passive fire equipment/wall and ceiling linings.
- Each Sub- *Contractor* will provide licensing and list of experience to *LTU* Infrastructure and Operations Group prior to commencing the works.
- All products will be listed by CSIRO, SSL or UL for use.
- Installation of fire barriers will be in accordance with the approved products guidelines provided by the manufacturer.
- All new penetrations will be recorded a the "Penetrations Register" Input information will include date of installation, name of company, product used, exact location using drawing reference name of installer and a photograph.
- All penetrations through fire / smoke walls will be Fire Rated using a listed and approved fire sealant having the same or higher Fire Resistant Level (FRL) rating.

Materials

- Material Safety Data sheet will be provided to the *UPR*.
- Prior to use the shelf life of the material will not have passed.
- Material will be nontoxic, and no asbestos products will be used.
- Maintain Cable separation (between comms data, fire detection, high and low voltage).

5.07.07. Aspirated Smoke Detection Systems

An aspirating smoke detection system known as a VESDA Laser PLUS (VLP) or approved equivalent will be installed where nominated by the *Project Brief* or *Building* Surveyor.

The system will consist of highly sensitive LASER-based Smoke Detectors with aspirators connected to a network of pipework. Display and Programmers will be provided at locations nominated on the drawing. Connect each of the VLP units to the Fire Indicator Panel serving the *building*.

Supply a display module as part of the VESDA unit that shows visual representation of smoke levels, scanning action, the first alarm sector (*FAS*) and alarms detected by the detectors.

The *Contractor* performing the installation works will be qualified and accredited to maintain ongoing certification of the completed system to the relevant *authority* having jurisdiction.

Scope or Works

- All aspirating smoke detection systems will comprise the following:
- Low level interface to the nearest Sub Fire Indicator Panel
- Addressable input/output devices
- Addressable input devices

- Short circuit isolators
- Fire Alarm Bell
- Visual Warning Device (where required)
- System cabling
- Independent Certification by Approved *Certifier*

Approvals

- The aspirating smoke detection system must be of a type tested, approved and/ or listed by:
- SSL (Scientific Services Laboratories) & UL (Underwriters Laboratories Inc.).
- FM (Factory Mutual Insurance Approval Guide) AS1603 part 8.
- Will conform to the requirements of EMC standards.
- EN 50081-1: Emissions, EN 55022/CISPR22: 1993 Class B, EN 50082-1: Immunity, IEC 801-2: 1984 Level.
- 3, IEC 801-3: 1984 Level 3, IEC 801-4: 1988 Level 3.

Codes, Standards or Regulations

- The entire installation will be installed to comply with AS1670, AS1603 Part 4, AS3000, and other appropriate Australian Standards.

Design Requirements

- The systems will consist of a highly sensitive LASER-based smoke detectors, aspirating fans, and filters. It will be modular, with Display's and Programmer that can be integral or remote. The system will allow programming of the four smoke threshold alarm levels, time delays, faults including airflow, detector, power, and filter, and configurable relay outputs. It will consist of an air sampling pipe network to transport air to the detection system.
- Performance Requirements - Each system will provide four output levels corresponding to
  Pre Alarm, Action, and Fire. These will be able to be set at sensitivities ranging from 0.005–20% obsc/metre.

Submittals

Quality Assurance:

- The manufacturer will be certified as meeting ISO 9002 for manufacturing.
- Both Light Scattering and Particle Counting will be utilised in this device as follows:
- The LASER detection Chamber will be of the Light Scattering type.
- A particle counting method will be employed for monitoring contamination of the filter.

Detector Assembly

- Each Detector, Filter and Aspirating Fan will be housed in a mounting box and will be arranged in such a way that air is drawn from the fire *risk* area through the Filter and Detector by the Aspirator. The Detector will also incorporate facilities to transmit detector fault and air flow fault conditions. The filter must be a two-stage disposable filter unit. The aspirator motor will be a rotary vane air pump utilising a Brushless DC Motor. The Assembly must contain software programmable relays for alarm and fault conditions. The Assembly will be able to be surface or recessed mounted. The assembly will have built-in data logging, with up to 12000 event storage per detector.

Displays and Programmers

- When required, a Display and/or Programmer will be supplied that is able to be located within the detector mounting box or a mounting box or rack remote from the detector. The Displays could alternatively be mounted in a cabinet specifically designed for this purpose and located as nominated in the Drawings. The system Programmer could alternatively be provided as a portable hand-held unit.

Device networking requirements

- The devices in the smoke detection System will be capable of communicating with each other via shielded twisted pair RS485 cable. This will be a daisy chain loop network. Multi-drop networks are not acceptable.

Digital Communication

- Will comply with EIA RS485 Protocol and be able to communicate with up to 250 other nodes.

Equipment

Detection Alarm Levels

- The Laser based aspirating detection system will have four independently programmable alarm levels; they will be used as follows.
- NOTE: The alarm level functions as listed are possible scenarios. Consideration should be given to the best utilisation of these facilities for each application and the requirements of the local authorities

Initial Detection Alarm Settings

- **Alarm Level 1 (Alert)** - Activate a visual and audible alarm in the fire *risk* area.
- **Alarm Level 2 (Action)** - Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.
- **Alarm Level 3 (Fire 1)** - Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Brigade and activate all warning systems.
- **Alarm Level 4 (Fire 2)** - Activate a suppression system and/or other suitable countermeasures (e.g. evacuation action or shut down of systems).
- Settings for the alarm levels will be determined by the requirements of the fire zone. However, the setting for Fire 1 will always appear as 100% on the bar graph scale. The initial settings will be:

Table 17. Initial Alarm Level Settings

Alarm Level 1		**0.08% obs per metre**		**Delay**		**10 seconds**
Alarm Level 2 (Action)	-	0.14% obs per metre	-	Delay	-	10 Seconds
Alarm Level 3 (Fire 1)	-	0.2% obs per metre	-	Delay	-	10 Seconds
Alarm Level 4 (Fire 2)		20 % obs per metre		Delay		10 Seconds
Fault-Airflow	-	5 seconds				

Fault Alarms

- The Urgent Fault relay will be connected into the appropriate alarm zone on the Fire Panel in such a way that Faults would register a fault condition on the Fire Panel.

Power Supply and Batteries

- The system will be powered from regulated 24 V DC supply. The battery charger and battery will comply with the requirements of AS 1603 Part 4.

The Detection System

- The *Contractor* will install the system in accordance with the manufacturer's installation and instruction manual and local codes (AS1670).
- The *Contractor* must also be able to provide documentation that indicates individuals performing site works have attended and passed a factory sanctioned training course, this documentation must include course certification. Note: for certification to be current, the course must have been completed within two previous years. This requirement must be stated on the *Consultant*'s *tender*/quotation documents.

Sampling Pipe Network

- All piping will be supplied and installed in accordance with AS3000.
- The main sampling pipes will be grey/white of the PVC electrical conduit type and comply with AS 2053, be of 25 mm nominal diameter and will comply with AS1670 (Clause 6.2.3Ch).
- All changes of direction will be made with long radius bends.
- The far end of each trunk pipe will be fitted with an end cap and drilled with a hole or holes normally of 2 mm diameter, or otherwise appropriately sized to achieve the performance as specified and as calculated by the system design.
- All joints will be air tight and made by using solvent cement, except at entry to detector mounting box.
- All pipework will be supported at not less than 1500 mm centres NOTE: Sampling pipework will be anti-statically treated.

Kerb

- Sampling holes of 2 mm diameter will be separated by intervals not more than as specified in AS1670 and typically in the range of 9 to 10m intervals along the length of the pipework.
- The following aspects must be in accordance with the relevant Australian Standard (s)
- Identification of each Sampling Point
- the number of Sampling Points and
- the distance of the Sampling Points from the ceiling or roof structure and forced ventilation systems.

Air Sampling Network Calculations

- Air Sampling Pipe Network Calculations will be provided by a sampling pipe aspiration modelling program such as ASPIRE™ (latest Version) Pipe work calculations will be supplied with the proposed pipe layout design to indicate the following performance criteria:

Transport Time

- Local codes or end users' standards may also apply. For example:
- BFPSA Code of Practice, UK, 120 seconds
- The maximum transport time must never exceed the local codes.

Balance %

- The sample point balance for the pipe will not be less than 70% as indicated by ASPIRE. That is, the volume of air drawn from the last sampling point will not be less than 70% of the average volume of air through the other holes.

Share %

- The sample hole share for the pipe will not be less than 70% as indicated by ASPIRE. That is, the sum volume of air drawn through the sampling holes must always be greater than 70% of the total volume of air entering the pipe (i.e. the End Vent must not exceed 30% of the total flow).

Commissioning Tests

- The *Contractor* will allow for the manufacturer or their representative to attend the commissioning.
- All necessary instrumentation, equipment, materials and labour will be provided by the *Contractor*.
- The *Contractor* will record all tests and system calibrations and a copy of these results will be retained on site in the System Log Book and supplied to the end user.

System Checks

- Visually check all pipework to ensure that all joints, fixing, bends, sampling points, etc., comply with the Specification.
- Check the system to ensure the following features are operational and programmed in accordance with the specification.
- Alarm levels and Indicators, for both day and night. Set clock function to local time.
- Time delays.
- Bar graph display.
- Air flow fault indicators.
- Isolate/Reset buttons.

- Check to ensure that all ancillary warning devices operate as specified.
- Check interconnection with Fire Indicator Panel to ensure correct operation.

Tests

- Introduce Smoke into the Detector Assembly to provide a Go/No-Go Test.
- Introduce smoke to the least favourable Sampling Point in each Sampling Pipe. Response time is not to exceed ninety (90) seconds and *is to be* within 15% at the ASPIRE calculation.
- Activate the appropriate Fire Panel zones and advise all concerned that the system is fully operational. Fill out the log book accordingly.

5.07.08. Sprinklers

General

- An Auto test facility will be installed to the pump set to allow the accurate testing and reporting of cut in pressures.
- A Closed Loop Flow Switch Test Circuit similar to a TYCO Zone-check re-circulation system will be installed on each valve set to ensure that water wastage is minimised.
- All drains will be fitted to pump systems and the test facility and will run to an appropriate waste.
- All flow switches will be fully addressable and networked back to the La Trobe MFIP and connected up to the existing fire graphic system.
- A pressure relief for the pump as well as system pipe work will be installed. A throttle valve *is to be* installed to allow for accurate flow readings.
- All pumps will be installed with Mechanical Seals only.
- All gauges will be installed with a ball valve to enable the service or replacement of the gauge.
- Doors to pump rooms will be signed appropriately with details of the *building* that the fire pump services.
- The *Consultant* will ensure that final documentation contains a "Sprinkler Block Diagrams" with "As Built drawing" provided by fire services *Contractor*.

***Hazard* Classification**

- Unless detailed below, all *buildings* will be classified as described in AS2118 and Appendix A of AS2119.1.
- *LTU* does not permit the use of Light *Hazard* classification, unless the *building* is used for accommodation or concealed spaces.
- All areas with sprinklers will be protected by *FAS*t Response sprinkler heads, having an RTI of less than 50.
- Library stack areas greater than 100 m² will be protected to High *Hazard* Category 1 having a design criteria of not less than 7.5mm/min over an area of operation of 260 m². Libraries and smaller stack rooms will be protected to Ordinary Group 3, 5mm/min over 216 m².
- Water supply will be designed to ensure the fire sprinkler systems can achieve the design criteria of the sprinklers plus an additional hose stream allowance of 1800 L/min.
- All laboratories used for the storage and handling of chemicals will be protected by sprinkler designed in accordance with Ordinary *Hazard* Group 3 over an assumed area of operation of 300 m².

Approval

- Where complete major upgrade of existing *buildings* (without sprinklers) *are to be* undertaken, consideration *is to be* given to installing an approved automatic fire sprinkler system as part of the scope of works

- Where new *buildings are to be* constructed and sprinklers are not required by code, consideration should still be given to installing an automatic fire sprinkler system.
- Fire sprinkler systems for all works will be installed where required by the *BCA/NCC*.
- Sprinkler heads installed in student residential *buildings* will be of the concealed type.
- Systems *are to be* fully hydraulically calculated by registered competent *Engineers*.
- Systems pipework will be designed to accommodate a 30% increase in connected sprinkler heads.
- Where possible system testing water *is to be* re-circulated or collected for re-use in *landscape* watering systems.

5.07.09. Gas Suppression System

General

The use of Gas Suppression Systems will be subject to the *Project* Brief but would typically be considered for areas such as data centres, substations, turbine enclosure, and critical equipment areas such as electron microscopes.

