Expert Knowledge, Innovative Thinking

# Urban Insight

## Healthy buildings, cities and you

### How to design future living environments

Allerød, Denmark. Visualisation: Omega Render, Sweco Architects

SWECO

Urban Insight

# Healthy buildings, cities and you

## How to design future living environments

Contents

## THE CITY AS A HEALTH INCUBATOR

The city as a health incubator can be seen as a balance between three equally vital components: an inviting green city, healthy buildings and healthy lifestyles.


City as a health incubator

=

A sustainable living environment

+

Healthy buildings

+

Healthy lifestyles

# Introduction

The perceived environment and the climate affects people´s physical and mental health. More than 50% of the world's population live in urban areas and it is estimated that in the year 2050, this number will reach 70%.[1] The way we design and develop our cities is crucial for our health and well-being.

A significant part of the disease burden in Europe is still attributed to environmental pollution. Air and noise pollution are among the most significant environmental threats to health on the continent. Similarly, light pollution is not only a hazard to our environment and biodiversity but also to human health. At the same time obesity, stress anxiety and depression are increasing at a rapid rate in most of the EU member states.[2]

The risk of developing depression is 20% higher among city dwellers than among people living outside cities.[3] On the other hand, the city provides more options and solutions for healthy lifestyles, to move actively, to share resources and reduce impact on the living environment. Nature is a mechanism to help improve public health and well-being both mentally and physically, and it helps reduce both air and noise pollution.

The Covid-19 pandemic has greatly affected people's health and the way we live, work and communicate. It has raised awareness of people's physical health, mental health and how space and spatial conditions impact our lifestyle. There is a clear link between the state of the environment and the health of our population.[4]

The pandemic is a stark reminder of the complex links between the environment, our social systems and our health, both physical and mental.[5] We need to be aware of the importance of the way we design our future cities and buildings on improving the health and well-being of the people and addressing the climatological challenges that our living environments are facing.

How do the environment and human activities affect human health, both mental and physical? What can cities do to design urban areas and buildings in the future to help improve human health and happiness? What can we expect of the development of environmental pollution in the future? These are the questions this report seeks to answer. By looking at some of the important factors affecting our health – greenery, air, light, noise and movement – we can do much to incorporate health and well-being into urban living.

**DID YOU KNOW?**

## 90% of people's time

on average is spent indoors – by the time you are 80, you will have spent 72 years indoors.[6]

## If you live closer than 50 metres

to a green area, you will visit it between about 3–4 times a week, but if you live 1,000 metres from a green area you will only visit it approximately once a week.[7]

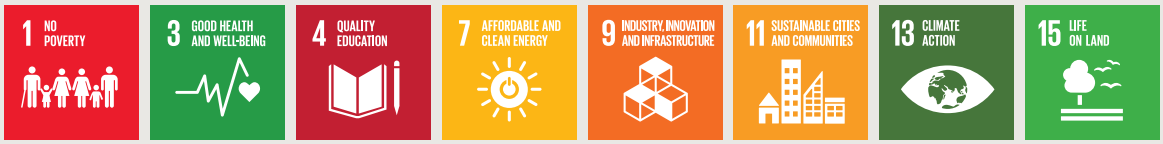
## More than 100 million

people in Europe alone suffer from harmful noise pollution levels.[8]

## 80% of the world's population

lives under light-polluted skies. Light pollution is known as a hazard to our environment and human health.[9]

This report support multiple UN Sustainable Development Goals, with a particular focus on:



# Greenery for well-being

Nature, plants and natural materials have a positive effect on human health and well-being.

Many European cities are already increasing the greening in cities, yet at the same time the number of inhabitants is rising. The greening is not happening fast enough.

In Europe, public space makes up between 2 and 15% of land in city centres. The WHO recommends a minimum amount of 9 $m^2$ of green open space per inhabitant.[10] While there are contradictions in how a city can define green space, many cities struggle to reach the recommended targets.[10] Therefore, there is an even greater need for cities to become more green and to design future public green spaces in a quality that accommodates the inhabitants' health and well-being.

People today spend up to 90% of their time indoors.[6] The way we design the indoor environment, using plants and open vistas onto green areas, is therefore vital to our health and well-being.

**BAKKEGÅRDEN, HOLSTEBRO KOMMUNE, DENMARK**
Location: Holstebro, Denmark
Designer: Sweco Architects Denmark
Cooperation: Arkitektfirmaet Bo Christensen
Client: Brunstad Kristne Menighed, Holstebro

Bakkegårdene is a new urban development project in Holstebro that represents Denmark's first circular district Bakkegårdene is a new, privately financed urban development project, which in terms of energy and resources is 100% part of its own cycle. The project contains more than 550 new homes and incorporates initiatives that contribute to the UN's global goals and supports sustainable development. The project strengthens the area's existing nature with a focus on biodiversity and quality of life for the area's residents. At the same time, small-scale food production is conceived as a resource and social hub.

# Designing for urban health means designing for people

Bas Horsting, architect and expert on healthy living environments, Sweco.

## NATURE AS AN INTEGRAL PART OF OUR CITIES

Many studies have shown that there is a connection between a person's proximity to nature and their mental health and well-being. If you live closer than 50 metres to a green area, you will visit a green area between about 3–4 times a week, but if you live 1,000 metres from a green area you will only visit it approximately once a week.[7] Not only do green areas positively impact our mental health – they also encourage physical activity, social contact and create spaces for physical and mental restitution, all of which can help lower the chances of developing more serious conditions like obesity, diabetes, cardiovascular disease and depression. These conditions represent large costs to society and threaten welfare due to the high cost of medical treatments. Designing more green areas thus brings a financial benefit.[11]

To plan for a healthy amount of urban greenery, the 3-30-300 rule was raised as a suggestion by Cecil Van Konijnendijk, professor in Urban Forestry at UBC: Everybody should be able to see 3 trees from their home, live in a neighbourhood with at least 30% tree canopy (or vegetation) cover, and be no more than 300 metres from the nearest green space that allows for multiple recreational activities.[12]

## PLANT-BASED INDOOR LIVING

Because we spend most of our time indoors, there are many benefits to having plants in an indoor environment. They increase the air quality, people's concentration, overall well-being and job satisfaction. Furthermore, plants can reduce irritation and stress. It is also found that the view can play a vital role in your daily well-being.

