Creative Spaces Design Guide

PART 3I
TECHNICAL APPENDIX:
REHEARSAL SPACE - THEATRE AND DANCE

CREATIVE VICTORIA ARUP

CITY OF MELBOURNE CITY OF SYDNEY

We acknowledge the Traditional Owners of Country throughout Victoria and their ongoing connection to this land and water. We pay our respects to their culture and their Elders – past, present and future.

In preparing these guides, we acknowledge that First Peoples self-determination is a human right as enshrined in the United Nations Declaration on the Rights of Indigenous Peoples.

We also acknowledge that past injustices and continuing inequalities experienced by First Peoples have limited, and continue to limit, their participation in all land and resource management[1], including development of creative spaces.

Creative spaces exist on land for which sovereignty has not been ceded and, as such, development, design and operation of creative spaces should involve consultation with First Peoples and Traditional Owners. Engagement and operation must be carried out in a culturally safe manner.

Any use of First Peoples design should follow the principles outlined in the International Indigenous Design Charter[2], which stipulates that First Peoples must have opportunity to meaningfully participate in and influence design and development processes that affect their Country and community.

Artist — Dixon Patten, Yorta Yorta and Gunnai
This artwork, commissioned in 2019 by the (then) Victorian Department of Jobs, Precincts and Regions is about developing the economy by working with community to create First People's employment opportunities, supporting inclusion and economic prosperity and thriving First Peoples' communities.

The symbolism used represents opportunities for First Peoples to achieve personal and economic prosperity and improved employment outcomes, the diversity of First Peoples' knowledge, skills and resources in community, and the connection to cultural practices and ceremonies.

Terminology:
First Peoples – Throughout this document the term Victorian First Peoples is used to refer to Traditional Owners of Victoria and all other Aboriginal and Torres Strait Islander peoples who reside in this state.

Culturally-safe Spaces[3] – Culturally-safe spaces are built environments, places, areas, groups, dialogues or bodies of work that positively and proactively acknowledge, accept and provide for the inclusion of the full spectrum of diversity of participants in that space. They are empowering places of mutually-beneficial exchange, personal and collective growth, and strength-based approaches.

For First Peoples, culturally safe spaces are places where imbalances of power, primacy and status are identified and structural adjustment is made to ensure equitable conditions are achieved and maintained. Culturally safe spaces are cognisant of, and proactively provide cultural safety at all levels of operation.

1. DELWP, see Traditional Owner and Aboriginal Community Engagement Principles on page 10 https://www.delwp.vic.gov.au/__data/assets/pdf_file/0031/508099/Traditional-Owner-and-Aboriginal-Community-Engagement-Framework-compressed-2.pdf

2. The International Indigenous Design Charter, see Guiding Principles on page 8 at https://indigenousdesigncharter.com.au/international-indigenous-design-charter/

3. More information can be found via the UTS Design Index. http://www.utsdesignindex.com/researchmethod/culturally-safe-spaces/ and the Victorian Government's cultural safety framework: https://www.dhhs.vic.gov.au/publications/aboriginal-and-torres-strait-islander-cultural-safety-framework

Contents

Cover: Castlemaine Goods Shed rendering Credit: Samantha Slicer
Prepared by Arup for Creative Victoria, Office of the Victorian Government Architect, City of Melbourne and City of Sydney.

Introduction

An abundant and diverse supply of creative space is essential to support a productive cultural sector. Due consideration for the operational, spatial, and technical requirements of these creative spaces can better support the functions and meet the needs of its users, operators and the community for the long-term.

Designing and delivering creative spaces that are fit for purpose will amplify its creative potential as well as increase operational efficiency, in turn reducing costs to the owner and/or operator.

Purpose of the technical appendices

The technical appendices to the Creative Spaces Design Guides have been developed to guide good decision making in the planning and delivery of creative space projects. They demonstrate best practice in effective, efficient and sustainable design of creative spaces, and not all aspects will be applicable or achievable for every project.

These appendices are technical in nature, relating to program, spatial requirements, structure, amenity and serviceability of space. Readers of these technical appendices should be mindful of the very specific technical focus of the documents and use them in conjunction with other guidance on the proposed programming, management and operation of the proposed creative space. In particular, these technical appendices should be read in conjunction with **Part 1: Making space for creativity** and **Part 2: Principles for creative spaces** of this document which provide a wider context within which creative spaces are typically conceived and delivered.

These technical appendices are a live document that may be updated from time to time. They do not capture the breadth of all the possible types of creative space. They prioritise spaces that were identified through consultation as being in high demand and low supply. Guidance on other types of spaces are intended to be added in future iterations.

How to use the technical appendices?

The technical appendices to the Creative Spaces Design Guides are intended to provide a preliminary technical brief prior to undertaking design work. These technical requirements include architectural, engineering and specialised design advice. The technical appendices:

— are aimed at providing 'best in class' outcomes and should be considered as a foundation for the development of detailed design briefs with project teams.
— are intended to be a practical resource to inform early planning and design conversations.
— should be used as a tool to facilitate early engagement with operators and user groups. Continued engagement throughout design and delivery is key to the development of fit-for-purpose creative spaces.
— are intended to support understanding and a shared language between stakeholders about the technical requirements for the type of creative space they wish to deliver.
— do NOT substitute specialist design, architectural and engineering advice as would be expected and required on any design and construction project.
— do NOT substitute early engagement with operators and end-users whose specific needs would need to inform project-specific design briefs.

Users of the technical appendices

The intended audience and users of these technical appendices might include (but not limited to):

— Private property developers incorporating creative space into a larger property development.
— Local and/or state government arts and culture agencies that are delivering or supporting the delivery of creative space.
— Arts and creative organisations that are planning to upgrade, deliver or occupy creative space.

Appendix structure

The first section titled **Key principles for designing creative spaces** provides guidance applicable equally across all space types and important considerations that need to be addressed alongside the technical framework of these appendices. These include:

— End-user and operational needs
— Project process
— Procurement
— Code compliance
— Departure guidance

The second section identifies the following technical requirements of a theatre and dance rehearsal space:

— Programmatic – key spaces and spatial relationships
— Spatial – key dimensions and spatial relationships
— Technical systems – specialised equipment relevant to functions of the spaces
— Universal design
— Sustainability
— Structural engineering
— Lighting
— Electrical engineering
— Acoustics
— Fire engineering
— Hydraulic engineering
— Mechanical engineering

A glossary section is included for reference.

Key principles for designing creative spaces

Creative spaces are places where people gather, inspire, connect, create and present their work. They are unique and respond to the needs of the environment in which they are located.

Embedding good design in a creative space

These spaces will be used by professional artists, producers, construction and technical production staff and the broader community. It is imperative that good design is at the core of every creative space delivered.

The Victorian Government Architect recognises the critical need for good design. The 'Good design - Issue 1' publication by the Office of the Victorian Government Architect identifies that:

"*Good design comes in many forms and is defined by much more than how something looks. It refines the purpose and aspiration of a project, improves how it works, creates additional benefits and elevates how people feel and behave in the final outcome. Good design creates inspiring places and greater, lasting financial value. And of course, good design also looks and feels good.*"

Incorporating good design in creative spaces includes designing for and understanding:

— User and operational needs
— Project processes
— Efficient procurement of goods and services
— Compliance with codes and standards
— Universal design
— Sustainability
— The local, national and international arts and culture ecosystem

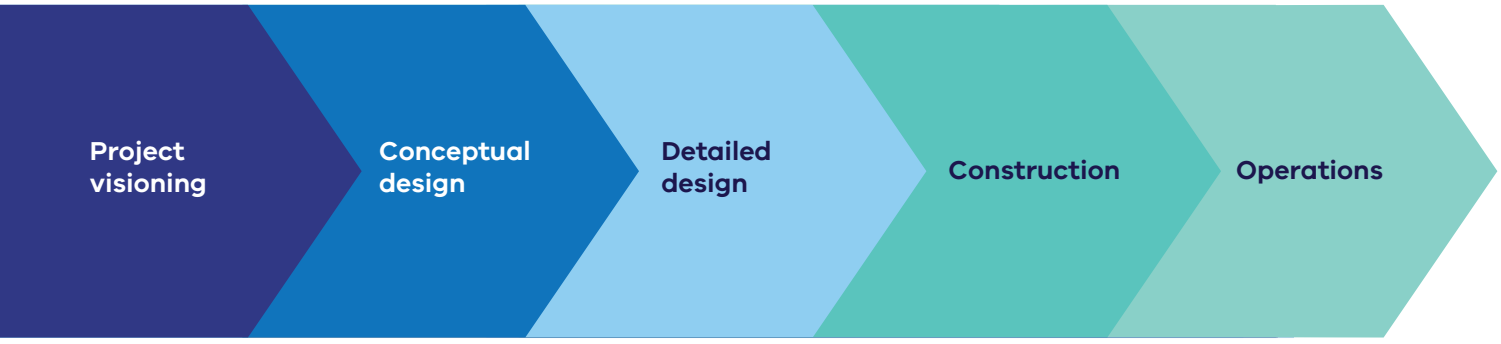
Operational and end-user needs

Early and ongoing engagement with operators, user groups and other stakeholders is a key component in the successful delivery of creative space projects. The establishment of critical success factors with primary stakeholders lays the foundation for the development of spatial, operational and management structures. The conception of a vision, operating models and target markets are all essential to designing creative spaces with a unique identity and place within the arts and cultural ecosystem.

Accordingly, defining operational and end-user needs is often the first step in a project delivery process.

Project process

These technical appendices provide the key requirements for best practice design. However, design itself does not guarantee good project outcomes. Design of creative spaces is part of a bigger 'process' of project delivery, and these technical appendices are a tool to be deployed throughout a project process that can provide differing points of value. The diagram below outlines one possible project process.



Ultimately, the success of the technical appendix will be realised through its application throughout a design and delivery process. The appendix is intended to be used as a reference at different phases of a project, as well as serving as a tool to facilitate collaborative discussions as project details unfold during design and construction. The table below presents some examples of how the technical appendix may be of value at each phase in the project process.

Project visioning - Project inception phase where site is selected, vision and direction of the project is established.