Provide NOVEC 1230 automatic and manual fire suppression systems in accordance with Australian Standards.

The installation will comply with the requirements of the Local Fire Brigade for conditions of connection documentation.

The System will consist of a Fixed Pipe Engineered NOVEC 1230 Fire Suppression System being made up as follows:

- NOVEC 1230 storage and distribution pipe work nozzles inclusive of pipe sizing
- Detection and controls
- Accessories
- Stop Gas/Manual Release Arrangement
- Evacuation and Warning Signage and Sounders including System Inoperative Signs.

The system consists of a number of cylinder banks and a fixed pipe reticulation to nozzles suitably positioned to apply the agent to the *risk*. The pipe sizes and nozzles will be sized in strict accordance with the manufacturer's guidelines.

System Description

- The system will use NOVEC 1230 to flood the occupied areas. The system will activate from a simultaneous VESDA and single point detector alarm.
- The FIP will have an exhaust fan control and also control the visual and audible alarms.

Wiring Standard

- Quality, supply, installation etc. in accordance with relevant standards.

Circuits

- Run through accessible ceilings, electrical riser ducts or other concealed spaces wherever possible. Where exposed to view in corridors and public spaces the wiring will be enclosed in rectangular ducting equal to "Aussieduct" except for plant rooms which can be run in conduit. Install as far as possible in corners between walls and ceiling. Fixing will be made internally and at sufficient frequency to prevent any sagging. Support cables independently of ceilings and other services. Do not use explosive powered *FAS*tenings.

Fire Suppression System

- The system will be designed around the use of "NOVEC 1230" fire extinguishing agent.

- The agent will be stored in purpose-made storage cylinders, connected to distribution pipework through electrically controlled actuators.
- The quantity of agent to be stored will be calculated in accordance with the equipment supplier's recommendations.
- The system will be activated automatically by the SFIP upon registration of a “FIRE LEVEL 2” alarm from the *VESDA* and the single point smoke detectors alarm zone.
- Provide suitable system isolate and manual discharge facilities, both independent of SFIP logic controls, to allow safe servicing of the system or direct emergency discharge.
- Include all wiring and terminations between the FIP and the electric actuators on the storage cylinders.
- Provide flexible discharge hoses and pressure reducing unit to connect the storage cylinders to the distribution pipework.
- Pipework will be constructed of seamless galvanised pipe and forged steel fittings having a working pressure suitable for the agent.
- Pipework will incorporate flanged or screwed connections and as much as possible will be pre-fabricated off- site by welding.
- Ensure all pipework is adequately supported and provide additional supports at junctions, nozzles and changes of direction to absorb thrust forces generated during agent discharge.

***Area* Volume and Extent of Protection**

- The proposed system will be based on the "Total Flooding" concept which consists of a supply of the NOVEC 1230 fire extinguishing agent, arranged to discharge into and fill to a uniform concentration of 5.2% or higher as recommended by the Manufacturer. The ceiling void will not require protection.
- Calculate and size the gas bottle storage capacities in accordance with AS4214.

Discharge Controls

- Provide Manual Gas Control Station to override the automatic discharge gas system in accordance with AS 4214- 2002 for each system. The manual control to have a safety interlock such that the system can return to fully automatic control when necessary or required.
- Total gas discharge must occur within 10 seconds in accordance with AS4214-2002.
- Exhaust fans control will be located adjacent to the gas discharge release switch. The control will be locked off to prevent unauthorised operation.
- The controls to include manual initiate switch as well as a mechanical release device which will initiate audible and visual indicators and extinguisher inhibit switch to stop the system discharge. Locate manual control stations where at 1500 above floor level.
- Provide manual release at storage cylinder bank.

Delay Function

- Provide a time delay unit in each gas control panel. The time delay to be determined in consultation with the local fire authority and be of approximately 30 seconds following activation of the second detector circuit before gas is released.
- Activate 'DO NOT ENTER' and 'EVACUATE AREA' signs and alarms, close relief and exhaust fire dampers and shut down exhaust fans at the beginning of the time delay period.

Nozzles

- Provide approved surface mounted gas nozzles. Locate and install nozzles in accordance with the manufacture’s recommendation, and to AS4214.

Gas Storage Cylinders

- Provide gas storage cylinders designed to hold the gas at up to 650C. The steel cylinders to comply with AS1210.
- In a multiple cylinder system, connect all cylinders with a common manifold and by suitable copper loops, with non-return valves. Provide each cylinder with its individual pressure gauge.
- Provide substantial cylinder brackets with red enamel coating, cylinder mounting to be *UPR*ight and as shown on the drawing.
- Provide 100% reserve cylinders as a back-up discharge in event of fire and to allow plant to continue operating whilst cylinders are being recharged.
- Discuss 100% reserve with La Trobe property prior to including.
- Locate cylinders and associated accessories as shown on the Drawings.

Release Devices

- The releasing device will be easily removable from the cylinder without emptying the cylinder. While removed from the cylinder, the releasing device will be capable of being operated, with no replacement of parts required after this operation. The use of explosive devices to actuate agent discharge will not be permitted. Upon discharge of the system, no parts will require replacement other than gaskets, lubricants and the NOVEC 1230 1230 agent. Systems which require replacement of disks, squibs or any other parts which add to the recharge cost will not be acceptable.

Mechanical Manual Release

- The NOVEC 1230-cylinder configuration will have a Mechanical manual Actuator for manual release and discharging of the NOVEC 1230 gas to the *risk area/s*.

Local Control Stations (LCS)

- A LCS will be provided at the main point of entry into each Protected space comprising an abort switch (inhibit) and manual discharge switch. Operation of the abort switch will send a “system abort” indication to the fire indicator panel when a fire condition exists. A separate “trouble” indication will result if the abort switch is operated when no alarm condition exists. Audible alarm indications will change when the abort switch is operated as an audible acknowledgement that the control panel has received the abort signal.
- Operation of the manual discharge switch will initiate the time delay and activate audible and visual signage in accordance with AS4214 – 2002.

Discharge Nozzles

- Discharge nozzles will be used to disperse the NOVEC 1230 agent. The nozzles will be brass with female threads and available in 15mm dia. to 50mm dia. sizes. Each size will come in two styles, 180° and 360° dispersion patterns. The nozzles used will be provided with pipe threads that correspond with the nozzle size. The nozzles will have Active Fire Listing approvals.

Piping

- All system pipework will be schedule 40 galvanised steel, seamless to ASTM A106. Use only approved gas seal Teflon tape to make on fittings.

Fittings

- All screwed pipe fittings will be galvanised steel BSP.

Hangers

- All system pipe supports to meet the requirements of the manufacturer’s recommendations and the Australian Standards for Gaseous Fire Extinguishing Systems: AS4214 – 2002.

Distribution System

- Gas distribution pipe system to be galvanised steel in accordance with AS1397 and "Pipework and Valves" section of this specification.

Warning Signs

- Supply and install 24 Volt DC LED Matrix Double Sided Evacuate Area warning signs with 32mm lettering and sounders will be supplied and installed in the protected space.
- Supply and install 24 Volt DC fluorescent Do Not Enter warning signs with 32mm lettering and sounders will be supplied and installed at the entrance doors to the protected space.
- Supply and install 24 Volt DC florescent System Inoperative signs with sounders adjacent to the Do Not Enter Signs.
- Supply and install zenon flashing light with sounder at the entrance door the protected space.
- The lettering of the internally illuminated "EVACUATE *AREA*" and "DO NOT ENTER" signs will be red and not less than 32mm high on a black background. The signs will be energised upon initiation of the system discharge sequence. Lettering on the "SYSTEM INOPERATIVE" signs will be as required by AS4214.

Instruction Signage

- The warning and instruction signs will have black lettering on a yellow background and will have a letter size equal to or greater than that illustrated in AS4214.

Fire Rate Penetrations

- Seal penetrations for fire suppression services through fire rated barriers to ensure fire rated integrity of barriers is maintained.

Equipment Shutdown

- Contacts will be supplied within the control panel for equipment shutdown.

Fire Alarm System – Sequence of Operation

- The NOVEC 1230 gas suppression system will be initiated via a dual circuit principle involving *VESDA* fourth stage alarm in conjunction with a point type smoke detector second stage alarm.
- Upon the fourth stage alarm a 30 second time delay sequence will commence in which when expired will discharge the gas suppression agent to the nozzle locations to flood the compartment.
- The main gas control panel will be incorporated into the new SFIP and connected into the existing fire alarm system for local fire brigade call out.

5.07.10. Hydrants

Hydrant systems for all works *are to be* installed where required by the *BCA/NCC*. New or substantially reworked fire systems are to tap into the existing fire ring main, subject to a review by qualified *Consultants*.

Existing Hydrant protection must be considered when any internal refurbishment is undertaken. Provide required documents to satisfy *Building* Surveyor that existing hydrant is adequate to meet *building* code requirements.

All new hydrants types and locations *are to be* approved by *FAS*, *I&O*.

All new fire hydrant systems will be designed, installed, commissioned and certified in accordance with AS2419.1.

Wherever possible, utilise external double hydrants to provide hydrant coverage throughout *buildings*. Where significant hydrant coverage shortfalls remain that cannot be accepted by the relevant Fire Brigade, provide internal hydrants within fire isolation stairwells.

All shortfalls in fire hydrant or fire hose reel coverage will be subject to a Regulation 309 application presented to the relevant Fire Brigade for consideration. All hydrants *are to be* fitted with couplings suitable for use by the relevant Fire Brigade.

External Fire Hydrants

- External fire hydrants will be mill-cock type individually valved and fed from a 100mm galvanised flanged branch directly from the main. Hydrant outlets will be in accordance with the relevant Fire Brigade requirements. Install two landing valves on a pillar per location. Provide wire tie and lead seal to each valve/hand wheel.

Internal Fire Hydrants

- Install internal fire hydrant outlets in fire isolated stairs as directed by *Project* services drawings.
- Install a single valve-controlled outlet per location. Provide wire tie and lead seal to each valve/hand wheel.

5.07.11. Hose Reels

Fire hose reels for all works *are to be* installed where required by the *BCA/NCC*.

Existing Hose Reel protection must be considered when any internal refurbishment is undertaken. Provide required documents to satisfy *Building* Surveyor that the existing Hose Reel location is adequate to meet *building* code requirements.

All new hose Reels *are to be* in keeping with new fittings installed at *LTU*.

Manufacture fire hose reels in accordance with AS1221, installed to AS2441 and be approved by the Local Fire *Authority*. Hose reels will be Fire Master (Tyco) or approved equivalent. Provide hose length of 36m unless noted otherwise with a 20 mm outside diameter 3 ply rubber hose and 6.5mm internal nozzle diameters. The nozzle must be twist adjustable for on and off control and interlocked with the hose reel stop cock. Water supply pipework to be not less than 25mm nominal diameter. Mount the centre of the reel hub 1500 above the floor and display the operating instructions. Provide mounting stand or bracket to suit location. Do not attach to racks.

5.07.12. Portable Extinguishers

Portable extinguishers and fire blankets *are to be* provided in accordance with AS2444 and the *BCA/NCC*.

Where extinguishers are required in computer centres or communications rooms, dry chemical type will be provided in preference to CO2 type.

All new extinguishers *are to be* in keeping with new fittings installed at *LTU*.

The *Contractor* will supply, install, test and maintain fire extinguishers in accordance with AS2444, *MFB* Guideline GL-16 and as required by the *Project building* surveyor.

Each laboratory will have a fire extinguisher near the exit door, usually 4.5kg ABE dry chemical. The provision of fire extinguishers for laboratories will be as per *BCA* requirements, and any particular *project* requirements.

AS4224.8 requires a fire extinguisher to be located in close proximity to every fume cupboard.

5.08 Hydraulics

5.08.01. Performance Requirements

The design of the hydraulic services for the *building* is to:

- minimise the use of potable water
- reduce landscaping water demands
- harvest rainwater for reuse
- reduce water going into the sewerage system; and
- minimise the size and cost of energy consuming systems and minimise the operational energy consumption of these systems.

All plant and equipment will be supported locally with respect to service and spare parts.

All branches and spurs off *campus* mains for water and gas supplying *buildings* will be fitted with tested isolating valves.

For new *buildings* and works requiring new valves or meters the *Consultant* will consult with *I&O* to determine the site boundary for the works prior to approaching Authorities.

For new *buildings* and major refits of *buildings*, the available water pressure *is to be* monitored over a 24-hour period during typical *campus* use, and then verified that available water pressure is available.