Several experiments indicate that the presence of plants has a positive effect on concentration, productivity and creativity.

Studies have indicated that the presence of plants in an office not only increases employee productivity but reduces absences due to sickness.[13]

**VÆKST, COPENHAGEN, DENMARK**
Location: Copenhagen SV
Designer: TRUST
Team: TRUST partnership: Enemærke & Petersen, Sweco Architects, Nøhr & Sigsgaard, Norconsult, DOMINIA, Lytt Architecture, Kragh & Berglund
Client: Københavns Kommune, ByK
Vizualisation: TRUST

**KING BOUDUIN PARK**
provides a large variety of species and diverse habitats with many options for natural play and encounters. This child-friendly design focuses on the future generation as they are the best indicators of a healthy city.

Location: Jette, Brussels, Belgium
Client: BIM Brussels Institute for the Environment
Cooperation: BUUR – ARA
Project lead: BUUR part of Sweco
Photographer: Stijn Bollaert

**GRØNTTORVET, COPENHAGEN, DENMARK**
In the urban area of the old Historic Market district of Copenhagen, a park is being created for the benefit of the residents. It will form the green heart of the district.

Location: Valby, Copenhagen, Denmark
Designer Buildings: Sweco Architects
Designer Landscape: WERK
Client: FB Gruppen A/S
Photo: Niels Nygaard

### A ROOM WITH A VIEW

It's not just indoor plants that bring health benefits. The view, too, can play a vital role in daily well-being. All the above-mentioned benefits can also be gained from having a view of a pleasant green environment. When people in their offices or children in a school have a view of green spaces, they exhibit significantly better performance.[14]

One study found that people who had a view of plants solved a test 19% faster than those who did not have a view of greenery.[15]

### GREEN QUALITY – NOT JUST QUANTITY

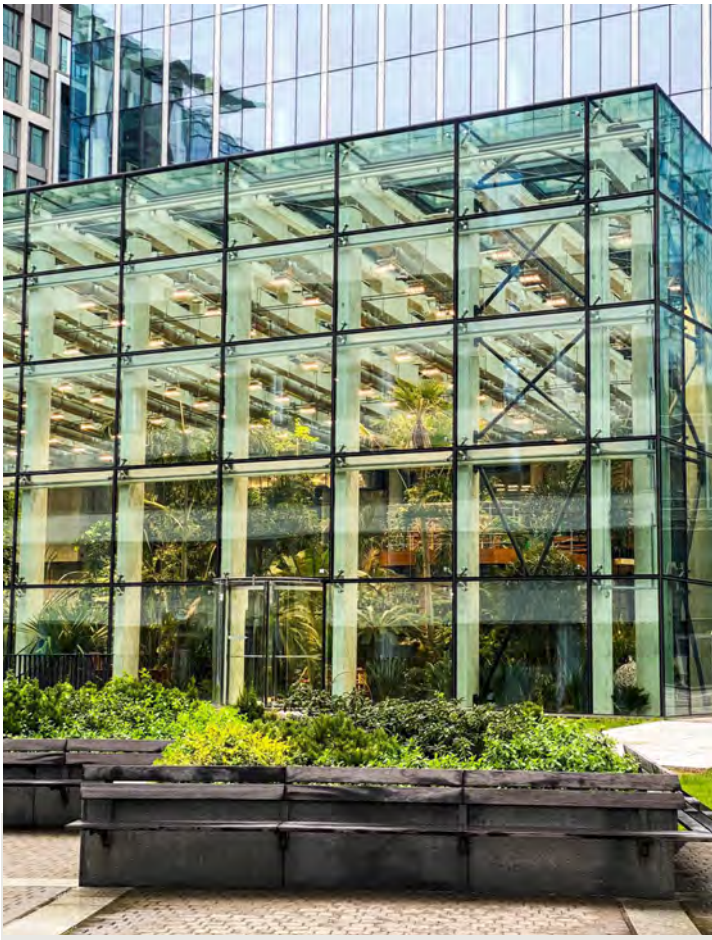
When developing green spaces, it's not enough to plant trees or other green structures and elements. The quality of the space is important, too, as well as how it's perceived and experienced by the user.

Urban dwellers have a need for different spatial experiences. Various research studies have uncovered eight perceived sensory dimensions: nature, culture, prospect, social, space, rich in species, refuge and serene.[16]

These eight perceived sensory dimensions can be incorporated in a green area when designing. Studies have shown that combining these perceived sensory dimensions in a green area can have a huge positive impact on public health.[7]

**It's important to use local, native species and consult with biologists to find the specific species with the best potential for the area.**

Camilla Hvid, engineer and landscape architect



### OLIVIA BUSINESS CENTRE, GDANSK, POLAND

Olivia Garden is a 8720 m³ green space in the middle of an office complex. It contains 150 species and nearly 3000 plants, a meditation zone, dialogue and relaxation zone as well as deep work zone.

Client: Olivia Business Centre
Designer: Konior & Partners Architects, BJK Architekci, Malinowski Design
WELL Health-Safety Rating, BREEAM certification: Sweco

## THE NEED FOR GREEN AREAS

The Covid-19 pandemic has revealed the significance of green urban spaces to human health. The pandemic has seen an increase in people's use of green areas, such as local parks, public beaches, marinas and national parks. These areas provide important health benefits that can mitigate some of the stress associated with the pandemic. They can also provide a feeling of social cohesion as people continue to practice social distancing.

People who had access to green areas during lockdown were less likely to show symptoms of mental health disorders than those who didn't have such access. It was found that people who had views of green areas during the pandemic had a more positive emotional situation and showed lower symptoms of anxiety and depression than people who didn't have a green view.[17, 11]

Green urban spaces have also provided safe spaces for physical activity during the pandemic and physical activity can help improve your immune system and have a positive effect on our mental health and well-being. Physical exercise three times a week in parks or other green areas can result in a 25% increase in perceived physical health.[11]

The pandemic has illustrated the value of green areas to governments, and the need for taking actions towards more green and sustainable cities.

