DESIGN & FACILITY STANDARDS

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University Operations

Campus Development

Campus and Collegiate Life Services | Chief Operating Officer
Health and Safety Compliance | Information Technology Services | Project Management
Property Services | Risk, Assurance and Compliance | Shared Services | Sustainability

University of Otago | PO Box 56 | Dunedin 9054 | New Zealand

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Contents

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DESIGN & FACILITY STANDARDS

SECTION 01:

GENERAL INFORMATION

01

1.0 GENERAL INFORMATION

1.1 UNIVERSITY OF OTAGO

The University of Otago is a world leading research and teaching University with its main Campus in Dunedin, New Zealand. The University has in excess of 20,000 students and 4,000 staff across New Zealand, with other Campuses located at bases at the Christchurch and Wellington Schools of Medicine and Health Sciences, the Auckland Centre, Auckland Manukau Dental, and at the Southland Campus in Invercargill.

The University's Dunedin Campus is ranked in the top 15 most beautiful campuses in the world, top 100 in 15 core subject areas and top 300 in major international rankings. The University has a strong sense of heritage and celebrated its 150th anniversary in 2019.

The University's mission is to create, advance, preserve, promote and apply knowledge, critical thinking and intellectual independence to enhance the understanding, development and well-being of individuals, society and the environment. It will achieve these goals by building on foundations of broad research and teaching capabilities, unique Campus learning environments, its nationwide presence and mana, and international links. The University's core values are:

- Intellectual independence and academic freedom
- Excellence
- Knowledge
- Leadership
- Partnership
- Treaty-based partnerships
- Collegiality and collaboration
- Ethical Standards
- Equity and social justice
- Stewardship

In addition to the University's strong research focus, studying at Otago is widely recognised as being the embodiment of the student lifestyle. As a result, the University places a heavy emphasis on the collegiate aspect of undergraduates and has in excess of 3,500 college beds, located both on and in close proximity to the Dunedin Campus. In addition to Research, the University's main growth market is in the national and international student field and as a result the University is focussed on ensuring that the facilities it offers are world class.

1.2 LOCATIONS

1.2.1 DUNEDIN CAMPUS

The University's Dunedin Campus includes central administration and the divisions of Health Sciences, Humanities, the Otago Business School and Sciences. This Campus has some key heritage buildings which are both physically and metaphorically at the heart of the Campus.

The Campus has a wide variety of building stock ranging from the 1870's through to present day, with a core building stock that was built during the 1960s and 1970's.

1.2.2 CHRISTCHURCH CAMPUS

The University's Christchurch Campus is located at Christchurch Hospital. It provides clinical training and education for the schools of Medicine and Health Sciences, Physiotherapy and Dietetics, along with research, distance education and postgraduate education within the Health Sciences Division.

1.2.3 WELLINGTON CAMPUS

The University's Wellington Campus is based at Wellington Hospital. It provides clinical training and education for the schools of Medicine and Health Sciences and Physiotherapy, along with research, distance education and postgraduate education within the Health Sciences Division. Course information and advice is also available from this location.

The Wellington Liaison office is based in Lambton Quay. It provides an array of support services, including summer school and distance learning.

1.2.4 AUCKLAND

The Auckland Campus is located in Otago House, Queen Street in Central Auckland. The courses it provides include children's issues, course information and liaison and distance educations. The facility is an important focal point for Alumni as well as being a schools liaison facility for prospective students.

The Dental School operates a facility located at the Manukau Super Clinic, South Auckland which provides placements for 5th year dental students as well as providing an essential service for the community.

1.2.5 INVERCARGILL

The Invercargill Campus (Ahuahu Te Matauranga) is located in Georgetown and provides a range of teacher education programmes in early childhood, primary and primary bilingual education. A secondary Campus is located at Kew Hospital, for the Health Sciences Division.

1.3 LEVEL OF STANDARD

In light of this diversity of study and research areas, and the array of Campus experiences available, the University is commencing on a building programme that will create world

leading facilities for teaching and research that reflect the unique characteristics and heritage of this education institution while complementing the wider built environment. The University looks to lead the way in design and facilities and aspires to exceed the minimum standards presented by the New Zealand Building Code, specifically around Accessibility and Sustainability where a new standard can be created.

1.3.1 DOCUMENT PURPOSE

The Design and Facility Standards are intended to capture the University's desired standard for facilities in both new and refurbished building stock with the emphasis being on the delivery of a consistent, quality and safe Campus. These standards are intended to inform both the internal Facilities Management team and external Design Consultants, providing guidance and direction on the requirements of the University.

The Standards provides guidance as to what is acceptable and unacceptable to the University, and also provides specific solutions and performance specifications. The Standards are not intended to be a 'one solution fits all' reference manual and in many cases will set out the University's desired outcomes, from which it will be the responsibility of the design consultant to develop a solution which meets the University's needs for the specific project.

The University is cognisant of the benefits of innovative design and encourages its adoption for individual projects, while maintaining consistency across the University's Campuses. The University welcomes suggestions for further improvements where a better standard or outcome can be achieved.

As a large organisation, the University has a wealth of experience across a number of subjects relating to design and the built environment. The intention of this document is to draw on the collective knowledge and experience and collate the information in a central source. In many cases existing information exists in policy documentation. Where this is the case, reference will be made with hyperlink to the relevant document.

1.3.2 DOCUMENT USE

The proposed guidance and standards presented within this document will in many cases supplement and exceed statutory legislation. These standards do not relieve designers of their professional or legal liability. Designers must ensure that their designs meet the legislative requirements and should stay up to date with changes in legislation and industry practice. Where no commentary has been provided in this document as to a particular standard, current legislation should be followed.

The document has been split into sections for ease of use. Where information is provided in hyperlinks to external documents it will be highlighted in blue underlined text. Some of these links are accessible only to University employees. Where consultants require access to these documents, please contact the author(s). Links to other sections of this document are indicated in **bold underlined blue text**.

Whilst this document is presented as guidance, it is intended that it will be adhered to in full.

The document is structured in the following format:

- Section 1: General Information
- Section 2: Process and Procedure
- Section 3: Accessibility
- Section 4: Sustainability
- Section 5: Cultural
- Section 6: Health & Safety
- Section 7: Architecture and Space
- Section 8: Structural and seismic
- Section 9: Mechanical, Hydraulic & Electrical Services
- Section 10: Fire
- Section 11: Security
- Section 12: ICT & AV
- Section 13: Vertical Transportation
- Section 14: Project Documentation

It is intended that this is a live document which will be added to as required or as legislation and standards change.

1.3.2.1 APPROVAL & DEVIATION FROM GUIDANCE

On major Capital projects, designers will collate and present a schedule identifying where designs meet / do not meet the University Design and Facility Standards. This matrix will allow design team and client discussion as to where it is appropriate to deviate from the standards and the decisions can be recorded. The schedule should first be collated at Preliminary Design stage and should be issued for review at completion of each subsequent design drop.

Final approval and decision making around deviations will sit with the University Strategic Architect and Building Services Engineer for respective disciplines (seeking additional advice internally as necessary). These decisions can be overruled by the Project Steering Committee or Chief Operating Officer when presented with all the relevant information.

1.4 ORGANISATIONAL STRUCTURE

The Central Organisation Structure provides a general overview of the key positions within the University. The Chief Operating Officer is responsible for a number of functions, as shown in the Operations Structure, including Campus Development and Property Services.

The Campus Development Division is responsible for the planning and delivery of the University's Strategic Capital Works programme including oversight of individual projects.

This also includes maintaining the University's Campus Masterplan. There are a number of divisions and stakeholders that Campus Development need to consult with during the planning and implementation phases of projects.

The Property Services Division is responsible for the operation, repairs and maintenance of all of the University's buildings with a replacement cost of NZ$3.5 billion, and more than 45 hectares of land. The size of the Campus and the number of staff and students it supports makes the Property Services role similar to the management and running of a small city. As part of the design and implementation of repairs and maintenance Property Services need to consult with appropriate University divisional staff.

1.5 DESIGN ASPIRATION

The University aspires to deliver high quality facilities across all of its Campuses that are functional, sustainable, maintainable, flexible, safe, aesthetically pleasing and best value. The facilities which are created need to be built with longevity in mind and in most cases will have a life expectancy in excess of 50 years.

If a proposed building, or an existing building proposed to be altered, is intended to have a specified limited life of less than 50 years, consultation should be undertaken with Asset Management and Building Information and Compliance to develop a plan which addresses the potential risk and ongoing funding implications of a limited life building. The plan shall be approved by the Asset Management Committee.

Durability of buildings and materials are important to the University as these factors can have a significant impact on operation, life cycle costs, maintenance and environmental factors. All elements of the building should be designed in line with the specified building life expectancy.

1.6 ABBREVIATIONS & DEFINITIONS

The following is a brief summary of some relevant abbreviations and definitions:

- **ACM**: Asbestos Containing Material
- **AMP**: Asset Management Plan
- **ANARP**: As Near As Reasonably Practicable
- **BBC**: Better Business Case (the methodology by which project Business Cases are developed)
- **BIC**: Building Information and Compliance (within Property Services)
- **BIM**: Building Information Modelling
- **CaCLS**: Campus and Collegiate Life Services Division
- **CCC**: Code Compliance Certificate
- **CDC**: Capital Development Committee (gives advice to the University Council)
- **CDD**: Campus Development Division
- **CEP**: Capital Expenditure Plan
- **CMP**: Campus Master Plan
- **CFO**: Chief Financial Officer
- **COO**: Chief Operating Officer
- **CPU**: Certificate of Public Use
- **DO**: Design Office (within Property Services)
- **EFTSL**: Equivalent Full Time Student Load
- **EPT**: Executive Planning Team (deal with operational and design-related issues to reduce unnecessary PSC involvement)
- **FENZ:** Fire and Emergency New Zealand
- **FF&E**: Furniture Fittings and Equipment
- **FM**: Facility Manager
- **FSC**: Forest Stewardship Council
- **FTE**: Full Time Equivalent (staff)
- **GFA**: Gross Floor Area
- **HAIL**: Hazardous Activities and Industries List
- **H&SC**: Health and Safety Compliance
- **HSD**: Health Sciences Division
- **ISA**: International Symbol of access; wheelchair symbol
- **ITS:** Information Technology Services
- **ITSS:** IT Support Services
- **IWMS:** Integrated Work Management System
- **LTCP:** Long Term Capital Plan
- **MBIE**: Ministry of Business Innovation and Employment
- **MEWP**: Mobile Elevated Work Platform
- **MTHW**: Medium Temperature Hot Water. This is used to heat a large portion of our Campus
- **NZBC**: New Zealand Building Code
- **O&M Manual**: Operations and Maintenance Manual
- **OIA**: Official Information Act
- **OURDrive**: University's SharePoint-based document and records management system
- **PCG**: Project Control Group (Coordinate the management of projects on a day-to-day basis)
- **PFP**: passive fire protection or passive fire penetrations
- **PM**: Project Manager
- **PMIS**: Property Management Information System
- **PMO**: Project Management Office
- **PSC**: Project Steering Committee (responsible for ensuring delivery of project outcomes)
- **PSD**: Property Services Division
- **PVC**: Pro-Vice Chancellor
- **SAMP**: Strategic Asset Management Plan
- **SSD:** Shared Services Division
- **SSF**: Sustainability Strategic Framework
- **TA**: Territorial Authority
- **TEFMA**: Tertiary Education Facilities Management Association
- **'the University'**: University of Otago
- **UFA**: Useable Floor Area
- **UOCE**: University of Otago College of Education
- **'University'**: University of Otago
- **VC**: Vice Chancellor

- **VAD**: Visual Alerting Device
- **VCAG**: Vice Chancellor's Advisory Group
- **Workspace**: A space allocated to support work activities; e.g. workstation
- **Workstation**: A desk provided for the purpose of work activities.

DESIGN & FACILITY STANDARDS

SECTION 02:
PROCESS & PROCEDURE

02

2.0 PROCESS & PROCEDURE

The University uses a number of mechanisms to guide project definition, implementation, and procurement. These mechanisms may be guided by legislation (for example, the Building Act, the Resource Management Act, the Heritage New Zealand Pouhere Taonga Act 2014), best practice (for example the Better Business Case approach defined by the New Zealand Treasury, or the Tertiary Education Facilities Management Association Space Planning Guidelines), the Campus Masterplan or an array of other policies, procedures and guidelines that are specific to the University. This section also sets out a number of specific matters that are useful to the administration of any University Project.

2.1 PROJECTS

The University utilises a number of processes for project delivery which can be categorised as:

- Maintenance and Adaption projects, run by the FMs within the Property Services Division and informed by the Strategic Asset Management Plan (SAMP).
- Capital Projects, run by PMs within the Campus Development Division
- IT Projects, run by the IT Project Management Office (ITPMO) within the IT Services Division
- Other Projects, run by individual Divisions or Departments

All projects are governed by procedures as set out in the following documents:

- Project Governance Framework
- Project Approvals Procedure
- Campus Development Project Procedures

2.1.1 PROJECTS: PROPERTY SERVICES

Facility Managers are responsible for liaison with allocated Divisions, ensuring that maintenance and upgrade projects are aligned to Department and Divisional needs. Those projects are funded under Strategic Asset Management via an annual work plan process. Projects will generally be <$5M and will be delivered by a Project Manager who will appoint design consultants and suppliers to deliver the projects. Construction delivery will be through either an internal or an external contracting model.

2.1.2 CAPITAL PROJECTS: CAMPUS DEVELOPMENT

Capital Projects are defined and prioritised by Campus Development and inform the Long Term Capital Plan (LTCP). PMs are allocated to each Capital Project and will be responsible for managing the project from inception to completion. Capital Projects generally range from $2M upwards.

2.1.3 IT PROJECTS: IT DIVISION

IT Projects are typically delivered by ITPMO PMs and may require integration with many other divisions including Property Services and Campus Development to provide support with regard to buildings, infrastructure and strategic planning.

It is imperative that IT are involved early in all new facility concept design, business cases and high-level / detailed design stages. Please contact its.design-facility-support@otago.ac.nz in the first instance.

2.1.4 OTHER PROJECTS: DIVISIONS OR DEPARTMENTS

Individual divisions may wish to instigate their own projects which may not be building or service related. Any projects relating to buildings, services or infrastructure will involve either Property Services, Campus Development or IT Divisions.

2.2 UNIVERSITY GUIDANCE

2.2.1 POLICY DOCUMENTS

The University holds and maintains a Policy Library, which is publicly available through the University's website. There are also a number of property-specific operational policies which need to be obtained directly from Property Services. The University's policies that are relevant to design and construction include (with links to the Policy Library where available):

2.2.1.1 Policy

- Artworks Collection Policy
- Asbestos Management Policy
- Brand Policy
- Campus Design for Access and Mobility Policy
- Closed Circuit Television (CCTV) Security Systems Policy
- HSNO-Exempt Laboratory Compliance Policy
- Health and Safety Approved Contractors Policy
- Health and Safety Policy
- Infrastructure Asset Management Policy
- Māori Language Policy
- Parking Policy
- Risk Management Policy
- Seismic Strengthening Policy
- Space Management Policy
- Testing of Portable Electrical Equipment Policy

2.2.1.2 Procedures

- Procurement Procedure
- Tree Management Procedure

2.2.1.3 Guidelines

- Post-Earthquake Building Inspection Guidelines
- Space Use Guidelines
- Testing of Portable Electrical Equipment (Non-specialised) Guidelines
- Thermal Comfort Guidelines
- University of Otago Brand Guide
- Space Numbering Guidelines

2.2.1.4 Strategies

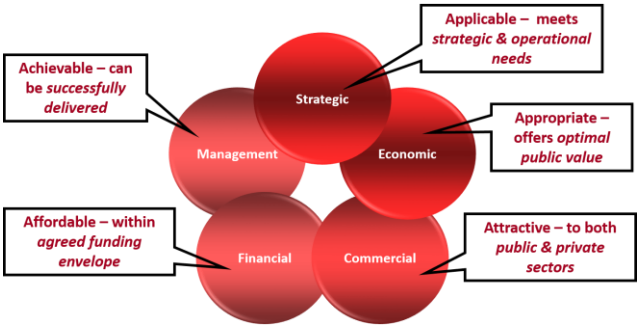
- Campus Masterplan (2010)

2.2.2 CAMPUS MASTERPLAN

The Campus Masterplan was prepared in 2010 and sets out a vision for the short, medium and longer term for the University, with a specific focus on the Dunedin, Christchurch and Wellington Campuses. Whilst many aspects of the Masterplan have been adopted and progressed, many other aspects have changed as a result of economic, political and environmental changes. As such, there has been deviation from the Masterplan in many areas and whilst it provides useful guidance it should not be solely relied upon as the direction for the University. Designers should check with the PM and the Strategy and Planning Section of Campus Development for any update on specific areas of the Masterplan. The Campus Masterplan is proposed to be reviewed in 2022 and will be informed by recently completed Precinct and Divisional Plans.

2.2.3 BUSINESS CASE

As set out in the Project Approvals Procedure document, projects will be assessed and categorised to determine the route for funding application. Projects in excess of $250K are required to follow the Better Business Case (BBC) Methodology which will assess projects against their Strategic, Economic, Commercial, Financial and Management Cases. The process is set out in the Business Case Framework. Guidance for preparation of business cases can be obtained from the Project Management Office (PMO).



2.3 RECORDS & EXISTING BUILDING INFORMATION

The University holds a significant level of information on its building stock. Some of the older buildings on Campus have information relating to the original build, in some cases dating back 140 years. Whilst a lot of this information will not be readily accessible to external consultants, they should be aware of its potential existence and refer to their University contact for further information.

Information typically held by the University on building stock includes:

- Current and historic plans (including BIM models)
- Current Compliance Certification
- Services manuals and as built information
- Fire reports
- Accessibility reports
- Asbestos and Hazard reports
- Information relating to previous projects
- IT information, networking, systems and specialist IT and research facilities

Whilst existing documentation may be provided by the University, it will be presented as reference material only and ***should not be relied upon as being accurate***. Designers should take all necessary steps to confirm accuracy of information, in particular with regard to measured surveys and locations of services.

The Property Services Division is responsible for the maintenance of building records and utilises a building coding system for all buildings in the University's portfolio. This is primarily centred on the Dunedin Campus and has been created based upon a grid reference system from the Campus Map, i.e. the Information Services Building is located in grid reference F4, hence the building is numbered F419, denoting the 19th building in this grid. Other buildings that are off Campus or are more generic facilities are referenced using:

- XA – Auckland
- XI – Invercargill
- XC – Christchurch
- WX - Wellington
- ZZ – Campus-wide

Information for the Dunedin Campus can be found on the Campus Map.

The Property Services Division will require as built and record information at the completion of each project. The Design Office team within Building Information and Compliance should be consulted early in the project as to expectations for as build information.

2.4 ACCESS TO UNIVERSITY PROPERTY

Consultants and Contractors must be escorted around University property unless they have been inducted in H&S and issued with an ID card. Consultants must hold a University ID card before they can work on Campus. Cards can only be obtained after the company has been H&S approved and individual employees have attended a H&S induction. These are held weekly and take around 30 minutes.

University H&S ID cards are valid for two-years and may be electronically set to be used as "swipe" cards for access to relevant buildings.

Any queries about the H&S approval system may be referred to the University Construction H&S Manager.

Keys may be issued to Consultants or Contractors for access to restricted areas. Please refer the appropriate PM for authority.

Access to any building IT facility, device, cabinet or wiring must be authorized by IT Services before work begins. Please contact its.design-facility-support@otago.ac.nz in the first instance.

2.5 DESIGN

2.5.1 DESIGN BRIEF

Every Project will have a design brief prepared by the University. This will be used for validation of the project requirements with the relevant stakeholders or PSC. The University Design Brief will also be utilised for procurement of Consultants on a project. Where consultants are engaged, it will be expected that a 'Reverse' Brief is issued by the Consultant as part of the Concept Design stage to ensure the full requirements of the project have been captured and understood.

2.5.2 DESIGN STAGES

Design of Projects will generally follow NZCIC Design Guidelines and be organised into the following stages:

- Project Establishment
- Concept Design
- Preliminary Design (*required for business case*)
- Developed Design
- Detailed Design
- Procurement
- Construction Administration Observation
- Post Completion

2.5.3 CONTRACTOR DESIGN PORTION

Consultants should as a matter of course prepare a full design without performance specification. Where performance specification is required it should be agreed in advance with the PM.

Where a design or element of a design is to be contractor designed, this should be made clear in all contract drawings and documentation and referred in tender documentation. The design parameters and legislative standards should be set out in a performance specification document prepared by the consultant outlining the requirements for the design. It should be made clear as to whether any contractor design is required at tender stage or the timescales for issue following tender. It should be confirmed that the contractor has both the capability and the professional indemnity insurance to undertake the work. Consultants will be responsible for reviewing the contractors design and providing comment and recommendation to the University.

2.5.4 REFERENCE GROUPS

The University has a number of internal departments that should be consulted with on every project. All consultation should be arranged through the University PM. These include:

- Relevant Divisional / Departmental Stakeholders
- Office of Māori Development
- Office of Sustainability
- Disability Information and Support Office
- Marketing and Communication
- Health and Safety Compliance Team *(including the Statutory Committee)*
- Property Services
- ITS (Network, structured cabling & telephony)
- ITSS (AV and Desktop)
- Students *(appointed representative or OUSA representative)*
- Equity Manager

Other departments which may be relevant to individual projects would include:

- Property Services Facility Management
- Property Services Asset Management
- Property Services Building Information and Compliance
- Property Services Property Management Unit
- Property Services Custodial Services
- Proctors Office / Campus Watch

2.5.5 PROGRAMMING OF PROJECTS

Careful consideration must be given to the timing of construction works as the majority of the University's buildings will be occupied during construction works. Specific consideration should be given to existing building occupants and neighbouring buildings with particular regard to noise transfer, traffic management and access to facilities. Disruption to student facilities, particularly around exam times is a critical consideration and must be factored into the construction programme. There may also be times when works are required to cease to accommodate academic priorities.

2.6 CONTRACT MANAGEMENT & DOCUMENTATION

2.6.1 STANDARD SCOPE OF SERVICES

Where the services of a consultant are engaged on a project, the PM will provide a scope of services relevant to the discipline. This will form part of the contract with the consultant.

2.6.2 PROCUREMENT

The University's Procurement Procedure should be followed on all project work.

2.6.3 PROJECT DOCUMENTATION

Refer **Project Documentation Section**.

2.6.4 PRODUCT / SYSTEM REVIEW & ALTERNATIVE PROPOSALS

Consultants and Contractors should consider only limited use of highly specialised equipment where servicing or assistance is not readily available within the region. Similarly, consideration should be given to procurement timescales for products particularly where sourced from overseas. The University will give preference to the use of locally sourced products and services, before nationally sourced products and services. International products and services are considered least preferred.

No equipment should be purchased without prior approval from the University.

Consultants and Contractors may propose alternative equipment or materials where supported by programme, cost and quality information to support their proposal. The University will assess alternative products and may approve or reject substitute products.

2.6.5 PROJECT COMPLETION & OPERATIONAL READINESS

The University has a Project Completion and Handover Checklist for Operational Readiness which should be utilised towards the completion of a project. This is intended to ensure the key building completion tasks are undertaken and stakeholders are ready for occupation. Consultants will be required to support PMs as required with this process.

2.7 CONSENTING & APPROVALS

2.7.1 CONSENTING & CONSULTATION STRATEGY

Once the project is suitably defined, the Consultant shall prepare a strategy for obtaining the required consents and any other approvals required. As a minimum, this strategy should set out the approach to be utilised for obtaining any building and/or resource consents, the timeline for the preparation and submission of the application(s), and any consultation required. Once agreed by the University, either the University or the Consultant shall implement the strategy.

Details as to the cost of any consents or approvals should also be included in the consenting and consultation strategy. On approval of the consenting and consultation strategy, the University will advise the consultant whether the University or the Consultant should raise and submit the lodging fee (the latter being treated as an expense to be claimed back by the consultant).

Preparation of the consent documentation should not commence until the University has provided approval to the consenting and consultation strategy proposed.

Any consents or approvals required shall be lodged in the name of the University as property owner/applicant.

Consultants will be responsible for preparing information for any applications required. All applications shall be made on the basis of drawings, specifications and additional information provided by the Consultants (or by the contractor / subcontractors acting on the instructions of the consultants).

No applications shall be lodged without the University's express approval of the documentation.

The consenting and consultation strategy shall identify any parties or stakeholders with an interest in the project, and/or any parties that could be considered to be affected by the proposal within the context of the Resource Management Act 1991 in particular. The strategy should set out

recommendations for the engagement process and include any areas where University staff should also be involved in consultation.

Consultation with the Reference Groups identified below may not necessarily be required for every application, however should consultation be required with iwi, the University's Office of Māori Development should be involved in consultation.

During the consultation phase of the project, the Consultant shall take a 'no surprises' approach, and shall provide regular updates to the University as to progress.

2.7.2 BUILDING CONSENTS

Consultants and Contractors should comply fully with the Building Act including any current amendments and the New Zealand Building Code.

As per the consenting strategy, Consultants will be responsible for preparing information for the application for Building Consent.

The consultant shall confirm with the University Building Information and Compliance Manager the systems requiring a compliance schedule identifier and proposed inspection/ maintenance/ reporting procedures.

The consultant should advise of any changes to the works which will affect or require an amendment to the building consent and of the cost for any changes.

The main contractor will be responsible for developing the Certificate of Public Use (CPU) and covering the cost of the CPU application and any controls. The Building Information and Compliance Team at Property Services are available to support the development and coordination of the CPU controls and documentation. The contractor will be responsible for all further CPUs for sectional or late completion.

The contractor shall arrange all site inspections required by the local authority. Where subsequent costs arise in the form of re-inspection fees, these costs shall be met by the contractor.

When all items required for the building consent are complete, the contractor should obtain and deliver the Code Compliance Certificate (CCC) to the University. The timing of this will generally be of critical importance for the occupation of staff and students to completed areas. If it is not possible to achieve this in time, a Certificate for Public Use (CPU) occupation should be obtained to allow for University usage of the new construction prior to issue of the Code Compliance Certificate. This should be obtained and paid for by the contractor and maintained until the CCC has been issued. The Building Information and Compliance Team at Property Services are available to support the development and coordination of the CPU controls and documentation

All consents to be copied to the Building Consent and Documentation Officer at the University.

2.7.3 RESOURCE CONSENTS

Consultants and contractors should be fully cognisant of the requirements of the current Resource Management Act, which includes any relevant national policy and environmental standards, regional policy statements, and unitary, regional, and district plans. This also includes the conditions applicable to any relevant designation, consent, or approval under that Act.

In the majority of cases, the University Strategic Resource Planner will be responsible for the preparation and submission of Resource Consent applications.

Where applicable, the University may appoint Consultants to assist in the preparation of documentation and/or to make application for Resource Consent.

Where a Consultant is engaged for this activity they shall:

- ensure that suitably qualified professionals will be responsible for preparing resource consent information, draft applications and assessments of environmental effects.
- ensure that applications for Resource Consent shall be accompanied by suitable technical reports in support of the proposal. The provisions of the Fourth Schedule of the Resource Management Act 1991 should be followed in the preparation of the assessment of environmental effects.
- provide regular updates on the preparation of resource consent information
- where empowered by the University, follow up with the Council as required. The University should be promptly advised of any request for additional information, and the Consultant should provide a timeline for the University's approval that demonstrates how a response can be provided to any such request within the statutory timeframe. No response to a request for additional information should be submitted without its approval by the University
- review the draft resource consent decision, and provide clear advice to the University as to its suitability for the intended purpose. The University shall also be provided with a copy of any draft conditions of consent. The University's approval of the proposed draft conditions shall be required prior to the Consultant's confirmation of their suitability to the Council.
- subsequent to the issue of any decision on a resource consent, provide an assessment of the suitability of the resource consent decision and a recommendation in respect of whether an appeal of any aspect of the decision is necessary. No appeal shall be lodged in the absence of University approval to this process.

2.7.4 ARCHAEOLOGICAL AUTHORITIES

An Archaeological Authority is required before work is undertaken that may affect an archaeological site. The University currently holds a number of Archaeological Authorities for various works. The University PM and Strategic Resource Planner should determine whether the project site is included in any of the existing Archaeological Authorities. The University Strategic Resource Planner will appoint the necessary Archaeological Consultant as required to prepare the accompanying documentation.

DESIGN & FACILITY STANDARDS

SECTION 03:
ACCESSIBILITY

03

3.0 ACCESSIBILITY

The University is committed to providing accessible facilities for all students, staff and public across its Campus. There are currently a number of older buildings across Campus where accessibility is poor and where possible the University has made reasonable adjustments as part of ongoing maintenance to try and address the situation and improve accessibility. In many cases however this is simply not possible within the constraints of an existing building or maintenance funding. As such when a larger project is proposed either for adaptation or refurbishment, the accessible route should be reconsidered and all efforts made to improve the situation. Whilst the requirement for 'As Near As Reasonably Practicable (ANARP)' is a sensible approach to sometimes difficult situations, it somewhat dilutes the desire by the University to strive towards a better accessible environment.

Any project work affecting the accessible route should be accompanied by an access statement setting out the sacrifices and benefits of any required work to make the accessible route compliant – this should be a separate document to support any drawing work for the proposals.

The University also acknowledges the somewhat outdated standards for accessibility within the NZ Building code and NZS4121:2001. The University guidelines for accessibility therefore set a more onerous standard than the current legislation and should apply to all new and refurbished accommodation.

3.1 ACCESSIBILITY AUDITS

The University holds a large number of Accessibility Audits for buildings across its estate. These are maintained on a 5 yearly cycle and are utilised to assess 'ANARP' alterations whenever works of a consentable nature is undertaken. Consultants should check with the University FM or PM to ascertain the existence of an Accessibility Audit for individual buildings and projects.

Historic accessibility reports may not include current information or recommendations from these guidelines and should be checked and cross referenced for up to date information and guidance.

3.2 ACCESSIBILITY CONSULTATION & REVIEWS

Every Project will require consultation with the Disability Information and Support Office. Early consultation in the project is recommended to address or discuss any potential issues. A review of the design will be carried out by the Disability Information and Support Office before completion of Preliminary Design. A further review or consultation should be undertaken as the project develops to gain the approval of the Disability Information and Support Office for the final design.

3.3 PLANNING FOR CONSTRUCTION ACTIVITY

Consideration should be given to any altered routes or spaces as a result of proposed construction work. Consultants and contractor should work together to ensure that routes are maintained for all groups of Campus users.

3.4 ACCESSIBLE ROUTE GUIDANCE

The following information has been prepared in conjunction with John Marrable Consultancy and the University Disability Information and Support Office. The University Guidelines are not a substitute for, and should always be used with reference to the New Zealand Building Code and official documents approved by the Ministry of Business, Innovation, and Employment (MBIE), for the purpose of providing access and facilities for people with disabilities. Where appropriate, a University increased standard has been presented in Bold and Underlined.

3.5 ACCESSIBLE JOURNEY

The concept of the 'accessible journey' is a theoretical path of travel between the three primary components of the built environment:

- Transport Systems
- Public Spaces
- Buildings

Critical points in the "Accessible Journey" occur at transitions between these components, and if accessible features are not present at the transitions then the accessible journey is broken for a user.

3.5.1 ACCESSIBLE ROUTE

NZS4121:2001 defines an 'accessible route' as:

"A route that is usable by people with disabilities. It shall be a continuous route that can be negotiated unaided by a wheelchair user, walking device or by a person with a guide dog. The route shall extend from street boundary and car parking area to those spaces within the building required to be accessible to enable people with disabilities to carry out normal activities and processes within the building"

To test if an accessible route is present a building should be looked at in terms of approachability, accessibility and usability:

- Approachability - Ensures that people with impairments can get to a particular feature and is concerned with the exterior environment, including environmental factors and car parking.
- Accessibility - Ensures that people with impairments can enter and move about freely within a space or environment, without having to call for assistance.
- Usability - Means that the environment and its facilities are actually usable by persons with impairments

If one feature of the 'accessible route'; being approachable, accessible or usable is not present then the accessible route is broken for a user, and therefore not meeting the requirements of the New Zealand Building Act 2004.

These practical design principles relate the concept of the Accessible Journey to an individual component or space. In doing so, they connect the legislative requirements for accessibility to the specific compliance detail of the Accessible Route.

An accessible route requires:

- Continuous route with a clear width of 1200mm throughout the route from the street and car parking, around the building to all 'public' entrances and throughout the building;
- Minimum 2100mm height clearance throughout the route;
- No single, isolated steps to be present;
- All ground, floor and stair tread surfaces must be stable, firm and slip resistant under all normal environmental conditions;
- Any obstructions such as turnstiles or trolley traps etc. along the accessible route into a building must allow unimpeded passage to a person with mobility aids including guide dogs;
- There must not be any isolated columns or built in furniture that reduces the 1200mm minimum corridor width;
- Signs must be Informative, directional and locational, both inside and outside the building and mounted in the comfortable zones for viewing Refer to NZS 4121

University standard - Increase the clear width to a minimum of 1500mm.

A clear width of 1800mm is preferred where possible particularly where large pedestrian flows are anticipated and to facilitate wheelchairs passing.

Refer:

- NZS 4121:2001 Section 4,
- NZBC Clauses A2, D1.1(c), D1.3.2, D1.3.3, D1.3.4,
- Acceptable Solution / Compliance document D1/AS1 sections 1.1, 1.3, 1.4, 2.2, 2.3,
- AS/NZS 1428.4:2009; "Means to assist the orientation of people with visual impairment - tactile ground surface indicators."

3.5.2 CARPARKS

Since 2001 the number of persons identifying as disabled and the number of persons using accessible carparks has increased.

In 2001, when the Standard NZS4121:2001 was developed, an estimated 743,800 people with disability were living in New Zealand. This is a disability prevalence rate of 20%.

In 2013, an estimated 24 percent of people living in New Zealand were identified as disabled. A total of 1,062,000 people were limited in their ability to carry out everyday activities by at least one impairment type.

University Standard - Increase the number of required accessible parks to cater for the increase in the percentage of persons with a disability (*fig 3.1*).

Total number of car parks	University Standard Number of accessible car park spaces
1 - 20	Not less than 2
21 - 50	Not less than 3
For every additional 50 car parks or part of a car park	Not less than 2

fig 3.1: accessible parking quantity

3.5.2.1 Carpark dimensions

It is important that the accessible car park dimensions provide sufficient area for a variety of vehicles to use.

Parking should cater for vehicles where:

- the driver is an independent manual wheelchair user, drives the vehicle from the vehicles driver's seat and gets out on the driver's side of the vehicle either:
    - manually lifting their wheelchair and placing it by the driver's door,
    - having a hoist either roof mounted or inside the vehicle that places their wheelchair beside the driver's door or
    - Accompanied by a support person to get their wheelchair out of the car and place it by the driver's door.
- the driver is using, either a manual wheelchair or powered wheelchair, drives the vehicle from their chair, gets out of the vehicle (This type of vehicle is classed as a Wheelchair Accessible Vehicle – or WAV for short) by either:
    - rear mounted hoist or ramp
    - Side mounted hoist or ramp (usually on the passenger side of the vehicle).
    - The passenger is the person with the mobility issue.

More persons using wheelchairs are starting to travel in WAV's and stay in their wheelchairs to eliminate the need to transfer in and out of their wheelchairs.

International best practice is to provide designated parking bays for larger vans and vehicles with a wheelchair hoist at the rear with dimensions of 4800mm x 7200mm.

Where ramps are used on vehicles, spaces are being designed to provide even more width, with dimensions being 5400mm (W) x 7800mm (L), including a 3000mm accessibility zone to the side and rear of for safe transition to and from the vehicle.

For example

- Chrysler Grand Voyager has a height of 1740mm, length of 5096mm and a width of 1997mm
- Mercedes Sprinter (shortest model) has a height of over 1900mm, length of 5926mm and a width of 2020mm.
- Volkswagen Transporter has a height of 1990mm, length of 5006mm and a width of 2297mm.

University Standard – Individual accessible parking spaces should be as close to the principal entrance as possible, 3700mm wide to allow transfer from a wheelchair into the vehicle from either the drivers or passenger side. The park shall incorporate a marked 1200mm access/safety zone for rear access or to facilitate vehicles with rear hoists/ramps.

University Standard – When more than one accessible park is provided in a row, the width must be at least 2500mm wide with the 1200mm wide transfer/shared space between them.

University Standard - The length of accessible carparks to cater for vans with a rear hoist is 6600mm. This can be achieved by utilising the designated access/safety zone.

University Standard – Accessible carparks are to have flush kerbs either side of the parks or kerb ramps.

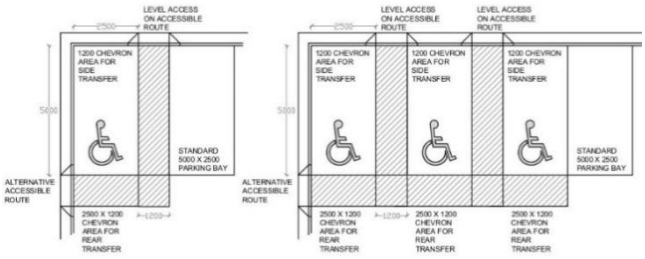


fig 3.2: Accessible off-street parking spaces

Signage

- Accessible parking spaces should be painted blue with the ISA painted in white to tie in with signage.
- The whole accessible park should be painted blue with the ISA painted in the middle:
- Directional signage should be positioned so as to locate accessible parks on entrance to the facility
- Signage on a post should be located at each space to allow identification of the space from afar. Mounting height 1600mm AFFL.

fig 3.3: ISA symbol

Localised signage may also be used to prevent misuse of the facility:

fig 3.4: ISA signage

Refer:

- NZS 4121:200 Section 5
- NZ Building Code Clauses D1.1(c), D1.3.5, D1.3.6 and;
- Acceptable Solution / Compliance Document D1/AS1 10.0 [AS2890:1].
- Reference should also be made to local district plans

3.5.2.2 Car Park Location

- The accessible carparks (where building specific) should be located on the shortest accessible route to the accessible entrance or to an accessible lift to the building or facility and
- The accessible carparks located should be so that persons do not have to pass behind parked cars when moving to an accessible route or when approaching an entrance

Refer:

- NZS 4121:200 Section 5
- NZ Building Code Clauses D1.1(c), D1.3.5, D1.3.6 and;
- Acceptable Solution / Compliance Document D1/AS1 10.0 [AS2890:1].

fig 3.5: rear transfer, side transfer

3.5.3 TICKET DISPENSER MACHINE

These machines are to be accessible for a person in a wheelchair to pay for their parking fee.

University Standard - Provide ticket machines that offer slots for coins or cards that need to be operated from a wheelchair should not be less than 750mm and not more than 1200mm high. Any variable message displays or control instructions should be centred on 1500mm above ground level (fig 3.6).

Keypads on those parking machines which require registration numbers to be typed in, should be no more than 1200mm high.

Access to ticket machines should be on a level surface 1500mm x 1500mm

Refer:

- NZS4121:2001 Section 11

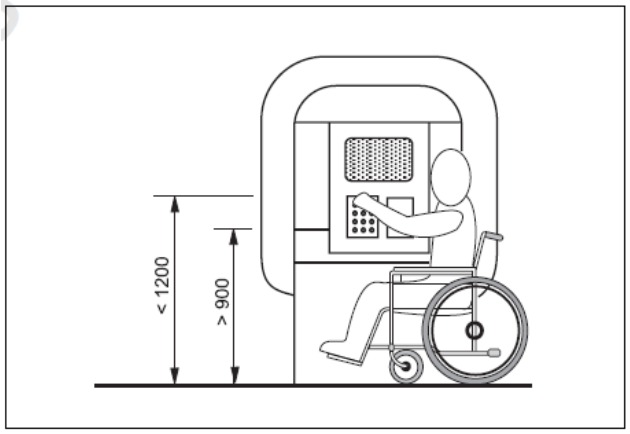


fig 3.6: NZS4121:2001 Figure 39 – Automatic teller or vending machine

3.5.4 KERB RAMPS

University Standard - Ensure that the kerb ramp is flush to the carriageway, with a maximum gradient of 1:12 on the direct approach. At the foot of the dropped kerb, the camber of the road should be no more than 1:20 for a wheelbase distance (approximately 600mm) away from the kerb line. This avoids the wheelchair front wheels or footrest being caught by an opposing up slope (fig 3.7).

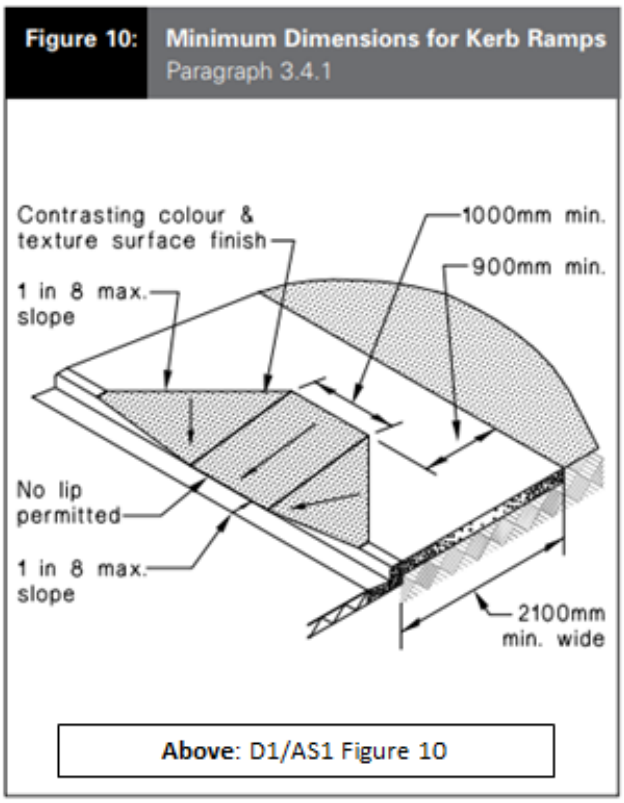


fig 3.7: ZS4121:2001 Min dimension for accessible kerbs

Refer:

- NZS 4121:2001 Section 4.4 and 13.4;
- NZ Building Code Clauses D1.1 (c), D1.4.3 (d), Acceptable Solution / Compliance Document D1/AS1 Section 3.4; and
- RTS 14 Guidelines for facilities for blind and vision-impaired pedestrians

3.5.5 FOOTPATHS ON ACCESSIBLE ROUTE

The transverse gradient or cross-fall of a footpath can pull a wheelchair to one side.

A flatter surface also reduces the inclination of people with visual impairment.

Wherever possible the transverse gradient should be flatter than the minimum requirements of NZS4121:2001.

University Standard - Ensure all vegetation is kept well-trimmed along the accessible route so it does not create an obstruction or hazard.

Refer:

- NZS4121:2001 Section 6.2

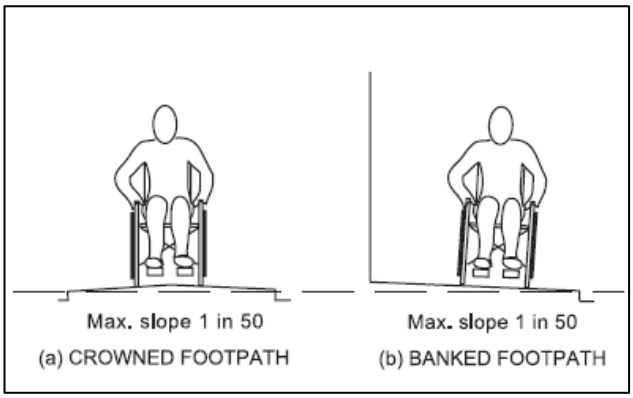


fig 3.8: NZS4121:2001 Maximum allowable camber for footpaths and ramps

3.5.6 BOLLARDS

Bollards on the accessible route must:

- Have at least 1200mm clearance around all bollards;
- Be colour contrasted with their surroundings;

Above: NZS4121:2001 Figure 43 – Space required between bollards, etc.

University Standard – Bollards are to be 1000mm high,

Refer:

- NZS4121:2001 Sections 6.1, 11.0 and 13.2.5;
- D1/AS1

3.5.7 FOOTPATHS HIGHER THAN 600MM

University Standard - If the footpath, ramp, or landing is situated so that a person could fall 600mm or more, then a barrier shall be provided that meets the requirements of NZBC Clause F4/AS1.

Refer:

- NZS4121:2001 Section 6.1
- NZBC Clause F4/AS1

3.5.8 RAMPS & LANDINGS ON ACCESSIBLE ROUTES

Ramps can be straight, zigzag, or L-shaped. Curved or circular ramps should not be considered as part of an accessible route as these can be difficult to negotiate as the use has to push more with the outside arm when pushing up the ramp, or brake more with the outside hand when going down.

University Standard – Ramps to have a longitudinal gradient no steeper than 1:15 (preferred 1:20 gradient)

University Standard - Ensure the approach to the ramp allows a wheeled turning space of 1800mm. This allows sufficient room for wheeled equipment and ambulant people to pass one another.

Width of a ramp – 1500 ideally. Or 1200mm clear width

Refer:

- NZS4121:2001 Section 6.4 / Section 8.6.22 and Appendix F / and figure 13
- NZBC Clause F4/AS1

3.5.9 RAMP HANDRAILS

The current legislation is ambiguous as to if raised buttons are required on ramp handrails.

University Standard – All handrails, be it for stairs or ramps, to have a raised domed button mounted on the top surface, 150mm from the ends, with a diameter of 10mm and thickness of 5mm

Handrails should be 40mm diameter (preferably stainless steel) at the height described within the building code. This also applies to stairs; internal and external.

Handrails should be located at 900mm above the ramp to the top of the handrail.

3.5.10 OPENING OF DOORS TO STAIRS

University Standard – Provide a clear width of 1200mm between the fully open door and the top or bottom of the stair.

This will provide a safe haven for a person in a wheelchair in case of an emergency and will also provide them sufficient space for negotiating the stairs either independently or with a helper, should they choose to exit the building by way of stairs.

3.5.11 ENTRANCES, DOORS, DOORWAYS & CORRIDORS

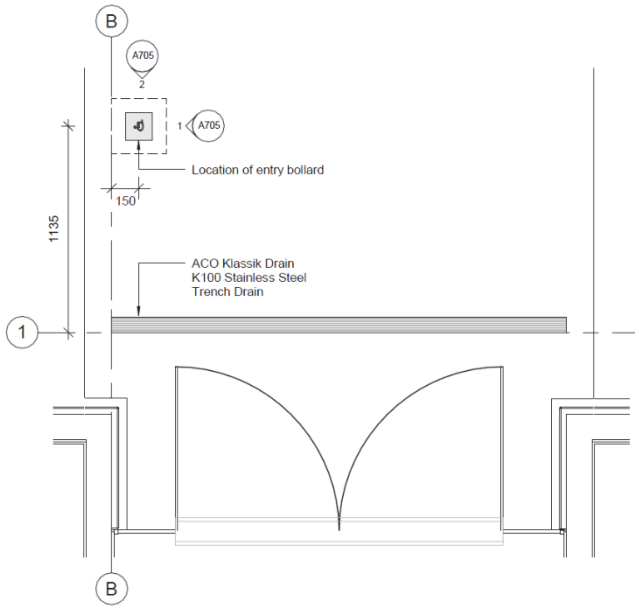
Direct access, on an accessible route, is required to the main entrance of a building and to the internal space served by the main entrance via the accessible route.

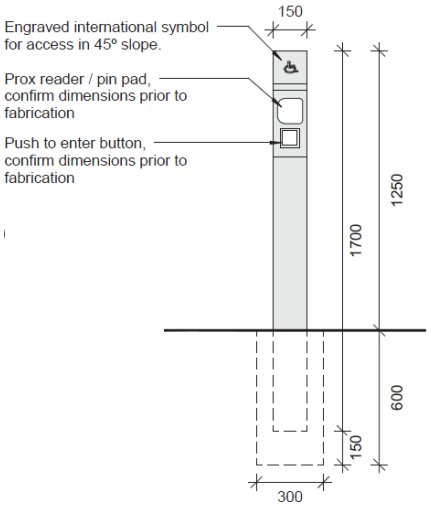
University Standard - All entrances are on accessible routes.

3.5.11.1 Entrances

University preferred - 600mm-wide clear space adjacent to the leading edge of the door to entrance lobbies on the inward opening face (fig 10).

Any entrance on an accessible route requiring an automatic door opener should utilise the University standard entry bollard detail where a suitable mounting surface is otherwise not present.





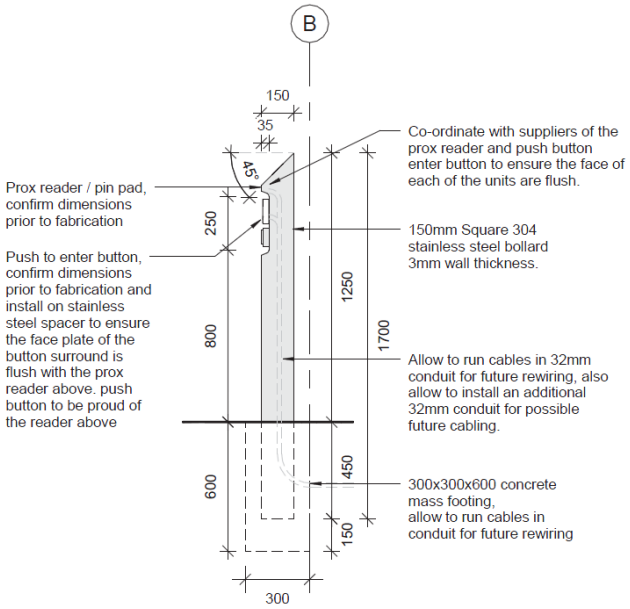


fig 3.9: University entrance bollard details

Refer:

- NZS 4121:2001 Section 7.1
- NZ Building Code Clauses D1.1 (c), D1.3.1 (b), D1.3.2 and D1.3.4 (D) and (f);
- Acceptable Solution / Compliance Document D1/AS1 Section 7.

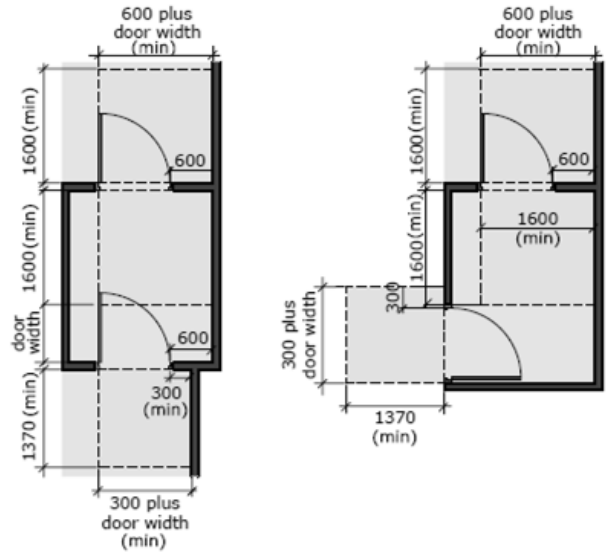


fig 3.10: "Building for Everyone – A Universal Design Approach," Clear space requirements for lobbies

3.5.11.2 Threshold

The current requirements NZBC/D1/AS1/1.3.2 state that when a stepped threshold is required and the change in level is 20mm or less, no ramp is required. A strong visually contrasted strip shall be incorporated that is effective when approaching from either direction.

If however the change in level is greater than 20 mm a ramp is required which shall have a gradient not steeper than 1 in 8 and a going of not more than 450 mm.

University Standard - Thresholds should be level, but if this is not possible, the maximum acceptable threshold rise is 10mm. Any rise of more than 5mm should have a bevelled edge.

3.5.11.3 Doors and Doorways

University Standard – All doors irrespective of their location to have a minimum clear opening of 850mm provided for both single leaf, and at least one leaf of double doors. In most cases this can be met with the use of a 910mm leaf. A multi-leaf door should be to the same standard to assist access for wheelchair users.

Care should be taken when specifying sliding pocketed doors. A clear opening of 850mm will be required which may require a leaf size larger than 910mm to achieve the opening.