For new *buildings* and bathroom refurbishments samples of fittings *are to be* provided to *LTU* for approval.

A single capped connection point *is to be* provided for and within all tenancies, for each hydraulic service.

Provide access to all hydraulic services infrastructure as much as possible. Full access for servicing and repairs *is to be* incorporated into the design of new works, utilising access panels as necessary. Panels to have metal frame and lock to approval of the *I&O* Representative for the *campus*.

- Each service e.g. Water, natural gas, compressed air, vacuum, steam etc. will be fitted with a control valve adjacent to each fitting or small group of fittings suitable for the service provided.

5.08.02. Hot Water

Hot water systems (not Boiling Water unit for sinks) will be designed to suit the intended application. In general, this will require the following:

- Storage temperature (domestic use) minimum 60°C.
- Supply temperature (domestic use) maximum 50°C.
- Supply temperature to disabled facilities maximum 45°C.
- Hot Water systems will comply with AS3500.
- Pressures to be similar to cold water systems.
- Pressure reducing valves to be provided at point of supply to fixtures where required and these must be easily accessible for maintenance.
- System capacity to be determined to service the system peak demand.
- Hot water unit make and model to be confirmed and approved by *LTU*.

5.08.03. Stormwater

Eaves Gutter Systems

- Average recurrence interval (ARI) 1:20 years.
- Intensity derived from AS3500 Part 3.
- Duration 6 minutes.

Box Gutter Systems

- Average recurrence interval (ARI) 1:100 years.
- Intensity derived from AS3500 Part 3.
- Duration 6 minutes.

Design Requirements

- Note that the above does not account for the effects of hail. Overflow design must be installed on all systems and include for the effects of hail.
- All required eaves gutters, box gutters, overflows, expansion joints and downpipes will be made by the roofing *Contractor* and covered in the Architectural documents.
- Where greater than 10% of roof gutters to a roof, new or replaced gutters will have fitted an appropriate gutter guard to prevent the accumulation of leaves and other debris. Detail of gutter guard and method of installation *is to be* approved by *FAS*.

- Qualified/Experienced Hydraulics *Engineer* to prepare computations in accordance with AS3500 to assist *Architect* in sizing of all gutters, downpipes, sumps and overflows.
- All overflows *are to be* designed and sized in keeping with the primary downpipes.
- All gutters, sumps and rain heads will be constructed from stainless steel.
- Typically, connections to downpipes and trench drains *are to be* no less than 100mm unless otherwise approved.

5.08.04. Sub Soil Drainage

Sub soiled drainage to be designed in accordance with AS3500 Part 3 Section 8.

Allow for adequate clean out points on system to assist with future maintenance.

5.08.05. Water Sensitive Urban Design

When part of the works, or if agreed to be within the *Brief*, stormwater leaving the site at any time, up to a 1-in-20-year storm event should be treated and filtered in accordance with either:

- Urban Stormwater Best Practice Environmental Management Guidelines (CSIRO, May 2006); or
- Australian and New Zealand Environmental Conservation Council (ANZECC)'s Guidelines for Urban Stormwater Management.

Minimum Objectives to be complied with:

- Suspended solids (SS): 80% retention of typical urban annual load
- Total phosphorus (TP):45% retention of typical urban annual load
- Total nitrogen (TN):45% retention of typical urban annual load
- Waste: 70% retention of typical urban annual load
- Flows: Maintain discharges for the 1.5 ARI at pre-development levels.

Compliance with the above objectives should be confirmed via MUSIC urban stormwater software modelling.

For Green star communities' credit, the *project* must meet all of the following minimum requirements for stormwater:

- -75% of the total annual stormwater runoff is evaporated or
- retained within the *project* site, via both harvesting and infiltration;
- -The post-development peak 1-year Average Recurrence
- Interval (ARI) event discharge from the *project* site does not exceed the pre-development peak 1-year ARI event discharge; and
- The quantity of key pollutants discharged in site stormwater is limited, based on the percentage reduction of sediment, phosphorus, nitrogen, and litter in *project* runoff when compared to untreated runoff.
- For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 24A.1** – Storm Water & Credit **24A.2** – Greenhouse Strategy.

5.08.06. Rainwater Storage and Reuse

For new buildings and major refurbishments rainwater catchment and storage at nearest possible location e.g. basement storage tank connected to flusher tank in roof/plant room to be considered for use in toilet flushing, landscape irrigation and general wash-down as required. Rainwater storage is to be sized in accordance with the above objectives for Water Sensitive Urban Design.

Rainwater that is not captured and reused onsite at Bundoora can be diverted into the moat, and then extracted from the moat for landscaping irrigation.

The system will be sized based on:

- The intended use of rainwater (e.g. toilet flushing, irrigation) and expected rate of use;

- The collection rate based on the collection area and rainfall data; and
- Compliance with the minimum objectives nominated above for Urban Stormwater Best Practice.

5.08.07. Sanitary Drainage

Designed to provide flexibility for future connection of additional fixtures.

Up to 5 fixtures per 1000 sqm of office space for each contiguous floor or as required.

10% additional fixtures should be strongly considered across the entire facility.

5.08.08. Gas Supply

Designed to meet the maximum demand of connected equipment without the use of consumer side pressure boosting systems.

Designed and sized in accordance with AS5601 with additional 10% for future connections.

5.08.09. Water, Drainage & Gas for Laboratories

Water

- Potable water required to hand basins, perimeter and bench sinks, safety showers and eye baths.
- Non-potable water may be used as required
- All outlets to be appropriately labelled.
- Reverse Osmosis (RO) water to be as per below.

Drainage

- Eye wash to be drained to plumbed waste lines. Safety showers are not to be plumbed to waste lines.
- Sinks must be stainless steel to cope with corrosive chemicals, dry ice and other hazardous agents.
- All drainage pipe work to be HDPE.

Gas

- Compressed air, double gas outlets to all perimeter and central lab benches as required.
- Other specialist gas provision as required.
- Gas points for Oxygen, Nitrogen, Helium and Vacuum systems, medium pressure compressed air and high-pressure air as required by lab *Briefs*.
- Allow for CO2 and other emergency buttons, and *hazard* monitors as required.

5.08.10. Water Metering

Water metering will be provided to the *building* level and for all major water uses, including:

- Leased tenancies
- Evaporative heat rejection systems
- Irrigation systems
- Wash-down systems
- Recycled water supply
- Rainwater supply
- Humidifiers
- Boilers.

All meters *are to be* connected to and be compatible with the *LTU* cloud hosted energy monitoring system (AZZO) in a manner so that data is readily available for *LTU* upon request

During Design, *Project Consultants* should liaise with AZZO for systems integration connection requirements and further hardware specifications when installing meters.

5.08.11. Water Metering Performance Specifications

The following are general water meter performance specifications. Final meter selection to be confirmed in liaison with AZZO Pty Ltd.

Table 18. Water Metering Performance Specifications

Metric	*Building* Level
Measurement Method	Turbine wheel
Measured value acquisition	Contiguous
Accuracy	2% on transitional flow 5% below minimum flow
Connection	Treaded or flanged
Protocols	Modbus or Pulse output
Measurement Variables	Volume (m3/h)
Display	Digital or mechanical dial

5.08.12. Moat Extraction Point Metering

LTU's Melbourne *Campus* must comply with a Melbourne Water Take and Use Licence in regard to the extraction of stormwater from the moat system. The licence requires all extraction points to be metered using meters specified by Melbourne Water. Current extraction point water meter specifications should be sought from the Diversions team at Melbourne Water. Meters *are to be* connected to and be compatible with the *LTU* cloud hosted energy monitoring system (liaise with AZZO).

5.08.13. Hot Water Metering

Where new hot water units are installed (to high use areas) allow to supply pulse meter on cold water supply to hot water. Meters *are to be* connected to and be compatible with the *LTU* cloud hosted energy monitoring system (liaise with AZZO).

5.08.14. Cold Water

Domestic cold water services will include:

- Incoming metered cold water service.
- Provision for reticulated cold water supplies to all sanitary fixtures, fittings and tapware as required, incorporating quarter turn maintenance isolation valves to each fitting.

All required internal/external hose connection taps to assist general cleaning and wash down, complete with vacuum breakers and all necessary backflow prevention devices.

A complete *landscape* irrigation system including all required backflow prevention devices.

Sub-metering for all major water end uses via remote electronic meter reading, including main *authority* meter, cold water supply and rainwater storage supply, mechanical services and hot water supply.

Supply to mechanical equipment, hot water units, hose taps etc. complete with backflow prevention.

Provisions for fluid aprons to all tap breaches in walls and ducts.

Water hammer and its effects *are to be* eliminated by addressing the following issues:

- Design of water service pipework to maintain water velocities to a maximum of 1.5 metres/second.
- Use and spacing of pipe supports and fixings.
- Exclusion of quick closing tapware such as ceramic disc, quarter and half turn tapware.
- Hammer arrester devices to items such as dishwashers, glass washers, washing machines and mechanical services equipment.

All external water pipelines through open trench technique are to have detectable tape with tracer wire installed approx. 300mm above pipe in the backfill.

5.08.15. Hot Water

Hot Water services will include:

- Provision of gas boosted solar hot water systems, comprising evacuated tube collectors, storage tank with integrated gas heater or separate instantaneous gas fired heater. Alternate systems utilising waste heat for generation of domestic hot water may be submitted as an alternative. Final selection of hot water unit including make and model to be approved by *LTU* prior to finalisation of design documents
- Reticulation of domestic hot water in insulated (Min insulation per AS3500.4 plus 20%) pipework to all fixtures and tapware and incorporating all required maintenance isolating valves and temperature control devices.
- Only *LTU* approved Thermostatic mixing valves *are to be* used to all disabled bathrooms, showers, baby baths and high *risk* areas. Approved tempering valves can be used to service basins.
- All thermostatic mixing valves and tempering valves *are to be* located at low level for ease of access and maintenance. Allow for stainless steel access panel where located in walls.
- Provision for all required backflow prevention devices and temperature relief valves.
- Provision for reticulated hot water supplies to all tapware as required, incorporating quarter turn maintenance isolation valves to each fitting.
- Provision of adequate stop valves on all fixtures including branch lines off hot water flow and return
- Hot water supply pipes must have high-performance pipe insulation including joints, elbows and valves.

5.08.16. Sewer and Trade Waste

Sanitary waste and discharge systems are to include:

- The collection of all domestic waste discharges from fixtures and fittings via PVC fixture and branch wastes, including:
- Toilets.
- Hand basins.
- Urinals.
- Drinking fountains.
- Cleaner's sink.
- Showers
- Floor wastes in toilets.

Exposed fixture wastes will be chrome plated copper.

All required floor wastes and tundish wastes, maintenance access and inspection openings.

Floor wastes will have a removable chrome plated brass grate. Floor waste risers will be not less than 80mm diameter. All risers will be fitted with an approved flange and will be cast into the concrete floor slab. Floor wastes will have charging provision (i.e., 'trap primers'). Provide deep seal (75mm) traps to plant/air handling and laboratories. Floor will be graded to the floor wastes. Any sub-flooring membranes will also be graded to the puddle flange.

All required fire stop collars to services passing through structural slabs, fire walls and floors.

All required sanitary waste and drainage ventilation services terminating to atmosphere at roof level.

Below ground PVC sanitary drainage services collecting waste discharges from waste stacks, fixture wastes etc. with gravity connection to the sites sanitary drainage services infrastructure and incorporating all required maintenance and inspection openings.

On-site trade waste treatment systems for ongoing operations. i.e. grease arrestor/s.

Typically Trade waste drains to be sewer grade HDPE and fit for purpose. Nature of discharge to be confirmed and assess adequacy of HDPE.

Provision for the collection and disposal of all mechanical air conditioning plant condensate waste via all required floor drains, and tundish wastes, with connection to stormwater disposal system and/or grated waste sump boxes as required.

Height of tops of pits *are to be* co-ordinated with finished garden beds materials to maintain identification of pit.

Grease traps *are to be* accessible to service vehicles.

Minimum external pipe size to be 150 mm diameter.

Provide concrete junction sewer grade pit at all major changes in direction and grade to external infrastructure.

Provide minimum 225mm sewer maintenance shaft on minor external sewer drains for ease of maintenance.

5.08.17. Stormwater

All required eaves gutters, box gutters, overflows, expansion joints and downpipes will be made by the roofing *Contractor* and covered in the Architectural documents.

The stormwater system will be designed for 100 years return rainfall intensity as a minimum requirement.

