



HEALTHY BY DESIGN: CREATING BETTER INDOOR ENVIRONMENTS

Forbo Flooring Systems



INTRODUCTION

HEALTHY BUILDINGS

FACT

Many of us are spending most of our time indoors¹.

The quality of these indoor environments has a significant bearing on human health and performance in any setting – be it industrial, commercial, public or healthcare.

A building's ability to either promote or harm the health of its users can have both direct and far-reaching economical and societal impacts, affecting anything from an organisation's safety performance and absenteeism levels to individuals' psychological wellbeing and healthcare expenses.

This whitepaper examines the role of architecture and design in promoting and sustaining health, and how deliberate design choices can make a positive contribution to the quality of an indoor environment.

¹ European Environment Agency 2019, *Indoor air quality*, <https://www.eea.europa.eu/signals/signals-2013/articles/indoor-air-quality>





BARRIERS TO HEALTH

FACT

There are a number of dimensions to a building and indoor environment that can help or hinder health and wellbeing.

We address some (but not all) of the major challenges here, categorised under the headers air, hygiene & safety, sensory physiology, comfort & design and lifestyle & community.

Air

Indoor air quality is of major concern given how vital air is to sustaining life and the amount of time we spend indoors. Indoor air quality is affected from the inside out and

from the outside in. Proper ventilation is important to let out carbon dioxide being exhaled by the people inside a building, along with any indoor sources of contaminants or odours, whilst good filtration is required to cleanse incoming air of pollutants.

Poor ventilation is thought to be a cause of a Sick Building Syndrome (SBS).

SBS is an imprecise term used to describe those buildings in which there is a prevalence of a range of symptoms causing discomfort and a sense of being unwell rather than a distinct illness. There is a particularly high incidence in certain types of buildings, especially offices which are sealed and mechanically ventilated or air-conditioned.²

Another contributor to SBS, along with a host of specific conditions, are chemical emissions from manmade materials that can be found indoors; specifically, what are known as volatile organic compounds (VOCs). VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors.

'VOCs comprise volatile hydrocarbons and other organic molecules released into the atmosphere.'³ Other harmful chemicals could be found in flame retardants, stain repellents and plasticisers⁴ used on building materials and everyday consumer products, such as paints, cleaning products and printers, personal care products and air fresheners. Such indoor air pollutants have been associated with a myriad of health conditions: from minor irritation to the airways, to cancers.

Hygiene & safety

Hygiene and safety belong high up on the agenda for any building. In some environments, they are crucial. In healthcare, manufacturing and technology sectors, for example operating theatres and clean rooms require specialist materials that meet very stringent standards of safety and cleanliness.

Clean rooms are designed to maintain extremely low levels of particulates, such as



dust, airborne organisms, or vaporised particles. Clean rooms typically have a cleanliness level quantified by the number of particles per cubic meter at a predetermined molecule measure.

Even in an office or school setting, regular household dust can be particularly problematic to many people: 'Dust acts as a reservoir for a variety of harmful agents – outdoor particles that penetrate indoors, viruses, bacteria, chemicals, allergens (pets, mites, mould spores, pollen), building materials, dander, fabric fibres and flakes of paint with lead.'⁵ 'Carpets on concrete floors can trap moisture allowing dust mites and mould spores to thrive.'⁶

² Health and Safety Executive, 1992, *Sick Building Syndrome: Guidance for specialist inspectors*