Door leafs across a corridor on an accessible route should be provided with a vision panel giving a zone of visibility between 500mm and 1800mm above finished floor level. The vision panel may be a single panel or interrupted between 800mm and 1150mm to accommodate a horizontal mid-rail if necessary. The minimum width of glazed vision panel should be 150mm. Further consideration will be required in a fire door situation.

Refer:

- NZS 4520:3:2

3.5.11.4 Revolving Doors

Most revolving doors are difficult for wheelchairs, scooters, prams and people with walking aids to negotiate.

Where a revolving door or turnstile is installed a hinged or sliding door must be provided as an alternative alongside it.

The alternative side door must display an access sign to identify it as the accessible entrance and must be unlocked during normal building occupation.

If the side door is to be installed adjacent to a return-wall and if the door handle is to be on the side of the door adjacent to the return wall then a side panel with a minimum width of 300mm must be provided.

Refer:

- NZS 4121:2001 Section 7.1, 7.3, and Appendix C.5
- NZ Building Code Clauses D1.1 (c), D1.3.1 (b), D1.3.2 and D1.3.4 (D) and (f);

3.5.11.5 Double Doors on an Accessible Route

University Standard - At least one leaf must provide a minimum clear opening of 850mm.

3.5.11.6 Full Length Glazing

Transparent glazing can be mistaken for an unimpeded path of travel and therefore the glazing should have its presence indicated by the provision of an opaque band across the full width of the glazed opening or by a motif or other decorative treatment (e.g. colonial bars).

Where motifs or other decorative treatments are installed they must provide similar levels of manifestation (when viewed from both sides) to the opaque band.

University Standard - The manifestation on glazing material that may be mistaken for a doorway or an unimpeded path of travel shall have either the provision of an opaque band across the full width of the glazed opening or by a motif or other decorative treatment (e.g. colonial bars).

This band will be a minimum of 500mm wide centred at 1000mm from floor level, cover the full width of the door and adjacent side panels and shall provide similar levels of manifestation (when viewed from both sides) to the opaque band. The band need not be a solid design and provides opportunity for cultural of project related design motifs.

Refer:

- NZS 4121:2001 Section 7.1
- NZ Building Code Clauses D1.1 (c), D1.3.1 (b), D1.3.2 and D1.3.4 (D) and (f);
- Acceptable Solution / Compliance Document D1/AS1 Section

3.5.11.7 Automatic Doors

While automatic sliding doors are recommended in preference to manually operated doors there are many active wheelchair users who prefer to use manual operated doors to ensure that they do not lose the skill in opening doors independently and also find that they can negotiate manually operated doors faster than automatic doors.

University Standard – Automatic doors to remain open for at least 10 seconds to allow time to clear doorway.

University Standard - Have on the moving edges of automatic doors a full height, contrasting, visibility marking strip.

Often the leading edge of automatic glass doors do not have the leading edge of door sufficiently colour contrasted to ensure it is easy to distinguish whether the door is open or closed. This results in the person walking into a half open door. While a requirement of NZS4121:2001 it is often overlooked and therefore will become a University standard requirement.

Refer:

- NZS 4121:2001 Section 7.1
- NZ Building Code Clauses D1.1 (c), D1.3.1 (b), D1.3.2 and D1.3.4 (D) and (f);
- Acceptable Solution / Compliance Document D1/AS1 Section 7.

3.5.11.8 Door Closers Tension

If manual doors are used, it must be possible to open them with minimal effort: some people with severe disabilities cannot exert a force even as low as 13.3N (3lbf).

University Standards – Door closers to have the maximum amount of force required to push or pull a manual interior door open set at 15N (3.37lbs). Where this standard cannot be met, automatic door gear should be considered.

3.5.11.9 Door Hardware

While it is a requirement for door handles to be of a lever type with the end of the handle returned to the door, this is often overlooked when the handles are chosen. The handles have their end turned towards the door so that a person with limited hand function will not have their hand sliding off the handle when attempting to open the door.

University Standard – Door handles are to have a lever action and the end of the handle shall be returned towards the door. There shall be 45mm gap between the inside of the handle and the surface of the door to avoid people catching their knuckles on the door.

University Standard – Door hardware to be mounted at a height of 1000mm above the finished floor level.

Refer:

- NZS 4121:2001 Section 7.1
- NZ Building Code Clauses D1.1 (c), D1.3.1 (b), D1.3.2 and D1.3.4 (D) and (f)
- Acceptable Solution / Compliance Document D1/AS1 Section 7.

3.5.12 Corridors

The current requirement of a 1200mm clear width no longer caters for those persons using larger wheelchairs or mobility scooters or for the many varied users.

- Someone not using a walking aid can manage to walk along a corridor less than 700mm wide,
- Someone using a walking stick requires a minimum of 750mm.
- Someone using two sticks or crutches, or a walking frame needs a minimum of 900mm
- A blind person using a long cane or with an assistance dog needs 1100mm.
- A visually impaired person who is being guided needs a width of 1200mm.
- A wheelchair user and an ambulant person side-by-side need 1500mm width.

University Standard – Corridors to have a minimum clear width of 1500mm (1800mm preferred)

Intermittent obstructions such as columns may be present in the corridor, reducing the width of the corridor to no less than 1200mm. Obstructions should be colour contrasting when encroaching into the accessible route.

University Standard - The end wall of a corridor should be highlighted by e.g. good colour and tone contrast between the wall and floor and a change in lighting. This will enable a visually impaired person identify the end of the corridor

Refer:

- NZS 4121:2001 Sections 7.2 and 7.3
- NZ Building Code Clauses D1.1 (c), D1.3.1 (b), D1.3.2 and D1.3.4 (d) and (f)
- Acceptable Solution / Compliance Document D1/AS1 Section 7.

3.5.13 STAIRS

In all buildings where there is more than one floor a minimum of one “accessible” stair, opening off an accessible route, shall be provided whether or not lifts are installed.

Spiral stairs, open riser stairs, and single steps are not acceptable for an accessible stair. Best practice is to ensure all stairs are accessible stairs.

3.5.13.1 Stairs

University Standard – All stairs are to be compliant accessible stairs

University Standard - Width between handrails of not less than 1000mm (1200mm preferable to allow for person with a disability and their companion)

3.5.13.2 Risers

Have a uniform height over each flight;

Have a maximum 180mm height;

Have a top riser 300mm back from any return wall;

A bottom riser 300mm plus the depth of tread back from any return wall.

Be closed riser. Open risers are not permitted under normal circumstances. Open risers will be permitted in plant rooms.

3.5.13.3 Treads

Have a uniform depth over each flight;

Have a minimum 310mm depth;

Have a slip resistant and stable surface.

3.5.13.4 Nosings

University Standard - All nosings must:

- **Be rounded (no sharp or abrupt angle to prevent foot sliding up step)**
- **Project no more than 25mm into the tread depth**
- **Have a strong colour contrast with rest of stair made up of:**
    - **A strip not less than 50mm and not greater than 75mm on the tread at the nosing with a minimum luminance contrast of 30% to the background, extending for the full width of the step;**
    - **A strip not less than 25mm and not greater than 50mm on the riser edge of the nosing with a minimum luminance contrast of 30% to the background extending the full width of the step**

Consideration to be given to photo luminescent nosings on exterior steps.

Refer:

- NZS 4121:2001 Sections 8.1, 8.2.
- NZ Building Code Clauses D1.1 (c), D1.3.2, D1.3.3 and D1.3.4 (g) and (h)
- Acceptable Solution / Compliance Document D1/AS1 Section 4.

3.5.13.5 Stair and Ramp Landings

NZ Building Code currently makes suitable provision for landings on ramps, however there may be instances where wheelchair users decide in the event of an emergency to utilise a stair as an egress route either independently or with a helper. As such the same standard should be applied to stair landings.

University Standard – Provide a clear width of 1200mm between the leading edge of the door and the top or bottom of the stair to all stair flights and ramps (fig 3.11).

Refer:

- NZS 4121:2001 Sections 8.1, 8.2.
- NZ Building Code Clauses D1.1 (c), D1.3.2, D1.3.3 and D1.3.4 (g) and (h)
- Acceptable Solution / Compliance Document D1/AS1 Section 4.

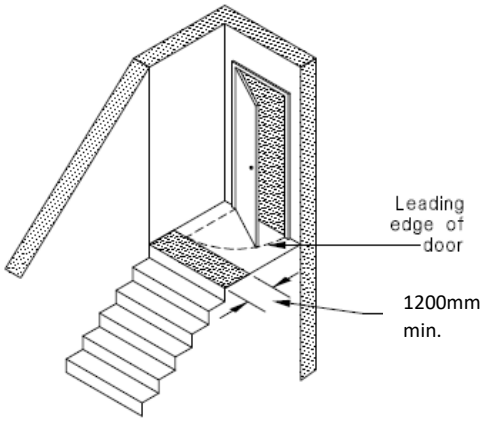


fig 3.11: increase on NZBC D1/AS1/4.3

3.5.13.6 Provision of Auditory and Visual Cues

To assist persons with a visual impairment to negotiate the stairs safely, a change in surface treatment, with strong colour contrast shall be provided at the head and foot of any internal flight of steps. The use of proprietary tactile studs (of the variety typically used externally) should not be used inside the building for this purpose. A contrasting carpet, vinyl or similar finish should be used internally with suitable visual and tactile contrast.

3.5.13.7 Stair handrails

University Standard – Handrails to be installed on both sides of the stair under all circumstances

University Standard – Handrails to be installed down the centre of stairs where the unobstructed width (between handrails) exceeds 1800mm.

University Standard – All handrails, be it for stairs or ramps, to have a raised domed button mounted on the top surface, 150mm from the ends, with a diameter of 10mm and thickness of 5mm

Handrails should be 40mm diameter (preferably stainless steel) at the height described within the building code.

Handrails should be located at 900mm above the pitch of the stair to the top of the handrail.

Refer:

- NZS 4121:2001 Sections 8 and Appendix F;
- NZ Building Code Clauses D1.1 (c), D1.3.2, D1.3.3 and D1.3.4 (g), (h) and (k) and D1.3.4 (i)
- Acceptable Solution / Compliance Document D1/AS1 Section 4 and 6

3.5.14 LIFTS

3.5.14.1 Accessible lifts

University Standard - All lifts servicing a building are accessible lifts. Platform lifts, stair-lifts and escalators are not to be used as an alternative to the requirements below (refer to NZS 4121 section 9.1.1)

University Standard – The internal measurements of the accessible lift must be 1800mm x 1500mm. This will enable wheelchair users, persons using strollers and people using mobility scooters manoeuvring space. This dimension will require to be larger in residential colleges to accommodate a gurney.

University Standard – The accessible lift is to be fitted with a continuous 40mm stainless steel (or equal) support rail around the car, excluding doorways or where it impedes the primary panel. This is in NZS4121:2001 but often overlooked.

University Standard - Lift door musts remain open for up to 10 seconds to provide a wheelchair user or ambulant disabled person time to enter or exit.

University Standard – A half-height mirror is to be mounted above the handrail on the rear wall to assist with a person in a wheelchair reversing out of the lift, if there is not sufficient turning space due to other occupants or non-compliant dimensions.

The University requires a primary and secondary lift control panel to be installed. The primary panel is to be installed vertically as per NZ4121. The secondary panel is not a legislative requirement but is required by the University and should be installed horizontally with the buttons centred at 700mm above finished lift car level on the side wall of the car. The secondary panel should be fitted flush (parallel to the wall; not sloping) and can sit below the perimeter handrail.

Where an existing lift car is being amended or adapted the continuous handrail should cover as much of the car as possible breaking only to provide access to the primary panel. Preference is for continuous radiused corners to the handrail.

New or refurbished lift cars shall feature voice announcements provided in in English language and te reo Maori.

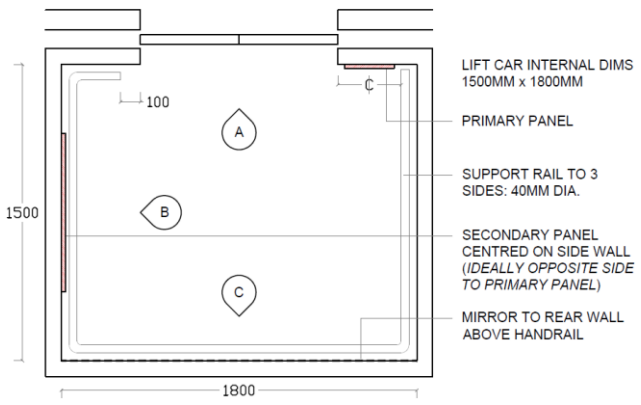


fig 3.12: Plan of proposed lift dims and setting out

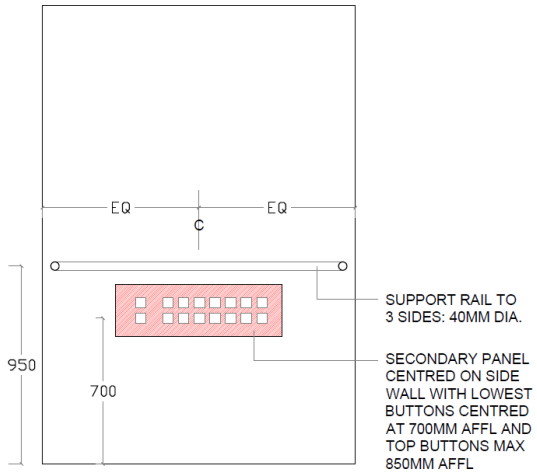


fig 3.13: Elevation 'B' of proposed lift side wall

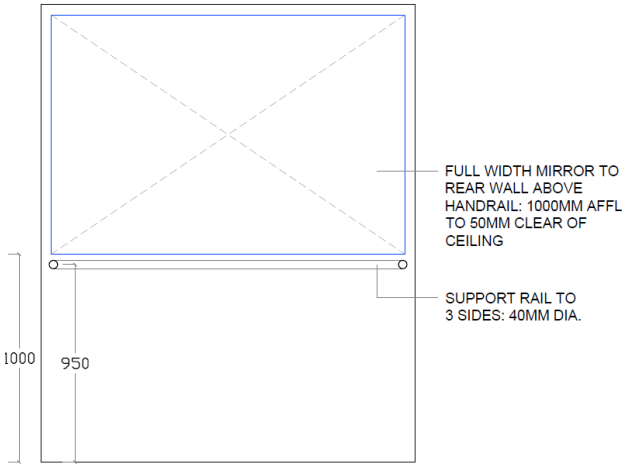


fig 3.14: Elevation of proposed lift rear wall

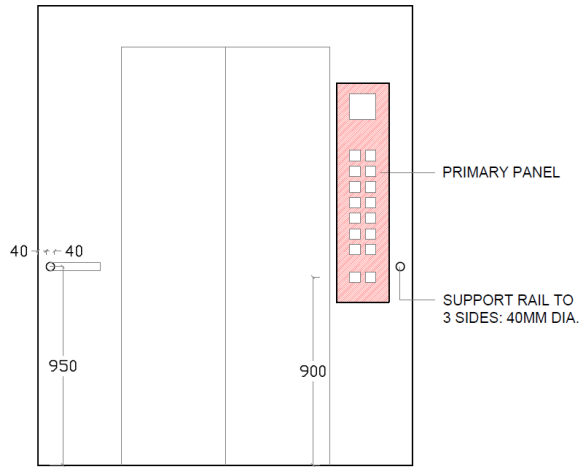


fig 3.14a: Elevation of proposed lift front wall

Refer:

- NZS 4121:2001 Section 9;
- NZ Building Code Clauses D1.1 (c), D1.3.4 (c), D2.1 and D2.3.5;

- Acceptable Solutions / Compliance Documents D1/AS1 Section 12 and D2/AS1 Section 1.0 (NZS 4332 – 70).

3.5.15 TOILET FACILITIES

Refer **Architecture & Space Section** 7.3.3.

3.5.15.1 Entry doors

University Standard - Provided with a hinged, outward swung door with a clear opening of 850mm. A sliding door, if well maintained, is a preferable solution as it is easier wheelchair users to open and close.

Hinged doors to be provided with a horizontal grab rail fixed 900mm above floor on the internal surface of the door (not required on sliding door).

University Standard – All doors to the accessible toilet to have a kick plate both sides at a height of 400mm above the finished floor level to protect against knocks from footplates etc.

Whilst not mandatory, it is recommended to install an automatic, button operated door to both the accessible toilet and the corridor door leading to the facility.

3.5.15.2 Dimensions

University Standard – Accessible toilets to be 2200mm long by 1800mm wide (This provides a clear turning circle of min 1500mm x 1500mm)

The University of Otago Accessible bathroom standards sets out the requirements, specification, dimensions and full setting out of the room.

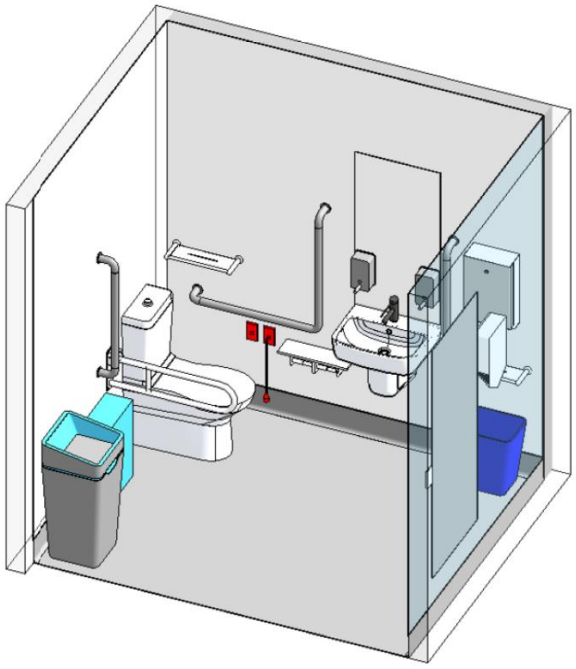


fig 3.15: University Standard for accessible WC (left handed transfer indicated)

3.5.15.3 Toilet Pan

University Standard - If two or more accessible toilet units are provided they should provide right and left-handed arrangements of fixtures and fittings.

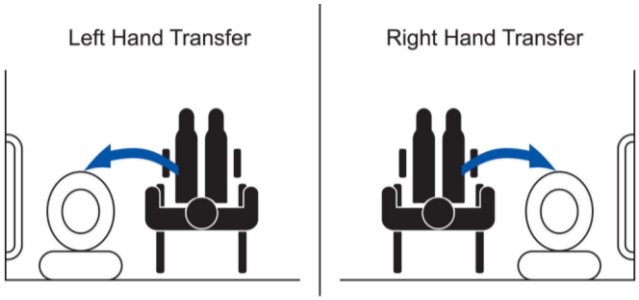


fig 3.15a: Left and right handed transfers

fig 3.15b: Signage for left and right handed transfers

Signage should be provided to indicate handing as 3.5.15.13.

3.5.15.4 Toilet Seat

University Standard – The height of the top of the seat to be between 450mm and 480mm above finished floor level.

University Standard – Toilet seat to have a lid that can be supported between 10º and 15º beyond the vertical to provide a backrest for the user. If this is not possible then a padded backrest is to be provided.

Toilet seats should be provided with a soft close function.

Refer the University of Otago Accessible bathroom standards for acceptable specification.

3.5.15.5 Toilet Flush Buttons

University Standard – Cistern flush handle or buttons are to be positioned on the transfer side to the WC so that it can be easily reached by the person from their wheelchair without having to lean over the pan.

If buttons are installed then they are to be large enough to operate with a fist or elbow and only require a small depression of the button. Buttons mounted on the wall are not deemed acceptable as they can be difficult to reach across the cistern.

Refer the University of Otago Accessible bathroom standards for acceptable specification.

3.5.15.6 Grabrail Rail

University Standard – For corner mounted toilet pans in addition to the compliant L-shaped grab rail, a hinged rail should be provided on the transfer side of the pan. This is to support people with limited strength on either side of their body.

Refer the University of Otago Accessible bathroom standards for acceptable specification.

3.5.15.7 Toilet paper holder:

The common practice of installing commercial toilet roll dispensers immediately above the horizontal grab rail impedes the safe use of the handrail and can be a health and safety issue and is not to be located there. The paper can also become trapped inside the dispenser making them difficult to use for a person with limited hand function.

University Standard – The toilet roll dispenser to be located forward of the pan by no more than 300mm and no higher than 700mm being the height of the horizontal handrail. Refer Architecture & Space Section for specification.

3.5.15.8 Mirror

University Standard – A Mirror shall be placed immediately over the wash basin, with a second longer mirror located away from the basin. This mirror should be at least 1500mm tall and 600mm wide with the bottom edge 300mm above the floor.

Refer the University of Otago Accessible bathroom standards for acceptable specification.

3.5.15.9 Coat Hook

University Standard - A coat hook shall be provided at a level that can be reached by a wheelchair user (1250mm above floor level) as well as one set at 1700mm AFFL. This will apply to all locations (offices, bedrooms, toilet etc).

3.5.15.10 Other Fixtures

University Standard - A shelf for placing handbag, toiletries, etc. to be provided on the wall closest to the hand basin. This shelf should be at the approximate height of the wash hand basins lip.

Refer the University of Otago Accessible bathroom standards for acceptable specification.

3.5.15.11 Assistance Alarms

An emergency alarm or call for assistance cord, in a contrasting colour to its surrounding should be provided.

Two emergency alarm call points to be installed beside the toilet pan, both installed at 500mm AFFL:

- one with a cord that reaches to 100mm AFFL to assist someone that has fallen on the floor,
- one with a push button and no chord to assist someone seated on the WC.

Indicator required within the space to let the user know they have successfully activated the alarm. 'Cancel' switch to be located on the panel to allow the user to deactivate the alarm.

The alarm reset switch should be positioned inside the cubicle.

The emergency alarm cord should be clearly labelled as such, and should trigger audible and visual signals outside the cubicle and in a reception point or area which is staffed.

Where a Shower is installed, a cord from the ceiling is required, with two rings positioned beside the vertical grab rail. The height of the rings are to be 100mm AFFL and 1000mm AFFL.

The alarm to be linked back to Campus Watch.

Refer the University of Otago Accessible bathroom standards for acceptable specification.

3.5.15.12 Urinals

If accessible urinals are to be provided, they shall be constructed without a step and at least one stall shall be fitted with a horizontal grab rail.

3.5.15.13 Signs

If complying with the above requirements, a sign is to be displayed featuring the ISA fixed 1400-1700mm above floor on outside of entry door. Refer **Architecture & Space Section.**

University Standard - Braille to be included on the toilet signs and to identify the location of transfer (left or right hand). This will assist a person in a wheelchair that has a preference to which side they transfer in and out of their wheelchair from or for a person who has a weakness on one side of their body (fig 3.15a).

Any sign utilising the ISA wheelchair motif shall use the standard ISA safety blue background with white motif. The Wheelchair sign will remain consistently pointing to the right unless for directional signage where it will face in the direction of travel (fig. 3.15b)

Refer:

- NZS 4121:2001 Section 10;
- NZ Building Code Clauses D1.1 (c), D1.3.2 (c), G1.1 (c), G1.3.4, G12.1 (d) and G12.3.10;

- Acceptable Solutions / Compliance Documents G1/AS1 Sections 1.1.1, 1.1.5, 1.2.2, 4.0 and 6.1.1 and G12/AS1 Sections 6.13.1 and 8.0.NZS4121:2001 Section 3.3.2.

fig 3.16: Image deleted

3.5.15.14 Ambulant Toilets

Refer **Architecture & Space Section** 7.3.3.3.

3.5.16 SHOWERS

NZS 4121:2001 identifies that where showers are provided for staff or public use, a wet-area shower shall be provided for people with disabilities.

If two or more shower cubicles are provided, at least one shall have a seat and controls on the opposite side.

Where showers are provided within a facility, accessible showers should also be provided.

Accessible showers may be provided as either shower only or Shower and WC combined facilities.

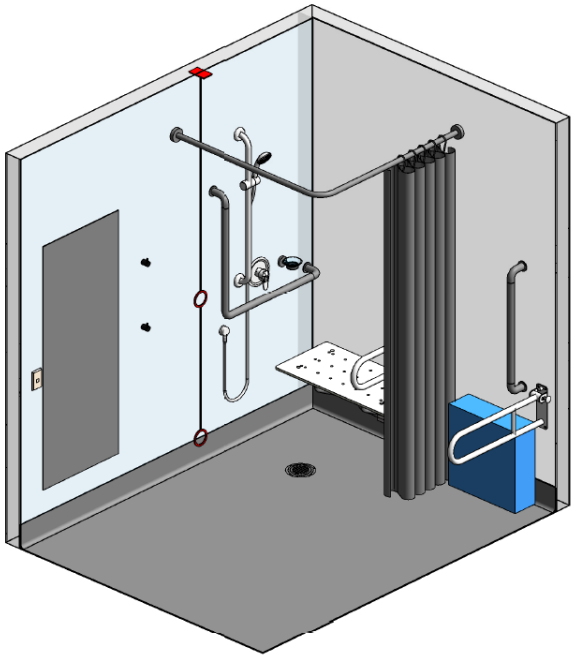


fig 3.16a: University Standard for accessible shower (WC & WHB image omitted)

University Standard – The accessible shower floor to have a self-draining floor, sloping (max 1:40) to floor drain.

University Standard – The accessible toilet and shower compartment (combined) shall measure 2500mm wide x 2500mm long.

University Standard – The accessible shower compartment (without combined toilet) shall measure 2800mm wide x 1800mm long in accordance with NZ4121:10.5.11.1.

University Standard – Install a hinged handrail the transfer side of the fold down shower seat.

Refer the University of Otago Accessible bathroom standards for acceptable specification.

Refer:

- NZS 4121:2001 Section 10.5.11;
- NZ Building Code Clauses D1.1 (c), D1.3.2 (c), G1.1 (c), G1.3.4, G12.1 (d) and G12.3.10;
- Acceptable Solutions / Compliance Documents G1/AS1 Sections 1.1.1, 4.0 and G12/AS1 Sections 6.13.

3.5.17 CONTROLS & FITTINGS

University Standard – Door hardware, light switches and electronic access should be located at a height of 1000mm above the floor level, horizontal with door handles and be a consistent distance from the door edge so that they are easy to locate. If, because of the nature of the room, there are a number of controls, then they can be mounted at a range of between 900mm to 1200mm with the majority at the 1000mm height.

NZ 4121 requires all control fittings to be mounted at between 500mm and 1200mm AFFL

The University requires all power and data outlets to be located at a min. 500mm above finished floor level for accessibility; where these fittings are located in general areas such as corridors, offices etc then they would be installed at 500mm AFFL to the centre of the fitting.

Where power and data outlets are mounted above 500mm to support desking, in dado height trunking or above benches in labs or kitchens:

- Flush wall outlet at dado height: 1000mm AFFL to center of the fitting.
- Trunking at Dado Height: 1000mm AFFL to center of the fitting.
- In kitchens: 150mm above the bench surface to center of the fitting.
- In labs; 150mm above the bench surface to center of the fitting, or to suit the intended specialist purpose.

Note that desks in offices may have to sit away from walls or trunking to allow sufficient space for the desk to rise and fall without affecting cables.

Soft wiring can support the installation to allow desk mounted power where required which has greater flexibility as to location and presentation.

Where power or data needs to be installed for other purposes, i.e. at high level to support, AV, IT or in other areas that are not intended to be accessible by general building users, the fittings can be located sensibly as required.

Refer:

- 3.5.25 Visibility factors
- NZS 4121:2001 Section 4.11;
- NZ Building Code Clauses D1.1 (c), D1.3.4 (f), G9.1 (b) and G9.3.4;
- Acceptable Solutions / Compliance Documents D1/AS1 Section 7.0.5 and G9/AS1 Section 2.0.

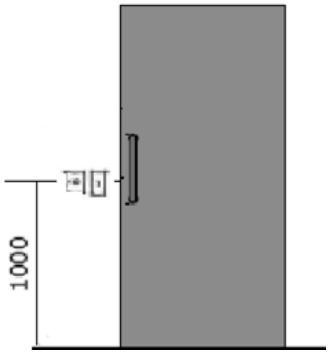


fig 3.17: location of controls

3.5.18 PUBLIC FACILITIES (COUNTERS, DESK & TELEPHONES)

People with disabilities must be able to carry out the normal activities and processes for which counters or desks or both are provided.

Receptions desks may be presented at two heights with an accessible lower level, but only when neither section is seen as the main part of the counter and both are equally visible when the counter is approached.

Accessible counters / receptions should have an increased knee space over and above that indicated in NZ4121 which indicates 900mm. 1800mm is the University preference where possible. The surface should be a max height of 760mm with a minimum of 700mm high clearance below.

An alternative to this where the counter is higher (say 900mm) is to provide a shelf of 300mm deep; max height of 760mm with a minimum of 700mm high clearance below. This may also be appropriate where the reception space is less transactional or where filling in forms or writing may be inappropriate or unnecessary.

Signage should be provided within the reception area to highlight key facilities such as lifts, stairs, toilets and the main building functions. The provision of clear signage that is easy for everyone to understand benefits all building users and increases independence. Some people who experience communication difficulties may prefer not to have to ask for directions or assistance, so the provision of effective signage is essential.

Refer:

- NZS 4121:2001 Section 11;
- NZ Building Code Clauses G5.3.4;
- Acceptable Solutions / Compliance Documents G5/AS1 Section 3.0.
- DBH Guidance document "Accessible reception and service counters" 2007

3.5.19 PLACES OF ASSEMBLY, ENTERTAINMENT & RECREATION AREAS

Refer:

- NZS4121:2001 Section 12
- Acceptable Solution D1/AS1

3.5.20 CIRCULATION SPACE IN MEETING, ENTERTAINMENT & RECREATION AREAS

Provision is required to accommodate people with disabilities in rooms and areas used for meetings, entertainment, and recreation, however there are no standards or specific recommendations in the NZS4121:2001.

In all cases this provision is required to be on an accessible route and enable people with disabilities to be seated as part of an audience, to speak, lecture or entertain an audience from the main stage and have access to all backstage facilities, and access and use all parts of a recreation facility.

When looking at furniture layout it must be positioned so that there is adequate wheelchair manoeuvrable space

University Standard - In all rooms allow for a clear space of no less than 810mm down all straight sides with a clear turning circle of 1500mm at the changes of direction from these straight lines.

3.5.21 SWIMMING FACILITIES

Refer

- NZS4121:2001 Section 12.
- Acceptable Solution D1/AS1

3.5.22 SPORTS STADIUMS

Refer

- NZS4121:2001 Section 12.
- Acceptable Solution D1/AS1 Section 8

3.5.23 LISTENING SYSTEMS

Listening systems should be considered in all buildings and provided where required.

Listening systems are Specified Systems. These systems shall comply to the same requirements for inspection, maintenance and reporting for 12 months from issue of CCC.

Refer:

- NZS 4121:2001 Section 12. and Appendix H;
- NZ Building Code Clauses D1.1 (c), D1.3.2G5.1 (D), G5.3.5 and G5.3.6.
- Compliance Schedule Handbook SS 12, SS 14/2 and SS 15/4
- AS/NZS 2107:2000
- Acceptable Solution / Compliance Document D1/AS1 Section 8.0.
- Assistive Listening Systems: A guide for Architects and Consultants (Oticon)

3.5.24 SURFACE FINISHES

Refer:

- NZS 4121:2001 Sections 4.6 and 4.7;
- NZ Building Code Clauses D1 (c) and D1.3.3 (d);
- Acceptable Solution / Compliance Document D1/AS1 Section 2.1.

3.5.25 VISIBILITY FACTORS

The visual environment shall be designed so as to maximize the usefulness of whatever level of vision a user may have.

Socket outlets, switches and outlets should be a contrasting colour to the wall on which they are located to assist users with low vision operate facilities in a room. This will apply to all sockets, switches and outlets up to 2000mm AFFL. Anything above this height or in areas where they are purely for service or maintenance operators only will not require a visual contrast (unless specifically required under NZCB).

The University standard is for a contrasting faceplate and opposing contrasting switch and sockets (Black faceplates indicated below for use on light coloured walls):

fig 3.17a: Colour contrasting controls

Refer:

- NZS 4121:2001 Sections 4.10 and 7.3.2;
- NZ Building Code Clauses D1 (c), F2 and G8;
- Acceptable Solution / Compliance Document G8/AS1 Section 1.03.
- Accessible signage guidelines. Royal New Zealand Foundation of the Blind. 2010.

3.5.26 SIGNS

Signs shall be positioned and located in a consistent manner and fixed on a wall at between 1400 mm and 1700 mm above floor level to the lower edge of the sign plate.

All accessible entrances to a building shall be identified with appropriate signs, only if they are other than the main or principal entrance.

If the entrance is not accessible then sign(s) indicating the location of the accessible entrances must be displayed.

All accessible wayfinding signage should utilise safety blue backgrounds with white text or pictograms:

fig 3.18: accessible wayfinding on safety blue backgrounds

University Standard – Have the wheelchair facing the direction of travel (fig 3.19).

fig 3.19: the wheelchair is facing the direction of travel

3.5.26.1 Braille

While not a legislative requirement it should be included where appropriate on wayfinding signage as standard.

3.5.26.2 Letter Casing

Signage lettering in all in capitals can prove difficult for persons with lower vision or cognitive impairments to read. Consideration should be given when designing signage with a prefereance for lower case with first letter capitalised (fig 3.20)

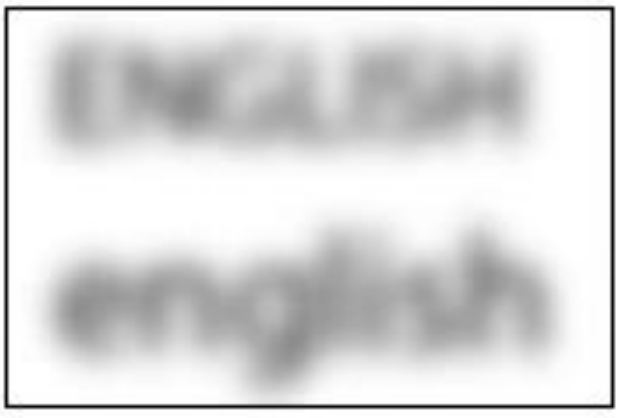


fig 3.20: Comparison of all caps vs. lower case legibility

3.5.26.3 Signage Font Size

The Blind Foundation recommends that for non-tactile print, the size of the text should be related to the distance at which the information is to be viewed.

Letters should have a minimum height of 15mm. If signs will be viewed from more than 3m away, the text should have a height of 5mm for each metre of viewing distance.

For example, if a sign is designed to be viewed from a 5m distance, text should have a height of 25mm.

University Standard - Where appropriate, provide signage in Māori

Refer:

- NZS 4121:2001 Section 4.8 and Appendix E;
- NZ Building Code Clauses D1 (c), D1.3.6 (c), F8.1 (c), F8.2 (d), F8.3.4 and G5.3.6;
- Acceptable Solutions / Compliance Documents D1/AS1 1.1.1 and F8/AS1 Section 5.0;

3.5.27 ALERTING DEVICES

Refer:

- NZS 4121:2001 Sections 4.12, 14.6.6 and 14.7.1;
- NZ Building Code Clauses F7.1 and F7.2;
- Acceptable Solution / Compliance Document F7/AS1 Section 2.1.1 (c).

3.5.28 REFUGE AREA

A Refuge Area is a waiting area next to an emergency exit route in a building, designed to be used by persons with disabilities who are not able to evacuate the building safely on their own when an emergency evacuation of the building is required. Refuges areas should be limited to locations with the capability to provide adequate protection i.e. a safe path stair or exit way and a sprinkler system to manage smoke and fire spread.

It must be remembered that when the NZS4121:2001 was produced that “Areas of Refuge” were not formally in use.

Directional Signage showing location of area(s) of Refuge should be installed. Please note that these signs should also have braille on them.

University Standard - Have designated Area of Refuge located on all the floors above the ground floor with appropriate signage advising of their location (fig 3.21).

Refer:

- University of Otago Area of Refuge Guidelines (rev 0.4)

fig 3.21: directional signage for Refuge Area

3.5.29 LOCKERS

Accessible lockers should also be provided wherever lockers are provided.

They should provide adequate security and suitable storage for clothes, bags, shoes, valuables, and other personal items, and include space to hang clothes on coat hangers.

Lockers should be conveniently located in relation to changing and shower facilities and be positioned with sufficient clear space in front to enable people to approach and open the locker doors without obstructing circulation routes or being obstructed themselves.

University Standard – Provide accessible lockers with dimensions of 300mm wide x 600mm deep (maximum) x 1200mm high, with the base between 400 to 800mm above floor level. Some larger lockers should be available to store items, such as sticks, walking frames, crutches, or artificial limbs.

3.5.30 ACCESSIBLE ACCOMMODATION

Refer:

- NZS 4121:2001 Section 14;
- NZ Building Code Clauses D1.1 (c), D1.3.2 (c), G2.1, G2.3.4, G5.1 (b) and (d), 5.2.1 (b) and (d), G5.3.3, G9.1 (b) and G9.3.4; Compliance Document D1/AS1 Section 9.0 and G5/AS1 Section 3.0.1 and G9/AS1 Section 2.0.

3.5.31 LAUNDERING

Refer:

- NZS 4121:2001 Sections 14;
- NZ Building Code Clauses D1.1 (c), D1.3.2 (c), G2.1, G2.3.4, G3.1 (c), G5.1 (b) and (d), 5.2.1 (b) and (d), G5.3.3, G9.1 (b) and G9.3.4;
- Acceptable Solution / Compliance Document D1/AS1 Section 9.0 G2/AS1 Section 1.2 G5/AS1 Section 3.0.1 and G9/AS1 Section 2.0.

3.5.32 FOOD PREPARATION AREAS

3.5.32.1 General Requirements

Staff kitchens and kitchenettes should be designed in buildings to provide staff with suitable amenity to prepare food and drink for both breaks and meal times. The design shall take account the number of prospective occupants to provide adequate, fit for purpose facilities and space.

Standardised designs have been prepared for small and large kitchens to articulate those key accessibility features and functions that must be provided.

Refer the University of Otago Accessible Small Kitchenette standards and Accessible Large Kitchen standards for acceptable specification and layouts.

Refer:

- NZS 4121:2001 Sections 14;
- NZ Building Code Clauses D1.1 (c), D1.3.2 (c), G2.1, G2.3.4, G3.1 (c), G5.1 (b) and (d), 5.2.1 (b) and (d), G5.3.3, G9.1 (b) and G9.3.4;
- Acceptable Solution / Compliance Document D1/AS1 Section 9.0 G2/AS1 Section 1.2 G5/AS1 Section 3.0.1 and G9/AS1 Section 2.0.

3.5.33 EDUCATIONAL INSTITUTIONS

Consideration should be given to furniture types and their ability to be adjusted by the user to suit a variety of needs. Height adjustable desks, height adjustable lab benches and fume cupboards should all be considered as part of the project design.

Refer:

- NZS 4121:2001 Section 3.3 (b).

3.5.34 ACCESSIBLE OUTDOOR AREAS

Refer:

- NZS4121:2001 Section 3 and 13
- AS 1428.2

3.5.35 SEATING

The design and installation of seating must be as follows:

The front of the seat shall have a clear space between any legs at ground level to within 150 mm of the front edge of the seat, and to within 100 mm of the seat height to allow for rearward adjustment of feet when rising (see NZS4121:2001 figure 50);

Where armrests are provided, the top surface of the armrests shall be at a height of 260 ±40 mm above the seat.

University Standard - Seats should generally be 450 mm high.

In areas of larger congregations (lecture theatres) a range of seat heights should be provided ranging from 400mm – 500mm for a small proportion of the overall facility.

Lecture theatres should make appropriate space available in the front row for wheelchair users.

In public areas with loose furniture, a range of seating heights should be provided ranging from 400mm – 500mm to accommodate those with varying mobility needs.

Refer:

- NZS4121:2001 Section 3 and 13
- AS 1428.2

3.5.36 TACTILE GROUND SURFACE INDICATORS (TGSI)

TGSI provide pedestrians with visual and sensory information.

University Standard – Both warning and directional indicators will be of the Stainless Steel design with a height of 5mm above the ground surface installed in accordance with NZ4121 (fig 3.22). These fitments should be utilised externally only. Ref 3.5.13.6 for internal requirements.

Concrete sets with warning and directional indicators may also be utilised in a contrasting colour to the ground surface. Tones of grey are preferred to safety yellow.

Refer:

- AS/NZS 1428.4:2009
- RTS 14 Guidelines for facilities for blind and vision-impaired pedestrians

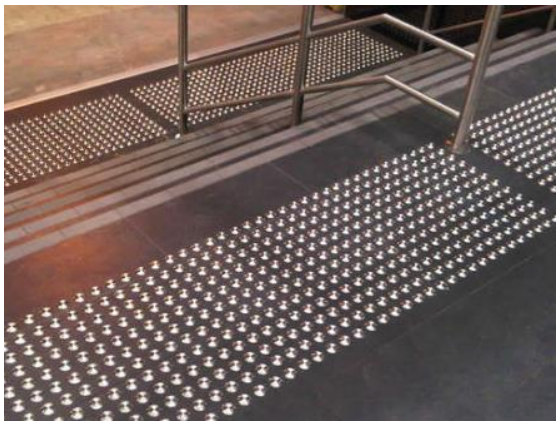


fig 3.22: stainless steel tactile indicators

DESIGN & FACILITY STANDARDS

SECTION 04:
SUSTAINABILITY

04

4.0 SUSTAINABILITY

The University's strategic plan communicates a desire to strengthen our efforts towards sustainability, becoming genuinely world class in how we respond as a tertiary institution. While the University has made significant improvements in its response to sustainability in recent years, there remains a need to continue these gains.

The University Strategic Direction to 2020 sets out the vision, mission, core values and strategic imperatives that guide activities at the University. The Sustainability Strategic Framework: 2017–2021 (SSF) does not seek to replicate or usurp these. Instead, it clarifies the University's commitment to enable a consistent, productive focus on sustainability, and to better communicate its efforts at all levels of the organisation.

A key target for the University is to become net carbon zero by 2030. How we design new facilities and upgrade existing ones has a significant impact on greenhouse gas emissions, from the upfront impact of construction, through to energy and waste from operations and landfill impact at end of life.

In addition, the built environment contributes to other kinds of sustainability, such as those captured by the UN's Sustainable Development Goals:

- Good health and well-being (SDG 3)
- Gender Equality (SDG 5)
- Reduced Inequalities (SDG 10)
- Sustainable Cities and Communities (SDG 11)
- Responsible Consumption and Production (SDG 12).

4.1 GREEN STAR REQUIREMENTS

The Green Star NZ rating system was developed by the New Zealand Green Building Council, a member of the World Green Building Council, to validate the sustainably initiatives of the design, construction and operation phases of building projects, and is tailored to the New Zealand context.

To ensure sustainability is a core consideration in the design and construction of new buildings and renovation projects, the University requires the following level of Green Star Certification for different project types:

Project type	Green Star Requirement
All new builds	At least 5-star Green Star certified (design and as-built)
All eligible[1] major renovations over $10M upfront capital cost	
Renovation projects between $1M-$10M	Green Star – or suitable alternative (e.g. Homestar[2] for residential projects) - requirements determined following in-house mapping of project against Greenstar scorecard to determine extent to which certification is achievable and which points should be targeted (with or without certification). • Undertaken during concept design stage • Updated at preliminary design stage

Where an in-house assessment is required, the level of Greenstar certification must be agreed by the Office of Sustainability and Project Sponsor. Any new builds or renovation projects over $10 million that do not wish to achieve at least 5-star Green Star certification must be approved by the Chief Operating Officer.

Where a Green Star Rating is being targeted on a project a Green Star Accredited Professional will be appointed and all Consultants and Contractor will be expected to work collaboratively to achieve the desired objective

.

Sections 7, 8 and 9 are presented with headings identifying the key Greenstar criteria and relevant credits in an effort to raise the agenda of sustainable design and potential opportunities in each section, whether Greenstar is being targeted or not.

4.2 SUSTAINABILITY IN DESIGN

[1] The NZGBC's Green Star guidance defines which projects are eligible. This includes the need for "spatial differentiation" (project components are currently not eligible). As such, some high value renovations of part of a facility may not fit well into the Green Star framework. An in-house assessment should be undertaken to determine whether the project should achieve particular Green Star points, even if certification will not be pursued.

[2] Homestar is the NZ Green Building Council's independent rating tool for assessing the health, efficiency and sustainability of homes.

Good design will embody good sustainable practices. Consultants will be expected as a matter of course to consider sustainable design measures on every project whether a Green Star Rating is applied or not.

Key considerations include:

- Integrated Design – planning, design, use, construction, operation and maintenance of the facility are considered throughout the design process
- Life Cycle Costing – assessing the impact of design decisions on total cost of ownership
- Energy and Greenhouse Gas Modelling – to assist project teams to create energy efficient designs that minimise greenhouse gas emissions
- Metering and Ongoing Verification of Performance – to facilitate efficient building operations, energy conservation, measurement and verification
- Good Health and Well-being – ensuring the building supports occupant and community well-being through design, including land use & ecology, indoor environment quality, materials, access and transport considerations.

4.2.1 SUSTAINABILITY REVIEWS

Every Project will require consultation with the Office of Sustainability. Early consultation in the project is recommended to address or discuss any potential issues and agree targets. A review of the design will be carried out by the Office of Sustainability at concept design issue and again at preliminary design issue. This enables sustainability issues to be captured and addressed early in the design process. Further review or consultation should be undertaken as the project develops to gain the approval of the Office of Sustainability for the final design.

4.2.2 GREENHOUSE GAS EMISSIONS

Regardless of the level of Green Star rating that is required, Consultants must provide a Greenhouse Gas Emissions report at preliminary design that:

- shows the greenhouse gas impact (in tonnes of CO_2 equivalent) of:
  - construction, including material choices (with impact of alternative materials shown for comparison), and any enabling demolition works
  - building operations through energy consumption
- describes how greenhouse gas emissions are being minimised through the design of the building.

Consultants are invited to make use of the NZGBC's Energy Consumption and Greenhouse Gas Emissions Calculation Guide and refer to Green Star guidance on responsible building products, sustainable products and construction and demolition waste.

4.2.3 DECISION INVOLVING ENERGY

Consultants shall involve the University in all decisions involving energy, including consideration of boilers, transformers, reticulation, HVAC, internal climate, and lighting. At each phase of the project, the consultants shall programme time for the University to complete its part of the work described in the Mechanical and Electrical Sections of this document.

4.2.4 THERMAL STANDARDS

Refer **Architecture & Space Section**.

4.2.5 ENERGY CONTROLS

Refer **Mechanical Hydraulic and Electrical Services Section**.

4.2.6 WASTE MANAGEMENT

Construction Waste accounts for a significant volume of waste to landfill. The University is committed to reducing waste to landfill, both in the construction and operational phases of a building.

With respect to construction waste, consultants must consider the use of materials and their contribution to the waste stream in their design, actively seeking innovative ways in which 'waste' material can be used on the project. The University will require Contractors to provide a Site Waste Management Plan (SWMP) for all major projects. The SWMP should include consideration of the following:

- Who is responsible for waste
- Estimate waste types and amounts
- Establish goals and targets for waste reduction
- Describe recycling methods / reuse methods (Noting that the segregation of waste streams will be mandatory)
- Tracking of waste (the University will require documentation of waste types and quantities on completion)
- Communication and training for site

4.2.7 RECYCLING

For operational waste, refer to Recycling & Waste in the **Architecture & Space Section**.

4.2.8 INNOVATION

The University, as a centre for research and learning, supports and encourages innovation. Consultants are encouraged to use innovative approaches to deliver sustainable buildings and achieve broader sustainability outcomes. The Green Star framework provides several categories in which innovation may occur. Where Green Star certification is required, the University expects 'innovation' points are pursued as a priority, while also ensuring risks are adequately managed and all project objectives can be met.

The University also encourages sharing good practice widely in order to influence change across the sector. Contractors should work with the University to develop case studies or other appropriate material to communicate successful aspects of a project to a wider audience.

4.2.9 INTERNAL PROJECT COMMUNICATION

The University encourages the minimisation of waste. This ethos should also extend to the design teams in their preparation of Project information. Electronic transfer of information should be considered the first communication with paper copies produced only where they are required or specifically requested.

DESIGN & FACILITY STANDARDS

SECTION 05:
CULTURAL

05

5.0 CULTURAL

The University has a strong commitment to achieving its Māori Strategic Framework goals and objectives. This includes:

- Demonstration of strong accountable leadership which contributes to whānau, hapū and iwi development;
- Undertaking research that is transformative and beneficial for Māori Communities;
- Creating and enhancing exemplary learning and teaching environments which allow staff and students to engage with Māori language and culture;
- Increase the use of Māori language and cultural practices across each level of the University;
- Increasing Māori student success by providing an environment in which Māori students are supported to thrive and succeed as Māori;
- Increase the number of Māori staff and support their professional and cultural development.

The University has also established a Pacific Strategic Framework 2013-2020 which sets out a number of goals, including:

- Demonstrating and valuing leadership on Pacific Matters;
- Encouraging Pacific research excellence;
- Strengthening community engagement;
- Promoting growth and development;
- Encouraging Pacific curricula;
- Contributing to the Pacific region and international progress.

5.1 DESIGN

Acknowledging our Cultural Heritage is an opportunity for the University to further develop its point of difference among other international institutions.

Any new development (refurbishment and new build) requires to acknowledge the cultural objectives of the University across all facets for the project.

The Office of Māori Development will be a key party in the development of the project and should be engaged at an early stage to discuss cultural concepts and how this may manifest itself in the project

The University is currently in the process of developing its cultural design guidelines to provide improved guidance to design teams.

The University has entered into a Framework with Aukaha for provision of cultural design and consultancy services. The use of this framework on projects will be guided by the Office of Māori Development.

5.2 SIGNAGE

All projects should be signed in English and Māori with equal weighting. This may extend to include the establishment of interpretative panels or a visual display to acknowledge the special relationship of the tangata whenua with the site where such an approach is appropriate.

5.3 MANA WHENUA

Consideration should be given to local iwi input on project work, particularly in those areas where the University has an existing relationship with local iwi. The Office of Māori Development will be the primary conduit for any such discussions.

The University will communicate information and opportunities to Pacific communities in effective, appropriate ways, and consideration should be given to how a project may enable the continued establishment of strong relationships with Pacific families. It is key to ensure that Pacifica students are informed, inspired and able to capture the opportunities provided by the University.

DESIGN & FACILITY STANDARDS

SECTION 06:

HEALTH & SAFETY

06

6.0 HEALTH & SAFETY

The University aspires to the highest level of H&S on Campus. This applies to the use of spaces in practice and in construction of new space.

A risk management approach should be taken to all projects as defined within the Australian Standard document 'Code of Practice, Safe Design of Structures'. The lifecycle of the facility should also be considered in conjunction with end users including maintenance, cleaning and operational staff.

Hazardous substances may be in use across any of the University's Campuses for research or teaching and it is important that all staff, students, contractors and visitors follow procedure carefully to avoid incidents.

There are a number of key documents relevant to H&S at the University:

- Health and Safety at Work Act 2015
- Code of Practice, Safe Design of Structures
- Managing Health and Safety in Construction Policy
- Asbestos Management Policy
- Asbestos Management Plan
- Health and Safety Approved Contractors Policy
- Health and Safety Policy
- H&S Checklist of New Builds
- Contractor Health and Safety Guidelines
- University of Otago Risk Management Framework
- AS/NZ 4801:2001 Occupational Health and Safety management systems - Specifications with guidance for use
- AS/NZS ISO 31000:2009 Risk Management-Principles and guidelines

A full list of University's H&S Policies can be found here.

The University's Health and Safety A-Z is a useful location for advice about specific hazards and how to manage them.

All contractors and their subcontractors wishing to carry out work on University sites are required to be approved prior to commencement of work in accordance with the Health and Safety Approved Contractor Policy.

In accordance with NZBC/F1:2.1 the University will provide all information currently held in relation to hazards or hazardous material on any University owned land or occupied space and as far as reasonably practicable.

6.1 HAZARDOUS MATERIALS (HSNO)

The University manages hazardous or dangerous goods through its H&SC team. Consultants working on projects with hazardous materials should contact the H&SC team directly or through the PM.

