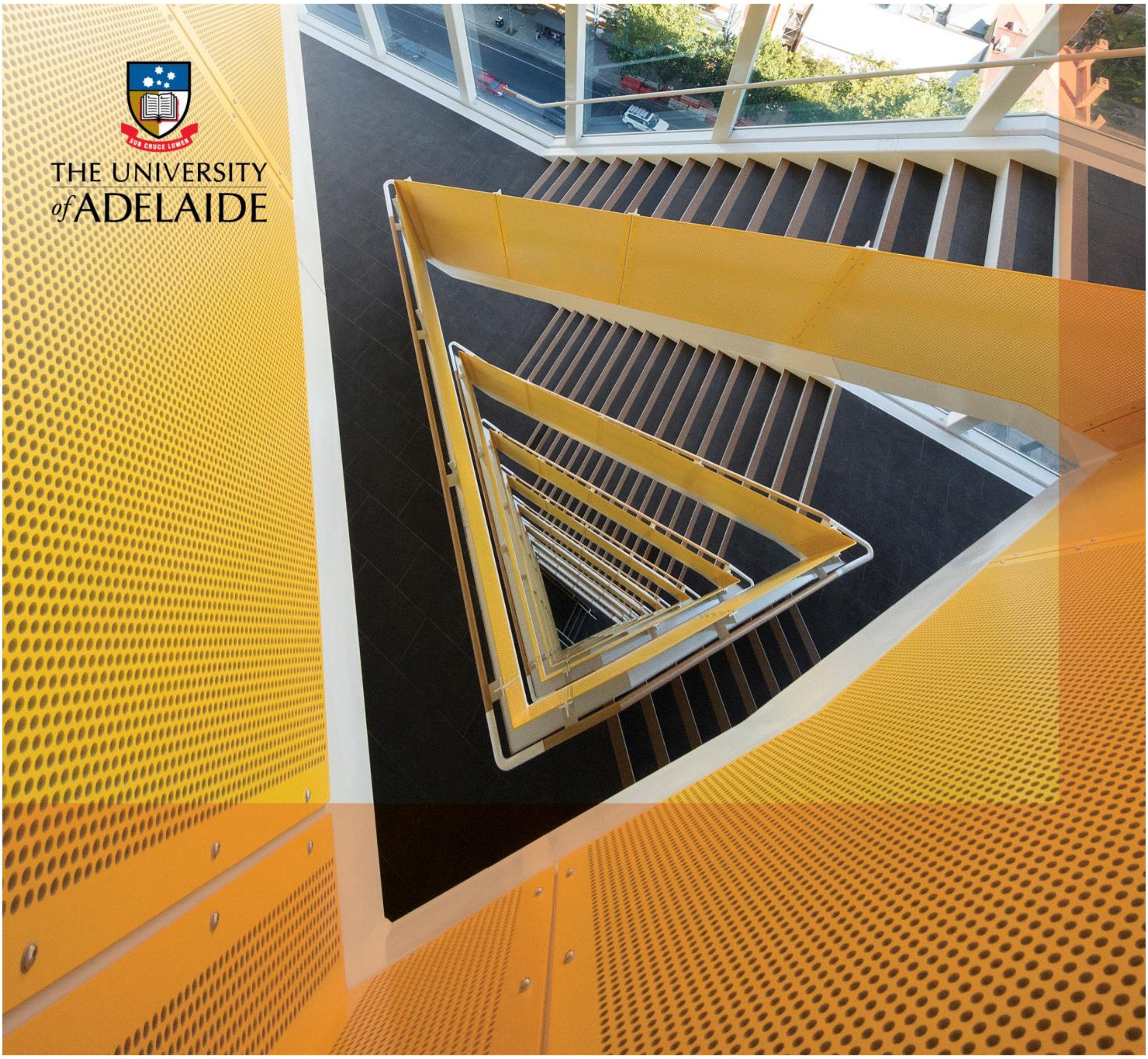

DESIGN STANDARD

N. Audio Visual

Contents

Revision log

Current issue

N. Audio Visual - UoA Design Standards. FINAL Version 4. August 2018.

Previous issues

Version	Authors	Description	Revision	Date
1.0	Noel Threapleton, Technology Services, UoA	N. Audio Visual - UoA Design Standards	DRAFT Version 1	December 2017
2.0	Noel Threapleton, Technology Services, UoA	N. Audio Visual - UoA Design Standards.	DRAFT Version 2	December 2017
3.0	GHD	N. Audio Visual - UoA Design Standards.	DRAFT Version 3	March 2018
4.0	Vicki Jacobs, Capital Project Delivery, UoA, GHD	N. Audio Visual - UoA Design Standards.	FINAL Version 4	August 2018

List of revised items

Version	Authors	Revised items	Date

Revision management

It is envisaged that revisions to this document will be undertaken at intervals of not more than two (2) years.

Endorsement body

Director of Infrastructure

Owner

Capital Projects Delivery

Contact person

Associate Director, Capital Project Delivery

Authors and acknowledgements

The standards have been developed by Capital Projects with the assistance of UoA staff, external consultants, contractors, and colleagues from other education institutions. The University conveys its thanks.

Abbreviations

AS/NZS	Australia or Australian/New Zealand Standards
BCA	Building Code of Australia
CPD	University of Adelaide- Capital Projects Delivery
DDA	Disability Discrimination Act
NCC	National Construction Code
OSH	Occupational Safety and Health
SEPP	State Environmental Planning Legislation
SiD	Safety in Design
UoA	University of Adelaide
WHS	Work, Health and Safety

1. Introduction

This section outlines the purpose, structure, related documents, and definitions for the University of Adelaide (UoA) Design Standards.

1.1 Purpose of the document

The UoA Design Standards (the Standards) respond to the strategic vision for the University, outlined in Beacon of Enlightenment 2016-2035, and the guiding planning principles contained in the UoA Masterplan 2016-2035. Prepared in recognition of the University's unique historical context, the Standards are guided by the aims of supporting physical, social and cultural connectivity, embracing diversity, equity and accessibility, and promoting sustainability and academic excellence.

The Standards specify the minimum, mandatory requirements for the design, construction and management of all University of Adelaide infrastructure projects. Requirements are specific to the University's needs, and are over and above minimum mandatory Authority requirements. They include:

- Methodological requirements for project delivery
- Technical requirements for the finished product.

The objective is to support the consistent delivery of a high quality product, while allowing sufficient scope for innovation, creativity and technological advancements.

The Standards must be used by any parties involved in the planning, design, construction, occupation management, maintenance and operation of UoA facilities. This includes external consultants and contractors, UoA planners, designers and project managers as well as professional and faculty staff, facility managers, maintenance contractors and other service providers – all of whom must be aware of the Standards as they apply to their project and scope of work.

1.2 Structure of UoA Design Standards

N. Audio Visual Design Standard (this document) is a part of the UoA Design Standards suite of documents (the Standards).

The Standards are divided into the following volumes for ease of use:

- A. Project Process Checklist
- B. Building and Architecture
- C. Mechanical Services
- D. Electrical Services
- E. Communication Services
- F. Hydraulic Services
- G. Fire Services
- H. Security Services
- I. Vertical Transport
- J. External Works
- K. Documentation
- L. Metering and Monitoring
- M. Audio Visual (this document)
- N. Signage and Wayfinding

The Standards must be considered in their entirety, regardless of the project's size, specific disciplines or responsibilities.

In particular, UoA staff and consultants using this volume must ensure familiarity with the mandatory project procurement obligations, detailed in A. Project Process Checklist.

- Each volume within the Standards is structured into four parts:
- Part 1 – Introduction
- Part 2 – General requirements
- Part 3 – Technical requirements
- Part 4 – Schedules

1.3 Related documents and legislation

1.3.1 Documents

During the earliest strategic feasibility and planning stages of the project, review and analysis of the latest edition of the following UoA strategic planning documents must be carried out and outcomes of that review reflected in the Project Brief (refer to clause 1.4 – Definitions of this volume).

These documents should also be read in conjunction with the UoA Design Standards.

- UoA Masterplan 2016-2035
- UoA Strategic Plan - Beacon of Enlightenment, 2013-2035
- Disability Action Plan 2013-2019
- Campus/ Building-specific Disability Action Plans
- Dormwell Framework
- UoA Reconciliation Statements
- Campus/ Precinct/ Building-specific Masterplans (e.g. Waite Masterplan, Union House Masterplan)
- Campus/ Building-specific Conservation Management Plans
- Faculty Masterplans
- Technical discipline/ space-specific Masterplans, including:
  - ITS Strategy Masterplan
  - Mechanical Services Masterplan
  - SAMP
  - Teaching Spaces Masterplan
  - Labs Standards and Masterplan
  - Library of the Future Masterplan
  - Space Standards Guidelines
  - Deferred Maintenance Schedule
  - Bushfire Prevention Plans
  - Campus Water Management Plan
- Campus Sustainability Plan 2017 and associated documents, including:
  - The Carbon Neutral Adelaide Action Plan 2016-2021
  - Innovation Hub/ Smart Cities
  - Building Performance Rating System

1.3.2 Relevant legislation

The planning, design and construction of each UoA facility must fully comply with current legislation. Legislation includes but is not limited to:

- Australia or Australian/ New Zealand Standards (AS/NZS)
- National Construction Code (NCC)
- Building Code of Australia (BCA)
- Occupational Safety and Health (OSH) legislation
- Disability Discrimination Act (DDA)
- Accessibility Aspiration Design Factors
- State Environmental Planning Legislation (SEPP)
- Commonwealth and State Legislation
- Local Council and Authority requirements
- Relevant Heritage Acts (for both Places and Natural Resources)

1.4 Definitions

For the purpose of this document, the following definitions apply:

Must	Indicates that a statement is mandatory
Should/ shall	Indicates a recommendation
May/ can	Indicates the existence of an option
The Standard/s	The University of Adelaide Design Standards
Project Manager	University of Adelaide staff member responsible for delivering the building project
Project Brief	The strategic brief detailing project scope and objectives, developed at the project feasibility and initiation phase, from which the Return Brief mustbe developed.
Return Brief	The detailed design brief prepared by the Design Team and signed off by the Project Stakeholder/s prior to commencement of Concept Design

2. General requirements

This section outlines:

- General administrative requirements related to the use of the B. Building and Architecture, and the process for project delivery for all projects, including: project specific documentation; discrepancies; departures; certification of compliance; project procurement process; value management; safety in design; WHS; environmental management; independent building commissioning; manufacturer's specifications; and professional services requirements; and
- General design requirements related to the B. Building and Architecture, including the University policy on sustainable design as well as durability, economy and flexibility.

2.1 Project specific information

Project-specific information will be contained in project- specific documentation, such as Project Brief. The Standards will supplement any project-specific documentation. Refer below clause 2.2- Discrepancies for clarification of precedence, should a discrepancy between Project Specific Documentation and The Standard arise.

Extracts from the Standards may be incorporated in contract documentation specifications. However, the consultant and the contractor must fully investigate the needs of the University and produce designs and documents that are entirely fit for purpose, which meet the intent of the Project Brief.