Sump Pumps

- Install duplicate pumps in stormwater and sewer pits where required.
- Pumps controls will include a high liquid level indicating alarm. Alarms will be visual and audible.
- Each pit controlled by common control panel with automatic run-standby alternating facilities together with sensing probes. Provide high level local audible alarms at control panel.
- Submersible pumps will be designed to enable easy removal with lifting eyes
- Height of tops of pits *are to be* co-ordinated with finished garden beds materials to maintain identification of pit. Consideration will be made in the design to exclude garden mulch entering the drainage system causing blockages and reducing efficiency.

5.08.18. Gas Service

This section covers gas supply for *building* services equipment and domestic hot water services with provision for additional authority metered connections to service retail tenancies.

The installation will include gas meter room/enclosure with space provision for additional meters to service retail tenants, incoming gas service line, consumer piping and venting systems.

All new in ground pipes are to have tracer tape over the pipes, approx. 300mm above the pipes, to allow detection and warning for any future digging.

5.08.19. Gas Metering

Gas use should be metered at the *building* and tenancy level and new metering should be installed or old metering that does not confirm to the performance specifications below should be replaced, when a *Project* interacts with the supply line to a *building*.

All new gas meters *are to be* connected to and be compatible with the *LTU* cloud hosted energy monitoring system (AZZO) in a manner so that data is readily available for *LTU* upon request

During Design, *Project Consultants* should liaise with AZZO for systems integration connection requirements and further hardware specifications.

Table 19. Gas Meter Performance Specifications

Metric	*Building* Level
Measurement Method	Turbine wheel or diaphragm*
Measured value acquisition	Contiguous
Accuracy	1.5% on flow
Connection	Threaded or flanged
Protocols	Modbus or Pulse output
Measurement Variables	Volume (m3/h)
Display	Digital or mechanical dial
Enclosure	Suitable for Class 1 explosive atmospheres (if located internally). Must include intrinsically safe barrier.

*Ensure meter selected to not adversely impact gas pressure at outlets.

Reverse Osmosis Systems

- Reverse Osmosis (RO) water filtration systems will be Evoqua Protegra ROEDI 120 or Siemens systems. This must be confirmed in writing with the *UPR*.
- Associated pipework will be confirmed compatible with selected systems and approved by the *UPR*.

5.09 Vertical Transport

5.09.01. Performance Requirements

The design of the vertical transport services for the *building* is:

- To suit the intended application and location.
- To maximise energy efficiency (minimise cost of energy consumption) and minimise associated greenhouse gas emissions from the operation of the plant.
- To minimise operational and maintenance costs.
- Be designed to respond to the *buildings*, usage pattern.
- In accordance with the *NCC/BCA* volume 1 - *NCC 2014* (or subsequent versions).
- Comply with waste management, low voc emissions, etc.
- To facilitate the transport of ambulatory personnel and equipment.

The lift system will be designed and installed in accordance with the following codes and regulations:

- *Building* Code of Australia / National Construction Code;
- AS1735 Lifts, Escalators and Moving Walks (including full compliance with AS1735.12 – Facilities for persons with disabilities); and
- AS3000 Wiring Rules.

Vertical transport services will meet (as a minimum) the following design criteria:

- Lift Benchmarks:

For new office *buildings* only, the capacity will be as per the "Grade A" benchmarks contained in the Property Council of Australia's, "A Guide to Office *Building* Quality", 2012 edition.

- E1: Car Capacity, No of Persons >= 16
- E2: Lateral Vibration, mg <= 20
- E3: Waiting Intervals, seconds, Up Peak <= 30, DCS Lunch Peak <=40
- E4: Handling Capacity, %, Up Peak >= 13, DCS Lunch Peak >=11
- E5: Goods Lift, No. >= 1 (shared goods/passenger lift if under 30,000m2 NLA)
- E6: Goods Lift, Capacity (kg) >= 1,400

Notes:

Handling capacity is based on a total assumed population of 1 person per 12m² as per the PCA Guidelines.

DCS - destination control system.

- For other *building* types refer to the *Project Brief* for specific requirements

Design Life and Durability

- Lifts will be designed to operate without undue maintenance, based on the following usage pattern.
- 12 hours per day / 6 days per week.
- Cars and landing doors systems, buttons, indicators and controls and finishes in lift cars - 15 years.
- Basic mechanical components, motors - 25 years.
- Rated starts per hour - 240.

Lift Quality of Ride Criteria

- Acceleration/Deceleration rate: 1.0m/s2
- Jerk rate level: <1.8m/s3
- Levelling accuracy: ± 6mm

5.09.02. General Lift Requirements

Lift Types

- Machine room-less lifts with regenerative drives are preferred.
- Conventional overhead traction lifts are preferred for lift speeds over 2.5m/s where applicable, and for goods lifts.
- Hydraulic lifts will be avoided in preference to MRL lifts.

Lift Equipment

- Each lift car will include the supply of a protective blanket for the walls of the car. The car interior will be designed to allow easy installation of the blanket.
- Door width to be minimum 1000mm.

- Visual and audio direction and floor information to be provided.
- The lift controls and wiring will allow for the connection of an access control system to control the operation of the lift including wiring for installation of an access card reader in the lift car as per the following extract from the Security systems Spec Guidelines.
- Where lift security is specified, the Lift *Contractor* is to provide a trailing cable and tie cables to an enclosure (to be provided by the Security *Contractor*) located outside the lift motor room from each lift car for connection of the following:

Table 20. Lift Security

Security Item	Location in Lift	Cable Type
Card Reader	Mounted on Lift Panel	2 x Single (2 wires) pair screened
Camera video and power cabling	Corner of lift car roof in ceiling space	1 x RG-6 coax for video 1 x Single (2 wires) pair screened for power

Note: All cables within lift car to be suitably labelled to identify intended purpose.

- Machine rooms *are to be* provided with mechanical ventilation and air conditioning operated under thermostatic control to suit the thermal operating range of the equipment as per the manufacturer's recommendations. Push button timed override switch to be provided to temporarily adjust the room temperature setpoint for the safe thermal comfort of the lift maintenance personnel.
- The lift Fire Services Mode key will be a "TOC 9" key.

Lift Car Interiors

- At least one lift in every *building* will be configured for stretcher use.
- The lift car will incorporate the following features:
- the interiors will have low maintenance, high resilience type finishes;
- single point non-maintained emergency lighting;
- ceiling mounted exhaust fan;
- hand rail;
- visual and audio car position indicator
- control panel will contain an exclusive key switch regulating ON, OFF and PARK facilities.
- tactile labelling of lift buttons;
- centre-parting stainless-steel doors with electronic motor control;
- *building* occupant warning system evacuation speaker and associated wiring;
- Intercom system to connect direct to the *Campus* Security Centre; and
- "Fireman" operation mode.
- Lighting to be LED or fluorescent. Controls to be provided to turn off lights and extraction fans when the lift cars are not in use.
- Shared goods/passenger lifts must include a boot providing a clear internal height of at least 3m.

5.11 Service Tunnels, Culverts and Plant Rooms

5.11.01. Service Tunnels

Service Tunnels are mainly used at Melbourne *Campus* (Bundoora). If and where required by the *Project Brief*, service tunnels and crawl ways will be in-situ reinforced concrete or waterproof pre-cast construction of the following minimum internal sizes.

- Tunnels 2.56 metre high by 2.0 metre wide.
- Crawl ways 1.5 metre high by 2.0 metre wide.

Crawl ways will only be used where height limitations preclude the provision of tunnels. Both walls and ceilings of crawl ways and tunnels will be provided with cast-in "Unistrut" P1000 (min) at 1.25 metres spacing.

Crawl ways and tunnels are required to be naturally and/or mechanically ventilated to maintain temperatures below a peak figure of 35ºC.

5.11.02. Culverts

Culverts will be constructed of reinforced concrete cast in-situ or pre-cast. Culverts will be provided with removable reinforced concrete lids fitted with substantial lifting eyes along the entire length. The culverts will be formed up internally and externally prior to casting. Piping supports and fittings will be galvanised. Pipe supports will be installed in slots casing the culvert walls rather than by the use of masonry anchors. All supports should be 65mm clear of the floor of the culvert so as not to impede the flow of possible seepage water. Lids on culverts should be sealed at sides and ends with an approved mastic compound. Notwithstanding, all culverts will be laid to a grade and be provided with sumps and outlets for drainage. Piping supports should not impede the free flow of seepage water along the floor of the culvert. All piping fittings including valves, expansion bellows and flanges will be accessible from pits brought up to ground level.

Service culverts will be provided with natural ventilation where there is a potential for culvert temperatures to exceed 50ºC.

5.11.03. Ducts

Ducts and ceiling spaces will have adequate lighting for maintenance and inspection purposes.

Allowance to be made in the documentation of all *Projects* for duct access to accommodate future services installation to all areas within the *buildings*.

Unrestricted access from tunnels to ceiling spaces via vertical shafts will be incorporated in the design at Melbourne *Campus* (Bundoora).

5.11.04. Plant Rooms

Location of plant rooms within *buildings* will take into consideration the most direct point of vehicular access which can be achieved without the introduction of extensive service road connections.

Stairway and/or full door access will be provided to upper level plant rooms. Roller door and/or full door access will be provided to ground level plant rooms. Accesses will enable existing and future equipment to be removed and installed.

Basement plant rooms are not approved due to possibility of flooding.

Plant room floors will be well graded to drain and provided with floor outlets of not less than 75mm diameter to permit hosing down. Floors will be of impervious coat finish.

Plant rooms will be provided (where required) with mechanical exhaust ventilation.

A sign indicating plant room will be provided on the face of the plant room door.

The *Consultant* will nominate in the schematic design the percentage allowed for future expansion.

Full concrete plinths will be provided under all floor mounted equipment. Partial concrete pads are not permitted.

Section 6.Information Services / Audio Visual

6.01 Cabling Systems

Requirements for cabling infrastructure, racks and associated equipment are specified in *LTU's*

- Information Services Communications Brief and
- Information Services Data Cabling Standards

Cable management on and within furniture must provide a safe and tidy system with ease of access for maintenance and adjustment. Cable trays or baskets will be provide below work surfaces. Cable management includes cables from sockets to computers and other equipment on the work surfaces, as well as cables into sockets from sources such as walls. Cabling *is to be* minimised on work surfaces.

Power and data may be fed to furniture from the floor, walls and ceiling with purpose designed 'umbilical' ducts, poles and other ducts that are fully compatible with the furniture and *building* finishes.

6.01.01. Data Outlets

Refer to Information Services Data Cabling Standardsand Information Services Communications Brief for required number of data outlets, data cable requirements and other requirements. Provision of data for all rooms is to include confirmation with *Information Services* of infrastructure capacity. Data outlets would generally be under work surface-ensure blocks can accommodate required data outlets.

6.01.02. Wireless Networks

Refer to Information Services Communications Brief for general requirements regarding *LTU* Data Network Connectivity and IT related requirements

All new/ refurbished spaces are at minimum to provide for access to *LTU* provided wired and wireless networks.

Fully functioning wireless network *is to be* considered a standard utility within the *LTU* environment. This will apply to both indoor and outdoor spaces. *LTU Information Services are to be* consulted with regards to wireless design and are to provide approval of this design prior to any construction phase.

Access to *LTU* provided networks is a mandatory requirement in all teaching, research & administrative and where required, external spaces.

At Melbourne (Bundoora), FTTP high-speed broadband will be provided to all habitable *buildings* within the *project* that are not provided with fixed wireless

Access to the *LTU* network is subject to the Information Services Computer Statute (https://intranet.latrobe.edu.au/__data/assets/pdf_file/0009/134001/Use-of-Computer-Facilities-Statute-2009.pdf). Access to networks other than *LTU* networks may be required by third parties and external users. *LTU* currently provides access to third party networks (e.g. such as NBN connectivity) via various methods and is dependent on physical location and individual requirements. *Information Services are to be* consulted and will provide advice regarding the preferred method of connection to available external networks.

For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 22.1 and 22.2** – Digital Infrastructure.

6.01.03. Communication Rooms

In new *buildings* and major refurbishments communication rooms will typically be required on each floor.

Shared use of communication rooms with other University units (e.g. Security) *is to be* co-ordinated with *Information Services*.

Refer to the *Project Brief* for specific requirements.