6.1.1 ASBESTOS

The installation of ACM on University property is prohibited.

"asbestos means the asbestiform varieties of mineral silicates belonging to the serpentine or amphibole groups of rock-forming minerals, including the following:

- actinolite asbestos:
- grunerite (or amosite) asbestos (brown):
- anthophyllite asbestos:
- chrysotile asbestos (white):
- crocidolite asbestos (blue):
- tremolite asbestos:
- a mixture that contains 1 or more of the minerals referred to above

Note that not all countries consider crysotile to be 'asbestos'.

6.1.2 LEAD PAINT

The use of lead paint on University property is prohibited.

6.2 H&S IN DESIGN

The University aspires to attaining the highest standard of Health and Safety across all its facilities, construction sites and in all its designs.

Designers are required, so far as reasonably practical, to eliminate risks to those carrying out construction, maintaining or cleaning or working in the designed structure or facility, decommissioning, demolishing, removing the facility or components thereof at end of life.

This process will be inherent within design for many and alien to others. As such there is a need for consistency across all design disciplines.

Designers should give specific consideration to access for safe maintenance and allow space above ceilings or within plant rooms and ducts as necessary. This should be carefully coordinated with Services Consultants and discussed with contractors prior to installation. Designers should avoid the creation of areas classified as 'confined spaces' as defined in AS 2865.

There are specific risks associated with the University that require inclusion in the design process. This includes, but is not limited to:

- Balustrade heights
- Laboratories to PC2 standard
- All surfaces meet the NZ Standard with particular attention to kitchens, ramps, entrance ways and stairs.
- Defibrillators are incorporated into the design based on the emergency response guidelines
- Roof access eliminates the need for the use of harnesses or anchor points for safe access.

The H&SC safety in design for new builds/refurbs should be used as a minimum requirement.

Every Project will require consultation with the H&S Compliance Team. Early consultation in the project is recommended to address or discuss any potential issues. A review of the design will be carried out by the H&S Compliance Team before completion of Preliminary Design. A further review or consultation should be undertaken as the project develops to gain the approval of the H&S Compliance Team for the final design.

6.2.1 RISK IDENTIFICATION

All design disciplines shall consider the risks inherent within their individual and collective designs with a view to identifying and eliminating risks.

Residual risks shall be written down in a designer risk assessment schedule and provided at tender stage to the tendering parties such that contractors may assess the risks; ***Risks should also be identified clearly on any relevant associated drawings*** to draw the risk to the attention of the contractor or subcontractor (never assume that site operatives will be party to a designer risk assessment, however they will all see the drawings).

Where designers cannot eliminate a risk they should consider management of the risk to allow further assessment as to whether this risk is acceptable to the University.

Specific consideration should be given to general cleaning and maintenance and future maintenance or replacement. Being mindful that University buildings will in the main be designed for in excess of 50 years, building services may be replaced several times within this period and this should be taken into consideration in the base build design.

The main contractor is responsible for identifying any residual risks on completion of construction. Designers should also feed into this process. This information should be fed into the O&M Manual by the contractor.

H&S should be present on all Design and Construction meeting agendas and will be discussed and debated in the meetings.

Any incidents will be reported to the PM and to the University Construction H&S Manager.

Where multiple projects or contracts are being carried out in the same building, the Project teams will identify the work being undertaken and ensure that the Contractors carrying out the work meet to discuss their prospective works and programmes and agree who takes overall responsibility for the working site.

6.2.2 ABSEIL ACCESS & FALL RESTRAINT

The University will not accept abseiling as an acceptable method of maintaining difficult to reach elements of building fabric which require periodic access on the Dunedin Campus. Designers should propose methods which allow safe access either from the ground, safe working platforms or acceptable MEWPs. The reason for this approach is that there is insufficient abseiling specialism in the local market which restricts the University's ability to maintain buildings in this manner. The use of abseiling in other campuses should be discussed with the H&S Compliance Team to assess whether it would be appropriate.

The University will not accept installation of fall restraint systems as acceptable methods of accessing roofs or guttering for maintenance, or for the cleaning of roof level glazing. Designers should propose methods which allow safe access either from the ground, safe working platforms or acceptable MEWPs. Consideration should also be given to use of parapets or permanent elements for restraint which in themselves do not increase the requirement for maintenance. The reason for this approach is to remove the requirement to maintain safety bolts and safety systems which themselves have the possibility of failure.

6.2.3 FIXED LADDERS

Fixed ladders should be avoided where possible for access to plant and maintenance areas. When designing a new build, consideration should be given to providing access stairs to plant and maintenance areas sufficient to enable safe access of personnel carrying tools and spare parts.

6.3 SITE H&S

All H&S Approved contractors are required to have site specific safety plans or similar based on the size and complexity of the work. Such plans are either signed off by PSD or the Construction H&S Manager. H&SC will audit these plans and may inspect sites at any time. Where there is a major non-compliance, the University reserves the right to stop the work and/or remove individuals from site.

The H&S approved contactors induction covers the on-site rules. Site audits by the H&SC team will review the H&S performance of contractors. Identification cards must be carried on site at all times, and are valid for 2 years, after which time the induction training must be completed again.

6.3.1 PERMIT TO WORK SYSTEM

High risk activities such as height work (1.5m+), confined space, hot work and isolation of services are required to be managed by a permit to work system. If the H&S approved contractor has an existing permit to work system, this can be approved by the H&SC team for use on site. Alternatively, contractors may use the University system if they have met the training requirements.

6.3.2 PPE

All contractor operatives should comply fully with use of appropriate PPE as defined by the main contractor. Failure to comply with this may result in operatives being removed from site. Consultants and visitors must also fully comply with contractor's PPE and site rule requirements. **There are no exemptions to this rule.**

DESIGN & FACILITY STANDARDS

SECTION 07:

ARCHITECTURE & SPACE

07

7.0 ARCHITECTURE & SPACE

7.1 INTRODUCTION

Creation of quality architecture and interior space is paramount to the University as it sets the tone for the learning and living environment it provides for students and staff. Each of the geographically diverse University locations have specific needs and requirements which will impact upon design and should be considered on an individual project basis.

The following information has been prepared to provide design guidance on standards of architecture and Interior Space. For further information or clarity around the guidance, contact the Strategic Architect within Campus Development Strategy and Planning.

7.1.1 DESIGN ETHOS

The University has a wide variety of buildings across multiple Campuses. Dunedin is the main Campus with a diverse range of buildings ranging from student accommodation, to academic teaching space, laboratories, general office and administrative space and a range of informal, social and support activities. The buildings perform differently in function and differ greatly in age and style from Neo-Gothic to Modernist to Post Modern. Continuity of style on Campus has therefore been very difficult to manage as the estate has expanded and this will remain a challenge. One of the key elements which assists in binding the Campus together has been landscaping, where a common thread can tie the differing building styles together and make sense of the journey through the Campus. This will become increasingly important as the University continues to grow and develop.

The link back to the city is also an important consideration. The University represents around a fifth of Dunedin's population and is very much a city centre University rather than an out of town Campus. The facilities in the city and on the Dunedin Campus are therefore intrinsically linked. The historic precinct in the University is an important element of the overall heritage within the city and further cements the University's ties to the city. It is also one of the key characteristics that the University of Otago is known for.

Any new buildings which the University commissions therefore need to take account of the University's needs as well as an understanding of the building's place within the city and should be sympathetic to its surroundings. The University wants to create great architecture which fulfils the functional brief but also enhances the environment and embodies the University's values. The University welcomes innovation within the design and is willing to be challenged throughout the design process to create excellence in the built environment.

7.1.2 BUILDING STOCK

The majority of the University's building stock is pre-1980. Many of these buildings are functionally inadequate for modern University environments and will require adaption or upgrade in the coming years. Many of these buildings are scheduled for improvement, however finite budgets dictate that works are prioritised to address the most pressing needs first. Current prioritisation has been made on the basis of the following criteria:

- Seismic rating
- Non-compliant fire egress / systems
- Essential systems failure
- Non-compliant biological/animal/plant/chemical/radiation standards
- Asbestos presence
- Facilities not meeting required course standards
- Building envelope

Consideration will be given on individual assessment basis as to whether buildings or facilities will be retained or replaced.

7.1.3 SPACE EFFICIENCY

The space that supports the University operations has grown organically in line with academic departmental growth over the University's 150 years. The result is that many of the buildings are now inefficiently used or no longer fit for purpose as functional requirements, teaching technology and pedagogy have changed. When considering project work to address functional requirements to support operational needs, the University will look at both repurposing and new build as options for addressing the need. In many cases space may be able to be adapted and consolidated to create space within the existing 'estate envelope' which may represent a more cost effective solution and is aligned to the University sustainability objectives to reuse where possible. Where this fulfils the functional requirement, this will be the preferred option over new build.

The University Senior Space Planner should be consulted with when determining space usage and department locations.

7.1.4 HISTORIC PRECINCT

Many of the buildings within the Dunedin Campus are of historic significance both to the University and to New Zealand. Many are Listed by Heritage New Zealand and protected in the District Plan.

The cloister of historic buildings present within the central Campus are of particular importance and represent a key visual image for the heritage the University. A Conservation Maintenance Management Plan has been prepared for the preservation and visual continuity of their external envelope to preserve the character and appearance. This information is available from the Property Services FM appointed to manage these properties. The properties include:

- Clocktower Building
- Geology Building
- Consumer and Applied Sciences Building (CApS)
- Staff Club
- Marama Hall
- Archway Building

Property Services are responsible for the ongoing maintenance and preservation of these buildings however it is prudent if major works are proposed for any of these buildings to consider an element of preservation or maintenance as part of the works. Any works proposed to these buildings should include consultation with Property Services and Heritage New Zealand and the Strategy and Planning section of Campus Development.

7.2 EXTERNAL ENVELOPE

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Energy (15-16)
- Water (18)
- Materials (19-22)

7.2.1 ROOF

7.2.1.1 FLAT ROOF

Roof construction will vary from project to project. It is the University's preference to avoid flat roof construction where possible due to the longer term maintenance issues that this creates for Property Services. Where flat roof structures are unavoidable they should be installed with a proprietary single ply membrane with a minimum 25 year guarantee. The product should be installed as a system, fully integrated with all outlets and penetrations. The system should be installed by a suitably qualified and manufacturer approved installer.

Any proposed roof access paths should be delineated with a proprietary mat (of the same system) and any areas where walking is not permitted should be suitably marked in contrasting colour.

Roof colour should be light to minimise radiant heat build-up or utilise cool colour paint systems where darker colours are desired for aesthetic reasons.

A minimum pitch should be applied of 3 degrees to any flat roof construction.

Suitable flat, strong and appropriately sized space should be created for any access equipment around the perimeter of the building.

Any penetrations through proprietary roof membrane systems should be carried out by an approved installer of the system to ensure guarantees are maintained.

7.2.1.2 PITCHED ROOF

A pitched roof is the preferred roofing solution either using a built up system or utilising a composite insulated roofing panel.

Roof colour should be light to minimise radiant heat build-up.

A minimum pitch should be applied of 5 degrees to any pitched roof construction, particularly where wind driven rain may penetrate junctions at the apex or abutments on profiled metal roofing systems.

7.2.1.3 GUTTERING

Internal guttering should be avoided where possible due to maintenance and internal noise.

Appropriately sized overflows should be included as standard.

Leaf guards should be specified on any areas adjacent to foliage.

Snow guards should be considered, depending upon location, to ensure snow does not remove the gutter from the facia. This may be achieved through additional strapping or suitable snow guards.

7.2.2 WALLS & CLADDING

7.2.2.1 COMPOSITE INSULATED PANELS

The University will not accept the use of any exposed combustible insulant in the construction of external walls (reference Grenfell Tower). This includes built up systems with rain screen cladding in front of the insulant but excludes fully enclosed factory sealed composite panels.

Aluminium Composite Panels are not to be incorporated into future design proposals of new buildings, except with specific approval in the following situations:

- For a building that does not require CodeMark to demonstrate fire compliance with the building code and/or
- If a product CodeMark is appropriate to the proposed application and satisfies all fire code requirements.

The University preference is for Steel Composite panels as opposed to Aluminium composite panels where possible.

Consideration should be given to colour as part of the design process and its impact upon heat build-up in the building envelope should be kept to a minimum where possible.

7.2.2.2 TIMBER CLADDING

Careful consideration should be given to the use of timber cladding and the long term maintenance of the timber. Designers should be clear as to the desired look and feel of the timber cladding both on day one and in future years, particularly where natural stains are used to show the natural colour of the wood. All timber should be from FSC certified sources as standard.

7.2.2.3 STONE

Many of the Campus buildings, particularly in the Heritage Precinct utilise masonry construction. Refer the Conservation Maintenance Management Plan for further details through the relevant FM.

Oamaru stone should not be used as a rain screen cladding due to its porous surface and difficult maintenance and repair. Where Oamaru Stone has been used on Campus, any repairs should be done in consultation with Property Services and the Strategic Architect. Repairs to Oamaru stone on heritage listed buildings may also require input from Heritage New Zealand.

7.2.3 EXTERNAL DOORS

External doors should be designed to be in keeping with the rest of the architecture and design aesthetic and selected to suit the proposed environmental conditions and intensity of use (dependant on user group). Doors should be designed to allow passage of materials and people into the building and sufficiently large enough to assist evacuation in the event of emergency, all in line with the NZ Building Code and the Design and Facility Standards.

Consideration should be given to prevailing winds and whether a wind lobby should be incorporated to reduce heat loss and manage internal temperatures for occupants, particularly at reception spaces.

Consideration should be given as to the proposed user groups and whether automatic opening devices should be fitted (these are not mandatory to the University, but are becoming increasingly appropriate, particularly in public access buildings and for accessibility purposes). Where the door opening force exceeds that described within NZS4121 (7.3.5 as of 2001) a manually operated power assisted door opener is required.

All principal entrance doors should be a minimum clear opening of 850mm, requiring a min 910mm leaf. Where a door is double or leaf and a half, at least one leaf should meet this standard. As outlined in the **Accessibility Section** it will be preferable to improve access to the side of the door from 300mm (NZBC/D1/7.01) to 450mm on the inward opening side at the leading edge of the door.

It is likely that most, if not all doors of the external envelope will receive access control (refer Access Control Section). Consultation should be undertaken with Campus Watch to determine the required level of security.

7.2.4 WINDOWS

Windows should be Double Glazed, Low E with Argon Gas as a minimum. Thermally broken Aluminium or timber windows will be considered acceptable.

All windows which could have seated occupants next to them require a Low-emissivity component so people can be comfortable at standard room temperature.

North, East & West facing windows without adequate external solar shading require a solar reflectance component for the glazing or film.

- North & West will require a maximum 50% solar heat gain coefficient (SHGC).
- The majority of the solar energy must be reflected and not absorbed (avoid tints).
- Visually clear and adequately reducing glare
- Internal blinds are considered a secondary solution.

Windows should be easily accessible and openable for all building users including those with reduced mobility. Careful consideration should be given to cleaning of glass (internally and externally) either through careful selection of window opening type to allow cleaning from the inside, or provision of access for cleaning externally. It will not be acceptable to utilise harness or restraint systems for cleaning of glass. Designers should provide a statement as to the proposed cleaning method.

Windows will ideally be locally sourced and provided with a guarantee.

Where a fall from height of over 2m is present, windows should be fitted with a window restrictor, limiting opening to 200mm maximum. This facility should have the ability to be overridden for cleaning purposes.

Window frame and glazing specifications to be approved by the Property Services Energy Team and Strategic Architect prior to order.

7.2.4.1 MANIFESTATION

Manifestation design should be in keeping with the rest of the architecture or interior scheme and should be designed prior to tender stage. Manifestations offer an opportunity to incorporate the cultural theme for the building both internally and externally. (refer **Accessibility Section**).

7.2.4.2 SOLAR GAIN / SOLAR SHADING

Orientation of glazing in new build construction should be carefully considered. Design shall make positive use of solar gain through passive solar principles. Solar gain can however become a nuisance in the summer months creating increased heat beyond design parameters. Consideration should be given to methods of solar shading internally and externally to better manage solar gain throughout the year.

Blinds may be fitted internally to either new build or retrofitted as required. Blinds are considered a secondary means of managing glare and heat and solar shading and glazing specification should always be the first line of defence. Provision should be made for mounting of blinds above windows and to the type of window opening method to avoid clashes. Roller blinds are preferred either with solid fabric or mesh fabric with the following characteristics:

- White or metallic backing to reflect sunlight and reduce heat penetration
- Fire retardant fabric
- Solid fabric OR mesh (1% openness factor preferred, 3% openness factor max.)

Blinds should be fitted to the North, East and West elevations but not to the South unless for AV / blackout

requirements or where the adjacent building can result in reflectivity concerns for the building's occupants.

Blackout blinds should be considered for areas where AV is being installed. These may either be roller blinds or cassette type fittings sized to suit the windows.

Blind chains should have a safety link in them to break under excessive pressure and a retaining clip at the base of the chain mounted to the wall or architrave.

7.2.4.3 SOLAR FILM

Solar film may be required on new build or retrofit to assist manage solar gain. Consideration should be given to all design and functional factors prior to installation of solar film and advice should be taken from both Property Services, Campus Development and specialist advice from suppliers where necessary. Where solar film is required the following guidance should be followed:

- Reduce Solar Gain (North & West facing): 'Glazing Films ICM 1307' performance film or equal and approved.
- Reduce Heat Loss (where cold window surfaces create discomfort in winter): 'Glazing Films ICM 1667' performance film or equal and approved.

The design shall, as much as possible, make positive use of solar gain through passive solar principles.

A minimum 12 year Manufacturers warranty will be required for all solar film installations.

Solar film specifications to be approved by the Property Services Energy Team and Strategic Architect prior to order.

7.2.5 THERMAL STANDARDS

Sustainable design tends to concentrate on new buildings when in reality they only represent around 5% or less of existing building stock on the Campus. Where feasible, insulation should therefore be retrofitted to existing buildings when they are being upgraded. This may include external insulation, internal insulation or a combination of both.

With the introduction of a revised H1 section of the NZ building code in November 2021, thermal insulation standards have been significantly improved on the previous version. However, the University still aspires to a higher standard of insulation than the current building code in some specific areas; walls and floors. Whilst this will have a higher capital cost, the payback over the life of the building will be improved in terms of energy reduction. This also aligns with the University's sustainability targets for energy reduction and reduction of greenhouse gases.

Whilst there are many variables which affect the thermal envelope such as orientation, location, % glazing, occupancy, power loadings etc, this increased standard sets out the expectation for the improvement of thermal performance of for all University buildings. This applies to all buildings on University Campus (large and small).

H1/AS1 and H1/AS2 should be followed in full, taking account of building type and climate zone. The University requires the following minimum standards to be achieved in addition to this where the current code compliance allows a lower standard in certain instances or zones (*reference given to building elements that do not contain embedded heating systems*):

Zone 3: Minimum *R*-values:

Building Thermal Envelope Component	**Minimum *R*-value**
Roof	As per code
Wall	R3.25 (or as per code if higher)
Floor	R3.0
Windows, Doors and Glazing	As per code
Skylights	As per code

fig 7.1: minimum R-values

Calculation methods for compliance should be undertaken in alignment with H1/AS1 and H1/AS2. The University will require to see an elemental breakdown of all differing construction types and % of areas utilised (i.e. all different wall types, roof types, glazing etc) to allow an informed view to be taken on the average R value of construction elements.

Whilst this standard shall be achieved on new build construction, it may not be possible to achieve on refurbishment or extension to existing buildings, however it should remain the *target* for these projects. The requirements of NZBC:H1 shall be complied with in all other respects.

7.3 INTERIOR FITMENTS & SPATIAL DESIGN

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Operational Waste (8)
- Indoor Environment Quality (9-14)
- Energy (15-16)
- Water (18)
- Materials (19-22)

7.3.1 SPACE GUIDELINES

The University manages the allocation of space and space planning through the Asset Management Unit in the Property Services Division. The relevant policy and guidance includes (in hierarchical order):

- Space Management Policy
- Space Use Guidelines
- Design & Facilities Standards

The objective of the policy and guidelines is to create space which:

- best meets the strategic goals of the University
- is efficient and future flexible
- is environmentally sustainable
- is financially sustainable
- is equitable, consistent and fair
- maximises the utilisation of space across all University Campuses; improving utilisation rates
- effectively utilises University Assets, reducing the amount of additional built or leased space required to meet the operational needs of the University

The University's Asset Management Committee is ultimately responsible for allocating space and it is administered by the Property Services Division. University groups and departments must not vacate space, or occupy additional space without the consent of the Asset Management Committee.

The University utilise TEFMA space guidelines as a reference tool for approximate space budgeting at the early stages of a project. During detailed planning the University space guidelines should be followed, and benchmarked back to TEFMA guidelines.

7.3.1.1 GUIDING PRINCIPLES OF OFFICE SPATIAL DESIGN

The University aspires to create modern, flexible, varied and appropriate working environments that allow staff to perform to their best. The University has aligned itself with the guiding principles set out in the New Zealand Government Property Group guidelines for office design to assist and guide new or refurbished space development. These guiding principles include:

i. **Open Plan Working Environments:** Shared open plan collaborative work spaces for communal activity supported by collaboration space for use by individuals or for group communication and socialisation;
ii. **Shared Collaborative and Quiet Spaces:** Shared space which supports group collaboration and meetings and flexible quiet space which supports individuals undertaking concentrated work;
iii. **Utilisation of Technology:** Harnessing technology to allow staff to do their job;
iv. **Mobility & Adaptability:** The desk is no longer considered the only viable work setting. Dynamic working environments embrace a wide range of technologies, spaces and settings that encourage areas for high concentration work, discussions and collaboration;
v. **Consistent Design:** Staff move while the furniture stays in place. A fixed, generic layout will be designed to maximise the efficiency of the floor plate. Teams should be formed and reformed around the requirements of projects and activities, not pods of desks;
vi. **Choice of Workplace Settings:** The design of the open-plan working environment should be dynamic enough to enable staff to choose from a range of work settings;
vii. **Safe and Secure Environments:** The University is committed to providing safe and secure work environments for all employees and visitors, including clients and contractors, considering the needs of people with disabilities in the design and fit-out of the working environment,
viii. **Spaceless Growth:** In any expansion the University will first maximise the current space before acquiring additional space.

In certain circumstances, the Design & Facility Standards will take precedence over the guiding principles, such as in the case of furniture sizing and selection and in department management of flexible staff working arrangements.

The needs of staff undertaking teaching or research will be taken into consideration alongside these principles to ensure that space is appropriately located relative to teaching and laboratory facilities, however it need not be directly adjacent in all cases.

For smaller scale adaptations where there are constraints on configuration, these principles will still apply as far as is practicable in the circumstances.

7.3.1.2 STAFF SPACE ALLOCATION

The following guidance includes the information set out in the Space Use Guidance and is provided as supplementary

information to assist and define a starting point for a spatial design. Consideration of other factors such as department function, building and growth will also need to be taken into consideration to refine the spatial design.

7.3.1.2.1 Office Accommodation Allocation

The University acknowledges its obligation to provide safe and healthy working conditions for its staff. The University will maintain flexibility in planning for current and future space needs and retain the ability to modify its space to satisfy those needs. Space will be managed and allocated in alignment with industry benchmarks for space utilisation and functionality, with a view to achieving best practice. In order to meet this growing demand, the University will adopt shared office space for all academic and professional staff **as the default use of space**. Cellular accommodation will be provided as noted below.

Staff will be allocated space in shared work areas or single occupancy offices depending on the availability of space, the requirements of their roles, levels of space utilisation and building configuration.

Staff working across multiple University buildings or campuses will be allocated a workspace at their primary location, with access to hot desk facilities at secondary locations. Multiple dedicated workspaces are not supported.

Administrative functions should be centralised where possible to allow sharing of task and job roles.

Space should be adequately supported by ancillary cellular space for meeting, hot desking, focussed work and breakout. Communal space increases informal and social interaction and is intended to help support knowledge sharing.

New build or refurbishment project teams should identify exemplars of best practice relevant to the proposed work function to help demonstrate shared environments and their support spaces.

Right-sizing the spatial requirements and increasing the quantity of shared accommodation can help realise the following benefits:

- Improved flexibility and sustainability
- Improved efficiency
- Reduced Capital and Opex costs to both University and individual Divisions & Departments
- Improved staff and student satisfaction
- Improved collaboration and social interaction

Staff will be allocated space on the basis of a 1:1 desking ratio. This ratio may be reviewed at a future date as the University moves towards a more agile workstyle.

Retired staff do not have an entitlement to allocation of space. Upon retirement, staff must relinquish their allocated space. Honorary staff will have access to hot desking.

Office space should not be designed at a density detrimental to the health and wellbeing of staff.

Table 1 describes the types of workspaces available for allocation to staff:

Workspace	Description	Guidance
Dedicated Workspace	Allocation of a workstation for a dedicated role. Allocation on a 1:1 desk ratio. Workspace may be in shared or single occupancy space.	Full time staff OR part time staff >0.6 FTE
Shared Workspace	Allocation of a workstation which will be shared between 2 or more users.	Part time staff <0.6 FTE
Hot Desk	Non-allocated workstations for use by anyone	Casual staff, staff with a dedicated Workspace elsewhere on Campus, external consultants and contractors, Visitors, Honorary staff
Visitor Space	Workstations allocated solely for the use of visitors	Visitors

Table 1

7.3.1.2.2 Workspace Styles

The following concept presents the most economical and future flexible use of space and should be adopted as the default use of space. The concept is one of a shared environment, locating staff in an efficient and collaborative manner and making best use of space. Space should be fit for purpose and should follow the furniture guidelines set out in the Design & Facility Standards document.

The concept of 'shared space' can vary greatly from a two person shared office through to larger areas of open plan accommodation for many staff. Space within shared environments can successfully be notionally subdivided utilising furniture or screening to create protected or private space without the need to introduce permanent structures. This allows for the creation of more private space without the need for costly construction work and is ultimately more future flexible.

Staff who work less than 0.6 FTE *may* not be allocated a dedicated desk and *may* be required to share the workstation with either another member of staff OR allow the workstation to be utilised as a hot-desk or visitor desk when

they are not present. Access to secure storage facilities should be provided.

Staff who are not office-based (eg trades, field and clinic staff) but are required to undertake some desk activity will have access to hot desk or shared workstations as appropriate.

A variety of workstation styles are proposed to meet the requirements of the varying roles across the University as set out in table 2 below:

Style	Provision	Function
Style 1: Workstation in shared space: Low storage / Low privacy	Desk: 1600 x 800 in clusters of 1 – 6 desks with under desk pedestal, chair and access to department storage nearby and use of communal ancillary support space.	Administrative, General Professional *Ref. Table 3*
Style 2: Workstation in shared space: Medium storage / Medium privacy	Desk: 1600 x 800 in clusters of 1 – 4 desks with under desk pedestal, chair and local storage unit and access to department storage nearby and use of communal ancillary support space*.	General Prof, Managerial, Academic, Research *Ref. Table 3*
Style 3: Workstation in shared space: Medium storage / High privacy	Desk: 1600 x 800 in clusters of 1 – 2 desks with under desk pedestal, chair and local storage unit and access to department storage nearby and use of communal ancillary support space*. Use of local, shared open plan meeting space if required.	Managerial, Academic, *Ref. Table 3*
Style 4: Cellular office with no meeting space	Single occupancy office with Desk: 1600 x 800 with under desk pedestal, chair and storage and shelving as required. Provision of visitor chair.	*Ref. Table 4*
Style 5: Cellular office with meeting space for 2-3 people	Single occupancy office with Desk: 1600 x 800 with under desk pedestal, chair and storage and shelving as required. Small meeting table with seating for 2 – 3 visitors (shared facility for other staff when not in use by occupant)	*Ref. Table 4*
Style 6: Cellular office with meeting space for 3+ people	Single occupancy office with desk which may be larger than 1600 x 800 with under desk pedestal, chair and storage and shelving as required. Meeting table with seating for 3+ visitors	*Ref. Table 4*

Table 2

**It should be noted that spaces supporting academics will require a higher level of support spaces to ensure access to private space for dedicated research or collaborative meeting space.*

Workstations will be allocated to staff on the following basis as described in table 3.

Designation (Professional Staff)	**Style**
Director *(with less than 10 staff)*	Work Style 3
Head of Department	Work Style 2 / 3
Manager	Work Style 2 / 3
General professional staff	Work Style 1 / 2
Administrator	Work Style 1
Designation (Academic Staff)	**Style**
Academic Director	Work Style 3
Associate Dean	Work Style 3
Executive Assistant	Work Style 2
Professor	Work Style 2
Academic	Work Style 2

Visiting Fellow / Visiting Professor (when on campus)	Work Style 2
Professional Practice Fellow / Teaching Fellow	Work Style 1
Emeritus Professor	Hot Desk
Administrator	Work Style 1
Academic Support / Research Assistant	Work Style 1
Tutor	Hot Desk

Table 3

7.3.1.2.3 Single Occupancy Offices

Single person offices present an inefficient use of space and a high capital and maintenance cost whilst limiting future flexibility. The University supports shared accommodation of workspace wherever possible. The University acknowledges that some role functions require use of an individual office, however many functions can be undertaken in shared accommodation with adequate support space such as meeting rooms and quiet space. The need for private conversations within any role does not determine entitlement to single person offices; private conversations are a requirement for most roles within the University. Not all senior staff will be allocated offices; offices should not be seen as a status symbol or demonstration of hierarchy within the University.

Where offices are required they will (in general) not exceed the guidance set out in the table without prior agreement.

It is intended that all offices will be supported by access to nearby shared meeting space.

Offices will not necessarily contain meeting space within them. Where meeting space is provided within single offices it will also be deemed to be meeting space that can be utilised by other staff members and is not provided solely for the use of the office occupant.

Staff who have been allocated a single occupancy office are expected to ensure their office can be used by other occupants during limited periods of absence from campus.

Part time staff will not necessarily be allocated a single office. All staff are allocated one desk. If duties mean staff spend time in multiple locations hot desks (or bookable offices/meeting spaces) will provide a short stay option.

Should staff who are not entitled to a single occupancy office be requested to utilise a cellular office in order to work within an existing building's architectural constraints they may be asked to share that office should it exceed 12m2. Where a single occupancy office is provided due to existing arrangements or building constraints, that does not create any ongoing entitlement to a single occupancy office.

Single person offices will only be allocated as a default on the following basis as described in table 4:

Designation (Professional Staff)	**Style**	**Area**
Vice Chancellor	Work Style 6	25m^2
Chancellor	Work Style 6	18m^2
Deputy Vice Chancellor	Work Style 6	18m^2
Chief Operating Officer / Chief Financial Officer	Work Style 6	18m^2
Registrar	Work Style 6	18m^2
Directors *(with 10 or more than staff)*	Work Style 5	13m^2
University Librarian	Work Style 5	13m^2
HR Project Managers, Service Managers, Divisional HR Managers	Work Style 5	13m^2
Manager Promotions and Remuneration	Work Style 4	10m^2
Designation (Academic Staff)	**Style**	**Area**
Pro Vice Chancellor	Work Style 6	18m^2
Dean	Work Style 5	13m^2
Head of Department	Work Style 5	13m^2

Table 4

Any other single person offices will be designed to 10m^2.

All other staff other than those noted above will be allocated space based on Workstation Style 1, 2 or 3 depending upon work pattern and role undertaken.

Whilst the above noted designation is entitled to an office, they will equally be entitled to work in a shared environment with their teams.

7.3.1.2.4 Meeting Space

Meeting space can be both formal and informal space and will be made available to all building users.

All staff will be granted access to appropriate meeting facilities, in their building where available and otherwise in close proximity.

Meeting rooms should be available for use by all. Meeting rooms will all be bookable on the Outlook calendar booking system and will be managed by Client Service Administrators.

7.3.1.2.5 Staff Facilities

Staff common rooms, tea rooms and kitchen spaces will function as staff break-out areas and informal meeting spaces and will not be allocated or dedicated to specific departments or divisions; staff rooms will be accessible for all building occupants and will be shared across departments.

Staff facilities may not always be created to a size and scale where all department or building staff can congregate at one time. Where special events involving large numbers of people are required, departments should consider use of larger facilities which may be outside of their building or department; infrequent large gatherings do not necessitate provision of additional space.

Staff facilities will take into account the number of prospective occupants to provide adequate, fit for purpose space.

Occupants will be jointly responsible for management of the space.

7.3.1.2.6 Reception Areas

Reception areas will be customer-focused. They will normally include some form of staffed area and will have space adjacent for a range of support functions from copy and hand-in facilities to PC access. This will be dependent upon function and location.

Reception desks should be easily maintainable, secure and readily accessible for staff and students. All receptions should incorporate a designated wheelchair access space in accordance with current building code.

7.3.1.3 ALLOCATION OF SPACE FOR STUDENTS

The University endeavours to provide space appropriate to the needs of undergraduate and postgraduate students supporting a range of pedagogical learning and teaching methods, research, and social learning spaces.

Student space should acknowledge the changing nature of technology within the student environment and should support learning and study in a wide variety of environments to encourage the activation of buildings and space. Adequate power and data provision should be provided to all of these spaces.

7.3.1.3.1 Undergraduates

Undergraduates will not be provided with dedicated space for individual students.

Collaborative learning and interaction spaces should be provided within departments/buildings to allow undergraduates to stay within their department and benefit from increased interaction with peers and staff; refer Social and Informal Learning Spaces below.

Undergraduates should have access to good quality study and learning space both in library buildings and in other spaces across campus. These spaces should be varied in nature and acknowledge the different learning environments required to suit differing student preferences.

7.3.1.3.2 Postgraduates

Where possible postgraduate space should be allocated close to academic space to allow supervision and interaction.

Workspaces will be made available for postgraduate students in dedicated shared work areas depending on the postgraduate student's research activities and space availability.

Workspaces will be managed in a collaborative and flexible way across departments, so that space can be reallocated to respond to changes in the relative number of postgraduates in different departments.

Postgraduate space should be supported by access to sufficient meeting spaces to allow for confidential conversations and teleconferencing when required and have access to student amenities including space for eating and refreshments and social spaces which encourage interaction.

Style	Description	Area	Users
Post Grad Style 1	Post Grad Open plan in clusters of 1 - 6 desks: desks of 1200mm x 800mm / 700mm with dividing screens front and sides and access to lockers for personal storage.	3.5 - 4.0m2 NUA per person	Masters Hot Desks, PHD students who only require hot desking or who are part time
Post Grad Style 2	Post Grad Open plan in clusters of 1 - 6 desks: desks of 1400mm x 800mm / 700mm with dividing screens front and sides and personal	4.0 – 4.5m2 NUA per person	PHD Students with write-up requirements OR desk based research

	pedestal and access to limited shared filing.		

Table 5

Postgraduate Masters Students and part time Post-graduate students will only have access to hot desking space in line with table 5 above.

Postgraduate (taught) students will not be provided with a dedicated workstation however, those engaged in disciplines involving laboratory work will be provided with access to shared write-up space (hot desking).

7.3.1.3.3 Social and Informal Learning Space

Students spend a large proportion of their time outside of the classroom. Students and academic departments value time spent with peers discussing academic work. Creating spaces for spontaneous discussion is particularly important and should be included within every remodelling and capital project.

Spaces should be flexible and allow regular reorganisation of the layout both by students and staff. They can be located in rooms, or within circulation space (subject to compliance with fire regulations). There should be a variety of furniture types, to allow flexible working and suit personal preferences.

Consultation with the ITS Division on the provision of equipment and facilities is essential, before planning these spaces. Traditional catering and Library spaces will also provide this type of learning space.

7.3.1.4 ALLOCATION OF SPACE FOR TEACHING

Teaching spaces will be provided as required to suit teaching pedagogy. Consideration should be given to future pedagogy and flexibility of space to support varying teaching styles.

Teaching spaces proposed to be incorporated into new capital developments shall be considered from a timetabling perspective to ascertain if they are required.

All new and refurbished teaching spaces shall be centrally managed pool spaces, shared by default and managed in accordance with the Academic Timetable Policy and Casual Bookings Policy.

Formal learning spaces are one of the most visible components of campus life. Formal learning spaces have relatively straightforward requirements; line of sight, good acoustics, technology enabled and a focal point at the front of the room. When designing the teaching space it is important to understand what type of learning is required and support this with the appropriate workplace allocation.

Refer TEFMA Space Planning Guidelines for target Room Frequency, Occupation and Utilisation rates.

Table 6 summarises teaching space allocation as follows:

Space Type	**NUA m² per seat**
Lecture Theatre - raked seating	1.7 - 1.8
Lecture Theatre/Seminar/Tutorial/Class Room	2 - 3.25
Case Study Room	2.25
Learning Studio	4.5
Small Scale Vocational (language lab,computer lab,multi-media studio)	2.8 - 4.5
Laboratory – scientific / medical / engineering / WET / DRY/ PC1 / PC2 / PC3 / PC4	3.2 - 7.5
Medium Scale Vocational (audio visual,clinical, occupational therapy, and physiotherapy	5.0
Large Scale Vocational (gyms,dance/music studios and practice rooms)	6.5
Large Scale Vocational Operating Theatre (inc PC2)	6.5
Extra Large Vocational (recording studio, metal work studio, dental clinic)	7.5 - 8.5

Table 6

Refer:

- Worksafe Guidelines for using computers
- Worksafe Guidance on Working Posture

7.3.1.5 SPACE & DOOR NUMBERING GUIDELINES

The University has a Space Numbering Guideline for the purposes of standardised numbering of areas for all buildings. Property Services exports data directly from the Revit BIM Model to populate their own database which in turn uses the naming convention for processing numerous reports and schedules, including compliance schedules. As outlined in the Space Numbering Guideline this includes; levels, spaces, rooms and the building gross area.

Building numbering must be approved by Property Services Asset Management Unit and Design Office. This should

occur early in the project, ideally after Concept Design and prior to Detailed Design, once the floor layouts have been set so consultants are referencing the correct numbering in their documentation for the remaining duration of the project.

Door numbering conventions are equally as important as they are used for numerous compliance reports. The Space Numbering Guideline refer.

Each door has a unique numerical suffix to identify it starting with the main entry door and working clockwise around the floor. Example DG.10/1; Door number 1 in room G.10.

Typically doors relate to the room they open into. Linking doors to rooms allows flexibility for changes that occur during the life of the building.

7.3.2 ACCOMMODATION

7.3.2.1 OFFICE ACCOMMODATION

This section has been deleted. Refer section 7.3.1.

7.3.2.2 LABORATORY ACCOMMODATION

The University has a large portion of laboratory space of varying standards and requirements.

Laboratory design should be to AS/NZS:2982 laboratory design and construction 2010. AS/NZ 2243 should also be referred for Safety in Laboratories: Microbiological safety and containment.

The University employs a standard detail for eyewash stations in labs. This should be discussed with the Property Services Plumbing team who will organise for its fabrication.

All laboratory plans are required to be signed off by the Statutory Budget Committee in line with the Statutory Budget Laboratory Upgrade and/or New Facilities Process.

Refer to Lab standard AS/NZS 2243 part 1–10.

In new build developments, all laboratory space should be designed to enable future conversion to PC2 grade labs, allowing suitable service connection and reticulation space.

7.3.2.3 RESIDENTIAL ACCOMMODATION

The University is a collegiate focussed University leading the way in world class teaching and exceptional student lifestyle experience. Residential colleges are a key element of the undergraduate experience allowing students to discover like-minded people, build friendships and provide a strong basis for their learning experience.

The University currently offers 15 different residential colleges ranging in location, size and character and house around 3,500 undergraduates (2,500 University owned with the remainder in affiliated colleges). Each college offers a unique experience to students combining balanced lifestyle, study and community in facilities ranging from 125 – 500 students per college. Students are welcomed into the college whānau and add to the flavour and feel of each college. The unique 'flavour' of each college is a key component of the 'Otago experience'.

The collegiate experience is extremely important to the University and is at the heart of the student experience. It is a unique point of difference for the University. The design of any new college should acknowledge and develop the spaces to support an overall college experience but also acknowledge the individual and group opportunities that exist to provide identity and sense of place. The University seeks to create great residential space that students can feel part of and which will enhance their overall University experience.

Typical room sizes have been prepared for standard, accessible and residential assistant bedrooms which should be used as guidance for all new facilities. Proportions of the rooms can be varied to suit conditions, however designers should revert to first principals with regards manoeuvring space to ensure standards are maintained. Refer also NZ4121.

Residential accommodation space is frequently used for accommodating the public for special events or conferences. Design aspects, particularly for life safety, may differ from a residential requirement and may be more onerous.

Toilet and shower facilities within residential colleges should be provided such that individual cubicle walls span from floor to ceiling to provide a suitable level of privacy. Doors should also span from floor to ceiling / wall and not be under or over cut for ventilation. Mechanical ventilation will be required to these spaces.

7.3.3 FACILITIES

7.3.3.1 PARENTING ROOM / WELLNESS ROOM

Where appropriate, facilities should be provided to meet a range of wellbeing functions and specifically include the needs of new parents returning to work and study. Such facilities should be arranged to accommodate the following:

- Medication application (for instance providing self administration of medication)
- Quiet space (for migraine sufferers)
- Lactation for nursing mothers
- Breastfeeding

The room should be minimum 6m2 but preferably larger and should contain a comfortable seating area, countertop with sink, changing area, microwave (for sterilising equipment and heating milk), fridge and power. The space should also be able to accommodate a task chair to allow users to continue to work at a laptop whist feeding, expressing or preparing food should they wish to do so.

Parenting rooms / wellness rooms should be designed into all new medium to large scale buildings on the Campus and

where opportunities arise elsewhere on refurbishment projects to provide a reasonable level of provision across Campus.

The facility should be capable of accommodating wheelchair users and an assistance alarm should also be provided.

The room acoustics will be dependent upon the functions in adjacent rooms. Walls should be rated to no less than Rw50.

Provision should be made for signage outside the room to allow users to inform others of occupancy and likely time in use. Directional signage should be provided indicating the location of the rooms within buildings. The room should have signage noting 'Parenting & Wellness Room'.

The door should have a simple lock with thumbturn internally and external indicator and emergency over-ride.

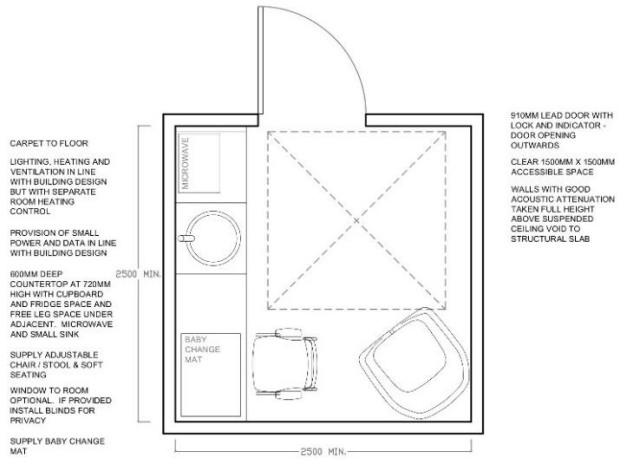


fig 7.2: Typical parenting / wellness room

7.3.3.2 MULTI FAITH ROOM

Where appropriate, facilities should be provided to meet the specific cultural and religious needs of all staff and students. Rooms should be provided on a 'drop-in' basis and should not be bookable. In some instances rooms may service multiple functions of a non-bookable nature and users will need to share the facilities which are offered. Rooms will be provided for prayer, meditation, contemplation, reflection and quiet and will be available to those of all religious beliefs and none.

Rooms should be provided in a quiet area of the building and have a high level of acoustic attenuation. Rooms should ideally be rectangular, neutral in colour and devoid of highly patterned finishes. Carpet floor finish should be provided. It should be a minimum of 8m^2 with a small rectangular table and 4 stackable chairs (to allow faiths that may have a requirement to congregate). A toilet and ablution facility should be provided adjacent or close by but separated at least by a lobby.

The ablution facility should ideally have proprietary Wudhu facilities which allows for washing of feet before entering the multi-faith room. Smaller prayer facilities can be supported by shower facilities where provision of Wudhu would not be practical.

Provision should be made for signage outside the multi-faith room to allow users to inform others of occupancy and likely time in use. Directional signage should be provided indicating the location of multi-faith room within buildings. The room should explicitly be called 'Multi-faith room' as opposed to any reference to prayer or iconography.

The room acoustics will be dependent upon the functions in adjacent rooms. Walls should be rated to no less than Rw50.

The door should have a simple lock with thumbturn internally and external indicator and over-ride.

Multi-faith rooms should be located strategically across Campus to provide ease of access for all users.

fig 7.3: deleted

7.3.3.3 Sanitary Facilities

7.3.3.3.1 Terminology:

The University will employ the following terminology in relation to toilet types:

- **All Access** for accessible toilets (note these are also gender neutral toilets)
- **All Gender Toilets** for gender neutral toilets (single facility with full height walls, WC and WHB)
- **Male** for segregated Male toilets with cubicles
- **Female** for segregated Female toilets with cubicles

7.3.3.3.2 Calculation & Provision:

When calculating toilet numbers, the 'University' category should be utilised unless there is a specific high demand function required. The more onerous of these 2 options should be selected. It may be appropriate to calculate the provision based on a floor of a building, part or whole building depending upon the circumstances.

Designers should undertake an assessment of toilet facilities as part of Concept Design and present the information to the University for consideration. This may require an assessment of a larger area than the project constraints.

Toilet provision should be in line with NZ Building Code as a minimum standard. Designers must carefully calculate the number of toilet facilities required in line with NZBC/G1/AS.

Capacity, gender, accessibility and cultural requirements need to be given equal consideration in the provision of campus facilities.

Decisions will be made on project by project basis around the type of facilities to be provided; fully segregated, all gender or a combination of both.

All University new build facilities or major refurbishments should allow for provision of 25% of toilets as All Gender toilets / All Access toilets as a minimum.

All buildings should include facilities for All Access and All Gender as a minimum (recognising this may not be possible in smaller buildings with low occupancy).

Consideration should be given to public and staff toilets as there may be differing needs depending upon the building users. This is particularly relevant in healthcare buildings where it may be inappropriate for patients and staff to use the same facilities.

7.3.3.3.3 All Access Toilets:

Accessible toilets shall go above the standard provided within the code. Please refer the **Accessibility Section** for more information.

7.3.3.3.4 All Gender Toilets:

The University, in line with its commitment to Rainbow Tick certification, recognises a rising demand for privacy in toilet facilities and a rising need to provide an increased quantity of All Gender toilets. The University is striving for continuous improvement of its existing building stock to meet this growing need.

All Gender toilets are sometimes referred to as Unisex toilets (the building code still refers to 'unisex' facilities). The University will use the term 'All Gender' for toilets going forward rather than 'Unisex' or 'Gender Neutral'.

Every new or refurbished building should incorporate a proportion of All Gender toilets such that users can access one facility per floor of the building or at very least travel a maximum of 1 floor to reach a facility. Segregated Male and Female toilets may still be provided in addition to All Gender toilets.

All Gender toilets should be a single room facility with full height walls with good acoustic attenuation, door (with no undercut), WC pan, WHB and associated supporting facilities (toilet dispenser, soap dispenser, mirror, sanitary towel disposal bin etc). These facilities must be able to be accessed without passing through a segregated Male or Female space (toilet or toilet lobby) and should be afforded the same amount of privacy as other toilets with the building.

7.3.3.3.5 Toilet Signage:

Signage for toilets should be in line with the guidance set down on the Toilet Signage Standards & Setting Out document which details content, language, style and presentation.

Toilet signage should utilise the University current signage standards for consistent typeface and colour. The signs will be vinyl applied to a 1.5mm thick grey laminate and should be of size and configuration noted on the Toilet Signage Standards & Setting Out document. Signage should be affixed to doors with adhesive.

All signage to be in accordance with NZBC/F8/8.1.

Any sign utilising the ISA wheelchair motif shall use the standard ISA safety blue background with white motif.

Braille will be incorporated into all toilet signage including the transfer side for the accessible facility.

fig 7.4: Toilet signage

7.3.3.3.6 Cultural Considerations for Ablutions

The University acknowledges its wide multicultural student and staff cohort and the need to cater for a wide variety of users. Whilst it will not be standard practice to install squatting toilets as part of any fit-out, consideration should be given to the building use and proposed user groups.

Consideration should be given to provision of a bidet spray adjacent to the toilet to provide those cultures that require it to perform ablutions prior to and after use of the toilet facility. The quantity and location should be discussed by the project team, however in most instances it will be appropriate to install these hoses within All Access or All Gender toilets to make the facility widely available to all. Where a bidet spray hose is fitted, a floor drain should also be fitted as standard.

7.3.3.3.7 Toilet Space Dimensions

Toilet cubicles within segregated facilities should have an increased minimum dimension to that provided in NZBC/G1/AS1/3.1.1. Minimum dimension should be 850mm with a min door leaf of 750mm. A sphere of 450mm should be able to be accommodated between the leading edge of the door, the WC pan and the wall (fig 7.5).

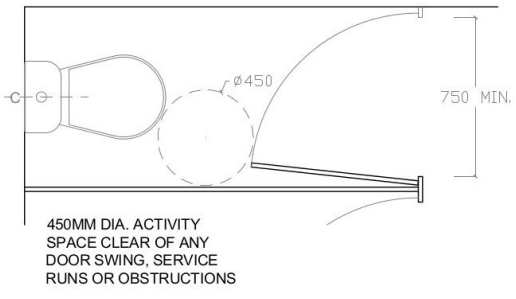


fig 7.5: standard toilet cubicle

Where more than 3 cubicles are provided within a segregated facility, one of the cubicles should be of an increased dimension of width 1200mm and have an outward opening door (fig 2).

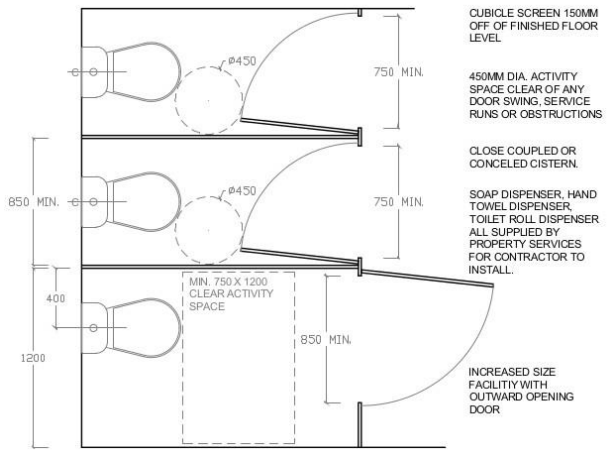


fig 7.6: ambulant toilet cubicle

Where All Gender or All access toilets are provided they should be to the following standard:

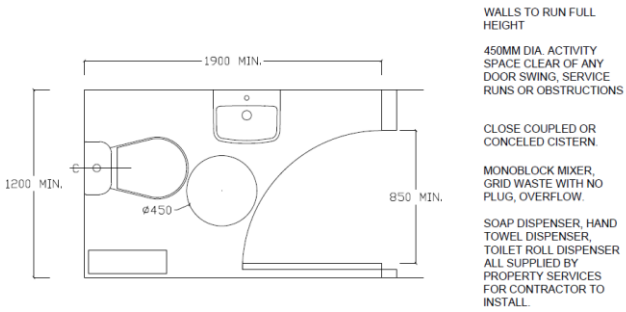


fig 7.7: All Gender toilets

Floor mounted WC pans are preferred for robustness.

7.3.3.3.8 Urinals

Where urinals are provided they should be wall hung bowl type urinals with automatic water flush. Trough and continuous wall type urinals are not permitted.

7.3.3.3.9 Toilet Cabinetry Finishes

Robustness of materials is essential in toilet environments. Certain materials are not fit for purpose in a toilet or wet environment. The following should be adhered to:

- Veneered panels – not acceptable
- LPL (Low Pressure Laminate): only to be used in areas where no regular exposure to moisture (such as toilet doors or cubicles). 18mm board thickness with 2mm PVC edge banding.
- HPL (High Pressure Laminate): to be used where light exposure to moisture (aprons under WHB countertops, IPS systems adjacent to and below WC and urinals). 18mm board thickness with 2mm PVC edge banding.
- SGL (solid Grade Laminate) / Solid Grade material: to be used in shower areas, counter tops).