## ONE WATERLOO, LONDON, UNITED KINGDOM

A green promenade garden creates a scenic journey from Waterloo Station directly into the building. In addition, three acres of outdoor space with over 100 new trees planted, cascading terraces complementing the workspace, and an urban sky farm offering fresh produce to enjoy will all be included in One Waterloo.


Client: HB Reavis
Designer: Allford Hall Monaghan Morris
Building services, WELL certification, BREEAM certification, WiredScore Certification: Sweco

## PARKING HOUSE, SORTEBRØDRE PLADS, ROSKILDE, DENMARK

With an innovative brick facade, the new car park at Sortebrødre Plads in Roskilde integrates into the historic urban environment. At the same time, the car park enhance the urban space with distinctive hanging gardens that contain several sustainable and social benefits. The green walls contributes to the local air quality and urban thermal comfort as well as provide attractive views.

Location: Roskilde Denmark
Designer: Sweco Architects
Cooperation: MOE A/S and 5E Byg A/S and Cowi A/S.
Client: Roskilde Municipality, Denmark.
Photo: Niels Nygaard

# The air we breathe

Air pollution is the single biggest environmental health risk in Europe.[18] Although it has been getting better in the past few decades, air pollution is still the major cause of premature death on the continent.

Air pollution shortens people's lifespans and contributes to serious illnesses such as heart disease, respiratory problems and cancer.

Estimates by the European Environment Agency show that approximately 379,000 premature deaths were attributable to high particulate matter levels (PM2.5) in the 27 EU Member States and the United Kingdom in 2018.[19]

**The healthy city is both efficient in reducing air pollution and stress as well as providing a playful, active green indoor and outdoor environment**

Daniel Hojniak, senior sustainability and well-being consultant

## Three basic strategies help to improve indoor air quality: source control, improved ventilation and air treatment.[20]

### 1) SOURCE CONTROL

#### LOW-POLLUTION SITES

Siting is a fundamental task that impacts all health-related aspects of a building. Siting a building in an area with low air-pollution levels can greatly benefit it and allow design teams to use more environmentally friendly solutions, such as natural ventilation. For most buildings, thoughtfully designed natural ventilation can be as effective as mechanical ventilation, eliminating the use of energy and, in turn, carbon emissions.

Outdoor urban areas that use more pedestrian zones during specific times or on weekends can help to reduce noise and air pollution. Many European cities are transforming their streets into pedestrian-only zones and massively expanding cycle routes.

#### BEWARE OF INDOOR SOURCES OF POLLUTANTS

It's not just the outdoor air that affects our health. The air inside buildings can be equally harmful. This is particularly due to volatile organic compounds (VOCs) – chemicals that can cause eye, nose and throat irritation, shortness of breath, headaches, fatigue, nausea, dizziness and skin problems. These gases are given off by various products such as building materials, new paint, furniture, air fresheners, candles and even perfumes. The products we use on a daily basis for cleaning can also significantly affect the air quality.

Pollutants from indoor sources are usually highly specific to the building and building processes, so careful consideration must be taken during the design phase as well as the operations and maintenance stages.

Client: Triple Living
Designer: Stefano Boeri Architetti,
Engineers: Swecio Belgium
Location: Antwerp, Belgium
Visualisation: Stefano Boeri Architetti

**PALAZZO VERDE (NIEUW ZUID), ANTWERP,BELGIUM, STEFANO BOERI WITH SWECO**

The plant-based shield of the Palazzo Verde in Antwerp aims to allow filtered sunlight to enter, “regulates” humidity, produces oxygen and absorbs $CO_2$ and microparticles, thereby creating a welcoming internal microclimate.


**THE WARSAW HUB, POLAND**

The building utilises multiple technical solutions to provide clean and safe indoor air. This is particularly important in relation to the Covid-19 pandemic:

- UV-C lamps in air handling units to disinfect the air from dangerous microbes and mould
- UV-C lamps installed in lift cars to disinfect all high touch surfaces (activated only when there is no people inside)
- Fresh air supply significantly above the EU regulations, high-class air filtration systems
- Touchless access to the building via smartphone (including QR codes for guests)
- Lift algorithms limiting the number of users to reduce the risk of infection

Location: Warsaw, Poland
Client: Ghelamco
Designer: AMC-Andrzej M. Choldzynski, Massive Design
WELL Health-Safety Rating, BREEAM Certification: Sweco

## 2) IMPROVED VENTILATION:

### SMARTER VENTILATION

The issue we most commonly face in buildings is a high $CO_2$ concentration caused by poor ventilation. This can result in headaches, dizziness, restlessness, tiredness, difficulty breathing, sweating and increased heart rate. Adequate ventilation is one of the key ways of reducing exposure to viruses indoors.

The primary source of $CO_2$ in buildings is human respiration. Regulations across Europe set advisory levels for the minimum required fresh air flow in buildings. These advisory levels are also incorporated in certification methods such as WELL, BREEAM, DGNB and LEED.

Multiple studies show that human cognitive performance decreases considerably at excessive $CO_2$ concentrations, with the effect increasing exponentially with rising $CO_2$ levels.

Obviously, in a typical mechanical ventilation system, providing a high fresh air rate will negatively impact the energy consumption of the ventilation system. One solution that addresses this problem is a demand-driven ventilation system, which links $CO_2$ sensors and air handling units. The air handling units supply more fresh air when the sensors detect higher concentrations of $CO_2$.

Plants can also help improve the indoor air quality, because during photosynthesis they refresh the air by absorbing carbon dioxide and releasing oxygen. Studies have shown that higher $CO_2$ levels in a classroom can decrease student performance and at a workplace can lower productivity. Research has also found that some plant species can remove VOCs. VOCs are emitted as gases from certain solids or liquids, including a variety of chemicals, some of which may have short- and long-term adverse health effects.

## 3) AIR TREATMENT:

### AIR PURIFICATION EVEN MORE ESSENTIAL TODAY

Mechanical ventilation systems must incorporate filtration systems to capture particulate matter, soot and nitrogen oxide. The filtration of these pollutants should be incorporated in the building design to keep them out of the indoor environment.