POTENTIAL USES	EXAMPLE OF USAGE
Assist a property developer to determine appropriate creative infrastructure aligned to a development vision	What are the spaces used for and what needs to be built? How does that align with your intended project outcomes?
Assist arts organisations to survey possible options for creative spaces	Your organisation is ready to find a new home – what technical and spatial requirements does the site need and how much might it cost?
Assist with site selection and due diligence by validating if sites can accommodate technical needs	Your arts organisation has found space that could be converted into creative space – does it have the clear height and services on site to support your needs?

Concept design - Project phase in which the creative space is designed fit for purpose to meet user and stakeholder needs.

POTENTIAL USES	EXAMPLE OF USAGE
Assist a property developer to determine appropriate creative infrastructure aligned to a development vision	The technical appendix establishes some primary design requirements to be incorporated into early design – has the design team made the right spatial, structural and services allowances?
A departure point for a design brief which recognises that the technical appendix is 'best practice' and can be de-scoped with the guidance of the consultant/design team	The preferred site and design of an arts organisation cannot achieve the guideline clear height for dance – what are the impacts of a reduced clear height and is this acceptable to the organisation?

Detailed design - Project phase in which technical documents including construction documentation is produced.

POTENTIAL USES	EXAMPLE OF USAGE
Detailed design and engineering requirements to be used as 'basis of design' for project design team	The technical appendix provides a clear set of functional and performance design criteria that needs to be delivered unless otherwise agreed – for example: can the appropriate background noise levels be met against the nominated criteria or has the design team agreed to relax them for this project?

Construction - Project phase in which the creative space is constructed on site.

POTENTIAL USES	EXAMPLE OF USAGE
Provide a reference point for collaborative discussion between stakeholders, designers and builders as projects are being delivered	The technical appendix is a common point of reference for a shared understanding of what is being built and why – for example: does the kitchen have all the facilities that the company requires?

Operation - Ongoing phase that includes operation and maintanence of the creative space.

POTENTIAL USES	EXAMPLE OF USAGE
Post-occupancy validation	Has the intended functionality and performance been delivered?
Real world implementation of technical appendix used to provide lessons learned for future refinement of the technical appendix	Feedback, such as if aspects of the guidance prove to be persistently difficult to practically achieve, can be recorded and submitted.

Procurement considerations

Procurement methodologies – for both design and delivery, should be structured in a way that ensures alignment with, and ability to deliver against, the vision articulated by project stakeholders. The many varied ways that the design and construction of building projects can be procured are beyond the scope of this technical appendix, and each project will require its own specific procurement methodology.

Below are some examples of strategies that might be included within the procurement process to ensure best alignment of the creative space with the vision articulated by project stakeholders:

— A private developer delivering a creative space as part of a construction consent condition might be required to put in place governance structures that ensure stakeholders are consulted and their requirements are demonstrably met.
— Consent authorities should provide incentives to developers to establish and maintain ongoing outcome-oriented relationships with creative arts community members.
— Arts organisations are recommended to engage with specialised consultants at the outset of a project to determine their specific needs, aligned with organisation mission and values, to form the basis of a project brief.
— Arts organisations should be provided with quality advice for the procurement of design and/ or construction services.

Compliance to codes and standards

Any creative space needs to be designed, built and certified in accordance with current relevant statutory regulations. Of particular note:

— The facility is to comply with the National Construction Code of Australia (NCC) and all relevant associated Australian Standards (AS).
— A building regulations consultant and an accessibility consultant should be engaged to provide comprehensive advice and compliance check throughout design and documentation.
— For a change-of-use and/or works within an existing building, the building regulations consultant is to assess the extent of upgrade required for compliance in line with Clause 62 and 64 of the Environmental Planning and Assessment (EP&A) Regulations (NSW) and Building Regulations 2018 (Victoria). This assessment should be carried out in the concept phase of a project (pre development application in NSW).
— In an existing building, input from a fire safety engineer may be necessary to assist in defining the extent of upgrade to meet the required level of safety and assist the consent authority to determine the requisite level of upgrade.
— Part H of the NCC will apply to Class 9b spaces. In Victoria, if the space is a 'Place of Public Entertainment' (as defined in the Building Act 1993 and prescribed in the Building Regulations 2018), then part VIC Part H102 will apply. In NSW, if the space is an 'Entertainment Venue' (as described in the EP&A Regulations), then part NSW H101 of the NCC will apply.

Departures from the technical advice in these appendices

These technical appendices articulate a set of functional and performance requirements that should be considered in the delivery of a creative space project. However, it is not always possible, or appropriate, to achieve best practice outcomes. The design should principally align with the capability and expectation of key users and stakeholders. Misalignment between design and user/stakeholder expectations may result in creative spaces:

— that are not fit-for-purpose
— that are operationally burdensome
— that don't align to their broader built environment

These technical appendices represent best practice and are intended to be a 'point of departure'. Stakeholders should be empowered to descope from these requirements where appropriate. It is crucial that users are advised by a design, architectural, engineering and consultant team who understands and can explain the implications of descoping these requirements.

DEPARTURE GUIDANCE

Throughout the technical appendix document, there are boxes formatted in this style. These boxes contain commentary on the potential implications of descoping against specific requirements. Please note that descoping can have broader and more/less significant impact than the example given. It is important to gain advice from a professional design and engineering team to help understand these decisions on a case-by-case and project specific basis.

Rehearsal space

Rehearsal spaces are used for the creation, development, and planning of a performing arts production. A rehearsal space provides a private, safe and comfortable space for performers and artists to create, practice and experiment.

A rehearsal space (also referred to as rehearsal studio or rehearsal room) has several generic and specific requirements dependent on planned usage. Specific requirements must be met to successfully support individual performance types. Rehearsal spaces have several support spaces including changing rooms, kitchen, break-out or meeting rooms and storage.

Rehearsal spaces can also be used for informal performances and more general public uses for example dance or performance classes, play-reading, meditation, and yoga groups.

The general requirements of a rehearsal space are outlined within this technical appendix, with the individual needs of two specific variations indicated below:

Type A: Theatre focus

A rehearsal space to support rehearsal of a theatrical production

Type B: Dance/ Contemporary performance focus

A rehearsal space to typically support various styles of dance including, but not limited to; ballet, modern, contemporary, percussive dance (such as Irish dancing, Flamenco and tap), hip-hop, jazz, salsa, street, aerobics, and zumba.

Usage profile

A rehearsal space has a range of usage profiles:

— Occupation by a single user group for several weeks for 5-6 days per week and up to 8 hours a day
— Occupation by a single user group for a single day or a few days at a time for up to 8 hours a day
— Occupation by multiple user groups for a few hours of time per day

Expectations of the operator and user groups should be considered during the design phase. An example scenario is where one user group books a rehearsal space for an 8-hour day for a period of several weeks, while other users maintain access for evening bookings (e.g. for dance classes, etc.). In this example, greater storage requirements may be required to cater for the security of both user groups.

References:

Type A: Theatre focus
Sydney Theatre Company Rehearsal Room © Sydney Theatre Company

Type B: Dance/ Contemporary performance focus
Deakin University Arts Building © Arup

Programmatic requirements

Common to Type A and B

Key programmatic requirements are outlined below:

Performance area for rehearsal

Work area surrounding the performance area for technical equipment, production and creative teams

Amenities including basic kitchen, changing rooms with dedicated toilet and shower amenities

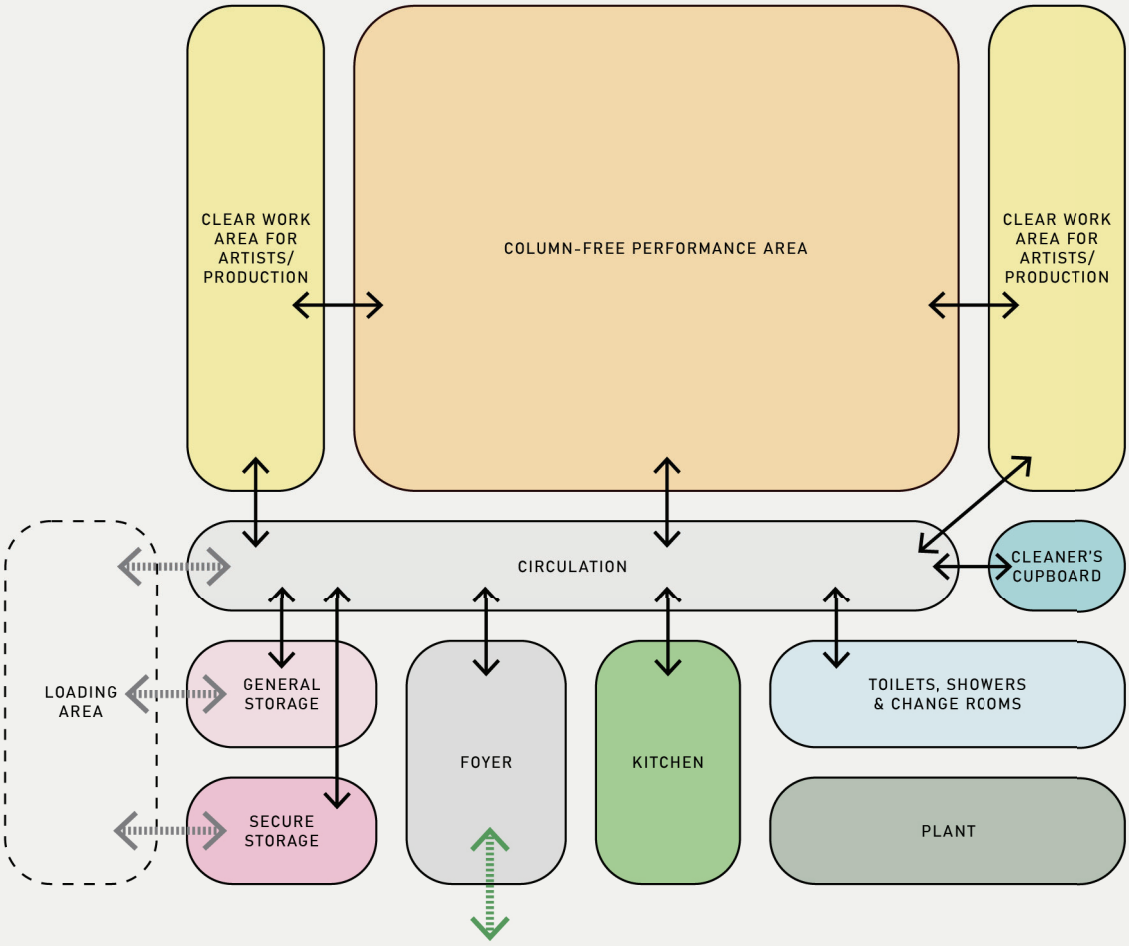
Storage areas

Loading zones for incoming technical equipment and rehearsal items

Step-free circulation and **obstruction free access**, sized (at minimum) for a grand piano or elevated work platform from the building exterior

Inclusive and legible **wayfinding signage** (including text, pictogram, visual, tactile and audible options)

Rehearsal space – Spatial adjacency diagram



Spatial requirements

The rehearsal space should support performers, artistic staff, technicians, and occasionally audiences/ observers.

