





OFFICE OF
THE VICTORIAN
GOVERNMENT
ARCHITECT

The Case for Good Design

<A guide for government>



“We cannot afford not to invest in good design. Good design is not just about the aesthetic improvement of our environment, it is as much about improved quality of life, equality of opportunity and economic growth.”



Sir Stuart Lipton

Cover

Project: Bendigo Hospital
Architects: Silver Thomas Hanley and Bates Smart
Landscape Architect: Oculus
Photographer: Peter Clarke


Authorised and published by the Office of the Victorian Government Architect, Melbourne
© 2019 Office of the Victorian Government Architect

Accessibility

If you would like to receive this publication in an alternative format, please telephone the Office of the Victorian Government Architect on 03 9651 6583 or email ovga@ovga.vic.gov.au

Executive summary	3
Healthcare	5
Education	15
Justice	25
Workplaces	33
Housing	39
Urban design	47
Transport	55
References	65

Executive summary



“A great building must begin with the unmeasurable, must go through measurable means when it is being designed and in the end must be unmeasurable.”

Louis Kahn, Architect 1901-74



Our everyday lives are touched by the places that surround us. The qualities of these places – our buildings, streets and parks – inform our interactions, understandings, wellbeing and memories. A review of research exploring healthcare, education, workplaces, housing, justice, urban design and transport projects demonstrates that good design enables people, places and the environment to thrive.

WHAT IS GOOD DESIGN?

‘What is good design? It’s a seemingly simple question that’s surprisingly difficult to answer. The more you think about it, the more complex the question becomes. Not only does “good design” mean different things to different people, it also changes at different times and in different contexts.’¹

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

MEASURING THE IMPACT OF DESIGN

There is extensive academic and scientific research that explores the benefits of well-designed places, and the effect of poor design on our lives. This research demonstrates that good design has far-reaching benefits, such as supporting health and wellbeing, improving environmental quality and improving productivity. As links between design and neuroscience, health and human behaviour continue to emerge, it is important that this evidence-base informs decision making about the shape, nature and function of our cities, buildings and landscapes.

MAKING THE CASE

It has been demonstrated that 'Good design does not cost more when measured across the lifetime of the building or place.'² Investments in the design of our built environment have a lasting legacy on their place and the people who visit. Yet design is often considered a superficial afterthought.

Good design may cost more in the short term, but this investment is generally paid off over the lifetime of the building or place. Construction costs are typically 2–3 per cent of the whole-life costs, while operating costs are estimated to be 85 per cent. In comparison, design costs are small, between 0.3–0.5 per cent, yet they can significantly affect the function of a project across its lifespan, and the operating costs associated with this.³

The research demonstrates a host of benefits of good design, including:

well-designed hospitals help patients heal faster, support staff performance, recruitment and retention, and reduce operating costs

well-designed schools improve student performance, and support staff performance, recruitment and retention

well-designed police stations, courts and prisons help foster fairness and reduce recidivism in our justice system

well-designed workplaces support productivity

well-designed housing creates a greater sense of community and reduces ongoing costs

well-designed urban spaces improve wellbeing and social connectedness

well-designed transport systems boost productivity, reduce congestion and pollution

This report is an overview of the research on the impact of the design of our surroundings. It is hoped that the findings generate conversations about the importance of embedding design quality in every stage of a project's lifecycle and inform decision-making about our built environment. It may also encourage others to share the evidence they have uncovered and influence researchers to investigate gaps.

Supported by this evolving evidence, quality design is at the heart of a successful place – it is not an optional extra. Quality design ensures a positive legacy to become the heritage of the future.



Healthcare

A hospital is the site of some of our best and worst life experiences, the site of birth and death, healing and loss. Of all public buildings, they should be the ones that are built with the greatest care and imagination.⁴

We feel a spectrum of emotions in healthcare settings, experiencing joy, fear and sorrow in places of birth, care, recovery and death. As important places that support us through some of our best and worst life experiences, healthcare settings need to be designed with empathy and creativity.

Good design adds the most value to healthcare projects when there is understanding of the needs of the patient, as well as their loved ones and the staff.

There is strong evidence that well-designed healthcare facilities have measurable positive outcomes, helping patients to recover sooner, improving patient and visitor experiences, and increasing staff effectiveness in their care.⁵

More than 1,200 studies demonstrate that good design qualities integrated in hospitals improve patient's health outcomes and experiences and support staff performance.⁶ This research finds that a range of good design qualities, including access to natural light, fresh air, views to nature, quietness, private rooms, clear wayfinding, and a sense of place, improve health outcomes as well as the operation of healthcare facilities.

These design qualities are linked with reducing the amount of time patients spend in hospital, improving sleep, reducing pain, stress and the need for medication, and minimising medical errors. Embedding principles of good design in the master planning and design of healthcare facilities contributes to the quality of care and experience of patients, as well as improving the efficiency of services.

+1,200 STUDIES

demonstrate the links between design and health outcomes.⁷

90% OF MEDICAL STAFF

believe good design is
linked to patient recovery.⁸

MEASURING GOOD DESIGN

Hospitals collect a great deal of data, including a patient's length of stay, the amount of medicine they require and observations of their condition and behaviour. Hospital performance is regularly measured through data about clinical processes and outcomes, quality and operating costs of hospital services and patient experiences. Many studies of the design of healthcare facilities use this data to explore the effects of the physical environment. Evidence-based design processes use credible research to make decisions about the design of the built environment in order to achieve the best possible outcomes for patients visitors and staff.¹⁰

Project: Dandenong Mental Health Facility
Architects: Bates Smart and Irwin Alsop Architects
Landscape architect: LBA Design
Photographer: John Gollings



CREATING THE BUSINESS CASE

Implementing good design principles does not necessarily cost more, and indeed, it has potential to save money through improved efficiency of care. Evidence shows that good design contributes to clinical outcomes through reduced patient stays in hospital, medication, infection rates and medical errors. It also supports staff attraction, retention and performance¹¹ and represents significant cost savings. Poorly designed health facilities increase danger and risk.

To estimate the economic impact of best-practice design, an imaginary hospital, the 'Fable Hospital', was conceived as an amalgam of the best design innovations implemented and measured by leading hospitals. The analysis showed that although design innovations may cost more initially as part of the building cost (calculated at 5 per cent of total construction costs), they offered a return on investment within one year by reducing operating costs and increasing revenue.¹² 'Fable 2.0', a follow-up analysis, incorporated additional evidence-based design features amounting to approximately 7–8 per cent of total construction costs, and was found to have a payback within three years.¹³

Benefits of good design

There is strong evidence that good design of healthcare facilities helps to:

- reduce patient recovery times and length of hospital stays
- reduce patient levels of pain and need for medication
- reduce patient behavioural issues
- improve patient experiences and satisfaction
- reduce patient, staff and visitor stress.
- improve staff attraction, performance, morale and retention
- reduce medical errors and improve patient safety
- reduce operational costs, improve efficiency and save money.



Not only is there a very large body of evidence to guide hospital design, but a very strong one. A growing scientific literature is confirming that the conventional ways that hospitals are designed contributes to stress and danger, or more positively, that this level of risk and stress is unnecessary: improved physical settings can be an important tool in making hospitals safer, more healing, and better places to work.⁹

Impact of good design – key findings

A study of two hospitals in the UK found that patients who were treated in refurbished wards spent less time in hospital, required less pain medication and were calmer compared with those recovering in older, conventional-style wards.¹⁵ This research demonstrates the significant effect that the design of the physical environment has on patient wellbeing and recovery, as well as on staff experiences and cost savings for hospitals.

RECOVERY

4–21% less time spent in an upgraded hospital.¹⁴

The study found patients at Poole Hospital spent 21 per cent less time in hospital and required less pain medication when treated in a refurbished ward compared with those in a conventional 1960s ward.¹⁶ Patients treated in a purpose-built psychiatric facility at South Downs Health spent an average of 14 per cent less time in hospital and there were fewer behavioural incidents compared with patients in older wards.¹⁷ Patients in newer wards gave higher ratings to their medical treatment, even though in many cases they were treated by the same people as those in the older wards. They also reported higher levels of satisfaction with their surroundings, rating the appearance, overall design and spatial organisation higher compared with those in the older wards.

Project: Dandenong Mental Health Facility
Architects: Bates Smart and Irwin Alsop Architects
Landscape architect: LBA Design
Photographer: Grant Cutelli



WORKPLACE

29% of time is spent walking or in transit by nurses.¹⁸

Studies link hospital design with staff attraction, morale, retention, and performance.¹⁹ A survey of 479 nurses found that the quality of internal and external spaces is perceived to play an important role in staff recruitment, retention and performance.²⁰ The design and layout of the wards has been found to affect the amount of time nurses spend walking and in transit. One study estimated nurses spend up to a third of their time walking around the ward.²¹ This finding highlights the importance of considering ward layouts and hospital master plans to enable staff to optimise their time and improve their efficiency in caring for patients.

WAYFINDING

\$220,000 per year for poor wayfinding.²²

Poor wayfinding in hospitals is disorienting for patients and visitors, causing unnecessary stress.²³ Poor wayfinding was found to cost a major regional 604-bed hospital more than \$220,000 per year, or \$448 per bed. Over the course of a year, 4,500 staff hours, or the equivalent of two full-time staff, were spent providing directions.²⁴ This shows the importance of taking an integrated and coordinated approach to the siting of buildings and their internal layouts in order to support logical and clear navigation.

VIEWS TO NATURE

1 day less spent in hospital in a room with a view of nature.²⁵

Access to or a view of nature helps to reduce stress and pain and speeds recovery for patients.²⁶ A study found that patients with a view of nature were discharged almost one day earlier from hospital than patients facing a brick wall.²⁷ Patients with the view of nature also required less medication and nurses noted they had more positive comments in relation to their wellbeing and experience.²⁸

LANDSCAPE

78% felt more relaxed and calmer from visiting the hospital garden.²⁹

Gardens provide restorative and calming places that help reduce stress and provide respite from the clinical setting.³⁰ A key design intent of the Maggie Cancer Centres in the UK and Hong Kong is the use of landscape for healing. Maggie Centres offer support to cancer sufferers and their relatives. A research project explored the qualities, patterns of activity and people's experiences at four hospital gardens in the San Francisco Bay area. Of the 143 people who were interviewed about their perspectives, 78 per cent described feeling more relaxed, less stressed, calmer and contented after spending time in the garden.³¹

NATURAL LIGHT

13–30% less time spent in hospital in a sunny room.³²

There is evidence that exposure to natural light while recovering in hospital aids recovery. Several studies have compared the recovery of psychiatric and heart-attack patients in sunny and dull rooms. They found that patients in the sunnier rooms recovered sooner, spending on average 13–30 per cent less time in hospital.³³ The study of heart-attack patients found that the mortality rate was 4 per cent higher for those treated in the dull rooms compared with those in the sunny rooms.

22% LESS MEDICATION

for patients with increased levels of sunlight.³⁴

Another study found patients undergoing surgery who were exposed to an increased level of sunlight in their room experienced lower levels of stress and pain, required 22 per cent less pain medication per hour and had 21 per cent lower pain medication costs compared with those in duller rooms.³⁵ These findings have significant implications for reducing patient suffering, improving efficiency of treatment and reducing healthcare costs through optimal siting and orientation of hospital buildings for sunlight.

AIR QUALITY

Good design practice not only affects things you can see, like views and materials, but the unseen 'dark matter' of building servicing systems, such as the air occupants breathe. Research highlights good air quality helps to protect patients from the spread of airborne diseases and reduces infection rates within the hospital.³⁶ A number of measures, including type of air filtration, airflow direction, air pressure, air changes per hour, humidity and ventilation system and maintenance are linked with reducing infection rates.³⁷ The need to create medically sealed and controlled environments is well known. An operating theatre cannot have openable windows, but hospitals contain diverse spaces. There is a strong perception that connected, centralised hospital air systems can make you sick, and that poorly managed or maintained systems can contribute to the spread of illness.³⁸

PRIVATE ROOMS

50% decreased rate of infection in intensive care unit with private rooms.³⁹

Thirty per cent of patients in intensive care units acquire infections while in hospital, leading to illness and fatalities.⁴⁰ These infections are associated with an increased length of stay up to nine days in intensive care.⁴¹ This additional time in hospital contributes a significant cost to society.⁴² A study found a significant reduction in patient infections for intensive care unit patients in single-bed rooms compared with shared rooms. A five-year study of more than 19,000 patient admissions to two hospitals in Montreal found that the rate of bacterial infections decreased by more than 50 per cent when shared rooms in the intensive care units were redesigned as private rooms.⁴³ The study also found that private rooms reduced the length of stay by 10 per cent.⁴⁴ Studies indicate other benefits of single-bed rooms, including a greater level of privacy and reduced medical errors.⁴⁵

NOISE

Patients recover faster in quieter environments where they are able to rest and sleep without disturbance. Noise levels also affect staff stress levels.

THE ROYAL CHILDREN'S HOSPITAL – A HOSPITAL IN A PARK

Architect: Billard Leece Partnership and Bates Smart

Landscape Architect: Land Design Partnership

Year: 2011

Cost: \$1 billion



The Royal Children's Hospital is designed to provide a healing environment to assist children with recovery. Replacing the original hermetically sealed building of 1963 that had little relationship to the surrounding Royal Park, the hospital design is based on a care model that places children and their families at the centre. Comprising 357 beds across seven levels, the hospital creates a welcoming and restorative environment by prioritising human values and experience. A generous internal thoroughfare at ground floor is designed as a 'main street' to help guide visitors, and provide spaces to capture children's interest, such as an aquarium, sculptures and interactive screens. The hospital is designed to improve the experience of patients, visitors and staffs by providing strong visual and physical connections to the surrounding landscape, bringing in natural light and fresh air, and creating spaces that do not feel institutional.