The Covid-19 pandemic has laid bare the importance of a building's air supply and purification systems. Various strategies are used to mitigate the risk of infection inside buildings.

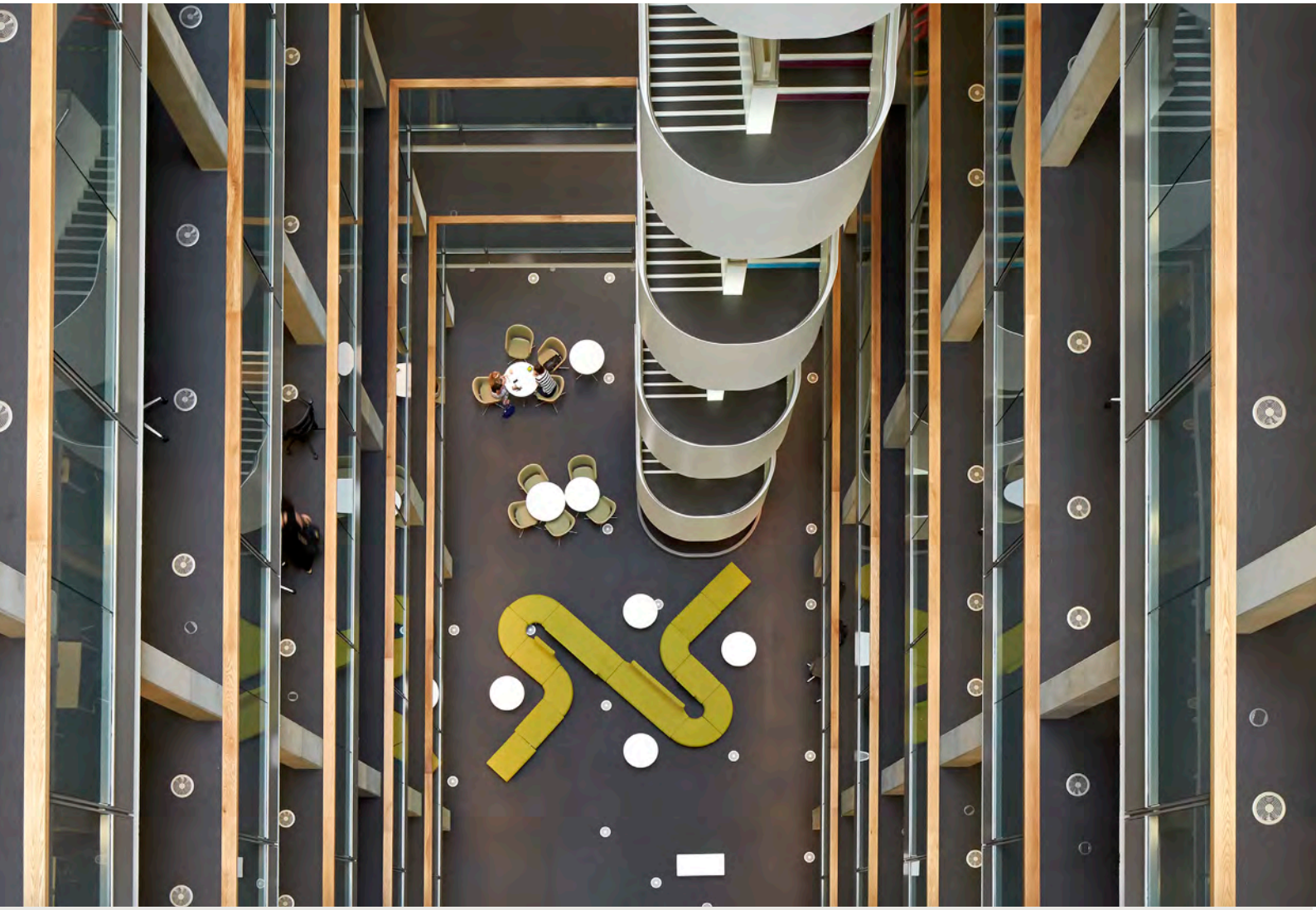
The easiest strategy is to supply as much fresh air as possible to dilute or flush out any pathogens in the indoor air. Modern air handling units avoid the recirculation of used air back into the building, so luckily infection from incoming viruses from outside is highly unlikely. Other strategies which help to fight the viruses as well as mould and other fungi in the ventilation system include electronic air cleaners and ultraviolet lamps, UV-C lamps, which are fitted in the ventilation system.

### HUMIDITY AS WE WANT IT

Humidity levels are important both in terms of thermal comfort and air quality. The golden rule when it comes to air humidity and air quality, also in relation to Covid-19, is an optimum air humidity range of 40-60%. Ideally such conditions should be maintained by the building air conditioning system; if this is not possible, then standalone air humidifiers and dehumidifiers can be used.

Low air humidity may cause skin and throat irritation, quicker dehydration, allergy-like symptoms and even poor sleep quality. On the other hand, high humidity levels cause great discomfort as they interfere with our natural sweating mechanism, which in normal conditions is used to regulate our body temperatures.

In situations where outdoor air is polluted or indoor activity causes pollution, air quality should be monitored in real time and action taken to reduce pollutant levels. For this purpose, a sensor that monitors particulate matter and other contaminants (for instance volatile organic compounds), in addition to $CO_2$ and temperature, can be used.



**5 PANCRAS SQUARE, LONDON, UNITED KINGDOM**

Another interesting solution is a so-called displacement ventilation system. In traditional mechanical ventilation, the air is supplied and extracted through the ceiling. The top layer of air in the room is filled with warm, used air. The fresh air needs to be pushed through it, which results in a mixture of fresh and used air at the occupant head level. In a displacement ventilation system, the air is supplied through the grilles on the floor and has a slightly lower temperature (just 2-3 degrees lower than the desired temperature in the room). Then, thanks to heat gains from the users and devices in the room (like computers), the used air is lifted to the top of the room (the heat convection process) and extracted through the ceiling. Thanks to this method, the air is always fresh at the level of the occupant's head. Such a system was implemented in the award-winning 5 Pancras Square building, the town hall of the Borough of Camden in London (notice the white rounded grilles on the floor).