6.02 Audio Visual Technical Design

Requirements for audio visual technical design, are specified in *LTU*'s,

- Information Services Communications Brief; and
- *Information Services* Digital Workplace Technology Standards

Teaching Facilities

- In Lecture Theatres - Lecterns with audio visual equipment controls are to have no other services equipment installed in within the lectern such as lighting, dimmers, ballasts, transformers, etc.
- *AV* systems that allow both the lecturer presented material and student material *are to be* considered in collaborative rooms and teaching laboratories. *AV* systems may be required to shut down in the event of a *building* fire alarm

Projection

- Teaching rooms will have at least one projector or electronic screen for the room. Note rooms may have two projectors (generally projected to the long wall). Projection system is to have speakers. Consideration *is to be* given to power outlets for system components. Projection onto the wall which is painted flat white is primary preference. Pull down Projection screens are an acceptable alternative when required. Screens may be motorised or manual.
- Teaching Rooms will have zoned lighting, to allow for reduced or no lighting adjacent Projection images.
- Teaching Laboratories will have projectors as required for teaching purposes. *AV* screens may be required to each bench to provide full coverage.

Section 7.Landscaping

7.01 Landscaping

Landscaping will provide engaging quality external environments suitable for the use by the University, from vibrant busy areas to quieter contemplative areas.

The *campus landscape* and grounds will:

- Be safe, functional and able to be maintained.
- Improve biodiversity and support habitat.
- Support learning and research where appropriate.
- Be coherent and legible to aid in orientation and navigation of the *campus*

Landscape elements should be accessible in accordance with *LTU* access policies.

7.01.01. Functional Statements

Consideration of accommodating weather elements such as the sun, effect of the wind, such as concentration effects near *buildings*, and rain, will be incorporated into external design.

Indigenous species *are to be* utilised unless approved otherwise by *I&O Director, Project Design & Delivery*. Refer to the *Landscape* Planting Guide for recommendations for species.

Protect existing significant indigenous vegetation.

Exotics may be used to strengthen existing plantings when such plantings help establish a sense of place within each *campus*. [At the Melbourne *campus*, such usage would be restricted to the courtyards, forecourts and squares of the *campus* core.]

Diversify the species range represented across each *campus* and ensure that species support habitats for native animals.

Use Water Sensitive Urban Design (WSUD) approaches within the landscaping. Applications include:

- Grassed or *landscaped* swales.
- Infiltration trenches and bio-retention systems.
- Grey water harvesting and reuse.

Applying 'Crime Prevention Through Environmental Design' (CPTED) principles where appropriate.

Visual and physical amenity will be supported through the types, location and placement of planting and furniture.

7.02 Primary Pedestrian Routes

At least one *Primary Route* will connect all significant *buildings* on a *campus* and to key locations in carparks, to public transport and to adjacent retail and commercial facilities as identified in the *Master Plan* where designated or otherwise where agreed with the *UPR*.

7.02.01. Functional Statements

A *Primary Route* will:

- Comply with Disability (Access to Premises – *Buildings*) (current).
- Meet the requirements of **AS 1428.1** for a Walkway.
- Be made of a smooth impervious material meeting **AS/NZS 4586** with joints having level differences not exceeding the requirements of **AS 1428.1**.
- Be drained to ensure that water does not pond.
- Be well lit.
- Be provided with appropriate way finding signage or intuitive way guiding *landscape* elements and furniture (e.g. lighting).
- Contain seating set back from the path edge min. 500mm to max. 800mm but accessible from it to **AS 1428.1** no more than 100 m apart where appropriate.

- Contain seating in open space or within park spaces accessible from it to **AS 1428.1**
- Rubbish and recycling bins to *LTU* requirements.
- Minimise post and rail fencing when planting boxes will substitute provisions for access and safety.

Slip resistance of materials on *Primary Routes* will comply with the requirements of **AS/NZS 4663** when tested wet.

7.03 Paths and Paved Areas

Paths and paved areas are to be guided by the *LTU Pathways, Signage & Wayfinding Strategy.* (Where a deviation is required, the proposal will be assessed against the design principles and objectives of the strategy.

Paths and paved areas *are to be* designed to eliminate trips, slips and falls, adopt accessible gradients in accordance with current standards and safe separation of bicycles.

Paths and paved areas *are to be* designed to ensure accessibility at kerbs when paths intersect with roadways. Provide *hazard* and/or directional tactile indicators for visually impaired at required locations.

Provide clear and easy movement along major routes throughout the *campus*, with a clear hierarchy of quality paths

Provide safe durable surfaces integrated within designs.

Create a consistent character for the *campus* and its neighbourhoods.

7.03.01. Performance Requirements

Primary Paths (concrete) and Tracks (non-hard surface) *are to be* well lit.

Ensure any middle story vegetation is not blocking views, particularly along main paths.

All paths and tracks *are to be* minimum two metres wide and edged with a galvanised metal edging or a concrete strip to match University standard.

Lilydale toppings (or matching equivalent such as Tuscan Toppings) *are to be* used as the standard track material (fully compacted).

The design of pathway and paved areas strength will consider whether they form part of an emergency access route for emergency vehicles.

Footpaths must be provided in accordance with the principles outlined in the Australian Model Code for Residential Development (AMCORD) for pedestrian facilities. Refer overleaf for details.

Table 21. Minimum AMCORD root Path Requirements

MINIMUM REQUIREMENT – FOOTPATHS (9.0)

AMCORD Requirements: The following is a summary of the AMCORD requirements for footpath provision.

Table 9.0: Characteristics of Street Types and Footpath Provision

Street Type	Indicative maximum traffic volume range (vpd)(1)	Target speed & design speed (km/h) (2)	Indicative Carriageway width (m) (3)	Footpath provision (minimum)
ACCESS STREETS				
Access Lane	100	15	See note (4)	No
Access Place (5)	0-300	15	Single-Lane 3.5-3.7 (6)	No
Access Street	0-300 (1)	40	5.0 only	No
Access Street	300-1000	40	5.0-5.5 only (7)	No
Access Street	1000-2000	40	5.5 or 7.0	1.2m wide (one side) (8)
COLLECTOR STREET				
Minor Collector	1000-3000	50 (20 at designated ped-cycle crossing)	7.0-7.5 or 6.0-6.5 plus intended parking	1.2m wide both sides located away from curb
Major Provide Collector	3000-6000	Designed using appropriate performance criteria		1.2m wide both sides located away from curb (9)

1. For single dwelling allotments apply a traffic generation rate of 10 vpd or a rate based on local data. For multi-unit dwellings apply a traffic generation rate of 6 vpd or a rate based on local data.
2. Streets are to be designed to achieve the target speed, and sight distances to accord with design speed.
3. The carriageway width is measured from kerb invert at outer edge of edge strip. Widening is required at bends to allow for wider vehicle paths (using AUSTROADS Turning Templates).
4. Lane width is determined by requirements for access to garages (Table 6). Minimum width is 3.0m.
5. An integrated design of street and building layout is necessary for speed control and to achieve the optimum result. Appropriate considerations are required for the collection of waste.
6. This requires parking provision and provision for widening to 5.0m if necessary in the future. Maximum length is 100m. A passing bay is required if length is greater than 80m.
7. Width is limited to 5.5m to deter vehicles parking opposite each other and blocking traffic.
8. Footpaths are to be provided on both sides of streets serving as bus routes. Footpaths are to be provided adjacent to multi-unit dwellings.

For specific information on compliance refer to Green Star Communities Submission Guidelines, **Credit 9.0** – Minimum Requirements Footpaths.

7.04 Parkland

One of the defining characteristics of the Bundoora *Campus* is its native bushland setting. The vegetation character beyond the core *campus*, such as the New Town Centre site, is predominantly native and of a bushland character. Indigenous plantings, remnant bushland and the La Trobe Wildlife sanctuary frame the core *campus*. Parkland consists of scattered planting of primarily native trees within lawn. It is predominantly found within the *campus* core. Scattered Eucalyptus are a dominant feature within this setting.

7.04.01. Vision

The *campus*'s parkland should consist of scattered, primarily indigenous, large canopy, tree cover over grass, contributing to habitat links through and around *campus*. It will provide a well-connected network of formal pathways that allow users to easily navigate the *campus*.

7.04.02. Performance Requirements

Parkland will include:

- Paths appropriate to their importance and usage. These should be concrete, minimum 2.0m in width, provide seating at irregular but frequent intervals, and be well lit for safety at night.

Development within this zone should consider incorporation of the following:

- Cluster tree planting of indigenous species. Native trees may be considered if the site's context already presents important, or place-making, plantings of these species.
- Hardy and drought tolerant native shrub and low-level indigenous vegetation.
- Expansive grass areas, as opposed to lawn areas of the *inner campus* zones.
- Furniture.
- Barbecue units.
- Rubbish and recycling receptacles located near to, but not immediately besides, seating and tables, barbecue units and path intersections.
- Lighting.
- Exotic species *are to be* selectively replaced over time.

7.05 Woodland

Consists of denser planting of native trees over grass. Incorporates the bulk of the *campus* car parks.

7.05.01. Vision

The *campus*'s woodland should consist of dense, primarily indigenous, large canopy, tree cover over grass. It will contain and define the character of the *campus*'s primary car parks, screening them from view and guiding their built form. It provides habitat, promotes, biodiversity and contributes to the University's aims of sustainability. As the primary vegetation character of the *campus* boundary, it serves to *project* an image of the *campus* as wooded, green and sustainable.

7.05.02. Performance Requirements

Development within this zone should consider incorporation of the following:

- Best practice car park design, protecting and integrating existing vegetation where possible
- Water sensitive Urgan Design (WSUD) where possible
- The Woodland should include dense indigenous tree planting. Tree arrangement should consider adjacencies, such as arranging trees in formal lines to the frame the edge of roadways and major pathways, strengthening corridors through the site and assisting with way finding. Native and exotic trees may be considered if the context already presents important, or place-making, plantings of these species;
- Shrub and low-level indigenous vegetation,
- Expansive grass areas, as opposed to lawn areas of the *inner campus* zones.
- Rubbish receptacles located near to, but not immediately beside, seating and tables, barbecue units and path intersections.
- Paths appropriate to their importance and usage.

7.06 Bushland

Bushland consists of indigenous plantings and remnant natural systems that are prioritised for their ecological and environmental significance. Understorey planting is a strong component of the setting to ensure biodiversity of flora and fauna are maintained.

7.06.01. Vision

Beyond the functions of screening and providing a defining margin to the *campus*, the *campus* bushland should provide quality indigenous habitat that builds on and protects existing significant habitat, flora and fauna, and that actively works to extend those habitat values out into the surrounds.

7.07 The Terraces

The Terraces to the Eastern boundary of Melbourne (Bundoora) *Campus* have a Heritage Overlay, which includes the gardens and grounds to the east of the *building* complex. The grounds offer a possibility for low impact passive recreation, such as table suites and BBQ's.

The flora is bound by the Heritage Overlay, for which there is an approved limited grounds development plan. A *Landscape Master Plan* approved for heritage development is available **here** (*This is a reference document only and has no current status due to the expiry of the permit*). This contains a Planting list for approve plants, which includes planting for the along the east veranda to the Terrace *buildings* and to the wider gardens.

A Heritage *Consultant* will be required for any works undertaken in the grounds shown on the plan referenced in the previous clause, or to the exterior of the *buildings*. Note that Heritage Victoria can take up to 60 days to respond to an application.

7.08 Tree Protection

Vegetation (including trees and ground flora) identified for retention *is to be* appropriately protected from construction impacts, events and activities that may negatively impact them, including compacting the surface around trees, disturbing tree roots or damage to the trunk or limbs from overhead machinery.

7.08.01. Performance Requirements

Ensure that that the design takes into account & identifies protection measures required when working near or adjacent to the moat at Bundoora *Campus* or in and around vegetation that *is to be* retained and protected during construction. These requirements would subsequently be reflected back &addressed in detail within the Environment Management Plan (EMP).

Where designing for large events or activities to be held that may impact vegetation, ensure the design accounts protection of trees and high traffic areas, identifying bunting zones and temporary path surfaces. These requirements would subsequently be reflected back &addressed in detail within the Environment Management Plan (EMP).

7.09 Soft Landscaping

Indigenous species *are to be* considered as the primary plant selection option

Exotics can be used to strengthen pre-existing exotic vegetation or where a particular place making character is desired

At Melbourne (Bundoora), use industry standard RAIN gardens to retain and pre-treat storm water to both minimise flooding *risks* and also ensure better water quality downstream (i.e. the Moat).

7.09.01. Performance Requirements

Consider use of exotics to strengthen existing plantings to help establish place identity within each *campus*.

Consider green wall type vegetation to help regulate *building* temperature during the hotter months.

Kikuyu grass is preferred for lawn areas. (Pennisetum clandestinum)

No trees canopies are to extend over *building* roofs to prevent leaves on roofs and in gutter and thus reduce ongoing maintenance.

