Spaces for Healing

Design Considerations for Walls & Ceilings in Healthcare Environments

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INTRODUCTION

A growing body of research demonstrates that patient outcomes are significantly influenced by the physical setting and environmental quality of a healthcare facility.[1] Medical professionals make better decisions, the standard of care rises, and patients heal more quickly in a well-designed environment. In addition, it can reduce patient anxiety, lower blood pressure and shorten hospital stays. The importance of good design in healthcare cannot be overstated.

Healthcare buildings are complex spaces that incorporate high-level technology to fulfil a range of functions. An effective design integrates these functional requirements with the human needs of patients, visitors and staff. This is not to mention the complex set of regulations, codes and standards that must be adhered to when designing such buildings.

Every component of a healthcare building contributes to the quality of the interior environment. Building owners, facilities managers, healthcare architects and all others involved in the design process must consider how the materials used within the building shape the user experience, including the air quality, acoustic comfort, perceptions of safety and security, and even concerns about sustainability.

Below we discuss the key design considerations for modern healthcare environments, and some potential wall and ceiling solutions that can help you meet a variety of hospital design challenges.

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DESIGN OF HEALTHCARE FACILITIES

The current gold standard in healthcare design is an "evidence-based" methodology that puts the patient at the center of the design process and acknowledges patient responses to their physical environment. There is an increasing understanding that all the design elements in a building can contribute to a "healing environment" that can improve patient recovery and staff productivity – walls and ceilings are no exception.

When talking about the health and wellbeing of patients and staff, Indoor Environmental Quality (IEQ) is one of the most important considerations. IEQ encompasses a range of environmental conditions, including indoor air quality (IAQ), acoustics, lighting, thermal conditions and ergonomics, and the effects they have on building occupants. Effective IEQ strategies utilise a combination of design features, materials and other solutions to safeguard people's health, enhance their quality of life, lessen their stress levels, and avert potential accidents.

Like almost all other industries, healthcare design is subject to local, state, and federal laws and regulations. However, there are also standards that have been established by numerous associations, societies, and other stakeholder groups that architects and designers must be aware of. A list of the key reference materials is provided below:

- National Construction Code (NCC);
- Australian Standards;
- Australasian Health Facility Guidelines; and
- Association of Australasian Acoustical Consultants (AAAC) Guideline for Healthcare Facilities.

Note that there are also various state and territory building guidelines that may be applicable depending on your jurisdiction (e.g. the Western Australia Design Standard for Hospitals and Health Facilities).

INDOOR AIR QUALITY

A recent study has highlighted the need for better monitoring of indoor air quality as smoke, fungal spores, and chemicals used in certain paints, varnishes and cleaners can lead to poor indoor air quality, which can be more polluted then outside air.[2] As more people spend the majority of their time indoors, maintaining adequate indoor air quality is essential to our health and wellbeing.

The need for effective IAQ management in healthcare facilities is highlighted by the presence of vulnerable people who are more likely to suffer negative health effects. Particle board, carpets, and other building materials release volatile organic compounds (VOCs) into the air that can be inhaled by both patients and staff. Exposure to harmful VOCs can affect the invariably weakened immune systems of patients, and cause healthcare professionals to complain of headaches, fatigue, dryness, and eye and skin irritation.[3]

The materials we use to shelter and care for our patients can release chemicals into their airways that can lead to the illnesses we are trying to treat. To minimise such effects, the Green Building Council of Australia (GBCA) Green Star Rating Tools encourage product suppliers, designers, and specifiers to use certified low VOC-emitting materials and finishes.

FIRE SAFETY

Healthcare buildings are frequented by people with varying degrees of mobility spread out over large, expansive buildings thus making fire safety among the highest priorities in facility design. In order to contain the fire in manageable compartments and stop it from spreading in the unlikely event of a fire, passive fire protection must be built into the structure of the building. By creating compartments within a building and separating them from one another with fire-resistant walls, floors and ceilings, the spread of fire within the structure can be controlled.