Early engagement with the operator and user groups to determine the usage is key to defining area requirements.

As an early planning guide, the rehearsal space should provide a minimum floor area of **14m x 14m**. Within this, a **10m x 8m** column free performance area is required. The areas surrounding the performance area will house creative and production teams sitting at desks and occasionally seated audiences/observers.

Changing rooms: **2 sqm per person**

Toilets: **as per NCC**

Showers: **as per NCC**

Kitchen: **10 sqm**

General storage: **15 sqm**

Technical equipment storage: **20 sqm**

Secure storage: **15 sqm**

Cleaners cupboard: **2 sqm**

All spatial requirements listed above denote Net Internal Area.

It is important that all spaces above are designed to be inclusive, allowing opportunity to participate regardless of someone's personal identity or circumstances.

A minimum clear height (clear of structure and services) of **5m AFFL** should be maintained above the performance area, and where possible the remainder of the room. Any reduction in clear height inside the room should be carefully considered and coordinated.

Internal linings for walls, floors and ceiling require acoustic treatment. Refer to the acoustic requirements section for more details. Finishes, fittings and furniture should also accommodate a wide range of user needs - including good visual contrast of key surfaces and features, avoidance of finishes that will cause confusion (e.g. heavy patterns, glare, reflections)

Natural light should be provided by windows, excluding roof lights that:

— have an aggregate light transmitting area measured exclusive of framing members, glazing bars or other obstructions of no less than 10% of the floor area of the room; and

— are open to the sky or face a courtyard or other space open to the sky or an open veranda, carport or the like. Refer to lighting requirements for more details.

Whilst providing windows for natural light, privacy must always be maintained. Any windows to publicly accessible areas should be fitted with privacy glass, or other strategy to ensure privacy for rehearsal participants. A method to successfully black-out the rehearsal space e.g. curtains, blinds, shutters in the event technical systems require a 'black out' theatre environment should be provided.

Secure, straightforward, and controllable access for user groups should be provided from the building exterior, such as an electronic keypad entry, or similar.

DEPARTURE GUIDANCE

If a reduction in height is considered, please note the impact on functionality of the space. For dance or movement purposes, a minimum height of **5m AFFL** enables choreography in which performers are lifted. For theatre purposes a reduction in height may impact rehearsal scenery and rigging capability of the space to accommodate lighting, special effects, etc.

Common to Type A and B

Kitchen
A kitchen is intended only for basic meal prep and reheating of pre-prepared meals. The kitchen should allow for food rinsing, utensil washing and the sanitary disposal of associated wastewater. There is no need to provide oven and stove top unless specified by the operator or user groups.

A minimum clear height of 2.4m AFFL should be maintained in the kitchen. It is noted that there should be dual height surface tops in kitchenette areas allowing users of various heights (e.g. very tall or short stature, and people who may be seated, such as wheelchair users) to access facilities safely and independently. For seated users, 760mm height countertops from FFL, or adjustable units, are recommended.

Basic kitchen provisions to include: a large fridge, microwave, sink and instantaneous hot water boiler for efficient tea and coffee preparation. A reasonable amount of bench space and storage should be provided. A dishwasher may be considered.

The kitchen can also be fitted with a respite space for providing users with a quiet area which can be used for breaks, religious requirements (e.g. praying), or as a sensory break (e.g. for neurodivergent people).

Toilets, showers and changing facilities
The NCC sets out the ratio of male and female toilets to the number of occupants, and the specifications for toilets. Provide at least one shower cubicle for every 10 occupants. Showers should have a floor area of not less than 1.8 sqm.

A minimum clear height of 2.4m AFFL should be maintained in the toilets, showers and changing facilities.

Changing facilities should also be provided with a clear space of no less than 1.5 sqm for each occupant changing at any time. Change rooms should be equipped with lockers for storing clothing and personal belongings. Lockers should be well ventilated, accessible, and secure. There should also be a clear space of at least 1800 mm between rows of lockers facing each other and at least 900 mm between lockers and a seat or wall.

Accessible toilets, showers and changing facilities should also be provided for people with a disability compliant with the NCC and the AS 1428 suite of Standards.

It is recommended that both gendered and gender-neutral facilities be provided to accommodate cultural preferences and non-binary gender identity.

DEPARTURE GUIDANCE
Change and bathroom facilities are not a luxury for a rehearsal space. Activities within the rehearsal space can involve a lot physical movements thus requiring showers for users. Rehearsal spaces also require discrete change facilities to change from day wear to active wear and/or costume as required.

Storage requirements
General storage areas adjacent to or within the rehearsal space should be provided and capable of storing:
— Height access equipment/ machinery platform ladder, with consideration given to manoeuvring a ladder between storage and the rehearsal space
— Loose furniture such as folding tables and chairs.

Secure storage adjacent to or within the rehearsal space should be provided, to safely store:
— Technical equipment associated with the room (audio equipment, etc.)
— High-value items belonging to users of the room.

Technical equipment storage must be provided within or adjacent to the rehearsal space, and may be used for:
— Lighting equipment
— Audio equipment
— Video equipment
— Loose cabling.

Cleaner's cupboard must be provided adjacent to or within the rehearsal space with the following:
— Mop sink
— Area to hang wet mops, and brooms
— Cupboard to store general cleaning products securely and safely (dustpan and brush, bin liners, cleaning fluids, etc.).

DEPARTURE GUIDANCE
Storage is a commonly overlooked facility in creative spaces design, sometimes sacrificed to allow area for other functional requirements. The saying 'you can never have too much storage' is true and failure to do so can have an impact on the safety and operation of a facility.

Technical grid
The rehearsal space should be fitted with overhead rigging infrastructure to support the temporary installation of production equipment and scenery. The technical grid should span the entire rehearsal space. This may be presented as a distribution of rigging points or a pipe grid system. Services zone should be nominated above the rigging infrastructure and integrated with production system cabling containment and facility panels. Please see Technical System and Structural design requirements.

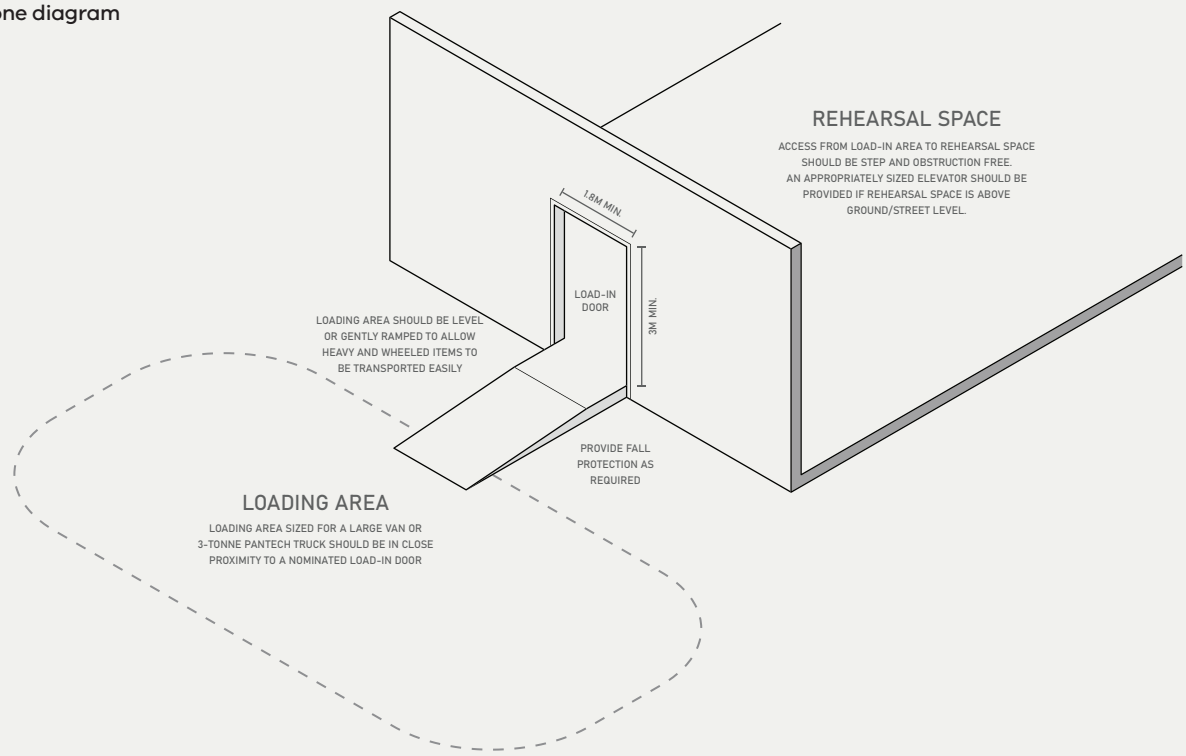
Loading zone and circulation requirements
The loading and unloading of equipment into the rehearsal space and/or the building in which the rehearsal space is housed should be carefully considered. The building's load-in door should be a minimum of 1.8m wide by 3m high to allow for large items and equipment destined for the rehearsal room. The load-in area should be level or gently ramped to allow heavy and wheeled items to be safely transported.

Circulation paths from the load-in area to the rehearsal room should be step and obstruction free and have legible way-finding signage. Doorways and accessways should be a minimum 1.8m. An appropriately sized elevator should be considered if the rehearsal room is situated above ground/street level.