2.1.1 The project brief

In accordance with A. Project Process Checklist and clause 2.4 Certification of Compliance, the Project Brief must be developed and signed-off in the following manner, and utilised as a measure, against which periodic certification must be carried out.

- The Pre-feasibility Statement and preliminary project brief contained therein, communicates proposed project objectives and scope, preliminary budget and any project- specific strategic targets (if known).
- The Strategic Project Brief is typically developed by the University during the feasibility phase of the project. This brief reflects outcomes of the strategic project investigations. The Strategic Project Brief must be interrogated and verified by the Project Delivery Unit, Project Manager and key strategic stakeholders, prior to proceeding to the next Detailed Briefing Phase of the project delivery process. It is from this verified Strategic Brief, that the consultants brief will be developed.

The Strategic Project Brief must:

- Identify project- specific sustainability targets, over and above the Standards, and associated reporting obligations;
- identify proposed project budget and funding source. This must include:
- Capital Budget (separated into construction and university costs), and
- Operating Budget (reflecting project- specific sustainability targets);
- identify other strategic targets associated with the project;
- identify list of known Stakeholders with a preliminary engagement plan developed. This includes identification of key stakeholders with whom sign-off approvals obligations will sit. Refer below Clause 2.4 Certification of Compliance with the Standard;
- identify general spatial and operational requirements of the end users;
- identify decanting and relocations proposals associated with works;
- identify a list of further investigations that are required (e.g. Heritage, DDA etc.);

- identify an indicative project program for the delivery of works;
- identify strategic risks associated with the project (Refer Clause 2.7 Risk Register);
- communicate any safety in design risks identified to date (Refer Clause 2.8 Safety in Design);
- The Return Brief (also referred to as Project Brief) is typically prepared by the Consultant at the end of the detailed briefing phase, during which intensive stakeholder consultation has occurred. The Project Brief must be signed-off by key stakeholders prior to proceeding to the next Concept Design Phase of the project delivery process. It is against the signed- off Return Brief (also typically referred to as Project Brief), that the mandatory, milestone, compliance certifications will be measured. (Refer to clause 2.4 Certification of compliance, in this document). For very simple projects, compliance may be measured against the Strategic Project Brief, or equivalent, provided it meets all mandatory due diligence obligations, related to the development of a brief, listed in A – Project Process Checklist.

The Return Brief must:

- Meet the obligations of the Strategic Project Brief (including, but not limited to budget and sustainability targets);
- identify detailed operational and spatial requirements of the end users;
- include room data sheets for complex projects (refer to Vol. A Checklist for clarification).

2.2 Discrepancies

The Standards outline the University's general requirements above and beyond mandatory authority requirements and legislation.

Where the Standards outline a standard higher than the relevant legislation, the Standards will take precedence.

If any discrepancies are found between any relevant legislation, the Standards, or project-specific documentation, these discrepancies must be highlighted in writing to the Associate Director, Capital Projects Delivery.

2.3 Departures

The intent of the Standards is to achieve consistency in the quality of the design and construction of the University's built forms.

In addition, University staff, consultants and contractors are expected to apply industry best-practice and strive for improvement and innovation in design and construction techniques wherever possible. In recognition of this expectation, application to depart from the Standards, must be made in writing to the Associate Director, Capital Projects Delivery via the UoA Project Manager, using the Alternative Design Solution Application Form. The application must include:

- Reference to the Standard clause under consideration
- Details of the departure and alternative proposal
- Impact of that departure on:
  - Compliance with the Project/ Return Brief
  - Project capital budget
  - Operating budget

Where a departure from the Standards is sought, dual-approval to proceed must be issued in writing by both the Associate Director, Capital Projects Delivery and the Director of Infrastructure. Until this approval is granted, the consultant is not authorised to proceed to the next project phase. Any departures made without written confirmation must be rectified at no cost to UoA.

At the completion of the project, all authorised Alternative Design Solution Application Forms must be submitted to the Associate Director, Capital Projects Delivery by the UoA Project Manager. Alternative Design solutions mustbe monitored over time for success and may be considered for inclusion in subsequent versions of the Standards.

2.4 Certification of compliance

At regular intervals the consultant team must certify in writing that both the Standards, and the Project Brief, have been met.

This can be done using the templates provided in A- Project Process Checklist, or an equivalent, approved reporting tool.

Discrepancies and departures must be declared, with justification, at this time, in accordance with clauses 2.2 Discrepancies and 2.3 Departures of this document.

Approval must be granted prior to proceeding to the next project phase in accordance with the process outlined in A- Project Process Checklist.

It should be noted that The Standards, as they relate to this clause, refer to all Volumes of the Standard, including A- Project Process Checklist.

2.4.1 Frequency of certification

Frequency of certification is based on the size and complexity of the project. Refer to A. Project Process Checklist for frequency of certification requirements based on the complexity of the project.

For new all new building projects, (multi-disciplinary) projects, or projects with a value greater than $500,000, Certification must occur at the end of each of the following project phases:

- Concept Design Phase
- Design Development Phase
- 50% Complete Contract Documentation Phase
- 100% Complete Contract Documentation Phase
- Project Hand-Over Phase

For very small or simple (single discipline) projects, Building Standard Certification must occur at the following times:

- At an agreed point, prior to the end of the 50% Complete Documentation Phase
- At an agreed point prior to the end of the 100% Complete Contract Documentation Phase

2.4.2 Additional certification requirements

In addition to the above mandatory certification check-points, certification of compliance with the Design Standards and The Project Brief, must also occur as part of any Value Management Session, in accordance with clause 2.6. Value management of this document.

2.5 Project procurement process

All project team members must follow the project process outlined in A. Project Process Checklist. The checklist is a planning and tracking tool to be used by the project manager, consultants and contractors, to ensure adherence to the approved UoA process for project delivery and to ensure the Standards are achieved as a minimum on all projects.

A. Project Process Checklist Design Standard caters for different project complexity types. For clarification of the project complexity type, refer to Manager, Capital Projects Delivery.

A. Project Process Checklist Design Standard does not alleviate any responsibility to ensure familiarity and compliance with all aspects of the Design Standards. The checklist (or an approved, project specific version) must be maintained as an active document throughout the project, and must be submitted to the Manager, Capital Projects Delivery, via the UoA Project Manager at project completion.

A. Project Process Checklist Design Standard is divided into project delivery phases. While the order of actions listed can be varied to suit a project, all actions listed must be completed, and certified as complete, prior to proceeding to the next phase. Project-specific variations of the checklist involving alteration to the number of mandatory milestone certification checkpoints, or elimination of any action, must be treated as a departure from the Standards and submitted for approval to the Associate Director, Capital Project Delivery at the commencement of the project start-up phase.

Project managers, consultants and contractors must ensure that adequate time and resources are allocated to meet the requirements of A. Project Process Checklist Design Standard and, in particular:

- Mandatory milestone certification checkpoints and associated approvals processes (refer to clause 2.4 Certification of compliance)
- Engagement and consultation obligations with stakeholders
- DDA, Safety in Design, and Risk Management workshops
- UoA peer reviews
- Two-step value management process, refer to 2.6 Value- management

2.6 Value management

1. A mandatory two-step value management (VM) session must be carried out when the project has reached the 50% Complete Contract Documentation Phase (or at a time deemed appropriate by the UoA Project Manager). Additional value management sessions may be required and must follow the same process. Consultants and Project Managers must make appropriate allowance for resources and time to meet the requirements of this clause.

Any value management sessions must take the following two-step process:

1. Value management (VM) session; followed by
2. Written certification (in accordance with disclosure and approvals obligations set out in clause 2.4 Certification of compliance in this volume), that the proposed value managed solution:

- Meets the requirements of the Design Standard
- Meets the requirements of the Brief. This includes (but is not limited to) confirmation of the following:

- Estimated order of cost for capital and operating budget; and
- Project-specific sustainability objectives

2.7 Risk Register

The Risk Register records details of all the risks identified at the beginning and during the life of the project, their grading in terms of likelihood of occurring and seriousness of impact on the project, initial plans for mitigating each high-level risk, the costs and responsibilities of the prescribed mitigation strategies and subsequent results.

This Risk Register must be maintained for all projects, throughout the life of the project. Initial risk assessment must form part of the Project Feasibility Phase for the project. If strategic risks are identified, they must be recorded and managed separately to those that are related to worksplace health and safety. The preliminary register (or list of issues) must be communicated in the Strategic Project Brief.

The register must continue to be developed and maintained by the UoA Project Manager for all projects. Later the register will be maintained by the Managing Contractor, Service Delivery maintenance staff, and potentially end-users. The register will be updated regularly as existing risks are re-graded in the light of the effectiveness of the mitigation strategy, and new risks are identified. For larger projects a Risk Management Plan may be required also. In smaller projects, the Risk Register can be used as the Risk Management Plan.

Refer to clause 2.8 for further discussion about Safety in Design and the mandatory Safety in Design Risk Assessment Workshop.

Refer to A. Project Process Checklist for the Project Risk Register Template.

Refer to clause 2.8 Safety in Design/ workplace health and safety for discussion on cultural safety.

2.8 Safety in Design/ workplace health and safety

Safety in Design (SiD) aims to prevent injuries and disease by considering hazards as early as possible in the planning and design process. A safe design approach considers the safety of those who construct, operate, clean repair and demolish an asset (the building, structure, plant or equipment) as well as those who work in or with it. Designers are in a unique position to reduce the risks that arise during the life cycle of the asset during the design phase.

In accordance with Safety in Design/ WHS Legislation, at each phase of the design process, risk identification must take place with the view to eliminating the risk, or where this is not possible, reducing risk as low as reasonably practicable, through the implementation of control measures. Safety in Design Risk Assessments must be carried out throughout the job and reported on at regular team meetings, keeping the status of control measures and the residual risks at a current level. Refer to clause 2.7 Risk Register for further information about reporting obligations.

For all new building projects, complex refurbishment projects, or high-risk projects a mandatory Safety in Design Risk Assessment Workshop must be carried out no later than the 50% Documentation Phase. This should be led by a member of the consultant team and in addition to the contractor, the consultant team and relevant other parties such as fabricators/ operators specific to the project, the workshop must be attended by a UoA WHS Representative and the UoA End-User Representative.

The assessment should involve hazard identification, assessment of risk of harm for each hazard, and strategy for eliminating or controlling the risk. One outcome of the assessment may be that Safe Operating Procedures (SOP) need to be developed. The SOPs identified in the Safety in Design Risk Assessment Workshop must be incorporated into the End-User Building User Guide and Safety Induction.

As part of the Safety in Design Risk Assessment, confirm with the Associate Director Capital Projects Delivery, as to whether consultation with the Gender Equity and Diversity Committee (or delegate) is required, to establish risks associated with cultural and gender safety associated with the project.

2.9 Independent building commissioning

For all new buildings, or where the Project Brief requires it, an independent commissioning agent not involved with the design or construction of the project must be engaged.

Detailed testing and commissioning requirements must be specified for each project by the UoA-appointed consultant/designer.

Project hand over inspection and testing plans (ITPs) must be developed by the consultant/contractor to allow the system to be handed over to the University. Detailed testing and commissioning records must be provided for each system and each component, taking into account the requirements of the Standards. All such records must be witnessed and verified by the UoA-appointed project consultant/ designer.