Client: Camden Borough
Designer: Bennetts Associates
Building Services, BREEAM
Certification: Sweco
Photographer: Hufton+Crow

# Let there be natural light

Lighting, whether natural or artificial, plays a key role in overall human health and impacts us both mentally and physically. From an evolutionary perspective, we are biologically hardwired by the natural light cycle that originates from a specific atmospheric composition and the spin, tilt and orbit of the earth around the sun, i.e. the day and night cycle. As a result, our biological clock – our overall health – is compromised by artificial lighting that does not respect this complex combination of properties. Artificial light at night can also be a threat to biological diversity.[21]

Around 80% of the world's population lives under light-polluted skies.[9] Many European countries, including Italy, Slovenia, Spain, France and Croatia, drafted policies to fight light pollution. Light pollution is known as a hazard to our environment and human health and can increase the risks of obesity, depression, sleep disorders and diabetes. Furthermore, according to research, prolonged exposure to artificial lighting, and lack of exposure to natural light, may be linked to decreased hormone melatonin levels, which negatively impacts circadian rhythms, our internal biological clock.[22]

### HEDLUNDA PRESCHOOL, UMEÅ

The most northern location globally for an internationally certified passive house building (PHI) – extremely efficient building in a very demanding climate.

### HEDLUNDA WEST FACADE

In December when sun sets at 13.45, with little more than 4 hours of daylight in Umeå, there is a great need to optimize the natural light indoors.

Extended window frames interact with the low Nordic sunlight offering a dynamic three-dimensional graphic effect. A double-height art studio/workshop and plant conservatory are located in the centre of the building, offering a dynamic three-dimensional graphic effect.

### HEDLUNDA UPPER GALLERY FACING ART STUDIO

Balcony overlooking the art studio/workshop. An overview of the surroundings is a basic quality that enables children to define their place in a larger context and exercise their right to experience the third dimension.

Location: Umeå, Sweden
Client: Municipality of Umeå
Cooperation: Sweco Architects AB Jonas Kjellander, Thomas Greindl, Jens Hoff
Designer: Sweco Architects, Jonas Kjellander, Thomas Greindl, Jens Hoff.

Considering natural light in the interior design of homes, workplaces and health care facilities is crucial because of the advantages of natural light on human health. Research shows that exposure to sunlight can improve the quality of sleep – employees exposed to natural light sleep 46 minutes longer on average compared to their colleagues working under artificial lighting only.[23] According to the American Medical Association, artificial night-time lighting is associated with "reduced sleep times, dissatisfaction with sleep quality, excessive sleepiness, impaired daytime functioning, and obesity."[24]

In healthy buildings and urban environments, it is important to design artificial lighting in a "biologically-aware" or "human-centric" way, with respect to the biological influences it generates.

When designing artificial lighting in buildings, it is therefore important to have focus on the general circadian lighting with a broad spectral content, and high "color rendering index," which changes the intensity and light color temperature between cool and warm white.

This way, we can create working and living environments that help you to work efficiently, creatively and focused, relax and sleep well, strengthen the immune system, and overall ensure healthy humans and other life, by limiting the pollution caused by the light that encroaches on the night sky from buildings and cities.

**HEMPEL, LYNGBY, DENMARK**

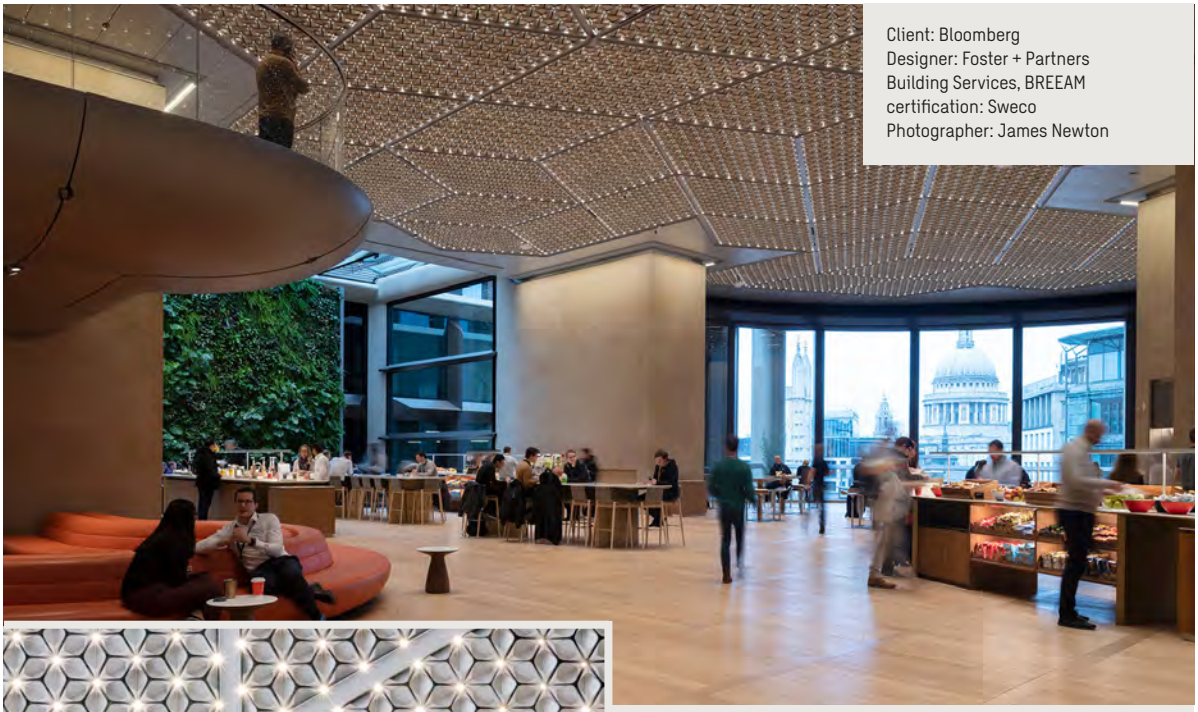
Hempel's distinctive domicile is located in Lyngby, Denmark. A sculptural spiral staircase in the central atrium serves as the main element and focal point of the entire domicile. The spiral is physically expressed as a sculpturally designed staircase in the center of the building. A roof window lets daylight into the atrium and illuminates the spiral staircase.