Use solid and sturdy garden bed borders (concrete, rocks, bluestone, bricks, and not flimsy timber edging) to retain mulch where required.

Select plant species and planting locations that ensure plants are not going to outgrow the space in which they have been planted.

Select species appropriate to the local micro climate(s) created by the *building* (i.e. shade, dry tops of mounds, wet boggy areas, water gardens).

Select drought resistant species to minimise watering requirements.

7.10 Toro Irrigation System

Where irrigation systems are required, the irrigation controller will be a Hunter Hydrawise Irrigation Controller, with the number of stations (12, 24, 36, 48) required to be determined by the irrigation system designer. The system *is to be* compatible with the Universities Hunter Hydrawise Sentinel Central Control System.

The irrigation system will be designed by a reputable irrigation system designer, such as Reece Irrigation and use components compatible with those already in use across universities irrigation systems. The irrigation system will include a flow sensor and Turf Guard™ (salinity and moisture sensors) and will connect to the Central Control System via 'Cellular- enabled Data Modems'. Design of the system *is to be* approved by a Director Facilities, Asset and Services via the *UPR*. The irrigation will be constructed as per the irrigation design and be commissioned by the installer with a university representative present. The Toro Sentinel Irrigation Controller will be installed as per the manufacturer's specifications and will be commissioned by a representative of Hydrawise with a university representative present.

7.10.01. Performance

Irrigation System Performance:

a) Spray irrigated areas are required to meet industry best practice for effectiveness of application and uniformity. The industry standard for sprinklers is Field Distribution Uniformity (DU) 75%

b) Drip systems are required to achieve high uniformity of emitter discharge. Emission Uniformity (EU) 85% is required.

c) Applied water is not to result in runoff or wasteful application

d) The selection of components is required to achieve effective and reliable operation and sound functioning of the irrigation system.

e) All equipment selected and installed is to meet local regulatory requirements and Australian Standards.

f) All spray fittings to be installed to throw away from buildings and hard landscape structures.

7.10.02. Requirements

Irrigation System Requirements

a) All pipework and associated fittings are to be new Class 12 uPVC, unless otherwise stated.

b) Trenching for pipework will be to a depth to allow for 300mm minimum cover over installed pipe unless agreement with the nominated University project officer is reached for alternative installation. Trenches are to be backfilled with soil, free of rock or other debris, to surface level. Trenches are not to be left open over night.

c) Conduits under paving for wiring & pipework are to be 100mm sewer grade PVC, unless otherwise stated. Any lifting of paving for conduit placement will require reinstatement according to the established University paving specification.

d) Solenoid control wires are to be coded, poly coated valve wiring of 0.5mm diameter between controller and all solenoid valves where wire runs are less than 100m. Allow for 500mm loop at each valve connection to provide for valve removal for servicing. All wire runs should be continuous with no joints. All wiring joints in the field must be made using 'king' type 3M DBY or heat shrink connectors

e) Two spare control wires to be left at the furthest solenoid in any direction from the controller, and at the master solenoid valve, unless otherwise stated, to allow for possible future extension or repair.

f) An external lockable 240v power switch/isolator in line to the controller

g) An appropriate backflow prevention device in line after the above gate valve is required unless backflow prevention is otherwise already provided on the supply line. Minimum requirement is a Double Check Valve Assembly (DCV).

h) Rain or soil moisture sensor to be fitted to all new systems

i) Irrigation systems utilising reclaimed water must use appropriately identifiable components (lilac colour)

j) On completion of installation the system is to be tested, in the presence of the nominated University project officer, for satisfactory performance.

k) The Contractor will provide to the University as built drawings of the installed system and any operational manuals and keys for the controller box.

7.10.03. Stipulations

Irrigation System Stipulations

a) All work is to be compliant with all applicable VBA & Plumbing Regulations and a Compliance Certificate issued to the University on completion.

a) It shall be the Contractor's responsibility to determine the location of any underground services in the area of the works. Repair costs to services damaged by the Contractor, shall be the responsibility of the Contractor.

b) All materials and quality of work shall be to the best of their respective kind, conform to manufacturer's recommendations for installation and shall meet the following established Australian Standards:

c) AS 1477 Un-plasticised PVC (uPVC) pipes & fittings for pressure applications

d) AS 3879 Solvent cements and priming fluids for use with un-plasticized PVC (uPVC) pipes and fittings

AS 1462 -> Methods for testing uPVC pipe & fittings

AS 4130 -> Polyethylene Metric – PE80B – pipe for pressure applications

AS 1432- > Copper tubes for water, gas and sanitation

AS 2032 -> Code of Practice for installation of PVC pipe systems

AS 2698.1-> Polyethylene micro irrigation pipe

AS 2053 -> Non-metallic conduits and fittings

AS 3000 -> Electrical installations

AS 3500.1-> National Plumbing and Drainage Code: Part 1 Water Supply

e) Where water used for irrigation is extracted from the moat at Bundoora, clause 21.02.05 shall be observed, which covers metering and Melbourne Water licensing.

f) Avoid standpipes / risers along edge of garden bed where a pedestrian path or roadway exist. These may cause an OH&S risk. Preference pop-up sprays instead.

g) A 12 month defects period for the system will apply from the commissioning date, unless otherwise stated, during which time the Contractor will be responsible for maintenance of the system.

7.10.04. Preferred Components

Preferred Components

a) Micro/drip systems

- Toro Drip Eze or Enviro-Drip 13mm pressure compensating 2/L p/h
- Emitters at 30cm spacing
- When laid in grid pattern, line spacing 300mm apart in garden beds; 600mm apart under trees, unless otherwise specified.

b) Garden (and short-throw turf) Sprays

- 1/2” threaded PVC no-flex risers for standpipe use
- Rainbird 1800 spray bodies (pop up height to suit application)
- Rainbird 1800 series matched precipitation rate nozzles for both standpipes and pop ups to be selected for each application
- Filter screens to be fitted to each spray
- Hunter's MP Rotator spray heads

c) Turf Sprays

- Hunter PGP rotors (nozzles selected according to application)

d) Irrigation controllers

- Basic automatic controller: Hunter Pro C (modular)
- Smart automatic controller: Hunter I-Core or Hunter ACC
- Smart WiFi enabled controller: Hunter ProHC
- Battery-operated programmable controller: Galcon 7101 or Hunter Node

e) Sensors (Rain, ET, Flow)

- Rain sensor (basic): Hunter Rain-Clik (wired or wireless)
- Weather sensor: Hunter Solar Sync (wired or wireless)
- Flow sensor (compatible with ACC and I-Core controllers): Hunter Flow-Sync

f) Valves

- Gate valves to function as isolation valves, prior to the solenoid valve, are to be fitted on the discharge side of the water meter or mains supply point, and to irrigation lateral lines. Gate valves must be tested, brass construction, with a maximum working pressure of 800 kPa, and 25mm BSP threaded female connection, unless otherwise specified.
- Solenoid valves are to be 25mm Irritrol (Richdel) 205 series with flow control, unless otherwise stated
- A Richdel master solenoid valve in line after the backflow prevention device (where fitted) or isolating gate valve, is to be installed.
- All control valves are to be placed below ground where possible and housed in suitably sized commercial grade valve boxes. Valve boxes are to be set flush at finish level in lawn areas and 50mm above in garden beds.

Where water used for irrigation is extracted from the moat at Bundoora, refer to the relevant sections of these Standards that cover metering and Melbourne Water licensing

7.11 Hard Landscaping

Provide safe durable surfaces integrated within designs.

External furniture is to:

- be sympathetically integrated with immediate surrounding areas
- be of a high quality and be fit for purpose.

7.11.01. Performance Requirements

Seats typically bench seats, sometimes with tables are provided at various places around the *campuses.* These are encouraged beside paths at appropriate places (will be well used, views etc). Bespoke seating and tables can be provided where appropriate.

Benches to be placed along main pedestrian routes with a minimum of 500 mm offset and maximum of 800mm. Benches *are to be* placed no further than 100m apart.

Shading will be provided to external tables exposed to the sun.

Rubbish and recycling receptacles *are to be* placed in visible locations, near to, but not immediately adjacent to seating, tables or path intersections. Installation of new rubbish and recycling receptacles *are to be* co-ordinated with *LTU* units responsible for cleaning and waste removal.

External bins will be in accordance with the University Waste and Recycling Bin Systems Guide.

Traffic management devices will be provided as appropriate to control access of vehicles to *landscaped* areas.

Timber decking will meet slip resistance requirements when wet.

Bollards are site specific on an as-needs basis, to comply with the *Master Plan*.

7.12 Courtyards

Courtyards, forecourts and squares within the *campuses* provide pockets of distinct spaces that create a matrix of diverse experiences and landmarks. Each courtyard, forecourt and square on *campus* differs in use, appearance and type. Each contains qualities which need to be considered on an individual basis.

In the context of these Standards courtyards, forecourts and squares will be categorised as:

- Urban Squares
- Garden Courtyards, Forecourts and Squares
- Residential Courtyards, Forecourts and Squares

Access to and from all courtyards, forecourts and squares should be clear, and easy, with appropriate wayfinding provided to courtyard if required, but to surrounding *building*s. Lighting & associated lux levels to the space are to ensure it can be utilised day and night. Rubbish

receptacles to be placed in visible locations, and not immediately adjacent

7.13 Urban Squares

to seating, tables or path intersections. Deciduous tree plantings to provide summer shelter and winter sun.

Urban squares are those with high student activity, have various permanent and temporary capabilities for activities and that encapsulate 'life on *campus*'.

Urban squares will be places of intense activity, where users eat, study and relax, and these spaces are associated with *campus* facilities such as eateries, retail and student services.

Urban squares should include:

- High quality pavements.
- High quality furniture.
- Areas for outdoor dining.
- Gathering spaces for groups of varying size.
- Lawn for seating.

- Low level structured vegetation cover (lawn and planting beds), to ensure that a suitable level of 'green' is provided.
- Arbours where applicable with deciduous canopy coverage for shade
- Seating walls should be incorporated into designs where appropriate to minimise stand-alone furniture.
- Water Sensitive Urban Design (WSUD) opportunities.

7.14 Garden Courtyards, Forecourts and Squares

Garden courtyards, forecourts and squares will offer a diverse range of places, from courtyards of quiet refuge that allow for a 'sense of solitude' within the *campus*, to display gardens that create an enjoyable outdoor environment for those within adjacent *buildings,* to displays of water sensitive urban design, and sites of public art.

Design responses will be varied according to the particular site and its intended use. Examples of the way these Garden spaces can be activated are:

- Insertion of small commercial outlets such as cafes.
- Re-siting or re-presenting of public art.
- Provision of small seating areas.
- Implementation of green infrastructure such as green roofs and walls or WSUD gardens.
- Considered replanting and resurfacing. In general, these Garden spaces should include:
- Lawn zones for passive recreation activities.
- High quality pavements to a limited area.
- Medium level of shrub and low-level vegetation, to create some enclosure while maintaining surveillance across the space.
- Minimal paving and furniture (excluding rubbish and recycling receptacles). Where these items are required, they should contain of a high level of finish and quality.
- Water features where applicable
- Water Sensitive Urban Design (WSUD) opportunities should be explored.

7.15 Residential Area Courtyards, Forecourts and Squares

Residential area courtyards, forecourts and squares should serve as communal living spaces, and provide for both passive and active recreation. Residential areas include Colleges and other Residential precincts.

In addition to some programmed spaces, such as barbecue and picnic zones, these spaces should allow for flexibility, to accommodate a wide variety of uses, and to allow users to interact in a variety of ways (for example, by providing movable furniture).

Residential courtyards may include productive gardens, either through intensive plantings (for example, vegetable beds) or through less intensive plantings (for example, fruit trees).

"The landscaping surrounding the colleges should have some connection with that of the core of the *campus*, but will be less formal, more intimate and domestic in character" (Yuncken Freeman Architects, 1965).

Residential courtyards could include the following:

- Intimate spaces.
- Spaces for small group activities.
- High quality pavements to a restricted area. Paving should be consistent throughout each courtyard.
- Lawn zones.
- A considered and structured mix of indigenous and exotic trees to support flexibility of use in spaces throughout the year.
- Shrub and low-level vegetation cover.

- High quality, movable, and fixed furniture.
- Barbecue units.
- Rubbish and Recycling receptacles.
- Temporary or demountable shade elements for shade and cover
- Recreation facilities e.g. half-court basketball court.

Section 8.Appendices

8.01 Appendix 1 - Management of Design Standards

Revision History

Below is a chronology of the key revisions made to this document since its inception in 2015.