A dedicated loading dock is not required to support this type of space, but a loading zone sized for a large van or 3-tonne Pantech truck should be in close proximity to a nominated 'load-in door'.

DEPARTURE GUIDANCE
Inadequate loading and circulation requirements can result in: operational inefficiencies, unsafe practices, disturbance to neighbours, potential loss of reputation and revenue. Rehearsal Spaces may be shunned by operators if they experience operational inefficiencies for 'bump-in' of events and productions. As such load in paths should avoid; stairs; lifts; lots of turns and bends; and uneven surfaces from the loading zone to the rehearsal spaces.

Rehearsal space – Loading zone diagram

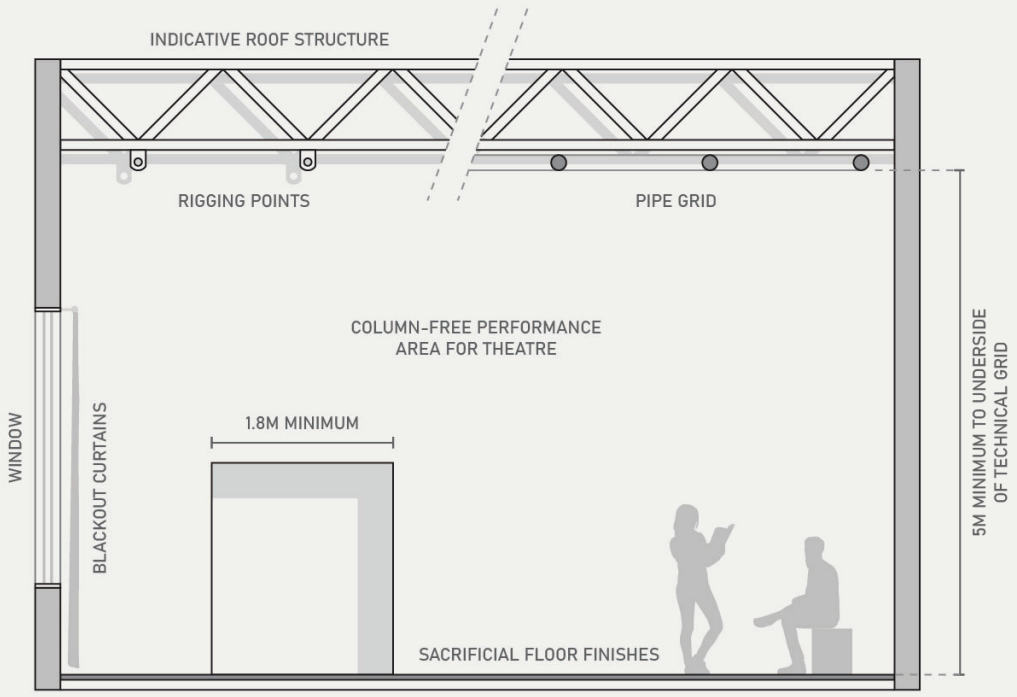


Type A – Theatre focus requirements

— A sacrificial floor finish that can be fixed into (for example screwing scenery to the floor by users as needed) should be provided to create a flexible work environment for rehearsal scenery to be temporarily installed. A typical construction example would consider plywood layers on joists, with a replaceable painted top layer painted for example Masonite or equivalent.

— Resilient wall finishes that can be attached to as needed or painted should be provided to support temporary installation of rehearsal scenery and props.

Type A (theatre) rehearsal space – Sectional diagram



Type B – Dance focus requirements

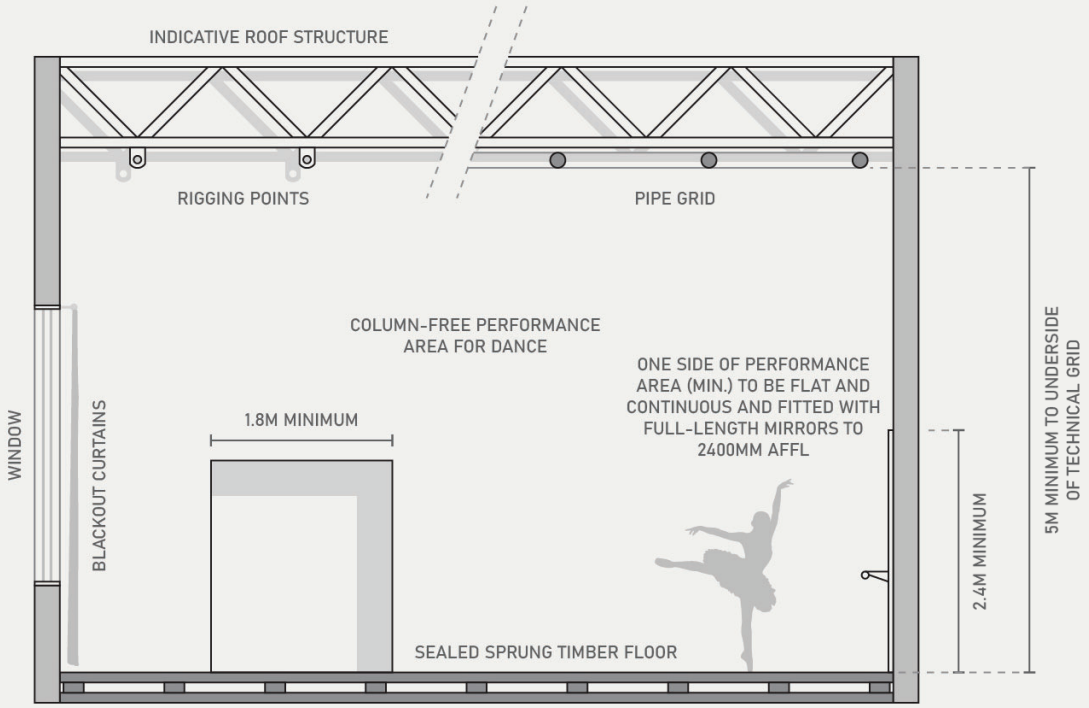
— A sprung, sealed timber floor should be installed to provide a safe work surface for dancers. The specific conditions and criteria for the floor product (shock absorbance, deflection, etc.) should be determined in consultation with the operator and end-users
— At minimum one side of the rehearsal spaces should be fitted with full height mirrors to 2400mm AFFL. Consideration should be taken to reduce the effect of glare in the wider rehearsal space (this can be distracting and cause discomfort for users, particularly for some neurodivergent people). A clear indication of the floor-wall junction will help people (e.g. partially sighted people) to understand the extents of the space, reducing the risk of confusion or injury.
— Wall or floor mounted ballet barres may be fitted along the wall in front of the mirrors. If not fitted, adequate storage will be required for portable barres
— A curtain track system should be installed to close off the mirrored wall when not in use or to alter the acoustics of the room.

DEPARTURE GUIDANCE

The flooring requirements provided above reflect functional, comfort and safety requirements. A floor that can't be fixed into is of less value to a theatre company. A floor that isn't sprung and sealed can have impacts on dancers' feet and cause injury.

Some rehearsal spaces will seek to service both dance and theatre uses. In this case, generally, flooring for dancers is prioritised, but the preference of the operator or end users should be considered.

Type B (dance) rehearsal space – Sectional diagram



Technical system design requirements

Key technical system requirements are outlined below:

Early engagement with the operator and user groups to determine the usage is key to defining technical system requirements. The overall design and capacity of the infrastructure or systems should be determined at the start of the design process.

Technical grid
Overhead rigging infrastructure should be provided above the entire rehearsal space to support the rigging of production equipment such as lighting fixtures, video projectors, LED walls, loudspeakers, curtains, and scenic elements brought in for a particular production. These systems will be reconfigured regularly as per each individual user's requirements. The overhead rigging may include one or a combination of the following systems:

Pipe grid
A pipe grid suspended from the structure above to allow for efficient rigging of permanent and temporary lighting or equipment. Key design requirements include:
- arrangement of 48.4mm OD steel pipe
- nominal 1.5m - 2m spacing in two directions
- capable of supporting:
  - 50 kg per lineal meter,
  - 100 kg point loads.

Rigging strong points
Rigging strong points to host a series of hoisting equipment (e.g. chain-motor or chain block) that is subsequently connected to either suspended objects or a production truss arrangement. The truss can be used to support a range of production equipment for example lighting fixtures, video projectors, LED walls, loudspeakers, curtains and scenic elements. Key design requirements for rigging points are outlined below:
- Rigging points may be presented as lugs fitted directly to building trusses or ceiling slabs
- Rigging points should be capable of individually supporting up to 500kg. Simultaneous loading of multiple points to support a distributed load will be required pending detailed design.

Building structure
Any steel building structure within the rehearsal space should expose steel members (such as universal beams and steel trusses) that can provide temporary rigging support for point loads via temporary means (such as beam clamps and spansets).

Please refer to Structural design requirements.

Curtain system
Hand-operated curtain track systems should be considered to control natural light.

Production lighting
Temporary production/theatrical lighting should allow users the capability to suspend and control temporary theatrical lighting fixtures with infrastructure at floor and ceiling levels. Connections to dimmer racks and lighting control will be managed by wall and floor facility panels.

Production sound
Temporary sound reinforcement system should allow users the capability to suspend and control temporary loudspeakers with infrastructure at floor and ceiling levels. Connections to an audio playback system should be managed through multi-core audio cables linked to the wall and floor facility panels.

An external portable sound rack housing equalisers, compressors, and Digital Signal Processors (DSP) devices should be linked to the console to provide signal processing to the final audio mix.

Production video
Temporary production video system should include overhead and floor level infrastructure to support temporary video installation and control. Connections to analogue or digital switching devices to distribute and process the video signal from video cameras will be managed via cabling linked to the wall and floor facility panels.

Production infrastructure
Facility panels will be required, mounted to the ceiling, wall and floor to interconnect the different Production Audio/Video/Lighting systems across the rehearsal space. Facility panels provide an identifiable connection point for analogue and/or digital signal cables between various systems and locations within the room.

Overhead access
Overhead production equipment may be accessed via:
— A suitable platform ladder
— Lightweight portable scaffold tower, or
— Height access machinery, such as a vertical lift or scissor lift.