Location: Kongens Lyngby, Denmark
Designer: Sweco Architects
Cooperation: Niras
Client: Hempel
Photo: Sweco Architects

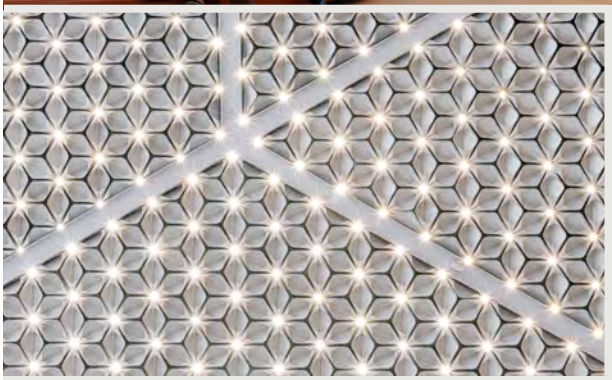
# From urban noise to city sound

In Europe noise pollution is the second biggest envrionmental health risk. 113 million people suffer from harmful noise pollution levels, leading to 48,000 new heart disease cases and 12,000 premature deaths.[25] Despite this, no substantial progress has been made in the last ten years, and noise levels are expected to increase.[18]

Sounds in the city are the result of human activity and are a part of urban culture – telling us that the city is alive and vibrant. But city sounds can turn into harmful noise and be perceived by residents as unnecessary and disturbing. Sources of noise in the surrounding environment include road traffic, air traffic, railways, businesses, wind turbines and noise in the neighbourhood. Sources of noise in the indoor environment include ventilation systems, office equipment, home devices and neighbouring activities.



Client: Bloomberg
Designer: Foster + Partners
Building Services, BREEAM certification: Sweco
Photographer: James Newton



Photographer: Nigel Young/Foster + Partners

**BLOOMBERG LONDON, UNITED KINGDOM**
The 'living wall' brings the outside in and adds life to the pantry.

Bespoke integrated ceiling panels combine acoustic functions, heating, cooling and lighting in an innovative petal-leaf design.

Noise exposure can cause annoyance, sleep disturbance, stress reactions, hearing impairment and associated increased risk of hypertension, and cardiovascular disease, and have negative effects on the metabolic system that can indirectly reduce life expectancy. Noise exposure also has a significant negative impact on students' cognitive performance and learning ability.

Approximately 82 million citizens living in European urban areas are exposed to road traffic noise levels above Lden (weighted average noise level over a 24-hour period) 55 dB, which is the threshold level for road traffic noise according to European Environment Agency (EEA) guidelines.[25] Furthermore WHO recommends to tightening the limit to 53 dB.[26]

The number of people exposed to road traffic noise varies widely between European countries. Austria, Bulgaria, Cyprus, Latvia and Luxemborg have reported that over 75% of residents in major urban areas are exposed to road noise exceeding 55 dB. At the other end of the spectrum, the number of exposed residents in Germany, Iceland and Finland is below 25%.[25]

## NOISE REDUCTION: OUTDOORS

Traffic reduction alone is not sufficient to ensure compliance with prevailing noise guidelines and directives. Using noise screens along roads and noise insulation in future homes can lower noise levels. Planning and protecting green areas and providing urban calm spaces helps reduce the harmful effects of noise.

When planning and designing new infrastructure, it is crucial to maintain a focus on noise – including during the early stages of the planning process – by making noise maps. The later we introduce plans to control noise, the harder it gets.  Examples of the most popular measures to reduce noise levels in cities include replacing older paved roads with smoother asphalt, better management of traffic flows and reducing speed limits to 30 kilometres per hour. Other measures aim to raise awareness and change people's behaviour by promoting less noisy modes of transport like cycling, walking or electric vehicles. Noise insulation of dwellings along motorways and railways is also a way to reduce the noise pollution inside buildings.

**ALLERØD, DENMARK.**
Visualisation: Omega Render, Sweco Architects

The close connection to nature, around and within buildings, improves health and well-being and can help reduce both air and noise pollution. Almanac is developed with the future residents and people from the local area to find out what functions the building should have. This means that the community starts before the building is finished.

## NOISE REDUCTION: INDOORS

At a European level, it is estimated that more than 15 % of people are exposed to high levels of traffic noise during the night-time, from which adverse health effects can occur.[25] When planning homes, taking simple steps can help to improve the indoor noise levels, for example by orienting bedrooms away from roads. Traffic noise is primarily transmitted into buildings through windows. Therefore, it is important to choose windows with sufficiently good sound insulation to achieve a satisfactory indoor acoustic environment, which is needed to ensure a good night's sleep. External shutters are another simple yet effective solution. Not only do they reduce the intrusion of outdoor noises, but they prevent indoor spaces from overheating in the summer. That's the reason why this passive design solution is so popular in many European countries.

Noise levels inside European homes have increased because Covid-19 has compelled more individuals to work and study at home. At the same time there has been a short-

## ACOUSTIC PANELS AND CEILING

Opening the facade towards the outdoor areas, both from living rooms and common rooms, creates immediate access to the outdoor areas. We have created a building that is consistent in its choice of materials, that is robust and actively relates to its users. Acoustic panels and ceiling are elements that help reduce the indoor noise and create a comfortable indoor acoustic environment. The integration between school and local area is an expression of a new and more sustainable way of understanding the interfaces in the city