2.10 Post-occupancy Building Services Performance Report

After one seasonal cycle of operation, an independent building services performance review must be carried out and report prepared. Refer to the Manager, Sustainability for details. This may be carried out internally, or by an external consultant. Requirements of the Post-Occupancy Building Services Performance Report will be established by the Manager of Sustainability.

2.11 Manufacturer specifications

All installation must be carried out in accordance with manufacturer specifications and data sheets to ensure product performance over its intended life and so as not to invalidate any warranties.

2.12 Sustainable design

The adoption of environmentally sustainable building philosophies must be considered a primary objective of all projects, regardless of size. Opportunity to implement responsible design and construction solutions must be considered as a matter of course during every phase of the project. Project specific sustainability initiatives and targets must be identified in the Project Brief along with associated reporting obligations relating to both:

a. the requirement for the designer to certify/ rate/ measure the proposed design solution prior to construction; and

b. the requirement for the designer to include physical equipment and processes for measuring the performance of the building throughout its life- cycle (refer Vol Metering and monitoring).

In the absence of the identification of project- specific sustainability targets, and in addition to sustainability considerations covered in the relevant Volumes, the following must be incorporated in all architectural and engineering services designs.

2.12.1 Energy demand and thermal comfort

To minimise energy demand and improve thermal comfort in buildings, the following must be considered:

a. Use of basements and underground parking areas and labyrinths to pre-cool intake fresh air in mechanical systems if viable and where excessive dehumidification is not required.

b. High levels of thermal insulation to roof, floors and walls.

c. Reflectance of external building materials.

d. Thermal and solar performance of glazing.

e. External shading of north, east and west facing windows and walls.

f. Building orientation and massing.

g. Design glazing to achieve optimal day lighting and solar heat gain and to minimise the need for mechanical heating or cooling.

h. Appropriate design for temperature, air velocity, fresh air ventilation rates, relative humidity for different functional spaces as required by C. Mechanical Services Design Standard.

2.12.2 Use of natural daylight

a. Design façades and windows to maximise natural daylight in usable floor areas and incorporate use of sky lights, light wells and internal atriums or courtyards where appropriate.

b. Avoid overshadowing and visual intrusion onto adjoining sites.

c. Design buildings to avoid undesirable glare impacts on pedestrians, motorists, people using open spaces and those in other buildings.

d. Minimise the impact of night lighting on adjacent sites and buildings.

2.12.3 Indoor environmental quality

a. Provide appropriate lighting to suit the use of the space in accordance with E. Electrical Design Standard. Record the as-designed lighting levels and controls per functional space within the post-construction As-built documentation package.

b. Use materials, fittings and furnishings with low-VOC content i.e. paints, adhesives, sealants, carpets, timber products and furniture to avoid and minimise off-gassing impacts on building occupants' health.

c. Design to minimise unacceptable noise.

d. Utilise natural cross ventilation of habitable rooms and corridors to minimize the requirement for mechanical air conditioning.

2.12.4 Energy efficiency

a. Electrical appliances with the highest Australian Government Energy Star Ratings must be used for the relevant capacity ranges of appliances. These appliances include but are not limited to refrigerators, freezers, clothes dryers, dishwashers, electric hot water boilers, televisions, computer monitors and air-conditioning units.

b. Preference must be given to locally manufactured products where multiple products have the highest energy rating.

c. Electrical equipment, including specialised laboratory equipment not covered by Energy Star Rating Scheme must include energy efficiency as part of the selection criteria and have controls to prevent unnecessary energy consumption.

d. All buildings must provide utility meters to monitor, electricity, gas and water in accordance with C. Mechanical Services Design Standard, D. Electrical Services Design Standard, F. Hydraulic Services Design Standard, and L. Metering and Monitoring Design Standard:

— Energy efficient lighting and lighting controls must be provided to meet minimum illumination requirements in accordance with the D. Electrical Services Design Standard.

- Buildings must incorporate technology to reduce peak power demand, i.e. use of thermal storage for cooling and heating, power factor correction devices, etc.
- Roof design must maximise orientation to the northwest to northeast to optimise potential for installing roof top solar energy systems.

2.12.5 Water use

a. Water sub-metering must be provided to monitor large water consuming processes in accordance with F. Hydraulic Services Design Standard and L. Metering and Monitoring Design Standard.

b. All sanitary fixtures and tap ware must achieve WELS ratings specified in F. Hydraulic Services Design Standard.

c. Rainwater harvesting and reuse (toilets, cooling towers, fire test water and landscape irrigation) must be considered for all projects and applied where feasible. Ensure system design allows for future upgrade and expansion. Opportunities to integrate 'demonstrator' education must be explored. Refer also to F. Hydraulic Services Design Standard.

2.12.6 Water sensitive urban design

University campuses must implement water sensitive urban design principles by:

a. Reducing potable water demand through water efficient appliances, hydraulic standard.

b. Capturing rainwater for beneficial reuse including irrigation, cooling water and toilet flushing.

c. Minimising wastewater generation and treatment of wastewater to a standard suitable for effluent re-use and or release to receiving waters.

d. Passively treating urban stormwater using bio-filtration and wetlands systems to meet water quality objectives for reuse and or discharge to surface waters.

e. Using stormwater in the urban landscape to maximise the visual and recreation amenity of developments.

f. Grey water must not be reused where expensive wastewater treatment involving significant inputs of energy, chemicals and high maintenance is required.

2.12.7 Materials

a. Materials must be selected to meet sustainability requirements specified in Section 12 of B. Architecture and Building Design Standard (this document).

b. Selection of construction materials must consider 'cradle-to-grave' environmental impacts which look at impacts associated with raw materials extraction, manufacture, use and re-use potential and disposal.

c. Preference must be given to construction materials with recycled content and reused materials where practical.

d. Life cycle costing principles must be considered in selection of materials and systems. This includes capital, operations and maintenance, and disposal costs.

e. Use recycled and recyclable content in building materials, where fit-for-purpose from a durability and performance perspective.

f. Use suitable demolition materials for on-site fill.

g. Rainforest timber and timber from Australian high conservation forests must not be used.

h. Consider appropriate design detailing for engineered products to avoid any off-gassing potential from volatile compounds used in manufacture.

2.12.8 Noise mitigation

a. During the planning process isolate noise generating activities to avoid impact on sensitive receptors and quiet activities.

b. Protect all occupied spaces from noise pollution from external and internal sources.

c. Plant and equipment located on roofs must have acoustic treatment if they generate excessive noise.

d. Plant locations and noisy equipment must be designed and situated to avoid noise impacts on sensitive receptors and local residents.

e. Minimise noise emitted from external equipment such as fans, air-conditioners, compressors, and from other noise generating sources.

f. Minimise noise transmission within multiple occupancy buildings.

2.12.9 Construction and demolition waste

Building contractors and designers must provide infrastructure for recovery of building, construction and demolition materials to minimise waste disposal to landfill. They must:

a. Prepare and implement a materials recycling and waste management plan in the construction phase for all construction and demolition waste as part of the project environmental management plan.

b. Identify the range of materials that will be collected for recycling and describe procedures, management practices and reporting.

c. Formally apply dimensional co-ordination where it will practically assist the efficiency of material use, preference for modular components and materials supplied in set sizes or dimensions.

d. Consider ease of disassembly and recycling of construction materials and components at the time of refurbishment or completion of a facility's life.

e. Ensure project planning, specification and programming for the recovery, storage and transfer of reusable materials from demolition works including their transport from site to recycling and re-use facilities.

f. Implement procedures for disposal or recycling of hazardous materials at properly licensed facilities.

2.13 Durability, economy and flexibility

The University’s goal is to achieve the optimal balance between capital and operating costs, whilst providing occupants a high level of environmental quality and service throughout the lifetime of each building. A whole-of-life asset value-for-money solution must be sought.

The University’s building elements, services and external spaces must be:

- Cost-effective to operate and maintain.
- Designed with consideration of capital as well as operating expenditure in mind.
- Robust and durable.
- Easily and safely cleaned and maintained.
- Standardised to minimise individual specialisation and customisation.
- Flexible in the design to allow for expansion or adaption to new uses.
- Designed with built-in flexibility of space, plant and equipment to reasonably accommodate future uses.

2.14 Building compartmentation and sealing

Building fire compartments (existing and proposed) must be clearly identified within the contract documentation package and within the post-construction package. All penetrations through the barrier must be fire treated. Provide motorized dampers connected to the fire alarm system for any fixed open louvers such as at elevator shafts. Provide damper and controls to all air intakes/ exhausts.

Building envelopes must be designed and constructed with a continuous air barrier to control air leakage into, or out of, the conditioned space. Clearly identify all air barrier components on construction documents and detail the joints, and penetrations of the air barrier. The air barrier must be durable to last the anticipated service life of the assembly. Do not install lighting fixtures with ventilation holes through the air barrier.

3. Technical requirements

This section outlines the specific technical requirements for M. Audio Visual Design Standard.

3.1 Control system programming

The University will conduct their own programming of control systems, unless otherwise requested. In the case where the University engages a contractor, all source code, modules, touch panel files and associated files must be provided at the completion of the project. The contractor will be required to work with The University (in cases of contractor supplied programming) to ensure control systems report to AMX RMS, source code and user interface functions similar to other spaces. This will be delivered by meeting the following milestones:

- Return brief and scope confirmation (UoA/AV Contractor)
- Draft layouts of code, user interfaces, DSP configurations and any other relevant files (AV Contractor)
- Draft review and approval (UoA)
- Final review prior to go-live (UoA/AV Contractor)
- Final implementation and handover (AV Contractor)

The University will not provide any security credentials (username or passwords) for devices, these will be set post hand-over and any additional access required after must be arranged with AV Services.

3.2 Project commissioning and completion

UoA AV Services will advise during the planning stage the amount of time required to complete any system configuration or programming. This must be accounted for in the project timeframe to ensure a working space is delivered within the deadline. All audio visual works must be included in the targeted Practical Completion date. Audio Visual works will be deemed practically complete once AV Services have carried out a defect inspection, performed a full room commission and as-built drawings are received. All defects must be resolved within 24 hours of notice unless otherwise agreed with AV Services.

3.3 Screen size and sightline specification

3.3.1 Introduction

The University of Adelaide abides by the ANSI/INFOCOMM V202.01:2016 'Display Image Size for 2D Content in Audiovisual Systems' standard. The specified screen should be sized in proportion to cover distance to the farthest viewer and to not overwhelm the closest viewers. Angles of view must also be taken into consideration as well as overall ceiling heights. Multiple screens may be used to overcome challenges in irregular spaces.

3.3.2 Guidelines for screen size and sightlines

To calculate suitable screen sizing, the designer must follow the steps detailed in the INFOCOMM standard. UoA has deemed the element height % to be 3% in spaces with an aspect ratio of 16:9 unless otherwise approved.

Both plan and elevation views are to be provided for all screens proving conformance to the standard. The views will demonstrate the closest viewer, the farthest viewer and area of conformance as well as horizontal and vertical viewing angles.