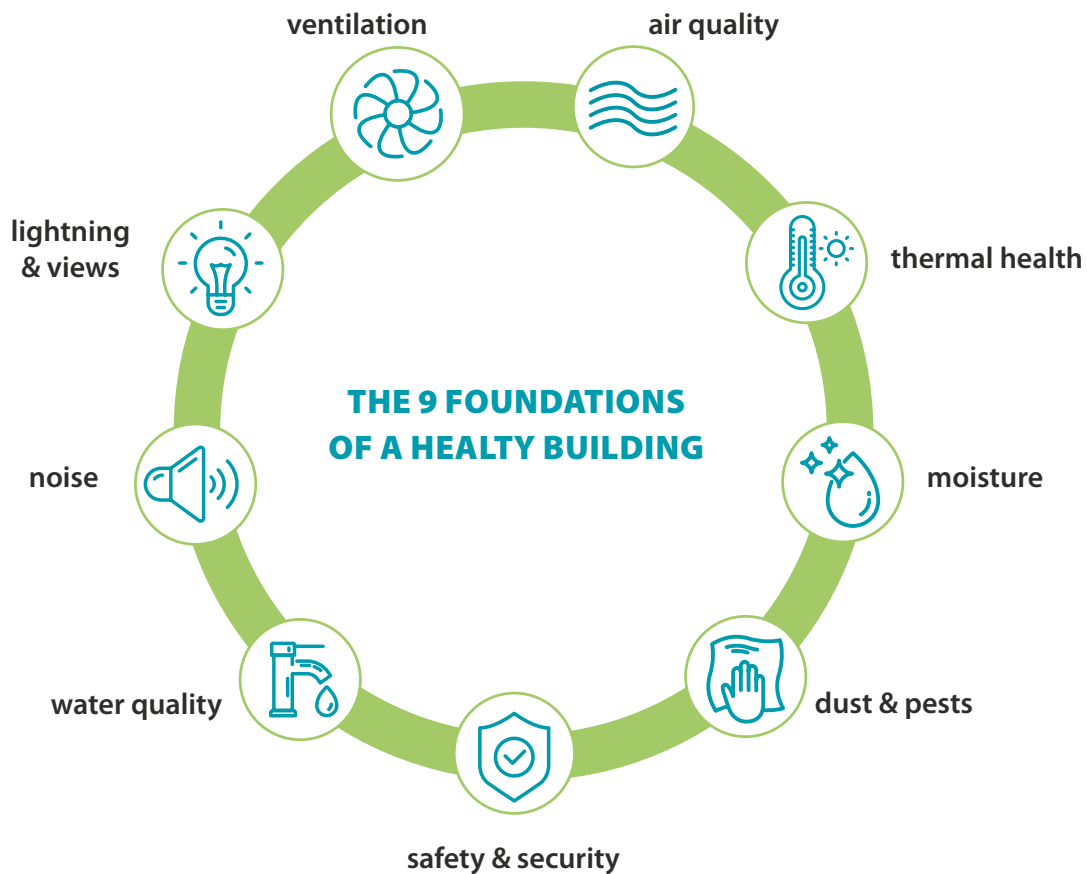
https://www.hse.gov.uk/foi/internalops/ocs/300-399/oc311_2.htm

³ Air Pollution Information System, *Volatile organic compounds (VOCs)*, http://www.apis.ac.uk/overview/pollutants/overview_VOCs.htm

⁴ Harvard T.H. Chan School of Public Health 2017, *The 9 Foundations of a Healthy Building*, p.12, <https://9foundationsforhealth.org/>

⁵ Harvard T.H. Chan School of Public Health, op. cit., p.21

⁶ Allergy UK 2012, *Work Fever: A report by Allergy UK into allergies in the workplace*, p.11, <insert web link>



Sensory physiology

The sights, sounds and light in a building all contribute to stress or vitality levels of users in a building.

Light not only enables us to see; it also governs our circadian rhythms - our natural body clock. Light tells us when to switch on, and when to switch off, affecting more than the duration and quality of our sleep alone, but many other physiological functions as well, including hormone regulation, metabolism and mood. As such, the lighting in a building has a significant role to play in promoting and maintaining health. Not all light is equal, however. The intensity and spectrum of light

can in fact be manipulated⁷ to maximise health and performance.

According to the World Health Organization, 'noise-induced annoyance may be considered an adverse effect on health.'⁸ Noise annoyance can cause psychological stress and irritation, particularly in a situation that requires concentration – such as at work and in any learning environment. The source of the noise disturbance may be colleagues or other building users, or machinery and equipment, such as printers, lifts, etc. Many modern office layouts are open plan, which represents a design challenge in the context of unwanted noise disturbance.

Comfort & design

The way an interior is designed has a powerful influence over a person's or group of people's experience of and in a space. When a

⁷ Harvard T.H. Chan School of Public Health, op. cit., p.33,

⁸ World Health Organization 2011, *Burden of disease from environmental noise*
Quantification of healthy life years lost in Europe, p. 91,
https://www.who.int/quantifying_ehimpacts/publications/e94888.pdf?ua=1

school is fresh and bright, it inspires learning; when a care home looks homely, its residents will feel at home.

Beyond the primary needs of feeling safe and secure in a place, design can be used to cultivate a certain feeling or ambience. In partnership with Senta Sensory Consulting (NL) in 2018, Forbo Flooring conducted a study on the sensory experience of indoor spaces furnished with a variety of interior materials and attributes. People were asked to experience four different room sets in the same building. All rooms were identical in their architecture, size and access to natural lighting, but each was furnished with a different type of floor covering and features. The tests measured participants' brain activity when in the different environments. The research revealed that the type of floor covering used has a high effect on the way the atmosphere and quality of an interior space is experienced.