Height access requirements should be assessed with operators and end users to determine the method of height access required. The assessment will need to consider the operational impact, risk profile, user needs and use-cases, frequency of use, adequate floor loading criteria, storage areas and access paths.

DEPARTURE GUIDANCE
The ability to easily access overhead rigging systems for temporary rigging/ hanging equipment (lights, drapes, scenery etc.) allows for efficient bump-in and bump-out of rehearsals. If the structure of the building does not have adequate rigging capability, it can introduce inefficiencies and complexities for temporary rigging of equipment thus making the space less desirable for users.

It will also be important to consider technical spaces in relation to universal design. This may include rethinking technical roles and their associated spaces, and automating / remotely controlling activities (which may reduce some of the historic need for heavy lifting and work at height). For example, for an accessible lighting grid, consider moving-head lights to minimise the work that needs to be done at height, and automate or motorise as many features as possible. On the grid itself, consider whether wheelchair access can be provided with wider, level routes.

Consideration of partially sighted people, and deaf people who lip read or use sign language, will also be important as part of an universal technical space design. Consideration will need to be given to the legibility of visual information, whilst maintaining the ambience; this may include designing technology interfaces that can help to communicate information to staff / performers that allow adjustment to personal requirements; or a suitable minimum lux level that will balance needs in the back of house areas.

Additional code compliance requirements

— Rehearsal spaces are occasionally used for small-scale performances and events. The classification of a space must not restrict advantageous uses of a facility. If a rehearsal room is to be used as an entertainment venue and/or assembly building this must be reflected in the classification of the facility and outlined in the Project Brief, as this will change the NCC requirements.
— In Victoria: if used as a 'Place of Public Entertainment', NCC Part VIC H102 will apply, which is in relation to temporary tiered seating and sanitary/amenity facilities.
— In NSW: if used as an entertainment venue, NCC Part NSW H101. The area of the stage will have a bearing on the complexity of fire safety measures in the venue.
— If used as an entertainment venue/place of public entertainment, the design and operation of the space is to be in accordance with schedule 3a of the EP&A regulations.

Universal design considerations

Universal design acknowledges human diversity and difference through design that is user-centred and responsive to people's needs, enabling people to participate equally, confidently and independently.

Creative spaces should work for everyone, but too often they fall short of this ambition. For a creative space to be inclusive, it must reflect and respond to the widest range of people's requirements, enhance visitor and user experience providing equal opportunities to access the space and use its facilities/services.

The key principles and goals of universal design are outlined below.:

- **Equitable use:** creating welcoming and accommodating spaces that offer equality in experience for different users, regardless of personal circumstance or identity
- **Flexibility in use:** creating spaces that can offer choice in use and adapt to future changes and requirements and reasonable adjustments based on user needs.
- **Simple and intuitive:** creating spaces that are intuitive to use
- **Appropriate size and space:** providing appropriate size and space for approach, circulation and use
- **Perceptible information:** effectively communicating information to all users, considering the needs of users and the constraints that the environment may place on communication

Universal design should be considered at every stage of the project lifecycle. By considering this earlier in the design phase, expensive late-stage alterations can be avoided, and the cost of management and maintenance can be lowered.

For universal design to be integrated into a creative space, compliance is required with the following codes:

The access provisions of the NCC
The DDA Access To Premises Standard
The local council's DCP relating to Access for People with a Disability
AS 1428 suite of Standards
AS 2890.6 for car parking

It is recommended that universal design considerations extend beyond compliance with codes and should respond to other areas including but not limited to:

- Provision of different sanitary facilities (i.e. accessible, ambulant accessible, gendered and non-gendered facilities)
- Provision of reflection and prayer rooms; these areas should be designed to be calm avoiding bold patterns which can be confusing for some neurodiverse users
- Equitable circulation around spaces by providing circulation paths of at least 1500mm (1800mm preferred) clear of obstructions from furniture or any door swings
- Step free vertical transportation across exhibition spaces
- Inclusive wayfinding consider all users with a particular focus on blind or partially sighted users, those where English may not be a first language, wayfinding should be simple and intuitive allowing all to navigate spaces successfully.
- Egress for all – considerations for an evacuation strategy that allows everyone to evacuate in a safe and equitable manner
- Inclusive presentation of information providing options for visual, audible and tactile means

Sustainability considerations

Every industry is able to influence emissions and its own sustainability performance.

Sustainability and climate change are increasingly front of mind for the general public and inform and impact consumer decisions. Effective sustainability approaches should apply systems thinking by considering the project holistically from its conception (e.g. "do we need to create something new, or will repurposing something we already have suffice?") to its end-of-life.

Sustainability considerations for a rehearsal space are arranged within key themes below:

Greenhouse gas emissions
Victoria has a goal of being net zero by 2050. Rehearsal spaces should aim to reduce greenhouse gas emissions to support this goal:

— Understand and quantify Scope 1, 2 and 3 greenhouse gas emissions for the space over its lifetime, including a clear definition of the emissions reporting boundary for the space in line with Climate Active or other credible guidance.
— Develop emissions reductions targets, targeting net zero emissions that are in line with or more ambitious than Victoria's emissions reduction targets

Energy usage
Reducing energy usage and selecting a low emissions source of energy can significantly reduce greenhouse gas emissions. Potential sustainable energy strategies include:

— Using energy efficient appliances with an Energy Rating label, economy mode
— Obtaining an energy rating for the space or meet energy rating requirements if rating is not available (NABERS Tenancy Energy Rating, Green Star)
— Exceeding National Construction Code Section J Energy Efficiency requirements
— Monitoring energy usage through use of on-site energy metering where possible
— Ensuring energy efficiency through design, including:
  - Use of programmable Building Management Systems
  - Insulation to reduce heating and cooling loads
  - Passive lighting and temperature control
  - Specification of LEDs
  - Specification of solar hot water and electricity panels

If space is to be leased within a broader commercial building context, ensure landlord has an energy rating for the base building:

- NABERS Base Building or NABERS Whole Building targeting 4.5 stars (without green power) for existing buildings and 5 stars (without green power) for new buildings, and/or
- Green Star Buildings v1 rating (minimum targets for new and existing building may be informed by Property Council of Australia guidance), and/or
- A reasonable equivalent rating

Energy source

— Minimise natural gas usage, replacing gas with electricity for cooking and heating wherever possible.
— Strategic energy procurement for the operation of creative spaces should be considered by applying the energy hierarchy outlined below when selecting a provider. Selection of energy source can contribute to ratings such as NABERS and Green Star and should be considered in concert with energy efficiency measures.

Energy hierarchy

HIERARCHY	ENERGY MEASURE
1	**Sustainable energy production** — Renewable energy from sun, wind, waves, tides or rainfall, geothermal — Bio-energy from combustion of biomass — Includes off-site renewable energy generation, Power Purchase Agreements (PPAs) and other renewable energy options from energy suppliers
2	**Low carbon generation** energy sources or generation that makes use of carbon capture and storage to reduce emissions from generation
3	**Offsetting** emissions from energy usage using certified additional emissions offsets

Water management
Reduction of water usage overall and use of non-potable water sources where possible contribute to sustainability performance and may contribute to sustainability ratings for the space.

Water management in rehearsal spaces should consider:
— Use of efficient fixtures and fittings with a WELS rating
— Monitoring water usage through on-site metering
— If space is to be leased within a broader commercial building context, ensure landlord has a water rating for the base building:
  - NABERS Office Water 4 star for new buildings, and/or
  - A Green Star Buildings v1 rating that includes achievement against Water Use credit, and/or
  - A reasonable equivalent rating
— Obtaining a water efficiency rating for the space or meet water rating requirements if rating is not available (NABERS Water, Green Star)
— Ensuring water efficiency through design, including use of recycled water, reticulated wastewater, rainwater capture

Waste management
Waste is a source of greenhouse gas emissions and its disposal can result in costs for rehearsal spaces. Management of waste can result in both emissions and cost reductions and can improve operational efficiency. Waste includes single use items, food waste and waste associated with the fit out of the space.

Waste management in rehearsal spaces should consider:
— Application of circular economy principles in line with the Victorian DELWP's Recycling Victoria A new economy Plan:
  - Design to last, repair and recycle
  - Use products to create more value
  - Recycle more resources
  - Reduce harm from waste and pollution
— Obtaining a waste rating for the space or meet waste rating requirements if rating is not available (NABERS Waste)
— Setting targets to reduce waste production overall, from both construction and operation of the Rehearsal space. This can be achieved through achievement of or alignment with Green Star Buildings v1 Operational Waste and Upfront Carbon Emissions credits
— Minimising use of hazardous waste, that is waste that has the potential to harm humans or the environment, in the construction and operation of the space, and provide adequate and safe storage and disposal options for hazardous waste where use of hazardous materials is unavoidable
— Setting targets to maximise diversion of waste from landfill and aligning with Victoria's target of 80% diversion by 2030. Strategies may include the following and should be captured in an Operational Waste Management Plan:
  - Having separate collection for multiple waste streams, including organics waste, and adequate space to accommodate these waste streams
  - Educate staff on waste sorting,
  - Provide signage and nudge mechanisms for staff, visitors and clients to promote waste sorting
— Implementing a sustainable procurement policy that guides procurement decisions during operation with the aim of reducing waste overall, reducing hazardous waste, increasing reuse and recyclability, and integrating circular economy and whole of life principles into procurement evaluation

If space is to be leased within a broader building context, ensure landlord has a waste rating for the base building:
— NABERS Waste, and/or
— A Green Star Buildings v1 rating that includes achievement against Operational Waste credit, and/or
— A reasonable equivalent rating

Structural design requirements

Key structural design requirements are outlined as follows:

Floor loading

Load allowances for the rehearsal room floor and adjacent spaces should consider the use of space and comply with AS1170.1:2000.

Generally, the rehearsal space floor should be designed for:
- Uniformly designed load (UDL) of 5 kPa
- Concentrated point load of 3.6kN over a minimum area of 300 mm x 300 mm
- Special consideration for the allowance of concentrated point loads should be made for scenery and production equipment. If these loads exceed the code specified maximum, the floor should be designed for the higher load requirement. Some heavy items that are likely to be used in the space might include:
  - a fully loaded chair trolley
  - a heavy road-case of technical equipment
  - a heavy trolley supporting multiple rolls of dance floor/ Tarkett
  - heavy scenic elements such as stage decks, flattage, etc.