3.3.3 Projector placement

The projector mustbe installed in a location to allow clear projection onto the screen surface and allow the presenter to freely move about the presentation area without casting any shadows. The projector location needs to be in accessible safely with a 6ft Platform Ladder for servicing and maintenance. If this cannot be achieved then a plan detailing how this can be achieved must be submitted, for example, a section of easily removed seats or utilising a projector mount that lowers to a serviceable height.

3.3.4 Dual screen projection

In venues that require dual projection to conform to the viewing standard, the projectors must be configured to show the same image. Venues that require to show two different sources of content should be designed to meet the standard, otherwise reinforcement screens may be implemented to ensure coverage.

3.3.5 Examples of plan and elevation views

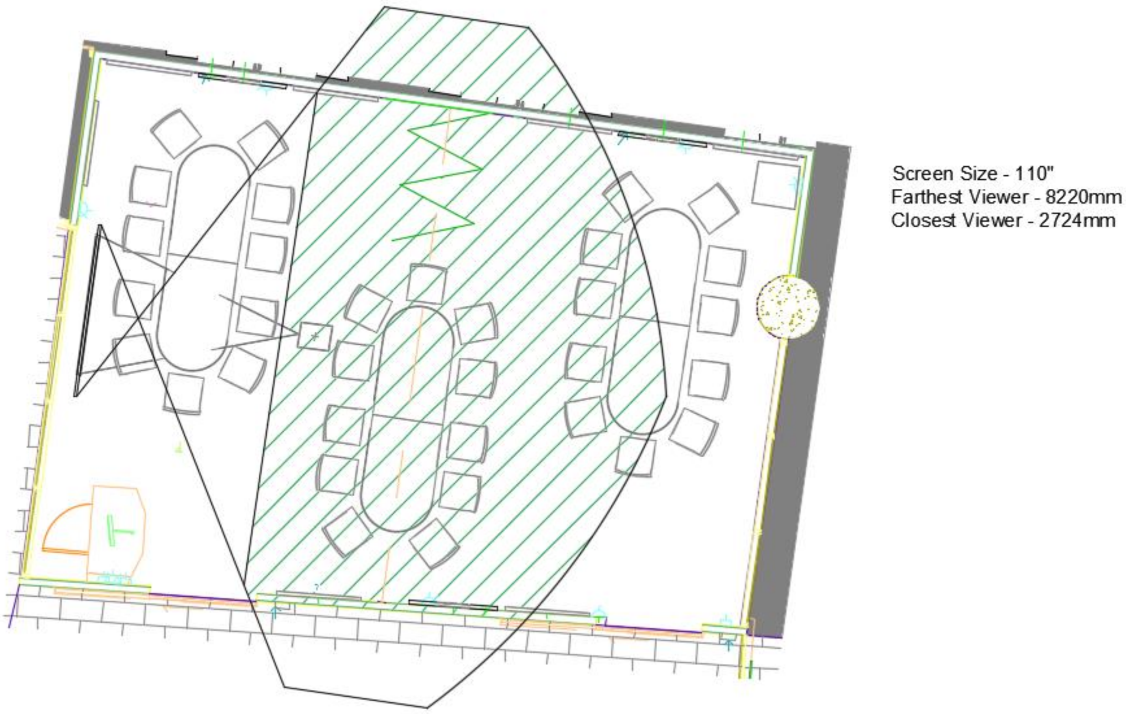

Figure 1 - Plan view showing conforming viewing area

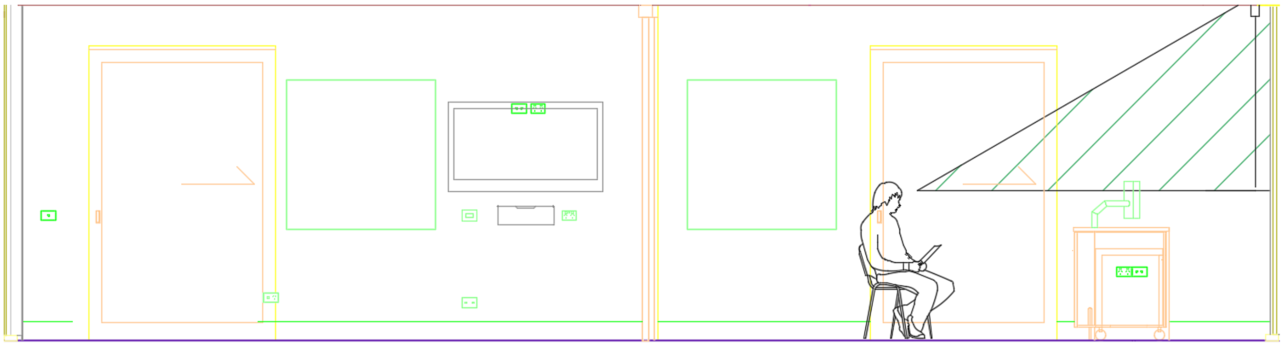

Figure 2 - Elevation view showing closest viewer and viewing angle.

3.4 Image quality and lighting

3.4.1 Standard compliance

Projected images must be legible and contrast ratio must meet the defined limits of the ANSI/INFOCOMM 3M-2011: 'Projected Image System Contrast Ratio' standard. All lighting sources (installed lighting, windows etc.) in a venue should be controllable so that minimum contrast ratio levels can be achieved at any point on the image area. Measurements of contrast ration must be carried out as defined in the standard. The table below demonstrates acceptable minimum contrast ratio.

Table 1 - Minimum projected contrast ratios

Projected Image	Examples	Minimum Contrast Ratio
Text and Numerals	Documents, spread sheets, bullet point text, charts and graphs	7:1
Pictures	Photographs, artwork and illustrations	15:1
Movies	Videos, film, recordings	50:1 (minimum) 80:1 (best practice)

3.4.2 Projection surfaces

Projected images should be onto matt white motorised screens with a gain of 1.0. Where high gain or rear projection is in use, the manufacturers specification on viewing angle must be observed. Walls are acceptable projection surfaces as long as they are painted flat white, uniformity flat and perpendicular to the projector. Where whiteboards are to be used as projection surface, ultra-short through projects mustbe used to minimise reflections on the audience.

3.4.3 Flat panel displays

Flat panel displays must adhere to the same standards as projected images (ANSI/INFOCOMM V202.01:2016 "Display Image Size for 2D Content in Audiovisual Systems" and ANSI/INFOCOMM 3M-2011: "Projected Image System Contrast Ratio"). LCD panels mustbe mounted with their bottom edge at 1200mm above finished floor level unless otherwise approved. Power and Data points must be coordinated to conceal the points. The elevation on the following page demonstrates power and data locations with display panels.

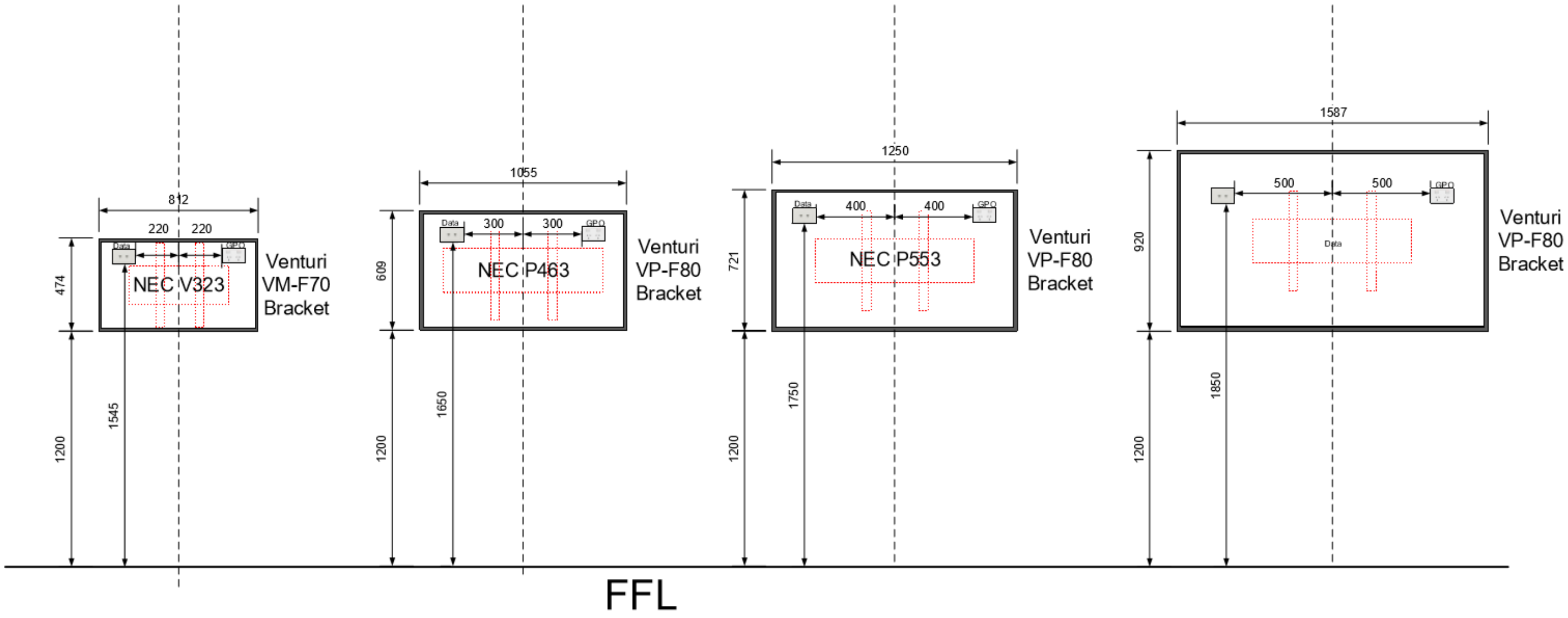

Figure 3 Flat panel display mounting arrangement details

3.5 Acoustic design

3.5.1 Introduction

This section addresses acoustic design requirements pertinent to the suitability of spaces for teaching activities.

3.5.2 Summary of criteria

Two acoustic criteria are considered: internal noise level and reverberation time (RT). These quantities are both properties of the acoustics of a space, and should be assessed independently of any installed sound system.

If uncontrolled, both quantities can have a detrimental effect on speech intelligibility, making it difficult for listeners in a learning environment to concentrate, leading to poor learning outcomes.

A distinction is made between criteria for general spaces, and those employing video conference systems, which need to be more stringent.

Table 2 - Criteria for general spaces

Quantity	Desirable	Acceptable	Unacceptable
Internal Noise LAeq, dB(A)	< 40	40-50	> 50
RT (s) (500Hz, 1kHz, 2kHz avg.)	< 0.5	0.5-1.0	> 1.0

Table 3 - Criteria for spaces with video conference equipment

Quantity	Desirable	Acceptable	Unacceptable
Internal Noise LAeq, dB(A)	< 35	35-45	> 45
RT (s) (500Hz, 1kHz, 2kHz avg.)	0.3-0.5	0.6-0.7	> 0.7

3.5.3 Measurement guidelines

Detailed guidance regarding internal noise level and reverberation time is provided in Australian Standard 2107:2000, Acoustics - Recommended design sound levels and reverberation times for building interiors. Refer to AS2107:2000 and its references for complete descriptions of internal noise level, reverberation time and their measurement and application.