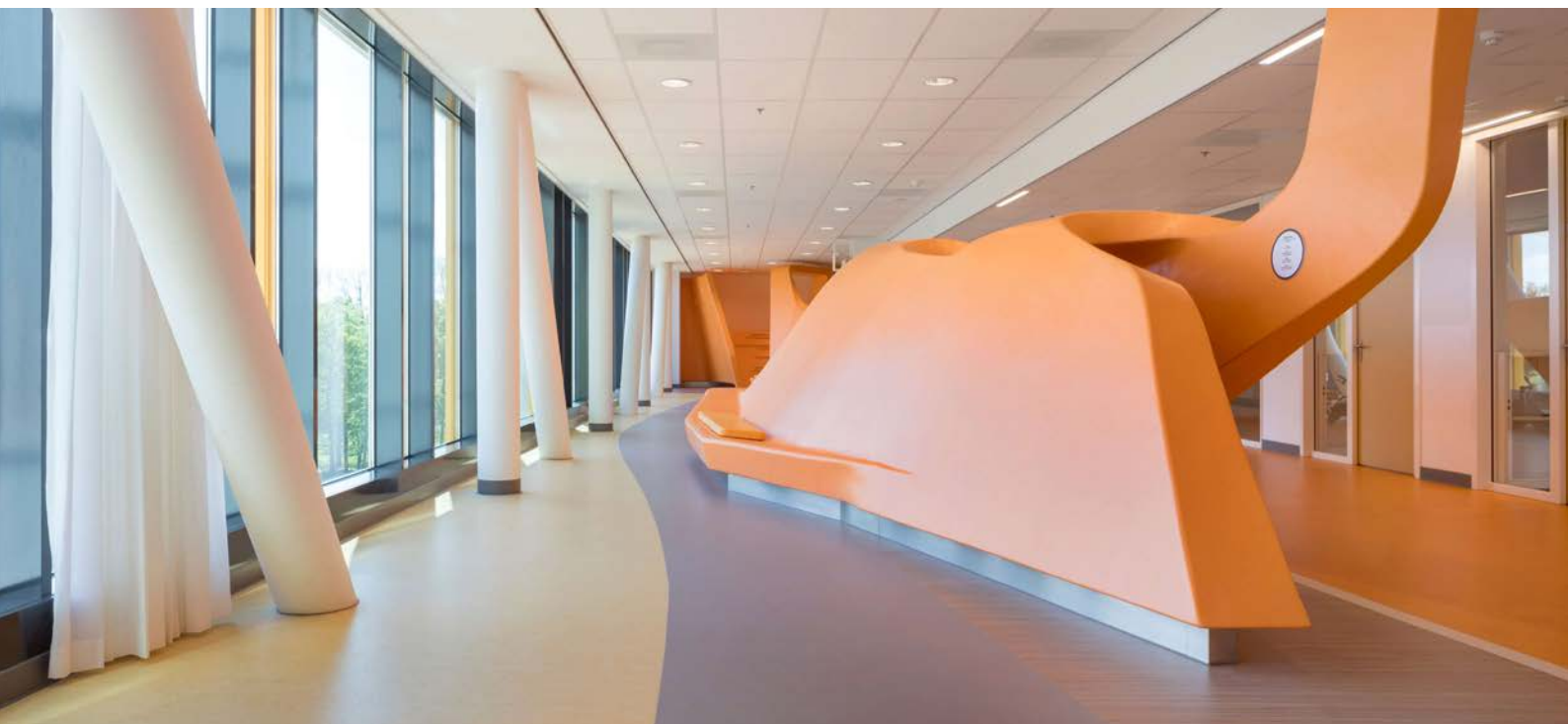
[see video](#)

Lifestyle & community

A healthy building is one that promotes healthful habits, of which physical movement is one. A sedentary lifestyle brings with it clear health risks. 'Sedentary behaviour is an independent risk factor to physical inactivity, meaning that even individuals who are sufficiently active at the recommended levels are at increased risk if they spend large amounts of time sitting.'⁹ Frequent breaks from sitting are thus necessary and should be encouraged in order to maintain health and wellbeing.

Besides physical activity, humans also need social stimulus. Humans are social creatures, and in an age in which loneliness has become an epidemic, interpersonal relationships and a sense of belonging are more important than ever.

⁹ British Heart Foundation 2017, *Physical inactivity and sedentary behaviour report 2017*, p.5, <https://www.bhf.org.uk/informationsupport/publications/statistics/physical-inactivity-report-2017>





HEALTHY BUILDINGS BLUEPRINT

FACT

Careful design and selection of materials can go a long way.

The careful selection and application of materials can go a long way in helping mitigate some of the risks present in buildings outlined above.

The health and wellbeing needs of an individual building's intended occupants / visitors should first be carefully analysed as part of the design and procurement process. Only then can decisions be made on the most appropriate and health-promoting design materials to be used.