The rehearsal room floor should have the capacity to support concentrated and uniformly distributed loads for temporary equipment (e.g. elevated work platforms (EWPs), to facilitate access to the overhead structure for operation and maintenance. The loading capacity of the travel paths for the temporary equipment should also be considered in the design and floors should be designed to facilitate these temporary loads. The equipment and the procedure implemented for overhead operation should also be carefully selected to ensure the floor is not damaged, in particular, the Type B (Dance) space sprung floor.

Overhead rigging suggested allowances

The following load allowances should be considered for rigging infrastructure outlined in Technical Systems requirements.
- Pipe Grid
  - Typically, 2kN point load at 2m grid, or 0.5 kPa UDL
- Rigging Points
  - Nominal 3m - 6m centres with a 5kN load capacity per point
  - A defined limit to the number of rigging points that are coincidently loaded should be discussed and agreed with the end user to avoid excessive loading requirements for the overhead structure
- Rigging to structure is only to occur at agreed rigging point locations.

Overhead rigging infrastructure should be supported from the floor/roof structure above. This floor/roof should be designed considering the hanging loads from the rigging equipment, including any dynamic load factors. Any items supported from the rigging system that are sensitive to vibration (e.g. lighting, sound) or have specific performance requirements, should be specified for consideration in the design of overhead rigging support structure.

The overhead rigging is frequently supported using chain hoists, clamps and other rigging hardware (as described in technical systems requirements). Exposed steel members (such as universal beams) are an effective support for rigging points. The possibilities for clamping to beams may be limited if fire treatment is required on the beam. These steel members can be secondary members attached to the primary structure, or direct attachment to the primary structure may be appropriate.

DEPARTURE GUIDANCE

A building that does not have adequate floor or ceiling/roof loading capacity could significantly impact the functionality of the space; ceiling/roof loading should allow for the rigging of equipment and/or connections for aerial performances; floors should allow loads such as large set constructions; floor should also allow for the concentrated loads of elevated work platforms to allow access to rigging points.

Vibration performance criteria

The impact of rhythmic activities such as dancing should be considered in the design of the rehearsal room and adjacent spaces. Large repeating loads due to dancing or other types of high energy movement are applied to the structure which can generate structural vibration that may cause complaints or concern to the occupants. Due to the architectural constraints of the space, namely the column free structural arrangement, suspended floors can have relatively low frequencies. This means that people can dance at the same frequency as the structure, causing large movements.

There may be areas in the structure where rehearsal rooms also support spaces with more sensitive usages increasing the potential to transfer structural vibrations between floors.

Careful consideration is required into whether vibrations within the rehearsal spaces and transferred vibrations into other spaces through the building will cause concern to occupants. Expected vibrations levels can be predicted using published loading and acceptability criteria from international codes and standards, including AISC Design Guide 11 and ISructE.

Lighting design requirements

Key lighting design considerations and requirements are outlined below:

Lighting design considerations
— Fixtures with indirect or diffuse light sources should be used to provide adequate lighting to the vertical plane to highlight faces.
— Natural light throughout is preferred. Control of natural light with blinds/shutters/drapes should be provided on all windows and glass surfaces.
— The colour temperature of the fixtures should be 3000K or 4000K and consistent throughout
— Luminaires should be concealed where possible and have a Unified Glare Rating (UGR) of 19 or lower.
— The Colour Rendering Index (CRI) of the luminaires should be 90 or higher.

Lighting controls
— All lighting should be dimmable, with smooth fading from 0-100%.
— A local control or over-ride should be provided so that creative teams can dim or black-out the room lighting when performing under temporary production lighting systems.
— A panic button should be incorporated to instantaneously activate room lighting in an emergency.
— Room lighting should be coordinated and controllable from the Building Management System.
— Lighting within the rehearsal venue should be zoned; the performance area should be one single zone, separately controlled from the remainder of the space.

Lighting design compliance
— Lighting illuminance and uniformity requirements should comply with AS 1680. The average horizontal illuminance level should meet 240 lux. This is indicated in AS1680.2.3 (Specific applications – educational and training facilities), Table D1 Auditoriums. The uniformity of the space should meet 0.3 as a minimum.
— The NCC Part J6.2a states that the maximum illumination power density for auditoriums, churches and public halls to be 8w/sqm. Motion sensors and lighting timers should also be considered to turn off the lighting and conserve energy when room is not in use.

Emergency lighting and exit signs
— AS2293 and NCC Section E4 compliance emergency lighting and exit signs should be provided throughout as required.
— Consideration should be given to incorporate integrated emergency lighting into the general lighting within the space.
— Exit signs should be able to operate with minimum brightness allowable for exit signs to eliminate glare and light spill during a ‘theatrical black out’.

Electrical design requirements

Key electrical design requirements are outlined below:

Electrical requirements

— Incoming power supply to the rehearsal space and the power supply authority power metering requirements to be provided based on the incoming power supply to the building and as per local power supply authority requirements
— A dedicated distribution board must be provided for the rehearsal room with separately metered power and lighting as required by NCC, for ESD purposes and for subleasing (if required)
— General power outlets to be provided for the user ports and cleaners' outlets around the perimeter
— Equipment power to be provided for all kitchen equipment together with spare general power outlets within the kitchen bench
— Power provisions to be provided for AV racks, toilets and loading docks as required
— Power provisions to be provided for all mechanical and hydraulic services equipment and to be coordinated with mechanical and hydraulic services installations.

DEPARTURE GUIDANCE

It is important for incoming power supplies for rehearsal spaces to be adequately sized to allow for the relatively large power demands of theatrical lighting. These loads are often transient in nature and supplies should be designed to accommodate these transients as opposed to average loads.

The rehearsal room should include at minimum:

2 of 40A 415V 3PN+E Wilco sockets, located on one wall to one side of the performance area

10A DGPO's fitted along the perimeter of the room at nominal 3m intervals

10A DGPO's fitted at the base of any columns within the room.

Consider in consultation with the operator and end user the following:

A production lighting patch system to distribute powered circuits to outlets distributed throughout the pipe grid

160 Amp 3 phase (415V) incoming supply to be provided based on the size of the area for the rehearsal space.

Communication requirements

Incoming communication services requirements to be developed based on the building/space requirements. Minimum 10 pair Cat 6 cabling connection to be installed from the building distributor to the floor distributor within the rehearsal space.

The rehearsal room should include at minimum:

Data outlets fitted to the perimeter of the room at nominal 3m intervals

Data outlets distributed throughout the pipe grid

A dedicated AV rack with network switch, where all local data outlets will be wired to

Internet access to the data switch for rehearsal room users to access

Wi-Fi network within the rehearsal room for users to access.

Electrical design standards and System Criteria

ITEM	STANDARDS	CRITERIA
Supply conditions	Supply Authority service rules	— 400V 3-Phase nominal — 50Hz
Main switchboard	AS/NZS 61439 AS/NZS 3000	— 25% spare space or one spare space (whichever is greatest) for each frame size excluding main switch(es) — Main busbars 125% initial load
Distribution boards	AS/NZS 61439 AS/NZS 3000	— Form 2 unless stated otherwise — 30% spare space or minimum 18 poles (whichever is greatest) for each frame size excluding local main control) — Local main control required — Fault interrupt capacity of circuit breakers minimum 6kA — Provide fault current limiters or use higher fault interrupt capacity circuit breakers as required — Internal DBs: IP52 min. — External DBs: IP56 min.
Consumer mains	AS/NZS 3000 AS/NZS 3008.1	— Voltage drop: max. 2% — Max. demand: + 25% capacity (current carrying and voltage drop) — Fire rate where required to AS3000 — At least 100% neutral; provide oversize neutral where harmonic currents are expected to be high
Submains	AS/NZS 3000 AS/NZS 3008.1	— Voltage drop: 1% — Max. demand: + 20% (current carrying and voltage drop) — Fire rate where required for Fire and Life Safety Services — At least 100% neutral; provide oversize neutral where harmonic currents are expected to be high.
Final subcircuits	AS/NZS 3000 AS/NZS 3008.1	— Voltage drop: max. 2% — Power 2.5mm² min. — Lighting 2.5mm² min. — Max. 80% utilisation to AS 3000
Lighting	AS/NZS 1680	— Use long life, energy saving lamps such as LEDs; use tungsten and tungsten halogen only to approval — Allow overall depreciation factor of 0.8 for clean, air conditioned areas, 0.7 for clean, non-air conditioned areas and 0.6 for dirty areas
Communications	AS/NZS 11801	— Provide Cat 6 UTP cabling — Contain Cat 6 cable route length to <90m — Cross power cables only at 90° — The maximum fill of a cable tray should not exceed 50%.
Electrical metering and EMS system	NCC Section J6 Supply authority standards	— Meters and CTs should comply with NCC and supply authority standards

Acoustic design requirements

The acoustic outcomes will be influenced by the site location, internal design, and interface with surrounding development. The key design considerations and requirements are outlined below:

Acoustic design considerations
The acoustic outcomes will be influenced by the site location, internal design and interface with surrounding development. The key design factors include:

— environmental noise and vibration emission
— internal design noise and vibration levels
— environmental noise intrusion
— building services noise and vibration control
— internal acoustic separation including spatial planning and physical isolation
— Room acoustics (e.g. reverberation)

DEPARTURE GUIDANCE
Acoustic design should be undertaken in the full context of its locality. Rehearsal spaces are both noise sensitive as well as noise generating. Careful design of the building envelope should aim to avoid noise disturbance both to and from neighbours.