Project: The Royal Children's Hospital
Architects: Billard Leece Partnership
and Bates Smart
Landscape Architect: Land Design
Partnership
Photographer: John Gollings

THE ROYAL CHILDREN'S HOSPITAL – A HOSPITAL IN A PARK

Architect: Billard Leece Partnership and Bates Smart

Landscape Architect: Land Design Partnership

Year: 2011

Cost: \$1 billion

Connecting with nature

Envisaged as a 'hospital in a park', with strong connections to Royal Park, the design reflects the therapeutic benefits of access to nature for healing.⁴⁶ The star-shaped footprint of the wards extends into the surrounding parkland and creates a series of internal courtyards. This maximises children's views to Royal Park to foster a connection with nature and a view to the outside, providing visual delight and a potential distraction. Eighty per cent of patient rooms and all-day medical chairs benefit from overlooking and views of Royal Park, and the remaining 20 per cent of patient rooms have a view to courtyards or gardens.⁴⁷ Windows along the circulation spine enable views to the gardens and city skyline, helping with intuitive wayfinding for visitors.⁴⁸

An inviting place

The design embraces the notion of a park within a hospital to create a playful and calming environment for children, visitors and staff. A two-storey aquarium is visible from the foyer and emergency department, and a meerkat enclosure developed with Melbourne Zoo provides a point of interest and distraction.⁴⁹ The social heart of the hospital is a six-storey thoroughfare, evocative of a 'main street', that links elements of the hospital and invites people through retail offerings, meeting places, as well as a performance space, playgrounds, and interactive video screens.

Elements drawn from nature are integrated into the textures, forms, patterns and colours. Each floor is inspired by a nature theme, with the signage, graphics, furniture and furnishings, reflecting the diverse landscapes of the state of Victoria, and supporting wayfinding.⁵⁰ The materials were carefully considered to be tactile and help 'de-institutionalise' the experience for children and visitors.

Letting in light

The interior of the hospital optimises access to natural light, recognising the importance this has for supporting the natural cycle of sleep for patients.⁵¹ Thirty-four per cent of the total floor area of the hospital is located within five metres of perimeter windows or an atrium.⁵² The central 'main street' has an abundance of natural light brought in through windows along a third of the north-facing side and the roof.⁵³

Fresh air

The building is designed to optimise fresh air internally. Louvres mounted on the roof enable the main circulation corridor to be naturally ventilated, and in good weather conditions doors on the main floor can be opened to capitalise on the cooling breeze.⁵⁴

Feeling at home

Eighty-five per cent of patient bedrooms are designed for single occupancy enabling privacy and children to personalise their space.⁵⁵ Bedrooms are designed with a 'clinical', 'patient' and 'family' zone intended to support the emotional needs of children, and enhance experience and recovery rates.⁵⁶

Project: The Royal Children's Hospital
Architects: Billard Leece Partnership and Bates Smart
Landscape Architect: Land Design Partnership
Photographer: Peter Bennetts



THE ROYAL CHILDREN'S HOSPITAL – A HOSPITAL IN A PARK

Architect: Billard Leece Partnership and Bates Smart

Landscape Architect: Land Design Partnership

Year: 2011

Cost: \$1 billion

Sustainability

The hospital is designed to reduce its environmental impact. It achieves a 45 per cent reduction in greenhouse gas emissions compared with a conventional hospital through a combination of tri-generation, bio-mass heating and solar thermal panels.⁵⁷ Support and clinical areas are separated to allow areas that do not operate 24 hours a day to be shut down to reduce energy consumption.⁵⁸ The facades of the east and west buildings feature brightly coloured leaves that function as sunshades and evoke the parkland setting.⁵⁹ On-site water treatment and reuse provides 20 per cent of the hospital's water through non-potable, reclaimed water sources.⁶⁰ Seventy-five per cent of the roof area is a catchment, with rainwater collected for irrigating the landscape and for the heat rejection system.⁶¹ A blackwater treatment plant recycles 180,000 litres of wastewater each day that is treated for toilet flushing, the cooling plant and garden irrigation.⁶²



Education

ONE ACADEMIC YEAR

between students in the best designed classroom compared with the worst.⁶³

Early childhood centres, schools, universities and TAFE institutes are important places for a student's educational and personal development. These places can play a role in nurturing a sense of curiosity for new knowledge and skills, encouraging exploration of the surrounding environment. Places for learning often serve as the heart of the local community, providing a place for a diversity of activities that enable social interaction, cultural events and recreation. The design of places for learning can reflect, reinforce and enrich social and cultural values, a sense of identity and local pride. Well-designed facilities and buildings for learning, provide an asset that can be enjoyed both by students and the broader community.

The design of places for learning has come into sharper focus in the last decade, which has seen a fundamental shift in how learning occurs and the development of new technologies. Contemporary education requires a variety of settings, complemented by a balance of technology and spaces for interaction, that facilitate different modes of teaching and learning. New learning spaces need to be flexible, both pedagogically and physically, to ensure teachers can refine their approach and incorporate future innovations in technology.

There is research linking well-designed education campuses and learning spaces with better outcomes for students and staff. Evidence shows that the adoption of good design in early learning, primary, secondary and tertiary education campuses supports student academic performance, as well as student and staff experience.

Studies demonstrate that design qualities, including open spaces, natural light, noise, and air quality, contribute to learning experiences and outcomes. Learning places, whether schools, training centres or universities, often comprise multiple buildings across a single site. It is important to develop master plans for campuses to consider all buildings, new and old, the spaces between them and the ways in which the site will change into the future. A well-considered masterplan can help to achieve the design qualities that enable access to nature, natural light, and air quality, which have been found to support learning.

Project: RMIT New Academic Street
Architects: Lyons, Minifie van Schaik Architects, NMBW,
Harrison White and Maddison Architects.
Landscape Architect: TCL
Photographer: Peter Bennetts



MEASURING GOOD DESIGN

Data collected on academic performance enables the design impact of schools to be measured over time. Post-occupancy evaluation (POE) is an important process for measuring and assessing design outcomes and understanding the successes and weaknesses of educational buildings. This kind of evaluation helps establish evidence of how students and staff interact with their space, and how design affects outcomes.

CREATING THE BUSINESS CASE

Education facilities are significant long-term community assets that both reflect and shape our values as a society. It is important that investment in design considers the whole-of-life costs, including maintenance and adaptability over the long term. Poor design costs more through higher maintenance costs, while good design is cheaper in the longer term and adds broader benefits. Adaptability of campuses embedded now, through master planning and the design of buildings, will allow for modes of teaching to evolve and support technology as it changes. Quality learning environments have a significant effect on the literacy, numeracy and social skills of students. These skills last a lifetime, and equip people to lead productive lives.

Benefits of good design

There is strong evidence that good design of education facilities offers many benefits, including:

increased academic performance

improved sense of safety and pride

improved behaviour

reduced vandalism and bullying

reduced absenteeism

helping to attract and retain staff.



Impact of good design – key findings

DESIGN-LED

Classroom design can improve academic progress by 16–25%⁶⁴

A year-long study found that classroom design can affect a student's academic progress by 25 per cent. Looking at data from 751 students in 34 different classrooms, researchers found that an entire academic year could be gained if a student is in the best-designed classroom compared with the worst.⁶⁵ Another study of 3,766 students at 27 schools by the same research team found that seven design parameters – light, temperature, air quality, ownership, flexibility, complexity and colour – boost academic performance in primary school students by 16 per cent.⁶⁶

OUTDOOR SPACES

4.5 minutes of physical activity per 100m² of grassed surface per child.⁶⁷

Traditionally, learning happened inside the classroom and playing outside. These activities are becoming more like each other, with outdoor spaces that can be used for learning as the interface between inside and outside becomes more fluid. Play-based learning, covered and protected outdoor learning spaces, nature-play spaces and other new approaches have made the outdoors a space of learning. A greater consciousness about indoor air quality has promoted the use of covered outdoor spaces for learning. Well-protected and covered outdoor spaces in our moderate climate can be used for large parts of the school year, and offer variation in the experience of light, view and air movement. By rethinking the outdoors as a space for teaching, spaces such as kitchen gardens and other productive plantings encourage a greater understanding of the environment, sustainability and health, complementing other learning activities.

4.5 TIMES MORE

physical activity at schools with more facilities for physical activity.⁶⁸

A study of 408 primary students at 27 schools in Perth found children had higher levels of physical activity during recess at schools with a higher number of grassed spaces per child.⁶⁹ Children participated in 4.5 minutes of physical activity each day for each 100 square metres of grassed surface at the school, highlighting the importance of integrating grassed surfaces within schools. It suggests that locating relocatable classrooms on grassed areas may negatively affect children's levels of physical activity. The study also found that children at schools with only unshaded grassed surfaces had eight more minutes of daily physical activity compared with those with at least one shaded grassed surface.⁷⁰ In another study, students at schools with many facilities for physical activity, such as a gym, or open fields, were 4.5 times more likely to participate in physical activity during recess, compared with students at schools with fewer facilities.⁷¹

26% FASTER IN READING AND 20% FASTER IN MATHS

for students with the most daylight compared with students with the least daylight.⁷²

LIGHT

Several studies show that the correct level of daylight in teaching spaces has an effect on student progress.⁷³ A study of 2,000 classrooms in the US found that students with the most daylight progressed 26 per cent faster in reading and 20 per cent faster in maths than those with the least daylight.⁷⁴ The study highlighted that this increased rate of learning allows for a great deal of extra time for additional learning in a student's day.⁷⁵ In cases where there are minimal opportunities for windows, studies have shown that skylights can offer a way to increase daylight levels. In one study, skylights were retrofitted in one group of schools to compensate for minimal windows, with students improving up to 20 per cent faster than in classrooms without a skylight.⁷⁶

ACOUSTICS

Different types of noise can impact learning, depending on the nature of the activity. Noise can be distracting and impair student performance in some situations, while on other occasions it can be calming, foster creativity or social interaction. Careful design and acoustic consideration is needed to mediate both sound coming from the outside, such as traffic and weather, and generated internally by interactions between teachers and students, equipment and technology. This can create the right conditions for desirable sounds to be generated and received.⁷⁷ As an example, Fuji Kindergarten in Tokyo, is designed to be deliberately noisy, with no walls between classrooms enabling sound to travel between spaces. Architect Takaharu Tezuka believes that noise is very important, observing at Fuji Kindergarten it helps the young students to relax and concentrate.⁷⁸

While some types of noise can be conducive to learning, some studies have highlighted that noise can have a negative impact. A 1981 study in New York investigated



the before-and-after noise levels in a teaching space that had received acoustic treatment to block out nearby train noise.⁷⁹ Students on the noisy side of the school scored more poorly on reading tests than students in quieter classrooms. Following acoustic mitigation, these students were found to be reading as well as the students on the quieter side. Internal noise generated by students and teachers can also have an impact.⁸⁰ This is a key issue, as more contemporary teaching styles such as project-based learning, collaboration and team teaching often require busier, larger areas that can be noisier.



8% FASTER STUDENT PROGRESSION

in classrooms with openable windows.⁸¹

AIR QUALITY

Several studies show that when an occupant can control and improve air quality, this helps improve education performance.⁸² Being able to open a window improves performance, with one study finding students progressed up to 8 per cent faster in rooms where windows could be opened compared with classrooms with fixed windows.⁸³ The ability to control temperature directly is surprisingly uncommon, with many facilities relying on centrally controlled air systems, whereas schools built before the mid-20th century often used natural ventilation for decent air quality and cooling. Schools built from the 1950s onwards were able to be less reliant on windows for air, and indeed light. As a result, 'deeper' building footprints became more widespread, with occupants losing control of the heating, cooling and ventilation options.

DIVERSITY AND FLEXIBILITY

Research shows younger students respond differently to the shape of learning spaces compared with older students. Learning spaces with more complex shapes can be beneficial for primary school students, while secondary school students tend to need simpler spaces.⁸⁴ Generally, the research shows that diverse spaces are needed, with varying sizes and different characteristics.⁸⁵ Much discussion around contemporary learning spaces focuses on flexibility of use to allow for different 'modes' of learning, including larger spaces for team teaching, smaller spaces for individual teaching and break-out spaces for informal learning. Allowing spaces to open to each other, or to be used in a variety of ways, is central to this. The use of relocatable classrooms in many schools has hampered uptake of these flexible education models. Relocatable classrooms help manage fluctuations in enrolments, but have limited adaptability and thermal performance, and affect the amount of space that can be allocated for play.

COLOUR

Colour plays a role in making spaces more inviting and conducive to learning. Research highlights that careful consideration of the use of colour is important to ensure student comfort, as too much colour can be overbearing.⁸⁶



FURNITURE

An extensive global survey of studies into children, learning and furniture found that if furniture is not well suited to a student's size, there is a detrimental effect on their ability to learn, and that adjustability in furniture optimises learning.⁸⁷ The selection and arrangement of appropriate furniture is also a design task, holistically integrated in the overall building design by the design team. Contemporary educational furniture allows for flexibility in configuration and different types of posture, for example, sitting, lounging, or leaning. Opportunities for informal sitting, play or learning can be integrated into the design of edges, floors and landscapes. Furniture can both allow for flexibility and improve student comfort and learning, and is an important consideration in well-designed schools.