A minimum 5 year warranty should be provided for the integrity of the product.

7.3.3.3.10 Toilet Accessories

Property Services Custodial Services are responsible for the ongoing cleaning and servicing of toilet facilities. The following products will be required in all toilet facilities and should be installed prior to completion. Custodial Services should be consulted with regards specification and quantity as part of the design process.

Function	Specifier	Supplier	Installer
Toilet Roll Holder	UO	UO	Contractor
Hand dryers	Designer	Contractor	Contractor
Soap Dispenser	UO	UO	Contractor
Hand Towel Dispenser	UO	UO	Contractor
Roller Towel Dispenser	UO	UO	Contractor
Sanitiser Dispenser	UO	UO	Contractor
Rubbish Bins	UO	UO	UO
Sanitary Bins	UO	UO	UO
Baby Changing Table	UO	UO	Contractor
Nappy Bins	UO	UO	UO
**All keys to be issued to Custodial services after installation*			

fig 7.8: toilet accessory responsibilities

Custodial Services maintain a product specification for the current products in use.

Paper towels will generally be installed for office / staff areas. Student areas may have roller towels to minimise the increased risk of paper towels being put down toilets. All toilet areas should have two methods of hand drying for Health Management and Pandemic criteria.

Electrical hand dryers are not a replacement for hand towels or roller towels which are more sustainable and hygienic. Hand dryers should be fitted in high use areas to supplement paper or roller towels. Where hand dryers are fitted, Dyson Airblade dB is preferred. Consideration should also be given to a plastic sheet fitted on the wall between the Airblade and the floor to manage drips and spray.

There is an increasing emphasis upon sustainability within the University's cleaning contracts. The University will avoid the use of harmful chemical cleaning agents where possible and will utilise microfiber cloth and water for all cleaning except toilet areas.

In facilities subject to high usage, provide space within the cubicles for several toilet roll dispensers. Allow the installation of the following dispensers, which the University will provide (at no cost to the project): Vertical dispensers holding three toilet rolls, or circular dispensers for 'Jumbo' toilet rolls. The toilet roll holder in disabled toilets should be a Bobrick model B2740 double holder

A liquid soap dispenser shall be fixed above the WHB and preferably directly through to a timber or masonry substrate

to allow it to be screwed to the wall. Where full height or full length mirrors are used soap dispensers have to be fitted with adhesive stickers however this is sometimes not robust enough for certain environments with high traffic or heavy use.

Sanitary towel disposal bins should be provided to all WC cubicles in female segregated facilities and in all 'All Gender' and 'All Access' facilities.

Special consideration shall be given to key note buildings on campus with regards fitments in washrooms to ensure that they are appropriate for the setting, which may require an alternative approach to the standard fitments.

7.3.3.3.11 Shower Facilities

Shower facilities should be installed in all new buildings to support the health and wellbeing of all staff and building users. Where a shower facility is created, suitable accessible showering facilities should also be provided. Refer **Accessibility Section**.

Shower facilities should include either a shower tray or wet floor arrangement. Shower trays should be a minimum dimension of 900mm x 900mm with a bi-fold or sliding door opening into the shower tray. Wet floor arrangements should be a minimum of 900 x 900 with a curtain or proprietary door system in solid grade laminate. Anti-slip vinyl should be used in all shower areas.

Consideration should be given to provision of lockers adjacent to showering facilities.

Shower facilities should be constructed with a water resistant substrate to ensure longevity of the facility and reduce maintenance. Moisture resistant plasterboard will not be appropriate. A cement based board will be acceptable. Wall finishes should be a sheet material rather than tiling. Careful consideration should be given to any joints in materials to ensure they are robustly details to avoid water penetration. Silicone sealant should not be relied upon for as the sole defence against water penetration as it is difficult to maintain and fails regularly.

7.3.3.3.12 Kitchen Facilities

Refer **Accessibility Section** for details of small and large kitchen facilities.

7.3.4 INTERNAL & EXTERNAL BARRIER HEIGHTS

The University has a variety of building users from staff, students, public and visitors. Building users will have varying degrees of understanding of building systems. Whilst some areas of Campus are restricted, the design of safety features within buildings should assume that occupants may gain access with family members and in some cases small children. As such design of all barrier constructions and stairs should assume the presence of children and be designed accordingly to deter climbing or falling though gaps in handrails or balustrades (reference NZBC/F4/AS1/1.2.1).

Barrier height requirements for stairwells, landings and balconies which open onto a void:

Potential fall height from top of barrier or balustrade	**Minimum barrier or balustrade height required**
<4.5m	As per NZ Building Code
4.5m – 2 levels	1.5m above floor level
> 2 levels	1.8m above floor level

fig 7.9: barrier height requirements

Should the NZ Building Code require a higher barrier, it will take precedence over these standards.

In all cases, the barrier or balustrade will be designed so as to inhibit climbing or inappropriate behaviour.

Where a stair flight extends through more than one category (eg from ground level to above 4.5m), then the highest applicable category should apply to the entire flight.

These requirements do not apply to stairwells with a spine where the fall height cannot exceed one level, so the NZ Building Code is the applicable standard in those cases.

Barrier or balustrade heights given are minimums only. A specific risk assessment should be made at the Safety in Design stage, and use of the next highest category should be considered where:

- The stairs are located in an area of high public use or higher-risk activity (eg libraries, student accommodation, licensed premises)
- Where the landing area for a fall presents increased risk (eg machinery, rock garden)

Barriers and parapets on roofs which are only accessible by maintenance staff may have a barrier height of 1100mm in line with building code.

7.3.5 ACOUSTICS

Noise transfer within buildings can be a source of disturbance if it is not designed correctly with the end users in mind. Different building types and room uses will require differing levels of noise control and technical treatment. These should be confirmed as part of a project briefing exercise.

Where a moderate to high level of acoustic performance is required, the walls forming the cellular space should be taken through the suspended ceiling and fixed to an element of structure OR taken through the suspended ceiling and an acoustic quilt mechanically fixed to the wall head and the structural ceiling. Robust detailing will be required for all but a low level of acceptable noise transfer. Consideration should also be given to flanking noise transfer. Consultants or designers should detail the proposed method of acoustic treatment together with the anticipated level of acoustic performance targeted. It will not be acceptable to have a wall taken to the underside of a suspended ceiling with an

independent acoustic quilt fitted in the ceiling void (unless low to no acoustic treatment is required).

Acoustic separation in Offices / cellular spaces:

- Meeting rooms – min. Rw50
- Cellular offices – min. Rw45

Acoustic separation standard for residential accommodation (horizontal and vertical):

- Sleeping room to sleeping room: Rw55
- Sleeping room to toilets / fire stair / common room: Rw60
- Sleeping room to corridor: Rw45

Wall systems should be over-rated during design to account for construction tolerances and service penetrations that will lower the overall rating of the walls.

Lower rated elements of construction can reduce the overall acoustic performance of a room (relative to ratings for wall construction). Careful consideration should be given to door specification, sealing and detailing. Where a high level of acoustic attenuation is required, automatic door bottom seals may be considered. Glazed partitioning can also reduce the overall effectiveness of acoustic integrity. Where a high level of acoustic performance is required, double glazed partitioning should be used as standard. Single glazed partitioning should only be used where low to moderate acoustic performance is required.

Acoustic attenuation should also be considered on the ventilation system and cross talk attenuators fitted between rooms where sound may transfer through grilles and ductwork.

Plant and equipment noise levels must be provided by the vendor and incorporated into the design where noise or vibration management is required.

7.3.6 CEILINGS

Ceilings should be project appropriate and designed to allow suitable access to all necessary plant installations or maintenance items.

Ceilings should be appropriately seismically braced.

Where plasterboard ceilings are installed they should be 13mm (10mm is not suitable) and taped and filled with a paint finish.

Ceiling access hatches may be used and should be appropriately sized for the access requirement. Access hatches should be metal with a white powdercoated finish and should have a lock. Flush fitted or picture frame fittings are appropriate.

Suspended grid ceilings may be installed and can be either mineral fibre tile or metal type to suit project budget and appearance requirements. The size of the grid should be considered in conjunction with access requirements and lighting proposals.

Ceilings in labs are to be easy clean Gib vinyl tiles.

Bespoke ceiling solutions or 'integrated' mechanical services should be avoided where possible as it restricts future flexibility for room layouts.

Careful consideration should be given to insulation above ceilings in a 'cold roof' application and to protection of services and integration with fire hoods where necessary to maintain fire and thermal performance.

Where the finished ceiling forms part of the fire separation system significant consideration is required to ensure a compliant passive fire stopping system can be installed. The majority of sealant based systems require greater than or equal to 26mm of substrate. Note that in non-sprinkler protected buildings achieving the required insulation resistance may be extremely challenging.

7.3.7 FURNITURE GUIDELINES

Historically departments were able to purchase furniture on a needs basis which created a wide and varied range of furniture being used across the Campus. While providing independence and individuality for each department this model has created inefficiency and inconsistency across the Campus. Having varying size, colour, styles and types of furniture has meant a lack of versatility and ability for furniture to be reused or recycled across different departments which has resulted in a stock of unwanted furniture.

These guidelines will assist when selecting and purchasing office furniture and equipment with a view to standardising the size, look and feel across the Campus while providing the most efficient use of space and financial resources. This will give departments the ability to continue to purchase their own furniture while delivering a Campus wide stock of furniture that is more consistent and thus versatile which will achieve some desired improvements in efficiency.

7.3.7.1 OBJECTIVES

- provide a safe and health promoting work environment
- provide effective and efficient work space
- provide consistency and long-term flexibility
- promote collaboration
- procure at an appropriate cost and level of quality
- Reuse or recondition where possible

For more detailed Information on the University commitment to sustainability, technical questions or clarifications contact the Office of Sustainability. For advice and information on the ergonomic requirements of furniture, contact the H&SC office.

7.3.7.2 PROCUREMENT

The University will utilise a number of different procurement vehicles for provision of furniture. This will be dictated by overall anticipated spend:

Spend	Procurement Model	Furniture specific
< $5,000	- Single source - Request for Quotation	- University approved supplier*
$5,000 to $100,000	- Min. 3 written Quotations	- University approved supplier* Tender - Government Property Group Tender
> $100,000	- Market Evaluation via Tender Process	- Government Property - - Group Tender GETS to open Market

**Contact Procurement for list of up to date approved suppliers*

fig 7.10: procurement schedule

In order to ensure required minimum standards are met when selecting and purchasing new furniture and equipment, the following guidelines are provided.

7.3.7.3 SPACE

This section has been deleted – refer 7.3.1.

7.3.7.4 FITMENTS

7.3.7.4.1 Task Chair

Chairs should have:

- adjustable height (gas operated lift mechanism)
- back with adjustable lumbar support
- seat depth adjustment (or a range of seat depths available)
- without arms as standard however from a range with an option for adjustable arms
- five star base for stability, and swivel through 360 degrees
- colour: Back office areas, preferably black for consistency
- shall meet AS/NZS4438:1997.

7.3.7.4.2 Workstations

- desks should be rectangular; 1600mm wide x 800mm deep with a scalloped back for cable entry.
- open plan bench desks, grouped in 2s, 4s or 6s. Individual desks where necessary.
- bench desks should provide the same working area as a singular desks
- metal framing for legs with adjustment at floor level for stability
- have appropriate cable management (basket) located under the desk
- shall meet AS/NZS4442:1997 and AS/NZS4443:1997.

Refer Worksafe Guidelines for using computers for further information relating to workstation set-up.

New build and refurbishment projects will provide electrically adjustable sit-stand desking to all office accommodation; the intention being to provide staff with adjustable 'Sit to Stand' workstations within the ACC recommended range of 650mm – 1100mm (or as close as standard supplier stock allows).

Standard height desking will be provided in all other areas at a height of 700mm – 725mm to height of working plane. Reuse of existing desking should be undertaken where possible provided it is space appropriate for the task. Existing desking to areas of Campus not under refurbishment will only be replaced with new sit-stand desking where recommended by the University H&S office following an occupational health assessment.

Desk tops shall be constructed from 25mm Low Pressure Laminate (HPL or SGL for Labs) with Low Formaldehyde content; E0.

Edge banding is to be 2mm thick PVC with radius corners.

Approved desk top colours are currently under review however back office desking should be Melteca 'Snowdrift' as standard.

The use of L shaped or corner desks is not endorsed due to the inefficient use of space; the University is actively removing these design types from the estate and no further desks of this design should be purchased.

Monitor arms may be considered on a project by project basis. Individual monitor arms are preferred over dual monitor arms for increased flexibility and reuse opportunity.

7.3.7.4.3 Desk Screens

- Top of desk screens shall not exceed 1200mm from floor level (max 500mm) a desk screen of 300mm high is preferred.
- Partitions should span the width of the desk they are attached to.
- Should have acoustic properties.
- Partitions provide an opportunity to add some colour to an environment but must be in keeping with the environment they are to be placed in.

Additional equipment may be necessary depending on the individual and their workstation set up. Copy holders, wrist rests and foot stools may be required. The University Health and Safety office are available to assist with deciding whether these items are necessary.

7.3.7.4.4 Storage and filing

There are two main types of storage:

Storage	Type	Description	Area/volume
Personal Storage	Under desk pedestal unit for personal belongings OR Lockers	2, 3 or 4 drawer lockable 'under desk' unit Multi-locker units	300 wide preferred
On floor team storage	Lockable cabinets	Tambour units	Width and height to suit installation.

fig 7.11: storage allocation

Lockable tambour units (sliding doors) is the preferred option for storage in most cases as it allows a variety of options and the ability to store filing away in a clean, tidy and secure manner. Conversely book shelving is not preferred.

The University has an abundance of 4 drawer metal filling in its recycling centre. No new 4 drawer metal filling cabinets should be purchased. The University preference is for tambour storage of varying heights to suit space requirements.

7.3.7.4.5 Meeting Rooms, Teaching Spaces and Common Space Furniture

In most instances rooms will be required to be highly adaptable spaces, with flexible arrangements which support meetings as well as informal and formal learning environments. In these rooms chairs shall generally be of the stackable lightweight type, and tables of a reconfigurable system to allow additional flexibility to the space. Chairs and tables will ideally be on castors to increase flexibility of teaching pedagogy. Higher levels of AV and IT provisions are also likely to be required, and the design should be carefully coordinated to ensure that the use of these technologies is supported through the design of the space.

There is an abundance of older style steel framed meeting chairs and tables around the Campus and in the recycling centre and as a result no additional chairs or tables of this nature should be purchased. The goal is to have a more modern and versatile stock of furniture for these types of spaces to allow greater flexibility of use.

All furniture purchases should be discussed with the PM or relevant FM.

Requirements for lectern provision and design should be discussed with the University AV team.

7.3.7.5 INTERNAL PLANTING

The use of planting within building interiors is supported. Any new planting within buildings should be discussed with Property Services Custodial Services early in the design process. Custodial Services will advise on supply, installation and management of any new planting.

The decision to install plants or not as part of the interior fitout will be taken by the department in question as they are responsible for the operational costs associated with supply and ongoing maintenance of plants.

7.3.7.6 SUSTAINABILITY

Property Services operate a Recycling Centre for used furniture. Open days are held each fortnight where departments can view what is available and make a request for any items that they could use. Items provided are on a first come basis and will be provided free of charge. Items are listed on the warp-it.co.uk website regularly.

7.3.7.7 H&S COMPLIANCE

Discomfort and injury in the office is one of the largest Health & Safety issues facing workplaces. For advice and guidance around workstation set ups and specific requirements please contact the University Occupational Health Nurse.

7.3.7.8 PROCUREMENT

The University Procurement Office can offer support and advice to staff regarding purchasing, making the most of the University's combined purchasing power and specialist knowledge.

7.3.8 INTERNAL DOORS & HARDWARE

7.3.8.1 DOORS

All internal doors to be robust, fit for purpose and in keeping with fire and aesthetic design of the surrounding space.

Any new doors in a proprietary glazing system should be supplied by the system provider.

Any timber doors should be solid core ideally with prefinished faces and lippings to suit the building.

Consideration should be given as to the Acoustic properties of the door and its integration with the adjacent partitioning. The weight of glazed doors should not to be excessive.

Double swing doors should not be used in most circumstances as it limits the ability to manage security and access control through use of maglocks.

All internal doors should be a minimum of a 910mm leaf (giving a clear opening of 850mm) to improve accessibility within buildings, particularly for wheelchair users. Refer **Accessibility Section**. Care should be taken when specifying sliding pocketed doors. A clear opening of 850mm will be required which may require a leaf size larger than 910mm to achieve the opening.

7.3.8.2 DOOR HARDWARE

The University requires all door hardware to be commercial quality, robust and hard wearing so as to minimise the level of repair and replacement throughout the life of the building. As such, good quality hardware should be utilised throughout. Designers may select the finish to suit the rest of the design scheme as appropriate.

Power Assisted Door Opening Devices: to be used where doors exceed maximum weight for manual operation.

Door Closers: to be used on all fire doors and corridor doors and where appropriate in individual rooms to suit functional requirement. Door closers to be externally located to allow

maintenance and ease of adjustment. Dorma Door Closers or equal and approved.

Levers and handles: may be either lever on rose with / without associated lock or thumbturn **OR** plate lever with associated lock barrel.

- Rose Lever Furniture: Legge (with return on the lever; straight levers with no return will not be acceptable). Door handles to be positioned 1000mm above finished floor level (measured to centre of lever).
- Plate Lever Furniture: Legge (with return on the lever; straight levers with no return will not be acceptable). Door handles to be positioned 1000mm above finished floor level (measured to centre of lever).

Pull Handles: Legge or equal and approved. Pull handles to be positioned such that the base of the handle is no higher than 1000mm above finished floor level and a minimum of 300mm high.

Push Plates: Legge or equal and approved. Push plates to be positioned such that the base of the handle is no higher than 1000mm above finished floor level and a minimum of 300mm high.

Kick plates: to be used on all heavy traffic areas, locations where trolleys are utilised (250mm high) and on all disabled WCs (400mm high). Kick plates will be minimum 2.5mm thickness in stainless steel with pre-drilled countersunk holes and screw fixings. Kick plates should be face fixed on both sides of the door and the full width of the door (minus door stop width).

Locks: Locks will be keyed to the University keying system, to be arranged by Property Services. Where locks are to be keyed to existing University master keys, project keys are to be used during the construction. Requirements for suiting should be confirmed by the Project Team.

Key the locks on cleaners' cupboards/rooms to open with the same key.

Thumbturns should be fitted where doors to cellular accommodation which have locking devices to aid escape.

Lockwood locks should be used for lockcases with type to suit application.

Barrels / Cylinders: standard Lockwood oval shaped brass cylinders and brass barrels. Contractors should purchase through the University approved supplier; Begg Security.

The University master key system is managed by FMs. Keying requirements are:

- 2 keys per lock + 2 master keys to be retained in PSD master key system retained in PSD building (Numbered by PSD) (*e.g. one building has ten locks = ten pairs (twenty keys) + two master*).
- Spare keys will be supplied to end users only by request approval by FM.

Maglocks: to be in line with Security guidelines. Refer **Security Section**.

Hinges: to be Legge 13000 Series Stainless Steel. 1.5 pairs per door. Type to suit application.

Panic Hardware: where panic hardware is required it should be Von Duprin 22 series Exit Device.

Doorset markings: fire doors to have doorset markings in accordance with NZBC.

Door stops: to be fitted to all doors where opening against a wall. Preferably floor mounted and to match all other hardware finishes. Legge or equal and approved.

7.3.9 FLOOR FINISHES

7.3.9.1 CARPET

Carpet tiles should be specified in the main to allow for ease of replacement when damaged. Broadloom will only be considered for the Campus under special circumstances.

Carpet tiles should attain the following minimum standard:

- Commercial grade carpet tiles
- Total thickness no less than 6mm
- 10 year guarantee

Preference is for carpet tiles with a recycled content in excess of 25% and consideration should be given to utilising manufacturers that recycle offcuts and collect redundant carpet for recycling.

Consideration should also be given to transition with other flooring materials. Where differing carpets abut they should have a thickness differential of no more than 1.5mm to reduce the potential for trip hazards. Where carpet is abutted with sheet flooring materials such as vinyl a suitable proprietary transition strip should be utilised.

Latex screed should be used as required for preparation of the existing surface to provide a level substrate.

Allowance should be made in all projects for provision of spare tiles at completion (under the main contract). Allowance should be made for:

< 1,000m2: 1.5% of the overall floor area (minimum of 1 box)

> 1,000m2: 1% - 1.5% of the overall floor area (discuss and agree with the Facilities Manager)

Consideration should be given as to the design of floor coverings to:

- assist demarcation of circulation and fire escape routes
- differentiate public and private space
- compliment the interior design concept
- address entranceway transition zones with entrance matting
- address cleaning regime (plain and light colours should be discouraged over darker and patterned carpet)
- enable deployment of fire curtains or ensure correct operation of fire doors

7.3.9.2 VINYL & SLIP RESISTANT FINISHES

Vinyl floor coverings should be provided in the following areas:

- Labs
- Kitchens and Tea Prep areas
- Toilets

PC Lab vinyl shall be Tarkett IQ Granite with welded joints and 100mm coved skirting. In those areas where liquid nitrogen is decanted an epoxy floor sealer shall be used. Flooring must be assessed to the AS/NZS 3661 standard and copies of results recorded. Vinyl should be tested under the expected use conditions.

Marmoleum products or products which require regular polish application regimes are not to be specified due to high labour intensive cleaning and maintenance requirements.

Studded vinyl, non-slip vinyl and studded rubber flooring can all be utilised. Whilst they represent a compromise between safety and cleaning, they will be acceptable as long as they are carefully detailed. Dark coloured studded rubber products should be kept away from direct sunlight due to UV damage. UV resistant finishes should be specified where possible.

White or light coloured vinyls should be avoided.

Tiled flooring in toilets should be avoided as grouting is difficult to keep clean, particularly in high traffic areas.

7.3.10 DECORATION

Interior wall and ceiling finishes should be from the following paint manufacturers:

- Resene (preferred)
- Dulux

Following completion of a new build or refurbishment the Property Services Facility Management Team are responsible for ongoing maintenance for the remaining life of the building. Redecoration of spaces is planned on a Planned Preventative Maintenance cycle however incidents and wear and tear can necessitate repairs or patching to be carried out. As such it is important that following completion of a fitout, the following information is made available within the O&M Manuals to assist with repainting or patching:

- Name of Company that carried out the Decoration work
- Full specification of paint system including:
  - Manufacturer
  - Range
  - Product, including code and sheen type (Matt, Glass, Lustre)
  - Colour Reference
- Location of paints used.

Specifications for paints used by Property Services Division include:

- Walls (general): Resene Lumbersider; Water based, Low Sheen;
- Ceilings (general): Resene Ceiling Paint; Waterborne, Flat; 'White'
- Walls (Labs, Kitchens, toilets): Resene SpaceCote; Waterborne Enamel, Flat;
- Ceilings (Labs, Kitchens, toilets): Resene SpaceCote; Waterborne Enamel, Flat; 'White'
- Woodwork: Resene Lustacryl, Waterborne Enamel, Semi-gloss;

Where working within existing buildings please check with Property Services as to existing colours used.

Buildings within the Heritage Precinct have the following colours for exterior woodwork:

- Windows and Doors: Resene Enamacryl, Waterborne Enamel, Gloss; 'Cuban Tan'
- Downpipes, Gutters and Metalwork: Dulux, Roof and Trim, Micaceous Oxide, Gloss; 'Metallic Earth'

Resene Coolcolour should be considered for external wall and roof finishes where a paint finish is required and resistance to heat build-up, particularly on darker colours.

7.3.11 BRAND

The University Marketing and Communications division have developed a Brand Guide to provide clear guidance to ensure that the University's visual image and impact is as strong and consistent as possible and is seen to have integrity and meaning. The Guide outlines the requirement for stationery, promotional publications and advertising.

No guidance is provided for brand colours in relation to internal fitout and consultants should consider individual projects on their own merits. Whilst there may be occasions where brand colours may provide a useful tool in the design of a space, more often than not the brand colours should be more subtle in application.

7.3.12 SIGNAGE & WAYFINDING

The University signage and Wayfinding is currently under review. This includes internal and external signage as well as new media.

A student mobile app has been developed by IT Services to assist with student movement and wayfinding around Campus. The app's wayfinding functionality uses University ArcGIS data sets to produce a layered map of the campus, and dynamically links points on the map to Google and Apple wayfinding technologies. Additional wayfinding functionality is planned for future software releases.

If you need further IT information or advice regarding signage and wayfinding, please contact its.design-facility-support@otago.ac.nz in the first instance.

Please also note that University Enterprise IT roadmaps for Networking and Teaching Technologies, propose new

'smart building' initiatives that may include in-building and on-the-lecture-theatre-door digital signage in the medium term. For further details regarding the roadmaps please contact the IT Enterprise Architect in the first instance.

The University's Marketing team should be consulted as to signage content and the existing Otago Signage Standards should be followed. This will assist in building a strong and consistent brand across the Campus. Designers should decide on the quantity and location of required signage to suit individual Projects in line with the standard.

In most circumstances the Property Services Division will be able to supply and install the proposed signage, however timescales and workload will dictate whether this is possible. Please contact the Property Services Painting Department for further information.

Standardised signage should be utilised for the following:

- Campus Wayfinding Signage
- Building Signage
- Directory Boards
- Internal Wayfinding Signage
- Room Function (Door) Signage

External signage should be mounted on black painted or powder coated posts with all fixings to the rear (no face fixing). Accepted signage materials are 4mm and 6mm Aluminium Composite Panel with additional bracing to suit signage sizing.

All principal University signage will have a Māori translation provided. This should be offered on an equal weighting of size and scale with the English text. The office of Māori Development should be consulted on all matters of translation. Refer also the **Cultural Section**.

Room signage should be in line with room numbering (refer Space numbering Guidelines Version 2.1 – April 2017)

Directory boards should be present in main entrances and in all vertical circulation spaces (stairs and lifts at each floor). Directory boards will be in line with Otago Signage Standards and will be supplied and installed by Property Services.

Door signage should be in accordance with NZBC/F8. Signage should be pictorial and metal backed, screw fixed to the door. Refer also **Fire Section** and **H&S Section**.

7.3.12.1 CCTV SIGNAGE

Where CCTV is installed there is a legal requirement to comply with the Privacy Act and inform people that they are potentially being recorded. Where CCTV is present, signs should be installed:

- At all entrances into the building: Where there is access through more than one entrance / building, all entrance points should be covered.
- The signs should be installed as close to the main entrance(s) as possible

The University has a suite of standardised signs for the purposes of informing of the locations of CCTV. The signage states *'Crime Prevention Cameras Operating at all times in this area'*:

- Self Adhesive Small (positive / negative to suite wall / window) – window stickers should be placed on the internal pane
- Self adhesive Large (positive / negative to suite wall / window) – window stickers should be placed on the internal pane
- Aluminium Large (affix with high strength adhesive stickers)

In most cases the installation of the aluminium panel on a wall adjacent to or facing the entrance is preferred. Lesser entrances can be by means of a small sticker on the wall or on a door or side screen. Designer discretion will be required on a project by project basis. Signs should generally be installed at 1600mm (floor to centre) as standard and must be visible.

7.3.13 ARTWORK

The University has an Artworks Collection Policy. Any new project will make provision for artwork to be included. This may be by means of commissioning new artwork or utilising artwork already in University collections. Consultation should be undertaken at the early stages of a Project with Property Services who manage The University Project Artwork and the University Artwork Collections Committee. The selection or commissioning of artwork will be a collaborative approach involving the designers, FM, PM and cultural engagement as appropriate.

7.3.14 RECYCLING & WASTE

Recycling within buildings will be provided in centralised locations across the footprint of the building. Centralised recycling stations offer paper, mixed recycling ('co-mingle'), glass and landfill as standard. These centralised hubs will replace individual waste bins. The University utilises Method products which provide a cluster of easily accessible and attractive bins. Bins should be located where staff / students can easily access them ideally within a 10 second walk. Provision should be made for bins to be provided on a ratio of 3-4 bins per 30 staff. Consideration as to location and quantity should be given for student areas. Method bins come in standard colours corresponding to the relevant waste stream:

- Paper: Grey
- Mixed: Yellow
- Landfill: Red
- Glass: Blue

Where new recycling facilities are required contact should be made with the Waste and Recycling Manager to discuss requirements and design layout. The University's Property Services Division will place the order for the bins direct with the supplier.

The location of recycling bins must ensure minimisation of fire risk with consideration to recessing in access routes and potential for additional smoke detection. Bins should not be located in safe paths. Installation of bins in open path corridors may require consultation with the Fire Engineer or Building Information and Compliance Team to asses risk.

Organic Waste is likely to be added as a further waste stream in the near future. The University will begin to phase out individual waste bins at desks as centralised recycling is rolled out across Campus.

Skips stored adjacent or close to the exterior of the building may pose an exposure risk to sprinkler protected buildings. External waste storage around sprinkler protected buildings will require comment from the Fire Engineer or Building Information and Compliance Team.

Recycling bins are also provided across the Dunedin Campus grounds. These bins offer similar recycling opportunities, mixed recycling, landfill and glass and are generally provided as a cluster of 3 bins on a metal stand mechanically fixed to the ground. The specification of external recycling is currently under review and will be advised in due course.

Provision shall be made for storage of external skips for waste disposal and bins for both paper and cardboard recycling. Entry to the waste disposal storage area shall be from the adjacent street and of sufficient size to permit access for large service vehicles.

7.3.15 CLEANING PROVISION

7.3.15.1 INTERIOR & EXTERIOR SURFACES

Consideration should be given to ease of cleaning, with built in mats or mat wells at building entrances with appropriate threshold matting or brush carpet.

7.3.15.2 CLEANING STORAGE

Consider the fact that most cleaning takes place at night. Areas that need "good light" include toilets, corridors and stairwells, for both safety and so a proper job can be done.

Small buildings shall have a cupboard (approximately 1m2) with shelving starting halfway up the cupboard, and space below for the vacuum cleaner, bucket, and mop. Provide access to a hot and cold water supply suitable for filling buckets.

Medium size buildings shall have a cupboard (approximately 4m2) with shelving for toilet paper etc, space for the polishing machine, vacuum cleaner, bucket, and mop, and a cleaners' sink.

Large buildings shall have cupboards on each floor level at least, the same as for small/ medium size buildings. In addition, there shall be a room provided (approximately 12m2), with shelving for supplies, and space for cleaning equipment. Cleaner's cupboards in multi storied buildings also need to be big enough to accommodate a cleaner's trolley (currently utilising Rubbermaid Mega Brute with a footprint of 1350mm x 700mm).

All cleaner's cupboards should be ventilated to remove moisture from the air.

The following shall also be provided in all cleaner's cupboards:

- Lighting
- Small whiteboards in the cupboards to enable messages to be left between cleaning staff.
- Coat hooks to hang cleaners' belongings
- A minimum of two large hooks for power extension cords.
- A hot and cold water supply.
- Door locks are to be suited.

Provide lighting in cleaners' cupboards. Provide small whiteboards in the cupboards to enable messages to be left for cleaning staff. Provide also coat hooks to hang cleaners' belongings, and a minimum of two large hooks for power extension cords. Cleaners' sinks shall have a hot and cold water supply. Door locks on cleaners' cupboards / rooms are to be suited.

Check proposed cleaner's provision with Custodial Services and gain approval for proposals at concept design stage.

7.3.16 DESIGNING FOR ROBUSTNESS

Consideration should be given to fitouts where functional use of the space may cause damage to finishes over time. In many cases it may be appropriate to install sacrificial protection to limit and manage the level of damage. This should include consideration of:

- Increased heights for kickplates
- Wall and Edge protection: Service areas where use of trolleys is prevalent
- External Bollards and upstand kerbs in parking areas directly adjacent to buildings or plant areas with suitable stand off around overhanging eaves.
- Use of appropriate hardware and clarity around light, Medium and Heavy duty requirements
- Hardwearing and easily washable floor finishes

7.4 EXTERNAL WORKS

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Transport (17)
- Land Use & Ecology (23-24)
- Emissions (25)

7.4.1 LANDSCAPING

Landscaping across the Dunedin Campus is managed by the Grounds Maintenance Team within Property Services. The University is fortunate to have a rich landscape within the city. Over recent years significant investment has been made in landscaping. Landscaping is an important element which can connect the sometimes disparate and opposing styles of Architecture across Campus. It is therefore imperative that a high standard of landscaping and external amenity is maintained to preserve the Campus setting. The University programme of landscaping improvements will continue over time, extending the current rationale of hard and soft landscaping and improving amenity for students, staff and public.

The design of any new landscaping should make appropriate access for maintenance.

Many of the trees across Campus are mature and fine examples of their species as well as being an integral element of the Campus landscape. The University has a Tree Management Procedure which should be adhered to for any works associated with maintenance or removal. Some of the trees across Campus will also be protected and identified in the local District Plan and may therefore require consent to alter or remove.

The University prefers and supports use of native species where possible.

7.4.2 SMOKING

All of the University's Campuses are no smoking and no vaping zones and no provision need be made for smoking shelters or ashtrays.

7.4.3 PARKING

Parking should be provided for in line with local Authority guidance. Please refer **Accessibility Section** for further details of accessible parking spaces and heights for parking payment machines.

Parking spaces should be designed based upon dimension of 5000mm x 2500mm.

Where parking is provided within buildings, protection should be provided to reduce the potential for collision with building fabric. Bollards, vertical edge protection horizontal barriers or kerbs are all appropriate.

If any planned building parking spaces include IT sensor networks and/or parking space management IT systems, please contact its.design-facility-support@otago.ac.nz in the first instance.

7.4.4 ELECTRIC VEHICLES

Uptake of electric vehicles to date has not necessitated the University considering any requirement for electric vehicle charging stations. Notwithstanding this, the University is committed to sustainable energy use, and accordingly encourages designers to specifically consider any specific need for the provision of such charging stations at the time that design is undertaken.

Refer **Fire Section** 10.1.2 Lithium Battery Charging and **Electrical Section** 9.5.2.5.

CYCLE STORAGE

The University encourages cycling as a sustainable and environmentally friendly means of transport. In 2017 4% of students and 6% of staff cycled to the Campus. These numbers are likely to increase with cycling becoming ever more popular and the provision of cycle lanes immediately adjacent to the Dunedin Campus. Further, the introduction of e-bikes has boosted the trend. Whilst cycling is encouraged, there are areas of the Campus where cycling is prohibited and cyclists must walk with their bikes. This has been introduced to manage pedestrian safety on Campus.

There are a variety of cycle storage opportunities around Campus which vary in their quality and function from cycle hoops to covered and secure cycle storage. There is a distinct differentiation between the needs of staff and students and the University will look to provide the following wherever possible:

- **Students and public**: Provision of covered, non secure cycle storage at regular intervals across Campus to allow cycle storage close to all buildings. Students will provide their own locks. Provision of centralised changing and showering facilities.
- **Staff**: Provision of covered, secure cycle storage located at regular intervals across Campus and ideally within or adjacent to each building to allow cycle storage close to all places of work. Provision of local changing and showering facilities within each building.

Whilst facilities are not currently present in every building, when major refurbishment is proposed, the opportunity should be taken to introduce appropriate facilities.

The University has no 'standard' specification for covered cycle storage. Covered storage should be appropriate for its setting and should be of a high quality, enhancing the landscaping.

Similarly, the University has no standard specification for 'secure' cycle storage. Storage may be constructed using a variety of materials and should have secure access to the facility via a fob entry with mag lock utilising the existing Gallagher system (refer **Security Section**). Cycles can be hung from the ceiling to increase space usage.

Racks used for cycle storage should be stainless steel rather than galvanised and an inverted 'U' or 'D' rack should be provided. 'Toast rack' cycle storage should be avoided – there are plenty of these around Campus at present and they are being phased out.

The University has no standard specification for 'cycle changing facilities'. Facilities should be functional and close to cycle storage. Individual unisex showers may be provided and consideration should be given to quantity based on best practice and building type. Lockers should be provided for cycle storage.

Cycle storage and facilities should be designed into and around all new buildings.

7.4.5 SKATEBOARDING

Skateboarding is a small but recognised mode of transport across Campus and is permitted in most areas. Consideration should be given in key public buildings for public storage of skateboards at the main entrance within the building.

DESIGN & FACILITY STANDARDS

SECTION 08:

STRUCTURAL & SEISMIC

08

8.0 STRUCTURAL & SEISMIC

The University is in the process of developing this section of the guidelines. This section of the document will be updated in future revisions of this document. A holding statement of high level requirements is provided whilst the Structural standards are in progress.

8.1 SEISMIC POLICY

The University Seismic Strengthening Policy sets out the requirements for minimum acceptable standards of seismic design. This Policy sets out that all new buildings must fully comply with building standards and that all existing buildings which are defined as Earthquake prone should be brought to at least 34% (67% for Residential Colleges). These buildings will be given priority for improvement as part of the Capital Works Programme.

8.1.1 SEISMIC ASSESSMENTS

The university has carried out Seismic Assessments across a large section of its building portfolio. Consultants should request information from the PM as to whether an IEP (desktop assessment) or a DSA (Detailed Seismic Analysis) has been carried out.

The University is about to embark on a further programme of Assessments for post 1976 buildings and parapet and feature works to continue to reduce Seismic risk across the Campus.

8.1.2 SEISMIC BRACING

Seismic bracing and restraints should be considered for the following:

- Non-structural elements
- Ceilings
- Internal Screens and partitions
- Services reticulation and fixtures
- Plant and equipment
- Certain items of loose furniture & shelving

Design of seismic bracing should be carried out by consultant design prior to construction. Design works should be coordinated with all other fabric and services installations to ensure sufficient space for the bracing. Leaving the design to contractor designed portion whilst on site adds too much risk to project programming.

8.2 GROUND CONDITIONS

Recent projects on the Dunedin Campus have uncovered multiple issues below ground which have resulted in an increased project risk to both programme and cost.

- Ground Contamination:
- Geological ground conditions

As a result of these findings the following considerations should be made on future projects:

- Comprehensive testing for all contaminants, including HAIL review with TA, included in consultant SOS
- Standards for soil testing to the standards contained in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health, and BRANZ asbestos in soil guidelines 2017.
- NZGS Specification to be used by Geotech consultants for scope
- Consultant to conclude on both historical and current geotechnical information in tender.
- Have a proven alternative foundation solution ready for implementation if the testing does not confirm the viability of the selected solution.

The University may decide to undertake early testing of the site to confirm geotechnical information. This should be discussed and reviewed at the early stages of the project led by the PM. Any applicable consents and archaeological requirements must be addressed prior to any testing.

The University may decide to employ an independent resource to monitor foundation progress on site. This should be discussed and reviewed at the early stages of the project led by the PM.

Peer review must be undertaken for all Geotechnical and foundation design (including any alternatives proposed).

DESIGN & FACILITY STANDARDS

SECTION 09:

MECHANICAL, HYDRAULIC & ELECTRICAL SERVICES

09

9.0 MECHANICAL, HYDRAULIC & ELECTRICAL SERVICES

9.1 INTRODUCTION

These guidelines describe the University's expectations for the design, manufacture, installation, commissioning, operation, maintenance, decommissioning and disposal of the building services systems and equipment. The University recognises the building services are of major importance to the successful operation of its buildings.

These Guidelines are generally arranged with general performance requirements first followed by specific requirements for materials and methods. No direction in these Guidelines shall be construed as contravening legal requirements or accepting less than industry good practice. Where the Designer or Installer believes this may be the case, it shall be brought to the University's attention.

When appropriate these Guidelines will be supplemented by a Project Specific Brief prepared by Campus Development. The Brief will generally be used to expand on the Guideline requirements for a particular project. The Brief may also modify the Guidelines' requirements in some cases.

Building services' design and installation will be subject to review by the University Building Services Engineer.

9.1.1 PERFORMANCE

The performance requirements provide guidance or direction where the University's requirements exceed the NZBC and Territorial Authority by-laws and/or exceeds or differs from industry accepted practice/standards. It is not the intention of these guidelines to inhibit the adoption of new technology (once proven) or to discourage innovation. The University is open to discussions about improving outcomes or levels of performance.

9.1.2 MATERIALS & METHODS

The material & methods requirements provide guidance or direction where the University's requirements exceed, or differ from, accepted industry practice/standards. It is not the intention of these guidelines to inhibit the adoption of new technology (once proven) or to discourage innovation. The University will always consider the use of alternative materials and/or methods where they will provide an improved outcome.

9.2 GENERAL BUILDING SERVICES

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Commissioning & Tuning (2)
- Metering and Monitoring (5.1-5.2)
- Operational Waste (8)
- Energy (15-16)
- Water (18)
- Materials (19-21)
- Emissions (25-28)

9.2.1 COORDINATION WITH UNIVERSITY OPERATIONS

Where a project involves connection to, or modification of, existing systems or equipment, the Designer must maintain the design intent of the original installation and consult with Property Services as necessary. The Installer shall provide shop drawings for University review prior to commencing work on existing systems.

When construction occurs in an existing building which will be occupied or continue in operation, Designers and Installers must make due consideration of ongoing University activities, including ensuring acceptable environmental conditions and amenities are maintained for the occupants and other building users. In addition to implicit health and safety requirements, this includes power supplies to life safety systems and adequate ventilation, heating & cooling, cold and hot domestic water, sanitary facilities, lighting, general power and the mitigation of construction noise, dust and odours. For capital projects managed by Campus Development, a *Request to Interfere with Services or Safety Conditions* (RISC) system will be in use. Installers must complete a RISC application form and submit for approval by Campus Development & Property Services before commencing work.

All building services shut downs and outages must be agreed by, and coordinated with, Property Services. Where outages are scheduled for the benefit of the Installer's programme, the Installer may be required to provide temporary equipment or make temporary modifications to maintain existing systems during the outage. Strategies for outages must be agreed with the Project Manager (PM) and Facility Manager (FM) in advance of the work commencing. If maintenance of existing services or mitigation will not be possible, it must be brought to the attention of the PM and FM as early as possible.

All temporary disconnections/isolations of existing services required for a project must be carried out or managed by Property Services.

9.2.2 EQUIPMENT & SYSTEM APPROVAL

9.2.2.1 Acceptable Equipment

The University maintains a schedule of acceptable building services equipment manufacturers. Poor performance or reliability of the equipment and/or poor service support by a manufacturer or its agent will result in acceptance for a manufacturer's products being withdrawn.

The Designer shall refer to this schedule during design and select plant and equipment from these manufacturers' ranges whenever they can provide suitable products.

It is not the intent of this requirement to undermine competitive procurement or slow the uptake of better technology. A Designer or Installer may propose the products of a Manufacturer not on the schedule for the University's consideration where the products will provide a benefit over those of currently acceptable Manufacturers. The proposal must include the following information:

- Reference projects for the product (completed projects only and at least one must be in New Zealand)
- How the manufacturer or their agent will commission the plant or equipment (where required)
- How the manufacturer or their agent will provide local service support and stock spare parts
- The manufacture and/or Installation quality assurance methodologies used (where relevant)
- The warranties and guarantees provided by the manufacturer
- The legal relationship between the manufacturer and their New Zealand agent
- The associated benefits of using the alternative product
- Any spatial impact associated with the use of the alternative product
- Any performance impact associated with the alternative product (positive or negative)
- Any cost impact associated with the alternative product (positive of negative)

9.2.2.2 Pre-Fabricated/Modular Systems

Pre-fabrication of sub systems and modular construction is encouraged where it provides time, cost and/or quality benefits to projects.

Components of prefabricated building services sub-systems (e.g. Toilet/bathroom modules for residential colleges) shall only use products from Manufacturers on the University's acceptable manufacturers schedule or which have been accepted by the University prior to the commencement of manufacture.

Prefabricated sub-systems and modules must be designed and fabricated with adequate provision for maintenance access.

9.2.2.3 Sample Installations

For repetitive or modular building services installations, the preparation of a mock up or sample installation early in the construction period is required so that the University may make a thorough inspection and agree an acceptable quality standard with the Designer and Installer prior to full scale installation commencing.

9.2.3 SPECIALIST FACILITIES – GENERAL REQUIREMENTS

9.2.3.1 Laboratories

Designers shall review the University's HSNO Exempt Laboratory Manual and ensure that all requirements applicable to building services are included in their design.

9.2.4 LOCATION & APPEARANCE

9.2.4.1 Appearance & Finish

The University wishes to maintain the appearance of Campus heritage buildings and the general aesthetic standard of all facilities.

For all projects, the proposed location and finishing of external plant and equipment shall be submitted to the FM for approval.

For larger projects and all projects on heritage buildings, the proposed location and finishing of external plant and equipment shall be submitted to the University Architect for approval. This should include architectural screening of all major plant where necessary. The positioning of external plant on heritage buildings may also be subject to resource consent requirements and review by Heritage NZ. The Project Specific Brief may include additional requirements.

The finishing of exposed ductwork, pipework and electrical conduits shall comply with the requirements in these Guidelines.

9.2.4.2 Protective enclosures for external plant & equipment

All external plant and equipment at ground level or in any location which could be accessed by the public shall be secured within a protective enclosure to prevent unauthorised tampering and vandalism. The enclosure shall not prevent safe and convenient access to the plant by authorised personnel.

9.2.4.3 Corrosion protection of external plant & equipment

The majority of University sites are located in regions classified as having moderate to severe exposure to

windborne salt (as defined in the environmental classification of AS/NZS2312). Accordingly, all materials susceptible to corrosion caused by windborne salt shall have a suitable protective finish to ensure the expected life span of the plant or equipment is not significantly reduced by corrosion.

9.2.5 PASSIVE FIRE

All building services penetrations through fire and smoke separations and other fire rated building elements shall comply with the University passive fire guide.

Services passing through fire separations shall be installed so that there is adequate clearance between any fittings and supports (e.g. bends, tees, traps, brackets, transitions) and the face of the separation so that any passive fire collars, sealants, batts etc can be installed on a clear straight length of the service. Services must penetrate the separation perpendicular to the fire separation face.

9.2.6 RESILIENCE

Many of the University's facilities are important or critical to business continuity. The building services design must provide a level of resilience appropriate to the criticality of the building's functions for the following scenarios:

- Seismic events
- Flooding
- Utility electrical outages
- Utility water outages
- Disruption to fuel supplies
- Fire damage
- Damage or loss of building services equipment
- Outage of Specialist Equipment

The Project Specific Brief will advise the level of criticality of a building or a facility within a building.

The level of resilience for building services plant and systems required by the building's criticality level will be determined by the Design Team during concept design with the assistance of the client Department, the University Risk, Audit and Compliance Office, Property Services and Campus Development.

All University Divisions/ Departments have a Business Continuity Plan (BCP) which details the functions/services they need to be able to provide during the recovery period after an event. Designers must review the BCPs of client departments to ensure their designs include the features required to allow the BCP to be executed.

For high criticality buildings, a building services resilience report should be provided at preliminary design which details how the required level of resilience will be achieved. The report should capture the requirements of each building services discipline and ensure the level of resilience is consistent across the disciplines.

9.2.6.1 Seismic events

A building's level of criticality will define the level of earthquake protection required for building services.

Beyond preventing an equipment or system failure which creates a hazard to occupants, earthquake protection may be required to allow some systems to remain operational after a seismic event.

Where equipment or systems is not required to remain operational after an event but it is undesirable for there to be an excessive delay in returning the buildings to service, the required time to return to service will be advised in the project Specific brief or will be defined with the assistance of the Design Team during Concept Design.

Guidance on Building services earthquake protection is included in the Earthquake Protection section below.

9.2.6.2 Power Outage

The level of mitigation required for electrical outage will be defined in the Project Specific Brief. It may include:

- Power supplied from multiple sub-stations
- Generator or generator connection point for continued power supply to essential services including HVAC systems. lighting and access control.
- UPS for short term power supply to life safety and business critical systems.

9.2.6.3 Disruption to fuel supplies

Heating systems are dependent on continuity of fuel supply (e.g. LPG, NG, wood chips). The level of mitigation required for a disruption to the fuel supply will be defined in the project specific brief. It may include:

- Providing back-up heating plant which uses an alternative fuel.
- Providing a reserve cylinder manifold to allow appliances/boilers to be supplied from gas cylinders in the event of an outage of a reticulated gas supply.

9.2.6.4 Potable water Outage

The level of mitigation required for water outages will be defined in the Project Specific Brief.

The mitigation strategies may include:

- Multiple town mains connections
- Onsite storage tank(s). Tanks located inside the building shall be complete with a fill line and connection on exterior of building to allow refill by tanker.
- Operational precautions e.g. keeping collapsible water tanks ready for use.

- Operational contingency plans for obtaining water or reducing water consumption.

9.2.6.5 Flooding

The required level of protection from flooding will be defined in the Project Specific Brief.

The flood risk of locating critical equipment such as electric power supply substations, main switchboards and emergency standby power plant in basements or below ground floor level should be considered and adequately mitigated.

All below ground levels shall be provided with a sump(s) fitted with a sump pump complete with water high level alarm. Where the sump is in an area where the presence of water would be unusual in normal circumstances, a moisture sensor alarm shall be provided also.

The risk of flooding to any room which contains critical specialist equipment should be considered and the risk mitigated where appropriate. A suitable precaution would be a room moisture sensor with alarm.

9.2.6.5.1 External Flooding

Careful consideration should be made of the flood level of nearby water courses and all critical plant and equipment shall be located above the 1 in 100 year flood level unless impractical.

9.2.6.5.2 Internal flooding

Plant rooms containing water storage vessels shall have wall bunding adequate to contain the full volume of the largest tank or container in the space. The bunded area shall drain safely outside the building.

Plantrooms above ground floor which contain water storage vessels shall also have a sealed floor and sealed concrete upstands for any floor penetrations within the bunded area. A bund mounted moisture sensor with alarm should also be considered.

Adequate mitigation of the flooding risk from a higher storey shall be provided for switchboards and electrical risers.

9.2.6.6 Fire

Refer **Fire Section** for further information.

9.2.6.7 Damage or Loss of Building Services

The required level of resilience for building services plant and systems will be defined in the Project Specific Brief or with the assistance of the Design Team during concept design.

Single points of failure within a system shall be identified and mitigated in line with the level of risk and/or disruption they create.

Refer the Plant & Equipment Redundancy section below for further information.

9.2.6.8 Outage of Specialist Equipment

Requirements for resilience of specialist equipment (e.g. healthcare, laboratory, IT equipment) will be identified in the Project Specific Brief.

Resilience may include mitigation of the risk of specialist equipment outage due to fault or outage of building services systems serving the equipment e.g. loss of steam for sterilisers.

9.2.7 PLANT & EQUIPMENT REDUNDANCY

The required level of redundancy of building services plant and equipment will be defined in the Project Specific Brief or with the assistance of the Design Team during concept and preliminary design.

The importance of building services systems to the functions/services provided by a facility shall be evaluated. Building services systems that are essential to important or critical facility functions must be designed with adequate redundancy so that a failure of an item of plant or equipment will not disable the entire system or reduce its capacity below an acceptable level.

The evaluation should be holistic to identify all other systems, 'upstream' or 'downstream' of a particular building services system which are required for that system to perform adequately.

Redundancy could be provided by:

i. Duty/standby plant. Operation of the machines must be alternated to ensure each is ready in case of the failure of the other(s).
ii. Part load - parallel operation plant. Each machine must be selected to operate at high efficiency during normal operation.
iii. Plant internal redundancy e.g. multiple independent refrigerant circuits in chillers.

The use of operational measures to supplement, or take the place of, redundancy (e.g. keeping spare parts on site for quick swap out, installation of temporary plant or postponing/relocating activities to reduce demand) should be investigated with the Client Department.

Plant and equipment redundancy and operational measures must be consistent with any Service Level Agreement between Property Services and the Client Department.

For high criticality buildings, how the plant and equipment redundancy will be provided should be detailed in the requested Resilience Report.

This section will be expanded in the next revision of these Guidelines.

9.2.8 FUTURE ALLOWANCE & FLEXIBILITY OF BUILDING SERVICES

9.2.8.1 SPARE CAPACITY

The building services in all new and redeveloped buildings with more than 10 years remaining life shall include adequate spare capacity for future increases/changes in demand.