Version No.	Description	Publication Date	Approved By
13.0	Initial issue	February 2015	Executive Director, Infrastructure and Operations
14.0	6.04.02 Waste and Recycling Storage amended 7.01.14 Computer Management section added 7.02.03 Toilet Seats amended 7.02.03 Toilet Paper Roll Holders amended 7.02.03 Clause added-Floor wastes 7.02.04 Paper Towel Dispensers amended 7.07.03 Clauses added-Post grad workstations 10.01.03 Carpets-section amended 10.7 Reference added for Environmental Branding Guidelines 11.01 Loose Furniture section expanded to include Furniture Standards 11.05 Section added on wall stripping 16.08 Clocks-Clause amended Sec 20 Fire Services-Various minor amendments 21.04 External Cold water pipelines amended	August 2015	Executive Director, *I&O*
15.0	1.05.04 Works to over 50% of *building* 5.06 Acoustics-Classes & Sound Reduction Values altered 6.03 ESD Certification amended Waste and Recycling Bins System Guidelines requirements added (various sections) 7.01 Teaching and Learning. Section rewritten to incorporate Teaching Space Guidelines material. 7.02.07 Gender Neutral Toilet requirements added. 7.02.03.09 Requirements for refillable soap containers added. 9.06.02 Ceiling clause altered. 10.01 Interior Finishes-General clauses for floor finishes added. 11.01.05 09 Cl added for adjustable height workstations. 11.01.09 04 Teaching chair requirements amended. 11.01.11 04 Guide for work surfaces added re Mac mice 11.04.03 07 Door hardware requirements incl backsets 11.04.04 04 Access systems to be Gallagher 11.04.04 05 Reference for Electric and Magnetic doors 11.04.04 08 Fire hose/reel cabinet construction reference 13.07 Landscaping Planting Guide reference 13.07 Vegetation Removal Investigation Process reference 15.05.09 & 16.04 Metering requirements added to Section 20 Fire Detection & Alarm System requirements updated		Executive Director, *I&O*
15.1	7.02.03 09 Sachets are to not be used in refillable soap dispensers 7.06.04 Minimum workstation clearance adjusted		Executive Director, *I&O*

Version No.	Description	Publication Date	Approved By
	20.02.09 Smoke detectors specification deleted 6.03 New *building ESD* Certification altered		
16.0	Content and format review of all Sections	13-12-2017	Executive Director, *I&O*
16.1	Spelling and grammatical changes	20-03-2018	Senior Manager *Projects*
16.1	Correction to hyperlinks within Reference Documents	25-04-2018	Business Support Snr Coordinator
17.0	Full reformat of document. Main new inclusions are in response to changes to the 2019 *Building* Codes Australia, Green Star Communities, *AV* Standards and feedback from 2019 Space *Master Plan* *Minor formatting changes undertaken on 15.10.2020* *Minor formatting changes undertaken on 16.11.2020*	03-02-2020	Executive Director, *I&O*
17.1	Amendments ▪ Inclusion of Zip at 4.10.1 ▪ Master key system at 4.52.02 with new master key system from Bilock ▪ Metering at 5.03.04 removed AZZO replace with Power of Choice ▪ New Pit Load Table within Inground Pits at 5.03.13 ▪ Gas Metering 5.08.19 inclusion of Evoqua Protegra system. ▪ Insertion of new irrigation system performance, requirements, stipulations and preferred components at 7.10 ▪ Policies updated to refer to current versions ▪ Insertion of LTU Pathways, Signage & Wayfinding Strategy at 7.03	30-07-2024	Director Facilities, Asset & Services and Director Development & Delivery
17.2	Amendments ▪ Section 5.01.19 updated to included VSD operation frequency restrictions ▪ New irrigation controller system in Section 7.10 ▪ Section 5.02 updated to reflect Tridium Niagara N4 product suite for Building Monitoring Control System ▪ Inclusion of La Trobe Building Automation Standards Reference Document	13-05-2025	Director Facilities, Asset & Services
17.3	Amendments ▪ Revised link to revised Building Management System (BMS) Standards	07-07-2025	Director Facilities, Asset & Services

8.02 Appendix 2 - Glossary

The definitions in this Glossary apply throughout the *Design Standards*.

Key definitions are highlighted in *italics* through the text.

For the purposes of referencing through this document, plural versions of the singular form have the same referencing e.g. *Consultant* & *Consultants*

Word or Phrase	Meaning
Active Learning	Student centred, peer interactive learning guided by academic staff and focused on discursive group sessions, workshops and problem solving.
AFL	Above Floor Level
Architect	A person registered by the Architects Registration Board of Victoria (ARBV) and registered under the provisions of the Victoria *Building* Act.
Authority	An entity having a legal authority and duty to regulate *campus buildings* or operations. This includes La Trobe University as Public Land Manager on behalf of the Minister for Education under the Planning and Environment Act 1987, within PUZ2 planning zones.
Area	Measured in square meters.
AV	Audio Visual equipment within University spaces. Subject to *Information Services* requirements (refer to Section 19)
BCA	*Building* Code of Australia. Constitutes Volumes One and Two of the National Construction Code (*NCC*)
BCMS	*Building* Control Management System
Brief	A document setting out *LTU* requirements for a *project* which may include a relevant Schedule of Accommodation
Building	A physical structure, usually enclosed, that accommodates people and activities of a certain classification as defined in the *Building* Code of Australia
Building Contractor	A legal entity registered with the Victorian *Building* Authority permitted to construct *buildings* under the Victoria *Building* Act.
Campus	Area where *LTU* has a legal presence, including various property assets, including owned and leased properties.
Certifier	A person licensed under the Victorian *Building* Act to assess and certify *buildings* in relation to the provisions of the *NCC*. May also be known as *Building* Surveyor or *Building Certifier*.
CFA	Country Fire Authority
Consultant	A professional who provides expert advice on a specific discipline.
Consultant's Agreement	Mechanism by which a *Consultant* is legally engaged by *LTU* to undertake an activity/activities on its behalf
Contractor	An entity registered with the Australian Business Register with an Australian Business Number (ABN) to provide services to the University, either directly or as a secondary *Contractor*.
Dangerous Goods	Materials which are defined as Dangerous Goods by Worksafe Victoria
Design Standards	The La Trobe University *Design Standards*. This document.
Deviations from the *Design Standards* document	A form used to capture proposed deviations from the *Design Standards* to tabulate amendments over the course of the design period.
Didactic	Formulaic and structured teaching based on presentation and instruction by academic staff to a student audience.
Director, *Project* Design & Delivery	The *LTU* staff member responsible to oversee the management of these *Design Standards* within Infrastructure and Operations Group, *LTU*.
ED *I&O*	Executive Director, Infrastructure and Operations Group,
Engineer	A person registered by *Engineers* Australia and registered under the provisions of the Victoria *Building* Act.

Word or Phrase	Meaning
Environmentally Sustainable Design (ESD)	Design, construction & operational practices of *buildings*, their occupants and associated *landscape* that significantly reduce or eliminate the negative impact on the environment by addressing the following elements: site, water, energy, materials and resources, and indoor environmental quality.
FAS	Facilities, Assets & Systems, within Infrastructure and Operations.
GFA	Gross Floor Area. The area on a level of a *building* within the inside of the outside wall. Refer also to UFA below.
Governance Body	A body constituted in accordance with *LTU Project* Procedures or in accordance with *Policy* documents.
Hazard	A source of potential harm to people or a situation with potential to cause loss or damage to plant, property, equipment or the environment.
Hazardous material	A material that is hazardous to humans as defined by Worksafe Victoria.
Heritage Items	Items included in the Commonwealth or State Register of Heritage items. For the avoidance of doubt, this does not include heritage registers maintained by Local Authorities or the National Trust.
I&O	Infrastructure and Operations Group, *LTU*
IS	Information Services
Inner *Campus*	At Bundoora *Campus*, the area of *LTU* property inside the ring of carparks, delineated by the Ring Road, College Drive and Kingsbury Drive.
Landscape	Every structure or ground feature on a *Campus* which is not a *Building*.
Local Authority	A Council or fire authority with jurisdiction over an *LTU Campus*.
LTLT	La Trobe Learning and Teaching, *LTU*
LTU	La Trobe University.
Master Plan	The relevant *campus Master Plan* approved under the authority of the *LTU* Council.
MFB	Metropolitan Fire Brigade
NCC	National Construction Code. Comprises the *Building* Code of Australia (BCA) and the Plumbing Code of Australia (PCA). Under the responsibility of the Australian *Building* Codes Board (ABCB).
Pedagogy	The theory, methodology and practice of teaching as a profession.
Policy	*LTU Policy* documents as approved by *LTU* Council. A Draft *Policy* has not been approved by Council but may be adopted for implementation in the *Design Standards* with the agreement of the relevant *UPR* and the *ED I&O*.
Primary Route	The designated Primary Pedestrian Network in the *Master Plan* connecting all *buildings* on the *Campus*, or if no pathway is designated, then the route designated by the *UPR*. A Primary Route *is to be* accessible, lit, provided with security protection and may be protected from the elements.
Principal Consultant	An Architect or *Engineer* who is responsible for being the lead *consultant* on the *Project*. They are usually responsible for the management and co-ordination of other *Consultants* (usually related to the design) regardless of who has engaged them. Often directly engages Sub *Consultants*.
Project	Work of a Capital or Operational nature on a *Campus* as required by *LTU*.
Project Procedures	*Project* requirements of La Trobe University.
Reference Documents	*LTU* and non *LTU* documents that have been adopted by the *Design Standards*. Unless specifically noted in the *Design Standards*, the provisions in a Reference Document become part of the *Design Standards*.
Relevant Act	As set out in Law, recognised in *LTU Policy* documents, as instructed by a *UPR* or as determined by a *Certifier*.
Risk	The likelihood of an adverse event occurring and the potential consequence of such an event.
Safety in Design	A process of management of OHS design issues throughout the design process, to eliminate or, if this is not reasonably practicable, minimise Risks to health and safety throughout the life of the *building*/structure being designed.
Secondary Route	All other than the Primary Route designated in the *Master Plan*.

Word or Phrase	Meaning
Schedule of Accommodation	A list prepared using a spread-sheet or database showing the name of each room, providing an indication of its function, including number and positions of staff or students accommodated, and the required area of the room in square metres according these *Design Standards*.
Senior Leadership Team (SLT)	Senior management group within *I&O*. Will be consulted through the *UPR* or Director, *Project* Design & Delivery.
Senior Manager, *Campus* Planning	The *LTU* staff member responsible for overseeing the management & reviews of all matter pertaining to the alignment and development of *Campus Master Plans* within Infrastructure and Operations Group, *LTU*.
'Shall be', '*is to be*', '*are to be*'	All have the same meaning – the requirement *is to be* completed with the design contracts.
Statement of Compliance with *Design Standards*	Document to be signed by the *Consultants* confirming the design complies with the *Design Standards*.
Sub *Consultant*	A *Consultant* that has been engaged by the Principal *Consultant*.
Teaching and Learning	Processes of learning activities undertaken by *LTU* ranging from *didactic* to *Active Learning* based pedagogies, informal learning and others as developed by the University.
Tender	Process of obtaining multiple pricing for *projects* from *consultant* and *contractor* entities for selection of entity to do the work.
Tender Documents	Contracts, Special Conditions of Contract, Specifications, Schedules and Drawings prepared for a *Project* tender.
UFA	Usable Floor Area. The useable floor area comprises the sum of the floor areas measured at floor level from the general inside face of the walls of all interior spaces related to the primary function of the *building*. Note that toilets, primary circulation paths, cleaner's cupboards, services areas and non-inhabitable rooms are not included as UFA. Refer also to GFA definition above.
Universal Design	Design to ensure that all people have equal and dignified access to facilities, regardless of disability.
UPR - University *Project* Representative	The representative within *LTU*, appointed to oversee the *Project*. This is not referring to *Consultant Project* Manager outside of *LTU*.

8.03 Appendix 3 - Reference Documents Managed By La Trobe

Below is a selection of key *Reference Documents* that are managed internally by *LTU*. Those that are in blue underline are accessible weblink documents.

If you are viewing this document as a hard copy, the *LTU reference documents* can also be obtained by emailing iobsi@latrobe.edu.au and quoting the reference detail / number as listed below.