Measurement methods should comply with the AS2107:2000 Clause 6, which references other relevant Australian Standards regarding suitable methodology and instrumentation etc. General guidance regarding the intent of internal noise and reverberation time measurements is provided in the following sections.

3.5.4 Internal noise level

The internal noise level of a space describes the ambient noise that remains when all wanted sounds are absent, typically including contributions from:

- Building services e.g. Heating, Ventilation and Air-Conditioning (HVAC) systems, water and waste pipes, lifts etc.
- External noise sources e.g. road traffic
- Internal noise sources e.g. building occupants in adjacent spaces, printers, copiers etc.

Spaces for learning should aim to reduce internal noise levels such that wanted sounds are clearly audible above the ambient noise. If the internal noise levels are too high, listeners will have difficulty discerning speech sounds from unwanted noise.

3.5.5 Measurement locations

Noise measurements should be taken at the expected occupancy positions throughout the space, at approximate ear height for either seated or standing persons as appropriate for the space – i.e. 1200 or 1600mm AFFL respectively.

An indicative sample position can be chosen where there is little spatial variation in noise level. Where significant spatial variation exists (e.g. due to the operation of a particularly noisy piece of localised plant) the location should be chosen to reflect the maximum recorded level.

3.5.6 Reported noise level

The reported noise level should be the maximum found across the expected occupancy positions in the space.

3.5.7 Measurement conditions - inclusion of noise sources

Measurements should be made under the typically expected operating conditions of the space, i.e. with all heating, ventilation and air conditioning (HVAC) equipment operating, road traffic and building occupancy noise present.

Where a noise source is known to be out of the ordinary, (e.g. building construction works) it is acceptable to schedule the measurement for a time when it is not present.

3.5.8 Character of noise

Internal noise should not contain any distinctive characteristics such as prominent tones or significant temporal fluctuations. If such acoustic artefacts are present in any measured noise level, they should be assessed in accordance with Section 6.1.7 of AS 2107:2000, with a correction applied to the sound level as necessary.

3.5.9 Sound level measurements

Noise levels must be measured with an integrating sound level meter, capable of measuring the Equivalent Continuous A-weighted sound pressure level (LAeq), over a period that is appropriate for the dominant type of noise source being measured.

The measurement period used should be long enough to fully characterise any natural variation in the noise level, and as such, will vary depending on the nature of the dominant noise source. As a guide, the following is recommended at a minimum:

Table 4 - Minimum recommended noise source measurement

Dominant Noise Source	Minimum LAeq Period
HVAC	30s
Road Traffic	2m
Building Occupancy	5m

3.6 Reverberation time

When a sound source is placed inside a space, multiple reflections of sound from the internal surfaces combine, creating the acoustic 'character' of the space. This 'character' is often represented by the space's reverberation time, which is a measure of how long it takes for sound within the space to die away (i.e. decrease in level by 60 dB) after the initial sound has ceased.

Spaces for learning should aim to control (i.e. shorten) the reverberation time, so that listeners primarily hear the sound directly from the source, and hear little of the persistent sound caused by reflections from the room's surfaces.

3.6.1 Measurement locations

Reverberation time measurements involve the placement of a stimulus source (e.g. loudspeaker or balloon) and a receiver (microphone). It is recommended that multiple combinations of source and receiver are used across several measurements, to calculate a spatial average.

A minimum of three distinct measurement positions is recommended, with the final reported result being the spatial average across all positions.

3.6.2 Frequency dependence

Reverberation time varies with frequency. The reverberation criteria presented is for an average of the 500Hz, 1kHz and 2kHz octave bands, with each octave band value being the spatial average across all measurement positions.

3.6.3 Measurement method

There are numerous available methods to measure reverberation time. The method employed is not critical, as the accuracy of results with most methods is sufficient for The University's purposes. Example methods include:

- Impulsive noise (e.g. balloon burst)
- Interrupted noise (using a suitable loudspeaker and broadband noise source)
- Schroeder integration of Room Impulse Response (RIR)

3.7 Audio performance

3.7.1 Introduction

This section addresses the audio performance of finished spaces complete with installed sound systems.

Detailed guidelines for the measurement and reporting of audio criteria is provided below for the audio visual contractors who will be expected to assess them.

3.7.2 Summary of criteria

Multiple criteria are considered, covering both sound systems for program audio playback and speech reinforcement. The criteria provides The University with baseline performance levels that can be assessed at handover, providing consistency across all learning spaces.

Note, unlike the other criteria, STI is heavily influenced by the room acoustic environment; particularly reverberation time, but also internal noise level. As such, poor performance in this criterion is more an indicator of room acoustic issues than of poor sound system installation.

Table 5 - Baseline performance levels

Quantity	Desirable	Acceptable	Unacceptable
System Noise – Above Ambient, LAeq dB(A)	< 0	0 – 5	> 5
Program System SPL, dB(A)Slow	85	75 – 85	< 75
Program Frequency Response (100Hz – 10kHz)	± 3dB	+3/-6dB	> +3/-6dB
Speech System SPL, LAeq dB(A)	65 – 70	60 – 65	< 60
Speech Frequency Response (100Hz – 10kHz)	± 3dB	+3/-10dB	> +3/-10dB
Speech Transmission Index (STI)	> 0.68	0.68 – 0.56	< 0.56

3.7.3 Measurement guidelines

Measurement equipment and methods need not comply with any Australian or International Standards; however, it is expected that equipment designed and built for professional sound system measurement is used.

General guidance regarding the intent of each criteria and their appropriate measurement is provided in the following sections.

3.7.4 System noise

When powered, but not operating, the installed sound system should not produce any unwanted noise e.g. hiss, hum, buzz or tones, which can be distracting to listeners. Ideally, when the system is powered on it should be inaudible above the room's internal ambient noise level.

Where system noise exists, it is usually caused by an installation issue, such as:

- Improper system gain structure
- Incorrect termination of cables
- Ground loop hum – (various causes)

Where possible, the audio visual contractor should first investigate the source of the system noise and try to eliminate it. Where eliminating the noise can be shown to be impossible, it may be considered acceptable if it meets the criteria outlined.

3.7.5 Measurement locations

System noise measurements should be taken at the expected occupancy positions throughout the space, at approximate ear height for either seated or standing persons as appropriate for the space – i.e. 1200 or 1600mm AFFL respectively.

An indicative sample position can be chosen where there is little spatial variation in system noise level. Where significant spatial variation exists (e.g. close to a buzzing speaker) the location should be chosen to reflect the maximum recorded level.

3.7.6 Measured internal ambient noise

The internal ambient noise level must first be measured to assess the system noise level. Internal ambient noise measurements should be taken at the same location as the corresponding system noise measurement.

3.7.7 Reported noise level

The reported system noise level should be the maximum found across the expected occupancy positions in the space. The system noise level is:

- Acceptable, if it is indistinguishable from the internal ambient noise level
- Unacceptable, if it exceeds the internal ambient by more than 5dB.

3.7.8 Measurement conditions – inclusion of noise sources

Measurements should be made under the typically expected operating conditions of the space, i.e. with all heating, ventilation and air conditioning (HVAC) equipment operating, road traffic and building occupancy noise present.

Where an ambient noise source is known to be out of the ordinary, (e.g. building construction works) the measurement should be scheduled for a time when it is not present.

3.7.9 Sound level measurements

Both internal ambient and system noise levels must be measured with an integrating sound level meter, capable of measuring the Equivalent Continuous A-weighted sound pressure level (LAeq), over a 30s period.

3.8 System sound pressure levels–program and speech

System sound pressure levels (SPLs) should be consistent from space to space, regardless of their size. i.e. a lecture theatre's sound system should not necessarily be louder than a classroom just because it is a larger space. Larger spaces require attention to evenness of coverage, but not necessarily more SPL.

For this reason, the system SPL criteria apply to all spaces equipped with program playback and / or speech reinforcement systems.

For program audio playback in learning environments, sound systems should be capable of maximum SPLs commensurate with a foreground music reproduction system. i.e. the loudest one might comfortably operate a home Hi-Fi system.

For speech reproduction in learning environments, sound systems should be capable of average levels similar to unaided conversational speech at 1m. The system does not need to increase speech SPLs significantly above human levels, but should aim to deliver a similar level to all listeners.

3.8.1 Measurement locations – program SPL

Program SPL measurements should be taken at the nearest on-axis listener position for each loudspeaker system within a space (i.e. best-case listener position).

For point source loudspeaker systems:

- Outside the 'near-field' of the loudspeaker (at least 3x the height of the loudspeaker away)
- On-axis of the high frequency device in the loudspeaker
- Where multiple loudspeakers are part of a system (e.g. stereo), on axis of one chosen unit
- At ear height of either seated or standing listeners as appropriate

For distributed ceiling loudspeaker systems:

- Directly beneath one of the loudspeakers (i.e. on-axis of one chosen unit)
- At ear height of either seated or standing listeners as appropriate

3.8.2 Measurement locations – speech SPL

Speech SPL measurements should be taken at the furthest listener position from the presenter and furthest from the closest sound reinforcement loudspeaker (i.e. worst-case listener position), at ear height of either seated or standing listeners as appropriate.

3.8.3 Multiple loudspeaker systems

For systems consisting multiple loudspeaker systems, program and speech reinforcement SPL measurements should be taken with all channels driven, as per normal operation.

Where independent loudspeaker systems combine to form a complete system, separate SPL measurements should be taken at appropriate locations for each independent system, e.g.

- For main and fill loudspeakers in point source systems

- For each independent circuit (i.e. amp channel) in distributed ceiling systems

Recorded SPLs for separate loudspeaker systems should match to within a tolerance of 3dB.

3.8.4 Reported SPLs

The reported program SPL should be the maximum achieved by the system at the nearest listener position.

User volume controls should be at maximum during the measurement.

The reported speech SPL should be the average level achieved by the system at the furthest listener position, over a 30s period of continuous speech.

If user control of speech SPL is provided, it should be at its maximum level – before feedback – during the measurement.

3.8.5 Input signal

Program SPLs should be measured with a broadband pink noise signal input.

Speech SPLs should be measured with a live talker, using the microphone(s) provided for the presenter. The live talker should provide a slightly raised vocal effort, typical of a talker presenting to a group of listeners.

Where multiple microphones are provided, the speech SPL should be measured and reported for each.

3.8.6 Sound level measurements

Program SPLs must be measured with an integrating sound level meter, capable of measuring the overall A-weighted sound pressure level using a slow integration time (dB(A)Slow).

Speech SPLs must be measured with an integrating sound level meter, capable of measuring the Equivalent Continuous A-weighted sound pressure level (LAeq), over a 30s period of continuous speech.

3.9 Frequency response – program and speech

The response of installed sound systems should be adjusted to provide an even balance between frequencies across the audible spectrum. For both program and speech systems, the ideal target is a flat frequency response from 100Hz to 10kHz.

3.9.1 Measurement locations

Program frequency response measurements should be taken at the same position used to measure the program SPL from each loudspeaker system.

Speech frequency response measurements should be taken at the same position used to measure speech SPL. The same 'worst case' listener position should be used.