BUILDING QUALITY AND LIFECYCLE

Research shows that design can influence the perceptions of students and staff in learning environments. The Commission for Architecture and the Built Environment conducted student and staff surveys at five universities in the UK, finding that 60 per cent felt that the quality of the buildings had attracted them to study or work there.⁸⁸ Eighty per cent of staff stated the buildings positively affected their performance.⁸⁹ The UK's National Foundation for Education surveyed secondary school students before and after their new school building opened in 2007. They found that following the opening of the improved building, the number of students who felt safe at school increased by 30 per cent, perceived vandalism decreased by 51 per cent, and bullying decreased by 23 per cent. The number of students who felt proud of their school increased 34 per cent and the number of students planning to complete school increased by 13 per cent. These findings demonstrate that high-quality education facilities benefit not only the people who work and learn there, but also the society and the economy more broadly.⁹⁰

60% FELT QUALITY

of buildings attracted them to their university.

30% INCREASE

in students who felt safe at school, 51% decrease in vandalism, 23% decrease in bullying as a result of improved school facilities.

Project: Birralee Primary School
Architect: Kerstin Thompson Architects
Photographer: Derek Swalwell

ALBERT PARK COLLEGE, VICTORIA

Architect: Six Degrees

Year: 2016

Cost: \$5 million

The Environmental Arts Hub for year 9 students at Albert Park College does not look like a typical contemporary school from the outside. The adaptive re-use of two significant heritage buildings creates a new lease of life for the heritage fabric, and shapes the layered understanding of the past to enrich a modern approach to education for future generations.

Reinvigorating heritage

The hub unifies two important public buildings – the 1887 Sandridge Post and Telegraph Office, designed by colonial architect John James Clark, is one of the earliest surviving buildings in Port Melbourne, and the 1911 Naval Drill Hall, designed for the newly established Royal Australian Navy. The design takes advantage of features of the heritage

buildings that are ideal for creating inviting learning spaces, such as the scale and height of the Drill Hall as an assembly, performance and breakout teaching space, and the light and airy interiors of the buildings. New architectural elements are sensitively separated from the heritage structures, with subtle and recessive materials. The entrance to the school sits in a space between the two buildings at the rear lane, maintaining the integrity of the structures, and from the main street, appearing as they were in the early 1900s.

Project: Albert Park College Environmental Arts Hub
Architects: Six Degrees
Photographer: Simon James



ALBERT PARK COLLEGE, VICTORIA

Architect: Six Degrees

Year: 2016

Cost: \$5 million

Collaborative spaces

The school features flexible and diverse interior and exterior spaces to foster creativity, collaboration and interaction among students. The original double-height Drill Hall forms the centrepiece of the campus, and is retained as a large multipurpose learning, meeting and performance space. Timber tiered seating offers a space for performances or students to gather for group activities, connecting with an upper level and providing an appreciation of the building volume. The ground and mezzanine levels comprise four large multipurpose and science classrooms. The school's reception, meeting and music rehearsal spaces are located in the Post Office building. Reflecting the contemporary learning approach, the Hub was designed to enable flexibility, informal and online learning. Spaces are designed to be open and transparent, with spaces often separated by glass walls, aquariums or perforated steel mesh instead of solid walls. The campus also features a sustainable kitchen and cottage garden, courtyard and vertical gardens.

An inviting place

The Hub intends to create a new version of the 'community hall'. The school offers flexible, accessible and affordable spaces for the community to use for activities such as events, performances, exhibitions, rehearsals and classes. The Post Office and Drill Hall buildings were stripped back, leaving the shell and removing later additions. The Post Office walls display an unfinished state that is engaging, adding an inviting tactile quality. The original jarrah floorboards in the Drill Hall uncovered beneath a sprung floor were restored and polished. Along with the use of timber and plywood in the interiors, these materials provide warmth and texture.

Engendering environmental awareness

Re-using the heritage structures, as well as modern lighting and heating initiatives, reflect the school's environmental values, and also provide a tool for students to learn about sustainability. Insulation that improves thermal performance is exposed, using the building fabric to facilitate learning. Double-glazed windows improve thermal and acoustic performance. Reliance on fossil fuels is reduced through gas-fired hydronic heating and solar hot water. Rainwater is collected for irrigating the landscape and flushing toilets. Materials from the heritage buildings have been recycled, with old doors redesigned as bench tops, and the sprung floor that was removed from the Drill Hall was used as wall cladding. Original chain-operated pivot windows in the Drill Hall were reinstated, enabling night-time purging of heat and stale air. The project has brought new life to two heritage-listed buildings as a place for learning and an asset for the broader community.

Project: Albert Park College Environmental Arts Hub
Architects: Six Degrees
Photographer: Simon James



ALBERT PARK COLLEGE, VICTORIA

Architect: Six Degrees

Year: 2016

Cost: \$5 million



Justice

2 X MORE LIKELY TO BE CONVICTED

when defendants sit in a glass-fronted dock, compared with sitting at the bar table.⁹⁸

Design has an impact on those who use the justice system. The design of police stations, courts and prisons can contribute to the community's sense of fairness and safety. The community's experience of the justice system often starts with law enforcement, and often involves interactions at the police station. Integrating an open, transparent, and inclusive approach to police station design helps elevate the perception of the facility by the community and as a workplace.⁹¹ Research suggests that if this is achieved, then police stations can be welcoming and reassuring to the community.⁹²

MEASURING GOOD DESIGN

There has been limited research on the impact of the design of police stations, courts and prisons.⁹³ However, research from other institutional settings, such as healthcare and schools, is instructive to the design of justice facilities. Available research highlights that the design elements in courtroom design, such as ceiling heights, effective use of colour, artwork, adequate spaces, comfortable temperatures, visual access to trees and natural light, can have a calming effect to help reduce anxiety of jurors.⁹⁴ Over the past decade, research has emerged investigating the impact of the design of the prison environment, highlighting that good design is crucial to prison operations, and works in conjunction with administration, staffing and other activities.⁹⁵

CREATING THE BUSINESS CASE

There is evidence that prisoners in better-designed environments cause less harm and are less likely to reoffend when released back into the community.⁹⁶ In Norway, well-designed prisons have been found to cost less to operate and contribute to reduced reoffending rates. Countries that follow this model experience similar results.⁹⁷ Reduced reoffending rates is a better outcome for society, economically and ethically.

Benefits of good design

There is strong evidence that good design of justice facilities offers many benefits, including:

improved rehabilitation

reduced recidivism

improved behaviour of prisoners

reduced vandalism and bullying

improved sense of safety

improved build quality reduces operational costs, improves efficiency and saves money

improved landscape quality creates a restorative environment to improve prisoner experience

improved staff morale and reduced absenteeism

supporting improved integrity in the justice process.



Impact of design

The design of the courtroom can influence the jury's perceptions of a defendant. An Australian study found that defendants were twice as likely to be convicted when sitting in a glass-fronted dock compared with the same person sitting at the bar table. In this study, the traditional prisoner 'dock' models present the defendant in a way jury members see as more likely to be guilty, whereas if the defendant sits at a bench, there is less prejudice.⁹⁹ This study highlights the way in which design can support impartiality and fairness.

Better-designed courts

Court design traditionally focused on the separation between judges and all others in the court room. Design and internal amenity were often secondary to technical and functional issues. Jury members spend extensive periods of time in deliberation rooms, and if these rooms do not have good amenity, such as access to natural light, members of the jury feel frustrated and find it harder to undertake their emotionally draining work. The Australian Institute of Criminology surveyed 1,676 jurors, finding that facilities at courtrooms do not always provide a supportive

Project: Marysville Police Station
Architect: Kerstin Thompson Architects
Photographer: Trevor Mein



working environment for listening, waiting and deliberation. The survey found that the design of the courtroom environment, amenities and facilities, contribute to jurors' level of comfort and satisfaction with the experience of the jury service.¹⁰⁰ In the survey, only 42 per cent were satisfied with the quality of spaces for them to work while waiting, 51 per cent found the jury assembly room comfortable, and only 54 per cent were satisfied with the level of natural light.¹⁰¹ The report highlighted that jurors are often accommodated in cramped rooms that lack space, privacy and the ability to control temperature, airflow or lighting.¹⁰²



Better-designed prisons

The design of prisons has been influenced by competing theories of punishment and rehabilitation. The idea of imprisonment as the primary sentencing tool for criminal activity developed in the late 18th century. Prior to this, imprisonment was a holding bay for other forms of punishment, particularly capital punishment. The idea of the prison as a place of reform and betterment, akin to a school or a place of healing in some ways like a hospital, has varied over time. Contemporary thought today sits between prison as place of rehabilitation, and a place of oppressive 'warehousing', where prisoners wait out their terms. Given the nature of imprisonment drastically reduces the size of someone's environment, the design of a prison has a disproportionately larger influence on an occupant's wellbeing and mental health.

REHABILITATION

Some of the key factors for successful prisons are related to management – minimising overcrowding and creating a healthy culture. But all of this is facilitated by the nature and quality of the prison environment. The use of more humane and better-designed prisons is not, however, universal. Many new prisons in England that use 19th century typologies in both form and layout have seen recent riots.¹⁰³ An emphasis on reducing yearly costs in a highly privatised delivery model has saved money in one regard, but can result in greater flow-on costs arising from disturbances or recidivism.

OUTLOOK AND LIGHT

Like other building types, prisons perform better when staff and prisoners get access to natural light and views. Getting good outlook and light into interior spaces, including cells, visiting rooms, corridors, eating areas and staff areas needs to be embedded in the layout and design at the start of the process.

It is not just about layout, but also details such as how windows are treated. For example, thanks to the strength of modern safety glass, Halden Prison in Norway features no bars on windows, and prisoners have a clear view of surrounding greenery.

PRIVACY

Research clearly shows that prisoners are less aggressive when they have their own cell,¹⁰⁵ giving them an important sense of privacy. Prisoners who share cells have been shown to have more strained relationships with officers compared with those in single rooms.¹⁰⁶ A lower level of privacy is linked to a greater demand for health services by prisoners.¹⁰⁷

CEILING HEIGHTS

Lower ceiling heights in prisons can increase levels of stress and the sense of incarceration and confinement.¹⁰⁸ This makes sense – none of us feels good in continuously low spaces. Despite this, many prisons feature low ceilings, often in corridors and key social spaces. It has been shown more broadly that low ceilings affect people significantly, increasing a sense of confinement,¹⁰⁹ and this sensibility to increase ceiling heights should affect all building types, especially ones in which emotions may run high.

NOISE

Unwanted noise is associated with an increased likelihood of antisocial or violent behaviour by prisoners.¹¹⁰ Acoustic privacy can be most readily achieved using single-occupant cells. In addition, the cells themselves can feature better acoustic separation from each other and common areas outside. Large atrium-type circulation spaces offer visual connection and good ceiling heights, but when (as is common) they are finished in hard, sound-reflective materials, these spaces are disturbingly noisy. Using acoustically absorbent materials and more undulating spaces can alleviate this.

AIR QUALITY, SMELL AND TEMPERATURE

The quality of indoor air is important in any building type, and particularly in prisons, which are often sealed environments with few, if any, openable windows. The rate of air change is limited, and this can lead to increased smells, and evidence shows that poor odour increases aggression.¹¹¹ While mechanical-services design can lead to consistent air quality and temperature, people tend to prefer variation, which improves wellbeing and comfort.¹¹² Poor air quality can lead to a variety of illnesses, and this has been established for other building types.¹¹³ Many of these issues can be addressed with the use of restricted openable windows. Use of external air to moderate temperature can also reduce overall energy costs.

Access to nature

The ability for prisoners to engage with nature is often restricted due to the design of the prison within the landscape. However, there is evidence that a visual and physical connection to nature can reduce anxiety, stress and aggression for a variety of building types, including prisons.¹¹⁴

This connection is twofold – both getting outside into planted areas and seeing the wider landscape (through the use of transparent fencing) but also being able to see nature from the inside out.

MOVEMENT AND REPETITION

Being able to move around without encountering closed spaces is important in prisons and increases safety, helping prevent conditions for violence.¹¹⁵ It is important to avoid dead ends, and to connect spaces with each other and allow movement between them, to the extent possible. Much prison design repeats prison cell modules, but allowing this repetition to vary, both in terms of layout and façade treatments, can create a better environment for prison users and the wider community.

MATERIALS, FINISHES AND COLOUR

Prisons are associated with the use of institutional colours and materials that increase a sense of monotony, boredom and incarceration. A range of natural materials, textures colours can be positive,¹¹⁶ and when they are appropriately applied, they can bring a sense of place, functionality and calm to any environment. The properties of materials such as colour, texture, and smell can contribute to warmth and wellbeing within the prison environment. Well-chosen materials can also minimise maintenance and associated on-going costs.