**KINDERGARDEN RYMARKSVEJ COPENHAGEN, DENMARK**
Location: Copenhagen, Denmark
Designer: Sweco Architects
Cooperation: Ason | Niras | Active City Transformation (ACT) | Thing & Brandt Landskab
Client: Københavns Kommune, ByK
Photographer: Hampus Berndtson

term reduction in transportation noise levels as a result of COVID-19-related lockdowns. But when we do return to a more normal everyday life, traffic is sure to increase again even as the home workplace will certainly become a significant part of our everyday life in the future. Therefore, good acoustic conditions are a key enabler of high performance in concentration-intensive work, both at home and in offices and schools, as well as for student's learning ability. This applies both to insulation from outside noise through the use of soundproof windows and to achieving a pleasant indoor acoustic climate that has a sufficiently low reverberation time (the time a sound persists after it is produced), which enables people to stay in a room longer without feeling tired. Acoustic regulations specify noise level thresholds indoors, including a focus on sound-absorbing ceilings and walls.[25]

**ACCORDING TO EEA (ENVIRONMENTAL ENVIRONMENT AGENCY) PUBLICATION:**

## 12.500 European schoolchildren

are estimated to suffer learning impairment in school due to aircraft noise.[25]

## About 50 % of inhabitants

within urban areas in EU countries are exposed to road noise levels of 55 dB Lden or higher [25] during the day-evening-night period, which is the threshold level according to EEA (European Environment Agency).Furthermore WHO recommends tightening the limit to 53 dB.[26]

## 22 million people

suffer chronic high annoyance due to noise.[25]

## 6.5 million European people

suffer chronic high sleep disturbance due to noise.[25]


**NOISEMAP OF FREDERIKSBERG, DENMARK, MADE BY SWECO.**
Municipalities need noise strategies for ensuring healthy and quiet homes and institutions.

# Designing for movement

Over the past 30 years, the prevalence of physical leisure activity has increased, while occupational physical activity has declined.[27] However, more than one-third of adults are insufficiently active. This physical inactivity causes around 10% of a total of roughly 23.1 million deaths and 8.3 million disability-adjusted life years lost each year in the European region.[28]

Furthermore, urban planners and designers should take into account European cities' different transportation modes to promote more physically active behaviours. For instance, in 25 European cities, especially in Southern Europe, walking accounts for more than 40% of the total modal split.[28] According to research, a significant decline in physical activity and an increase in time spent in sedentary activities was observed during the Covid-19 outbreak, especially among young people.[29]

The healthy city should first and foremost be built around pedestrians and bicycles. Designing for healthy move-

**BUURTSCHAP TE VELD IN EINDHOVEN**

In Eindhoven, a neighbourhood "Buurtschap te Veld" is being built with about 670 homes scattered in small groups in the landscape. Affordable and sustainable. Here people and their neighbours live close to each other in green surroundings, with the city nearby.

**BUURTSCHAP TE VELD, EINDHOVEN**
Location: Eindhoven
Client: Municipality of Eindhoven
Designer: Tom van Tuijn Stedenbouw, LL040
Visualization: Tom van Tuijn Stedenbouw / Blackbone Visuals

ment requires buildings and public spaces that are safe, spacious and inviting to use for all ages and abilities. This requires an integrated approach to designing buildings and public spaces.

### DESIGNING THE JOURNEY

Designing the city from a user perspective requires thinking about the complete traveller journey. It starts with getting up in the morning and leaving your flat to arriving at your desk in the workplace, the terrace where you are meeting your friends in the park or your team at a sports club.

### THE CITY AS PLAYGROUND

Accommodating pedestrians means building mixed neighbourhoods that combine living, working and public facilities. The higher the density of the neighbourhood, the more likely people will be able to access all the facilities they need within walking distance of their homes.

Outdoor public space should be designed as an intricate network connecting places of interaction and activity. The ideal playground is a place that combines designed activity but also triggers the imagination of the use of space. Ideal-

### ISRAEL SQUARE, COPENHAGEN, SWECO

Israels Plads is a cohesive urban space located in inner Copenhagen. The square is a living urban, breathing space, protected from traffic that connects the square and park. It will accommodate Copenhageners' everyday life, and offers many activity opportunities for movement and play in addition to the living areas.

Location: Copenhagen, Denmark.
Designer: Sweco Architects
Client: Copenhagen Municipality.
Photo: Niels Nygaard.

ly the public space is designed like this as well. Efficiency and speed are often the cornerstones of street design. But for the purposes of health and well-being, it is also important to provide space for wandering, play and imagination.

Opportunities for sport should be readily available in the neighbourhood. Besides organised sports, urban sports such as boot camp, running, skating and parkour are growing in popularity. The pandemic has reminded us how much we enjoy public space in all its shapes and sizes, from local community gardens to metropolitan parks and regional green structures.

## Good public space design triggers people to use it actively, imaginatively and playfully

Bas Horsting, architect and urban planner

## ACTIVE ARCHITECTURE

Since we spend roughly 90% percent of our time indoors, the way we design our buildings is critical to promoting healthy movement. The design of a building's circulation elements should be pleasant and inviting, and should feature appealing walking paths and attractive stairways that are clearly visible, pleasant spaces encouraging people to take the stairs. Buildings that include spaces for play or sport, or that are well connected to outdoor spaces, are also more likely to promote healthy living.

## A 24-7 SCHOOL ENVIRONMENT FOR STUDENTS, TEACHERS AND COMMUNITIES

The new Lindbjerg School is a place where play, learning and movement are in focus. The school is one of Denmark's first 24-7 schools. Not only does it house teaching facilities, but it also functions as a new meetup space for the local community, with sports halls, after-school programme, café, library and cultural offerings.

**LINDBJERG SCHOOL**
Location: Herning, Denmark
Designer: Sweco Architects
Cooperation: KPC
Client: Herning Kommune Denmark
Credit for photo: Sweco Architects
Award: The school building of the year in DK 2020


The healthy building. Illustration by Tom Uyttendaele, Sweco.

## Did you know?

### GREENERY

Potted plants have been shown to remove between 10-50 micrograms of formaldehyde per square metre per hour. An experiment by Teknologisk Institut in Denmark shows that potted plants with a large pot volume and rapid growth are best for removing formaldehyde. Examples of good air purifiers are Nephrolepsis (fern), Alocasia (elephant ear) and Hoya (wax flower), all of which are leafy, water-demanding and fast-growing.[30]

### LIGHT

Light affects both well-being and sleep quality. Results from a pilot study showed the impact the daylight exposure had on the health of office workers. "Workers in workplaces with windows (...) slept an average of 46 minutes more per night during the workweek than workers in workplaces without windows." [31]

### AIR QUALITY

The issue we most commonly face in buildings is high $CO_2$ concentration caused by poor ventilation. There are three basic strategies help to improve indoor air quality: source control, improved ventilation and air treatment.