3.9.2 Reported frequency response

The reported program frequency response should be that achieved by the system at 75% volume, at the measurement position. i.e. the user volume control should be at 75% during the measurement.

The program frequency response is:

- Desirable, when all deviations fall within ±3dB;
- Acceptable, when all deviations fall within +3/-6dB;
- Unacceptable, when any deviations fall outside +3/-6dB; over the range 100Hz to 10kHz.

The reported speech frequency response should be that achieved by the system at nominal volume at the 'worst case' listener position.

The speech frequency response is:

- Desirable, when all deviations fall within ±3dB;
- Acceptable, when all deviations fall within +3/-10dB;
- Unacceptable, when any deviations fall outside +3/-10dB; over the range 100Hz to 10kHz.

Note: the speech frequency response criteria allows for greater negative deviations to account for the expected roll-off in high frequency from ceiling speaker systems when measuring at the 'worst case' position, off-axis.

Care should be taken to ensure dips in measured frequency response due to measurement conditions – e.g. floor bounce, side wall reflection, loudspeaker crossover etc. – are excluded from the assessment of frequency response.

3.9.3 Multiple loudspeaker systems

For systems consisting multiple loudspeaker systems, program and speech reinforcement frequency response measurements should be taken with all channels driven, as per normal operation.

Where independent loudspeaker systems combine to form a complete system, separate frequency response measurements should be taken for each independent system, e.g.

- For main and fill loudspeakers in point source systems
- For each independent circuit (i.e. amp channel) in distributed ceiling systems

3.9.4 Input signals

Program and speech frequency response measurements can be made with any signal suitable for 2-channel Transfer Function (TF) measurements as an input. E.g.:

- Broadband pink noise
- Swept sine signal (chirp)
- Minimum length sequence (MLS)

The input signal can be electrically connected to the speech reinforcement system directly, e.g. using a line input connection. It is not necessary to use a simulated talker loudspeaker with the system's microphone(s).

3.9.5 Measurement type

Program and speech frequency response measurements should be made as 2-channel, Transfer Function (TF) measurements, using a Fast-Fourier-Transform (FFT) based analyser.

3.10 Speech Transmission Index

Detailed guidance regarding Speech Transmission Index (STI) is provided in IEC Standard 60268-16:2011, Sound system equipment - Part 16: Objective rating of speech intelligibility by speech transmission index. Refer to IEC 60268-16:2011 and its references for a complete description of STI, its measurement and application.

Sound systems for both program playback and sound reinforcement should be adjusted to yield acceptable speech intelligibility, as accurate reproduction of speech is the primary use of sound systems in learning environments.

With the exception of RASTI, any of the methods outlined in IEC 60268-16:2011 is suitable for measuring STI. The STI-PA method is recommended for its convenience, as it is fast, and can be implemented using a hand-held device. Full STI calculated from analysis of a system impulse response is also possible, but typically requires more time on-site and in post-processing.

3.10.1 Measurement locations

STI measurements should be taken at a minimum of 4 measurement locations, including:

- The nearest on axis listener position (i.e. best-case listener) for each independent loudspeaker system
- The furthest listener position (i.e. worst-case listener) for each independent loudspeaker system
- Any locations where STI may be degraded, e.g. close to a noise source

3.10.2 Reported STI

The reported STI values for program systems should be that achieved by the system at 75% volume, at each measurement location. i.e. the user volume control should be at 75% during the measurement.

The reported STI values for speech reinforcement should be that achieved by the system at nominal volume.

As per IEC 60268-16:2001, at least three STI measurements should be taken at each measurement location. If the variance between the first three measurements is greater than 0.03, another three (for a total of six) should be taken. The reported STI for each location should be the average of the three (or six) measurements.

3.10.3 Input signals

As STI can be measured by several methods as defined in IEC 60268-16:2001, there are numerous appropriate input signals. Signals for the two recommended methods are discussed below.

If using the STI-PA method, use the specific STI-PA test tone supplied with your measurement device.

If calculating STI from a system impulse response, use any signal suitable for 2-channel Transfer Function (TF) measurements as an input. E.g.:

- Broadband pink noise
- Swept sine signals
- Minimum length sequence (MLS)

The input signal can be electrically connected to the speech reinforcement system directly, e.g. using a line input connection. It is not necessary to use a simulated talker loudspeaker with the system's microphone(s).

3.10.4 Multiple loudspeaker systems

For systems consisting multiple loudspeaker systems, program and speech reinforcement STI measurements should be taken with all channels driven, as per normal operation.

3.10.5 Separate program and speech systems

Where both program playback and speech reinforcement systems are present in a space, separate STI measurements should be made for each. A different set of measurement locations may be required for measurement of each system.

3.11 Venue lighting

3.11.1 Standards compliance

All lighting must meet the requirements of the Australian and New Zealand Standards – AS/NZS 1680 for Lighting (as amended) and relevant building codes. The particular sections that venue lighting must adhere to are:

- AS/NZS 1680.2.1:2008 (as amended) Interior and workplace lighting – Specific applications – Circulation spaces and other general areas
- AS/NZS 1680.2.2:2008 (as amended) Interior and workplace lighting – Specific applications – Office and screen-based tasks
- AS/NZS 1680.2.3:2008 (as amended) Interior and workplace lighting – Specific applications – Educational and training facilities

3.11.2 Lighting arrangement in venues

AV Services must be engaged to assist with the design of lighting in venues. The aim is to control all ambient (venue lighting, sunlight etc.) light to meet the required contrast ratio of the projected image, provide suitable note taking light, illuminate the presenter and any demonstration or presenter workspaces. All lighting and environment is to be controlled through the venue audio visual control system, the electrical contractor must provide an interface at the audio visual equipment rack location. AV Services are to be provided with a draft copy of CBUS/Lighting System programming configuration prior to hand over, to review and approve groups and channels. All lighting control systems are to be configured to the specified lighting VLAN.

Examples are shown overleaf of typical lighting arrangements in reaching venues.

