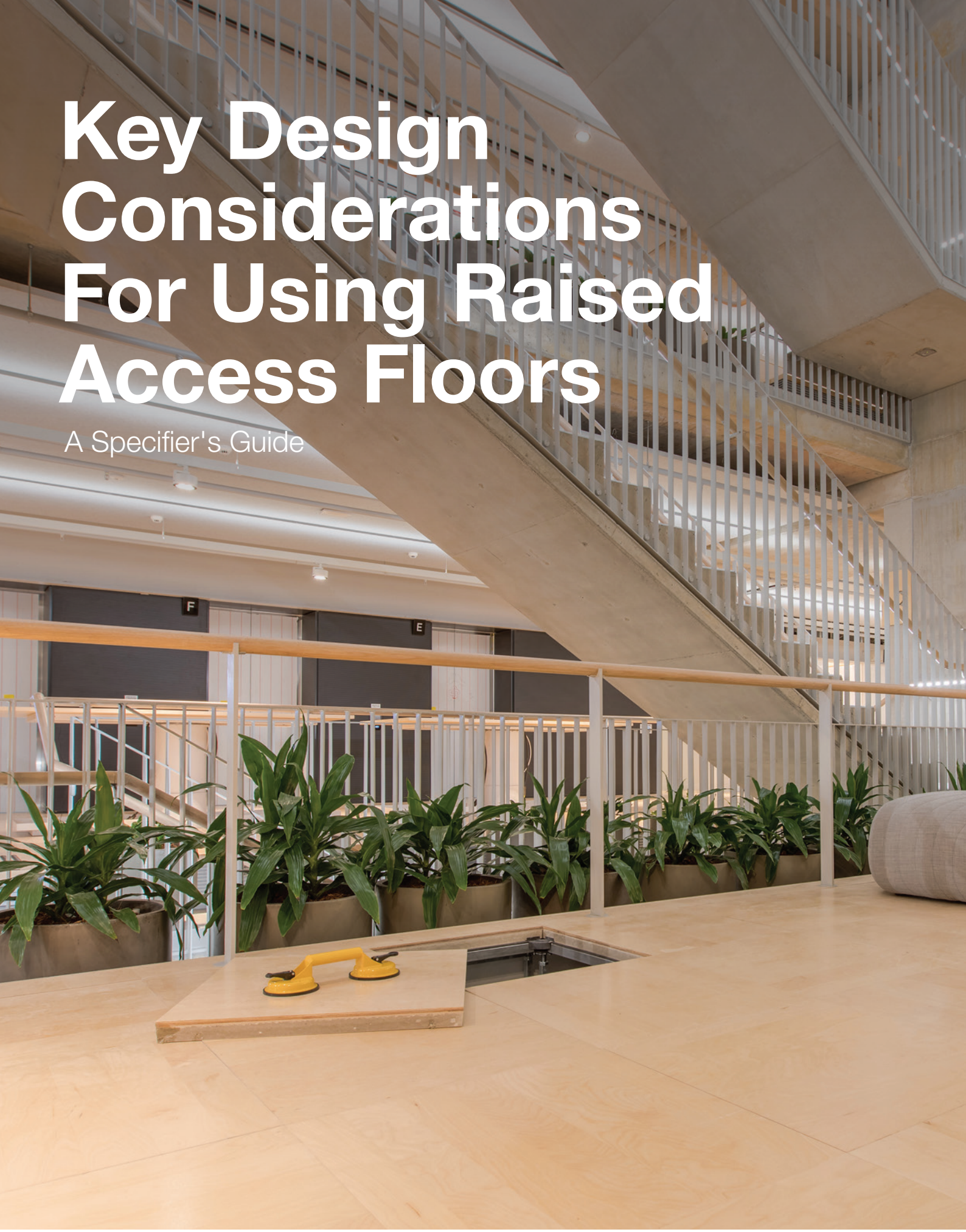
Key Design Considerations For Using Raised Access Floors

A Specifier's Guide



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Introduction

A **raised access floor** refers to an elevated structural floor above a solid substrate with a hidden access area between the two. This access area allows the passage of a variety of services, including cabling for data and telecommunications, electrical power, water supply and drainage, HVAC (heating, ventilation and air-conditioning) systems, and cabling for environmental controls, fire detection and security.