LAYOUT

The 19th century prison model which featured repetitive, linear, multilevel blocks often arranged in a pin-wheel form, is still used today, even though it generates poor experiences for those within. Research from the UK has shown that blocks of cells organised in a 90-degree formation radically increases the quality of outlook from cells, and the quality of outdoor spaces between the cell blocks.¹¹⁷

The design of the individual cell is a critical task in a prison, as small design elements are repeated on a large scale. Where blocks are arranged in pin-wheel formation, angled individual windows can help increase access to light and views. Careful consideration of the few items in a cell – the bed, desk, toilet and shelf can make a substantial difference.¹¹⁸



VISIBILITY AND SAFETY

In prisons, low-visibility spaces are often those where violence occurs, and so a competing need arises for good visibility throughout but also with spatial variation and interest. Good design can resolve these needs together, for example through subtle variations in form that still allow for good visibility, as well as better materials choices to create variation in colour and texture, which also allow for better acoustic absorption.

Project: Marysville Police Station
Architect: Kerstin Thompson Architects
Photographer: Trevor Mein

Better design supports restorative outcomes and a fairer justice system

The evidence relating to the design of prisons and the justice system more broadly supports the assertion that better design results in less crime within the system, and less crime through re-offending after people have served prison sentences. Better design in court buildings can make the justice system fairer and take less of a toll on all involved, and well-designed police stations can become true community buildings and productive workplaces for those who work there.

Well-designed justice buildings can help make a better, fairer and more ethical justice system. Learning from local and international precedents and by using key design principles – can lead to justice buildings that benefit everyone in the community.

HALDEN PRISON, NORWAY

Architect: HLM Arkitektur As and Erik Møller Arkitekter

Landscape Architect: Asplan Viak As

Interior Architect: Beate Ellingsen As

Year: 2010

Cost: \$252 million

With a reputation as the 'world's most humane maximum-security prison',¹¹⁹ Halden Prison in Norway is designed to support the rehabilitation of its 250 prisoners. Spaces for learning, work and leisure are designed to reflect the real world as much as possible to assist prisoners to reintegrate into the community when released. Norway's rehabilitative and humanistic corrective system contributes to the low rate of recidivism, with 20 per cent of released prisoners arrested for re-offending, compared with 45 per cent in Australia.¹²⁰ The architecture and landscape at Halden Prison contributes to a calming atmosphere, with clean, bright interior spaces, soothing colour palettes, soft materials and the use of nature as a social and rehabilitative factor. The effect of these design qualities on the behaviour and wellbeing of prisoners at Halden Prison is supported by appropriate funding, the quality of services and management, as well as the treatment by guards and staff.

Rehabilitative design

The buildings within the walls of the prison are designed to reflect a village. This is based on the idea that the transition from prison to freedom is easier if there are fewer differences between life inside and outside the prison. Located within a forested area, the buildings have their own identity and use materials inspired by the natural surroundings. The architecture steers away from symmetries and axial orders to avoid an institutional atmosphere, evoking a sense of security and comfort, similar to that of a community or school.

The prison comprises three main units, with Unit A separated and restrictive for prisoners who require close psychiatric or medical supervision and Units B and C featuring more open-living cells. The prison features a large activities building that includes an indoor sports room, concert hall and a chapel, as well as a recording studio, a gym with rock climbing wall, library, computer and education training room, wood and metal working areas, and car maintenance areas for vocational training. The different buildings are separated to bring prisoners outside to strengthen their connection with the forested environment. This also reflects the movement between 'home', 'school' and 'work', to help normalise the day-to-day experience for prisoners.

Connecting with nature

The landscape is an important element, as it is believed that nature plays a key role in supporting the rehabilitation of prisoners. The prison is located in a forested area, providing prisoners with access to woodland jogging trails and a soccer field. Nature enables prisoners to follow seasonal changes, which helps them to clarify the passage of time. Many of the existing trees were retained to provide outdoor shading. An area of untouched vegetation has been left in the centre of the grounds for recreational uses. An orchard and kitchen garden next to the kitchen is tended by prisoners. Trees screen the 6-metre-high wall surrounding the prison, obscuring its visibility to prevent the prison from looking hostile. The landscape emphasises the natural features of the terrain, with ridges retained.

Light, views to nature and comfort

Located in a forested area, the design of the buildings embraces the outdoor environment, providing access to natural light and views to the landscaped gardens from the inside. Long, vertical windows allow more sunlight into interior spaces. Eliminating bars from windows enables unobstructed views to the surrounding landscape. Prisoners can control the internal environment with acoustics and temperature, providing a sense of personal freedom to control their space to enable comfort.

Project: Halden Prison
Architects: Erik Arkitekter and HLM arkitektur
Landscape Architects: Asplan Viak
Photographer: Image courtesy of Erik Arkitekter



HALDEN PRISON, NORWAY

Architect: HLM Arkitektur As and Erik Møller Arkitekter

Landscape Architect: Asplan Viak As

Interior Architect: Beate Ellingsen As

Year: 2010

Cost: \$252 million

Materials

The buildings are designed as an extension of the surrounding woodlands, by using 'soft' materials such as bricks and larch wood, rather than 'hard' materials like concrete. These materials also change in response to the weather and light conditions to give prisoners a sense of time passing. With a humanistic approach to rehabilitation, the prison does not have conventional security devices, such as barbed tape, electric fences or towers. The prison uses safety glass to provide transparency and protection, rather than materials that evoke forcefulness and violence.

Interior spaces

Interior spaces have soothing colour palettes, high-quality durable and low-maintenance furniture and fittings and ample light. This is intended to avoid the prison feeling too institutionalised, which could provoke negative behaviour by prisoners. Cells are 10 square metres in size and have a stainless-steel countertop, wraparound sofa, flat-screen television, mini fridge, toilet and shower, which reflect a domestic setting rather than an institutional setting. Unbarred windows allow more light in. Hallways are decorated with large photographs, and the yard walls and toilet doors are painted by a Norwegian graffiti artist in an effort to normalise the prison.

The rooms for guards are deliberately cramped, to encourage them to spend time in common areas to interact with prisoners instead. The isolation room has not been used since the prison opened, reflecting the general wellbeing of prisoners and low rates of violent behaviour.



Workplaces

We spend an enormous amount of our time in workplaces. Evidence shows that good design can contribute to a more productive workplace for employers and a better experience for those of us who work in them. Good design brings different building and functional elements together to make a cohesive environment. It does not mean just doing one thing well, such as using quality materials or ergonomic furniture, but rather it is about getting everything right, from the fundamentals to the finishes.

The design of workplaces affects staff wellbeing, health and performance. Given that staff costs typically account for 90 per cent of business operating costs, improvements in staff productivity, including reducing absenteeism, retaining staff, as well as fostering staff creativity can contribute to significant financial savings.¹²¹

Research demonstrates that key elements of good design can improve workplaces in terms of staff performance, and those of a building more widely – in terms of energy use and financial return. Studies have investigated how a range of design attributes, including natural and artificial light levels, air quality, thermal comfort, layout, access to nature, views, colour, and noise, affect staff engagement, performance, productivity and satisfaction.¹²² Researchers have also investigated the effect of sustainable buildings on productivity and health.

MEASURING GOOD DESIGN

The impact of design can be measured using a range of business metrics including staff absenteeism, staff turnover, revenue, as well as complaints. Perceptions of workplaces can also provide a measure of the impact of good design, including attitudes to health, wellbeing, and productivity. The environmental conditions of workplaces such as temperature, air quality and light levels can be measured to assess the impact on health and wellbeing of staff.¹²³

CREATING THE BUSINESS CASE

Businesses want engaged staff who take fewer days off. Increased business performance is one of the key benefits of good design in workplaces – it increases staff productivity and reduces absenteeism, which is a major cost to business. Staff turnover can also be reduced through well-designed workplaces – there is an enormous cost in training and getting staff familiar with any organisation's systems and ways of working. One study has shown that better-designed work environments reduce staff turnover from 25 per cent to 11 per cent.¹²⁴

Good and sustainable design saves money. Research into green buildings demonstrates well-designed sustainable buildings have lower long-term operating costs.¹²⁵ Research shows that better-designed sustainable offices have higher rental returns and asset values,¹²⁶ as the market factors in the financial benefits of these improved performance buildings. Making better-designed workplaces works for all parties – workers, employers and building owners – who all see increases in either the quality of their experience while at work, or in greater financial return.

As with many building types, bad design comes at a cost. For workplaces, this can be a very direct financial cost, as staff wellbeing is directly linked with performance and attendance. Larger corporations, in particular, have led innovation in redefining the workplace, as their internal research has demonstrated the benefits of better designed spaces.

STAFF TURNOVER REDUCED

from 25% to 11% through better designed workplaces.¹²⁷



GREEN BUILDINGS 'OUTPERFORM' CONVENTIONAL BUILDINGS.

Benefits of good design

There is strong evidence that good design of workplace facilities offers many benefits, including:

increased productivity

attracting and retaining staff

reduced absenteeism

improved health

improved sustainability

reduced whole-of-life cost

improved organisational outcomes.

Increased light

IMPROVES PRODUCTIVITY 20%.¹²⁸

Increased daylight

REDUCES ABSENTEEISM BY 15%.¹²⁹

Impact of good design – key findings

SUSTAINABILITY

Much of the research and analysis on green buildings focuses on workplaces, particularly office buildings. Organisations have studied the benefits of green buildings, and found that good design reduces not only long-term energy use, but also all the costs a building generates over time. These studies make the strong argument that good design costs a tiny percentage of the eventual cost of a facility and its operations. An investment in good design now saves money in better staff productivity over the long term – and on-going staffing costs can be massive compared with one-off building costs.

LIGHT

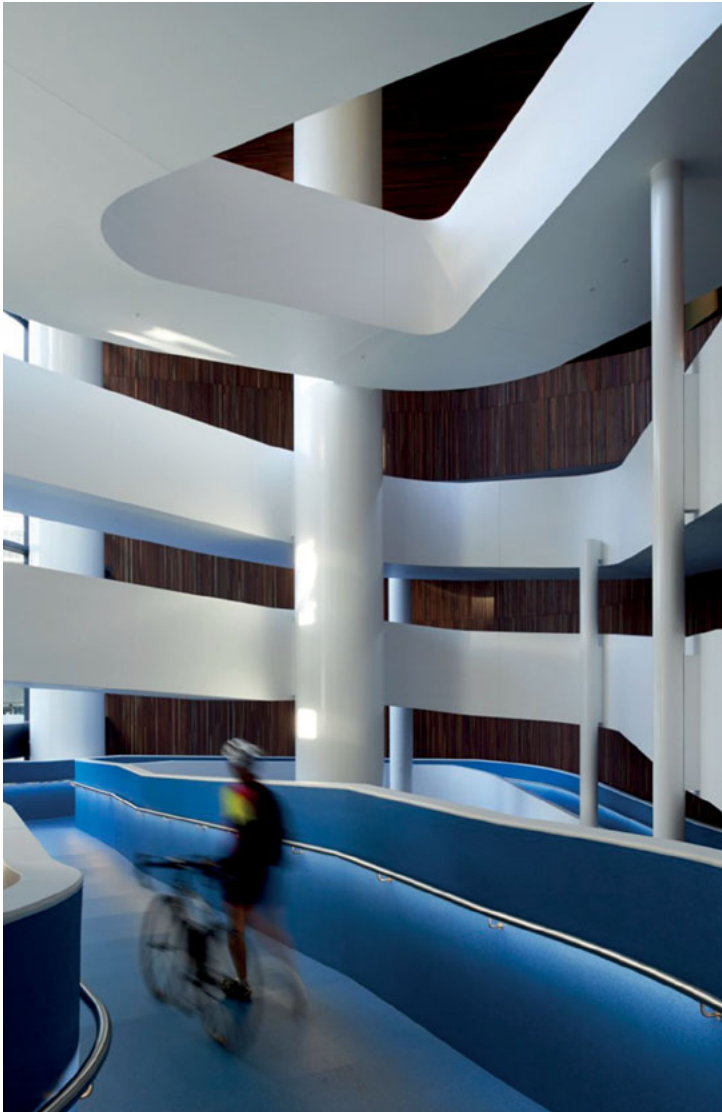
Access to good levels of light increases performance. Higher illuminance levels are associated with an increase in productivity of up to 20 per cent.¹³⁰ Studies show that daylight in the workplace is associated with a 15 per cent reduction in absenteeism.¹³¹ Good light cannot be easily retrofitted, so getting daylight into workspaces should be considered when a building is being designed.

ACOUSTICS

Good acoustics are critical in workplaces, particularly in open-plan environments. Good design strategies can mediate noise, along with the selection of suitable materials and furniture. Data suggests that some noise is useful, but too much can reduce performance.¹³² Ensuring the right level of noise in a workplace is a balancing act, and this is backed up by several studies. Too much noise can be distracting, while some 'buzz' can help a work environment.¹³³ Noise can be generated by other workers, but also by mechanical systems such as ventilation, particularly in the highly and centrally serviced building types that are common for office buildings. One study showed that eliminating low-frequency noise from the ventilation system increased performance by 8 per cent.¹³⁴ The use of absorbing surfaces in workplaces can help mute distracting sounds – but overdoing it can close people off too much from each other. Good design can help satisfy what appear to be opposing needs by balancing different elements.