### NOISE

It takes an average of about 25 minutes (23 minutes and 15 seconds, to be exact) to return to a task after an interruption.[32]

The rougher and the more holes a road contains, the noisier it is. A noise-reducing wear layer, which is the upper part of the road surface, can attenuate the noise by 1.5 - 2 dB compared to a traditional new pavement.[33]

### MOVEMENT

Researchers at one Canadian hospital found that when they had doctors take the stairs instead of the elevator, it saved each an average of 15 minutes out of the workday. The stairs were more efficient, it seemed, since there was no wait time, according to findings reported in the Canadian Medical Association Journal.[34]

# Conclusion

Our health and well-being are impacted by the world around us. A green, inviting city, healthy buildings, and citizens that understand how these components can benefit their well-being are the key to success. Below are 7 steps for healthier urban living and designing buildings and cities to make a positive impact on our well-being:

- **USE NATURE AND NATURAL PROCESSES IN DESIGNING URBAN HEALTH**
  Our future cities should be built using more green areas per inhabitant and higher-quality green areas. The benefits of nature should be considered when designing urban areas, streets and buildings. Nature not only benefits our mental and physical health but contributes to better air quality, lower noise pollution, more absorbed $CO_2$ emissions and, if planned well with a variety of species, richer biodiversity.

- **MIND THE LINK BETWEEN THE INDOOR AND OUTDOOR ENVIRONMENTS**
  Without a doubt, location and site-specific conditions have an impact on indoor environment. Designers need to think holistically about the built environment. In most cases, the need for a highly sophisticated and expensive air treatment system only exists because of the polluted outdoor air.

  Before starting to design artificial lighting systems, make the best use of natural light. It's free and human bodies like it – smart façade design and architectural solutions can provide natural light in the indoor environment.

- **REDUCE NOISE AND AIR POLLUTION BY REUSING EXISTING BUILDINGS**
  Aim to reuse and renovate instead of demolishing and constructing new buildings. Not only will this reduce noise and air pollution associated with the demolition and construction works, but it will also reduce carbon emissions that are harming our planet.

- **LET'S GET MOVING!**
  Our future cities and buildings should inspire people to make the healthiest choice when they move around. To accomplish this, engineers and architects have to focus on designing buildings, stairs, corridors, urban spaces and infrastructure in an inviting and innovative way. Walk and talk meetings are also a great idea to include a healthy element in our daily work.

- **EVERYONE IS WELCOME**
  Our cities should be accessible to everyone. It doesn't matter who you are or what your age is – the city and its infrastructure should support your physical health, mental health and well-being in general.

- **PROMOTE HEALTHY LIFESTYLES IN YOUR PROJECTS**
  It is designer's responsibility to create spaces that meet the users' needs and inspire them to live healthy lives. We strongly believe in the "snowball effect". We hope that inclusion of natural elements in the office design will encourage the users to do the same in their homes. Sometimes showing an inspiring example is enough to make people adopt healthy habits.

- **"IF YOU CAN'T MEASURE IT, YOU CAN'T IMPROVE IT."**
  The real estate industry noticed the importance of living in healthy cities and buildings long before the Covid-19 pandemic. This is why schemes such as WELL® and Fitwel® were introduced – third-party certification systems verifying healthy aspects of cities, communities and buildings. These two methods are considered the next level in terms of human health and well-being issues, included in well-known building sustainability schemes such as BREEAM®, DGNB® or LEED®. All these methods are commonly used as design, benchmarking and marketing tools by millions of developments around the world.

How can we plan and design cities, environments and buildings to improve people's health? Cities, buildings, and you and I are part of the solution.

Together, we can do much to promote health and well-being in urban living.

# About the Authors

If you have any comments or questions we are happy to help.
Please contact us at urbaninsight@swecogroup.com

**DANIEL HOJNIAK** is a Senior Sustainability and Well-Being consultant. He is passionate about engineering solutions that make buildings better places to live and work. Daniel was involved in a wide range of international projects including high-end office, retail, residential and industrial developments. He is a WELL, LEED and BREEAM Accredited Professional as well as 2019 IWBI Leadership award recipient.

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**CAMILLA JULIE HVID** (1986) is a Danish engineer and landscape architect working in Copenhagen in the climate adaptation department at Sweco Denmark. Her focus is sustainability and designing solutions that benefit both people and biodiversity. Camilla believes that interdisciplinarity and nature are the keys to designing great sustainable solutions for our cities and buildings for a better and healthier future.

**EXPERT CONTRIBUTORS**
Bas Horsting, architect, urbanist, expert healthy living environments, Sweco NL
Cor Kleinveld, expert energy management, Sweco NL
Remco Kemperman, expert installations HVAC, Sweco NL
Sammy Rogmans, architect, manager sustainability, innovation in architecture, Sweco BE
Christian Forester, expert sustainable materials, Sweco NO
Morten Hell, Head of Department Acoustica & Lighting Design, Sweco DK
Pernille Vad Nørmark, Landscape Architect, Sweco DK
Isabelle Putseys, Urban design expert in health and climate in blue-green networks, Sweco BE

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Geoffrey Palmer, Director Building Services and Energy at Sweco UK
Asma Sofla, researcher, trainee at Urban Insight.
Emma Sterner Oderstedt, Project Manager Group Communication.

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# Urban Insight

Urban Insight is a long-term initiative that provides insights about sustainable urban development, seen from a citizen's perspective. The initiative is built on a series of reports, based on facts and research, written by Sweco's experts. The initiative provides society and decision-makers with facts needed to understand and meet current and future challenges.

This report is part of a series of reports on the topic Urban Health and Well-being in which our experts highlight specific data, facts and science that are needed to plan and build safe and resilient future urban environments.

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