Raised access floors are commonly used where the building owner wants to achieve a clean aesthetic and an easily configurable space at reasonable cost. Removable floor panels enable easy access and maintenance in the underfloor services area. The accessible space also allows the indoor environment above to be reconfigured or refurbished with minimal disruption.

In some applications, the floor void can be used as a plenum to distribute conditioned air to the spaces above. Floor plenums are air compartments that form part of the ventilation of the building. A raised floor can be designed to provide ventilation air through floor diffusers directly to the occupied environment above. According to research on thermal behavior in commercial buildings, a raised floor can reduce the cooling load by as much as 40 percent.[1]

Given their architectural benefits, it is important for designers and specifiers to understand the key considerations when designing and specifying a raised access floor to meet the requirements of property owners and occupants.

Components and Structure

Raised floors have become a go-to solution for spaces that have a high demand for information and communications infrastructure.[2] The standard components of a raised access floor are as follows:[3]

- **Pedestals.** A raised access floor is supported by pedestals, which are a vertical support structure for the floor above.
- **Framework.** Pedestals are connected using stringer bars to form a framework that provides further support and horizontal stability.
- **Floor panels.** Floor panels are used to create the flat floor surface and can be installed in a variety of ways, from gravity or loose-lay systems to systems in which panels are screwed or locked in place.
- **Floor finish or covering.** Tiling, carpet or other coverings are overlaid on the floor surface. Where the finish inhibits accessibility, access to the floor void is provided through access hatches. These are floor panels and coverings that can be lifted and replaced.
- **Floor boxes.** These are spaces cut into floor panels that allow services to penetrate through the floor and provide connection points for electrical supplies and telecommunication services.

Design Objectives

The design objectives of a raised access floor will inform its features, structure and composition. In brief, raised access floors are commonly intended to achieve the following depending on the application:

- **Integrated services.** The design should provide space for required services to the occupied area above, including piping, cabling and ducting.
- **Adaptability.** The design should be able to respond quickly to organisational and technological changes undertaken by the building owner or occupant.
- **Indoor environment quality.** Raised access floors are often a critical component in maintaining the indoor environment through specification of underfloor air distribution systems and acoustic insulation.
- **Energy efficiency.** A well-designed access flooring system can integrate efficient cooling systems and better airflow to reduce energy consumption.
- **Durability.** Floors should be specified with fit-for-purpose materials and coverings for durability and comfort.
- **Maintenance access.** Raised access floors should provide the appropriate access to the floor avoid so that staff can conduct regular maintenance and upgrades safely and easily.
- **Ease of installation.** Underfloor services are typically cheaper and easier to install than those mounted within a ceiling grid.

Key Design Considerations

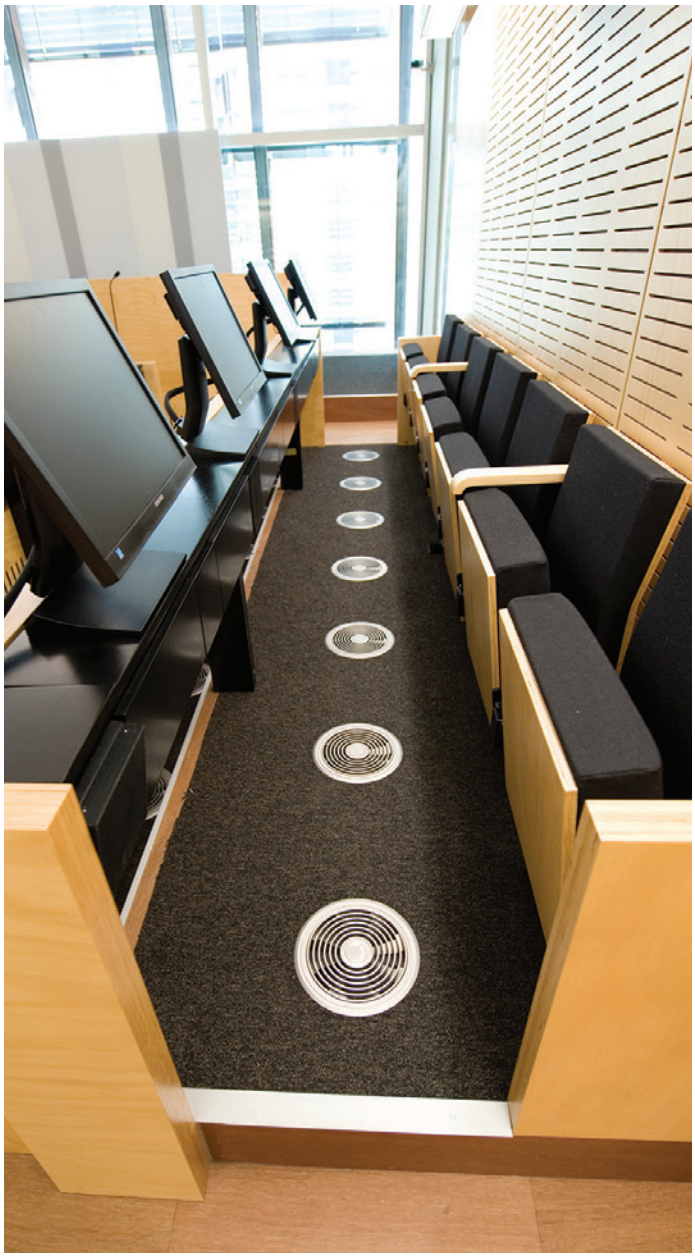
Use, Application and Install Environment