Air quality

Good air quality can increase productivity by a remarkable 20 per cent.¹³⁶ The problem is that the quality of air suffered greatly with the advent of building-wide heating and cooling systems in the mid-20th century, and this is still the default way of doing things. This actively prevents users from controlling, and 'owning' their direct environment. Newer, smarter systems have improved this situation, but often these are still technology-led solutions that workers have no control over, or involvement with. A new office workplace building with openable windows is a rarity, unfortunately – and despite its simplicity, this is actually hard to do well. The concept of personal control over environment is paramount, even if this is perceptual.¹³⁷



Project: Medibank Place
 Architect: Hassell
 Photographer: Earl Carter

**GOOD AIR
 QUALITY
 INCREASES
 PRODUCTIVITY
 20%.¹³⁵**

Interaction

Bringing people together needs to be done in a way that encourages interaction. It is suggested that 80 per cent of the most valuable interactions are informal, such as meeting in the hallway or kitchen.¹³⁸

At a direct level, we also need to be relatively close to each other – if we are more than 50 metres away from co-workers, we tend to interact with them less,¹³⁹ so proximity and ‘connectedness’ is a spatial idea as much as it is a digital one.

Design for physical activity

Providing secure bicycle parking and showers has a positive effect on workers’ decisions to cycle to work.¹⁴¹ The location and design of stairs and corridors can also encourage physical activity as well as social interaction.

STAIRS ARE MORE LIKELY TO BE USED

when visible from the building entrance.¹⁴⁰

Furniture and layout

There is emerging evidence that layout can influence the extent of sedentary behaviour, which is a health risk. A study found that office workers who had greater visibility of their co-workers and connectivity with other parts of the building, including between floors, took more frequent breaks from sitting.¹⁴²

SOUTH EAST WATER

Architect: BVN

Landscape Architect: Taylor Cullity Lethlean

Year: 2015

Cost: \$70 million



By bringing together 700 staff previously dispersed across three locations, South East Water's purpose-built headquarters is anticipated to generate \$20 million in operational savings to the organisation.¹⁴³ The consolidation of the separate offices at Frankston helped to reduce floor space by 20 per cent. South East Water recognised the role of workplace location and experience as a targeted way to attract talent to the organisation.¹⁴⁴ A generous verandah wraps along the ground level of the building with cafes and retail premises activating the Kananook Creek. A terraced landscape beside the waterway, with public seating, fig trees and grassed areas, contributes to the public realm, creating a revitalised place for people to walk and sit.

Project: South East Water Headquarters
Architect: BVN
Landscape Architects: TCL
Photographer: Diana Snape

SOUTH EAST WATER

Architect: BVN

Landscape Architect: Taylor Cullity Lethlean

Year: 2015

Cost: \$70 million

Sustainability

The building has revitalised a prime site in Frankston's CBD, which was previously occupied by a council owned car park, alongside the Kananook Creek and a short walk from Frankston Station and the beach. The project included the rejuvenation of the foreshore along the Creek, with an improved public promenade, landscaping and activation. Surveys of staff before and after the move highlights the impact of the design, with 85 per cent of employees feeling the new building provides a connection between work and the outdoor environment, compared with 32 per cent in the old buildings.¹⁴⁵

The project achieved 5 Star NatHERS Office Design. Rainwater is captured, stored and used for flushing toilets and irrigating the site's gardens. The main internal staircase, visible through windows on the western façade, connects the different floors, and shares views of the Bay with all staff, encouraging them to use the stairs. The configuration of the internal spaces enables potential flexibility to adapt to changing needs over time.

Light and views

Windows along the western side of the building provide views of Port Phillip Bay and bring natural light into the building. Small breakout spaces and meeting rooms are located adjacent to the windows, with those on the western side featuring timber panelling to help block the summer sun. A series of cascading atriums create a sense of openness and the ability to see others working in other parts of the building.

Interaction and collaboration

The integration of different aspects of the business into one location has enabled greater collaboration between teams.¹⁴⁶ The building features open-plan offices, with a diversity of meeting rooms and generous kitchens, intended to encourage interaction and collaboration. The rooftop terrace features furniture and barbeques, which offer a space for staff events and relaxation.

Project: South East Water Headquarters

Architect: BVN

Landscape Architects: TCL

Photographer: John Gollings



Housing

The design quality of our housing is central to how we live – from the single, detached house to the central city apartment – and how well our neighbourhoods and communities work. Housing provides us with shelter from weather, a place to rest, and offers safety, security, privacy and personal space. A good home is essential in a society that is healthy, inclusive, equitable and economically productive.

International human rights law recognises everyone’s right to an adequate standard of living, including adequate housing.¹⁴⁷ Getting everyone into housing is a critical task of any society. Evidence shows that inadequate housing is detrimental to those living in it and also the wider community. Once you have a basic standard of housing,

the task is to get well-located and well-designed housing that improves wellbeing, health and amenity. The OECD highlights the importance of housing quality, as ‘it is a major driver of health status with effects for both mental and physical health.’¹⁴⁸ There is a history of evidence of the impact that poor quality housing has on the community and the economy,¹⁴⁹ while poor neighbourhood design has health-related costs that are absorbed by all.

Good design can improve quality of life and a sense of wellbeing.¹⁵⁰ It can help people identify with and be part of a community. Good design in housing is fundamentally about how well things work and the level of amenity provided.



MEASURING GOOD DESIGN

The impact of good housing design can be measured in different ways. These include measuring property values, rental return and vacancy rates, the perceptions, experiences and preferences of housing occupants, and environmental performance and operational and maintenance costs.

CREATING THE BUSINESS CASE

Poor-quality housing results in significant costs to the householder, to society, the economy and the environment.¹⁵¹ For example, in England, it has been estimated that poor housing costs the National Health Service (NHS) £1.4 billion a year.¹⁵² 1.7 million homes in England were found to fail a standard for thermal comfort, resulting in homes that were inefficient and costly to heat for residents. By not improving these homes, it is estimated that the NHS will incur costs of £145 million to care for people who suffer illness from exposure to the cold.¹⁵³

Benefits of good design

There is strong evidence that good design of homes and neighbourhoods offers many benefits, including:

improved health and wellbeing

greater sense of community

improved sense of safety

improved environmental performance and reduced energy costs.

Residents of apartments
with inadequate light are

**1.4 TIMES
MORE LIKELY
TO REPORT
DEPRESSION
AND 1.5 TIMES
MORE LIKELY TO
REPORT A FALL.** ¹⁵⁴

Project: Nightingale 1
Architect: Breathe Architecture
Landscape Architects: Oculus / Openwork
Photographer: Peter Clarke

**Impact of good design
– key findings****SUN AND LIGHT**

Getting light into our living spaces is vital. People value daylight – there is a link between satisfaction and poor light in homes.¹⁵⁵ Daylight, if managed well, reduces the need for artificial light during the day, and sunlight can heat the interior. The formula is simple – bring in winter sun, block out summer sun – but it is insufficiently enacted. Studies have found links between levels of natural light in homes and physical and mental health of residents. One study found that inadequate levels of natural light in apartments is associated with increased rates of falls and depression.¹⁵⁶ An industry report found links between natural light or direct sunlight and improved wellbeing. Rooms with sunlight were found to reduce stress, lethargy, improve depressive symptoms, visual comfort and cognitive impairment issues.¹⁵⁷ Exposure to natural light in living spaces is also important for supporting sleep regulation. A disruption to the circadian rhythm has been linked to a range of health issues including depression, sleep difficulty, heart disease, diabetes, obesity and breast and prostate cancer.¹⁵⁸ Daylight has been found to contribute to a sense of comfort and satisfaction. A study of residents in an apartment building in Brisbane found natural light was associated with a sense of spaciousness and increased liveability.¹⁵⁹

THERMAL COMFORT

Indoor thermal comfort – the temperature and quality of air – affects our health and wellbeing, as well as the amount of energy used for heating and cooling our homes. Poor-quality housing and neighbourhood design has significant and sometimes extreme costs to the community and the economy.¹⁶¹ In Australia, exposure to cold weather contributed to 6.5 per cent of deaths, almost double that of Sweden, despite having a milder winter. Poor quality housing design and construction is a key factor that contributes to Australians' exposure to colder internal temperatures during winter. This is the result of poor orientation to the sun, poor or non-existent thermal insulation, and poor-quality windows and doors that allow air leakage and thermal loss. In Victoria, housing performance averages two stars or less, which is the equivalent of keeping a window open all the time in winter.¹⁶² In comparison, the quality of housing in Sweden, which is designed to be comfortable in different weather conditions, plays a role in the lower number of lives lost due to the cold compared with Australia.

Exposure to

COLD WEATHER CONTRIBUTED TO 6.5% OF DEATHS IN AUSTRALIA,

almost double Sweden.¹⁶⁰

Research in Glasgow, Scotland, found that improved thermal comfort affected the health of residents of four apartment blocks. The study monitored the apartment buildings before and after they were upgraded from being cold, damp and mouldy, to being comfortably warm, dry and mould free. As a result of improved thermal comfort, apartment residents experienced a significant fall in their blood pressure, enjoyed improved overall health, required less medication and hospital visits, and had reduced heating costs compared with those who remained in homes with poor thermal design.¹⁶³

PERFORMANCE AND SUSTAINABILITY

The rising price of energy has brought into sharp focus how much energy each home uses. The sun is important – in terms of both solar energy (hot water and electricity) and getting good winter sun for natural heating. Designing to optimise the sun involves using passive design principles.¹⁶⁴ If homes are well designed, heating and particularly cooling systems are far less needed, and sometimes not required at all. Good passive solar design drastically reduces heating and cooling costs, which account for 40 per cent of the energy costs in a home.¹⁶⁵ Research of more than 5,000 home sales in the ACT found that every improvement in star rating for energy efficiency added almost \$9,000 to resale value.¹⁶⁶

CONNECTIONS TO NATURE AND OUTLOOK

Outdoor spaces are important for providing recreation opportunities for residents and connections to the natural environment. Outdoor spaces are desirable and well-designed homes have good indoor–outdoor connections. Too much outdoor space on housing sites is residual. Good design is critical to provide usable space of sufficient area for entertaining, relaxing, children’s play and with good visual and functional links to appropriate rooms in the house, as well as space with trees or verandahs that offer shade at the right times while allowing sunlight in and keeping winds out during winter.



73% OF AUSTRALIANS PLAYED OUTDOORS

more often than indoors when they were young

COMPARED TO ONLY 13% OF THEIR CHILDREN.¹⁶⁷

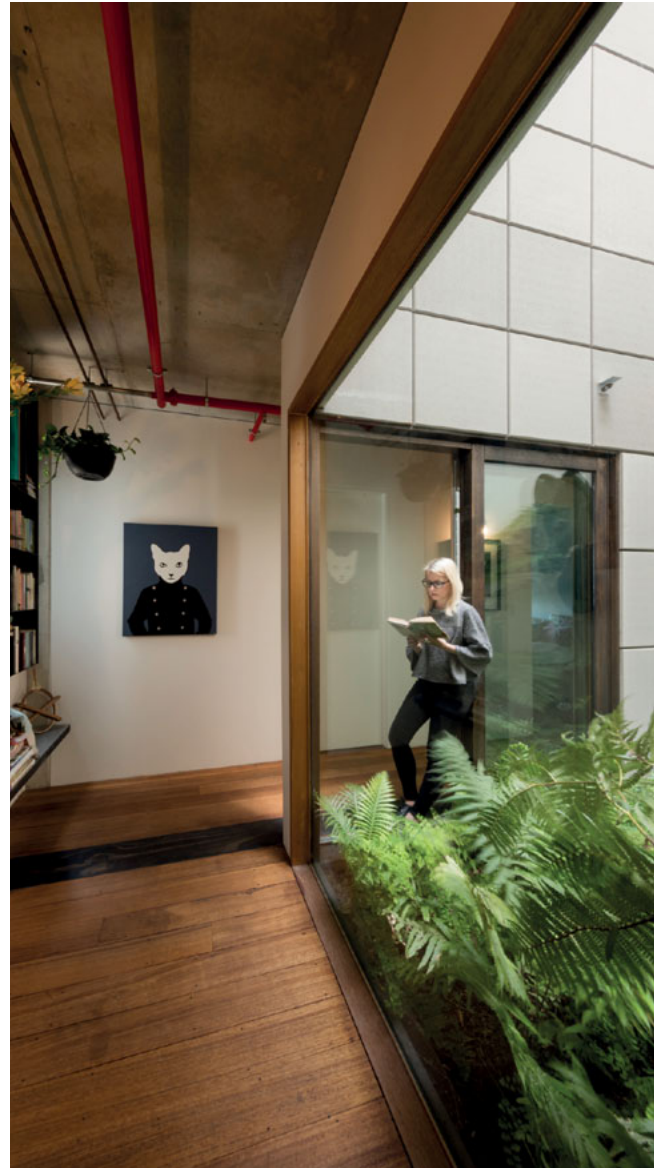
Views of trees, parks and streets contribute to visual amenity that makes the experience of being inside far more connected to the wider world. A study that analysed 5,000 house sales in Auckland found that different types of views have an impact on property values, with a waterfront view adding up to 59 per cent.¹⁶⁸ Attractive improvements to the surroundings of a property add 27 per cent in value, while the values of properties in areas with poor-quality landscaping can be depreciated by as much as 51 per cent. Views of activated streets, with people going about their daily activities, can also be important for some sections of the community, especially the aged and infirm.

In a drive to maximise internal space, we have often lost the value of good outlook. Views of trees, parks and streets all create visual amenity that make the experience of being inside far more connected to the wider world, while maintaining privacy. This amenity can also be shared – borrowing the view of a tree from a neighbours' garden or looking out onto trees in the street has positive effects.