In the NCC 2019, Specification C1.1 “Fire-Resisting Construction” and Specification C1.10 “Fire Hazard Properties” contain the essential fire performance requirements pertaining to internal wall and ceiling systems. Internal walls must meet a minimum Fire Resistance Level (FRL) in compliance with Specification C1.1. According to AS 1530.4:2014 “Fire-Resistance Tests for Construction”, the FRL of a building element is calculated and expressed as intervals of 30 minutes for each relevant criterion (structural adequacy/integrity/insulation).

A wall or ceiling lining system must adhere to Specification C1.10’s Group number requirements, which are listed in Table 3 of that provision. Fire tests in accordance with AS 5637.1:2015 “Wall & Ceiling Fire Hazard Properties” are used to determine the requirements for each Group number.

The requirements for fire compartment and separation are found in Clause C2.5 of the NCC, which deals specifically with Class 9a (health care) and Class 9c (aged care) buildings or facilities. This provision provides the required compartment sizes in a healthcare building, as well as FRL requirements and other design specifications. For example, ward areas, where the floor area exceeds 1000m2, must be divided into floor areas not more than 1000m2 by walls with an FRL of not less than 60/60/60.

With respect to healthcare and residential care buildings, Specification C2.5 prescribe construction requirements for smoke-proof walls required by Clause C2.5 in healthcare and residential care buildings. Among its provisions, this Specification requires that smoke-proof walls in such buildings must be non-combustible and extend to the underside of the floor above, or a non-combustible roof covering, or a ceiling having a resistance to the incipient spread of fire to the space above itself of not less than 60 minutes.

DURABILITY

Due to the nature of healthcare facilities, the majority of spaces are subject to heavy use, which can cause serious interior damage to walls. Due to the greater movement of mobile equipment in corridors, damage is typically more severe and so walls will generally require greater protection. In addition, tears, dents, and cracks in walls and ceilings can harbour dirt and bacteria, which can spread disease and also increase maintenance and cleaning costs.

The durability of wall and ceiling materials is a key consideration in high-traffic areas such as hospitals. Designers should consider impact-resistant wall sheets or panel protection systems. Leading products will have undergone impact resistance testing to confirm their ability to withstand impact damage.

In Specification C1.8, the NCC describes structural tests to be applied to and criteria to be satisfied by a wall system of lightweight construction. These tests include:

- **Material tests** — The methods specified for the constituent materials of the construction of the standards adopted by reference in the NCC.
- **Resistance to static pressure*** — The provisions for testing walls under transverse load in ASTM E72-15.
- **Resistance to impact*** — The soft body impact test in ASTM E695-03.
- **Resistance to surface indentation** — The test for resistance to surface indentation described in Clause 5(d) in Specification C1.8.

*Note that for the static pressure and impact tests, the NCC prescribes changes to the ASTM test methods.

In addition to NCC structural tests, ASTM C1629 establishes classifications of abuse resistance based on the abrasion resistance and impact resistance performance of plasterboard. Along with surface abrasion, surface indentation and soft-body impact testing, ASTM C1629 includes requirements for the hard body impact test, which measures the ability of a plasterboard to withstand the impact of a hard object such as a hammer. These tests provide a way of comparing the expected performance of different brands of impact-resistant plasterboard.

Along with higher-performing materials, the proper placement of crash rails and handrails, and the ideal height for corner guards should all be considered when choosing the appropriate impact protection. Other factors that may be considered when choosing materials include ease of cleaning, retention of appearance over time, and any requirements for infection control.

ACOUSTICS

Numerous studies show that patients are adversely affected by excess noise while they are hospitalised. The findings of these studies demonstrate how noise exposure affects a variety of physiological and psychological processes, including speech processing, sleep quality, and more.[4] Conversely, research has established that a good acoustic environment is advantageous to the patient's therapeutic and healing process.[5]

Hospital staff can suffer negative effects from internal noise levels as well. Consequences include increased levels of stress and fatigue, poor job performance, hearing damage from loud noises, general annoyance, and a higher rate of job burnout.[6]

It is recommended that the acoustic performance of walls and ceilings is considered in the early design stages of healthcare facilities. The walls, roofs and ceilings services of the building must incorporate solutions to control reverberation, maintain acoustic separation between rooms and minimise the effects of internal and external noise. Refer to the AAAC Guideline for Healthcare Facilities for more detailed requirements.[7]