The first consideration when designing a raised access floor is understanding what the floor will be used for. Whether it will be used primarily to store data and communication systems, for integrating HVAC services or as a plenum, each potential use will impact the final floor design.

Each install environment and application will have its own priorities and design requirements. For example, commercial office spaces will generally experience moderate to high foot traffic and are focused on delivering flexible environments that can be adapted quickly and are conducive to comfort and productivity. Meanwhile, educational spaces will have elevated requirements for indoor environment quality to support learning outcomes.

Data and computer rooms are among the most common applications for raised access floors. Floor design in this context will typically focus on enabling appropriate cooling and airflow, providing sufficient space for services and cabling, and providing sufficient flexibility to meet future needs. These spaces may also have special requirements for air conductivity and electrostatic control to protect electrical and IT equipment from damage.

Any foreseeable changes to how the space will be used should be factored into the floor design. For example, if the building owner foresees that a small computer room may be converted into a heavy duty equipment data room in the future, the access floor must be able to accommodate elevated requirements for load capacity, cabling, temperature control and so on.



Understanding Load Capacity and Tolerances

Definitions

Load capacity refers to the amount of weight a flooring system can safely bear. The proposed application and use of the space will give designers and specifiers an indication on levels of foot traffic, the type and weight of equipment that will be placed or rolled on the floor, and the type of furniture that the floor must support. These factors will determine the required load capacity of the access floor panels and understructure.

To determine load tolerances and capacity, you will need to understand the types of loads the floor system will be subjected to. Load types are described below:

- **Concentrated load.** Loads applied to a small area typically imposed by stationary furniture and furniture with legs. Testing for concentrated loads involves a 25x25mm load applied onto the surface of the panel at its weakest point.
- **Ultimate load.** To determine ultimate load, a concentrated load is applied to the surface of the panel then increased until the panel reaches structural failure. The ultimate load is sometimes expressed as the floor's "safety factor" (calculated as a multiple of the concreated load). A safety factor of two is generally recommended.
- **Impact load.** Testing for impact load will look at the maximum load that can be dropped on the floor without damaging the system.
- **Rolling load.** Rolling loads refer to the load imposed by equipment on wheels moving across the floor. Considerations include the number of passes, size and hardness of the wheel, and the combined weight of the cart and its contents on each wheel.
- **Uniform load.** These are loads typically imposed by furniture and equipment that sit evenly flat on the floor. Uniform load is usually specified in Newtons per square metre.

If heavy loads are anticipated, designers and specifiers can choose a panel with a higher load rating, or consider additional pedestals or the use of spreader plates, to accommodate the extra load.

Understructure Loads

The floor's understructure (pedestals and framework) is a major supporting element. The following loads must be considered in the design of the understructure:

- **Overturning movement.** This refers to a lateral load applied to the pedestal due to rolling load traffic and underfloor work due to cable installations. The pedestal's ability to resist such loads is determined by the attachment method to the structural slab, size and thickness of the baseplate and pedestal tube size.
- **Axial load.** Axial loads are vertical loads applied to the centre of the pedestal from the floor above.
- **Seismic load.** Seismic loads are the vertical and horizontal loads typically caused by earthquake movement.

Load Testing and Relevant Standards

Designers and specifiers must select raised access flooring systems that support the above loads to the required limits for their specific application. The load capacity of different flooring systems should be tested and verified against the relevant industry standards.