ITEM	CRITERIA AND REQUIREMENTS
Environmental noise and vibration emission	— Minimum requirements will be according to council consent requirements and will be dependent on surrounding or adjoining development — The design must be based on the full operating hours of the space and maximum noise and vibration levels potentially generated by the use — The acoustic design requirements will be heavily influenced by the proximity and sensitivity of nearby or adjoining receivers. Site location will be critical to minimising design requirements and maximising operational flexibility — A noise monitoring system is recommended to be included to aid noise management. Where temporary or portable sound systems are used, a sound monitor is recommended in the space (e.g CESVA RS-60, NTi Audio XL2), to identify when sound levels are above allowable noise levels. Where different noise limits apply at various operating times, the device should include or support multiple time-based settings — If a permanent sound system is installed, sound levels can be controlled by a DSP limiter. An RMS compressor/limiter with multi-band compression is recommended
Internal background noise and vibration levels	— Criteria related to the noise and vibration in the space excluding occupant activity — Internal background noise levels, from both environmental noise intrusion and internal plant and equipment should not exceed the lower bound design sound level range in AS/NZS 2107:2016 by more than 5 dB. Refer to Educational > Drama studios occupancy/activity in Table 1 for rehearsal space — Internal background vibration not to exceed the maximum levels in British Standard BS 6472:2008.
Internal acoustic separation, including spatial planning and physical isolation	— Design will need to consider vibration and structure-borne noise control from dancing. A specialist structural dynamics engineer should be consulted.
Room acoustics	— Reverberation should be minimised for noise control, occupant comfort and space functional requirements. — For Type A (theatre) rehearsal space, a lower reverberation time is recommended in accordance with Curve 1 or 3 of Appendix A, AS/NZS2107:2016. Where the space may be used for prolonged use, the lower reverberation time is preferable. — When Type A (theatre) is used for music rehearsal, consideration should be given to sufficient room volume and absorption to address excessive loudness. As high-level guidance, 25 m3, per person for quiet instruments (e.g. strings, wood winds), 50m³ for loud instruments (such as percussion, brass and amplified instruments). Detailed assessment could be carried out as per Norwegian standard NS 8178. — For Type B (dance) rehearsal space, the reverberation time should not exceed Curve 2 (Music) of Appendix A, AS/NZS2107:2016. — Where non-absorptive wall linings are required for functional purposes, angling of walls (7 degrees off parallel) should be considered to reduce flutter echo.

Fire safety design requirements

Key fire safety design considerations and requirements are outlined below:

Rehearsal facility only

— Fire exits and egress routes are to be in accordance with the requirements of the NCC. Where temporary equipment or props are expected, management provisions are to be implemented to prevent blocking of the exits and egress routes.
— Audibility of the occupant warning system is to be considered. competing sound systems are to shut down in accordance with AS1670.1-2018 clause 3.22.3.
— The placement of occupant warning speakers is to consider any sound-proofing measures within the facility.
— Visual warning devices are to be located in areas where portable sound systems may be used.
— Linings are required to meet the fire hazard property requirements outlined in C1.10 of the NCC. This requirement is to be considered in conjunction with any acoustic or sound proofing linings.

Rehearsal facility proposed to operate as an entertainment venue /Place of Public Entertainment

The use of a rehearsal facility as an entertainment venue/place of public entertainment should be clarified in the design brief, as this is likely to change the NCC and fire safety requirements. If a rehearsal facility is proposed to operate as an entertainment venue or place of public entertainment, the following should also be considered.

— The use of staging or seating is to be identified in the early stages of design, along with proposed layouts. This applies to both temporary and permanent staging and seating. The layout of temporary staging and seating layouts will need to form part of the approvals documentation to ensure that NCC requirements are maintained during event layouts.
— The design of fire safety systems is to consider the presence of any temporary staging or seating, particularly in relation to fire system coverage, and exit signage layouts. Additionally, the size of any stage will drive differing fire safety measures in the building. Therefore, it is important to clarify this and manage future performances within the requirements of the fire strategy.
— Where the use of theatrical smoke is to be allowed for, the impact of false alarms due to a smoke detection system is to be considered. Isolation of a smoke detection system is non-compliant in NSW (as clarified by NSW Department of Planning) and would need to be supported via a performance solution which outlines an alternative strategy for detection of a fire and meets the performance requirements of the NCC. In Victoria, it is to be confirmed by the project building surveyor as to whether a non-compliance exists, but is to be a consideration of the design regardless. The impact of isolating the detection system would need to consider occupant evacuation and initiation of active fire safety systems such as smoke exhaust that are required to be operated by smoke detection.
— If a smoke exhaust system is required, smoke is to be exhausted at high level and make-up air introduced at low level. Where a smoke exhaust system is required, it is recommended that it be designed on a performance basis by a fire safety engineer.

The design of an entertainment venue can often benefit from a performance based fire safety strategy, carried out by a fire safety engineer. Designing in accordance with the prescriptive NCC requirements, whilst possible, may prove restrictive to the space. A performance based design, considering the fire safety strategy as a whole, can often lead to a more usable (less restrictive) outcome that considers the operational needs of a

theatre.

Hydraulic design requirements

Key hydraulic Services provisions should be considered as part of the design.

Domestic water and sanitary drainage are to be provided to any kitchens, toilets and cleaners sinks which are part of the space.

— Where the space forms part of a building, domestic water services should be metered separately from the base building supply to allow landlord billing of water use.
— Mechanical condensate should drain to the sanitary system via a trapped tundish.
— Domestic hot water should be generated local to the space and consider the frequency of use. Where spaces are used infrequently, instantaneous electric hot water generation is preferred to avoid energy associated with heat losses. Where the space is used daily, electric storage may be more appropriate.
— Hydraulic services should not be located in the rehearsal space. Where this is not possible, they should be acoustically treated and located in a way to avoid impact on the rehearsal space during routine maintenance or repair.

Hydraulic design criteria

SYSTEM	STANDARDS	DESIGN CRITERIA
Domestic hot and cold water	NCC 2019 Amdt. 1 AS/NZS 3500.1 – 2018 AS/NZS 3500.4 - 2018	— Cold water average supply temp: 14°C — Hot water storage: 60°C to 65°C — Hot water distribution: 55°C to 60°C — Amenities (visitor and non-visitor): 43°C — Utility rooms (kitchens, cleaners sinks): 50 to 55°C — Max. velocity: 2.4m/s externally and in ground — Max. velocity: 1.5m/s in risers, BOH spaces — Max. velocity: 0.8m/s in acoustically sensitive spaces — Min. operating pressure: 200kPa — Max. operating pressure: 500kPa
Sanitary Plumbing and Drainage	NCC 2019 Amdt. 1 AS/NZS 3500.2 – 2018	— Min. grade: 2.5% for 40-65mm, 1.65% for 80-100mm and 1% for 150mm pipelines — Sanitary stacks design capacity: 22% to 33% full — Drainage design capacity: max. 70 % full — Velocity: 0.75m/s to 1.2m/s
Building Rainwater Drainage	NCC 2019 Amdt. 1 AS/NZS 3500.3 – 2018 Australian Rainfall and Runoff Guidelines City of Sydney requirements	— Flat roofs, box gutters: 5min 1% AEP — Eaves gutters: 5min 5% AEP — Climate change allowance: +10% — Full capacity overflows to be provided to all building rainwater drainage catchment areas — Velocity: 0.75m/s to 1.2m/s — Siphonic drainage velocities TBC by hydraulic calculation; insulation where required to limit noise in noise sensitive areas

Mechanical design requirements

Key mechanical design considerations and requirements are outlined below:

General mechanical requirements

— For mechanical sizing, internal gains within the space should be based on increased metabolic rates to reflect high activity level from dancing
— Relevant ASHRAE and CIBSE external design criteria should be used. Consideration should be given to future climate change and resultant elevated ambient design temperatures
— Increased outside air (50% above code minimum is recommended) in normal operation
— If system supplies >1000 l/s, economy mode should be provided in line with NCC 2019 Section J requirements. Economy mode should be offered with smaller units to achieve energy reductions
— Openable windows should be incorporated for passive temperature control where possible to allow for natural ventilation in low-load scenarios when the external temperature is acceptable
— For spaces with a floor-to-ceiling height of 4-6m, minimum air change rate of 6 air changes per hour should be achieved
— For spaces with >6m floor-to-ceiling height, minimum air change rate of 8 air changes per hour should be achieved.
— When determining airflow and mechanical equipment sizing, consideration should be given to up-lighting vs. downlighting so that the mechanical system is not oversized (a proportion of high-level lighting and equipment load will not land in the space so does not require direct air conditioning)
— Mechanical system should be designed to meet acoustic requirements of the space.

Rehearsal space requirements

The mechanical systems should ensure a comfortable environment for users, who will likely be performing exhausting physical movement, in groups, for varied periods of time. Heat loads in rehearsal rooms can be quite dynamic (e.g. large groups of dancers suddenly starting an intense session) and mechanical systems should be designed to respond to this.

— The mechanical systems serving the theatre should maintain an environment within the following specified values during times of use:
  - Temperature: 20°C to 23°C, with ability to widen temperature criteria depending on space use to save energy
  - Humidity: 40% to 60% (note: this will not be directly controlled but will naturally fall into this range as a result of the air conditioning)
— CO_2 sensors should increase the outside air proportion to the space in response to high CO_2 levels. Mechanical equipment should be sized to maintain internal temperatures and deliver increased outside air at high ambient temperatures.
— Wall-mounted temperature and CO_2 sensors should be installed at 1500mm AFFL inside the space and in areas that will be representative of the conditions inside the space.
— Mechanical system should be variable volume and respond to temperature and CO_2 levels within the space.
— All ductwork should be above rigging zone OR can be wall mounted if it does not clash with other services/uses.
— Ensure access to ductwork is maintainable and takes into account rigging infrastructure and associated production equipment within the space.
— Consideration should be given to performance of diffusers in heating mode, especially for spaces with high floor-to-ceilings (more than 3.2m).
— If extensive lighting and equipment is used, make allowance for mechanical system to offset expected maximum lighting and equipment loads.
— Air supply should be 'low velocity' to reduce noise, avoid drafts and avoid moving drapes/curtains.
— Diffusers should be high induction to reduce drafts in space.

Other areas

— Cleaners store to be exhausted directly to outside in line with AS1668.2 requirements
— Ventilation of toilets and change rooms to be in line with AS1668.2 requirements (change rooms may be conditioned by a small FCU/PAC if desired to provide additional comfort for occupants). It is recommended extract ventilation is 200% of code minimum to ensure odours are effectively removed from the space.

Fire engineering/smoke control

— If smoke exhaust is required, all components are to be compliant with AS1668.1 requirements and Spec E2.2b of the NCC, except where deviated by a Performance Based Fire Engineering strategy developed by a Fire Safety Engineer.