9.2.8.1.1 Plant & Reticulation

Central plant and backbone reticulation should be sized to provide some spare capacity. Preferably the spare capacity for the remainder of the systems will be provided by allocating spare space for the future installation of additional equipment and reticulation. However, where such retrofitting will be impractical or uneconomic the spare capacity should be included in the initial design.

It is expected the design of this spare capacity will take account of the spare capacity inherent in the following:

i. The use of standard pipe and duct size increments.
ii. The use of good design practise safety margins/factors. (Compounding of safety margins which will lead to the significant oversizing of plant should be avoided).

It is preferred that spare capacity of plant be available by adjustment (e.g. re-pitching axial fans blades, increasing motor speed by VFD or belt & pulley change) rather than replacement of major components (e.g. fan or pump motor).

Plant should be selected to

i. operate at high efficiency at the current design conditions and,
ii. to be capable of providing the spare capacity without significant loss of efficiency.

Refer Mechanical Services, Hydraulic Services and Electrical Services sections below for indicative requirements for the spare capacity of plant and reticulation.

9.2.8.1.2 Space

Adequate space allowance for future expansion or addition of building services systems should be provided in the design of new buildings and major redevelopments. Indicative space allowances are detailed below however the appropriate space allowance will depend on the size, layout and function of the building and should also be informed by any site or precinct masterplan.

9.2.8.1.2.1 Plantrooms

For large technical facilities, main plantrooms should have the greater of 10% of floor area or 30 m2, as a single clear area with access to risers or other distribution routes. Additional space that would be required for circulation should also be provided.

9.2.8.1.2.2 Switchboard Rooms & Cupboards

New main switchboard rooms should have a 900 mm wide clear area for future expansion or additional equipment.

Large distribution board cupboards should have 600 mm wide clear area for future expansion or additional equipment.

The space allowances should include for the likely required access clearances.

9.2.8.1.2.3 Risers Shafts

All new riser shafts in multi-story buildings must be provided with a degree of spare space, which can be accessed for future installation of ductwork, pipework and cables. As a minimum:

iii. Main service riser shafts should include adequate spare space (and installation access) for the future installation of any of 2 no. 300 x 300 mm duct risers or 4 no. 80 mm diameter pipe risers or 2 no. 100m diameter drain stacks or 2 no. 300 mm wide cable ladders.
iv. Secondary service riser shafts should include adequate spare space (and installation access) for the future installation of any of 1 no. 300 x 300 mm duct riser or 2 no. 65mm diameter pipe risers or 1 no. 100m diameter drain stack or 1 no. 300 mm wide cable ladder.

The spare space must be in the form of an unobstructed vertical corridor and include pathways for branches to exit/enter riser.

9.2.8.1.2.4 Ceiling Voids

For new technical facilities, the ceiling voids in corridors and other main reticulation routes should include a reasonable space allowance for the future installation of some additional pipework or ductwork. This space allowance should be included in the ceiling void zone allocated for building services by the Design Team.

9.2.8.2 FLEXIBILITY

For facilities likely to undergo organisational 'churn (e.g. office building, laboratories), Designers shall consider the possible need to modify systems (e.g. HVAC, domestic water, lighting & power) to suit new layouts and usages and select systems which have an appropriate level of flexibility.

9.2.9 EARTHQUAKE PROTECTION

The design of earthquake protection should consider how it will affect, accommodate and integrate with the building services equipment or system's non-seismic requirements, such as thermal expansion in piping systems and wind forces on roof-mounted equipment.

9.2.9.1 Seismic Restraints

Building services plant and equipment shall be provided with seismic restraints designed in accordance with NZS4219 for the building Importance Level defined in the Project Specific Brief. Design must be by a suitably qualified structural engineer unless covered by NZS4219 non-specific design prescriptions.

The design shall also follow current guidance from MBIE and BRANZ as far as practicable.

In line with current MBIE/BRANZ guidance:

- Water supply piping shall be considered as at least category P5.
- Steam piping and gas piping shall be classified as category P1, P2 or P3.
- All components and cabling of non-essential electrical systems should be classified category P7.
- All components and cabling of emergency electrical systems should be classified category P4.
- The P4 classification extends to systems that support emergency components, such as emergency lighting mounted in a suspended ceiling.

Seismic restraint shall include horizontal bracing for all tall and heavy equipment (e.g. vertical water storage vessels) unless manufacturer's certification confirming the seismic performance of equipment supports is provided.

To avoid unnecessary duplication of restraints, the restraints for different services following the same routes shall be combined as far as practicable.

The design and installation of seismic restraint must not prevent operation of antivibration devices or necessary thermal expansion and contraction (of pipework systems for example).

9.2.9.2 Seismic Joints

Building services plant and equipment shall be provided with seismic joints designed in accordance with NZS4219 for the building Importance Level defined in the Project Specific Brief. Design must by a suitably qualified structural engineer.

Pipe lines reticulated between adjacent buildings/structures shall be provided with seismic joints to accommodate the expected differential movement.

Depending on the building's level of importance the following may also be required:

- Provision for risers to accommodate differential movement between the building's storeys.
- Suitable seismic joints for underground pipelines at entry to buildings and connections to inspection chambers and other buoyant underground structures.

9.2.10 ACOUSTICS & VIBRATION

9.2.10.1 Internal noise levels

All plant and equipment shall be installed to allow the noise levels for all spaces to comply with the noise levels defined in the **Architecture & Space Section** above. Additional or higher requirements may be specified in the Project Specific Brief for special facilities.

External plant shall not create a noise nuisance for occupants. This includes through opened windows where these are required for the ventilation or cooling of a space.

Sanitary and stormwater drains reticulated through occupied areas (including within bulkheads and ceiling voids) shall be provided with acoustic insulation to reduce flow noise.

Building services penetrations through building elements must be sealed sufficiently to maintain the sound transmission class (STC) /Sound Reduction Index (Rw) of the element.

Building services shall be routed to avoid the need to penetrate high STC/Rw elements unless it cannot be avoided. Acoustic seals for such penetrations shall be designed or reviewed by an Acoustic Engineer.

9.2.10.2 External noise levels

Beyond complying with the Territorial Authority's district plan for noise levels at the boundary with a property owned by another Party, it is also expected that a building's plant and equipment will not create a noise nuisance to the occupants of adjacent University buildings or other users of the Campus. The combined noise level of all plant and equipment, when measured at a distance of 10 metres from the facade of the building, shall also not exceed the Territorial Authority District Plan boundary noise limits.

9.2.10.3 Mechanical Vibration

Vibration isolation shall be provided consistent with current CIBSE and ASHRAE Guidance and best industry practice.

Facilities will higher vibration isolation requirements will be identified in the Project Specific Brief

9.2.10.4 Plant & equipment

This section will be expanded in the next revision of these Guidelines.

9.2.10.5 Reticulated services

Pipework connected to rotating or reciprocating plant shall be provided with resilient supports for the distance from the plant recommended by CIBSE/ASHRAE guidance. Pipework wall/floor penetrations within this distance shall be oversized and filled with an appropriate flexible sealant.

9.2.11 PIPEWORK – GENERAL REQUIREMENTS

9.2.11.1 Provision for Isolation

Local isolating valves shall be provided for all mechanical services terminal units and hydraulics services fixtures. Isolating valves for kitchen and sanitary fixtures should be easily accessible, preferably from floor level. Local isolating valves shall be as close as is practicable to their fixture and must be on the same floor level.

A branch isolating valve must be provided for each branch line connected to a ring main and to any branch, serving more than 3 units or fixtures, connected to a trunk main.

A floor isolating valve (or valves where required by a ring main) must be provided for each floor branch adjacent its connection to the riser.

The Designer shall ensure branch and local isolating valves are clearly indicated on pipework layouts and/or schematics.

9.2.11.2 Pipeline Anchoring & Movement

The Designer shall not rely on generic information for the pipeline anchoring and movement control in their specification. Project specific requirements shall be detailed on drawings and in the specification.

9.2.11.3 Thermal Expansion

Where a pipeline will experience thermal expansion, the provision for accommodating the movement including expansion loops, anchoring and guides shall be indicated on Designers construction issue drawings. It is acknowledged that these items will be subject to development and verification by the Installer during construction. Final provision for expansion loops, anchoring and guides shall be shown on the Installer's shop drawings and shall be developed in conjunction with the design of seismic restraint to ensure the compatibility of these provisions.

Where pipelines pass through fire separations, the fire stopped penetration should be considered as a fixed pipe support.

It is preferred that thermal expansion is accommodated using expansion legs e.g. bends, offsets and loops. Bellows and other mechanical devices for accommodating thermal expansion are not preferred and shall only be used where specifically approved by the University.

9.2.11.4 Fluid Thrust

Where a pipeline will be subject to significant fluid thrust, the location of thrust blocks shall be indicated on the Designer's construction issue drawings. It is acknowledged that these items will be subject to development and verification by the Installer during construction. Final provision for thrust blocks shall be shown on Installers shop drawings.

9.2.12 UNDERGROUND SERVICES – GENERAL REQUIREMENTS

All underground services to University sites whether outside or within the property boundary must be installed in accordance with the requirements and specifications of relevant standards and the Territorial Authority, Utility Operator or other supervising authority.

All private underground services shall also be completed to the requirements or specification of the relevant standards and supervising authority for the type of service as far as reasonably practical.

The requirement for separations and clearances, bedding and backfill materials, ground cover for traffic loading, marker tape, metallic tracer strips for non-metallic ducts/pipes, anchoring, thrust blocks etc. shall be in accordance with the applicable standards and specifications. The designer should include relevant details and/or locations for anchors, thrust blocks and accommodation for thermal expansion on their construction issue drawings.

Where it is proposed to reticulate different services in a common trench, the overall design of the reticulation and trench must be coordinated by a suitably qualified civil engineer.

The Installer shall provide a photographic record of the underground services provided as part of As Built documentation. The As Built drawings or model must show levels or inverts of all services.

9.2.13 THERMAL INSULATION – GENERAL REQUIREMENTS

9.2.13.1 Insulation

All services that may carry or contain fluids greater than +/- 5ºC of the temperature of the surrounding spaces shall be insulated to conserve energy and/or prevent condensation. Typically this will include drains carrying condensate from cooling coils, mains cold water pipework and outside air ductwork installed within conditioned areas of a building.

All insulation shall have a thermal conductivity of no more than 0.040 W/mK at 50ºC. Thickness of the Insulation shall be selected to provide the insulation R-value required under the Energy Efficiency section below.

Insulation on chilled services (where the fluid temperature may be below the dewpoint temperature of the surrounding air) should be continuous through wall and floor penetrations to prevent condensation. Insulation on chilled services should be continuous through pipe/duct supports to prevent thermal bridging.

All valves and fittings on heated services with fluid temperature greater than 85ºC (e.g. MTHW, steam and condensate) must be provided with removable insulated jackets or muffs to reduce heat loss and/or prevent accidental contact with hot surfaces.

All plate heat exchangers with a rating of more than 100 kW and a hot side entering fluid temperature of 70ºC or more shall be fitted with an insulated jacket to reduce heat loss into the plant space.

Internal insulation on supply and return air ductwork should be avoided for high cleanliness areas such as clean rooms and clinical areas. Where internal insulation is necessary for noise attenuation it shall be provided with a PE terephthalate ('Melinex' or 'mylar') lining to prevent erosion and moisture absorption

All insulation for equipment and reticulation carrying/containing chilled fluids must include a durable vapour barrier (including sealing of insulation joints). Closed cell foam insulation (e.g. elastomeric, polyethylene, phenolic, polystyrene) should be used for chilled services.

Fibre based insulation materials must be complete with an exterior facing. Fibre based insulation should not be used for chilled services.

All buried pipework requiring thermal insulation (e.g. chilled water, heating hot water, steam and condensate) must be a proprietary pipe system including factory installed insulation complete with fully sealed protective jacket.

The insulation and adhesives must be compatible with the surface material of the equipment or reticulation e.g. low chlorine products must be used for stainless steel pipework.

All substances used in the manufacture or composition of insulation shall have zero Ozone Depletion Potential and a Global Warming Potential of less than 10.

9.2.13.2 Cladding & Finishing

The preferred material for cladding is aluminium.

9.2.13.2.1 Internal

Insulation on exposed services below 2100 mm AFL (e.g. plant rooms but not risers) shall be clad for protection from mechanical damage. Cladding shall be omitted for equipment and components requiring routine access.

Insulation on exposed services above 2100 metres AFL is not required to be clad.

9.2.13.2.2 External

All external insulation shall be clad, taped, painted or otherwise finished to meet the manufacturer's requirements for protection against UV light, weather and mechanical damage.

The paint or other finish on chilled services must minimise heat absorption from sunlight (e.g. high reflectivity cladding, light colour or *CoolColour* type paint)

Insulation on exposed services below 2100 mm AFL (e.g. plant decks) shall be clad for protection from mechanical damage. Cladding shall be omitted for equipment and components requiring routine access.

9.2.14 SUSTAINABILITY

The University seeks to incorporate environmentally sustainable design principles in all projects. Building services designs shall provide for the efficient use of energy, water and other resources and minimisation of greenhouse gases, other air pollutants, liquid and solid waste.

9.2.14.1 ENERGY EFFICIENCY

All building services equipment covered by the NZ Government Energy Efficiency (E3) Programme shall comply with the relevant minimum energy performance standards (MEPS).

All mechanical services plant, equipment and systems must comply with MBIE *H1/VM3 Energy Efficiency of HVAC Systems In Commercial Buildings as a minimum*.

All energy conversion systems should have the maximum economic thermodynamic cycle efficiency (based on Life cycle cost) e.g. use the highest practical chilled water supply temperature. Refer the relevant Mechanical and Hydraulic Services section below for detailed requirements.

All fluid distribution systems should be sized for the minimum economic system resistance (based on life cycle cost). Refer Mechanical and Hydraulic Services section below for detailed requirements.

9.2.14.2 METERING

Metering of energy and water consumption is used by the University to monitor the performance of energy and water consuming systems and to target efficiency improvements.

Check meters are required for

- Domestic water
- Steam
- Energy sources
    - Electricity
    - Fuel gas
- Thermal liquids
    - Heating Hot Water
    - Chilled Water
    - Solar hot water

Building main and sub metering shall be provided as required under the Mechanical, Hydraulic and Electrical Services sections below. It may be acceptable to rationalise metering devices where the consumption of one form of energy can be accurately derived from the data provided by the meter for another.

9.2.14.3 MODELLING & ECONOMIC ANALYSIS

Where required by the project specific brief, the following analyses shall be undertaken in addition to the typical heating, air conditioning and other required design simulations and analyses necessary to complete the design.

9.2.14.3.1 Life Cycle Cost Analysis

Life Cycle Cost (AKA Whole Life Cost) analysis is the preferred way of achieving the economically optimal design. Life Cycle cost shall include initial capital cost, energy and other operating costs, maintenance & refurbishment costs and replacement cost.

Life cycle cost shall be calculated as the net present value (NPV) over a twenty year period. The discount rate the University wishes to use for calculating the present value of future costs and benefits will be defined in the Project Specific Brief.

Life cycle cost analysis is expected when:

i. the Designer presents multiple design options for selection by the University (The lowest life cycle cost option will generally be selected).
ii. when an ESD equipment or system enhancement is proposed (a positive investment return, i.e. positive incremental NPV, will generally be required).

The life cycle cost analysis should include a basic sensitivity analysis to provide an indication of how significant uncertainty in the value of an input is to the calculated NPVs.

9.2.14.3.2 Energy Consumption modelling

Computer modelling of energy consumption of building services systems will be required to compare the relative energy consumption of different design options presented for selection by the Designer. Therefore this modelling will generally be done in parallel with life cycle cost analysis described above.

The University Energy Manager may also request energy modelling be done to calculate approximate building energy consumption.

Energy costs used for Life cycle cost analysis and energy modelling shall be confirmed with the University Energy Manager as these may vary by site or the commercial arrangement the University has with its supplier (e.g. electrical line charges and CPD costs).

Load profiles for occupancy, lighting and equipment shall be defined in consultation with the Client Department and the University Energy Manager.

For the Dunedin Campus, the University Energy Team prefers a standardised weather year, based on a Campus weather station data file, be used for calculating the energy consumption of HVAC systems.

9.2.14.3.3 Thermal Comfort modelling

Computer modelling for thermal comfort shall be done for new developments and major façade or HVAC modifications in existing buildings. The modelling will be used to demonstrate the design will achieve an acceptable level of thermal comfort or to assist with selecting the optimal façade or HVAC option.

The University Energy Team prefers a standard occupant to be used for modelling occupants at sedentary or light activity levels:

- The winter standard occupant (Dunedin) shall be modelled as wearing 1.0 clo of indoor clothing with an average metabolic rate of 1.2 met.
- The summer standard occupant (Dunedin) shall be modelled as wearing 0.65 clo of indoor clothing with an average metabolic rate of 1.2 met.

Outputs from the thermal comfort modelling shall include a Predicted Mean Vote (PMV) index for spaces. The PMV calculation must include due allowance for occupants seated close to external glazing or other sources of asymmetric thermal radiation.

9.2.14.3.4 Natural Ventilation Modelling

Computer modelling of natural ventilation performance is required when natural ventilation is the proposed ventilation and cooling solution for large, high occupancy spaces such as atria or large open plan offices.

Outputs from natural ventilation modelling shall include Predicted Mean Vote (PMV) index for spaces.

9.2.15 IDENTIFICATION

Identification of building services shall be consistent with Industry good practice. Reticulated services shall be identified in accordance with NZS5807.

Pipework, ductwork, electrical busduct, tray, trunking, conduits shall be identified with letter and colour coding in accordance with NZS 5807. Apply identification lettering and banding:

- For buried and concealed reticulation (including in floors and walls) – at the points where the service disappears/reappears.
- For concealed reticulation in ceiling spaces and accessible floors – every 5m but at least once at point of entry to/exit from concealed space.

- For exposed and external reticulation - every 15 m but at least once within each space. This requirement overrides the architectural finish or colour scheme.

Provide flow direction arrows for all pipework and ductwork at the same frequency as above.

The Installer shall label major plant and plant equipment to Property Services Standards.

The Installer shall label ancillary equipment to Property Services Standards.

Labels shall be sized to accommodate both the equipment reference used on Record Drawings & operating & maintenance manuals and the University asset management ID.

Only valves, dampers or other adjustment or isolation devices that will be used regularly and which are not adjacent to the fixture/ equipment they serve need to be labelled.

Only Instrument displays or BMS field devices which are not adjacent to the equipment it serves and/or whose purpose is not readily apparent need be labelled.

All controls which can be adjusted by occupants shall be clearly identified and the identification shall match the name used in the Building Users Guide.

9.2.16 EQUIPMENT LIFESPAN

All building Services plant, equipment and system components must have a Useful Life equal or greater than that required by the NZBC.

It is also expected plant, system and components will be selected to achieve an Economic Life equal or greater to that given in *CIBSE Guide M: Maintenance Engineering and Management,* except where this would be unnecessary due to a limited facility lifespan or upcoming obsolescence of the technology.

The University Asset Manager may also provide project specific requirements.

9.2.17 DEMOLITION & SALVAGE

9.2.17.1 Demolition

The University wishes to maintain plant rooms and service spaces in a tidy and safe condition throughout the life of the building. Accordingly, the modification and refurbishment of building services must follow good housekeeping and health & safety practices including the removal of all redundant plant, equipment, enclosures, plinths, ductwork, pipework, cabling and conduit, control switch gear and field devices, labelling and signage.

Where complete removal of redundant equipment is considered impracticable, The Designer or Installer shall substantiate this and if accepted agree an alternative approach with Property Services. Any remaining redundant services must be clearly identified as such by signage and/or markings.

9.2.17.2 Salvage of Redundant Plant and Equipment

When existing sites are redeveloped, all existing plant and equipment which has been in service for five years or less and is no longer required shall be considered for salvaging for future use elsewhere. Additionally the Designer shall confirm with Property Services during the design phase if any other (older items) of equipment are also to be salvaged.

The Designer shall include the salvaging requirement in project documentation and the Installer shall allow for the salvaging or disposing of items as directed by property Services.

9.2.18 HEALTH & SAFETY

All building services installations shall be designed and installed to comply with current Health & Safety Legislation and regulations. The design and construction processes shall include a suitable Safety in Design methodology. Safety in Design reviews must consider the entire life cycle of building services systems including installation, operation, maintenance, decommissioning, disposal and replacement.

9.2.18.1 Hazards

Due consideration shall be given to the following common hazards during design and installation:

- **Trip hazards** e.g. drains running across floors, plantroom bunding at entrances, floor wastes & mud tank grates protruding above floor/ ground level. Where drains must be run across floors, avoid main circulation routes and provide top hat covers or ramps, with high visibility markings, for protection.
- **Head hazards** e.g. pipes, ducts, structural supports at head level especially sharp objects such as the end of threaded rods or the edges of duct trapeze supports.
- **Guards/ covers** on all moving components e.g. drive belts of AHU fans
- **Safe location for discharges of hazardous liquids or gases** e.g. safety valves, steam vents, laboratory exhausts.
- **Insulation of services** at hazardous temperatures in accessible locations e.g. steam & MTHW pipework and fittings. This shall include services where insulation is not specified for energy efficiency e.g. generator exhaust

- **Adequate lighting in plant rooms and risers** including at low level where overhead services may block lighting installed at ceiling level.
- **Access from floor level** to all valves and other equipment that is operated frequently or used for emergency isolation.
- **Controlled access** to potential enclosed spaces e.g. a large water storage tank drained for cleaning.
- **Roof plant and equipment** – positioning of plant or equipment that will require access to a roof or working at height for maintenance will not be acceptable unless there is no practical alternative.
- **Circulation & Egress** - For large, densely serviced plantrooms, the main safe circulation routes and path to emergency exits shall be marked on the floor.
- **Unauthorised access** - all equipment must be secured from unauthorised access to prevent vandalism or tampering.
- **Safe storage** of compressed and toxic gases
- **Energy hazards** – Overhead and buried cables, high voltage equipment. Site survey of locations, hazard identification and methodologies to avoid contact (e.g. during craneage or excavations).
- **Leaks of hazardous substances** including combustible, toxic and asphyxiant gases – adequate safety devices, detection and alarms
- **Toxic/hazardous off-gassing from stored materials** e.g. carbon monoxide from wood pellets, hydrogen gas from lead acid batteries – adequate ventilation, detection & alarms and safety signage
- **Deep excavations** - Connections to deep site infrastructure shall be designed to minimise the need for deep excavations e.g. the use of drop pipes within an existing manhole to connect to a deep drain.
- **Radiation hazards** – MRI equipment, Xray equipment and the like, radioactive materials within laboratories, antennas (on roofs etc).

9.2.18.2 Maintainability

Access to operate, service and replace plant and equipment shall be subject to Safety in Design review by the plant and equipment Designer and Installer to ensure they have fulfilled their duties under the Health & Safety at Work Act 2015 and associated regulations. A Maintainability review shall be undertaken for every new building or major development.

Due consideration shall be made by the Designer for the incorporation of the following common access scenarios/provisions during design and installation:

- **Access** from floor level to all plant room valves and other equipment that are operated frequently or used for emergency isolation.
- **Minimise disruption to occupants –** plant and equipment should be located so that maintenance can be carried out with the least practicable disruption to the activities of building occupants.
- **No access through/from sensitive spaces** e.g. clinical rooms, physical containment (PC) laboratories, IT infrastructure rooms. All equipment should be laid out so that it does not require maintenance access through/from sensitive spaces e.g. plant requiring regular maintenance such as FCUs should not be located within PC laboratories.
- **Visibility** - All displays e.g. gauge dials, meter and controller screens, regulating valve handwheels to be visible from a convenient and safe location.
- **Mezzanines and other elevated plant platforms** – safe access and working space for maintenance by personnel carrying tools, equipment and spares.
- **Accessible risers** – platforms at each floor to allow access to all valves, dampers and equipment (where present) from floor level. Platform to be designed to minimise risk of items falling through a grate floor onto people on a lower platform.
- **Access to plant above ceilings** – locate equipment so FF&E will not obstruct ladders etc. Locate/hand equipment so access for maintenance is not prevented by adjacent columns or full height walls etc.
- **Convenient access into risers, ceiling and wall voids** for all equipment including valves, dampers and fire dampers that require adjustment, maintenance or inspection. This includes suitable riser/ceiling/wall access panels sized and located for safe access.
- **Labelling of ceiling tiles** to identify where there is maintainable equipment above (i.e. which tile(s) to lift to access equipment).
- **High level services** in Atrium and other double height spaces e.g. lighting must be provided with a means for safe and reasonably convenient access for maintenance and/or replacement.
- **Roof Plant and equipment** – where this is unavoidable e.g. solar collectors, chillers- safe access and working space for maintenance must be provided.
- **Clear access** ways in plantrooms and service areas to remove and replace large plant. A practical access route from the plant space to the site boundary must be defined for large plant e.g. crane access, building entry point.
- **Adequate clearance** around co-located equipment e.g. pump duty/stand by pairs so that there is easy maintenance access to both.
- **Adequate clearance** around equipment so that components that are removable by design can actually be removed e.g. heat exchanger tube bundles of boilers and calorifiers
- **Adequate clearance** around heavy equipment to allow lifting frames to be positioned.
- **Pipeline mechanical joints** - Provide sufficient union or flanged joints in pipelines to allow valves, fittings, equipment to be removed and, if necessary, to allow sections of pipework to be temporarily removed to allow plant being replaced to pass through.

- **Unmaintained components** which may fail prematurely - avoid installing equipment that has the potential to fail prematurely (through wear and tear), rendering a system inoperative, in inaccessible locations. e.g. constant velocity discharge damper on tall fume cupboard exhaust discharges.
- **Maintenance of critical systems –** Configure building services systems which provide essential services to critical facilities so that maintenance can be carried out without disrupting the operation of the facility e.g. provide duplicated equipment or reticulation so the system can continue to operate or provide sufficient safe isolation points to allow a section of the system to be isolated while the remainder contuse to operate.
- **Isolation** valves and switches shall be grouped in locations that are accessible without ladders/ steps.
- **Housekeeping pads -** All plant and equipment in plantrooms shall be elevated above the floor on a suitable plinth or rails. This may not be required where the equipment incorporates its own stand or other support.
- **Telecommunications –** reasonable Wi-Fi and cellular coverage shall be provided in main plant spaces to allow maintenance personnel to communicate and access/transfer digital information.

9.2.19 COMMISSIONING & HANDOVER

For larger and/or more complex projects the University will employ an Independent Commissioning Agent (ICA) to manage the commissioning process.

Whether or not an ICA is engaged, the Designer is required to take an active role in briefing and coordinating with the commissioning engineer, to help ensure and to confirm that the systems they have designed, are commissioned and operate in accordance with their design intent. The level of witnessing required by the Designer may however be reduced where an ICA is employed, but must still be sufficient for the designer to fulfil their construction observation duties and provide producer statements at completion.

The following commissioning and handover activities are expected.

9.2.19.1 Pre-commissioning & Setting to Work

- Each Designer shall provide a checklist of all deliverables required from the Installer (including commissioning plans and programmes) in their specification. This checklist will be reviewed by the University prior to tender and relied upon during the project handover process.
- A Commissionability review shall be conducted by the installer and Designer (and ICA if engaged) in early stages of the Construction
- Commissioning plans and programmes shall be produced by the installer (with additional input from the ICA if engaged) and agreed following the Commissionability review. Once agreed the programme shall not be varied without the PM's approval.
- Factory acceptance testing of plant should be carried out where load testing cannot be done satisfactorily on site and no independent certification scheme exists.
- The Installer shall provide written confirmation that pipework and ductwork has passed the specified pressure/leak testing.
- Copies of all regulatory certificates e.g. electrical certificate of compliance and safety certificate, gas safety certificate shall be provided to the University.
- Equipment shall be pre-commissioned and set to work in accordance with the relevant CIBSE Commissioning Codes, ASHRAE standards and equipment supplier requirements.

9.2.19.2 Commissioning

- All performance testing and measurement activities must be carried out by an independent certified and approved commissioning specialist. Commissioning by the Installer will not be accepted.
- Mechanical services shall be commissioned in accordance with relevant CIBSE Commissioning Codes and ASHRAE standards.
- Hydraulic services shall be commissioned in in accordance with NZ Standards.
- Electrical services systems shall be commissioned in accordance with NZ Standards.
- Copies of the calibration certificates for all measuring instruments shall be included in the commissioning report.
- Required testing parameters (e.g. design tolerances, filter loadings) must be clearly identified by the Designer in the specification and reflected in the commissioning plan.
- Witnessing & verification of test measurements shall be conducted by ICA (where engaged) and/or Designer. The University Building Services Engineer may choose to witness some tests and shall be given adequate notice of commissioning and testing activities.
- Integrated system testing including fire detection and alarm systems shall be carried out for all projects.
- Scenario testing shall be carried out for highly complex and/or important buildings.
- Where factory acceptance testing has not been done, deferred full load tests of heating and cooling plant shall be scheduled for an appropriate season.
- The Designer shall provide a formal commissioning review report to the University's PM and Building Services Engineer confirming plant, equipment and

systems have been satisfactorily commissioned and are operating in accordance with their design and advising any variances from the design and the proposed course of action to remedy.

- All new plant and systems are subject to formal acceptance by the University. This will be provided following receipt of a satisfactory report and producer statements from the Designer and inspections confirming the plant and equipment is operating satisfactorily and in satisfactory condition.

9.2.19.3 Training

Training shall be provided to both building occupants and Facility Management Staff. The training shall be provided separately for these two groups and presented at the level of technical content appropriate to their needs and level of knowledge. Training shall be conducted by representatives of both the Installer and Designer to ensure that the design intent is accurately communicated. Training must be undertaken prior to occupancy.

9.2.19.4 Building Users' Guide

A building users' guide (BUG) shall be provided for all new buildings and where an existing building has undergone significant alterations, The BUG should be brief plain-English instructions about the how the building services systems operate and what adjustments can be made by the building occupants. The BUG should be in the form of a booklet or information posters. It must be either written or reviewed by the Designer to ensure the design intent is accurately communicated.

9.2.19.5 Building Tuning

9.2.19.5.1 Energy Analytics

The University has adopted the Coppertree Kaizen energy analytics platform. All major new developments will be added to this platform. It is intended each new facility will be onboarded soon after commissioning is completed so the platform can assist with initial building tuning

All onboarding will be done by the vendor Coppertree. This will include a discovery phase for data points using information from the project's building services drawings, specifications, equipment schedules, control functional descriptions, O&M manuals etc. This documentation will be issued to Coppertree by Property Services, It is expected these documents will be made available by the Project team in line with normal project completion & handover time frames

Confirm all requirements for implementation and onboarding with the University Energy Manager during detailed design.

9.2.19.5.2 Initial tuning

- The Installer shall provide seven days post-occupancy trending for review by the Designer and the University Building Services Engineer and Plant & Controls Engineer.
- For large and/or highly complex projects, the Designer shall remain involved in building tuning and trouble-shooting activities post-handover. A suitable methodology for this work is CIBSE Soft Landings stage 4 methodology (*Initial After Care*).
- For large and/or highly complex projects, the Designer shall review the operation and performance of the building services every three months for the first year after handover. The Designer shall provide a quarterly report to the University summarising the operation and performance of the systems and equipment and noting significant variances from the design intent. The review should be based on BMS data, site visits and discussions with the Installer's maintenance staff, the University FM and Plant & Control Engineer and the building occupants.

9.2.19.5.3 Continuous tuning

The University will implement continuous building tuning for large and/or highly complex facilities using the energy analytics platform. Continuous tuning will be used to ensure the facility's building services continue to operate at optimum performance so that energy costs and greenhouse gas emissions are minimised.

The continuous tuning process/platform will use data from sources including BMS, meters & utility billing, and temporary sensors (e.g. wireless sensors communicating over a cellular LPWA network). The Designers shall ensure their design for BMS and metering systems will facilitate continuous tuning.

The Designers shall also ensure their design intent is clearly communicated to the Facility & Energy Management teams so that the required system functionality is taken into account during the continuous tuning process.

9.2.19.6 Record drawings and Operating & Maintenance manuals

- The Draft O&M Manuals and As-Built Drawings must be provided prior to Practical Completion.
- The Designer shall review the O&M manuals and as-built drawings. It is the primary responsibility of the Designer to verify the Installer's as-built drawings and O&M documentation is an accurate reflection of the installed building services. The Designer shall provide a statement to the University to this effect.
- The O&M manuals must include functional descriptions of every building services system which comprehensively describe how the system is configured, how it will operate and how it integrates with other systems. It is expected the O&M functional descriptions will incorporate information from the Automatic Control & Monitoring functional

descriptions. The O&M functional descriptions must be reviewed by the Designer to ensure the design intent is accurately communicated.

- As-built schematic drawings (laminated or otherwise protected from damage) of all building services systems shall be provided in main plantroom(s).

9.3 MECHANICAL SERVICES

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Commissioning & Tuning (2)
- Metering and Monitoring (5)
- Indoor Environment Quality (9-14)
- Energy (15-16)
- Water (18)
- Emissions (25-28)

9.3.1 ENVIRONMENTAL CONTROL

This section cover the requirements for HVAC systems & equipment used to provide suitable environmental conditions for building occupants, equipment and academic research activities.

The use of passive and environmentally sustainable design features to reduce the HVAC loads, such as:

- external solar shading
- performance glazing
- Wind lobbies
- thermal mass/capacitance

should always be investigated before finalising the HVAC solutions. Refer **Architecture & Space Section** for Guidelines.

Suitable HVAC options shall be presented to the University Building Services Engineer for review.

9.3.1.1 INTERIOR ENVIRONMENT

9.3.1.1.1 Internal Conditions

The University has a Thermal Comfort Guideline which applies to all occupied spaces. The architectural and mechanical services design must enable all occupied spaces to meet this policy. It is expected that good practice design will allow this to be done without difficulty.

It is expected best practice architectural and mechanical services design will address a greater range of factors important to human physiological comfort than are covered in the Thermal Comfort Guideline. These factors include the following:

1. Temperature
    a. Air temperature
    b. Surface radiant temperature (including the effect of asymmetric thermal radiation e.g. due to glazing)
    c. Room vertical temperature gradient
2. Humidity
    a. Air relative humidity
    b. Surface condensation
3. Air movement
    a. draughts
    b. Effects of air circulation (including stratification, natural ventilation for cooling)
4. Air quality
    a. Respiratory carbon dioxide
    b. Volatile organic compounds and body odours
    c. Internal contaminants and external atmospheric pollutants and particulates
    d. Effect of mixing or stratification of supply air in room air.

Environmental conditions within occupied spaces shall be controlled within the human comfort range defined by CIBSE Guide A or ASHRAE handbook – Fundamentals. Indicative comfort ranges for sedentary and light activities are shown in the following table:

Acceptable Range of Physiological Comfort Factors for Sedentary & Light Activity Levels	
Air Temperature	From 21ºC to 24ºC in combination with acceptable relative humidity
Vertical temperature Gradient	≤3 K difference between ankle and head height of seated occupants
Radiant temperature asymmetry	≤ 10 K difference between warmest and coldest room surfaces
Floor surface temperature	From 18ºC to 27ºC.
Relative humidity	From 30% to 60% in combination with acceptable air temperature
Air movement	≤ 0.2 m/s within occupied zone
Air quality	≤ 800 ppm CO_2

Set points and control ranges of HVAC systems should take into account the usual activity level and differences in seasonal clothing of occupants. In some cases, activity or seasonal set point adjustments may be appropriate e.g.

- The occupants of some workplaces & teaching spaces must wear PPE (e.g. laboratories). The temperature set point and range must allow the occupants to be comfortable while wearing these additional layers of clothing in all seasons.
- Multi –purpose spaces like gyms and larger circulation spaces may also be used for sedentary and light activities at times (e.g. sedentary occupants sitting exams in mid-winter) so their HVAC systems should be designed to be capable of providing comfortable conditions for a range of activity levels.
- The temperature in residential bedrooms may be lowered at night when occupants are sleeping.

Internal spaces with transitory occupancy such as corridors, storerooms and toilets should be at least 16ºC during occupied hours. It is expected this will not usually require direct heating, instead relying on spill heating from occupied spaces. However transitory spaces on the ground and uppermost floors or on the perimeter of a building may require direct heating. To allow a collegial working environment in buildings with a cellular office layout,

corridors onto which offices open out should be maintained at a temperature which will allow office doors to be left open without excessive heat loss or air drafts.

The University seeks to minimise the use of mechanical cooling and expects an effective façade and architectural passive design which reduces solar gain will be provided first. However mechanical cooling will be considered when a room cannot be maintained at a temperature of 24 C or less when experiencing any or all of i) the peak internal load, ii) peak solar gain or iii) summer 2.5% external air temperature. The need for mechanical cooling shall be verified using appropriate peak load calculations and/or computer modelling.

To demonstrate that acceptable environmental conditions will be provided, the Architectural and Mechanical Services design must be able to provide a thermal comfort modelling PMV of between + 1 & -1 (i.e. a prediction of no more than 20% dissatisfied occupants). A lower level of dissatisfaction is desired, however it is recognised it may be difficult to provide environmental conditions that satisfies every occupant due to natural differences in physiology.

The heat transfer to a space from an adjacent plant room, or from reticulated services (e.g. steam pipelines) transiting through the space should be considered. If the heat cannot be removed at source then the Mechanical Services Designer should coordinate with the Architect to ensure the heat gain into the space is mitigated.

9.3.1.1.2 Specialist Spaces

The University operates a wide range of specialist facilities containing equipment, research, clinical activities or archival material (e.g. operating theatres, consulting rooms, research laboratories, animal housing, archival and exhibition spaces) which require specific environmental conditions. These environmental requirements are typically defined by a Technical Standard. Where this is not the case, the requirements will be defined in the Project Specific Brief.

For specialist facilities, the required environmental conditions will generally form part of a Service Level Agreement between the Client Department and Property Services. It is therefore essential the design and installation of the HVAC systems allow these environmental conditions to be met throughout their lifespan.

Where no specific environmental requirements are defined for a space the environmental conditions shall default to those required for occupant physiological comfort.

9.3.1.1.3 External Conditions

Unless amended by the specific project brief, external design conditions shall be based on the following. The designer shall confirm external design conditions (and all other design assumptions made or proposed) at concept design stage and before any detailed system design:

Dunedin Facilities

Application	External Design conditions	Spaces types
Comfort (General)	Summer: Dry Bulb 24°C Wet Bulb 19°C Winter: Dry Bulb 0°C	General use spaces: e.g. offices, meeting rooms,
Comfort (Specialist)	Summer: Dry Bulb 25°C Wet Bulb 19.5°C Winter: Dry Bulb -1°C	Specialist spaces: e.g. clinical spaces, laboratories. teaching spaces
Critical	Summer: Dry Bulb 27°C Wet Bulb 20°C Winter: Dry Bulb -2°C	Where conditions must be continuously maintained within mandatory limits e.g. research requiring environmental control for verification, AAALAC Animal holding spaces

Daytime or 24 hours design conditions shall be selected based on the usage pattern of the space.

Other Centre Facilities

NIWA climate records for the site's locality with due allowance for projected climate change over the life of the HVAC systems. Different external design conditions shall be used for comfort and critical applications

Application	External Design conditions	Spaces types
Comfort (General)	2.5% design conditions (daytime or 24 hours)	General use spaces: e.g. offices, meeting rooms,
Comfort (Specialist)	1% design conditions (daytime or 24 hours)	Specialist spaces: e.g. clinical spaces, laboratories. teaching spaces
Critical	Refer to specific project brief for requirements.	Where conditions must be continuously maintained within mandatory limits e.g. research requiring environmental control for verification, AAALAC Animal holding spaces

Daytime or 24 hours design conditions shall be selected based on the usage pattern of the space.

9.3.1.1.3.1 HVAC System Operation

All HVAC systems shall be divided into sufficient zones to allow adequate environmental control and energy efficient operation.

Systems shall be timetabled to operate only when necessary. System start times shall be optimised to ensure the desired conditions have been achieved by the start of occupation.

On demand after hours operation should be provided for all buildings where occupants have access outside of usual working hours. HVAC systems should be zoned for after hours operation to minimise the number of unoccupied space being served. An after hours push button (dedicated or integrated in room controller) shall be provided for each zone in a convenient location.

Rooms should be provided with local set-point adjustment on the room thermostat/controller where appropriate for the usage of the space. The controller shall initially be set to the design setpoint and the adjustment range should be limited (when the control device allows this) to +/-2ºC. Local setpoint adjustment is only appropriate where a space contains a few permanent occupants i.e. it is not appropriate for public or common areas, including open plan offices with more than six occupants.

9.3.1.2 VENTILATION & PRESSURISATION

9.3.1.2.1 Natural Ventilation

The University prefers the use of natural ventilation for ventilation and cooling when it can be made to work satisfactorily.

The University prefers to exceed the NZBC requirements for natural ventilation opening area to ensure the natural ventilation will provide satisfactory air quality.

For natural ventilation to be used in a space should include openings on two different walls or a wall and ceiling to allow a cross flow or, where only a single wall is available, to use windows with high and low level opening sashes.

The window joinery for naturally ventilated spaces shall incorporate trickle ventilators to allow background ventilation to be provided without the window being open. The selection and location of the trickle ventilator joinery should allow at least 0.5 air changes/hour to be achieved at a normal external – internal pressure differential.

Natural ventilation design shall consider external noise and pollution e.g. traffic noise/pollution next to roads and in carparks. Where external noise/pollution would discourage occupants from using natural ventilation openings, mechanical ventilation should be provided instead or as well (i.e. mixed mode ventilation).

Because of the need to keep windows closed to reduce external noise and/or to close blinds to reduce external light affecting visual displays, it is expected that natural ventilation will not be suitable for teaching spaces.

Where natural ventilation is being used for ventilation and cooling for large, highly occupied spaces (e.g. atria, large open plan offices) the natural ventilation must be controlled by the BMS. The automatic control shall include interfaces with the fire alarm and security systems. Consideration should be given to providing bird mesh across window openings if the presence of food in the space would attract birds (e.g. atria, dining halls).

Where mechanical ventilation is also required due to the variability of external conditions or internal loads (i.e. mixed mode ventilation), the design shall include for interlocking the mechanical ventilation fan and natural ventilation openings or the mechanical ventilation flowrate shall be modulated on air quality.

9.3.1.2.2 Mechanical Ventilation

All external intakes/ discharges of ventilation systems that do not run continuously, or throughout the occupied period, shall be fitted be back draft dampers or equivalent to reduce the loss of heated or conditioned air.

Ventilation systems must be adequately balanced and their make-up/ spill air openings adequately sized so that rooms are not over/under pressurised causing doors to be difficult to open or close and/or causing whistling.

9.3.1.2.3 Outside Air Ventilation

The University prefers to exceed the NZBC requirements for outside air flowrates. Flowrates shall be 125% of the NZBC requirement (rounded up to nearest 5 l/s). This flowrate shall be achievable when filters are fully loaded.

Demand control ventilation shall be used where suitable. All rooms supplied with more than 300 l/s of outside air that has been tempered or conditioned shall be provided with air quality monitoring, and the associated fan or air handling unit shall be provided with fan speed control and/or motorised dampers to allow the outside air flowrate to be reduced when occupancy is low. The air quality control will typically use a setpoint of 600 ppm CO2.

Ventilation and air conditioning systems for all intermittently occupied spaces shall be provided with occupancy sensing or a bookable time schedule to allow system to be disabled when room is unoccupied.

Central ventilation systems which provide outside air to a large number of rooms must be zoned appropriately for after-hours operation (e.g. using a motorised shut-off damper for each zone or floor branch) so that outside air is not unnecessarily supplied to unoccupied areas.

Care should be taken to avoid locating outside air intakes adjacent to areas which may contain sources of air pollution e.g. major roads, bus stops, carparks.

Outside air intakes shall not be located where the temperature of the incoming air will be significantly increased by heat released from surrounding surfaces in summertime (e.g. from a sunlit roof). If such a location

cannot be avoided, the surrounding surfaces shall be provided with a finish that minimises heat absorption.

Coarse mesh pre-filters suitable for capturing seasonal pollen and insects shall be provided for main outside air intakes.

It is preferred that plantrooms are not designed to be outside air plenums to avoid the risk of contamination of the ventilation air due to activities or substances stored in the plantroom. If this is not practical then signage must be provided to make plantroom users aware of the need to avoid contaminating the outside air.

9.3.1.2.3.1 Ventilation for technical facilities

Where outside air ventilation is provided to a laboratory as 'dilution ventilation' to reduce the concentration of hazardous airborne substances released into the space, the flowrate (or air change rate) should be based on a specific requirements of the laboratory's function and hazards. Dilution ventilation is only a secondary line of defence behind the implementation of safe handling procedures for hazardous substances.

The use of demand control of dilution ventilation systems should be considered to conserve energy. Pollutant/hazard sensors and occupancy sensors could be used to allow system flowrates to be reduced when the maximum flowrate is unnecessary. The demand control ventilation should include a manual override via emergency push button.

Where animal holding rooms use Individually Ventilated Cages (IVC) the room ventilation system should use the minimum flowrates prescribed by AS2243.3 to conserve energy.

9.3.1.2.4 Extract air ventilation

9.3.1.2.4.1 General Extract

All Kitchenettes shall be provided with a general exhaust intake above the kitchen bench.

Enclosed spaces containing copying machines and other devices which may release contaminants (e.g. toner particles, ozone) should be provided with a general exhaust intake.

Heat recovery from general extract ventilation shall be considered for all systems with flowrate greater than 300 l/s. Heat recovery should be provided where it is practical and has a positive investment return.

9.3.1.2.4.2 Local Extract

9.3.1.2.4.2.1 Fume Cupboards

All new fume cupboards shall be variable exhaust volume type maintaining a constant face velocity at all sash openings (e.g. TPE Ecoair).

All new fume cupboards shall include a sash which closes automatically to minimise the sash opening area when the fume cupboard is not in use (e.g TPE Ecosash).

Manifolding of fume cupboard exhausts is acceptable in principle where it is appropriate for the function and usage pattern of the fume cupboards and permitted by legislation and relevant technical standards.

The design of the fume cupboard exhaust manifolding must include adequate redundancy in the event of fan failure.

This may require:

I. Duty/standby exhaust fans to provide a reasonable level of redundancy.
II. Grouping fume cupboards into more than one manifold to ensure some fume cupboards will remain in operation in the event of a fan failure

Exhaust air heat recovery shall be considered for all facilities with large numbers of fume cupboards and manifolded exhausts. Heat recovery should be provided where it is practical and has a positive investment return.

9.3.1.2.4.2.2 Extract hoods & Industrial Extract Ventilation

All local exhaust ventilation systems (including associated make up air systems) for capturing airborne contaminants including harmful dust, vapour and fumes shall be designed and installed to comply with current Health & Safety legislation and regulations.

An acceptable design standard for exhaust hoods and industrial extract ventilation is the American Conference of Governmental Industrial Hygienists (ACGIH) *Industrial Ventilation: A Manual of Recommended Practice for Design.*

9.3.1.2.4.2.3 Kitchen Extract

The mechanical Services Designer should coordinate with the Architect/ Kitchen Designer to ensure, as far as practical, cooking appliances are laid out in a way that will allow the size of the extract hood and flowrate of exhaust air to be minimised.

Engineered hoods (e.g. Halton Capture Jet type) should be considered where they will allow exhaust air flowrates to be reduced.

Kitchen exhaust duct routes shall be designed to minimise horizontal duct runs to reduce grease deposition.

Long external duct runs shall be externally insulated to reduce grease deposition due to condensation on the interior duct surface.

Kitchen exhaust ductwork shall be provided with adequate cleaning access panels and drain points fitted with air tight grease collection container. All access panels and grease collection points must have convenient and safe access.

The design volumetric flowrate for Kitchen exhaust air fans should be corrected at commissioning for the lower density of heated cooking effluent to ensure the correct exhaust mass flowrate is achieved in operation.

Excessive fan noise is a common problem for kitchen extract systems. The Designer shall ensure the sound level of the

extract system does not cause the acceptable kitchen noise level to be exceeded.

9.3.1.2.5 Pressurisation

Ventilation systems are commonly used to maintain a pressure difference in laboratory, clinical and animal holding facilities.

The Designer and Installer shall coordinate with the Architect and Builder to ensure the room(s) is constructed (or made good) sufficiently airtight to allow pressurisation to be achieved without excessive air flowrates.

Where it is critical to maintain a continuous pressure differential, the ventilation control system may need to allow for effect of door openings e.g. by using a micro switch on door and temporary control loop override.

9.3.1.3 AIR CONDITIONING

The term Air Conditioning in these Guidelines refers to the use of conditioned supply air to control the environmental conditions of a space. In this context, air conditioning refers to the altering of a supply air stream's temperature and/or humidity by heating, cooling, humidification and dehumidification systems and equipment.

Air conditioning systems shall be divided into sufficient zones so that spaces with similar occupant, equipment and façade loads are grouped together. No zone shall include more than one floor.

AHU economy cycles (use of outside air for space cooling) shall be used wherever practical.

A night purge (aka night cooling) ventilation strategy utilising the outside air ventilation systems shall be considered where the construction of the building (e.g. exposed thermal mass) and the function and usage pattern of the spaces will make it beneficial.

Where air conditioning system also provides space heating, the system shall operate to maintain unoccupied rooms at a reduced standby temperature setpoint throughout building occupied hours. When the space is unoccupied, outside air flowrate shall be minimised (except in economy cycle mode).

The use of displacement ventilation should be considered for auditoriums and atria to minimise requirement for heating/ cooling of outside air.

9.3.1.3.1 Air Conditioning Plant

9.3.1.3.1.1 Hydronic Air Conditioning Plant

This section will be expanded in the next revision of the Guidelines.

9.3.1.3.1.2 Direct Refrigerant to Air Conditioning plant

Direct refrigerant to air (AKA direct expansion or DX) air conditioning systems are not preferred.

Split system heat pumps for space heating and cooling may be considered on a project specific basis where there is a limited number of discrete areas requiring air conditioning and ChW and/or HHW is not available or centralised ChW and HHW plant is not economic to provide.

The use of multiple spilt or variable refrigerant flow (VRF) systems for space cooling and heating is generally not acceptable due to their poor flexibility for future layout changes and the greater risk of large volume refrigerant leaks in occupied spaces.

Packaged direct refrigeration plant (i.e. PAC units) will be considered where they provide the most economic solution for zone cooling and heating on a life cycle cost basis. PAC units used for comfort cooling must be able to maintain comfortable environmental conditions without drafts.

9.3.1.3.2 Air Conditioning Terminal Units

This section will be expanded in the next revision of the Guidelines.

In-room fan coil units are not preferred for laboratories and similar technical facilities (and are not acceptable for microbiological containment laboratories) due to the problems caused by their more frequent maintenance requirements including i) the difficulty of providing safe and convenient maintenance access around laboratory FF&E and ii) the disruption to laboratory operations caused by the maintenance work. Refer also the General Building Services – Maintainability section above.

9.3.1.4 HEATING

9.3.1.4.1 General

The preferred energy source for a building's heating systems will be determined by the University Energy Manager and will be advised in the Specific Project Brief. Typically the preference will be to use district energy systems (where available) before providing separate heating plant in the building.

Alternative energy sources may be proposed for consideration. These should have a low Life cycle cost relative to other options and meet the University's objectives for reducing carbon emissions.

9.3.1.4.1.1 Thermal Metering

HHW systems (including MTHW, LTHW) shall be provided with a building level thermal meter when the connected load is greater than:

I. 100 kW when imported.
II. 100 kW when generated on site.

University standard thermal energy meters shall be specified.

Thermal energy meters shall be accessible in real time via BacNet or by using M-Bus – BacNet interfaces.

The Designer shall confirm project-specific meter technical requirements with University Energy Manager.

9.3.1.4.1.2 District Heating Systems

All new connection to Campus district heating systems must be agreed in writing by the University Energy Manager before design commences. Any significant increase in load at an existing connection must also be agreed with the Energy Manager.