PRIVACY AND NOISE

Central to the idea of a home is visual and acoustic privacy. Levels of privacy vary according to times of day and even the year, as well as in different parts of a home. Our living spaces, indoors and outdoors, often need to be separated from neighbours both visually and acoustically to enable privacy.

Project: Accordia, UK
Architects: Feilden Clegg Bradley Studios, Maccreevor Lavington & Alison Brooks
Landscape Architect: Grant Associates
Photographer: Tim Crocker



Project: The Commons
Architect: Breathe Architecture
Landscape Architects: Land Projects
Photographer: Diana Snape

People living in areas with high traffic noise are

25% MORE LIKELY TO EXPERIENCE SYMPTOMS OF DEPRESSION.¹⁶⁹



Noise comes from surroundings, both immediate such as neighbours above and below in apartments, or next door in houses – but also from traffic, trains, planes and other infrastructure. Noise can cause annoyance by disrupting living activities such as communication, tasks that require attention or concentration, and rest. External noise, especially from traffic, has been found to affect wellbeing and health, with studies linking it to sleep disturbance, stress, hypertension, cardiovascular issues, depression, and respiratory issues.¹⁷⁰ A study of 3,300 people found that people living in areas with higher traffic noise (above 55 decibels), were 25 per cent more likely to have depressive symptoms compared to those living in quieter areas.¹⁷¹

FLEXIBILITY AND ADAPTABILITY

Change is a constant in housing. Needs change, families change, all of our living situations change over time. Children are living at home longer, there is a return to extended family models, and people are sharing houses to make them affordable. Despite this, most new housing is still designed around nuclear family models based on two parents and two or three children.¹⁷³ This model of the 1950s is still being applied in a context that is far more complex and heterogeneous.

Making housing flexible and maximising access for all ages, abilities and life stages involves design strategies common

in public-sector housing – flat floors, wider doorways and corridors, and decent clearances in front of kitchen cabinetwork and bathroom appliances. Such techniques allow for a variety of residents over time to use spaces – the physically and mentally less able, the elderly and young children. An adaptable home is able to respond to the changing needs of residents without expensive retrofitting or modifications costs. This enables people to stay in their home if they choose to as they age, their household grows or abilities change. Universal design supports flexibility, adaptability and the longevity of housing.

The cost to home owners for integrating key design features to meet changing needs is

22 TIMES MORE EFFICIENT THAN RETROFITTING

when an unplanned need arises.¹⁷²

Housing projects from Australia's leading design researchers have shown that flexibility, adaptability, sustainability and amenity can be fused together to create affordable fit-for-purpose homes for a range of household types.¹⁷⁴



Project: Accordia, UK
 Architects: Feilden Clegg Bradley Studios,
 Maccreehan Lavington & Alison Brooks
 Landscape Architect: Grant Associates
 Photographer: Tim Crocker

CPTED INITIATIVES DECREASED ROBBERIES BETWEEN 30% AND 84%.¹⁷⁴

While the arguments for pursuing good design are very strong, it needs to be demanded by households and encouraged by regulators. Many aspects of good design are not easily marketable because they are not immediately visible, but they do deliver significant long-term benefits in the running cost of the home and the pleasure to be gained from living in it.

A significant increase in apartment development in recent years has resulted in many units with poor ventilation and access to sunlight and, as a result, focused research on their impact on health and wellbeing. Simultaneously, as lot sizes on the fringe of the city have been reduced as part of the strategy to inhibit sprawl, house sizes have increased, with the average house built today approximately 30 per cent bigger than 30 years ago.¹⁷⁶ This has resulted in oversized houses on small lots, with a lack of useful outdoor space and poor tree canopy, which reduces bird life and biodiversity. Too often, the housing provided is for an assumed 'market-norm' buyer, ignoring the changing nature of Australian demographics and household formations. Recent research has demonstrated the importance for cities to offer a mix of housing that suits people's needs in terms of households, lifestyle and location. This includes a mix of tenures; private, public, social housing – and a mix of housing types – detached, semi-detached, apartments. All of these types, if well-located, accessible and well-designed, can make measurable differences to the wellbeing of residents, quality of life and create a legacy for the city.

We are producing new housing that is not always fit-for-purpose nor suited to current needs. This is largely due to the idea of housing as an investment, a consumer product, rather than as a space for living. A greater focus is needed on the quality and design performance of homes.

Good design is absolutely central to ensuring the provision of quality housing. Astute design enables the juggling of competing needs, with the result being the optimisation of initial budget, running costs, location, appearance and the satisfaction of how well it works.

CONNECTIONS TO NATURE

Outdoor living is desirable and well-designed homes have good indoor–outdoor connections. Too much outdoor space on housing sites is residual, what is left over between the building and the boundary. Good design is critical to provide usable space of sufficient area for entertaining, children's play and with good visual and functional links to appropriate rooms in the house, as well as space with trees or verandahs that offer shade at the right times while allowing sunlight in and keeping winds out during winter.

SAFETY

Many years ago New York writer Jane Jacobs established that being able to see what was happening in the street made the street itself safer, driven by our natural desire to observe.¹⁷⁵ This has been further validated by recent research that shows the ongoing importance of active streets, with visibility of the street increasing awareness of safety and security. Crime prevention through environmental design (CPTED) is prominent in this new understanding. Despite this, much housing in Australia turns its back on the street, reducing safety and diverting outlook opportunities to small, often poorly considered outdoor spaces. In addition, our preference for high fencing and generally closing ourselves off from one another reduces security and makes crime easier.

THE COMMONS, BRUNSWICK, VICTORIA

As the name suggests, The Commons, a five-storey apartment building in Brunswick offering communal rooftop spaces for residents to share, with a community garden, beehive and laundry. At street level, two retail spaces activate the street and are designed to bring in the local community. The building highlights the nexus between sustainability, affordability and liveability, with the design integral to the comfort, social experience and living costs of residents. The Commons is a prototype for a different development model that promotes designer-led, rather than developer-led, housing.

Communal spaces

Fifteen per cent of the building is devoted to communal spaces that encourage residents to casually meet or come together.¹⁷⁷ The rooftop terrace features 360-degree views, a garden, beehive and shared laundry that are managed by residents. Each apartment has an individual garden plot that enables access to nature and the opportunity to grow food.

The fire stair is designed to be inviting, with operable windows that provide natural ventilation and daylight. This encourages people to walk instead of using the lift, promoting physical activity and reducing energy use.

Amenity and comfort

All 24 apartments have strategically placed windows to provide access to natural light and cross ventilation, giving residents control over the comfort of the indoor environment. Double-glazed, floor-to-ceiling sliding doors to balconies create a connection with the outside, and contribute views, light and a sense of space to compact living areas. Two internal light wells in the building provide access to natural light and ventilation and are used to cool the apartments in summer. Exposed, rather than plastered, ceilings increase height to provide a sense of spaciousness.

North facing apartments have generous timber deck balconies that provide shading from the summer sun, while allowing the sun into internal spaces in winter. Vertical gardens climb up the north façade.

Materials

A minimal approach which used only materials that are needed reduced building costs and environmental impact. Plastered ceilings and bathroom tiles are not used in the interiors, exposing the architectural structure and pipes, as well as creating an urban industrial aesthetic. Recycled timber floors in apartments and the use of bricks from the previous building on the site at the entrance add interest and give new life to old materials. The majority of materials are non-toxic, natural, locally sourced and have a low embodied energy.

Affordable, sustainable and healthy living

A focus on reducing the environmental impact contributes to cost savings for residents. Passive design principles, where natural sources including the sun and breezes, are used to heat and cool the building. The apartments maintain a comfortable temperature without mechanical heating or cooling. Building temperatures are moderated by external shading, double-glazed doors and windows, natural cross-ventilation, insulation and ceiling fans. Insulated and exposed concrete ceilings provide thermal mass, and hydronic heating assists with heating during cooler weather. With a 7.5 Star Green Star Rating, the energy footprint of a two-bedroom apartment, is reduced to approximately one-quarter of a typical two-bedroom house.¹⁷⁸ The environmentally sustainable design features reduce residents' energy bills by up to 90 per cent compared with a standard apartment. Rooftop solar panels power the common areas of the building including lifts and lighting, and water is collected for the garden plots. The apartments share its solar hot water system and hydronic heating boiler.

With the building just a short walk from a train station, tram stops, a bike path, and only 6 kilometres from the central city, the designers challenged the requirement for car parking. With zero car parking, the building required no excavation or above-ground car parking, which has reduced the construction cost and carbon footprint. Where a typical apartment building would provide car park access, two retail spaces on the ground floor activate the streetscape and invite the local community in, creating a positive relationship with the local area. The building has 72 bicycle parking spaces on the ground floor, and a dedicated car share vehicle for residents to use. This encourages residents to walk, cycle, or use public transport which improves physical activity, and reduces the traffic of surrounding streets, providing health and environmental benefits.

THE COMMONS, BRUNSWICK, VICTORIA

An economical approach to apartment and building design saved \$1.2 million in construction costs – a saving that trickles down to purchasers.¹⁷⁹ Many aspects of the design reduce purchase and living costs for residents. Replacing private car parking with bicycle parking and car share means residents do not need to own a car. A communal laundry and covered clothesline reduces the cost to buy, and space needed in each apartment, for an individual washing machine. This also consolidates the plumbing to one laundry, providing efficiencies for construction and maintenance. The environmental footprint and construction costs are also reduced by eliminating second bathrooms, no air conditioning, and the considered paring back of unnecessary materials.

The architecture acknowledges community values and provides a healthy social environment for residents to form acquaintances and friendships.

Project: The Commons
Architect: Breathe Architecture
Landscape Architects: Land Projects
Photographer: Diana Snape



Urban design

Urban design is not just a well-designed building. It includes the spaces between buildings, infrastructure, landscape elements, plazas or streetscape elements. Good urban design is central to ensuring the liveability of our cities and regional towns.

Well-designed civic buildings, such as libraries, galleries, performing arts centres and community centres are often the cornerstones of our neighbourhoods, towns and cities. Public open spaces, including parks, gardens, waterways, civic squares, streets and laneways, support health and wellbeing by providing places for social interaction, recreation and the ability to connect with nature. Green spaces often serve ecological functions such as protecting biodiversity, reducing the heat-island effect, and improving stormwater and air quality, and are essential for resilience to extreme weather events such as heatwaves, storms and floods.

Public places are by definition accessible to everyone. Civic buildings and public open spaces are central to the vitality of our communities, providing places for people to come together for enriching social, cultural and recreational experiences. These places serve as important social and environmental infrastructure that helps build community by contributing to local character, identity, and pride, including our sense of belonging.



MEASURING GOOD DESIGN

Measuring good urban design requires quantitative and qualitative data that works from a baseline for comparison. In 1994, a baseline was created through a survey of the City of Melbourne by Jan Gehl Architects. Gehl returned to Melbourne in 2004 to conduct a new Public Life and Public Space survey, which demonstrated that significant urban design changes increased pedestrian traffic in the Bourke Street Mall between 1993 and 2004, from 43,000 people per day to 81,000.¹⁸⁰ In addition, night-time pedestrian traffic increased 98 per cent between 1993 and 2004, reflecting the growth of bars and cafes and a safer, more welcoming environment.¹⁸¹ This baseline continues to be monitored by the City of Melbourne through ongoing public space and public life surveys.

CREATING THE BUSINESS CASE

Urban design can have a profound impact on the local economy of a city. The City of Melbourne's Walking plan 2014 demonstrated that if the walking connectivity within the Hoddle Grid was increased by 10 per cent, the value of the economy of the Hoddle Grid would be increased by up to \$2.1 billion a year, which is a 6.6 per cent increase in the value of the current economy.¹⁸²

Equally, research into the cost of bad urban design by the New Zealand Ministry for the Environment in 2005 uncovered evidence that '[p]oor design ... is likely to have significant adverse environmental, social and even economic effects. The perpetuation of poor design can lower quality of life and limit employment opportunities. An example ... is low-density peripheral urban development with rigidly segregated land uses, and residential areas poorly connected to commercial activity and with poor internal connectivity. The literature is clear that the "external costs" generated by such development are significant. Essentially, much urban design is unsustainable.'¹⁸³

Benefits of good design

There is strong evidence that good design of public places offers many benefits, including:

improved physical and mental health

encouraging physical activity and recreation

improved sense of wellbeing and happiness

supporting cognitive development of children by encouraging play

less car use

improved biodiversity and provide habitats for birds, animals and insects

improved air and stormwater quality

cooling urban areas to mitigate the urban heat-island effect

increased social capital and connectedness.



Impact of good design

STREETS FOR PEOPLE

The street is a public space. Well-designed streets are full of movement, nature and recreation. Many streets are, however, dominated by transport, particularly cars. Streets with wider footpaths, trees and seating become mini public spaces. Making streets work as 'strips' of public space is particularly important where there are no squares or plazas within walking distance.

Street trees have multiple benefits – providing weather protection to people walking, mitigating stormwater loading and reducing the impacts of heat-island effect. Well-chosen tree species can bring light into streets in winter and provide shade and cooling in summer, while providing habitat for birds and wildlife. People naturally gravitate to shady trees when it is hot.

In a traditional city layout, streets often meet at public spaces, and squares and plazas help make cities legible and easier to navigate – they are the anchors of the city. Walkability is increased with both generous footpaths, and good destinations to get to – the ability to walk to local parks along tree-lined streets was linked to a five-year increase in life expectancy in a Tokyo study.¹⁸⁵ Designing streets to create a walkable network also means facilitating access to places people are likely to visit.