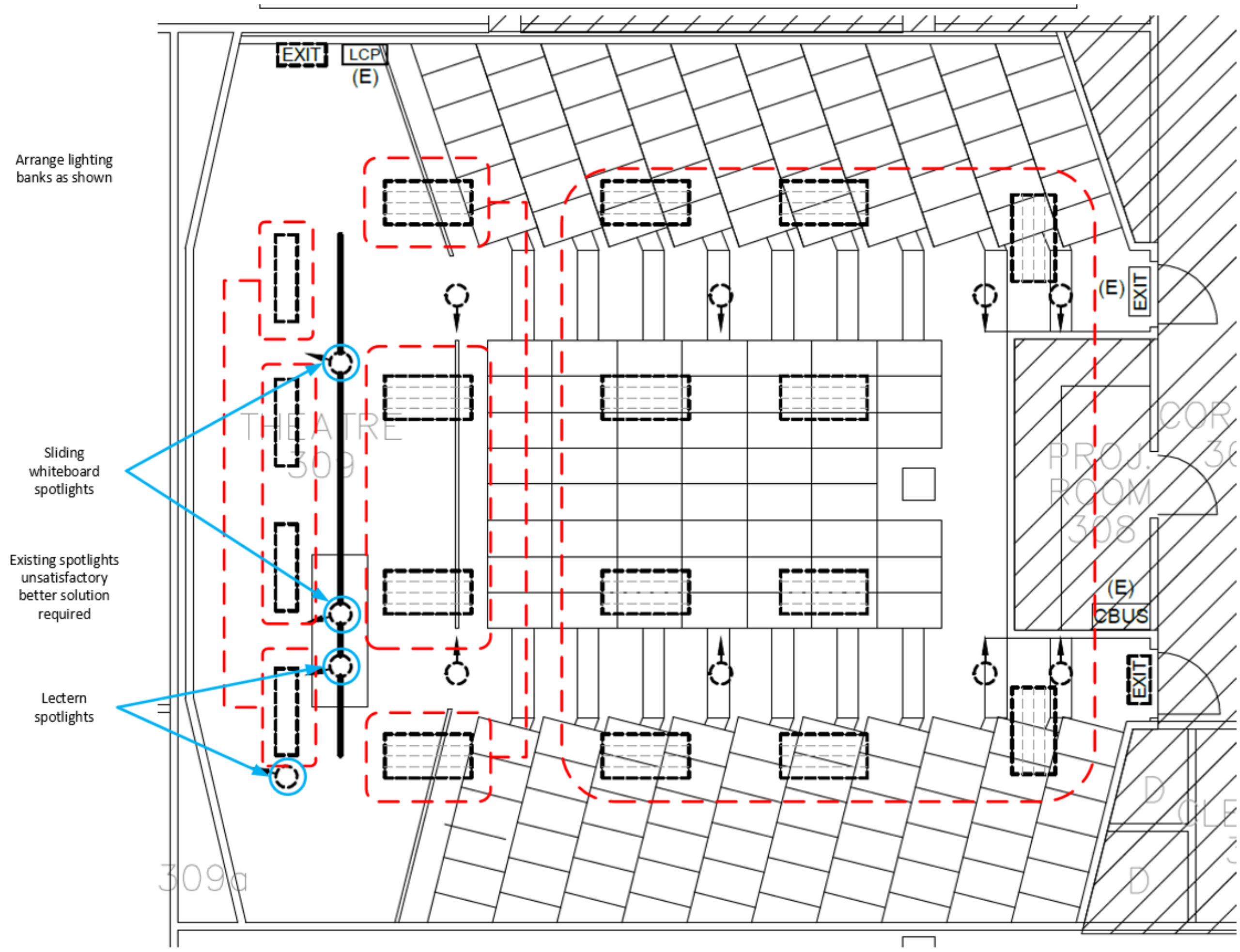

Figure 3 - Lecture theatre

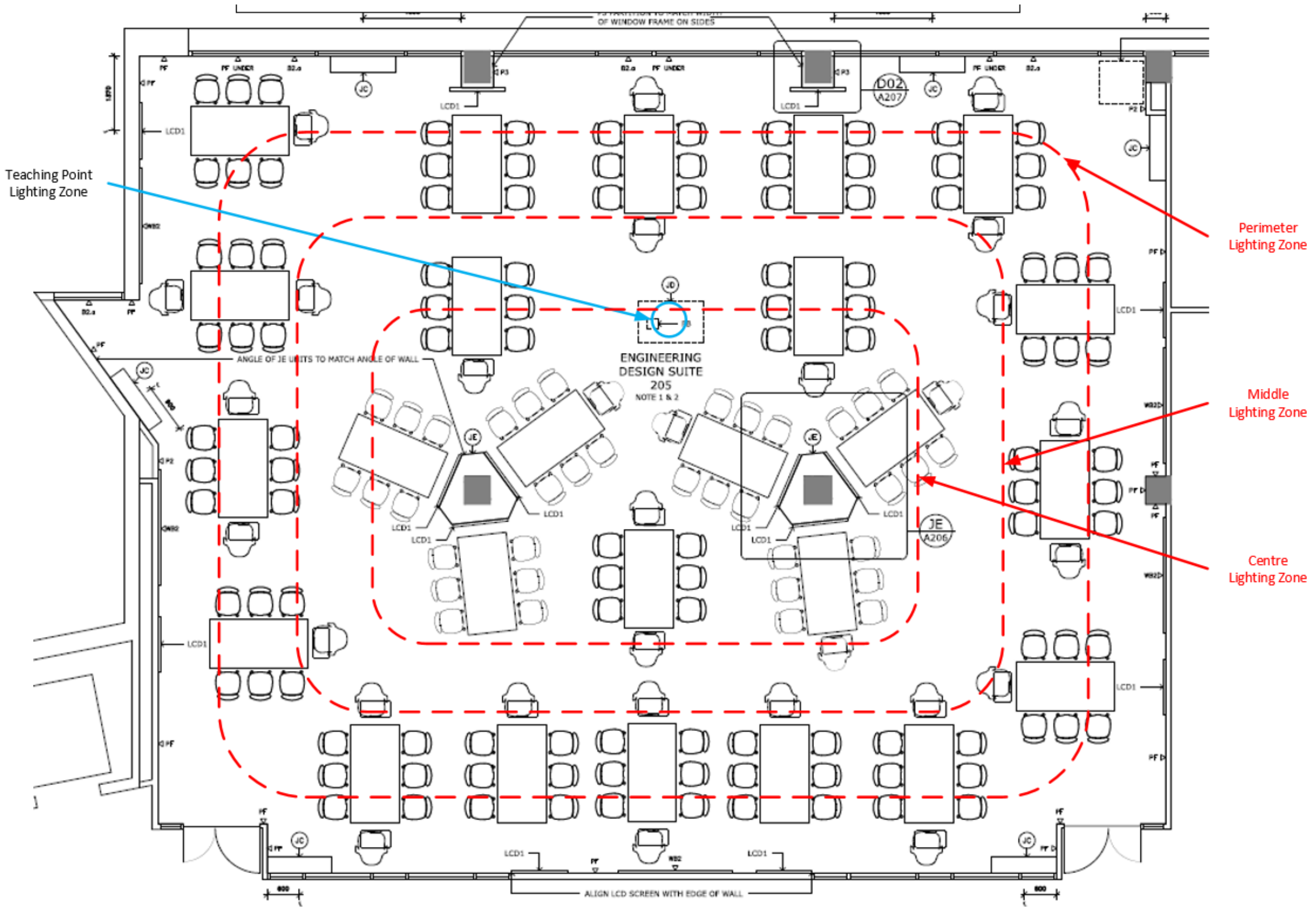

Figure 4 - Flat floor small group space

3.12 Audio visual equipment housing and cabling

3.12.1 Joinery provisions for equipment racks and equipment

In spaces that Audio Visual equipment is present, there must be lockable, ventilated and AV Services approved joinery. Provisions for power, data and audio visual connection cables must be made within the joinery. Suitable clearance between the equipment rack and services connections must be maintained.

Lectern and workbench areas will be coordinated to allow for devices to be permanently fixed (where applicable) whilst maintaining a sizeable work area for teaching materials.

All joinery or housing containing audio visual equipment must be keyed to The University's Audio visual key set (Abloy key – ITN-12).

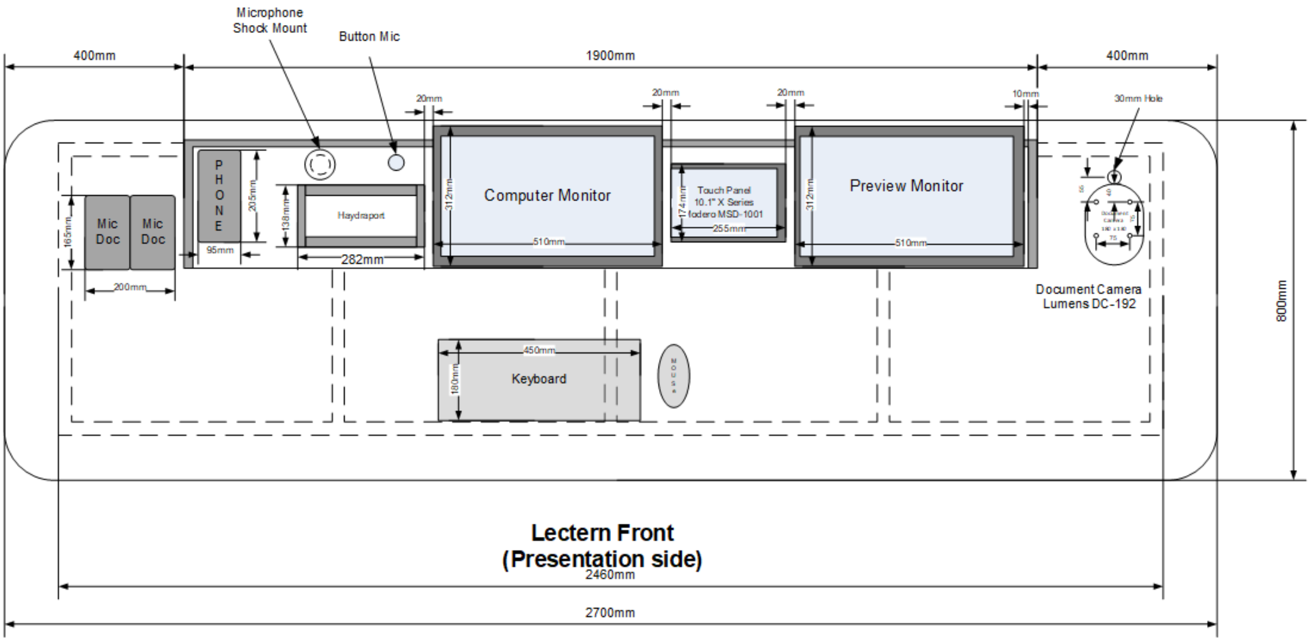

Figure 5 - Typical lecture theatre lectern layout

AV Services have a standard design lectern for venues outside of lecture theatres. AV Services preferred joiner is MigDesign. Shop drawings can be provided at request for manufacturing. Any deviation for the design mus tbe submitted for approval by the AV Services Manager.

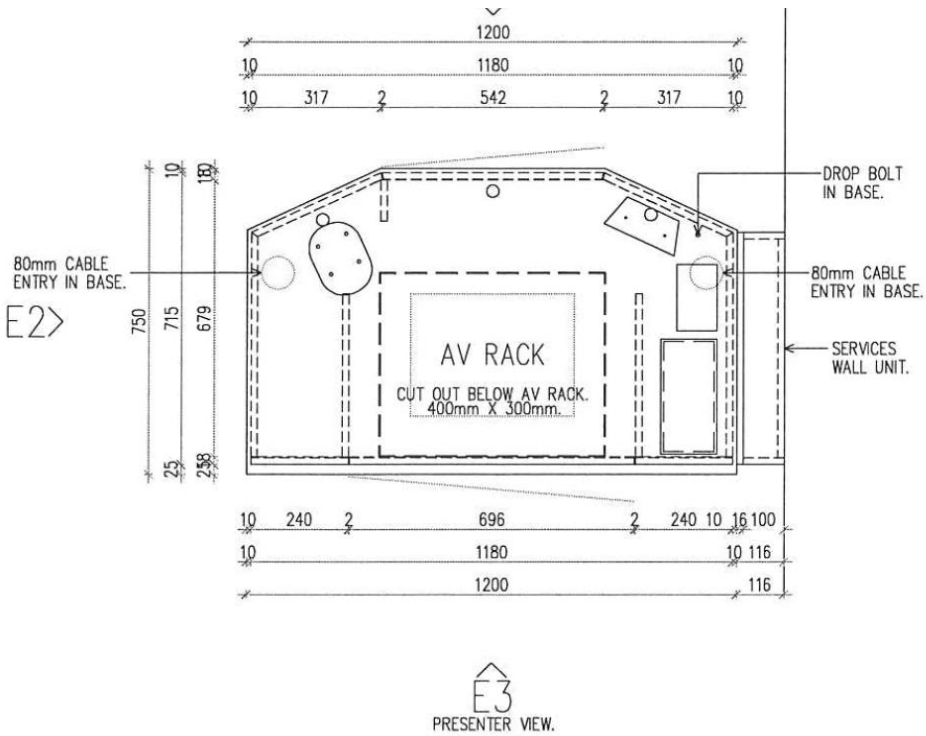

Figure 6 - Standard lectern design

3.12.2 Maintenance access

Front and rear access for audio visual equipment racks or suitable cable length (as to allow an equipment rack on casters to be removed from joinery and maneuverered to allow front or rear access) is required for all spaces. Enclosed equipment rack areas should have enough clearance for technicians to freely be able to remove equipment with the need of dismantling joinery, equipment rack or equipment.

There must be a clearance of any equipment rack access of at least 800mm.

3.12.3 Ventilation

All joinery containing audio visual equipment needs ventilation, there must be vents at the bottom of the joinery to bring cool air in and vents towards the top of the joinery to allow warm air to be exhausted. Vent covers should be selected or manufactured to reduce intrusion of rodents.

The temperature of the equipment rack should not exceed 40 degrees, this can be managed by utilising active cooling equipment. Cooling equipment can be in either the form of low voltage fans or rack mounted fan arrays.

3.12.4 Standard rack assembly

All equipment racks are to be Elgee 19” Reinforced Rack Frames, with additional structural reinforcement. Devices that are not able to be rack mounted will reside on an equipment shelf and held in place with Velcro, in a way that is easy for removal. Rack shelves and equipment allocation will be documented in provided audio visual schematics for each project.

8-way rack mounted PDUs and Network Services approved switches are to me mounted at the rear of the rack, with the network cabling facing outwards.