Third-party credentials - such as certifications from sustainability and wellbeing assessment methods, BREEAM and WELL - can help guide healthy choices and provide further confirmation of sustainability and human health interests.

Air

Proper ventilation and well maintained air-conditioning and filtering systems will help fresh air flow in and stale air flow out of a building.

Indoor air quality can be enhanced through avoidance of materials and furnishings containing high levels of harmful VOCs and other chemicals that can leach out into the air. Opting instead for those with low emissions and for natural materials will help address indoor air quality. Certain indoor plants have also shown to play a major role in removal of organic chemicals from indoor air.¹⁰ Examples are sansevieria and peace lilies.

¹⁰ NASA 1989, *A study of interior landscape plants for indoor air pollution abatement*, accessed from

https://archive.org/details/nasa_techdoc_19930072988/page/n11/mode/2up

Using products that are EN 14041 REACH-certified will offer a level of assurance that the relevant EU requirements in relation to chemical substances have been met.

Hygiene & safety

The accumulation of dirt and dust in a building should be minimised or better still, kept out of the building altogether through the introduction of easy-to-clean barrier mats, for instance.

Ideally, surfaces will be free from dust and dirt-trapping grooves or cavities, easy to keep clean with minimal chemical detergents and resilient enough to withstand regular cleaning regimes.

Natural bacteriostatic linoleum floors, for example, offer a solution in buildings where risk of infection and contamination are higher, such as hospital wards and childcare institutions, whilst solid flooring in general offers greater protection from allergens such as dust mites. Products that carry the Allergy UK Seal of Approval, such as Marmoleum - which is proven to have a closed surface that naturally inhibits the growth of bacteria - have undergone rigorous scientific testing to this end.

Slip and trip hazards can also be avoided with specially designed anti-slip surfaces. To improve safety in wet rooms, it is wise to install slip-resistant flooring with unique Step Anti slip additives, which offer excellent non-slip properties.

Sensory physiology

Optimal application of lighting for health within a building can be achieved by maximising daylight exposure. Windows and views to the outside have also been positively corre-



lated to wellbeing.¹¹ Electric lighting should be fit for purpose in terms of spectrum and intensity required for the task in hand.

Selecting interior colours and coverings with a high light reflectance value (LRV) can also maximise levels of light present and brighten a space. The LRV of a flooring indicates how much light it reflects. Designers can use this value to ensure that an area has the perfect light condition for its intended purpose. In some cases, LRV contrast are in fact required for demarcating specific spaces or transitions between flooring. There are specified in local or regional regulations.

Creating dedicated quiet spaces in an office building, for example, and blocking out as much external noise as possible will be protective against noise annoyance. The acoustics and sound-dampening qualities of coverings

¹¹ Dreyer BC, Coulombe S, Whitney S, Riemer M, Labbé D, 'Beyond Exposure to Outdoor Nature: Exploration of the Benefits of a Green Building's Indoor Environment on Wellbeing', *Frontiers of Psychology*, 2018 Aug 30;9:1583. doi: 10.3389/fpsyg.2018.01583. eCollection 2018, accessed from <https://www.ncbi.nlm.nih.gov/pubmed/30214420>

and materials should also be considered. Some manufacturers offer both soft and hard flooring options with lower dB values thanks to special backings and insulating layers.

Comfort & design

The power of design can be put to good use to create health-promoting indoor spaces, quite literally setting the tone for a person's visit to or stay at a building.

Aligning users' needs with design features and attributes that enhance safety, ease and comfort within a building will reduce stress, lead to a greater sense of wellbeing and introduce a 'feel-good' factor. Certain populations in particular can benefit from functional design choices, such as dementia patients who find navigating their environment easier if the flooring is unfussy, and contrasts between floor and wall distinct.

Lifestyle & community

A healthy building encourages users to be as mobile and physically active as possible throughout the day. Stairs or walking routes should be within sight or reach and feel inviting. Access to attractive outside spaces will also encourage occupants to get fresh air and sun-

light, as well as getting the screen breaks that are necessary for maintaining eye health.

A building designed for health can offer space for connection and community.

In the workplace and at schools, design should incorporate recreational areas that facilitate interaction and community among colleagues and pupils respectively, as well as features and furnishings that offer opportunity to rest and recharge.

Conclusion

Although the challenges to achieving an indoor environment that supports optimal health in the modern day are multiple and widespread, there are many aspects of a building's design that, when carefully considered from the perspective of health, wellbeing and the environment, have been proven to have a tangible and positive impact.

Whilst an amount of due diligence and research on the part of the designer or architect may be necessary, it is for manufacturers to offer complete and transparent information on their products, in order that choices be made that serve the best interests of human health and potential.



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