Speech privacy is especially important in the healthcare context. Patients are aware that if they hear conversations happening in adjacent spaces, others will be able to hear them as well. This may lead to patients withholding vital medical information if they feel they will be overheard.3

Designers should consider the application of flanking path treatments to improve acoustic separation between consultation rooms. Flanking sounds reach adjoining areas by indirect paths, rather than through the dividing element. The primary pathways for flanking sounds are the components and cavities of the surrounding walls, floors, and ceilings. Careful detailing and construction of the junction between elements is needed to eliminate or minimise flanking.

SUSTAINABILITY

Every single element that goes into creating a building, from the raw materials to its structural design, has a sizable impact on the health of its occupants and the surrounding environment. Several factors should be considered when assessing the sustainability of building products, including its lifespan, embodied emissions, lifecycle energy consumption, resource use and recycling potential.

Plasterboard is a highly sustainable product because nearly all of it is recyclable after use. The paper is often made of high recycled content. The plasterboard industry also promotes greater recycling through supporting various recycling programs and focusing on resource efficiency in their manufacturing operations. Furthermore, plasterboard is a lightweight building material that lowers transportation expenses, emissions, and overall building weight.

BUILDING SOLUTIONS FOR HEALTHCARE FACILITIES

CSR Gyprock

CSR Gyprock is the leading brand of plasterboard in Australia with a comprehensive range of plasterboard, compounds, cornices and associated finishing products. The company's product range offers a selection of lightweight, high-performance building systems to meet a variety of hospital design challenges, tested and proven by CSR's unparalleled technical support

The EC08™ Range ticks all the boxes

Gyprock EC08™ was the first plasterboard in Australia to be manufactured with high levels of recycled content. Selected waste by-products, such as fly ash, from other industries that would otherwise be sent to landfill are included in the manufacturing process. While being an environmentally responsible initiative, these materials also assist in boosting product performance attributes.

The GECA-certified EC08™ range has expanded to include application specific plasterboards that target the higher performance needs of commercial wall, ceiling and shaft systems. All boards in the EC08 range contain high levels of recycled content and are manufactured to AS/NZS 2588:2018 "Gypsum Plasterboard". Their low VOC emissions make them an ideal choice for applications where maintaining high levels of indoor air quality is important.

The ultimate plasterboard that is designed to meet the highest standards across a broad range of performance requirements, EC08 Complete is manufactured with a dense, fibre-reinforced core and is specially formulated to provide superior performance and durability. With a Group 1 fire rating and up to a 2-hour fire rating, EC08 Complete can be used as part of a fire-rated system. In addition, its mould, impact, acoustic and moisture resistance properties make it an excellent and versatile choice for a range of applications within a healthcare facility.

Launching soon, EC08 Extreme will offer even greater levels of durability. It is suitable for healthcare environments, especially hospitals and mental health facilities where extreme impact resistance is a necessity. Testing conducted by Gyprock has shown that EC08 Extreme delivers double the hard body impact resistance of our already high performing EC08 Complete, making it easily the highest performing multi-function plasterboard in the Gyprock range for hard body impact resistance.

Gyprock Ultra-Base MR 60 & Ultra-Top

Both GECA-certified compounds, **Gyprock Ultra-Base MR 60** and **Ultra-Top** provide the perfect complement to the EC08 range. Gyprock Ultra-Base MR 60 is a setting type base coat formulation with a working life of approximately 60 minutes from application. It is a low-VOC dry powder compound manufactured to stringent product specifications. Its lightweight formulation is ultra-easy to apply, and it offers enhanced moisture and mould resistance.

Ultra-Top is a lightweight, low-VOC topping compound used as the final coat in a three-coat jointing system. It has been formulated to offer superior coverage and its ultra-light and creamy consistency makes mixing and application simple with effortless sanding for an ultra-smooth finish.

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References

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6 ScienceDaily. "Rise In Hospital Noise Poses Problems For Patients And Staff." Science Daily. https://www.sciencedaily.com/releases/2005/11/051121101949.htm (accessed 1 November 2022).

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