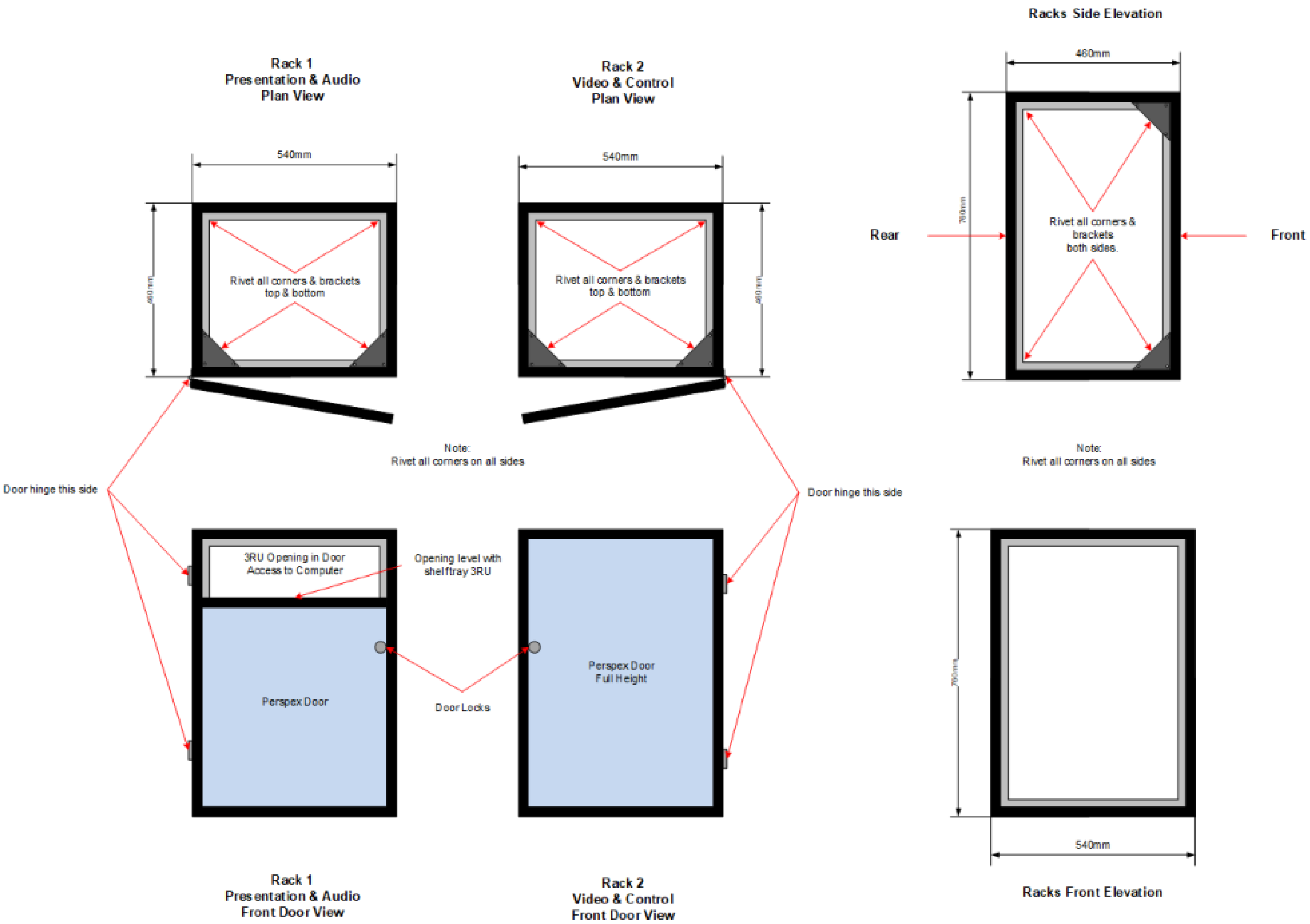

Figure 7 - Typical equipment rack build

3.13 Equipment rack cabling management

3.13.1 Standard of works

Wiring and workmanship must comply with the relevant standards provided by Standards Australia and the International Organisation for Standardisation, including all future amendments. Subsequent cabling works must comply with requirements of the Electric Supply Authority Regulations, Australian Communications and Media Authority, the Building Code of Australia and the Insurance Council of Australia.

All audio visual devices must reside on the same power circuit, as to not introduce electrical interference between equipment.

All cabling contained within the equipment rack must be supported by lacing bars and held in place by Velcro straps. Any cabling feeding into the rack externally will be bundled together and contained within a nylon cable jacket.

When cabling is broken out from the nylon cable jacket, low level audio, video, control and any other low voltage cables will be run on the left-hand side of the rack (when viewed from the rear). Power and amplified audio cables will reside on the right-hand side of the rack. In the case of multiple racks, cable runs will alternate between sides as to lower the risk of interference.

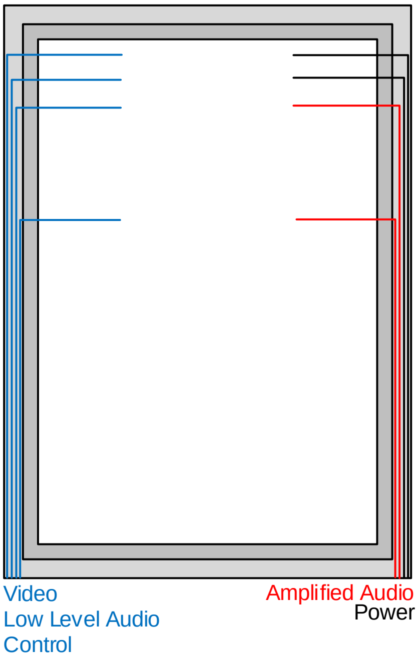

Figure 8 - Cable pathways for equipment racks

3.13.2 Cable termination

All internal cabling must be cut to suitable length to ensure excessive cabling is not left in the rack. Terminal blocks, connectors or plugs will be provided by the contractor for all cables that interface with audio visual equipment.

Cables and any specific connectors will be specified by The University on the Bill of Materials.

Exposed wiring at the equipment end must have the wire strands twisted back and be covered with heat shrink tubing.

3.13.3 Cable labelling

All equipment rack labelling must be labelled with adhesive labels and clearly display cable number from The University's provided cable schedule. Labels will be affixed to both ends of the cable and must have printed text (handwritten will not be accepted). Fixed labels (affixed to other devices such as touch panels etc.) are to be engraved metal or plastic laminate.

3.13.4 Network cabling

All rack network cabling and visible network cabling can be performed by the AV Contractor. Any concealed cabling (cable that is run not viewable such as to IP Cameras mounted in the ceiling, floor track or down door frames to Room Booking panels) must be completed by a licenced communications cabling system installer.

All network cabling must be TE Commscope CAT6/CAT6A, which will be specified on the Bill of Materials.

Network cabling utilised for transferring Audio and Video (HDBaseT/Extron DTP etc.) mustbe TE Commscope CAT7 F/FTP Orange (171163-2). This cable must have its own pathway created and not run along the current UofA Communications paths (e.g. cabling must have its own separate catenary run in the ceiling space).

3.14 Whiteboards and writing surfaces

3.14.1 Standard type

All writing surfaces in teaching spaces must be dust free, this will be achieved by using whiteboards and dry erase pens. Dust from chalkboards are damaging to audio visual equipment and have negative health impacts. The standard surface for whiteboards is enamel on steel. Trays must be provided to store pens and erasers, the tray needs to be installed in a location as to not obstruct any users.

Fixing height

All white boards will be mounted where the edge of the writing area must not exceed 900mm, or be lower than 850mm from the finished floor level.

3.15 Digital signage

3.15.1 Standard digital signage

Digital signage screens will be specified on a per location basis taking into consideration content size and reach as well as the environment. Digital signage systems will consist of an LCD Display and signage player. Each digital signage location will require dual power and data unless otherwise specified.

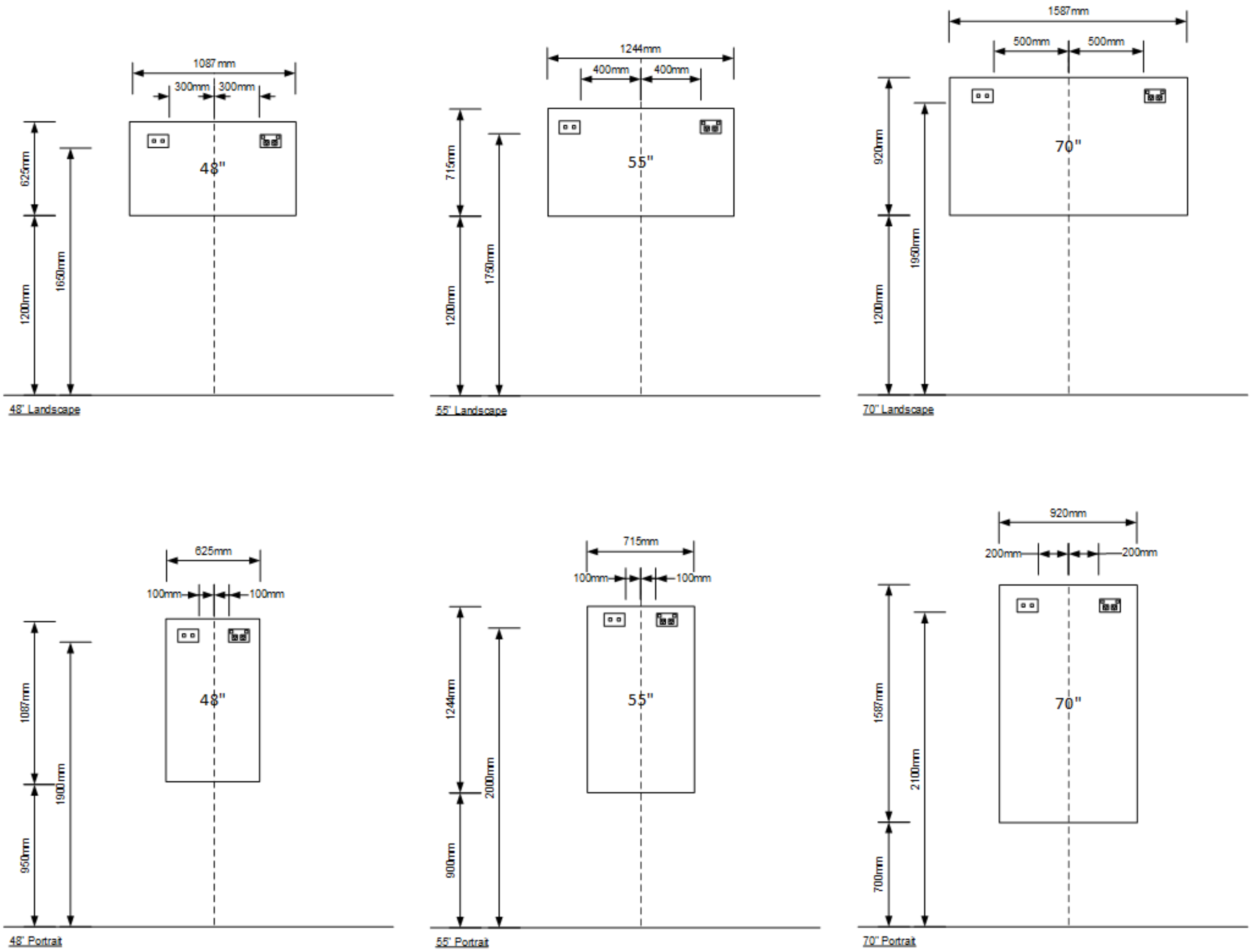

Figure 9 – Typical mounting heights for digital signage

3.15.2 Digital wayfinding

Digital wayfinding screens will be specified on a per location basis taking into consideration content size and reach as well as the environment. Digital Wayfinding systems will consist of an Interactive LCD Display/Kiosk and signage player. Each digital signage location will require dual power and data unless otherwise specified.

3.16 Room booking panels

All Room Booking panels must be capable of displaying both Microsoft Exchange calendar bookings as well as bookings from Scienta Syllabus +. Room Booking panels will have LED indicators to show room availability, touch enabled and be either wall mountable or mountable to door frames. Room Booking panels must be mounted in landscape orientation and mounted between 900mm and 1200mm AF L to allow user interaction where required. In the case where the Room Booking Panel is installed to a doorframe, the data contractor must install network cabling to the room booking panel position for connection.

3.17 Video conferencing

Video conferencing will be carried out via a software and any associated hardware (Microphones/Speakers etc.) must be compatible with the software. All spaces mustbe designed in consultation with AV Services to ensure all acoustics, lighting and equipment requirements are addressed.