In Australia, access floor panels and pedestals should be tested to the requirements of AS 4154:1993 "General access floors (elevated floors)". This Standard refers to the testing methods for access floors set out in the AS 4155 series, which includes tests for concentrated, ultimate, impact and rolling loads as well as loads applied to pedestals.

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Floor Panel Selection

Access floor panels will come in various materials and thicknesses. Panels are typically made of steel-encased cementitious compound, wood or calcium sulphate. Floor panel type selection will be dependent on various factors such as the location of the access floor, what will be placed on the floor and what loads the floor will experience. Other considerations such as durability, air leakage, acoustics and structural requirements will also impact panel selection.

Floor panels may be installed in two ways: screw fixed or gravity fixed. Screw-fixed panels are best used when overlaying floor covering, such as tile or stone, to minimise movement in the panel. Gravity-fixed panels are supported by all four sides by a stringer and held in place by their weight. This method allows for quick access to the floor void by simply lifting the panel.

Floor Finishes

Floor finishes come in a range of styles and materials. There are factory-applied finishes such as high pressure laminate, vinyl, timber, terrazzo and porcelain tiles. Carpet, sheet vinyl, stone, tiles and timber finishes may also be applied onsite over the top of the access floor. Floor coverings with static-dissipative or static-conductive properties may be required for computer and data rooms to protect equipment.

The type of floor finish will help determine which raised access floor system is best suited for the proposed application. Building movement can affect flooring systems, causing deflection and stress in access floors. Such conditions can cause tiling and stone finishes to crack. Specific raised flooring systems have been designed to address this problem by disseminating load transference through the system to minimise stress and deflection within the system.

Acoustic Rating

Access floors can be specified with an acoustic barrier to meet specific acoustic requirements. When specifying a raised access floor for acoustic applications, ensure the system has been subject to performance testing under the relevant Australian standards including AS/NZ ISO 717.1:2004 “Rating of sound insulation in buildings and of building elements - Airborne Sound Insulation” and AS/NZ ISO 717.2:2004 “Rating of sound insulation in buildings and of building elements - Impact Sound Insulation”.

Fire Resistance

The National Construction Code requires building elements to meet stringent fire resistance requirements. The flooring system must meet the fire performance requirements for the proposed application, building class and type of construction. There are several Australian and International standards that are applicable, including the AS ISO 9239 series “Reaction to fire tests for floorings.”

Plenum Airtightness

If the underfloor space is being used as a plenum as part of the building’s ventilation system, the airtightness of the floor system is a key consideration. Specific raised flooring systems have been designed to address this requirement.

Unique and Versatile Raised Flooring Solutions

ASP Access Flooring

With over 20 years' experience, ASP Access Floors are a leading global company in the access flooring industry. ASP Access Floors has developed and patented unique access floor designs which have been used in iconic commercial projects around the world. Ongoing research and development allows the company to produce innovative solutions that offer the market quality, versatility and infinite support.

ASP Access Floors has developed the **Access Floor Selector,** an online tool which helps architects and designers navigate to the flooring system that is best for their project. The Access Floor Selector helps architects, designers and specifiers find the system that meets the requirements of their proposed application with supporting guidelines and technical information that help take the guess work out of specification.

Each ASP flooring system has a specific application with features, benefits and properties to suit the demanding requirements of modern building projects. For example, the ASP Urban Interlock System has been designed for applications where stone or tile finishes are to be applied with a proprietary interlock system that is able to take great loads both static and dynamic. For changing technological and space-driven operations, the Concept + series modular design offers a balance of practical accessibility, functionality and design flexibility. The Icon Data range, with its static-dissipative finishing, provides the ideal system for data centres, communication rooms, theatres or other applications requiring electro-static discharge properties.

For assistance in selecting the ideal access floor for your next project, visit **https://www.aspfloors.com.au/access-floor-selector**

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References

1 Schiavon, Stefano, Kwang Ho Lee, Fred Bauman and Tom Webster. “Influence of raised floor on zone design cooling load in commercial buildings.” UC Berkeley: Center for the Built Environment. https://escholarship.org/uc/item/7bf4g0k1 (accessed 4 August 2021).

2 Designing Buildings Ltd. “Raised floor.” Designing Buildings Wiki. https://www.designingbuildings.co.uk/wiki/Raised_floor (accessed 4 August 2021).

3 Ibid.

All information provided correct as of August 2021.

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