9.3.1.4.1.3 Medium Temperature Hot Water System (Dunedin Campus)

All new connections must be sized for:

i. maximum flow temp of 85ºC,
ii. flow/return delta T of 20 K,
iii. maximum heat exchanger pressure loss of 30 kPa,
iv. maximum differential pressure of 75 kPa across connection to existing mains

All MTHW equipment and pipework must be rated for continuous operation at 115ºC and 10 bar.

9.3.1.4.1.4 College of Education Low Temperature Hot Water System (Dunedin Campus)

All new connections must be sized for a maximum flow temp of 70ºC. Each building shall be provided with secondary pumps to circulate HHW within the building

9.3.1.4.1.5 District Steam System (Dunedin Campus)

Any connections to the steam system must be agreed in writing by the Steam System Operator (currently Pioneer Energy) and University Energy Manager. Any significant increase in load at an existing connection must also be agreed with the Steam System Operator and Energy Manager.

The Dunedin District steam system has a nominal supply pressure of 10 bar however all new connections shall be sized for a maximum incoming steam pressure of 9 bar to allow for the effect of upstream demand.

The quality and cleanliness of the plant steam from the district steam system cannot be guaranteed. Due consideration must be given to the load profile and required stream cleanliness for the building's plant and equipment and filter stations, clean steam generators and accumulators provided where necessary. Condensate return shall be returned at no less than 60°C.

9.3.1.4.2 Heating Plant

Biomass (wood) fired boilers are preferred heating plant for new buildings where site spatial requirements can be met and there is a secure fuel supply chain. Gas fired boilers will be considered where biomass boilers are not practical or economic.

Heat pumps will be considered where they have a relatively low life cycle cost and assist the University's objectives for reducing carbon emissions.

9.3.1.4.2.1 Heating Water Boilers

For gas boilers, condensing types should be considered where it is practical and economic to operate the HHW system with lower flow and return temperatures. The increase in boiler efficiency should be weighed against the higher capital cost of larger heat exchanger areas using a life cycle cost analysis.

All new heating hot water systems with conventional boiler plant serving radiators shall be designed to provide the design heat output at maximum flow temperature of 75°C.

All new heating hot water systems with condensing boilers shall be designed to achieve the design heating load when HHW is supplied at flow temperature of no more than 60°C. HHW must be returned to the boiler at 50°C or less.

9.3.1.4.2.1.1 Boiler Discharges

Boiler flue gas discharges are required to comply with the conditions of the University's campus Discharge to Air consents. The Designer shall confirm requirements with University Energy Manager prior to equipment selection.

Over the course of the project, the Project Team must

I. provide preliminary equipment details and specification to the University to allow the boiler to be assessed and included within the University's Air Discharge Consent. This information should be provided to the Project PM, Energy Manager and Strategic Resource Planner.
II. carry out emissions tests verifying the boiler is within consent conditions during commissioning
III. provide comprehensive equipment details for the University prior to hand over.

9.3.1.4.2.2 Water Heat pumps

Due to deterioration in performance at low ambient temperatures, Air source heat pumps shall not be used as the primary heating plant on South Island Campuses unless alternative heating plant (typically a condensing gas boiler) is provided to supplement the heat output.

The University will consider this use of Water Source or Ground Source heat pumps where these systems are acceptable to the Territorial Authority.

All new heating hot water systems using heat pumps shall be designed to achieve the design heating load when HHW is supplied at flow temperature of no more than 45°C.

The use of reversible heat pumps as common central plant for HHW and ChW systems has been problematic at University's sites and is not preferred. The use of a single reversible heat pump will generally not be acceptable.

A proposal to use reversible heat pumps shall demonstrate how the changeover between heating and cooling modes

will ensure stable heat pump operation and minimise energy waste.

9.3.1.4.2.3 Heat recovery

Recovery of waste heat (e.g. from chillers, Steam condensate & flash steam) should be considered whenever the grade of waste heat available can be utilised and the heat recovery will provide a positive investment return.

9.3.1.4.3 Heating Distribution Systems

This section will be expanded in the next revision of the Guidelines.

9.3.1.4.4 Terminal Heating Equipment

Heating hot water Radiators are the preferred terminal equipment when a space only requires space heating.

Wall mounted electric space heaters will not be acceptable except where HHW is not available and centralised HHW plant or DX heat pumps are not economic to provide.

When the use of radiators is not practical due to furniture layouts, fan coil units or fan convectors should be considered. Generally fan coil units will only be used in large area, such as an open plan office or a laboratory.

Space heating using tempered supply air may be used when a space also requires ventilation.

Radiant heating panels may be considered for large volume, high ceiling spaces (e.g. gymnasiums) or areas which have large, frequently open, outside openings or high untempered make up air flowrates (e.g. warehouses, changing rooms) Due to the physiological discomfort caused by asymmetric radiant temperatures, radiant heating is generally not be acceptable for areas with normal ceiling heights (less than 3.2 m) and permanent occupancy.

Underfloor heating is the preferred heat source for large open areas that do not have permanent occupancy, e.g. atriums. The use of this type of heating in other areas will require a full heat model to be produced to justify its use, and may require an alternative more reactive heat source.

9.3.1.5 COOLING

9.3.1.5.1 General

9.3.1.5.1.1 Mechanical Cooling

The term mechanical cooling in these Guidelines refers to cooling systems based on plant and equipment operating on a thermodynamic refrigeration cycle (e.g. vapour compression, vapour absorption).

The University prefers to minimise the use of mechanical cooling and to use ventilation instead wherever practical. In New Zealand's temperate climate, ventilation will often be sufficient to remove heat from rooms, particularly unoccupied spaces where drafts are not a concern. Heat removal using natural or mechanical ventilation should be investigated before mechanical cooling is considered.

When mechanical cooling is necessary the system should be designed to utilise free cooling where practical and economic.

9.3.1.5.1.2 Thermal Metering

ChW systems shall be provided with a building level thermal meter when the connected load is greater than:

I. 100 kW when imported.
II. 100 kW when generated on site.

University standard thermal energy meters shall be specified.

Thermal energy meters shall be accessible on the BMS in real time via BacNet or by using M-Bus – BacNet interfaces.

The Designer shall confirm project-specific meter technical requirements with University Energy Manager.

9.3.1.5.2 Ventilation for Cooling

9.3.1.5.2.1 Natural Ventilation

Natural ventilation for open plan offices should be under automatic control by the BMS. Local override buttons should be provided to allow occupants to override BMS control if necessary.

9.3.1.5.2.2 Mechanical Ventilation

ICT equipment rooms
Ventilation will generally be suitable for the small distributed ICT equipment rooms in typical University buildings. Ventilation shall be designed to maintain the temperature at less than 28°C during a 5% summer design day. The preferred method is to use a filtered supply or transfer air system however extract air systems or the use of natural ventilation may also be considered. Refer **ICT Section** for further information.

9.3.1.5.3 Cooling Plant

The preferred scheme for distributed mechanical cooling is central refrigeration plant with chilled water reticulated to AHUs and terminal units.

9.3.1.5.3.1 Water Chillers

All new chilled water systems shall be designed to achieve the design cooling loads when ChW is supplied at flow temperature of no less than 7°C.

Designs shall be based on air cooled chillers as water cooled chillers are generally not acceptable. Chillers serving facilities with high internal loads on south island Campuses must be capable of operation in low ambient temperatures.

9.3.1.5.3.2 Direct Refrigerant to Air Cooling plant

Direct refrigerant to air (AKA direct expansion or DX) cooling systems are not preferred.

Split system heat pumps may be considered on a project specific basis where there is a limited number of discrete areas requiring cooling and chilled water is not available or centralised chilled water plant is not economic to use.

Packaged direct refrigeration plant (i.e. PAC and CRAC units) are acceptable where they provide the most economic solution for mechanical cooling on a life cycle cost basis.

9.3.1.5.4 Cooling Distribution Systems

Chilled Water systems shall be provided with frost protection where appropriate. This includes the protection of cooling coils (where upstream of heating coils) in AHUs that operate overnight during winter. The University typically uses glycol dosing for frost protection of ChW systems.

9.3.1.5.5 Terminal Cooling Equipment

Split system heat pumps for space cooling may be considered on a project specific basis where there is a limited number of discrete areas requiring cooling and chilled water is not available or centralised chilled water plant is not economic to use.

9.3.1.6 HUMIDIFICATION & DEHUMIDIFICATION

Due to New Zealand's temperate climate, it is expected humidification and dehumidification will generally not be required to maintain interior relative humidity within the physiological comfort range.

9.3.1.6.1 Humidification

Active humidification is generally not expected to be needed except for specialist spaces where a required humidity range is defined by Technical Standard. However, for South Island Campuses where the moisture content of ambient air can be low during winter, consideration must be given to maintaining an acceptable minimum relative humidity in general spaces which require large quantities of outside air during winter.

The type of humidification system shall be selected on lifecycle cost. Electric steam generators for humidification are generally not preferred due to the high energy costs.

9.3.1.6.2 Dehumidification

Active dehumidification is generally not expected to be needed except for specialist spaces with a humidity range is defined by Technical Standard.

For high latent gain spaces, moisture removal using ventilation should be investigated before active dehumidification is considered.

Where active dehumidification is necessary, mechanical cooling and desiccant dehumidification are acceptable methods. The type of dehumidification system shall be selected on lifecycle cost.

9.3.2 STEAM

9.3.2.1 General

9.3.2.1.1 District Steam System (Dunedin Campus)

Any connections to the steam system must be agreed in writing by the Steam System Operator (currently Pioneer Energy) and University Energy Manager. Any significant increase in load at an existing connection must also be agreed with the Steam System Operator and Energy Manager.

The Dunedin District steam system has a nominal supply pressure of 10 bar however all new connections shall be sized for a maximum incoming steam pressure of 9 bar to allow for the effect of upstream demand.

The quality and cleanliness of steam imported ot the University steam system cannot be guaranteed. Due consideration must be given to the load profile and required cleanliness for the building's plant and equipment and filter stations, clean steam generators and accumulators included where necessary. Condensate return shall be returned at no less than 60°C.

9.3.2.1.2 Condensate

Design should maximise the quantity of steam condensate returned to boiler house. For imported steam, ensure the temperature of the return condensate is not below the contracted return temperature.

Heat recovery should be considered for condensate which cannot be returned to boiler house.

9.3.2.1.3 Metering

A building's steam supply shall be provided with a BEMS connected flow meter when the connected load is greater than:

I. 600 kg/h when imported.
II. 300 kg/h when generated on site

Flow meters shall be accessible in real time on the BMS via BacNet or by using M-Bus – BacNet interfaces.

The Designer shall confirm project-specific meter technical requirements with University Energy Manager.

9.3.2.2 Steam & Condensate Distribution Systems

9.3.2.2.1 Testing

BS EN 285 test points for steam quality & purity testing must be provided at the steam connection to each steriliser and at a building's incoming main connection for an imported steam system.

9.3.3 GASES

9.3.3.1 Fuel Gases

Designers are to ensure all piping systems comply with the NZBC and AS/NZS5601 and are complete with all necessary piping, valves, supports, vent and all fittings necessary for safe operation.

Fuel gas used on Dunedin, Christchurch and other South Island Campuses is reticulated or bottled liquefied petroleum gas (LPG). Fuel gas used on Wellington, Auckland and other North Island Campuses may be reticulated natural gas (NG) or bottled liquefied petroleum gas (LPG).

Fuel gas supply to boilers shall include the following:

- A suitable gas detection and alarm system complete with a gas detection sensor located adjacent the boiler's burner, external siren and visual alarm unit and BMS alarm.
- An external emergency gas shut off solenoid valve with a hard wired interlock with the boiler burner such that the burner will be disabled prior to the valve closing (to avoid burner lock out).
- Interlock with sprinkler alarm in accordance with AS/NZS5601 where the burner is not provided with a flame safeguard device.

9.3.3.1.1.1 Gas Metering

Reticulated gas supplies shall be provided with a check meter or BMS output from the Utility revenue meter. Gas sub meters may be required for tenancy gas use.

Gas meters shall have flow totalisation facility and shall be provided with suitable output to allow BMS monitoring.

9.3.3.1.2 Laboratory Gases

Gas houses and reticulation systems shall be provided for any gas installation in accordance with HSNO regulations. The storage of combustible, toxic or compressed gas cylinders within the building is generally not preferred.

The design of LPG supplies to teaching laboratories should comply with current Ministry of Education Standards. The emergency shut off push button shall be located behind a break glass to discourage its use for routine gas shut off.

Ring main systems shall be used for laboratory LPG supplies with isolation valves provided at each floor served by gas. This, however, may be overridden by the AS/ NZS 2982.1: 1997 clause 3.3 requirement for a clearly identified isolation device in each laboratory 'remote from the outlets in a readily accessible position', somewhere economical and consistent between labs, but out of obvious sight to ordinary users. The isolation devices shall be valves not electric solenoids.

9.3.3.1.3 Medical Gases

This section will be expanded in the next revision of the Guidelines.

9.3.4 MECHANICAL SERVICES EQUIPMENT & MATERIALS

9.3.4.1 GENERAL

9.3.4.1.1 Acceptable Equipment

All plant and equipment must be from manufacturers on the University's Acceptable Building Services Equipment Manufacturers schedule unless agreed otherwise by the University Building Service Engineer and Property Services Trade Supervisors. Refer General Building Services/ Equipment & System Approval section above for further information.

9.3.4.1.2 Future Allowance & Flexibility

Refer General Building Services – Future Allowance & Flexibility section above for detail on the requirements for spare capacity and future flexibility of plant and reticulation.

Indicative future allowances for mechanical services are given in the following table:

Equipment/Service	Allowance
Boilers	15% of air tempering & domestic hot water demand only ((i.e. a future allowance should not be required for additional space heating)
Heat pumps	15% of air tempering demand only (i.e. a future allowance should not be required for additional space heating)
Air handling units (including fan, heat exchanger coils)	As required to provide the future allowance in the duct riser/main(s) to a maximum of 15%
fans	As required to provide the future allowance in the duct riser/main(s) to a maximum of 15%

pumps	As required to provide the future allowance of the heating/cooling plant or pipe riser/main(s) to a maximum of 15%
Duct risers	15% flow (outside air, supply air, general extract only)
Duct primary branches	10% flow (outside air, supply air, general extract only)
Pipe risers/mains	15% additional flow
Pipe primary branches	10% additional flow

9.3.4.2 VENTILATION & AIR CONDITIONING

9.3.4.2.1 Air Handling Units

Air handling unit installations shall meet the following requirements:

- The entire casing shall be well sealed with no discernible air leakage under normal operating conditions. The units shall achieve leakage Class L2 when tested in accordance with clause 6.1.2 of BS EN 1886 at 700 Pa positive test pressure.
- The casing, all fixings, attachments and associated components shall be designed and constructed so that no external cold tracking with subsequent condensate sweating shall occur. The units shall meet the requirements of Class T2 for thermal transmittance and Class TB1 for thermal bridging as defined by clause 7 of BS EN 1886.
- The Frame shall be constructed from:
    - Extruded aluminium sections
    - Pentapost frame system incorporating thermal breaks
    - Removable side panels attached to frames by quarter turn clips integrated in to the panels to permit removal. Not required on sides which will not be assessable in the installed situation
    - Framework to stand alone with all panels removed
    - Removable panel and door air seals: Panels shall have a dual seal arrangement with 2 separate seals for providing an air seal between panels and frame. One of the seals shall be integrated into the frame and be self-inflating
    - Include a floor constructed as per the wall panels, with additional stiffening and reinforcement to provide protection during internal access for service and maintenance.
    - Base: Rigid heavy gauge galvanized steel designed to support the unit without deflection during lifting and transportation.
    - Install coils in stainless steel 316 slide rails to permit removal. Support cooling coils independently of condensate tray
    - Construct condensate tray of stainless steel, with the full void of the tray insulated with a 2-pack polyurethane foam fill or equivalent
- Panels shall be constructed from prefabricated twin stressed-skin sandwich panels consisting of a sheet of insulation bonded to metal skin on both sides. Bond at high temperature and pressure using thermosetting adhesive. Stress both skins equally in the finished panels to result in stable performance under varying temperature and humidity conditions. Complying with the following:
    - Metal skin: ≥0.55 mm base metal thickness factory pre-painted metallic-coated steel sheet
    - Conform to AS 4254 clause 2.7.1(a)
    - Insulation: Single layer rigid cellular polyurethane to AS 1366.1. Use insulation in continuous form without voids and free of line faults through or across the sheet.
    - Blowing agents: Do not provide materials:
        - Which use CFC or HCFC as blowing agents in the manufacturing process
        - Which use a blowing agent with a global warming potential ≥140.
- Heating Coils:
    - The preferred heating medium is heating hot water as described in Heating section above.
    - Heating coils shall be designed/selected in accordance with *CIBSE or ASHRAE guidance*.
- Cooling coils:
    - The preferred cooling medium is chilled water as described in Cooling section above.
    - Cooling coils shall be designed/selected in accordance with *CIBSE or ASHRAE guidance*.
    - All coils which will provide both sensible and latent cooling (dehumidifying coils) the airflow face velocity must be less than 2.5 m/s.
    - Cooling coils must be selected/designed to minimise condensate carry-over. Where the coil's primary purpose is dehumidification or where the entering air will have a high dew-point temperature relative to the temperature of the cooling, a lower face velocity may be required.
    - In no circumstances shall condensate carry-over impinge on downstream equipment within the AHU. Moisture eliminator plates shall be provided if the preferred solutions (lower face velocity, longer drain tray section) are not possible.
- Fans shall be:
    - good quality backward curved centrifugal type in housed or plug fan configuration
    - Plug fans are acceptable where they will not provide a significantly lower energy efficiency than a housed fan.
    - Direct drive is preferred but belt drive may be used where necessary.
    - rated at not less than 150% of actual full load capacity and having a minimum of 2 belts
    - Include guards on belt driven fans.
- Motorised dampers:
    - Drive mechanisms for motorised dampers shall use steel or aluminium linkages, control bars and crank arms. Plastic gear drives are not acceptable.
- Maintenance access:
    - Service Lights (preferably LED) to each section, switches with neon indicators
    - Adequate clearance for access to maintain components including cleaning of both sides of coils.
    - Minimum 450 mm clearance and access opening width on both side of coils.

- Control switch (Off-Manual-Auto) and indicator lights panel mounted on switchboards (MSSB).

9.3.4.2.2 Ventilation Fans

Ventilation fans shall meet the following requirements:

9.3.4.2.2.1 Centrifugal

- Backward inclined aerofoil, where a suitable selection exists
- Fitted with either long life, sealed bearings
- Minimum of two belts in belt drive type
- Heavy gauge metal fan casing or PVC if required

9.3.4.2.2.2 Axial

- Multi blade aerofoil section fan
- Adjustable pitch blades
- Galvanised or epoxy coated steel casing
- Direct drive, unless duty dictates otherwise

9.3.4.2.2.3 Mixed flow

- May be used in place of an axial or in-line centrifugal fan where required to provide an improvement in pressure development, acoustic performance and space. Total efficiency at duty point must exceed 60%
- Galvanised or epoxy coated steel or high strength polymer (e.g. reinforced polypropylene) casing.

9.3.4.2.3 Ventilation Heat Recovery Units

Direct Air to air heat recovery using plate heat exchangers or thermal wheels are the preferred method for ventilation heat recovery. Supply and exhaust fans should be located as close as practical to allow these methods to be used. Run-around coil heat recovery systems are not preferred but will be considered where they will have a positive investment return.

9.3.4.2.4 Variable Air Volume Boxes

Variable Air Volume (VAV) systems will be arranged with air handling units to handle specific building orientations and loads so that single units do not have to serve diverse loads requiring different supply air conditions. The VAV boxes on these units will be placed to enable easy service access and a specific quick removal/replacement system will be investigated for consideration in the design.

Requirements:

- Provide a pressure independent type
- Provide an Integral duct heater
- Provide a grid type averaging differential pressure velocity pressure sensor.

9.3.4.2.5 Fan Coil Units

All FCUs providing both heating and cooling must be the four pipe type. Two pipe FCUs with a common heating/cooling coil are not acceptable.

When FCUs are being provided to a building for heating only, consideration should be given to using four pipe FCUs to allow retrofitting of cooling in the future.

9.3.4.2.6 Fan convectors

The University currently has no additional/alternative requirements

9.3.4.2.7 Chilled beams

The University currently has no additional/alternative requirements

9.3.4.2.8 Air Curtains

The University currently has no additional/alternative requirements

9.3.4.2.9 Filters

All ventilation panel filters shall be washable and reusable.

Filter sizes shall be standard module sizes and 50% of project quantity shall be provided as spares to allow for swap out on rotation.

9.3.4.2.10 Electric Duct Heaters

- Provide stepped control to all heater banks with capacity up to 2.5 kW
- Provide SCR control to all heater banks with capacity equal to or greater than 2.5 kW.

Provide all heater banks, including VAV's, with the following hardwired protection devices:

- Heater Protection Thermostat (HPT)
- Air Flow Switch (AFS).

Protection devices are not to be wired into controls loop of the heating device.

9.3.4.2.11 Ductwork & Fittings

All ductwork systems shall be designed in line with CIBSE or ASHRAE guidance and constructed in accordance with AS4254.

- All sheet metal ductwork with operating pressure less than 500 Pa shall be constructed to achieve minimum AS4254 pressure class 500 and seal class B.
- All sheet metal ductwork with higher operating pressures shall be constructed in accordance with appropriate AS4254 pressure and seal class.

- All sheet metal ductwork serving with class filtration (e.g. HEPA filters) shall be constructed to achieve AS4254 pressure class 1000 and seal class A.

Generally, duct leakage testing will not be required. However duct systems where the difference between the flowrate measured at the fan and the sum of air register flowrates measured at commissioning time is excessive will not be accepted until remediation is carried out to reduce leakage. Refer commissioning section for further information.

University specific requirements modifying, or additional to, these requirements are described below.

PVC duct shall be used for fume cupboard or hood applications

Ductwork shall be sized to minimise energy consumption and airflow noise. Air flow resistance and velocities shall generally not exceed the following:

Duct Type			**Maximum Velocity (m/s)**		
			≥ NC40	NC35	NC30
Risers		Ducts within plantrooms or service risers	13.0	11.0	9.5
Main duct		Ducts within occupied space	8.5	7.5	6.0
Branch ducts			6.5	5.5	4.5
Run out ducts	rigid	Ducts connection branch ducts to air registers	5	4.0	3.5
	Flexible		3.5	3.0	2.5

Resistance to flow in any riser, main duct and branch ducts shall not exceed 1 Pa/m.

9.3.4.2.11.1 Sheet Metal Ductwork

Requirements:

- Manufactured using new galvanised steel sheet, except where other materials are required or nominated
- Minimum thickness of base sheet metal 0.6mm.

9.3.4.2.11.2 Flexible Ductwork

Requirements:

- 3 m maximum length of any one section of flexible ducting
- Make joints between the flexible ducts and sheet metal spigots with suitable metal or Nylon band clamps. A sample of the proposed jointing arrangement shall be submitted before installation
- Provide insulated metal spigots at the main duct and the cushion head box
- Changes in direction of flexible ducts is to be gradual, and the mean radius of the change of direction is to be a minimum of 1.5 x duct radius
- Support flexible ductwork off ceiling in accordance with AS 4254.1.
- Jointing of two or more pieces not permitted
- Do not use in lieu of solid metal ductwork on main duct runs
- Do not use damaged flexible ductwork
- Do not use flexible ducting for duct lines carrying moist airstreams e.g. shower extracts.
- Provide a butterfly damper complete with quadrant arm and locking device at the duct take-off spigot. The damper is to be adjustable from the fully open position to fully closed position. Mount the quadrant arm on a suitable stand-off bracket clear of the insulation such that the insulation does not need to be disturbed in order to adjust the damper setting

9.3.4.2.11.3 Plant Connections

All connections to air handling plant and fans should include suitable flexible connections.

9.3.4.2.12 Air Registers & Louvres

All air registers and louvers shall be of good commercial/institutional quality. All grilles shall be fabricated from aluminium or sheet steel. Plastic registers and louvers are not acceptable.

The Designer may select the supply air diffuser type which provides the required air distribution, pressure loss & acoustic performance.

The Designer may select the extract/return air grille type which provides the required pressure loss & acoustic performance excluding egg crate style grilles which are not acceptable.

The location and type of air registers in feature areas shall be due consideration for the Architectural design.

Return & extract air registers should include removable cores to allow easier cleaning. Removable cores must be fitted with seismic restraint.

The interior of grille boxes shall be finished matt black where it is possible to view through the grille.

All louvres must be provided with vermin mesh.

9.3.4.2.13 Attenuators

Noise attenuation will be provided generally via attenuators mounted within the applicable air handling unit's/exhaust plantroom. Attenuators will also be provided in other locations such as downstream from VAV boxes, cross talk attenuators in transfer ducts etc

- Attenuators will be selected to minimise noise regeneration
- Maximum pressure drop of 35 Pa

- Wherever practical, attenuators will be located in plantrooms or other suitable locations to facilitate removal for cleaning
- Attenuators in supply and return air ducts serving clean spaces such as clinical areas shall be provided with a PE teraphthalate ('Melinex' or 'mylar') lining.

9.3.4.3 HEATING & COOLING

9.3.4.3.1 Heating Water Boilers

9.3.4.3.1.1 Wood fired boilers

The energy and moisture content of the University's wood fuel supply shall be confirmed with the University Energy Manager prior to selecting boiler plant.

9.3.4.3.1.2 Gas fired boilers

Gas boilers shall only be considered where a reticulated gas supply is available.

9.3.4.3.2 Flues & Chimneys

The length of horizontal flues shall be minimised. All horizontal flues shall be provided with access panels at all 90 degree bends and every 4 metres for cleaning

9.3.4.3.3 Hydronic Heat Pump & Chiller Plant

9.3.4.3.3.1 General

Heat pump and chiller plant shall meet the following requirements:

- Be sized to meet Facility cooling loads, with spare capacity and redundancy as detailed above
- Maximise energy efficiency
- Have tested performance and selection certified to ARI 550/590
- Have high level interface to the BMS
- Have refrigerant leak detection if installed in a plant room
- Have refrigerant pump out system
- Refrigerant must be positive to ambient pressure
- Have minimum full load coefficient of performance in compliance with NCC for ARI standard 550/590 conditions.
- Heat pumps and chillers with output greater than 100 kW must include two independently operating and serviceable refrigeration systems.

The use of scroll compressors is preferred for South Island sites due to the greater ease for servicing or replacement.

All refrigerants must be acceptable for unrestricted use under the current revision of the Montreal Protocol (currently 2016 Kigali Amendment) including availability over the economic lifespan of the machine.

The use of best-practise refrigerants is encouraged. It should be practical to use refrigerants with a global warming potential (GWP100) of less than 700 and an Atmospheric Lifetime of less than 15 years or as required by any current legislation. Refrigerants must have an ozone depletion potential (ODP) of zero.

Refrigerants must have an ISO 817 classification of A2L (lower flammability and toxicity) or better.

The design and installation shall comply with IRHACE/CCCANZ code of practice for the reduction of emissions of fluorocarbon refrigerants in refrigeration and air conditioning applications

Refrigerant charge monitor or leak detector must be provided for all refrigeration central plant.

9.3.4.3.3.2 Heat Pumps

9.3.4.3.3.2.1 Air Source Heat Pumps

This section will be expanded in the next revision of the Guidelines.

9.3.4.3.3.2.1 Ground Source Heat Pumps

This section will be expanded in the next revision of the Guidelines.

9.3.4.3.3.1 Chillers

The chilled water system design shall comply with the manufacturer's requirements for minimum primary chilled water circuit volume

9.3.4.3.3.1.1 Air Cooled Chillers

This section will be expanded in the next revision of the Guidelines.

9.3.4.3.3.1.2 Water cooled chillers

The University wishes to avoid the use of cooling towers to eliminate a legionella risk therefore water cooled chillers will generally not be acceptable.

9.3.4.3.3.1.3 Evaporative cooled chillers

The University wishes to avoid the use of evaporative cooled chillers to eliminate a legionella risk.

9.3.4.3.4 Direct refrigerant (DX) cooling

This section will be expanded in the next revision of the Guidelines.

9.3.4.3.5 Dry Coolers

The use of waterside free cooling is encouraged where the building load profile and climate will provide a positive investment return.

Waterside free cooling shall use dry coolers only. The use of evaporative water cooling is not acceptable.

9.3.4.3.6 Evaporative Air Coolers

The University wishes to avoid the use of evaporative coolers to eliminate a legionella risk.

9.3.4.3.7 Heat Exchangers

9.3.4.3.7.1 Plate Heat Exchangers

The use of plate heat exchangers is preferred over other types of liquid-liquid or liquid-gas heat exchangers wherever suitable.

Heat exchanger gasket material shall be selected for minimum 8 year life at maximum operating temperature.

9.3.4.3.7.2 Shell & Tube Heat Exchangers

This section will be expanded in the next revision of the Guidelines.

9.3.4.3.8 Pumps

Pump installations shall meet the following requirements:

- Mechanical seals consisting of carbon elements rotating against a ceramic stationary face
- Maximum impellor diameter to be not more than 90% of maximum impeller size for the casing
- Motor to be sized for the maximum power required by the pump when projecting the system resistance curve to the maximum impeller size

9.3.4.3.9 Heating Terminal equipment

9.3.4.3.9.1 Heating Hot Water Radiators

Radiators shall be institutional grade. Domestic/ light commercial durability or quailty will not be accepted.

Radiators in high traffic and public areas (e.g. foyers, corridors, lecture theatres) shall be heavy duty welded tubular steel type. Radiators in other areas may be pressed steel panel type.

Radiators in public spaces must be provided with tamper proof TRVs. Alternatively, the TRV can be replace with a BMS actuated control valves.

Radiators shall be located under windows and depending on the room layout the use of remote temperature sensors shall be considered.

9.3.4.3.9.2 Underfloor Heating

This section will be expanded in the next revision of the Guidelines.

9.3.4.3.9.3 Radiant Heating

This section will be expanded in the next revision of the Guidelines.

9.3.4.3.9.4 Electric Space Heaters

If wall mounted electric convector heaters have been accepted, the Installer shall purchase from the University. The Installer shall fit the thermostat and timer supplied with each heater.

9.3.4.4 HUMIDIFICATION & DEHUMIDIFICATION

9.3.4.4.1 Airstream humidifiers

Humidifiers must be positioned such that moisture is fully absorbed into the airstream. This will require adequate duct or AHU compartment length to allow total evaporation. In no circumstances shall droplets impinge on downstream equipment within an AHU, or onto internally lined ductwork. Moisture eliminator plates shall be provided if total evaporation is not possible.

Where humidified air is ducted externally in winter, the R-value of the duct insulation should be selected for the worst case between heat loss and humidified air dewpoint temperature to minimise the condensation of moisture onto the interior surface of the ductwork to ensure the humidified air is not dehumidified prior to reaching the room supply grilles.

9.3.4.4.2 Airstream dehumidifiers

Dehumidification equipment shall be selected on whole of life cost.

The use of ChW cooling coils to dehumidify an airstream is not preferred.

9.3.4.5 STEAM

9.3.4.5.1 Steam Boilers

This section will be expanded in the next revision of the Guidelines.

9.3.4.5.2 Steam Accumulators

This section will be expanded in the next revision of the Guidelines.

9.3.4.6 GASES

This section will be expanded in the next revision of the Guidelines.

9.3.4.7 MECHANICAL SERVICES PIPEWORK & FITTINGS

Designers are to ensure all piping systems are complete with all necessary piping, provision for balancing, valves, supports, guides, drains, vents, expansion compensation and all fittings necessary for safe and efficient operation.

9.3.4.7.1.1 Plant & Equipment Connections:

Arrange connections to plant to permit dismantling of the plant without disturbing other pipes and to permit removal of the plant without removal of the piping. Provide union on at least one side of each screwed valve and screwed pipeline component requiring removal for inspection or maintenance. Make all connections to plant by one of the following methods:

- Flare compression joints (up to 20 mm copper, only where there is no vibration and only in accessible locations)
- Screwed brass unions (up to 50 mm size and for pressures up to 800 kPa)
- Bolted flanges (no limitation)
- Unions and flanges for dismantling and removal are not required in installations using grooved mechanical joint couplings. Couplings shall serve as unions and disconnect points.
- Binder test points shall be provided immediately upstream and downstream of all heating/cooling plant, heat exchangers and strainers pumps, strainers, coils, chillers, boilers.

9.3.4.7.1.2 Pipe Material Selection

Materials acceptable to the University are scheduled below. Refer “Pipework Specification” for specific material details.

Duty	Pipe Material
Chilled Water ≤ DN 100	Steel- AS1074 medium Stainless Steel - ASTM A312 or EN10312 Copper – AS1432 Type B Polypropylene – PP-RCT
Chilled Water > DN 100 and ≤ 150	Steel- AS1074 medium Stainless Steel - ASTM A312 or EN10312
Steam ≤ DN 25	Steel – AS1074 heavy Copper– AS1432 - Type A
Steam > DN 25	Steel – AS1074 heavy
Clean steam	Stainless Steel= ASTM A312
Condensate	Stainless Steel- ASTM A312
Laboratory Cooling Water	Stainless Steel - ASTM A312 or EN10312 Copper - – AS1432 Type B
Condenser Water	Stainless Steel - ASTM A312
Heating hot water≤ DN 100 ≤ 50°C	Steel- AS1074 medium Stainless Steel - ASTM A312 or EN10312 Copper – AS1432 Type B Polypropylene – PP-RCT (specifc project based approval required)
Heating hot water≤ DN 100 > 50°C	Steel- AS1074 medium Stainless Steel - ASTM A312 or EN10312 Copper – AS1432 Type B
Heating hot water> DN 100 and ≤ 150	Steel- AS1074 medium Stainless Steel - ASTM A312 or EN10312
Drain & Strainer Blowdown Lines	Copper - – AS1432 Type B
Gauge Lines	Stainless Steel – ASTM A312
Refrigerant Pipework	Copper - AS/NZS1571 Phosphorous de-oxidised non-arsenical

9.3.4.7.1.3 Water Pipework Systems

Water pipework systems shall be based on the following design parameters:

- Design maximum pressures shall be as follows:
  - 1000 kPa, or
  - Operating pressure x 1.5, or
  - The pump shut off head at the maximum impeller size, where applicable,

  whichever is the greater.

- Pipelines shall be sized to minimise the whole of life cost of the system (including the capital and operating costs of the pumps) and in accordance with *CIBSE or ASHRAE guidance*. Typically this would require the following:
- Base design pressure resistance on the following:
  - Resistance to flow in closed system: 450 Pa/m maximum
  - Resistance of flow in open system: 300 Pa/m maximum
- Base design velocity on the following:
  - Velocity of water in either open or closed systems: 0.6 m/s minimum at design flow
  - Maximum velocity of water in systems:

Nominal Pipe Diameter (mm)	Maximum Water Velocity (m/s)
32 and less	1.0
50 and less	1.5
65 and less	1.8
80 and less	2.0
100 and greater	2.4

9.3.4.7.1.4 Pipework Specification

Refer “Pipe Material Selection”.

Steel Pipe

Standard: AS1074

General: All plant, equipment, valves and pipeline fittings shall have joints which can be dismantled.

Type: Select from the following except where a specific jointing method is documented:

- Steel
  - Screwed and socketed up to 50 mm size
  - Flanges
  - Proprietary grooved joints
- Galvanised
  - Screwed and socketed up to 50 mm size
  - Galvanized screwed flanges
  - Proprietary grooved joints

Joint Consistency:

- All joints are to be the same type, except where equipment connection point requires a different type
- All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components
- All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability

Flange bolts, nuts & washers: Stainless steel

9.3.4.7.2 Heating Hot Water Pipework

9.3.4.7.2.1 General

This section will be expanded in the next revision of the Guidelines.

9.3.4.7.2.2 Underground Pipework

Manufacture and installation of all direct buried heating hot water (LTHW & MTHW from 55O to 120O C) pipework shall comply with EU standard EN 253.To comply with this standard, the proprietary pipe system will typically need to be prefabricated and will comprise steel carrier pipe, PU insulation and protective HDPE jacket. All bends and tees shall be prefabricated

The requirement for leak detection cables will be decided on a project specific basis.

Deviation from the pipe system manufacturer’s design, installation and testing instructions is not acceptable. The manufacturer’s instructions shall take precedence over more general direction in this specification.

9.3.4.7.3 Steam Pipework Systems

9.3.4.7.3.1 General

Steam pipework systems shall be based on the following design parameters:

- design pressures as follows:
  - Operating pressure x 1.5.
- Base design pressure resistance on design that does not result in excessive pressure loss at peak demand
- Steam velocity shall be no more than 15 m/s in mains, 25 m/s in branches and 40 m/s at terminals.
- Condensate requirements:
  - Maximum velocity of 2.4 metres/second
  - Base design on 2 x normal condensate load without flash steam
  - Design system to provide suitable and sufficient steam traps of appropriate type to adequately remove condensate from the steam distribution system.
- Arrange piping so condensate does not collect in any areas not served by a steam trap. Arrange piping, take-offs and grade steam pipe to best industry practice.
- Ensure dead-legs are minimised within each system. Remove all redundant pipework which may result in a dead-leg.

9.3.4.7.3.2 Underground Pipework

The University prefers underground steam & condensate pipework to be installed within a concrete duct or tunnel. In this case pipe materials shall be as specified for above ground. Mechanical expansion devices will be considered for accommodating thermal expansion where safe and convenient access for inspection can be provided.

Direct buried pipework is not preferred but may be considered on a project specific basis. In this case Manufacture and installation of all direct buried steam pipework shall comply with US standard ANSI B31.1.

This will typically require a steel service pipe within a steel carrier pipe with air gap surrounded by PU insulation protected by FRP or HDPE jacket. Both carrier and conduit pipes are fully welded. Pipelines are to be fully drainable and dryable and pressure testable using air.

For direct buried pipework thermal expansion must be accommodated using pipe offsets and loops.

The requirement for leak detection cables will be decided on a project specific basis.

Deviation from the pipe system manufacturer’s design, installation and testing instructions is not acceptable. The manufacturer’s instructions shall take precedence over more general direction in this specification.

9.3.4.7.4 Refrigerant Systems

Size refrigerant pipework to satisfy the following requirements:

- Equipment manufacturer's recommendations
- Ensure oil return to the compressor/s under all operating conditions

Include at least the following in each refrigeration circuit:

- Suction and discharge service valves at the compressor
- Vibration isolation pipe connectors where excessive vibration will be transferred
- Liquid line sight glass and moisture indicator
- Liquid line filter dryer
- Isolating valves on the forced/induced draught coolers (including dryers, TX valves, solenoid valves)
- Liquid line solenoid valves and pump down to LP control for all units
- Thermal expansion valves with external equaliser
- High and low pressure control and tappings for gauge connection
- Oil separators to all units, complete with a solenoid valve, strainer, sight glass and isolation valves in each oil line
- Auto reset LP control
- Traps in vertical risers, in accordance with equipment manufacturers recommendations

9.3.4.7.5 Valves

Valve types should be selected in accordance with good industry practise. Valve construction and materials must be suitable for the required fluid, temperature and pressure duty over the economic life required in the Equipment Lifespan section above. Valves shall only be from Manufacturers on the University's acceptable manufacturers schedule or which have been accepted by the University prior to ordering.

Specific University requirements are noted below.

9.3.4.7.5.1 Hydronic Systems

9.3.4.7.5.1.1 Isolating Valves

Ball valves or Gate Valves shall be used for Heating Hot Water isolation. Butterfly valves shall not be used in HHW systems which operate at above 60ºC without specific approval.

9.3.4.7.5.1.2 Flow Regulating Valves

Installers shall comply with Manufacturer's instructions for unobstructed straight length clearances upstream and downstream of the valve unless impractical.

9.3.4.7.5.1.3 Strainers

Fit plugged drain cock to basket cover of all strainers DN50 and larger.

9.3.4.7.5.2 Steam & Condensate Systems

9.3.4.7.5.2.1 Isolating Valves

Steam and condensate systems shall be provided with double block & bleed (double isolation) valve sets at designated main isolation points so that sections of the system can be safely isolated for maintenance while the remainder of the system remains in service. The number of main isolation points required in a system shall be selected based on the criticality of the equipment/services to which steam is being supplied. For district steam systems there shall be a main isolation point at the entry to each building's steam plantroom.

Double block & bleed valves sets shall use bellows sealed globe stop valves.

9.3.4.8 ELECTRICAL FOR MECHANICAL SERVICES

Power supplies and other electrical Installations required for mechanical services systems shall be designed and installed in accordance with the Electrical Services section below.

9.3.4.9 AUTOMATIC CONTROLS & MONITORING FOR MECHANICAL SERVICES

Controls equipment and systems required for the control and monitoring of mechanical services systems shall be designed and installed in accordance with the Automatic Controls & Monitoring section below.

9.4 HYDRAULIC SERVICES (INCLUDING CIVIL SERVICES)

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Commissioning & Tuning (2)
- Metering & Monitoring (6)
- Water (18)
- Emissions (25, 27, 28)

9.4.1 WATER SUPPLY

9.4.1.1 DOMESTIC WATER

9.4.1.1.1 General

9.4.1.1.1.1 Water Efficiency

All domestic water fixtures must have a WELS rating no more than one star below best available rating at the time of design.

9.4.1.1.1.2 Water Metering

All new building with more than 8 cold water fixtures (including supply to hot water system) shall be provided with water check meter on the incoming town mains supply. The check meter shall be connected to Campus BMS to allow for monitoring and data collection.

All new buildings with more than 10 hot water fixtures shall be provided with a sub-meter on the cold water supply to hot water system.

All new buildings with high water consumption equipment shall be provided with additional sub-metering, this includes the following:

i. batch washers
ii. sterilisers
iii. reverse osmosis water production
iv. landscaping irrigation

Sub-meters are not required for the make-up water supply to HHW and ChW systems.

Water meters shall have flow totalisation facility and shall be provided with suitable output to allow BMS monitoring.

The Designer shall confirm project-specific meter technical requirements with University Energy Manager.

9.4.1.1.1.3 Legionella Prevention

Due consideration shall be taken in the design of both domestic hot and cold water systems to ensure the risk of legionella growth is minimised.

Domestic hot water storage vessels shall be operated at a temperature at which legionella will die quickly (and not less than 60° C). The water temperature within flow and return circulating systems shall be maintained at not less than 60°C.

The use of automated pasteurisation cycles is not preferred but may be considered. When pasteuriation is being used, the Designer must ensure the domestic water system design is suitable for the elevated pasteurisation temperatures.

Care shall be taken to prevent water in cold water pipework being able to reach temperatures greater than 20°C due to an external heat source. Pipework shall be insulated where necessary to slow down the transfer of heat from the surroundings.

Where cold water used for clinical purposes (e.g. supply to dental chairs) will sit in pipelines for long periods (e.g. during a clinic holiday shut down) and will therefore be at risk of warming to room temperature automated dump valves shall be provided to allow water to be periodically flushed through the system.

All domestic water systems shall be designed to avoid dead legs. When domestic water systems are altered, all redundant pipework must be removed back to the junction with live pipework.

UV filters are an acceptable supplementary method of controlling legionella for domestic cold and hot water.

The domestic water system should be designed to avoid the necessity for regular hyperchlorination ('shock chlorination') due to the risk of chlorine damage to pipeline components.

9.4.1.1.1.4 Pressure Control

The University wishes to take precautions to avoid the risk of damage to pipelines due to a combination of factors such as the water hammer and cavitation (especially when combined with entrained air, high water temperature & flow velocities and the presence of chlorine products).

The effect of cyclical pressure loading must be allowed in the design and selection of equipment such as calorifiers and hot water cylinders.

Due consideration of water hammer shall be made for all systems and provision for dampening pressure fluctuations shall be included in the design.

Where booster pumps are used to increase water pressure. The pump shall not operate DOL but instead gradually ramp speed up and down.

Automatic air vents shall be provided at the top of domestic water risers to assist with removing entrained air from domestic hot water systems.

9.4.1.1.1.5 Protection from internal Flooding

The water supply to all domestic fixtures shall be fitted with self-acting flood guard valves.

9.4.1.1.1.6 Back Flow Protection

The incoming mains water supply to residential Colleges and other facilities requiring a 24/7 water supply should be provided with two back flow preventers in parallel to allow testing without interrupting the supply to the building.

9.4.1.1.1.7 Water Treatment

Section under review

9.4.1.1.2 Cold Water Supply

9.4.1.1.2.1 Water for Drinking & Food Preparation

Approved drinking water filters shall be provided at all kitchen sinks (e.g. in kitchenettes, staffrooms and tearooms).

9.4.1.1.2.2 Toilet flushing

The method of toilet flushing shall be selected to minimise the consumption of water and maximise availability of the WCs.

Flushing valves are preferred over cisterns for their greater durability. Flushing valves must be used when the WCs will have a consistently high usage rate or be subject to concentrated periods of high usage e.g. sports facilities, lecture theatres

The flushing water reticulation must be sized to allow manufacturers specified inlet pressure to be available at each flushing valve during peak toilet usage. WCs should be grouped together as far as possible to reduce the cost of reticulating the larger pipework required for flushing valves.

Mains pressure flushing valves are preferred however the design of the flushing system design must ensure pressure fluctuations in the upstream domestic cold water system are minimised. This may require the use of a break tank and booster pumps, in which case the alternative of down fed low pressure flushing valves should also be considered.

Cisterns are acceptable for buildings with a small number of WCs (where the cost of providing flushing valve infrastructure such as buffer vessel and booster pump is not economic). Cisterns will also be considered for buildings with a high toilet use diversity e.g. an office building. The Designer shall design the domestic water reticulation so that cisterns will refill within 60 seconds while at the diversified load. Cisterns must be concealed in toilets which are open to the public to prevent unauthorised tampering or vandalism.

WC cisterns in typical University buildings will be flushed more frequently than residential cisterns so the cisterns valves typically suffer more rapid wear & tear, therefore requiring more frequent maintenance access. The typical front access panels provided for concealed cisterns in residential applications may not be adequate to allow easy access to inspect all connections and replace all cistern components so custom-made wall access panels of sufficient size shall be provided instead.

Waterless urinals are not acceptable.

9.4.1.1.2.3 Hose taps

Hose taps shall be provided on the exterior of the building for housekeeping purposes. Hose taps shall be distributed around the perimeter such that all areas of the building's façade and the surrounding site can be reached using no more than a 20 metre hose (with minimum 150 kPa water pressure at the hose discharge).

A hosetap(s) shall be provided in all large plantrooms for housekeeping.

All hose taps shall be provided with vacuum breakers and anti tamper spindles.

9.4.1.1.2.4 Water supply to specialist equipment

The Hydraulic Services Designer shall confirm the water quality requirements for any scientific or medical equipment and ensure any pre-conditioning equipment has been included in the design. It is preferred that the specialist equipment is supplied complete with pre-conditioning equipment by the manufacturer.

9.4.1.1.2.5 Cold Water Storage

Cold water storage may be required for statutory compliance or to ensure business continuity for mission critical facilities. The type and volume of storage required for the latter will be stated in the Project Specific Brief.

Where required to provide adequate water pressurisation, a water storage tank installation shall be provided with duty/standby booster pump set.

All internal storage tanks shall be provided with a tanker refill line from a suitable secure point on the perimeter of the building at ground level.

All unsealed openings in water storage tanks (e.g. overflows, vents) shall be fitted with insect mesh screen.

Care should be taken to ensure there will be no growth of legionella (or other biological contaminants) in the stored water, this applies particularly where the surrounding air temperature will be warm (such as plantrooms). Consideration should be given to configuring the tank's connections in such a way that there will be regular draw off and replenishment of the stored water e.g. connecting the tank 'in-line' with the normal cold water supply so there is regular through-flow or using the tank as a header tank for toilet flushing also.

9.4.1.1.3 Hot Water Supply

9.4.1.1.3.1 Hot Water Production

Electric immersion elements, gas fired boilers (with water storage), dedicated heat pumps, heating hot water, steam and condensate are acceptable energy sources for producing hot water.

The acceptable energy sources for a particular site will be determined by the University Energy Manager and advised in the Specific Project Brief. Alternative energy sources may be proposed for consideration during Concept Design. The energy source with the lowest life cycle cost will generally be selected.

Centralised storage systems are preferred however a decentralised storage system will be considered if has the lowest life cycle cost.

Instantaneous hot water production systems are not preferred.

9.4.1.1.3.2 Solar Water Heating

To reduce building energy consumption, solar water heating shall be considered for all sites with hot water consumption greater than 750 litres per day.

Solar water heating must have a positive investment return when evaluated using a life cycle cost analysis.

Solar water heating must be evaluated in parallel with the alternative of photovoltaic electricity generation as these would typically utilise the same roof or other external area. It is expected PV installations will typically be both more efficient and more versatile than solar water heating.

9.4.1.1.3.3 Hot Water storage vessels

All hot water storage vessels shall be maintained at a temperature which will kill legionella quickly (not less than 60ºC). Refer Legionella Prevention section above.

All hot water storage vessels with a primary heat source other than electricity should be provided with back up electric elements to allow maximum 4 hour recovery. All installations with electrical elements shall also be provided with a suitably rated temperature pressure relief valve.

All vessels shall be rated for the pressure cycles which will occur as the mains pressure water expands with heating.

9.4.1.1.3.4 Hot water tempering

Every hot water storage vessel installation shall be fitted with a central thermoblending valve to control the temperature of the hot water distributed to the building's fixtures. This valve shall be set to 60ºC for recirculating domestic hot water systems.

Point of use tempering valves shall be provided where fixture domestic hot water temperatures lower than 55ºC are required by the NZBC.

9.4.1.1.3.5 Domestic Hot Water Recirculation or Trace Heating

The domestic hot water system shall be designed such that hot water will reach any outlet in less than 20 seconds (at design flowrate). If required, a pumped return system or trace heating shall be provided to achieve this. In all cases, the length of run out branch shall not exceed 12 meters.

Centralised systems with more than 10 hot water outlets shall be provided with pumped return circuit, trace heating or equivalent to maintain temperature of water in the hot water distribution network at 60°C minimum at all times.

Pipework shall be sized to ensure that velocities are within the domestic pipe velocities specified below. Where the recirculation system has more than one return loop, flow or temperature regulation valves shall be provided to ensure these velocities are not exceeded.

9.4.1.2 NON-POTABLE WATER

9.4.1.2.1 Back Flow Protection

For buildings with multiple areas requiring a non-potable water supply (e.g .Laboratories facilities) the preferred solution is a whole-building non-potable water system with all supplies reticulated from a centralised BFP. Where a centralised system is not practical, zone BFPs serving multiple spaces may be used. The use of a dedicated BFP for individual spaces or fixtures is the least preferred option.

9.4.1.2.2 Laboratory water

9.4.1.2.2.1 Reverse Osmosis

Typically building RO systems should provide water to ASTM type 3 standard. Where a higher water quality is required, the Department will provide polishing equipment to further process the building RO water.

9.4.1.2.3 Irrigation

The University currently has no additional/alternative requirements.

9.4.2 DRAINAGE

9.4.2.1 WASTEWATER DRAINAGE

9.4.2.1.1 Building Wastewater Drainage

9.4.2.1.1.1 General

Wastewater drainage systems shall drain by gravity unless physically impossible. Where pumping is unavoidable, requirements must be confirmed with the Territorial Authority before design commences. Any pumping systems which are

required to lift wastewater from below ground level shall have service and standby pumps and incorporate an alarm connection to the BMS.

Accessibility must be provided to allow clearing of blockages in the drains without disruption to the operation of the Facility. Adequate inspection openings (terminated at floor level) shall be provided to allow inspection of drains routed under a slab on grade. Ensure there is safe and convenient access to maintain air admittance valves and pressure attenuators. Access panels for maintenance must not be located in clinical and sterile areas

Where a building is sprinkler protected:

- a tundish connected to suitably sized waste drain shall be provided at the location of all sprinkler system drain down valves.
- a suitably sized drain shall be provided adjacent sprinkler valve to drain the discharge of sprinkler mains water during the periodic sprinkler system flow tests.