Good-quality public space will also encourage cycling. In Copenhagen, Denmark, a reduction in traffic movement led to a sixfold increase in high-quality public spaces in the city. The result was a variety of social, environmental and economic benefits, including a 65 per cent rise in bicycle use since 1970. Despite the relatively cold climate, there was an increase in the use of public spaces. This shows that if a city has good urban design with well-managed open spaces, people will use them.¹⁸⁵

Good urban design focuses on public places where people like to be and will feel safe. Empty streets and spaces feel isolated, uncared for, and potentially risky or dangerous. In Perth, Western Australia, adults who had access to large, attractive, public open space were 50 per cent more likely to undertake high levels of walking.¹⁸⁷ Further research in the US has demonstrated that by doubling the accessible land-use mix within a 1 kilometre radius of a household, it quadrupled the walking activity for that household.¹⁸⁸

Walking and cycling to school provides an important opportunity for children's physical activity and health. The urban design of the neighbourhood and the quality of the pedestrian environment in the area surrounding the school influences children's ability to walk or cycle. A study of 677 primary school students in Melbourne found that students were more likely to walk or cycle to school if their route was less than 800 metres. Factors such as a longer distance to school, the need to cross busy roads, and poor access to traffic lights and crossings had a negative effect on the ability to walk or cycle to school.¹⁸⁹

+5 YEARS LIFE EXPECTANCY

was linked to the ability to walk in local parks and along tree lined streets in a study of 3,100 older residents in Tokyo.¹⁸⁴

PUBLIC SQUARES

Well-designed and active public squares are the heart of a city, and provide focus for public events, celebrations, tourism and protests. However, a great public space works every day at every time of the day – not just when events occur. This requires activation, ideally from a combination of public buildings and busy commercial operations to make a space work successfully day and night. Public spaces do not have to be big, either, as people tend to group around the edges of a square.¹⁹⁰

A good, well-designed public space includes a combination of factors to attract and keep people in the space. If the space is well-designed, studies show there will be an increase in public life.¹⁹¹

SEATING

It has been shown that seating is an important ingredient for a successful public place.¹⁹² If seating is configured in the right way, to allow for both group and individual use, it will be more likely to be used. Sitting occurs on benches and seats, but also on tables, edges, steps and on the ground, particularly grass – and this kind of use should be encouraged to allow people to find different ways to use their public space. Seats should not be just fixed – the use of movable furniture gives users a sense of ownership and ability to customise the environment.¹⁹³ Poorly considered seating that is not designed for people to sit and talk to each other is far less likely to be used, further discouraging other people from using the space.

SHELTER AND SUNLIGHT

To enable public space to be used in all seasons, successful spaces often have different kinds of shelter. From constructed roof canopies or natural tree canopies, to the wind-breaking walls of surrounding buildings, providing weather protection from harsh sun, rain or wind, makes a public space more usable. These protecting elements can also help define a public space by giving it boundaries, which helps create a sense of enclosure. Good public space also enjoys good sunlight in winter, when direct sun is desirable. Generally, if the design of the public space allows for the different positions of the sun and different weather conditions, it is more likely to succeed.¹⁹⁴



ACTIVATION

It may seem contrary to the nature of public space, but private businesses help make public space better if handled well. Elements such as kiosks, cafes, bars, restaurants and busy retail premises bring people into spaces, or give them something to do when they get there. It is a balancing act – smaller commercial ventures are preferred, such as kiosks and smaller cafes, so they do not dominate. Seating for these should be located within a small section of the wider public space, but should be in addition to ‘free’ public seating. Generally, people like to watch other people.¹⁹⁵

SAFETY

Public squares and plazas, like all forms of public space, are safer when they have good visibility, with views into and around them. Typically, compact public spaces such as small parks or squares should have very good visibility to the street. Areas of public spaces that are not visible from the street, or are not looked into from surrounding buildings, are more at risk of crime, and do not feel safe. Active retail outlets provide security through observation, as does just having lots of people in a space. In contrast, vacant space that few people can observe attracts crime. When a vacant block adjacent to three low-rent apartment buildings and a school

was turned into a community garden, it led to a 56 per cent reduction in reported police incidents.¹⁹⁷ Good public space provides not only a good place to be, but also a place to look into from surrounding buildings. Good public spaces provide this visual amenity, and the more observation, the safer the space is for all.

56% LESS CRIME

when a vacant block was turned into a community garden.¹⁹⁶

Project: Caulfield to Dandenong Open Space Corridor
Architect: Cox Architecture
Landscape Architect: Aspect Studios
Photographer: Peter Bennetts

PUBLIC BUILDINGS

Public buildings often have some form of public space in front or around them – think of the State Library of Victoria in Melbourne as a great example. In this way, the edge of a public building is a threshold that leads to interior public spaces. These threshold spaces traditionally were often covered arcades or colonnades, spaces that provide aspect onto the wider public realm and form a transition with the interior.

Good contemporary public buildings are different to corporate and private buildings, and often gain their presence through public spaces in front of them and a direct openness into their interiors. These range from suburban libraries to major gallery buildings that define cultural precincts. All of these should be well designed to maximise their public benefit. Recent projects in Victoria such as the Geelong Library show that a well-designed public building can create a dramatic increase in public usage and engagement.

**EVERY DOLLAR
INVESTED
IN PUBLIC
LIBRARIES
GENERATES
\$4.30 OF
BENEFITS TO
THE LOCAL
COMMUNITY.** ¹⁹⁸



PARKS

Parks have many benefits for visitors and also the wider environment of plants and animals. Parks generate health benefits and tourism.²⁰⁰ There are two broad types of parks – large, more natural parks that capture and highlight native flora and fauna, and urban parks that sit within the density of our towns and cities. Parks act as the lungs of the city – literally helping us breathe better, and allowing for higher density living to be pleasant, based on the use of shared green space. In this way, urban parks are very efficient – they are highly utilised by different groups at different times. In comparison, private back gardens are used only on occasion. Good design in larger natural parks focuses on minimal design intervention – sensitive masterplanning provides subtle car and bus parking, well-considered paths and walkway structures, and a light touch to built elements that allows natural beauty to be the focus. Whether it is in the city park or a national park, access to green space is beneficial to all people's health – and research shows that better-quality space is more highly utilised.²⁰¹

Green spaces that provide opportunities for recreation, such as parks and sporting fields, allow people to be physically active. This helps to address public health by reducing obesity, lowering blood pressure and extending life spans. Research reported in *The Lancet* confirmed that access to green space is beneficial to people's health, regardless of their economic circumstances, and that the quality of green space is directly related to how well it is used.²⁰² Research also suggests that park size is an important factor for

encouraging recreational walking. There is evidence that parks that are greater than 1.5 hectares in size are more likely to encourage recreational walking compared to smaller pocket parks.²⁰³

\$200 MILLION IN AVOIDED HEALTHCARE COSTS

through physical activity
in nature in Victoria's parks.¹⁹⁹

Project: *krakani lumi* – 'resting place'
in the *wukalina*/Mt William National Park, Tasmania
Architect: Taylor and Hinds Architects
Photographer: Adam Gibson



PADDINGTON RESERVOIR GARDENS, PADDINGTON, SYDNEY

The Paddington Reservoir Gardens, a former water reservoir that served the growing population of Sydney, is now a public open space that embraces its history. Sydney City Council proposed a new park to replace the derelict subterranean infrastructure. However, the design team challenged the expectation that the site be capped, and the reservoir sealed below to enable a park to be built above. Instead, they convinced the council and community that the disused historic water chambers be preserved, and reimagined the site as a sunken garden that connects visitors with the past.

Project: Paddington Reservoir Gardens
Architect: Tonkin Zulaikha Greer
Landscape Architects: JMD Design
Photographer: Brett Boardman



PADDINGTON RESERVOIR GARDENS, PADDINGTON, SYDNEY

Adaptive reuse of heritage

The reservoir was decommissioned in 1899, and became used as a storage facility and petrol station up until 1990. In the 1930s, a grassed park was built above the water chambers which were constructed below street level. In the 1990s, the roof collapsed and the site abandoned. By 2006, the structure was in a dangerous state of collapse and the reservoir was listed on the New South Wales Heritage Register. Through the transformation into a civic park, the design team was able to stabilise the existing fabric and structure as a 'ruin' and insert new functions that celebrated its history with public use. The project was conceived as a civic garden over three levels: a raised lawn on the roof of the intact eastern chamber, a sunken garden in the roofless western chamber, and a public park and small plaza on the northern street frontage between the reservoir and Town Hall. Ensuring public safety was a challenge, and the existing structure needed to be propped for reuse. Although the structure of the reservoir was never intended for human occupation, the site has been successfully transformed into a garden that is imbued with urban memory.

Design and materials

Materials from the historic structure were retained and reused to conserve both the identity and embodied energy. The original reservoir was constructed of brick with ironbark columns, and cast-iron segmental arches that form the roof of the structure. The new elements are intentionally distinguishable, using a restricted palette of three materials (steel, aluminium and concrete) that complement the historic fabric. This acts as a connection between present and past, signalling entry and access across the site, and expressing the reservoir's form and function. The stabilisation of brickwork with pre-cast concrete elements shows a permanent melding of construction made from two different eras, forming the base for a new landscaped park to be built above. Two lightweight roofs, influenced by the shape of the brick vaults, float above the reservoir, indicating the main entries to the sunken garden.

Public open space

The garden is designed to be a new active meeting place in the heart of the precinct, with the intention of providing a recreational space for exploration and play in the midst of civic activities. In transforming what was initially seen by the public as a 'dangerous eyesore', the design team was 'captivated by the possibilities of revealing the 19th century structures as a ruin through which members of the public could wander'. The result incorporates a sense of discovery into an exciting and welcoming public space that is embedded with history, texture and environmental qualities. Paths, ramps and lifts through the site are designed to enable access by people of all abilities.

Landscape

The Paddington Reservoir Gardens has been carefully landscaped to convey a rich dialogue between nature and structure. This is achieved by dividing the park into 'rooms' that create intimate garden spaces of different environments, all of which complement the heritage elements of the site. These spaces also contrast with the vast open spaces that are often found in Sydney, providing a sheltered area of respite from the vibrant and noisy adjacent streets. The park uses a range of swamp species and formal exotic plantings to interpret historical landscapes that evoke the Victorian era of the reservoir's construction. The small pond in the sunken garden reflects the ruined fragments of the vaulted roof, serving a reminder of the reservoir's original purpose as a water storage facility. The design of the gardens is flexible and reversible, so that the site can be adapted over time without reducing its heritage significance. A water tank below the sandstone plaza captures water from the adjacent town hall to irrigate Paddington Reservoir Gardens.

Paddington Reserve Gardens has reinvigorated the Paddington civic precinct. The project successfully adapts and reuses a State Heritage structure that had been neglected for more than 16 years, creating a dedicated public space for a variety of activities. It is designed to be safe for all ages, with improved passive surveillance of the site, and it is accessible with carefully considered pedestrian links and walkways. The materials and details utilised in the construction are robust and built to last. The statement of significance by the New South Wales State Heritage Register states that 'long-standing community efforts to preserve the reservoir are a testament to the high level of regard in which it is held by the community'. Since its restoration into a civic park, Paddington Reservoir Gardens has had an important urban role in providing adequate open space adjacent to Paddington's civic precinct, which includes the Paddington Town Hall, Paddington Post Office and Juniper Hall.

Transport

Transport enables us to access the destinations we need to get to. Our experience of moving to and from different places to meet our day-to-day needs shapes our ability to connect with our friends, family and neighbourhoods. Well-integrated transport networks, including connected footpaths, cycle paths, public transport and streets, ensure we can safely, conveniently and efficiently get to work or school, do our shopping, visit family and friends, and engage in sport, cultural and recreational activities. Equitable access means that we can reach these places regardless of where we live, our age, income or physical abilities, at all times of the day.

The design of transport networks plays a significant role in the physical shape of the city, and our everyday choices to walk, cycle, use public transport or drive to where we need to go. How they are designed affects travel time, cost and safety, as well the comfort and experience of our journeys. When places are challenging for people to get around, they are less economically productive, less sustainable and socially isolating. Poorly planned and designed transport networks mean more time spent commuting, and less time for friends, family and social, community or recreational activities.²⁰⁴

Places that prioritise walking, cycling and public transport offer greater health and environmental benefits. Walking and cycling are inexpensive, emission free and offer health and social benefits.²⁰⁵ A high-quality environment for pedestrians benefits all citizens, as people with impaired mobility also need high-quality, safe and comfortable footpaths to move around. Walking contributes to the vitality of places, and is crucial for solving many challenges facing society, including pollution, global warming, congestion and health.²⁰⁶ Neighbourhoods and connections between destinations that are designed to prioritise cars can create unsafe and hostile environments for walking. Places that do not have high-quality, connected and safe walking and cycling links, and are cut off from public transport, contribute to our dependency on cars. This can contribute to social isolation and traffic congestion and makes it harder for people to access jobs and education. Driving is not only linked to sedentary lifestyles and an increased risk of obesity and other diseases, but is a significant contributor to air pollution, emissions and noise. Well-designed active transport improves productivity, the environment, and our health and wellbeing.