Document Title	Issued by
Approved Security Products Schedule	LTU – I&O
Aboriginal Heritage Act Compliance Procedure	LTU – I&O
Cultural Heritage Management Plan	LTU – I&O
Eco-Corridor Neighbourhood Project Flood Study	LTU – I&O
Environmental Sustainability Policy	LTU Policy
Environmental Branding Guidelines	LTU – I&O
Heritage Management Guideline	LTU – I&O
Information Services Digital Workplace Technology Standards	LTU – Information Services
Information Services Communications Brief	LTU – Information Services
Information Services Data Cabling Standards	LTU – Information Services
Standard Lecterns	LTU – I&O
Landscape Planting Guide	LTU – I&O
La Trobe Building Management System Standards	LTU – I&O
LTU Pathways, Signage & Wayfinding Strategy	LTU – I&O
LTU Policy Library (Health and Safety)	LTU Policy
Nangak Tamboree Cultural Heritage Management Plan	LTU – I&O
Procurement Policy	LTU Policy
Room Booking Panel Installation Guide	LTU – I&O
Security Services Brief	LTU – I&O
Signage Style Guide	LTU – I&O
Solar PV Specification	LTU – I&O
Space Allocation and Use Policy	LTU Policy
Sports Park Cultural Heritage Management Plan	LTU – I&O
Sustainability Plan	LTU – I&O
Terraces Planting List	LTU – I&O
Waste and Recycling Bins Systems Guidelines	LTU – I&O
Workplace Thermal Comfort Guidelines	LTU – I&O

8.04 Appendix 4 - Reference Documents Managed by External Parties.

Below is selection of key *reference documents* that are managed by external parties. The *Consultant* is to ensure that there are utilising the latest version of *Standards and Regulations* when referencing them

Document Title	Issued by
Aboriginal Heritage Act 2006 (VIC)	Victorian Government
Building Code Australia (BCA)	Australian *Building* Codes Board
Changing Places-Information Guide & Technical Standards	Association for Children with a Disability
Code on the Ethics of Co-existence in Conserving Significant Places	Australian ICOMOS
Dangerous Goods Act	WorkSafe Victoria
Disability (Access to Premises — Buildings) Standards 2010	Australian Government
Disability Discrimination Act	Australian Government
Disability Standards for Education	Australian Government
Environment Protection Act	Victoria Government
Environment Protection and Biodiversity Protection (EPBC) Act	Victoria Government
Food Standards Code	Food Standards Australia New Zealand (FSANZ)
Heritage Database Report – Former Mont Park Hospital	Heritage Council Victoria
Green Star Communities Submission Guidelines	Green Building Council Australia
National Construction Code (*NCC*)	ABCB Under Victorian *Building* Act
Occupational Health and Safety Act 2004	Victorian Government
Occupational Health and Safety Regulations	Australasian Legal Information Institute
Prevention of Falls in General Construction	WorkSafe Victoria
The Burra Charter	Australian ICOMOS
Victorian Building Act	Victorian Government
Victorian Heritage Act 2017	Victorian Government

8.05 Appendix 5 - Room Numbering Procedure

8.05.01. Room Numbering

Procedure for Number Allocation

- The *Consultant* is to follow the University room numbering system when undertaking the first draft of room numbering on all drawings by the completion of Schematic Design. The *UPR* is to submit and confirm the draft room numbers with the Facilities Systems Team The following documentation is to show all room numbers, to the University system, as worked out with the *UPR*:
- "Base Floor Plans",
- "For Construction" and
- "As Built" documents.

8.05.02. Allocating Floor Levels

La Trobe University has an established system for allocating floor levels. Floor levels are numbered thus:

- Ground Floor – Level 1
- First Floor - Level 2, etc.

Basements starting below Level 1 and are designated as:

- First Basement – B1 (first room is B101);
- Second Basement – B2 (first room is B201).

8.05.03. Room Numbering – Methodology

The flow of room numbering is to enable students and staff to easily navigate their way through the levels of the *building*s by following easily discernible sequencing of the numbers. This should start at the main entrance to the level and work its way through the most apparent main walkway, for the main rooms on that path, receiving the primary number set. Numbers should consecutively flow along this path. If the level has two main entries (usually at either end of the *building*) the *Consultant*s are to seek advice from the *UPR* which main entry to commence the numbering at. This may be by:

- Except as noted, rooms on Level 1 start with a "1". So, the first numbered room in Level 1 is 101, the second is 102. Similarly, the first numbered room on Level 2 is 201, the second room is 202. etc
- Going from side to side of the corridor where there is a reasonably equal number of main rooms flowing down each side.
- Flowing down one side of the corridor where the main rooms are predominantly on one side.

If there is no obvious direction for flow of numbers from the entrance, numbers will go in a clockwise direction.

8.05.04. Guide Points

A core of toilets to the level, off the main path would not normally continue the flow of primary numbers in a main corridor.

Main rooms surrounding a large open area would normally start on a dominant side (e.g. with a reception, or not toilets), and continue around the space.

8.05.05. Primary Room Numbering – Main Rooms

All functional Main Rooms and spaces that are accessible will be numbered with Primary Room Numbering in sequence, according to the above methodology. These rooms include:

- Classrooms
- Seminar rooms
- Offices
- Laboratories
- Libraries
- Toilets
- Waiting rooms
- Discrete kitchens
- Cleaner's room
- Storeroom
- Lifts
- Common rooms
- Foyer, where there is a waiting area or is a large space

Where a room is accessed ensuite (through another room) it *is to be* numbered with an alphabetical suffix to main room number e.g. Main room number 101, room off it to be 101A etc.

Rooms with Primary Numbering will receive the Primary Room Signage System (refer below). Exceptions are lifts, toilets and foyers. Lifts will not be signed with the room numbering, and toilets will receive the Secondary Room Signage system, but with the Primary Numbering.

8.05.06. Secondary Room Numbering

The remaining auxiliary/service spaces will be numbered next, starting at the next multiple of 10 above the highest Primary Number, following the methodology above. (e.g. If the highest Primary No. is 130, the remaining auxiliary/service spaces *shall be* numbered as 140, 141, 142 and so on). These spaces include:

- Corridors
- Foyers, if small, such as part of a corridor.
- Built in cupboards to corridors and Service cupboards.
- Stairs, ducts, etc.

Cupboards off main corridors and similar take a letter after the number of the corridor e.g. if the corridor is 215, cupboards would be 215A, 215B etc.

Secondary Rooms and spaces that can be reasonably and clearly signed will receive Secondary Room Signage System (refer below). These do not include voids, ducts but do include built in cupboards to corridors and service cupboards.

8.05.07. Albury Wodonga

The Albury-Wodonga *Campus* room numbering system incorporates the *building* number at the start of the room number. For example, 3215 is *Building* 3, Level 2, room 15.

8.05.08. City *Campus*

The City *Campus* (360 Collins St) room numbering system incorporates the level number at the start of the room number followed by a dot, then the room number. For example, 3.15 is level 3, room 15.

8.05.09. Open Office Areas

Open office areas will be assigned Primary Room Numbers.

They will receive Primary Room Signage as agreed with *UPR*.

Refer to the plan below for example of numbering sections and workstations in an open office area. The thick lines (labelled as "polylines") delineate different areas to receive room numbers. The main grouping of workstations *is to be* numbered (in the example) 205 and the walkway (circulation space) *is to be* numbered 251 (according to Secondary Number guidelines), with both combined forming the actual room proper. The space would be signed as 205, with the walkway not being signed. Refer below for Workstation bay numbering.

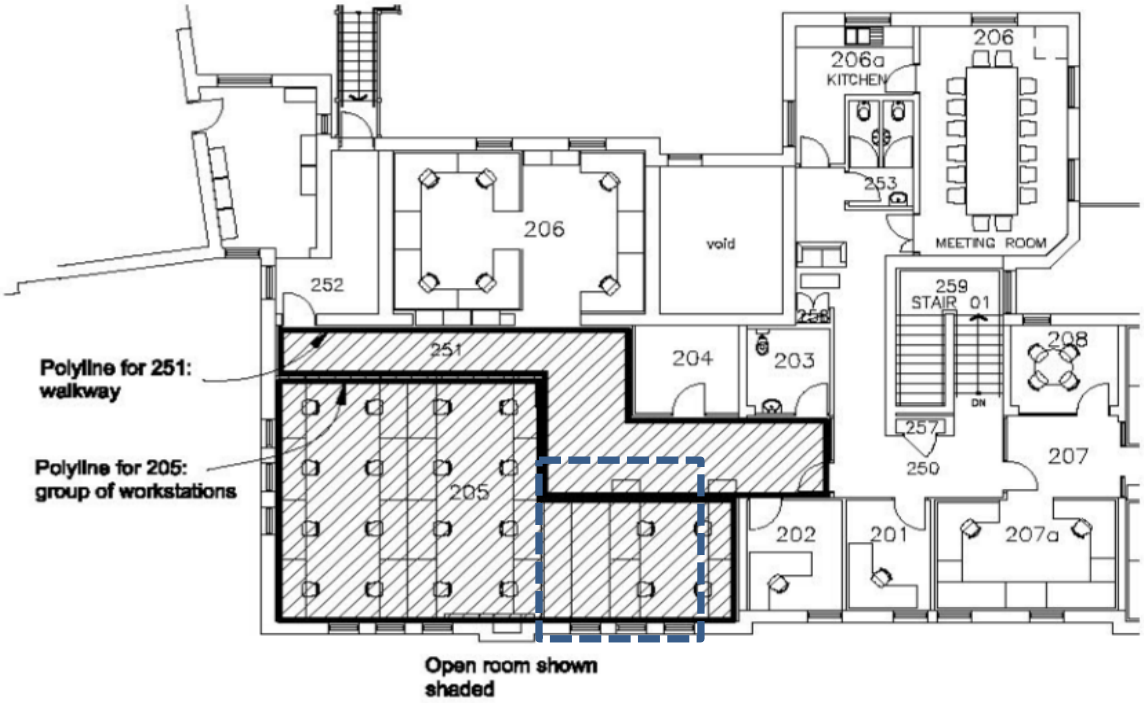


Fig 21. Room Types for Room Numbering

8.05.10. Work Stations

Individual workstations are to receive numbers as follows:

Bays

- Each bay of workstations, where required, receives a number as follows. For room 205, starting with the bay nearest main entry of the room, and numbering clockwise, where possible:
- 205A, 205B, 205C etc
  Refer drawing above.

Workstations

- Work stations, to a space as a whole, or within a bay, are numbered clockwise where possible, starting with the first on the left when entering the area (see below the plan showing the workstation numbering). The format is:
- For workstations in room 203, bay 203A
  W203A-1, W203A-2, W203A-3 & W203A-4
- Workstations in rooms without bays *are to be* numbered thus:
  W201-1, W201-2, W201-3 etc.

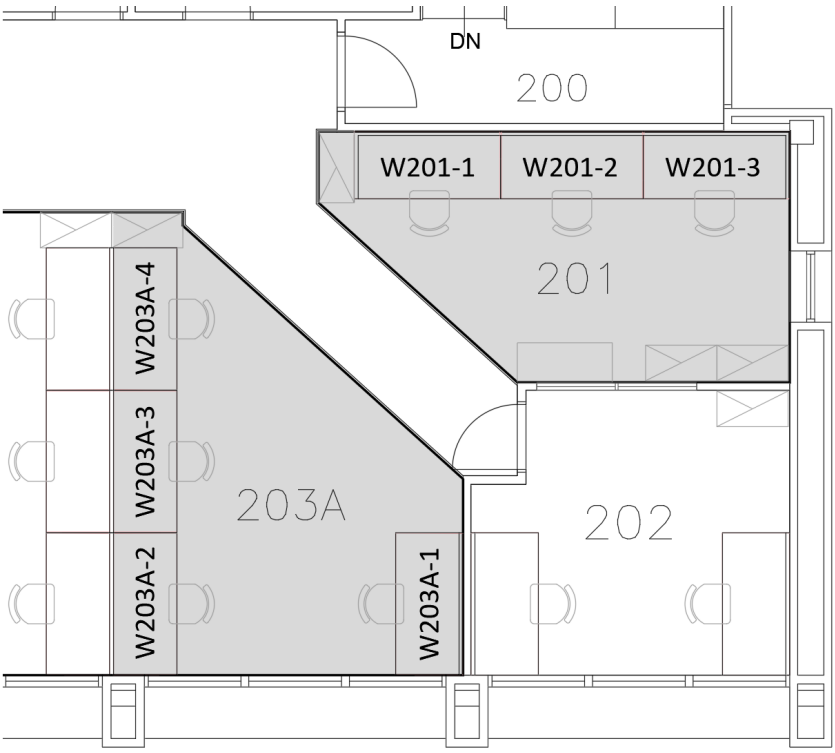


Fig 22. Numbering of Workstations