9.4.2.1.1.2 Air Conditioning Condensate

Each item of air conditioning equipment must be provided with a trapped condensate drain. Territorial Authorities typically require air conditioning condensate to be discharged to the waste water drainage system. The condensate drains shall be discharged into a tundish which is connected to the wastewater system upstream of a regularly charged trap e.g. the riser of a sink / WHB waste or a FWG charged by a WHB / sink. It is not acceptable to rely on the trap of the condensate drain or tundish unless it includes a priming valve. An approved waterless trap may be used where it is impractical to connect to a charged trap.

Condensate systems shall drain by gravity unless pumping of the condensate is unavoidable. Condensate pumps and pumped drain lines shall be located for convenient inspection and maintenance.

In-floor condensate drains shall be provided in all air conditioning plantrooms with a tundish (flush with floor level) located adjacent each item of plant which produces condensate. Running surface drains to discharge into central FWGs is not acceptable. Where it is impractical to provide in-floor condensate drains, the FWGs shall be located so that at least 800 mm of unobstructed access clear of surface drains is provided along circulation routes.

An approved waterless trap shall be fitted to the individual condensate drain outlet of any AHU serving PC laboratories to prevent the ingress of insects into the ventilation system.

9.4.2.1.1.3 Protection from internal Flooding

An external overflow relief gully should be provided for every building.

All sinks and basins shall include integral overflow outlets.

The following ‘wet areas’ shall be provided with floor waste gullies (FWG):

i. Toilets
ii. Cleaners cupboards
iii. Wet Laboratories
iv. Plantrooms containing domestic or mechanical water reticulation

FWGs charged by Cleaners sinks shall be fitted with anti-foam traps.

Priming valves shall be used to maintain the trap water seal for all floor wastes with infrequent flow.

Every lift shaft shall be provided with a sump complete with sump pump and moisture sensor and high water level alarm connected to the BMS.

9.4.2.1.1.4 Greasy Waste

External grease separators shall be used wherever practical. Underbench grease convertors are not preferred.

9.4.2.1.2 Site Wastewater Drainage Infrastructure

Site wastewater drainage infrastructure should be designed in accordance with the Territorial Authority's wastewater drainage standards.

i. For the Dunedin Campus, the Dunedin City Council "Dunedin Code of Subdivision and Development" should be used.

All drainage pipework under roads, driveways or other areas that may be used by heavy motor vehicles shall have a minimum rating of SN16 or equivalent.

The accuracy of historical as built drawings of Campus drainage infrastructure cannot be guaranteed. Except for recently developed areas where the drainage is accurately documented, any existing site infrastructure to which a new development’s drainage will be connected must be surveyed during Design to confirm condition and capacity. The survey shall cover the entire length of the site drain from the new development’s connection to the connection to the Territorial Authority’s infrastructure.

9.4.2.2 STORMWATER DRAINAGE

9.4.2.2.1 Building Stormwater Drainage

Conventional gravity drainage systems are preferred but syphonic roof drainage systems are acceptable where, due to site or building constraints, gravity systems are impractical or have a higher whole life cost.

All box gutters and water storage tanks must be provided with an overflow which provide a readily visible indication of a failure of the main drainage system.

All connections of downpipes to stormwater drains must be made with an inspection opening at the base of the riser, accessible through an access panel if concealed. The inspection opening must permit unimpeded maintenance access.

9.4.2.2.2 Site Surface Water Drainage

Site surface drainage should generally be designed in accordance with the Territorial Authority's stormwater drainage standards.

i. For the Dunedin Campus, the Dunedin City Council "Code of Subdivision and Development" should be used.

Drain grates and frames shall comply with AS3996 and be designed and installed to avoid tripping, slipping or entrapment hazard to pedestrians or cyclists.

Grates shall be fixed down to prevent tampering and dislodgement during a drain surcharge. All inspection chamber, bubble up chamber covers shall be restrained or a safety cage provided to avoid a fall or entrapment hazard being created should the cover lift in a surcharge

9.4.2.2.2.1 Protection from external flooding

Rainfall intensity should be calculated using the Territorial Authority's current local rainfall intensity curves.

i. For the Dunedin Campus, the Dunedin City Council "Method for Calculating Rainfall Intensity" should be used.

Consistent with the intent of the NZBC clause E 1.3.1, surface water collected or concentrated by a new building or site work, resulting from an event having a 10% probability of occurring annually, shall be disposed of in a way that does not add to the pre-existing flood risk of other Campus buildings.

9.4.2.2.3 Site Stormwater Drainage Infrastructure

Stormwater drainage systems must drain by gravity unless physically impossible. Where pumping is unavoidable, requirements must be confirmed with the Territorial Authority before design commences. All pumping systems shall have service and standby pumps and incorporate an alarm connection to the BMS.

Site stormwater drainage infrastructure should be designed in accordance with the Territorial Authority's stormwater drainage standards.

i. For the Dunedin Campus, the Dunedin City Council "Dunedin Code of Subdivision and Development" should be used.

All drainage pipework under roads, driveways or other areas that may be used by heavy motor vehicles shall have a minimum rating of SN16 or equivalent.

The outlet pipes from mudtanks/sumps/ cesspits located in driveways, carparks or similar shall have a minimum rating of SN16 or equivalent.

The accuracy of historical as built drawings of Campus drainage infrastructure cannot be guaranteed. Except for recently developed areas where the drainage is accurately documented, any existing site infrastructure to which a new development's drainage will be connected must be surveyed during Design to confirm condition and capacity. The survey shall cover the entire length of the site drain from the connection from the new development to the connection to the Territorial Authority's infrastructure.

9.4.2.2.4 Rainwater Harvesting

The University may consider rainwater harvesting to reduce building water consumption. It is expected it will generally only be practical or economic to use harvested rainwater as non-potable water for applications such as toilet flushing and irrigation. The Designer should consider rainwater harvesting for sites:

i. With more than 25 sanitary fixtures or equivalent and,
ii. with suitable rainwater catchment area greater than 400 m2 or,
iii. Where the Territorial Authority requires stormwater attenuation as part of the site development.

Rainwater harvesting must have a positive investment return when evaluated using a life cycle cost analysis.

Due consideration shall be given to cleanliness of the rainwater collecting surfaces. Collecting surfaces must have safe and convenient access to allow the removal of deposited foreign matter and organic material which may obstruct drainage outlets or contaminate the stored rainwater. Accordingly, rainwater shall not be harvested from green roofs due to the high organic matter content.

All rainwater harvesting systems must incorporate first flush diverters to minimise the ingress of contaminants into the water storage.

9.4.2.3 SUB-SURFACE DRAINAGE

The University currently has no additional/alternative requirements.

9.4.3 HYDRAULIC SERVICES EQUIPMENT & MATERIALS

9.4.3.1 GENERAL

9.4.3.1.1 Acceptable Equipment

All plant and equipment must be from manufacturers on the University's Acceptable Building Services Equipment Manufacturers schedule unless agreed, in advance, by the University Building Service Engineer and Property Services Trade Supervisors. Refer General Building Services/ Equipment & System Approval section above for further information.

9.4.3.1.2 Future Allowance & Flexibility

Refer General Building Services – Future Allowance & Flexibility section above for detail on the requirements for spare capacity and future flexibility of plant and reticulation.

Indicative future allowances for hydraulic services are given in the following table:

Equipment/Service	Allowance
Hot water storage	10% additional storage (general) Space and load allowance to allow 20% increase in demand (residential colleges, animal holding facilities only)
Pipe risers/mains	15% additional flow
Pipe primary branches	10% additional flow
Main drains/ discharge stacks	15% additional flow
Drain primary branches	10% additional flow

9.4.3.2 FIXTURES

9.4.3.2.1 Domestic Fixtures

All domestic fixtures and appliances including tapware, shower heads, washing machines and dishwashers shall have a Water Efficiency Labelling Scheme (WELS) rating within 1 star of the current best rating.

9.4.3.2.1.1 Drinking water boilers & chillers

Where water boilers are required, underbench water boiler units are preferred to the oversink type.

If water coolers are being provided, it is preferred these are provided as a underbench water chillers in a Kitchenette rather than as a standalone water cooler unit.

Where both Underbench water boilers and water chillers in are being provided they should be a combined unit in a Kitchenette.

9.4.3.2.1.2 Drinking Fountains

Property Services has a standard drinking fountain model which should be specified for all projects.

9.4.3.2.2 Sanitary Fixtures

All sanitary fixtures including WCs, urinals, shower heads and tapware shall have a WELS rating within 1 star of the current best rating

9.4.3.2.2.1 Toilets

Where toilets (WCs) are provided with an in-wall cistern or flushing valve, the wall access panel must be large enough for convenient maintenance of valves.

WC cisterns in typical University buildings will be flushed more frequently than residential cisterns so the cisterns valves typically suffer more rapid wear & tear, therefore requiring more frequent maintenance access. The typical front access panels provided for concealed cisterns in residential applications may not be adequate to allow easy access to inspect all connections and replace all cistern components so custom-made wall access panels of sufficient size shall be provided instead.

9.4.3.2.3 Laboratory Fixtures

9.4.3.2.3.1 Eye Washes

Property Services has a standard eye wash design which shall be used for all projects on the Dunedin campus unless it is unsuitable in a specific application.

9.4.3.2.3.2 Safety Showers

Property Services has a standard safety shower design which shall be used for all projects on the Dunedin campus unless it is unsuitable in a specific application.

9.4.3.2.3.3 Single pass water laboratory equipment

The use of domestic water for single pass water cooling (i.e. discharge to drain) of frequently used laboratory cooling equipment (e.g. condensers) is not acceptable. Where this type of equipment will be used, a closed circuit (recirculating) process cooling water system shall be provided.

Likewise domestic water should not be used for single pass water vacuum equipment (e.g. aspirators).

9.4.3.3 WATER HEATING

This section will be expanded in the next revision of these Guidelines.

9.4.3.3.1 Domestic Hot Water boilers

9.4.3.3.2 Domestic hot water heat pumps

9.4.3.3.3 Solar Water Heating systems

9.4.3.3.4 Hot water cylinders & calorifiers

9.4.3.4 WATER SUPPLY

9.4.3.4.1 Pipework & Fittings

Designers are to ensure all piping systems comply with the NZBC and are complete with all necessary piping, valves, supports, guides, drains, vents, expansion compensation and all fittings necessary for safe and efficient operation.

Designers shall comply with AS/NZS3500 except where identified below.

9.4.3.4.1.1 Pipe Material Selection

All pipe materials must comply with NZBC and AS/NZS3500. Materials acceptable to the University are scheduled below. Refer "Pipework Specification" for specific material details.

Duty	Pipe Material
Domestic Cold Water	≤DN100 Stainless Steel - BS EN 10312 Copper – AS1432 Polypropylene – PP-R or RCT (DIN8078)
Domestic hot Water < 65 ºC	≤DN100 Stainless Steel – BS EN 10312 Copper – AS1432
Domestic hot water >65 ºC & adjacent water heaters	≤DN100 Stainless Steel – BS EN 10312 Copper – AS1432
Distilled water	Polypropylene – PP-RCT (DIN8078) Stainless Steel - BS EN 10312
Softened water	Polypropylene – PP-RCT (DIN8078) Stainless Steel - BS EN 10312
Reverse Osmosis Water	Polypropylene – PP-RCT (DIN8078) Stainless Steel - BS EN 10312
Drain & Strainer Blowdown Lines	Copper – AS1432
Gauge Lines	Copper – AS1432 Stainless Steel –BS EN 10312

9.4.3.4.1.2 Chlorine & Cholramine Resistance

All domestic water systems connected to Territorial Authority's water supply and/or which may be dosed with chlorine shall have chlorine/chloramine resistant O-rings, gaskets.

9.4.3.4.1.3 Mixing of pipe materials and systems

Mixing of pipe materials shall only be done after consideration of the potential for cross- contamination or corrosion.

The following materials shall not be mixed in the same system:

- Copper and Polypropylene

9.4.3.4.1.4 Proprietary Systems

Installation of a proprietary pipe system must be done strictly in accordance with manufacturer's guidelines and shall only use tools and componentry specified by the system manufacturer.

Different proprietary pipe systems shall not be mixed/combined in the same installation.

All proprietary systems must be selected for worst-case pressure and temperature profile for the specific application to ensure the system remains fit for purpose should the system parameters be altered in the future.

9.4.3.4.1.5 Pipework Specification

9.4.3.4.2 Copper Pipe

Standard: Tube to AS1432

9.4.3.4.2.1 Pipeline Jointing

The following jointing methods shall be used except where a specific jointing method is documented:

All new and less than minor refurbishment projects: Other than for equipment and similar connections brazed joints shall be used.

For minor projects, maintenance work and repairs the following systems may be used.

- Press connect ('press-fit') joints to ASTM F3226
- Flare compression joints (up to DN 32 nominal size, only where no vibration occurs and only where accessible)

Joint Consistency: All joints should be the same type, except where equipment connection point requires a different type.

9.4.3.4.2.2 Equipment Connections

All plant, equipment and valves must have joints which can be dismantled. Select from the following except where a specific jointing method is documented:

- Flare compression joints (up to 20 mm copper and only where there is no vibration)
- Screwed brass unions (up to 50 mm size and for pressures up to 800 kPa)
- Bolted flanges (no limitation): Copamate or equivalent to AS2129 with stainless steel bolts, nuts & washers

Provide union on at least one side of each screwed valve and screwed pipeline component requiring removal for inspection or maintenance.

Arrange connections to plant to permit dismantling of the plant without disturbing other pipes and to permit removal of the plant without removal of the piping.

9.4.3.4.3 Stainless Steel Pipe

Grade: 316L

Standard: Tube to BS EN 10312

9.4.3.4.3.1 Pipeline Jointing

≤100DN

Type: Select from the following except where a specific jointing method is documented:

- Press connect ('press-fit') joints to ASTM F3226 (TBC)

Joint Consistency: All joints should be the same type, except where equipment connection point requires a different type.

9.4.3.4.3.2 Equipment Connections

All plant, equipment, valves and other pipeline fittings must have joints which can be dismantled. Select from the following except where a specific jointing method is documented:

- Screwed stainless steel unions (up to 50 mm size and for pressures up to 800 kPa)
- Bolted flanges (no limitation): stainless steel to AS2129 with stainless steel bolts, nuts & washers

Arrange connections to plant to permit dismantling of the plant without disturbing other pipes and to permit removal of the plant without removal of the piping.

Provide union on at least one side of each screwed valve and screwed pipeline component requiring removal for inspection or maintenance. Make all connections to plant by one of the following methods.

Unions and flanges for dismantling and removal are not required in installations using grooved mechanical joint couplings. Couplings shall serve as unions and disconnect points.

9.4.3.4.4 Polypropylene Pipe

Standard: PP-RCT (DIN8078)

9.4.3.4.4.1 Pipeline Jointing

≤100DN

Type: Select from the following except where a specific jointing method is documented:

- Electrofusion welded to proprietary system specification

All plant, equipment and valves must have joints which can be dismantled.

Joint Consistency: All joints should be the same type, except where equipment connection point requires a different type.

9.4.3.4.4.2 Equipment Connections

All plant, equipment, valves and other pipeline fittings must have joints which can be dismantled. Select from the following except where a specific jointing method is documented:

- Screwed stainless steel or brass unions (up to 50 mm size and for pressures up to 800 kPa)
- Bolted flanges (no limitation): stainless steel slip-on flange to AS2129 with proprietary flange adaptor and stainless steel bolts, nuts & washers

Arrange connections to plant to permit dismantling of the plant without disturbing other pipes and to permit removal of the plant without removal of the piping.

Provide union on at least one side of each screwed valve and screwed pipeline component requiring removal for inspection or maintenance. Make all connections to plant by one of the following methods:

9.4.3.4.5 System Design Parameters

Water pipework systems shall be based on the following design parameters:

- design maximum pressure shall be as follows:
  - 1000 kPa, or
  - Operating pressure x 1.5, or
  - The pump shut off head at the maximum impeller size, where applicable,

whichever is the greater.

- Design temperature shall be as follows:
  - for domestic hot water systems: 65 C or required operating temperature at fixtures + 10 C (whichever is greater)

- Operating pressures shall be as follows:
  - Minimum dynamic pressure of 100kPa or fixture's minimum recommended pressure (whichever is greater) when entire reticulation network is at design flow,
  - Maximum static pressure of 500kPa at any point within building reticulation network (downstream of pressure reducing/limiting valve)

- Design flowrates shall be based on the following:
  - Where the simultaneous demand exceeds the scope of AS/NZS3500.1, the design flowrate should be calculated using the methodology in BS 8558 or The Institute of Plumbing (UK) Engineering Services Guide.

- Design flow velocities shall be as follows:
  - Minimum flow velocity at design flow shall be 0.5 m/s
  - Due to concern about pipe erosion and flow noise at high velocities, the University requires

maximum pipe flow velocities to be lower than those given in AS/NZS3500.1 and 2. Until AS/NZS3500 is revised, the flow velocities shall be as follows:

Stainless Steel	
Location	**Maximum Water Velocity (m/s)**
Within plantrooms and service ducts	2
Within bulkheads/ ceiling voids of occupied spaces	1.5
Within occupied spaces	1.2

Copper (at AS1432 internal diameters)	
Location	**Maximum Water Velocity (m/s)**
Within plantrooms and service ducts, bulkheads/ ceiling voids of occupied spaces	1.5
Within occupied spaces	1.2

- For proprietary pipe systems, velocities shall comply with manufacturer's specifications

9.4.3.4.6 Valves & Fittings

Valve types should be selected in accordance with good industry practise. All valves and fittings in potable water systems must be lead-free and certified under the WaterMark scheme (administered by the Australian Building Codes Board)

Valve construction and materials must be suitable for the required fluid, temperature and pressure duty over the economic life required in the Equipment Lifespan section above. Valves shall only be from Manufacturers on the University's acceptable manufacturers schedule or which have been accepted by the University prior to ordering.

9.4.3.5 DRAINAGE

Designers are to ensure all piping systems comply with the NZBC and AS/NZS3500 and are complete with all necessary piping, valves, supports, vents, and all fittings necessary for safe and efficient operation.

9.4.3.5.1 Pipe Material Selection

All pipe materials must comply with NZBC and AS/NZS3500. Materials acceptable to the University are scheduled below. Refer "Pipework Specification" for specific material details.

Duty	**Pipe Material**
Sanitary Waste & Foul – above ground	uPVC - AS/NZS1260 PE – AS/NZS4401
High temperature sanitary waste (> 65 C) – above ground	Copper – NZS3501 Stainless Steel – ASTM A312 or EN10312
Chemical Wastewater – above ground	PP – Vulcathene or equivalent (confirm suitability for transported substances before specifying)
Waste & Foulwater – below ground	uPVC - AS/NZS1260 PE – AS/NZS4401
Sanitary waste & foul - pumped	uPVC - AS/NZS1477
Sanitary vents	uPVC - AS/NZS1260 PE – AS/NZS4401
Stormwater – above ground (concealed)	Stainless steel – NZS/BS 970 uPVC – AS/NZS1254 or AS/NZS1260 PE – AS/NZS4130 or AS/NZS2065
Stormwater – above ground (down pipes & other exposed)	Stainless steel – NZS/BS 970 uPVC – AS/NZS1254 or AS/NZS1260 Galvanised steel – Zincalume or equivalent
Stormwater – below ground	uPVC - AS/NZS1254 or AS/NZS1260 PE – AS/NZS4130 or AS/NZS2065
Stormwater - pumped	uPVC - AS/NZS1477

9.4.3.5.2 Downpipe and gutter materials

Stainless steel is the preferred material for downpipes, box gutters, sumps and outlets.

Metallic stormwater drains must be electrochemically compatible with roof gutter material and roof material to prevent electrolytic corrosion.

9.4.3.6 ELECTRICAL FOR HYDRAULIC SERVICES

Power supplies and other electrical Installations required for hydraulic services systems shall be designed and installed in accordance with the Electrical Services section below.

9.4.3.7 AUTOMATIC CONTROLS & MONITORING FOR HYDRAULIC SERVICES

Controls equipment and systems required for the control and monitoring of hydraulic services systems shall be designed and installed in accordance with the Automatic Controls & Monitoring section below.

9.5 ELECTRICAL SERVICES (INCLUDING CIVIL SERVICES)

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Commissioning & Tuning (2)
- Metering and Monitoring (5)
- Energy (15-16)
- Materials (19-21)

9.5.1 ELECTRICAL SUPPLY

9.5.1.1 GENERAL

All new connections to an Electrical Utility or University Campus private electrical network must be agreed in writing by the University Energy Manager before design commences. Any significant increase in load at an existing connection must also be agreed with the Energy Manager.

9.5.1.2 HIGH VOLTAGE SUPPLY

9.5.1.2.1 Substations

Where a Substation or transformer will be located on University property, the location shall be agreed between the University and Electrical Utility.

Substations shall be located externally unless impractical. In this case, locating the substations within a dedicated space on the perimeter of a building may be considered. Substation rooms below ground level or without direct access to the perimeter of the building will not be acceptable.

9.5.1.2.2 Private Transformers (Dunedin Campus)

The University operates a private 6.6 kV high voltage network on the Dunedin Campus. Where a new power supply is required from this network, a transformer (if appropriate) shall be connected to the 6600 volt cable using switchgear in ring main configuration. The transformer and switchgear shall be identical in specification to that currently used by the Dunedin distribution network operator (Aurora) and the University's Electrical utility services provider (Delta) who both services the University's 6600 volt network and provides emergency supplies of equipment in the event of breakdown.

9.5.1.3 LOW VOLTAGE SUPPLY

9.5.1.3.1 Power Factor Correction

Where the local electrical distribution network operator penalises low power factor, power factor correction shall be provided for new network connection. The power factor of power using components of the HVAC system and lighting should be corrected to at least 0.95. Where low power factor is not currently penalised, allowance shall be made for future installation of PFC equipment in the main switchboard.

9.5.1.3.2 Surge & Harmonics Protection

All building or site main switchboards shall be provided with coarse voltage protection for network voltage surges.

Fine voltage protection shall be given due consideration when a facility has sensitive electronic equipment which may be affected by harmonics from other nearby loads on the network.

Voltage protection appropriate to any IT equipment and facilities must be identified, documented and provided for. Please contact its.design-facility-support@otago.ac.nz in the first instance.

Electrical Switch rooms shall include space for future power factor correction equipment and active harmonic distortion equipment.

9.5.1.3.3 On Site Generation

The University will consider on-site electricity generation (including storage) where it will lower the life cycle cost of the building or contribute to the University's objectives for reducing carbon emissions. Preferred types of on-site generation will be identified in the Project Specific Brief and the Designer may discuss other opportunities with the University Energy Manager during concept design.

9.5.1.3.3.1 Photovoltaic arrays

Photovoltaic panel system with battery storage can provide multiple benefits for the University reducing peak demand and line charges and assisting with National Grid demand response services.

Consideration should be given to optimising the winter output from the panels (e.g. orientating panels for lower sun angles) when electrical usage of University buildings is typically highest.and electrical line charges are highest.

9.5.1.3.3.2 Vehicle-to-Grid systems

Refer **Electric Vehicle Charging** section below for information on supply from electric vehicle battery storage.

9.5.1.3.3.3 Generator Sets

Refer Emergency & Essential Power Supply section below for information on generator sets with prime movers.

9.5.1.3.3.4 Export to Grid

When the on-site generation will export power to the distribution network, the Designer shall assist the University Energy Manager with the application for preliminary

assessment by the Distribution Network Operator ('lines company').

The Installer must be certified for distributed generation installations and shall manage the inspection and certification process to obtain final approval to connect from the Distribution Network Operator.

9.5.1.3.4 Emergency & Essential Power Supply

It is expected most buildings will require an emergency power supply for life safety systems. Buildings shall also be provided with business-critical emergency and/or essential power supplies where necessary for their required level of resilience.

9.5.1.3.4.1 Essential Power

Where a building requires standby essential power supply, a generator set shall be provided. Any other building which would be required to provide functions/services during an extended power outage (e.g. accommodation colleges) shall be provided with a suitably located external connection point for a portable generator.

Generator sets shall be a standalone installation powered by a diesel engine prime mover. The Energy Manager may consider generator sets with a gas engine prime mover supplied from a gas reticulation network in appropriate situations. The type and capacity of all new generator set installations shall be agreed in writing by the University Energy Manager.

Switchboards should be divided into essential and non-essential loads. In the event of a power failure the non-essential load shall be automatically shed.

Essential loads must include all life safety systems, access control and security systems, all business-critical electrical, mechanical and hydraulic services systems (including the BMS controllers) and essential general power outlets on each floor. The essential load shall be determined during concept and preliminary design as part of resilience planning.

9.5.1.3.4.2 Emergency Power

The emergency lighting systems of larger buildings will require a centralised battery UPS power supply. Refer Emergency Lighting section below for further information.

As new buildings are no longer permitted to be connected to the Chorus copper voice network, life safety systems previously reliant on this network (e.g. lift emergency phones, fire service notification) must have a UPS power supply for the alternative digital communication system. Refer the **Fire, Vertical Transport, Security and ICT Sections** for more information on these digital communication systems.

Emergency power supply requirements for specialist scientific or medical equipment shall be confirmed with the client Department. Some facilities will require a UPS for continuity of power supply or controlled shutdown of computers and electronic instruments. True online type UPS units are typically required for research freezers.

Emergency power supply requirements for any IT systems and services must be coordinated and agreed with IT Services during concept and preliminary design phase.

9.5.1.3.5 Generator Load Shedding/ Peak Lopping and National Grid Services (Dunedin)

Beyond the provision of essential power during a grid outage, the University also uses its generators for the following purposes:

i) To load shed during Control Periods (Control Period Demand) on request from the Distribution Network Operator ('lines company'). An automatic enable/disable signal is provided by Lines Company's Ripple Control signal.
ii) To provide National Grid Demand Response services to the System Operator (Transpower). An automatic enable/disable signals is provided by BMS.
iii) To provide National Grid Frequency Keeping services to the System Operator (Transpower). An automatic enable/disable signals is provided by BMS.
iv) To load shed when the building's load exceeds transformer capacity. An automatic enable/disable signal is provided by BMS and/or generator controller.
v) To mitigate excessive electricity prices where the University has chosen to retain exposure to the electricity spot market. A manual enable/disable signal is provided by University Energy Team.

The Designer shall confirm all requirements for new generator sets with the University Energy Manager including confirmation of which of these additional operating modes will be utilised for the generator installation.

Where a generator set's operating modes will involve exporting power to the distribution network, the Designer and Installer are required to assist the University with obtaining the required approvals. Refer Export-to-Grid section above for further information.

Note: Where a generator supplies energy to any Specified System within a building, the generator becomes a specified system (SS14.1 Emergency Power Systems). Where emergency generators are specified for systems other than Specified Systems, consideration shall be given to only supply the intended essential load to avoid the additional inspection, maintenance and reporting costs required for Building Warrant of Fitness.

9.5.2 POWER

9.5.2.1 GENERAL

9.5.2.1.1 Electrical for other Building Services

The electrical installation for mechanical services, hydraulic services and other building services shall be to the same standard and, as appropriate, use the same componentry as the General Electrical installation.

Where the design and/or installation of electrical for Mechanical/ Hydraulic services is carried out by different parties than those for the General Electrical, the design and installation must be coordinated between the parties to ensure consistency.

9.5.2.1.2 Electrical for ICT

Confirm/coordinate power supply requirements for equipment in ICT rooms with IT Services during concept and preliminary design.

9.5.2.1.3 Electrical Metering

The University requires real-time information from electricity meters for load monitoring and load control purposes.

University standard electrical meters shall be specified for all projects.

Sub meters shall be provided for every distribution board and building services switchboard and all loads of 100 kVA or greater.

All meters shall be capable of real time monitoring, storing and reporting 15 minute consumption data and include fast acting load control outputs.

University standard meters typically use a master-slave configuration with a master unit BACnet interface for communication with the BMS or dedicated GridVis metering system.

The Designer shall confirm project-specific meter technical requirements with Energy Manager.

9.5.2.2 SWITCHBOARDS & SWITCHGEAR

To eliminate the risk of arc flash, it is intended that switchboards will only be worked on while they are isolated. Accordingly, critical areas/facilities which cannot tolerate an interruption of the power supply should be provided with duplicated electrical infrastructure so that a switchboard can be isolated for maintenance while the power remains on to the facility/area. Arc flash labelling, precautions and protection shall be provided in accordance with AS/NZS3000:2018 as applicable.

Distribution Boards shall be located so that cable lengths of final circuits are less than 30m.

9.5.2.3 DISTRIBUTION

9.5.2.3.1 Cabling

This section will be expanded in the next revision of the Guidelines.

The cabling design and installation must be in accordance with regulations, applicable standards and best industry practise.

Specification/selection of cable types must appropriate for the duty. The use of left-over cable for a different duty is not acceptable.

Cables must be identified in strict accordance with AS/NZS3000 (including labelling at the supply point and final termination, within switchboards/control panels and out in the field). The cable identifiers on the labels must be accurately recorded in as built documentation. Refer also the general building services Identification section above.

New submains cabling shall be sized with spare capacity for future load growth in accordance with the Future Allowance & Flexibility section below and rated at the full rating of the protection facilities to which they are connected.

9.5.2.3.2 Busbars & Bus Ducts

Bus bar installations are acceptable and should be considered where appropriate.

The ability to relocate junction boxes while the busbar remains live is typically not required for University facilities.

9.5.2.3.3 Cable trays and Ladders

Separate cable trays shall be provided for

i. Power
ii. Fire, security, BMS and lighting controls
iii. Data (Refer UoO_CablingStandards_V5-02 for further information)

9.5.2.3.4 Trunking & Conduits

Power supply cables below 2100 AFFL within plantrooms should be protected within rigid/flexible conduit or cable tray/trunking.

9.5.2.4 POWER CONNECTIONS & OUTLETS

9.5.2.4.1 Soft Wiring

Modular 'plug & play' wiring (AKA as soft wiring) for power outlets integral to work stations is acceptable and preferred for spaces that are likely to undergo regular reconfiguration of the furniture layout. Refer also General Building Services - Flexibility section above.

9.5.2.4.2 Luminaire power supplies

To allow easier maintenance & replacement of luminaries, it is preferred that lighting sub circuits within ceiling voids are terminated with an unswitched plug socket and luminaires provided with flex & plug.

9.5.2.4.3 Circuit Fault Protection

RCD fault protection should be provided beyond current AS/NZS3000 requirements to include power circuits in office spaces and kitchenettes.

9.5.2.4.4 Power Outlets

9.5.2.4.4.1 Cleaners power outlets

Cleaner's sockets are to be positioned to avoid the need for a cleaning machine lead to cross a corridor into an adjacent room creating an increased trip hazard.

9.5.2.4.4.2 Essential power outlets

Each essential power outlet shall comprise a single phase 10 amp double switched wall outlet complete with neon indicator. Essential power outlets supplied from the generator or dual power sources will be identified by a red faceplate and mounting block.

9.5.2.4.4.3 Plant Areas

All mechanical & hydraulic services plant rooms and external plant enclosures shall be provided with 10 A double outlets with suitable IP rating for maintenance and housekeeping.

9.5.2.4.4.4 ICT rooms

Each network cabinet will require a power supply. Note that in some cases multiple 15A feeds will be required. Refer UoO_CablingStandards_V5-02 for further information.

9.5.2.5 ELECTRIC VEHICLE CHARGING

Electric vehicle supply equipment (EVSE) installations shall comply with all applicable Worksafe NZ requirements.

9.5.2.5.1 Vehicle Charging

Dedicated low power EVSE shall be provided when electric vehicles will be based at a facility. This will typically be mode 3 charging station(s) with a maximum power output of 7 kW for slow charging, and be capable of being current limited for trickle charging only.

9.5.2.5.1.1 Departmental Vehicles

Facilities for Departments which operate vehicles (e.g. Property Services, Residential Colleges, Recreation Services) shall be provided with EVSE. These will typically be located in a garage/secure parking area to allow overnight charging of electric vehicles.

The design for the EVSE installation shall be confirmed with the facility's Department(s) to ensure the installation will meet their requirements.

9.5.2.5.1.2 Residents' Vehicles

Residential Colleges with on-site parking for resident students and staff shall be provided with EVSE. These will typically be located in an open-air car parking area for 24-hour charging of electric vehicles.

The Designer shall confirm requirements with the Campus and Collegiate Life Services Division (CACLS) to ensure the installation will meet their requirements. The number of charging stations shall be agreed with CACLS and the Energy Manager; an indicative allowance is provision of charging stations at 10% of the car parks and infrastructure (including underground conduit) for future provision of charging stations to a further 20% of car parks.

The arrangement for metering and cost recovery for the charging of private vehicles shall be confirmed with the Energy Manager.

9.5.2.5.2 Vehicle-to-Grid Systems

The University may implement Vehicle-to-Grid systems to make use of electric vehicle battery storage for grid stabilisation services.

Vehicle-to-Grid systems should be considered for new developments or major redevelopments which are close to electricity supply points and include, or are adjacent to, University staff car parking areas. Opportunities for such systems should be discussed with the Energy Manager during concept design.

9.5.3 EARTHING & BONDING

The University currently has no additional/alternative requirements.

9.5.4 LIGHTNING PROTECTION

The University currently has no additional/alternative requirements.

9.5.5 LIGHTING

9.5.5.1 GENERAL

9.5.5.1.1 Lighting Levels

Lighting shall be designed and installed in general accordance with AS/NZS 1680 and the luminaire manufacturer's specifications, The following space types have maintained lighting levels requirement exceeding AS/NZS1680:

Space types	Illuminance
laboratories, lecture theatres, staff rooms, offices	450 lux (measured on a working plane 750mm above floor level)
filing and storage rooms	300 lux (measured on a working plane 750mm above floor level)
corridors and amenities	100 lux (measured at floor level)

Light fittings shall meet the requirements specific to individual spaces within the project. As a guide, low glare fittings shall be used in areas of high computer usage, with conventional flush or surface mounted fittings to be used elsewhere. Except where low glare fittings are required, ensure that walls and ceilings receive an adequate level of illumination (to avoid the impression of being in a cave).

9.5.5.1.2 Luminaire Selection

High energy efficiency luminaires shall be used wherever possible. All light sources for general and accent lighting shall be Light Emitting Diode (LED) type. Light sources for other applications shall be LED whenever appropriate.

LRD factors shall be selected from table 12.2 in AS/ NZS 1680.1. Unnecessarily severe conditions should not be selected if it will significantly increase energy use.

Typical conditioned office accommodation would be categorised as follows:

i. Room category X
ii. Luminaires A

For example, for a recessed luminaire in a mechanically ventilated space with no opening windows, an LRD of 0.92 x 0.98 = 0.9 after 2 years would be appropriate.

The power factor of luminaires shall be corrected to 0.95. Performance data from an accredited test laboratory shall be available for all luminaires proposed.

9.5.5.1.2.1 Colour Temperature

Lamp correlated colour temperature (CCT) should generally be in accordance with the following table.

Space types	CCT
General (teaching & learning spaces ,workspaces)	4000 K ('çool white')
Clinical (healthcare patient diagnosis & treatment areas)	4000 - 5000 K ('çool white'- 'daylight')
Residential/Social (Residential accommodation, workplace social spaces)	3000 K ('warm white')

Additional/alternative requirements may be included in the Project Specific Brief or requested by the Client Department.

9.5.5.1.2.2 Colour Rendering

Lamp Colour Rendering Index (CRI) shall be at least:

Space types	CRI
High colour importance (e.g. Laboratories, Clinical, Exhibition spaces)	>90 (including value for reference colour R9 of 50 or greater)
Normal (e.g. Teaching spaces, offices, staff rooms)	>80

Additional/alternative requirements may be included in the Project Specific Brief

9.5.5.1.2.3 Specialist Requirements

The cyanosis observation index (COI) for luminaires in healthcare patient areas must meet the requirements of AS/NZS 1680.2.5.

9.5.5.2 GENERAL INTERIOR LIGHTING

The lighting power density for general interior lighting should be no more than 2.5 W/m² per 100 Lux.

Lighting design and luminaire selection for office spaces shall be in accordance with AS/NZS1680.2.2 and be consistent with recommendations in WorkSafe/ACC office ergonomics COP.

Luminaires in open plan areas shall be switched in zones. Where practical, interior and perimeter (i.e. adjacent to windows) luminaires shall be zoned separately.

9.5.5.2.1 Heritage Interiors

Luminaires for buildings with heritage interiors or rooms with heritage décor shall be selected to be sympathetic in terms of both type and appearance. Luminaire selections in these circumstances shall be submitted to the University Architect for review.

9.5.5.3 SPECIALIST INTERIOR LIGHTING

The University operates a variety of specialist facilities which include spaces with specific task lighting requirements e.g. illumination level, colour rendering. Specialist lighting design and luminaire section should be in accordance with relevant parts of AS/NZS1680.2 and other relevant technical standards .where rrequirements are not defined in the Project Specific Brief.

Sealed luminaires shall be used where necessary for hygiene or contamination control e.g. PC labs, animal holding areas, clean rooms, operating theatres.

9.5.5.3.1 Feature Lighting

Energy consumption of feature and accent lighting should be no more than 1 W/m2, averaged over the nett floor area of the building.

9.5.5.3.2 Security Lighting

24-hour lighting circuits for security lighting shall be provided where required by the Client Department or University Proctor's Office.

9.5.5.4 EXTERNAL LIGHTING

Overnight security or exterior lighting shall be by LED lamps where suitable otherwise metal halide or mercury vapour lamps.

All Dunedin Campus site exterior lighting required for safety and security shall be connected to the Campus lighting system. The lighting shall generally be controlled by the Campus outdoor lighting system, either directly or by relay control of the building's own power supply.

Other external lighting may be switched by PIR motion sensing, solar cell or time schedule depending on its function. Confirm specific project requirements with the FM and Proctor's Office. Where necessary provide an override switch for testing purposes.

To reduce energy consumption and light pollution, external lighting shall have an efficacy of at least 50 lumens/watt. The average illuminance in outdoor areas should be no more than 20% above the minimum levels given in AS/NZS 1158.

The configuration and CCT of external lighting fixtures should be selected to comply with requirements of territorial Authority's district plan and with International Dark-Sky Association guidelines (darksky.org).

9.5.5.4.1.1 External Plant Areas

External plant area containing equipment which may need to be serviced/repaired outside normal working hours must be provided with adequate lighting. External plant areas are also to be provided with power outlets which may be used for portable task lighting.

9.5.5.4.1.2 Heritage Precincts

External lighting fixtures adjacent to Heritage buildings shall be selected to be sympathetic in terms of both type and appearance. Fixture selections in these circumstances shall be submitted to the University Architect for review.

9.5.5.5 EMERGENCY LIGHTING

The type of emergency lighting system (self-contained or centralised) required for a site will be confirmed in the Project Specific Brief. Generally, larger buildings and those with a large number of fittings will have a centralised battery emergency lighting system and smaller buildings and those with a small number of fittings will have integral battery ('Single Point Use') fittings.

Emergency lighting (EML) shall be installed in accordance with the NZ Building Code with the following additions.

i. Toilet or shower areas to 0.2 lux, in the case of multiple cubicles within a single 'block' where cubicles are full height EML is installed in the lobby and any accessible toilets only, where cubicles are not full height provide 0.2 lux to all cubicles.
ii. In rooms with greater than 20 occupants that may be unfamiliar with the room (such as a teaching space or laboratory) to 0.2 lux.
iii. In spaces with significant equipment that may make finding the exit challenging to 0.2 lux. (For example workshops, commercial kitchens, loading bays or docks, plant rooms or decks, firefighting control rooms, significant switchboard rooms, significant motor control centres and lift machine rooms).
iv. In laboratory spaces where sudden darkness may pose a hazard to 0.2 lux. (For example use of chemicals, rotating machinery or similar).
v. Within walk in refrigerated spaces to 0.2 lux.
vi. Basement areas shall be considered on a case by case basis dependant on size, complexity, accessibility etc.

The University's requirement for emergency lighting will be confirmed in Project Specific Brief.

9.5.5.6 LIGHTING CONTROL

The level of lighting control shall be selected to provide sufficient lighting functionality and adaptability and/or to minimise lighting energy consumption while avoiding unnecessary complexity or cost.

The preferred level of lighting control will be defined in the Project Specific Brief. Local controls for automatic switching will be acceptable when they provide sufficient functionality. Digital Addressable Lighting Interface (DALI) control systems will be considered where additional functionality and flexibility is required.

All ICT requirements (including proposed connectivity to the University network) must be communicated to IT Services early during concept or preliminary design and must be incorporated into the final IT design.

9.5.5.6.1 Local Switching

Luminaires in permanently occupied cellular spaces e.g. small offices may be switched locally.

Plantrooms and other similar spaces where equipment and other obstructions will prevent occupancy sensors from working reliably shall be switched locally.

9.5.5.6.2 Occupancy Control

Occasional use offices may use occupancy sensing. The sensor must be capable of detecting people doing sedentary

tasks. Absence detection may be the best mode for these spaces.

Store rooms and other utility spaces may be controlled by occupancy sensor.

Standalone occupancy sensors with local switching may provide adequate functionality. However it may be advantageous for DALI occupancy sensors to also be used to allow occupancy control of HVAC systems. In these cases, the design of the sensors and the BMS interface should be coordinated with the mechanical services Designer.

9.5.5.6.3 Time Control

Open plan spaces with fixed operating schedules and no after-hours occupancy (e.g. clinics) should be controlled by a master switch or time clock.

9.5.5.6.4 Daylight Harvesting

Automatic switching or dimming of luminaires adjacent to windows ('daylight harvesting') shall be considered where appropriate for the function of space and where it will provide a positive investment return.

9.5.5.6.5 Illumination Control

Spaces requiring multiple lighting scenes e.g. teaching spaces with audio-visual systems will generally require a DALI system with local lighting control panel.

9.5.5.6.6 Lighting Control for Hazardous Areas

Lighting controls for the cold room/walk in freezers and similar should be located inside the room by the door (and not able to be overridden from outside) and activation of these should activate a visual indication on the outside that the room is occupied. (so that it is obvious to someone outside that the room is in use). Refer University Health & Safety Requirements for Walk-in Refrigerated Spaces Procedure for further information.

9.5.6 FIRE DETECTION & ALARM SYSTEMS

Refer the **Fire Section** for requirements for detector, call point, warning and monitoring systems and equipment.

9.5.7 SECURITY SYSTEMS

Refer the **Security Section** for requirements for access control, CCTV and intruder detection systems and equipment.

9.5.8 INFORMATION & COMMUNICATION TECHNOLOGY SYSTEMS

All ICT requirements (including connectivity to the University network and any ICT networking and other equipment) relating to Electrical Services (as described in section above) must be confirmed with ITS. Please contact its.design-facility-support@otago.ac.nz in the first instance.

Refer the **ICT & AV Section** for further information and more detailed requirements for data, telephony and Audio-visual systems and equipment.

9.5.9 ELECTRICAL SERVICES EQUIPMENT & MATERIALS

9.5.9.1 GENERAL

9.5.9.1.1 Acceptable Equipment

All plant and equipment must be from manufacturers on the University's Acceptable Building Services Equipment Manufacturers schedule unless agreed in advance by the University Building Service Engineer and Property Services Trade Supervisors. Refer General Building Services/ Equipment & System Approval section above for further information.

9.5.9.1.2 Future Allowance & Flexibility

Refer General Building Services – Future Allowance & Flexibility section above for detail on the requirements for spare capacity and future flexibility of plant and reticulation.

Indicative future allowances for electrical services are given in the following table:

Equipment/Service	Allowance
Main Switchboards	25% spare space & additional load (for each of essential and non-essential loads)
Distributions Boards	25% spare space & additional load
Power factor correction	Space allowance (if not currently required)
Harmonic filters	Space allowance (if not currently required)
Sub mains	25% additional load
In-ground conduits	1 spare for every 3 in use

9.5.9.2 POWER

9.5.9.2.1 Generators

Generators shall be capable of providing black start mains failure operation to support building essential load during a mains supply failure.

Generators shall be capable of synchronised operation with the supply grid for the purposes of providing a soft re-transfer of building load back to the mains supply after a mains failure event. The synchronised operation shall also be capable of peak lopping and load testing of the generator. The generator shall be provided with all necessary equipment for synchronizing and interfacing with the main switchboard's switchgear and controls.

Generator sets, including controllers and ancillaries, shall be selected in accordance with the acceptable manufacturers and products schedule. The specific requirements for a new generator set must be confirmed with the Energy Manager and Property Services Trade Services Electrical Team prior to the set being specified and the design of the site electrical infrastructure being finalised.

9.5.9.2.1.1 Generator Exhausts

Generator set exhausts are required to comply with the conditions of the University's campus Discharge to Air consents. The Designer shall confirm requirements with University Energy Manager prior to equipment selection.

Over the course of the project, the Project Team must

i. provide preliminary equipment details and specification to the University to allow the boiler to be assessed and included within the University's Air Discharge Consent. This information should be provided to the Project PM, Energy Manager and Strategic Resource Planner.
ii. carry out emissions tests verifying the boiler is within consent conditions during commissioning
iii. provide comprehensive equipment details for the University prior to hand over.

Generator exhaust pipework should be routed externally unless impractical.

The provision for accommodating thermal expansion of the exhaust including expansion bellows, anchoring and guides shall be indicated on Designers construction issue drawings. It is acknowledged that these items will be subject to development and verification by the Installer during construction. Final provision for expansion loops, anchoring and guides shall be shown on the Installer's shop drawings. Where exhaust pipework passes through fire separations, the fire stopped penetration should be considered as a fixed pipe support (so movement of the pipework through the fire/smoke stopping is minimised)

The exhaust shall be provided with suitable drainage to collect exhaust gas condensation.

The exhaust shall be insulated as required to prevent accidental contact with hot surfaces and to reduce exhaust gas condensation.

9.5.9.2.2 Uninterruptable Power Supplies

UPS units shall be University standard manufacture.

UPS units supporting IT equipment or facilities must provide for SNMP based monitoring over the Otago IT network.

9.5.9.2.3 Switchboards

The Property Services Electrical Department maintains a switchboard specification. All switchboards shall comply with this specification.

Switchboard manufacturers shall have local representation to allow site attendance for alterations and commissioning to be easily implemented.

All switchboards must be provided with circuit schedules to good industry practise, including information on the function and location(s) served by each circuit.

9.5.9.2.4 Distribution

9.5.9.2.4.1 Cabling

9.5.9.2.4.1.1 Conductors

It is generally preferred that all cabling is copper to avoid the need for bimetallic junctions and the larger spatial requirements of high capacity aluminium cables.

It is acknowledged that there may be a high cost premium for using copper rather than aluminium for high capacity cables, therefore this preference may be relaxed on large projects subject to agreement by the Property Services Electrical Department.

9.5.9.2.4.1.2 Cable Jackets

The use of cabling with low smoke zero halogen (LSZH) jackets is encouraged where suitable products are available.

9.5.9.2.4.2 Trunking & Conduits

All trunking shall be fabricated from aluminium.

9.5.9.2.4.3 Floor Boxes

All floor boxes must be fitted with stainless steel lids to ensure adequate strength and durability. Flexible (rubber or brush) cable entries are preferred to rigid metal doors to reduce the potential for a trip hazard.

Consideration shall be given to maintaining fire separation performance of the flooring system when installing floor boxes.

9.5.9.2.4.4 Switches

Power & lighting switch modules shall be front loaded type.

Power & Lighting switch face plates shall be a colour contrasting with the surrounding surface to assist the visually impaired. Refer **Accessibility Section**.

9.5.9.2.4.5 Power Outlets

Outlet switch modules shall be front loaded type.

Power outlet face plates shall be a colour contrasting with the surrounding surface to assist the visually impaired. Refer **Accessibility Section**.

9.5.9.3 LIGHTING

9.5.9.3.1 Luminaires

9.5.9.3.1.1 Light Emitting Diode Luminaires

LED lamps shall have an efficiency of greater than 90 lm/W and minimum performance rating of L80B10 @ 50,000 hours whenever suitable luminaires are available. It is acknowledged this rating is not currently available for all types of luminaires.

All LED lamp electronic drivers shall have a THDi <10%.

9.5.9.3.2 Lighting Control

9.5.9.3.2.1 DALI Control Systems

The predominant building DALI system currently in use on the Dunedin Campus is Philips Dynalite using a Philips Envision frontend. A gateway high level communication connection to the BMS providing similar functionality is also acceptable.

The University IT Shared Services AV Team typically uses Crestron DALI systems for teaching spaces where the wider building is not provided with a DALI system.

DALI and other proprietary Lighting control systems shall be capable of communication with the BMS via BACNet protocol.

DALI supervisory software shall allow monitoring of zone lighting pre-sets and floor plan graphics, scheduling, light levels, lamp status and operation for troubleshooting and for fittings to be recommissioned if required without the need for a specialised technician on site.

Any ICT requirements (including proposed connectivity to the University network) must be communicated to IT Services early during the concept or preliminary design phases and must be incorporated into the final IT design.

9.5.9.3.2.2 Occupancy Sensors

Occupancy sensors shall be capable of both presence and absence detection modes.

9.6 AUTOMATIC CONTROL & MONITORING

GREEN STAR CRITERIA

The relevant credits for Green Star accreditation in this section include:

- Commissioning & Tuning (2)
- Metering and Monitoring (5)
- Energy (15-16)

9.6.1 GENERAL

Best industry practice automatic control systems and equipment shall be provided to control and monitor building services as described in the Mechanical, Hydraulic and Electrical Services sections above.

Building services in all new and refurbished buildings shall be monitored and controlled by a direct digital control (DDC) system connected to the University Building Management System (BMS).

Standalone building services control systems are not acceptable on the University's Campuses. Building services in Off-Campus satellite facilities and tenancies should also be controlled and/or monitored by the University BMS via the University data network unless impractical or uneconomic.

The building services Designers shall provide a high level functional description of the control and monitoring of systems and equipment within their design scope for University review. These functional description should include the requirements within these Guidelines and any alternative/additional requirements in the Project Specific Brief.

9.6.1.1 Building Management System

The University BMS is operated and maintained by the Property Services Energy Team (in collaboration with IT Services). The University BMS performs the following functions:

- Timetabled operation of ventilation plant and systems.
- Timetabled and optimised operation of heating and air conditioning plant and systems.
- Occupancy operation of the ventilation, heating and air conditioning systems
- Electrical load monitoring and management
- Performance monitoring of mechanical, hydraulic and electrical systems.
- Monitoring of electrical and thermal energy consumption
- Interface with lighting control systems
- Interface with fire alarm systems
- Interface with security monitoring and access control systems

The Energy Team maintains a BMS Standard. The design, installation and maintenance of all new and refurbished automatic controls and monitoring systems shall comply with this standard. Refer to the Standard for detailed information on the following:

i. Engineering Standards
ii. Controller standards
iii. equipment points standards
iv. Communication protocol standards
v. Wiring Diagram Standards
vi. Naming conventions
vii. Graphics Standards
viii. Alarm management standards

The incumbent and preferred BMS systems provider is Setpoint Solutions, who currently provide maintenance as well as new installed solutions to the University of Otago.

Any BMS related IT requirements (including proposed connectivity to the University network) must be communicated to IT Services early during the concept and preliminary design phases and must be incorporated into the final IT design.

9.6.1.2 Independent Environment Monitoring Systems

Some research facilities may require interior environment data to be monitored and collected to verify research. The University BMS may be able to perform this activity but, in some cases, it may not have suitable functionality, sufficient data capacity or an acceptable level of independence for the required standard of verification.

The Designer shall confirm exact verification requirements with the Client Department during design and, where use of the BMS is not appropriate, a standalone verification system shall be provided. Standalone systems will be operated and maintained by the Client Department.

9.6.1.3 Data Analytics

The Energy Team may make use of data analytic processes for purposes such as continuous tuning of building services (refer General Building Services - building tuning section above). Data sources would include the BMS, meters, and temporary wireless sensors installed for troubleshooting.

The Designer should discuss and confirm the data analytics requirements for a project with the Energy Team.

9.6.2 MS ARCHITECTURE

The BMS architecture should be confirmed with the University Plant & Controls Engineer during Design. The building services Designers shall provide a

schematic/single line drawing showing proposed hardware architecture during Developed Design phase. Where the Mechanical services Designer is coordinating BMS interfaces for other building services, their drawing shall incorporates requirements for all other services.