Design criteria

EXTERNAL DESIGN CRITERIA	ASHRAE OR CIBSE CURRENT GUIDANCE
General ventilation	AS 1668.2:2012
Smoke control ventilation	AS 1668.1:2015
Battery ventilation	AS 2676.1:2020
Refrigerant	AS 5149:2016

DEPARTURE GUIDANCE
Early and ongoing engagement with operators and user groups or a consultant with relevant experience to advise on their behalf is required in the development of technical systems. A lack of provision may deem the space not fit for purpose. Rehearsal spaces can produce significant changes in thermal load once performers begin rehearsals that often involve physical movements. Mechanical systems can include mix-mode systems but needs to take into account ranges of comfort for the performers using the space as well as accommodate to rapid changes in thermal load.

In addition, the design should be compliant with the following codes and standards:
— 2019 National Construction Code/ Building Code of Australia (BCA)
— Building Permit conditions
— AS1668.1 (2015) – Fire and Smoke Control in Multi-Compartment Buildings (Amendment 1)
— AS1668.2 (2012) – Mechanical Ventilation in Buildings (Amendment 1 and 2)
— AS1668.4 (2012) – Natural Ventilation of Buildings
— AS 1940 (2004) – The Storage and Handling of Combustible Liquids
— AS/NZS 2107 (2000) – Recommended Design Sound Levels and Reverberation Times for Building Interiors
— AS 3000 – Electrical Installations
— AS 3500 – National Plumbing and Drainage Code
— AS 3666 (2011) – Air-handling and Water Systems of Buildings – Microbial Control
— AS 4254.1 (2012) – Ductwork for Air-Handling Systems in Buildings – Flexible Duct
— AS 4254.1 (2012) – Ductwork for Air-Handling Systems in Buildings – Rigid Duct
— AS/NZS 5601.1 (2013) – Gas Installations – General Installations
— All other applicable Australian Standards
— WorkCover requirements
— OH&S Regulations
— Safe Work Australia
— Electricity Supply Authority requirements
— Fire brigade requirements
— Australian Gas Authority requirements
— All local council regulations
— Fire engineering report

Pipework velocity and pressure drop
The following values should not be exceeded:
— Pipework pressure drop: 300 Pa/m
— Pipework velocity:

DIAMETER (MM)	VELOCITY (M/S)
25	1
50	1.1
100	1.25
150	1.5
200	2
250	2.2
300	2.5

Ductwork velocity and pressure drop
The following values should not be exceeded:

— Ductwork velocity - Variable Volume Systems (final velocity to be agreed with acoustic consultant depending on acoustic requirements of the space)
  - Risers and plant rooms: 7.0 m/s
  - In ceiling secondary ductwork: 4.0 m/s
  - In ceiling tertiary ductwork: 2.5 m/s
  - Flexible ductwork: 2.0 m/s
  - General duct discharges: 6.0 m/s
  - Louvres: 2.5 m/s face velocity

— Ductwork pressure drop
  - General ductwork: 0.8 Pa/m
  - Transfer ducts: 12 Pa
  - Riser take-offs: Kt £ 0.89
  - Bends: Kt £ 0.25
  - Rectangular contractions: Kt £ 0.19

— Where the total pressure loss through the fitting is defined as Pt = Kt × Pv
  - Pt = Total pressure loss through fitting (Pa)
  - Kt = Loss coefficient
  - Pv = Velocity pressure (Pa)

Mechanical equipment and accessories pressure drops
The following values should not be exceeded:
— Sound attenuators: 50 Pa
— Louvres: 20 Pa
— Cooling coils (airside): 150 Pa
— Cooling coils (waterside): 35 kPa

Glossary

Access To Premises Standard
The Disability (Access to Premises – Buildings) Standards 2010 (Premises Standards) is legislation under the Disability Discrimination Act 1992. The purpose of the Disability Standards for Access to Premises is to make sure: people with disability and their family members, carers and friends, have equal access to public buildings; and building certifiers, developers and managers fulfil their responsibilities to people with disability under the Disability Discrimination Act 1992.

AFFL
Above Finish Floor Level

AISC
American Institute of Steel Construction

Amdt
Amendment

amp
Ampere

AS
Australian Standards are published documents setting out specifications and procedures designed to ensure products, services and systems are safe, reliable and consistently perform the way they are intended to. They establish a minimum set of requirements which define quality and safety criteria. Standards Australia develops internationally aligned Australian Standards.

AS/NZS
Australian/New Zealand Standards. Joint standards developed by Standards Australia and Standards New Zealand

ASHRAE
American Society of Heating, Refrigerating and Air-Conditioning Engineers

AV
Audio Visual

back of house (BOH)
A term used to refer to the support spaces for the stage, most often immediately adjacent to the stage. This includes dressing rooms, storage rooms, loading dock. This term can also be used to refer to the rear of the auditorium.

BCA
Prior to the creation of the NCC, building was regulated by the Building Code of Australia (BCA), and had been since 1992. The BCA was the first collection of nationally-consistent building regulations. The BCA was superseded by NCC.

catwalk
A steel structure over the stage, audience area, or both, used by stage personnel to cross from one side of the house to the other, often used to support lighting instruments.

CISBE
Chartered Institution of Building Services Engineers

CNC
Computer Numerical Control router

control room
The dedicated zone or room from which the lighting, sound and AV equipment is operated during a performance.

CT
Current Transformer

DB
Distribution Board

dB(A)
The unit generally used for measuring environmental, traffic or industrial noise is the A-weighted sound pressure level in decibels, denoted dB(A). The weighting is based on the frequency response of the human ear and has been found to correlate well with human subjective reactions to various sounds. It is worth noting that an increase or decrease of approximately 10 dB corresponds to a subjective doubling or halving of the loudness of a noise, and a change of 2 to 3 dB is subjectively barely perceptible.

DCP
Development Control Plans. DCPs provide detailed planning and design guidelines to support the planning controls in the Local Environmental Plan.

DDA
Disability Discrimination Act

decibel
Measure of loudness of sound (pressure) level. For convenience, this is calculated on a logarithmic measurement scale.

DGPO
Double General Power Outlets

DMX
Digital Multiplex, a standard for digital communication networks that are commonly used to control stage lighting and effects

DSP
Digital Signal Processor

DX
Direct Expansion
EP&A Regulations
Environmental Planning and Assessment Regulation. The EP&A Regulation contains key operational provisions of any local or state planning system.

ESD
Environmentally Sustainable Design

FCU/PAC
Fan Coil Unit/Packaged Air Conditioning Unit

fire curtain
A non-flammable, vertical travel curtain immediately behind the proscenium, contained in the smoke pocket, used to protect the audience from possible smoke and fire originating from the stage. It is typically rated for 30 minutes of protection.

frequency
The subjective equivalent of frequency in music is pitch. Higher frequency sounds have a higher pitch. The unit of frequency is the Hertz (Hz). Human hearing ranges approximately from 20 Hz to 20 kHz. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used.

front of house (FOH)
A term typically used to collectively refer to the support areas immediately adjacent to the auditorium. This includes the lobbies, restrooms, cloak check, gift shop and box office.

GPO
General Power Outlets

Green Star
A Green Star rating provides independent verification that a building or community project is sustainable. Undertaking voluntary Green Star certification demonstrates leadership, innovation, environmental stewardship and social responsibility.

Hz
Hertz

IP
Ingress Protection rating

ISructE
Institution of Structural Engineers

l/s
Litres per Second

LED
Light Emitting Diode

loudness
Loudness provides for an exciting and dramatic aural experience and allows the musical director maximum dynamic range. The loudness of sound varies throughout an auditorium, and is equated to the distance from the stage to a listener.

m
Metres

m/s
Metres per Second

NABERS
National Australian Built Environment Rating System (NABERS). NABERS is a simple, reliable sustainability rating for the built environment. This helps building owners to understand their building's performance versus other similar buildings, providing a benchmark for progress.

National Construction Code (NCC)
The National Construction Code is Australia's primary set of technical design and construction provisions for buildings. As a performance-based code, it sets the minimum required level for the safety, health, amenity, accessibility and sustainability of certain buildings. The Australian Building Codes Board, on behalf of the Australian Government and each State and Territory government, produces and maintains the National Construction Code.

Noise Criteria (NC)
The Noise Criteria (NC) curves are commonly used to define building services noise limits. The NC value of a noise is obtained by plotting the octave band spectrum on the set of standard curves. The highest value curve which is reached by the spectrum is the NC value. Shown below is a plant noise spectrum that is equivalent to NC 40.

OH&S regulations
The Occupational Health and Safety (OH&S) Regulations build on the OHS Act. They set out how to fulfil duties and obligations, and particular processes that support the Occupational Health and Safety Act.

Preferred Noise Criteria (PNC)
A set of curves, similar in principle to NC curves, but considered to correlate better to subjective acceptability in very low noise areas such as music auditoria.

reverberation
The principal, subjective acoustic quality perceived by the majority of listeners in an auditorium is reverberation. This is most commonly experienced at the end of stop chords as the sustained sound that rings in the space. Reverberance assists the sustain of musical instruments and the blending of the orchestra sections. It also contributes to the feeling of envelopment, i.e. that the sound comes from all around you.

RMS Compressor
Root Mean Squared compressor

sqm
Square metre

typical noise levels
Some typical noise levels are given below:

NOISE LEVEL DB(A)	EXAMPLE
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy trucks at 5m
80	Sidewalk of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Movie Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

UDL
Uniformly Designed Load, a force that is applied evenly over the distance of a support

UTP
Unshielded Twisted Pair Cabling

WELS
Water Efficiency Labelling and Standards (WELS). WELS is Australia's water efficiency labelling scheme that requires certain products to be registered and labelled with their water efficiency.

wings
Areas on stage left and right of the proscenium opening edge not in direct view of the audience. The wings are used as a space for actors or scenery waiting to go on stage.

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Authorised and published by:
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Level 31, 121 Exhibition Street
Melbourne 3000

Developed by: Arup Australia Pty Limited, Sydney

If you would like to receive this publication in an accessible format, contact us on:
T: 03 8683 3100
E: creative.places@creative.vic.gov.au
ISBN: 978-1-76090-511-8
creative.vic.gov.au