9.6.2.1 SYSTEM SUPERVISION

The current BMS client application is Siemens Desigo CC Graphical Workstation. This application resides on a fully backed up Virtual Machine (VM) located in the Dunedin Campus ITS server room(s). Remote access to the BMS shall be provided via WEB or a one click client on the Campus VPN. Remote access shall provide full functionality to the BMS.

The BMS operates on a dedicated VLAN and as such all new control systems shall support connectivity in the same manner.

Controls and monitoring of facilities on satellite Campuses shall be integrated with the Dunedin Campus BMS. All controllers on Satellite campuses shall be connected to the Dunedin Campus BMS via the University data network. Full control and monitoring functionality shall be available from Dunedin.

9.6.2.2 BMS CONTROLLERS & OUTSTATIONS

All new controllers must be compatible with the current Desigo CC build version. All existing controllers within the scope of a major building refurbishment or adaption shall be upgraded to meet the current build standard.

New systems will be capable of future expansion or have spare capacity in memory and processing power and 20% spare Input / Output capacity.

It is a requirement that large plant e.g. Chillers and AHU are all controlled by one field controller and not split across multiple small controllers for that one piece of plant. The only exception is if there is a dedicated controller for enabling the plant at the MSSB. In such an instance, the plant that is being controlled can be split over no more than two controllers; one controller located locally at the Plant and one controller located adjacent to the MSSB.

It is preferred that each area of plant has its own controller where reasonable to reduce multiple pieces of plant being unavailable should that controller be offline.

In plant rooms and cupboards all BMS controllers must be installed in lockable, dustproof enclosures with minimum IP 24 rating. All controllers installed at the University of Otago must be new. No refurbished, repaired or second hand controllers are to be used except for repairs of legacy systems with written permission of the Energy team. Standard off the shelf controllers are acceptable; controllers that require individual licensing are not accepted by the University of Otago.

All controllers shall be capable of standalone (autonomous) operation if communication with the network is lost.

Where a building services system would normally be controlled and monitored by a BMS controller if it was site assembled, a pre-assembled system or sub-system shall also be connected directly to a BMS controllers (i.e. the use of proprietary controllers for pre-assembled modules is not acceptable).

9.6.2.2.1 Essential and Emergency Power for Controllers

For a building with essential building services, the BMS system must be on the building's essential power supply to remain operational during power outage.

Building BMS controllers shall be provided with a UPS to allow controllers to power down safely including saving database and parameters to memory. The UPS for the BMS shall be continuous type not dual mode as the switch in mode that occurs will prevent the controlled power down of controllers.

The UPS should also maintain power to ELV transformer providing power to field devices e.g. to allow actuated valves and dampers etc to move to safe position.

9.6.2.3 COMMUNICATION

The field level communication protocols that are acceptable to the University are

i. BACnet
ii. Modbus
iii. Mbus

All new building services equipment shall communicate using BACnet. The use of other communication protocols requires prior approval by the Plant and Controls Engineer.

The University will not accept proprietary communications protocols, with the exception of legacy Siemens control systems. Wireless communications shall not be used for field controller communication.

Power meters and VSD Drives to be connected via a separate communications cables from the main controller to prevent the networks being slowed down by slower baud rate systems being on the same wired network.

9.6.2.3.1 Data Network

The University data network is operated by the University IT Services Division. Network communication requirements for building services controls and monitoring shall be coordinated with IT Services and the Project's data network Designer. The network Designer must be made aware of all network connected equipment and products that will be connected to the University network should be checked for compatibility prior to installation.

The building services Designers shall confirm the quantity and location of the data outlets required for their control and monitoring equipment to the network Designer. Currently IT Services requires every internet device to have a separate MAC address which restricts the use of Ethernet daisy chaining of BMS controllers and field devices on the University network.

9.6.2.3.2 Equipment High Level Interfaces

Equipment HLIs shall be capable of communicating with the BMS via BACnet. The plant or equipment HLI should be used to provide the requested monitoring and metering information where ever practical.

9.6.2.4 MOTOR CONTROL

All motors with 3kW or greater power output must be provided with a motor speed controller to allow the motor speed to be reduced to match the required duty.

BMS plant & equipment control programmes shall prevent motor start frequency exceeding equipment/motor manufacturer's instructions.

9.6.2.4.1 Variable Frequency Drives

VFDs shall be University standard model unless VFD is provided integral to plant by manufacturer.

VFDs shall be located so that length of the cable to the motor is no more than 15 metres. It is preferred that VFDs are grouped within a ventilated enclosure however unenclosed mounting of VFDs is acceptable if required to avoid exceeding the maximum cable length. External VFDs must have a minimum IP55 rating.

The Installer must provide cabling and make terminations in strict accordance with manufacturer's instructions to avoid RF interference. Commissioning shall include harmonic tests at the point of common coupling (PCC) and at the in-plant point of coupling (IPC) to the converter input terminals for third to nineteenth harmonics under a full range of load conditions to demonstrate compliance. Submit test results.

Power supplies to VFDs shall be provided with suitable surge protection to avoid damage from voltage fluctuations.

9.6.2.4.2 EC Motors

The use of electronically commutated (EC) DC motors with integral controller is acceptable in principle. Motor data sheets and controller schematics shall be provided to the University for review before specific acceptance will be given.

The controllers of fan EC motor must be adequately protected when the motor is in the air stream.

9.6.2.5 CONTROL CIRCUITS

9.6.2.5.1 Cabling

The cabling design and installation must be in accordance with regulations, applicable standards and best industry practise.

Specification/selection of cable types must appropriate for the duty. The use of left-over cable for a different duty is not acceptable.

Cables must be identified in strict accordance with AS/NZS3000 (including labelling at the supply point and final termination, within switchboards/control panels and out in the field). The cable identifiers on the labels must be accurately recorded in as built documentation. Refer also the general building services Identification section above.

9.6.2.6 FIELD DEVICES

9.6.2.6.1 Room Controllers

Where user-adjustable room control panels are provided, the control functions shall be clearly explained in the building BUG and labelled accordingly.

9.6.2.6.2 Sensors

All sensors must be located/positioned to ensure measurement accuracy. Installation in strict accordance with manufacturer's instructions is expected.

Temperature sensors shall be located to avoid inaccuracy due to direct sunlight or heated or cooled surfaces or air streams.

9.6.2.6.3 Actuators

All control valve actuators must be capable of tight closure against at least 125% of the maximum expected differential pressure that may occur in the system.

9.6.2.6.4 Alarm Devices

Section under review

9.6.2.6.5 Meters

Electricity and thermal meters are connected to the BMS via BACnet communication protocol.

Gas and water meter pulse outputs are directly connected to the BMS.

DESIGN & FACILITY STANDARDS

SECTION 10:

FIRE

10

10.0 FIRE

The University has a number of required and preferred systems and products relating to fire and evacuation. Many of these standards have been developed in conjunction with industry experts and are nationally recognised documents.

Consistency of systems and products across the Campus provides a significant safety benefit for staff and students.

10.1 FIRE ENGINEERING

10.1.1 OCCUPANCY

Fire Reports or briefs are to include the occupancy calculated for the particular building, floor or room along with the maximum occupancy that each of these spaces is able to accommodate. The University regularly uses spaces in alternative ways, for example an atrium space may also be used as a function space, a gymnasium may be used as an exam space, a classroom may be used as a meeting space etc. As such is important to state use, occupancy and limitations.

10.1.2 Lithium Battery Charging

The Fire Engineering design shall consider spaces where the charging of lithium batteries is undertaken. Enclosed spaces charging lithium batteries (including vehicles) shall feature fire safety provision suitable for the risk. i.e. Fire detection, suppression, separation or firefighting first aid. Refer **Architecture & Space Section** 7.4.4 and **Electrical Section** 9.5.2.5.

10.2 FIRE PROTECTION

10.2.1 FIRE ALARM SYSTEMS

10.2.1.1 TRIAL EVACUATION SWITCHES

Trial Evacuation switches are to operate all auxiliary outputs such as:

- Smoke Curtains
- Mechanical Ventilation shut down (where safe to do so).
- Smoke clearance systems including makeup air features.
- Access controlled doors are to become insecure (with the exception of spaces where a hazardous environments or biosecurity risks are present).
- Fire and Smoke doors with hold back facilities are to remain held open where the system features local smoke detection to release doors upon the detection of smoke, those systems with 'global' smoke or fire door release shall release all held open doors upon operation of the trial evacuation switch. Electromagnetic hold open devices to be used.

Generally all connected auxiliary systems should operate on operation of the trial evacuation switch unless the operation of that system could adversely affect the occupants or any building system. Examples of systems that may remain operational; operating theatre systems, fume cupboards critical ventilation etc.

Fire Suppression Systems using stored extinguishants such as CO^2, Halon, FM200, Inergen, foam or water fogging shall not operate via the trial evacuation switch.

10.2.1.2 TEST SWITCHES

Fire Alarms systems shall have an individual test switch for each connected auxiliary system to allow each system to be tested independently such as but not limited to those items listed above.

Each switch shall require a key to operate, the key may be common across all test switches at each site and is to be stored within the main fire alarm control panel.

Each switch shall have three positions: Test, Normal and Isolate in that order with 'normal' in the 12 o'clock, vertical position.

- **Test:** The test position operates the interfaced system simulating operation in a fire condition.
- **Normal:** The fire alarm controls the interfaced systems operation.
- **Isolate:** The Isolate position prohibits the fire alarm system from operating the interfaced system.

The Isolate position shall cause a defect on the fire alarm system. If multiple Test Switches are present a common fire alarm defect is acceptable.

10.2.1.3 FLAMMABLE GAS ISOLATION

Where the Fire Alarm manages gas isolation, fit signage to the gas reset switch describing its operation including the words "This Gas Isolation Switch is only to be operated by a licensed gas fitter". See sprinkler systems for information specific to building with sprinklers.

10.2.1.4 FIRE ALARM EQUIPMENT

Only equipment listed on the FPA Equipment register is to be used.

10.2.1.5 BEAM SMOKE DETECTION

Beam type smoke detection is to include test facilities as standard.

10.2.1.6 MAINTENANCE INSPECTION & REPORTING

The installing contractor is responsible for ensuring that all inspection, maintenance and reporting of the fire alarm system has been carried out in accordance with the Compliance schedule and NZS 4512 until a date 12 months after issue of the Code Compliance Certificate. Where an existing system has been altered, responsibility for ensuring that all inspection, maintenance and reporting of the sprinkler system has been carried out in accordance with the Compliance schedule and NZS 4512 remains with the installing contractor until a date 12 months after issue of the Code Compliance Certificate unless agreed otherwise in writing with the Building Information and Compliance Manager.

For the purposes of this standard, inspection, maintenance and reporting includes the regular testing of systems in accordance with the respective standard. As an example for fire alarm and sprinkler systems this includes any monthly, quarterly, annual or biennial testing of but not limited to circuits, switches, sounders, enunciation devices, bells valves, water supplies, pressures, alarm transportation or pressure vessel certification.

The Operation and Maintenance Manuals shall include a full functional description of system operation including interfaced systems, devices and Fire and Emergency NZ signalling.

10.2.1.7 VISUAL ALERTING DEVICES

Visual alerting devices shall be installed throughout in accordance with NZS4512: 2021 or later. In instances where partial enhancement of the evacuation system is being undertaken, visual alerting devices shall be installed in the entire building unless agreed otherwise in writing with the Building Information and Compliance Manager.

Where research outcome may be significantly affected by VAD output colours, an alternative 'animal friendly' colour may be used throughout the building as part of a specific design with the approval of the University's Evacuation Consultant or Building Information and Compliance Manager.

The Operation and Maintenance Manual shall provide details of any alternative VAD Colour.

10.2.1.8 EMERGENCY WARNING SYSTEM

Fire alarm sounders are to be compliant with AS2220. Where partial enhancement of the evacuation system is being undertaken the entire building is to receive AS2220 compliant devices unless agreed otherwise in writing with the Building Information and Compliance Manager, in which instance alerting devices are to be consistent throughout the building.

Where research outcome may be significantly affected by AS2220 tones, an alternative 'animal friendly' tone may be used throughout the building as part of a specific design with the approval of the University's Evacuation Consultant or Building Information and Compliance Manager.

The Operation and Maintenance Manual shall provide details of any alternative tone.

10.2.1.9 FIRE ALARM PANELS

The Fire Alarm Mimic Panel or any control panel is not to include any branding from the Alarm Agent, installation contractor or any other party unless agreed otherwise in writing with the Building Information and Compliance Manager.

The Fire Alarm Mimic is to include any features required for Area of Refuge systems should they be featured in the building.

The Private Fire Alarm Number (PFA) is to be displayed on the mimic in the lower right hand corner unless otherwise stated by the relevant standard.

10.2.1.10 ACCESS CONTROL DOORS

'Fire Drop' means that upon operation of the fire alarm, sprinkler system or other emergency warning device, the access controlled doors within the building 'unlock' or transition to insecure.

All access controlled doors shall include the hardware and software to enable fire drop should the University choose to.

Generally, all access controlled doors shall fire drop upon activation of the fire detection systems installed.

For secure or high value sites, exterior doors may remain secure on a building wide fire drop. The Project Manager will advise which doors are to remain secure.

Doors controlling access to hazardous spaces may remain secure on a building wide fire drop. The Project Manager will advise which doors are to remain secure.

All access controlled doors must feature a 'break glass' type frangible element emergency door release (EDR) in the direction of escape as designated within the fire engineering brief or fire report.

Request to exit buttons may be omitted on final exits for secure or high value sites at the discretion of the University in agreement with the fire engineer.

10.2.2 SPRINKLER SYSTEMS

The University will design sprinkler systems into all major capital projects. Sprinkler systems may be appropriate in smaller buildings. Consultation should be undertaken with Building Information and Compliance for confirmation on a project by project basis.

10.2.2.1 FLAMMABLE GAS ISOLATION

Where a sprinkler system or other type of automatic fire extinguishing equipment is installed it shall, where required, isolate any flammable gas supply in accordance with AS/NZS5601, other applicable standards and the Building Act unless a specific alternative instruction is provided by the Fire Engineer.

Fit signage to the gas reset switch describing its operation including the words “This Gas Isolation Switch is only to be operated by a licensed gas fitter”.

10.2.2.2 SPRINKLER EQUIPMENT

Only equipment listed on the FPA Equipment register is to be used.

10.2.2.3 MAINTENANCE INSPECTION & REPORTING

The installing contractor is responsible for ensuring that all inspection, maintenance and reporting of the sprinkler system has been carried out in accordance with the Compliance schedule and NZS 4541 until a date 12 months after issue of the Code Compliance Certificate. Where an existing system has been altered, responsibility for ensuring that all inspection, maintenance and reporting of the sprinkler system has been carried out in accordance with the Compliance schedule and NZS 4541 remains with the installing contractor until a date 12 months after issue of the Code Compliance Certificate unless agreed otherwise in writing with the Building Information and Compliance Manager.

The sprinkler branch for each floor shall be provided with shut-off point with lockable isolation valve to allow floor-by floor draining and testing.

For the purposes of this standard, inspection, maintenance and reporting includes the regular testing of systems in accordance with the respective standard. As an example for fire alarm and sprinkler systems this includes any monthly, quarterly, annual or biennial testing of but not limited to circuits, switches, sounders, enunciation devices, bells valves, water supplies, pressures, alarm transportation or pressure vessel certification.

The Operation and Maintenance Manuals shall include a full functional description of system operation including interfaced systems, devices and Fire and Emergency NZ signalling.

10.2.3 ILLUMINATED EXIT SIGNAGE

Illuminated exit signage should be provided in accordance with NZBC/F8/4.5.1 for pictorial signage. It will not be acceptable to have ‘externally’ illuminated exit signage.

10.2.3.1 Photo luminescent exit signage

Photo luminescent exit signage will not be permitted in isolation of an integrated charging source. Photo luminescent signage will be permitted where it is integrated with an illuminated unit providing suitable charging. Suitable approved fittings include Ecoglo Hybrid LED Photo luminescent signage. Other brands will be considered and must be approved by the Property Services Building Information and Compliance Team prior to purchase. The University supports the use of these low energy fittings as it negates the requirement to maintain traditional battery packs and eliminates battery packs from the e-waste stream.

Photo luminescent signage shall not be used in specific locations where ‘dynamic’ exit signage is required.

10.2.3.2 DYNAMIC EXIT SIGNAGE

Dynamic exit signage may be used where required by the fire design.

The locations of Dynamic exit signage should be clearly indicated on the fire engineering and electrical design drawings.

The Fire Report should include the reason for the use of dynamic exit signage as well as ‘cause and effect’ details to indicate the control logic / interfacing to be used for this type of signage.

Dynamic exit signage with an integrated ‘No Exit’ or ‘crossed out’ display over the pictorial exit signage face integrated within a single luminaire or signage with a dot matrix type display is preferred.

Dynamic exit signage may include an audible tone to aid in gaining the attention of occupants escaping when in the ‘no exit’ or unsafe state.

Where separate luminaires are used for ‘Exit’ and ‘No Exit’, the inactive condition shall be not visible.

Dynamic signage shall comply with the NZBC/F8/4.5.1

Install switches to test dynamic exit signage functionality, these shall be located adjacent the Fire Alarm Panel. Refer Section 10.2.1.2.

10.2.4 FIRE & SPRINKLER ALARM TRANSPORTATION (MONITORING)

10.2.4.1 ALARM MONITORING

Co-ordinate the monitoring or ‘FENZ connection’ of sprinkler systems at the University with the Property Services Building Information and Compliance Team.

The University currently used its analogue network to connect Fire Alarm and Sprinkler Systems to its alarm transportation provider via the signalling equipment located within the Clocktower basement and at other locations

across Campus. The University is not extending this legacy copper network to into new buildings. Until a solution is found new buildings are likely to require a new Primary connection, in all instances consult with the Building Information and Compliance Team for direction.

10.2.5 RISER SYSTEMS

10.2.5.1 MAINTENANCE INSPECTION & REPORTING

The installing contractor is responsible for ensuring that all inspection, maintenance and reporting of the riser system has been carried out in accordance with the Compliance schedule and NZS 4510 until a date 12 months after issue of the Code Compliance Certificate. Where an existing system has been altered, responsibility for ensuring that all inspection, maintenance and reporting of the sprinkler system has been carried out in accordance with the Compliance schedule and NZS 4510 remains with the installing contractor until a date 12 months after issue of the Code Compliance Certificate unless agreed otherwise in writing with the Building Information and Compliance Manager.

For the purposes of this standard, inspection, maintenance and reporting includes the regular testing of systems in accordance with the respective standard, e.g. fire alarm and sprinkler systems; this includes any monthly, quarterly, annual or biennial testing of but not limited to circuits, switches, sounders, enunciation devices, bells valves, water supplies, pressures, alarm transportation or pressure vessel certification.

Where building construction includes installation of a permanent building hydrant system, the system shall be installed and brought into commission progressively as building work proceeds in accordance with the relevant section of NZS 4510:2008 or newer standard.

10.2.6 FIRE HYDRANT SYSTEMS

10.2.6.1 HYDRANT OUTLET VALVES

To meet NZS4510 and the University requirements either:

- Add padlocks to hydrant outlet valves (see NZS4510 clause 4.1.6). Padlocks to be suitably frangible by FENZ, or equal and approved.

Place hydrant outlets behind frangible and locked doors/panels (using a FENZ approved triangular key locking device)

10.2.7 HAND HELD FIRE FIGHTING EQUIPMENT

10.2.7.1 EQUIPMENT

Only equipment listed on the FPA Equipment register is to be used.

10.2.7.2 SUPPLY & INSTALLATION

For buildings with sprinkler systems, hand held firefighting equipment is to be specified, supplied and installed by the sprinkler contractor in accordance with NZS 4503, NZS 1841 or a specifically designed solution by the Fire Engineer. For buildings without sprinkler systems, hand held firefighting equipment is to be specified, supplied and installed by the fire alarm contractor in accordance with NZS 4503, NZS 1841 or a specifically designed solution by the Fire Engineer. Extinguishers are to be installed complete with tri-sign, blazon and bracketing (where appropriate). Fire Extinguishers are to be installed adjacent all fume cupboards in accordance with NZS2243.8 (part 2.14.3 as of 26 April 2006).

All Fire Extinguishers should be installed at Practical Completion.

Maintenance of Fire Extinguishers will be the responsibility of the Main contractor during the DLP period after which maintenance will pass to Property Services.

10.2.7.3 FIRE HOSE REELS

The University has a significant number of Fire Hose reels in use. Where a building is modified containing fire hose reels, the fire hose reels are to remain as the preferred hand held firefighting solution where practicable. Portable extinguishers are an acceptable alternative where reticulation, space, design or other factors make their installation impracticable. Fire Extinguishers of the appropriate performance level are acceptable in all other scenarios including new buildings.

10.2.8 FIRE & SMOKE DOORS

All Fire Smoke doors are to feature hold open devices with an adjacent easily accessed release button.

Magnetic hold back devices are preferred in general areas.

For Education Accommodation, bedroom fire doors shall feature *Dorma TS73 EMF LF* or similar electromagnetic/hydraulic closer to allow the occupant to manage their availability to others by adjusting their door position through its full range of opening, this will reduce the likelihood of bedroom fire doors being 'wedged' open.

Fire and smoke doors on circulation routes are to be primarily held open unless environmental comfort or control is affected or if specifically designed by the fire engineer. Circulation route fire and smoke doors are to feature local smoke detection to close the door as required.

Where the door opening force exceeds that described within NZS4121: 2001:7.3.5 a manually operated power assisted or automatic door opener is required. Refer also **Accessibility Section** where an increased standard has been placed on internal doors.

Fire door signage should be in accordance with NZBC and should reflect the actual use or function of the door.

10.2.9 FIRE & SMOKE CURTAINS

The Fire Alarm contractor is responsible for ensuring that all inspection, maintenance and reporting of the smoke and or fire curtain has been carried out in accordance with the Compliance schedule and manufacturers instructions until a date 12 months after issue of the Code Compliance Certificate. Where an existing system has been altered, responsibility for ensuring that all inspection, maintenance and reporting of the fire and or smoke curtain has been carried out in accordance with the Compliance schedule and the manufacturer's instructions remains with the Fire Alarm contractor until a date 12 months after issue of the Code Compliance Certificate unless agreed otherwise in writing with the Building Information and Compliance Manager.

10.2.10 PASSIVE FIRE SYSTEMS

Passive Fire Systems shall be installed in accordance with the University's passive fire guide.

Many passive fire systems require a minimum substrate thickness (typically 26mm), particularity gypsum based linings (Gib-board). To ease passive fire system installation consideration is to be given to lining service and riser shafts with two layers of 13mm fire rated gypsum board lining as a minimum to aid passive fire system selection and installation.

10.2.11 REFUGE SYSTEMS

In accordance with the University of Otago Area of Refuge Guidelines (rev 0.4).

10.2.12 FIRE EVACUATION SCHEME

The Health and Safety Compliance Team prepare the University's evacuation schemes.

DESIGN & FACILITY STANDARDS

SECTION 11:
SECURITY

11

11.0 SECURITY

The University is responsible for a large portfolio of buildings and facilities across New Zealand, with its main Campus in Dunedin. The Dunedin Campus is serviced by a dedicated security department which is the responsibility of the Proctor's office and which is known as Campus Watch. The Deputy Proctor performs the role of security manager within that department, alongside his other roles.

The Proctors Office and FM should be consulted with regard to all security designs around Campus.

Any security related IT requirements (including proposed connectivity to the University network) must be communicated to IT Services early during the concept and high-level design phases and must be incorporated into the final IT design. As the University network supports traffic segregation and isolation, all security services network traffic can and should be sent over the University network. Please contact its.design-facility-support@otago.ac.nz in the first instance.

11.1 ACCESS CONTROL

Campus Watch administers all electronic security services and systems on Campus, which it does from its 24/7 manned operations centre in St David Street, Dunedin, and which is centred around a fully integrated Gallagher Security Management system. All electronic access control, intruder detection, and CCTV systems administered by the Proctor's office are the direct responsibility of the Deputy Proctor who has developed these standard specifications in partnership with key stakeholders related to those systems. All electronic security equipment administered by the Proctor's Office is subject to a Comprehensive Maintenance Agreement (CMA) which covers all reactive and preventative maintenance to that equipment and establishes the foundation upon which work is carried out on a day to day basis. Due to the nature and criticality of the equipment and systems included within that agreement, the maintenance contract shall be involved (through the Deputy Proctor) in design discussions.

Please refer to the Gallagher Access Control Specification (February 2016 – Rev v 01) document for further details.

The Proctors office and Building Information and Compliance Office will collectively decide the location and quantity of access control required on each project. The Deputy Proctor should be consulted at Preliminary Design on individual projects.

The Deputy Proctor will engage the Maintenance Contractor to prepare a design for the new system. The design of the system will be passed back to the design team to integrate with the tender information. Access control will be procured as part of the Main Contractors package utilising the Main Contractor's preferred security contractor.

All Access Control should networked back to the Campus Watch operation in St. David Street.

Reference should be made to **Fire Section** 10.1.2.9 with regards to link to fire systems.

Note that electromagnetic locks are expected to be fitted as standard, other lock types such as strikes, drop bolts and electromechanical levers require prior approval from the Deputy Procter.

11.2 CCTV

The University has a Closed Circuit Television (CCTV) Security Systems Policy. CCTV is installed across Campus covering buildings and grounds. CCTV is managed and monitored by Campus Watch. CCTV is likely to be required in all new buildings and the Deputy Proctor should be consulted at Preliminary Design on individual projects. The Proctors office will decide the location and quantity of CCTV in conjunction with the Maintenance Contractor.
Campus Watch current use an Avigilon front end Software package. There is currently no standard or specification for camera type or manufacture – this will be project specific.

All CCTV should networked back to the Campus Watch operation in St. David Street. Many of the existing Colleges are currently monitored locally. The preferred solution for colleges in the future will be monitor at Campus Watch with a repeated monitor at the individual College site.

The Deputy Proctor will engage the Maintenance Contractor to prepare a design for the new system. The design of the system will be passed back to the design team to integrate with the tender information. CCTV will be procured as part of the Main Contractors package utilising the Main Contractor's preferred security contractor.

Where CCTV is installed there is a legal requirement to comply with the Privacy Act and inform people that they are potentially being recorded. Please refer the **Architectural Section** for information relating to CCTV signage.

11.3 ALARMS

The following alarms are present on Campus under the control of Campus Watch:

- Freezer alarms: particularly those held at below 80 deg C. These alarms are networked back to Campus Watch. There is currently no standard specification for Freezer alarms.
- Panic Alarms: located in various locations around Campus and networked back to Campus watch. There is currently no standard specification for panic alarms.
- Emergency Phones: These are locate around Campus grounds and allow students to raise alarm in an emergency. These alarms are networked back to Campus Watch. A specification for new Emergency phones is available from Campus Watch.

- Walk-in refrigerated spaces – refer the Health and Safety Requirements for Walk-in Refrigerates Spaces Procedure for design criteria.

11.4 INTRUDER DETECTION SYSTEMS

Section under review

11.5 LOCKS

Please refer the **Architectural Section** for Locks and suiting requirements. Any specification of new locking systems or security in a new or refurbished building should be checked with Campus Watch for any input from the Deputy Proctor.

DESIGN & FACILITY STANDARDS

SECTION 12:

INFORMATION TECHNOLOGY (INCLUDING AUDIO VISUAL SERVICES)

12

12.0 INFORMATION TECHNOLOGY (INCLUDING AUDIO VISUAL SERVICES)

IT Services (ITS) is responsible for the provision, maintenance, and support of the information and communications technology within the university. This includes the design, management and support of the University's network and telecommunications.

IT Support Services (ITSS) which is part of the Shared Services Division provides support for Media Production, eConferencing, Desktop support as well as the design, implementation and support of Audio Visual equipment.

Both ITS and ITSS are part of the Operations Group.

For additional help, advice or information regarding any of the following sections please contact its.design-facility-support@otago.ac.nz in the first instance.

12.1 DATA CENTRES AND NETWORK - BACKGROUND INFORMATION

12.1.1 Data Centres

The University's Data Centres primarily support software solutions running on the Windows Server and Red Hat Enterprise Linux operating systems. IT Services uses Oracle 12c on RHEL 64 bit for new enterprise level databases. The University is committed to using Oracle Data Guard within its database infrastructure. SQL Servers (2008 R2, 2012, 2014 editions) are predominantly used for smaller sized databases and data warehousing.

Enterprise replicated block storage is provided by Dell EMC vPlex / XtremIO / Unity, Enterprise File Serving. Is provided by the Dell EMC Isilon platform.

Within the Data Centres, IT Services supports and have in depth expertise in Java application servers including JBoss Wildfly, Oracle WebLogic and Apache Tomcat and applications deployed using ASP / IIS and .NET / IIS mid-tiers. Apache and IIS web servers are predominantly used.

IT Services has considerable experience with both single instance and clustered implementations of the above web-tier, mid-tier and database solutions.

The Data Centres use Citrix Netscaler network load balancers for web traffic failover and load balancing and makes extensive use of segregated VLANs, firewalls and various security solutions.

IT Services provide Science DMZs and segregated, hardened compute within each, in Dunedin, Christchurch and Wellington. The main workload running from these is a High Speed Data Transfer Service provided in collaboration with the New Zealand eScience Infrastructure (NeSI) and REANNZ. Users of this service are able to transfer large research data sets (typically 1-100 TB in size), from the IT Services Isilon Storage clusters to other sites within New Zealand and around the world at speeds exceeding 8 Gb/s.

Systems are monitored using a combination of Microsoft Systems Centre Operations Manager, Solar Winds and Oracle Cloud Control and the following systems are used as authentication repositories: Active Directory (Multiple Forests), Oracle Unified Directory. IT Services also supports and uses Oracle single sign-on 11g and Shibboleth.

IT Services currently supports and uses VMware ESXi for server virtualization and is fully committed to the virtualization of its core web/mid-tier infrastructure and applications where possible.

IT Services runs two primary data centres (in an active-active configuration) connected by dark fibre with SAN and software based data replication in place. In addition IT Services supports satellite 'data centre in a rack' type sites in Christchurch and Wellington, with local active networking services, Science DMZ, VMWare Compute and Isilon Storage to provide localised resources as required.

12.1.2 University Network Information

The University of Otago has one of the largest network infrastructures in New Zealand.

The network supports approximately 21,000 students and 5,000 staff; with concurrent client load measured in the 1,000's at peak. Of the computers that are owned by the University we can expect to see between 8,000 and 10,000 separate systems connect to the Internet at some point each day, with approximately 3,000 at any one time. When we add in the student and visitor systems this increases to approximately 5,000 concurrent systems. Users within the University use a variety of desktop systems as there is no standard desktop or build, these are mostly Windows and University owned desktop and laptop computers. Many students and visitors also connect their personal computers to parts of the University network. The network runs 24/7/365 with only small scheduled downtime periods; uptime for the system is typically > 99 %.

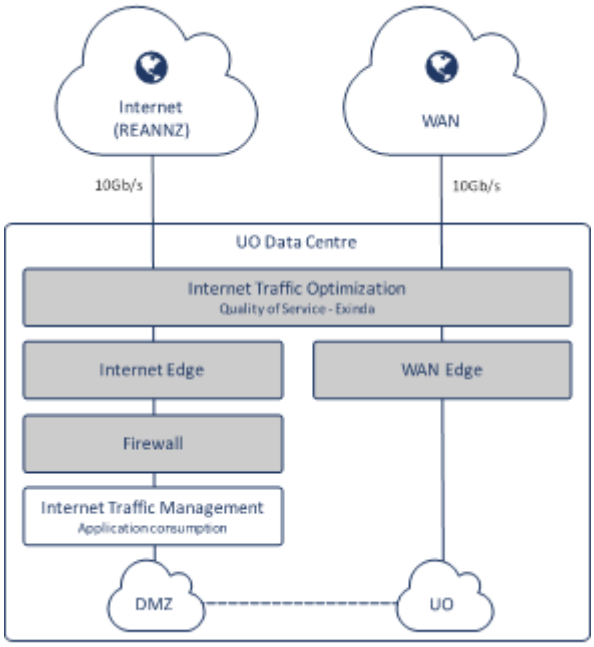
Mac OS X, with a small number of Linux systems. Varieties of phone and tablet devices are also used across the University running numerous version of Android, iOS and Windows Mobile operating systems.

The University network uses 802.1x authentication for both wired and wireless connections, this is built upon a Cisco infrastructure supported by Cisco Identity Services Engine (ISE).

The high level architecture depicted on the below is duplicated within each datacentre.

The University Internet connection is provided by REANNZ with a total current available capacity of 30GB. The

University also runs a WAN infrastructure between its various campuses with a central access point to the Internet via the two Dunedin data centres. WAN links are fully encrypted and can handle approximately 8 Gb/s.



12.2 DATA SYSTEMS

All buildings require the inclusion of standard University networking.

Consistency of network design and specification maintains a manageable standardized network.

Buildings must have a single common network for connectivity of all IP services.

A single Structured Cabling System is to be designed to support digital and any legacy analogue services.

Designs must specify current standard product sets. This information is available from IT Services.

The University network topology must be maintained in each building design. This information is detailed in the Otago University Cabling Standards guide. Refer UoO_CablingStandards_V5-02 for further information.

Documented applicable IT designs (including networking) are required at each phase of a new building design, and for existing buildings where a change in building layout is occurring.

12.2.1 Enterprise Architecture Standards

The Enterprise Architecture IT Principles and Standards document version 1.3 (2019) should be consulted when planning and constructing new facilities. The most relevant items from this document are listed below for convenience:

Section	Standard/Principal
General	Keep IT simple
General	Sustainably reuse existing IT infrastructure and services
General	Sustainability becomes a part of our IT decision making and operational perspective
Cyber Security	Design secure IT services
Cyber Security	IT security defences should be multi-layered and diverse
Cyber Security	Segregate IT service components at the network layer if they do not need to interact
Cyber Security	Build or procure IT services that handle failure scenarios safely
Networking	There is a single University network provided and managed by ITS
Networking	The new University network is used for new IT services and user devices
Networking	Protect the University network from external threats
Networking	Communicate any proposed building specific networking changes to maintain network performance for all
Networking	Multi-user and high throughput IT services are run from the ITS data centres where possible.
Networking	Before connecting new types of devices to the network for the first time, consult with ITS
User Experience	Aim for simplicity
User Experience	Support internationalisation and accessibility

12.2.2 Use of Deprecated IT Products/Solutions

Any product or solution which is deprecated, end of life or no longer industry standard should not be used. Company's providing IT products and/or solution should be commercially sound from a procurement perspective.

12.2.3 Wireless Network Design

A documented wireless network service must be designed to meet the following requirements:

- Minimum signal strength of no less than -65dBM
- Minimum Signal to Noise Ratio of 20dB
- Minimum data rate of 100Mbps
- Maximum of 20 clients per access point

Note: The above metrics are considered starting design principles that should be met.

If specific cases cannot meet this then justification must be made to and approved by the IT Services Network Group.

- Coverage customized to the building's areas of occupancy and anticipated client density
- Campus wide wireless LAN controller capacity planned
- Wireless access point placement defined and documented
- Channel management defined and documented
- Post build testing & acceptance requirements defined

12.2.4 Ethernet Network Design

A documented ethernet network design and specification must include the following elements:

- Capacity planning to the network core
- Network switch specification aligned with the current product set
- Network Router specification where necessary
- WAN design and dark fibre service specification where necessary
- High performance 10Gbps requirements where necessary
- PoE budgets documented
- Optical modules specified and scheduled

12.2.5 IP Services

Networking services must be defined and documented to provide downstream services including but not limited to the following:

- General Data
- CCTV
- Telephony, Emergency refuge stations
- PA Systems
- Security
- Audio Visual
- Mechanical control systems

12.2.6 Communications Rooms

The data plan documentation must include the following communication rooms' requirements:

- Size and count of communication rooms to service the building
- Ventilation/cooling requirements based on thermal calculations of active equipment
- Security and access requirements
- Rack/Cabinet specification and installation details
- Rack layouts
- Acoustic requirements based on active equipment specification
- Power requirements based on active equipment specification

Conformity with the current Otago University Cabling Standards

12.2.7 Backbone Data Cabling

Backbone data cabling design documentation must include the following elements:

- Duct design and capacity planning
- Comms pit specification and placement
- Airblown fibre design and capacity planning
- Campus fibre capacity planning
- Conformity with the current Otago University Cabling Standards

Specialized IT sites such as buildings hosting Data Centres, campus Cross Connects and regional network hubs require further planning. The University's IT Services division are to approve all network designs.

12.3 TELEPHONY

The University Telephones are managed by IT Services. There are currently digital and legacy analogue telephone systems.

The IT roadmap for telephony proposes University wide rollout of lift

over IP / IPTEL.

The legacy analogue system is end of life and should not be built out further.

PM's should discuss their requirements with IT Services early in the Project. The Project Owner (Department or Division) will be responsible for procurement of the telephone handsets through IT Services (this will not be purchased through the project).

An accessible telephone should be considered as part of projects which provides large buttons, visual display and braille.

12.4 AUDIO VISUAL

Audio Visual equipment has become an increasingly important part of everyday life for students and staff alike. Whilst buildings may last for 50 years or more, the AV equipment will likely be replaced on a 5 – 10 year cycle as new technologies are introduced. As such, AV installations need to be carefully considered, flexible and future proof.

The University has its own AV design specialists within the ITSS AV Support team within the Shared Services Division. The University AV Support team should be engaged at the early stages of a project to assist with the design and procurement of AV equipment and to assess whether any additional specialist services are required. In most circumstances, AV will be designed, and procured by the University. Preferred products and suppliers will change in line with technology and market forces. Installation may be carried out by either Property Services OR Main Contractors and this will be agreed on a project by project basis.

The University utilise the AETM (Association for Audiovisual & Educational Technology Management) Audio Visual Design Guidelines for Tertiary Teaching Space to inform design. In addition, the University have specific Wiring and Cabling Standards which should be adhered to.

12.5 IT Security

Cyber security is a critical aspect of all IT initiatives at the University. Anything getting connected to the network or being used to store, process or transmit data either locally or on the network needs to be as per an approved design.

12.5.1 Network

All equipment being connected to the network or use to store, process or transmit University data must be approved for use prior to purchase or use. ITS is developing an Approved Device Register that will be available in the coming months.

DESIGN & FACILITY STANDARDS

SECTION 13:

VERTICAL TRANSPORTATION

13

13.0 VERTICAL TRANSPORTATION

Vertical transportation should be provided in all buildings with more than a singles storey to allow for accessibility for all staff and students.

In clinical buildings consideration should be given to lifts with sufficient space for a stretcher or gurney.

13.1 LIFT REQUIREMENTS

13.1.1 CONTROL PANELS

Lift cars are to include an auxiliary car control panel on the side wall of the lift car opposite the main car operating panel but perpendicular to the car opening to meet the requirements of NZS 4121. Refer **Accessibility Section**.

13.1.2 LEVELLING ACCURACY

+/- 5mm.

13.1.3 EMERGENCY ALARM

Alarm bell on the Ground Lobby wall above the landing entrance compliant with NZS 4332.

13.1.4 AUTO DIAL TELEPHONE

Hands-free auto dial telephone system operated via the car alarm button and programmed to connect to the University security control centre.

13.1.5 EMERGENCY LIGHTING

Two hour capacity compliant with NZS 4332.

13.1.6 FIRE RECALL FIXTURE

Only where travel exceeds 15m.

13.1.7 FIRE PROTECTION

Shaft heat sensors for lift functionality by the lift contractor, shaft fire detection or suppression for building protection by the fire system contractor.

13.1.8 HYDRAULIC SERVICES

Lift pit water sensor by the lift contractor.

13.1.9 SEISMIC RESTRAINT

Provide seismic restraints for the installation in accordance with NZS 4203 and details in accordance with NZS 4219. Provide horizontal restraints to resist forces of not less than 0.5 Gc and vertical restraints to resist forces of not less than 0.25Gc where Gc is the weight of a component.

13.1.10 QUALITY OF RIDE

Minimise lateral movement, vibration and noise within the lift cars. Starting, acceleration, deceleration and stopping shall be smooth and without appreciable jerk or abruptness whilst being consistent with the guaranteed performance times.

13.1.11 SPECIAL REQUIREMENTS

- Provide LED baton shaft, pit and machine area lighting with switching from the roof control station and pit.
- Provide a door release device to open the Ground floor landing doors from the top of the pit ladder.
- Provide an alarm/telephone button on the underside of the car platform.
- Provide a pit water sensor and sump grate cover in accordance with NZS 4332
- Supply and install shaft heat sensors in accordance with NZS 4332
- Provide red and yellow ‘mushroom’ type emergency stop switches with guarding to prevent accidental release and located at the top and bottom of the pit ladder, adjacent the hoist motor and the car roof.

13.2 NON-PASSENGER SMALL GOODS LIFTS & DUMBWAITERS

Section under review

13.3 DISABLED ACCESS LIFT

Refer **Accessibility Section**.

Note that in Colleges, the lift car should be sized to accommodate a gurney.

DESIGN & FACILITY STANDARDS

SECTION 14:

PROJECT DOCUMENTATION

14

14.0 PROJECT DOCUMENTATION

Document management on every project should be well structured to allow effective communication within the Project team.

The University utilise an internal system for document management called OURDrive. OURDrive is used for storage of archive information and may hold relevant building information. Consultants may be given access to OURDrive as required. The PM can arrange access as appropriate.

Campus Development utilise Aconex Construction Management Software. Details of this software will be provided by the PM on a project by project basis. Consultants are expected to embrace this document management system to support positive project delivery.

On smaller projects, consultants are encouraged to effectively manage document transfer and may consider use of an FTP site for project information.

In most cases drawing information will be issued in PDF format and may be emailed or issued through file electronic file transfer and should be accompanied by a drawing issue register to assist tracking of changes. Paper copies of drawings may be requested by the University from time to time but are increasingly becoming less relevant and should not be issued as a matter of course. This is in line with the University Sustainability policy.

All drawn project work should be carried out in Autodesk Revit. The University may request at any time during the course of a project to have a copy of the Revit Model issued by the consultant. The Revit model should be updated in line with the University BIM protocols at completion of the project as part of the O&M information. Refer **H&S Section**.

Consultants may utilise their own drawing numbering and revision tracking protocols.

14.1 OPERATION & MAINTENANCE MANUALS

O&M manuals are valuable information to the University and key to safe operation of installed systems. The accuracy and completeness of the O&M information at completion of a project will improve the facilities management that the University deliver and assist ensure longevity of the facilities across Campus.

The University utilises the O&M information to inform Asset Management and maintaining schedules for cleaning, repair and planned preventative maintenance.

14.1.1 PRESENTATION

O&M manuals should be presented in a consistent manner on all projects:

- One hard copy: A4 portrait format, presented in white lever arch ring binder with plastic pockets for relevant information and A3 drawings
- One Digital Copy (fully digitised, not scanned): presented in PDF format with 1 PDF document per section; A4 portrait with A3 drawings.

Contractors may issue the O&M Manual digital copy via a variety of medium as they see fit; CD, email, flashdrive, secure hyperlink.

14.1.2 FORMAT

These manuals shall cover all equipment and systems (including any computer software provided as part of the project). These shall be provided prior to physical completion of the project as noted below. The content of O&M Manuals should be consistent in the following format:

1. Cover sheet
2. Contents Page
3. Project Description: A brief description of the project and the works carried out, location, dates and Main Contractor details.
4. H&S:
    a. Noting any specific project issues encountered (hazardous ground conditions, adjacent building issues, structural deficiencies)
    b. Noting any residual risk following completion of the project requiring ongoing management (method for accessing high level lighting for replacement, any hazardous material such as asbestos requiring management. Include location, type of hazard and control measures
5. Key Parties: Provide a schedule capturing the key parties to the Project including
    a. Client & Consultants (name of company, address and contact details, discipline and principal contact on the project)
    b. Contractor & Subcontractors. (name of company, address and contact details, workscope and principal contact on the project)
6. Finishes Schedule: Excel spreadsheet covering location and key room finishes details (colour, material, size)
7. Asset Schedule:
    a. Excel spreadsheet of asset information for key assets covering, location, make model, supplier, maintenance schedule
    b. List of recommended spares
8. Instructions and Information on Installed Systems and Equipment: Manufacturers literature relating to the operation and maintenance of the item. To be split into the following sections:
    a. Fabric
        i. External Envelope

ii. Internal Fittings
    1. Internal Walls and Joinery (inc Ceilings, Doors and hardware)
    2. Specialist Joinery
    3. Floor Coverings
    4. Decoration
b. Mechanical Systems
c. Electrical Systems
d. Hydraulic Systems
e. Security Systems
f. Fire Systems

9. Certificates:
    a. SS 1 – Automatic systems for fire suppression
    b. SS 2 – Automatic or manual emergency warning systems
    c. SS 3 Electromagnetic or automatic doors or windows
    d. SS 4 Emergency lighting systems
    e. SS 5 Escape route pressurisation systems
    f. SS 6 Riser mains for use by fire services
    g. SS 7 Automatic back-flow preventers connected to a potable water supply
    h. SS 8 Lifts, escalators, travellators, or other systems for moving people or goods within buildings
    i. SS 9 Mechanical ventilation or air conditioning systems
    j. SS 10 Building maintenance units providing access to exterior and interior walls of buildings
    k. SS 11 Laboratory fume cupboards
    l. SS 12 Audio loops or other assistive listening systems
    m. SS 13 Smoke control systems
    n. SS 14 Emergency power systems for, or signs relating to, a system or feature specified in any of SS 1 to SS 13 above
    o. SS 15 Other fire safety systems or features (systems for communicating information intended to facilitate evacuation, final exits, fire separations, signs, fire separations)
    p. SS 16 Cable cars
10. As Built Drawings:
    a. Schedules of all drawings in the manual
    b. Copy of all As Built drawings at A3 (folded down to A4)
    c. Updated BIM Model (provided electronically)
11. Warranties and Guarantees

14.1.3 TIMING & APPROVAL

The University operate a Project Completion, Handover Process and Checklist which will be implemented nearing completion of a project by the PM. Provision of information from the Contractor and Design Team to support this process is imperative and the O&M Manuals and certification play a critical part in operational readiness:

- **3 Months from Completion**: Draft O&M Manuals to be issued for review by the University Health and Safety Advisers
- 2 Months from Completion: Preparation of compliance schedule
- 1 Month from Completion: Completion of compliance schedule and completion of O&M manuals review including maintenance schedules.
- 1 Week from Completion: Issue of certification for sprinklers, passive fire and electrical

As noted above, O&M Manuals should be completed by the Contractor 1 month **prior** to completion of the building.

The draft O&M documents (in hard copy and digital format) should be issued to the PM 3 months prior to completion. The PM will circulate the documents to the following internal teams who will have a period of 1 month to review and pass comment back to the PM:

- Building Information and Compliance Team
- H&S Team
- Property Services FM / Trades
- Property Services Design Office

Following receipt of the comments the contractor will have a 1 month period to make the necessary amendments and complete the manual. The contractor will issue the final draft of the manual back to the PM (in hard copy and digital format). The PM will lodge the completed O&M Manual in OURDrive and confirm to the above noted interested parties of its completion. Should there be any residual amendments required to the O&M Manual these should be notified to the PM at the earliest opportunity. The University's respective teams will thereafter manage the information as per existing procedures and Building Information and Compliance Team will translate the information into the Planned Maintenance System.

All defects identified within the building during the DLP period should be highlighted to the PM in the first instance.

The Building Information and Compliance team will start the Owners Inspection at the point of Occupation.

14.2 BUILDING WARRANT OF FITNESS

14.2.1 INSPECTION MAINTENANCE & REPORTING

The Main Contractor shall be responsible for ensuring that all inspection, maintenance and reporting has been carried out including those systems installed by subcontractors until a date 12 months after issue of the Code Compliance Certificate (see sections for Fire, Sprinklers, Risers and Fire or Smoke curtains for additional information).

Where an existing system has been altered responsibility for ensuring that all inspection, maintenance and reporting of the sprinkler system has been carried out in accordance with

the Compliance schedule and NZS 4541 remains with the installing contractor until a date 12 months after issue of the Code Compliance Certificate unless agreed otherwise in writing with the Building Information and Compliance Manager.

14.2.1.1 Form 12A

Inspection, maintenance and reporting includes the issuing for Form 12A's for the respective systems

14.2.1.2 Means of Escape

The University of will carry out owners inspections for 'means of escape' commencing at practical completion, advise the Building Information and Compliance team of the practical completion date so these inspections can be initiated. Contact Property Services Building Information and Compliance Team.

14.2.1.3 Compliance Schedule

The University requires detailed Compliance Schedules. Please contact the Building Information and Compliance Team for assistance with the preparation of Compliance Schedules. Fire Reports are not to be included in any Building Compliance Schedules.

14.3 COMPLIANCE INFORMATION

In order for the Property Services Building Information and Compliance Team to maintain the Consents Database Records the following information must be provided to them for each project and should be collated by the PM or Facilities Manager. This information should be sent to the Property Services Design Office.

It is also important that details are provided relative to any Building Consent Amendment(s), Certificate of Acceptances, Exemptions from Building Consent and should any building consent be withdrawn.

	Requirement	Campus Dev't	PSD Ops Group
1	Building Name	☒	☒
2	Building ID	☒	☒
3	Physical Address	☒	☒
4	Job Description	☒	☒
5	BC Application Date	☒	☒
6	ABA Number (once known)	☒	☒
7	Notification of RFI letters	☒	☒
8	Electronic Copy of issued ABA Certificate	☒	☒
9	Link to issued building consent documents	☒	☒
10	CPU (Construction and Occupancy).		
	Application date.	☒	☒
	Expiry Date.	☒	☒
	Receipt Date.	☒	☒
	Notification of any subsequent extensions	☒	☒
11	Notification of DCC monitoring letters and their responses.	☒	☒
12	CCC application date	☒	☒
13	Electronic copy of Code Compliance Certificate	☒	☒
14	Name of Campus Development Project Manager	☒	
15	Name of PSD Facilities Manager		☒
16	Name of PSD Project Coordinator		☒
17	Name of PSD Design Office contact person		☒
18	Name and contact details of Main Contractor	☒	☒
19	Name and contact details of any Agent (e.g. Architect, project management company)	☒	☒
20	Job Number	☒	☒

fig 14.1: Compliance responsibility

14.4 BIM REQUIREMENT

The University is in the process of defining its BIM standards which will provide better clarity on the requirements for the process and the end output of the Model. This section of the document is under review. A holding statement of high level requirements is provided whilst the BIM standards are in progress.

The University requires that all projects are developed using the BIM methodology and that all projects are developed utilising Autodesk Revit. This has two key benefits for the University:

- Coordinated Design, minimising site alteration and additional cost
- Creation of an accurate post completion Revit Model to allow ongoing maintenance and future project work

14.4.1 BIM BRIEF

The University will be responsible for preparing the BIM Brief for each project.

14.4.2 BIM EXECUTION PLAN

The University will appoint a suitably qualified consultant to act as BIM Manager and prepare the BIM Execution plan. This document will identify the level of information required

and the roles and responsibilities together with requirements for coordination and completion.

14.4.3 EXISTING BIM INFORMATION

The University holds many of its building's information on Revit to varying degrees of information provision and accuracy. This information will be made available to consultants to assist with the design process, however it should not be relied upon as being accurate and consultants should undertake survey of the space and systems to ensure accuracy and amend as required.

14.4.4 OWNERSHIP OF MODEL

The Revit Model or Pointcloud Model remains the property of the University. On completion of any alteration works the contractor will be responsible for updating the Model to include the level of information as defined by the University. It should be noted that in many cases, Contractors will not be well versed in the requirements for maintaining the model. This should be discussed at the early stages of a project with the University PM and a decision made as to where the ownership of responsibility should lie with regards to the final model.

14.4.5 LEVEL OF DETAIL (LOD)

The University is in the process of preparing a schedule of LOD's for each of the building elements which will clarify the required output of the model at completion. Broadly, all elements of the building should be to LOD300 as a minimum.