MEASURING GOOD DESIGN

There are several ways that the impact of design is measured for transport. Travel behaviour is analysed through a range of data sets including journey to work and travel surveys. This data helps to monitor the number of people who get around by walking, cycling, using public transport, and driving. Access can be measured through the distance to different types of transport infrastructure such as a bus or tram stop or train station, but also proximity to a range of services such as shops, schools or parks within walking or cycling distance. The safety of transport infrastructure, such as safety and stops can also be assessed through crime prevention through environmental design (CPTED) principles. The quality of a street can be measured by monitoring the number of people walking or cycling at different times of day, week or year. Its safety can also be measured over time by monitoring the number of accidents. Traffic congestion is monitored by collecting data on vehicle numbers. Noise and air pollution can also highlight the effects of transport design.

Project: Frankston Station
Architect: Genton
Landscape Architect: McGregor Coxall
Photographer: Peter Clarke



CREATING THE BUSINESS CASE

Places that are designed to prioritise walking, cycling and public transport offer several economic, environmental and social benefits. Transport accounts for 25 per cent of carbon dioxide emissions, with 75 per cent of this generated from road transport. Prioritising walking, cycling and public transport reduces air pollution and greenhouse gas emissions.²⁰⁷ Investment in designing streets that have quality spaces for walking and cycling generates a higher economic return compared with other transport infrastructure projects. A study of data from department of transportation and public works departments in 11 US cities evaluated the number of jobs created through the design, construction and materials procurement of pedestrian, bicycle and road infrastructure. Across 58 projects, the study estimated that for every \$1 million invested on cycling projects, 11.4 jobs were created, compared with 10 jobs for pedestrian-only projects and 9.6 jobs for multiuse trails. Road-only projects were found to generate the least number of jobs, with 7.8 jobs per \$1 million.²⁰⁸

Places designed to prioritise and encourage cars have an economic, social and environmental cost. A study in Portland in the US revealed a 'green dividend', where the reduction of driving by 20 per cent compared with the rest of the country helped residents save more than \$1 billion, resulting in more disposable income to be spent with local businesses.²⁰⁹ Research also shows that increasing pedestrian activity offers benefits to the local economy. A study by Transport for London found that pedestrians spend approximately 65 per cent more than drivers, representing an additional £147 spent per month.²¹⁰

Benefits of good design

Evidence shows that good transport design offers many benefits, including:

increased productivity

improved environmental outcomes, including better air quality, reduced pollution and carbon emissions

improved health through active transport

increased social cohesion

improved safety

improved accessibility and connectivity

reduced congestion

improved perceptions, experiences and comfort

reduced maintenance cost of public transport facilities

increased pedestrian and cycling activity

increased public transport ridership.



Impact of good design – key findings

ACTIVE TRANSPORT

The design of streets affects whether people are likely to walk, and the presence and quality of footpaths is linked to active transport and recreation. Elements such as footpath surfaces, curb design, shelter, seating, lighting, trees and vegetation, public artwork and the design of surrounding buildings contribute to the quality and safety of streets for people to enjoy for walking, cycling, recreation and socialising.²¹¹ Streets with wide footpaths, seats and lighting support pedestrians. Street trees have many benefits including shade, noise reduction, mitigation of the urban heat-island effect, pollution reduction, economic benefit and visual delight.²¹² It is 5–15 degrees Celsius cooler walking beneath the canopy of a tree compared with walking on streets without trees, which increases comfort for pedestrians. This is particularly important given climate change is increasing temperatures. Good street lighting improves the perception of safety. Road crossings, traffic calming devices such as speed bumps, traffic lights with short pedestrian wait times, and lower traffic speeds and volumes encourage walking and cycling.²¹³

Residents of walkable neighbourhoods experience better social outcomes compared with those living in car-dependent areas. A study in Ireland found people living in walkable neighbourhoods had 80 per cent higher levels of social capital than those in car-dependent neighbourhoods.²¹⁴ They were more likely to know and trust their neighbours, and feel more engaged with their community.

Analysis of 66 places in Washington DC found that walkable places perform better economically,²¹⁵ and providing a walkable street gives a premium of \$9 per square foot for annual office rents, \$7 per square foot for retail rents, \$82 per square foot for home values and \$300 per month for apartment rents.²¹⁶

A range of features have been linked with cycling, including population density, connectivity, land-use diversity, accessibility to destinations, the provision of bike lanes and off-road paths, traffic levels and speeds and end-of-trip facilities including showers and secure bike parking. Infrastructure including separated bike lanes, lane markings or signage can support cycling.²¹⁷ In several countries, such as Germany, France, the Netherlands and Sweden, injury and fatality rates for pedestrians and cyclists fell by more than 70 per cent from 1975 to 2001.²¹⁸ This was supported by lowering speed limits, introducing high-quality transport systems and demand management strategies such as reduced car parking, road design that reduces conflicts between pedestrians, cyclists and drivers, and improved traffic signals.

Project: Darebin Yarra Trail Link
Designer: VicRoads Urban Design
Photographer: Emma Cross



INTEGRATED LAND USE AND TRANSPORT

A mix of destinations within neighbourhoods encourages people to walk and cycle, helping to create a sense of community and belonging. Locating shops, services, jobs and community facilities together enables people to undertake one journey to perform several activities.²¹⁹ Areas with diverse and accessible local destinations and transport options encourage people to walk. The benefits of this include the potential for unplanned social encounters that contribute to a sense of community, reducing loneliness and social isolation that can affect premature mortality.²²⁰ This also increases natural surveillance, which makes people feel safer and helps to prevent crime.²²¹ Neighbourhoods that are compact and designed to integrate parking and transport infrastructure encourage walking and cycling, which contributes to a reduction in fuel consumption by 43 per cent.²²²

Access to transport affects participation, with one in four people with limited access to transport in Melbourne experiencing difficulty participating in social activities at least once a week.²²³

Proximity of homes to schools is linked with children walking or cycling to school. A study found that 5–6-year-old children are five times more likely to walk or cycle to school if the walk is less than 800 metres,²²⁴ and 10–12-year-old children are 10 times more likely to walk or cycle to school using the same distance.

CARS

Major roads and traffic infrastructure create physical and social segregation, reducing the level of connections between neighbourhoods. In places that are designed for cars, not owning a car or not being able to drive is a barrier to mobility.²²⁶ Congestion is costly to the economy and affects productivity.²²⁷ It also has an environmental and social cost. Streets with high levels of traffic measurably reduce a community's wellbeing, with one study showing that residents on streets with lower traffic levels had three times more friends than those who live on streets with high levels of car traffic.²²⁸ Using cars for long commutes negatively affects wellbeing, prompting people to work even more to increase their spending to offset the negative effects of driving.²²⁹ Every kilometre travelled by car or bike incurs a cost to society, with research estimating that this is 0.5 euros per kilometre for car driving compared with 0.08 euros for cycling. After including costs of road accidents and pollution on health and the cost of carbon, one kilometre driven by car is found to cost society 0.15 euros, whereas there is a gain of 0.16 euros for each kilometre cycled.²³⁰

Project: The Bicycle Snake
Architect: DISSING+WEITLING architecture
Landscape: Marianne Levinsen Landskab
Photographer: Rasmus Hjortshøj



RESIDENTS LIVING ON STREETS WITH LOWER TRAFFIC VOLUMES HAVE THREE TIMES THE FRIENDS.²²⁵

FACILITY DESIGN

The quality of a train station, tram or bus stop affects our perceptions as well as our experiences, particularly our sense of comfort and safety. A well-designed transport facility provides an engaging space for its users, and is robust enough to handle very high use rates. Quality, durable materials can give long life spans and help form an identity for a station or interchange. Train stations, bus interchanges and airports are highly technical entities in terms of systems, circulation and servicing, but many are not designed for user experience, amenity and a sense of place, and they often feel the same. Train stations need to provide safe and secure environments for both commuters and staff. Transport facilities are public buildings and they create opportunities for public space around them. If well handled, these can be a focal point for community activity and provide natural meeting points, that can be activated by retail.

Research shows that design affects the experience and perception of public transport users. Research found that a better-designed station or stop makes the experience of waiting for the train, tram or bus easier.²³² Researchers compared the actual and perceived wait times of more than 800 people at 36 light rail, commuter rail and bus rapid transit stations across the Twin Cities in Minnesota.²³³ The researchers asked public transport users to indicate how many minutes they thought they had waited at the station or stop before boarding the train or bus, as well as their perceptions of the 'pleasantness' of the transport facility. The researchers found that people perceive their wait to be 1.3 times longer at stops with no amenities. People's perceived waiting times are significantly reduced by the presence of basic amenities, including benches and shelters.

Another study found that people are willing to walk further, wait longer for a train and pay a premium to access a better-designed train station.²³⁴ Civil engineers at the University of Naples in Italy surveyed riders of two lines with similar service standards, serving a similar corridor with similar travel time, frequency, security, access and egress times, trains and riding comfort and running times in the Campania regional metro. One line had a traditional design,

and the other was a new 'Rainbow' line with high architectural and aesthetic standards. They found the design of stations had a significant influence on people's choices about which line to take, with people willing to pay 0.50 euros more for a one-way fare at the nicer station, wait up to seven more minutes for a train, and walk an additional 10 minutes to get there. This is the equivalent of extending a station's catchment area by approximately 400 metres.

PEOPLE ARE WILLING TO PAY MORE,

wait up to seven minutes more for a train, and walk 10 minutes further to access a nicer train station – the equivalent of extending the station catchment by approximately 400 metres.²³¹

COPENHAGEN TRANSPORT STRATEGIES

Like many other cities, in the 1960s, Copenhagen's streets were filled with traffic and its public squares used for car parking. The quality of streets and public spaces for people to walk, cycle and enjoy, were compromised by the car. A series of initiatives over the following decades to transform the city to prioritise walking and cycling over cars has been successful in reducing congestion, improving health and safety, reducing pollution and emissions, and creating a vibrant place to live.

Walkable places

In 1962, cars were removed from the city's main street, Strøget, to become the longest pedestrian promenade in the world. In the first year alone, the number of pedestrians on Strøget rose 35 per cent.²³⁵ The removal of cars improved comfort and safety for pedestrians, with studies of public activity conducted from 1968 to 1995 revealing that the number of people sitting or lingering in public places increased by a factor of four.²³⁶ The city has continued to redesign streets, traffic islands and car parking into places for people, and discourage driving in the inner city by limiting the number of car spaces and traffic reducing lanes into the city. From 1962 to 2005, places for pedestrians grew from 15,000 to 100,000 square metres of car-free streets and public spaces.²³⁷ 80 per cent of journeys in the city centre are made walking.²³⁸



COPENHAGEN TRANSPORT STRATEGIES

Project: Norreport Station
Architect: COBE and Gottlieb Paludan Architects
Photographer: Rasmus Hjortshøj – COAST



Encouraging cycling

For several decades, Copenhagen has been committed to redesigning streets to improve access and safety for people cycling. From 1995 to 2005, the number of cyclists doubled and today, 41 per cent of journeys to work and education are made by bicycle, making it a primary way of getting around.²³⁹ The City of Copenhagen, Danish Government and private sector have invested in cycling infrastructure including bicycle lanes, dedicated bicycle bridges, bicycle parking, and improved signalling systems.²⁴⁰ These initiatives have improved cycling conditions, including safety, comfort, and travel time, encouraging more people to ride.²⁴¹ Cycle superhighways, featuring wide dedicated bike paths that prioritise bicycles to help cyclists travel faster to destinations. The Cycle Serpent, an elevated bike superhighway that opened in 2014, has over 20,000 cyclists each day.²⁴² A cost benefit analysis of the project anticipates a positive net present value of more than AU\$9 million over 20 years, due to the travel time saved and reduction in travel by car.²⁴³ With a 390km network of bicycle paths, 50 per cent of the population travels by bicycle, bringing many environmental and health benefits.²⁴⁴ Every kilometre cycled in Copenhagen is estimated to save AU\$0.20 in health costs, and the city's cyclists request 1.1 million fewer sick days.²⁴⁵ Cyclists also help to reduce CO2 emissions by an average of 20,000 tons a year.²⁴⁶

COPENHAGEN TRANSPORT STRATEGIES

Integrated public transport

The city is building a new metro line, the Cityringen, which will expand the Copenhagen Metro and connect two existing routes. Upon completion, 85 per cent of all homes, workplaces and educational institutions within the inner city, will be located within a 600 metre walk of a metro or train station.²⁴⁷ The new subterranean stations are designed to reflect some of the important qualities which are featured across Copenhagen Metro stations, particularly natural light, easy access between the street and platform, and a high level of bike parking.²⁴⁸

The renovation of Denmark's busiest public transport hub, Nørreport Station, extended beyond designing a new station building, to the creation of new urban space, integrating the needs of people walking, cycling, using public transport and driving. Designed by Gottlieb Paludan Architects and COBE, the project included an expansive public forecourt which is used by 350,000 people each day. A series of round glass buildings providing entry to the station are designed and located to prioritise the flow of pedestrians and their sense of safety. The station buildings are designed of natural and



COPENHAGEN TRANSPORT STRATEGIES

low maintenance materials including concrete, granite, glass and stainless steel, with feature lighting to activate the precinct at night. The canopies above the station entries feature green roofs and solar panels, and a series of towers which provide ventilation to the underground platforms serve as landmarks within the forecourt. Vehicular traffic in the area was largely redirected, with the exception of one street to the north of the station. A prominent bicycle parking area for more than 2,000 bikes is sunken slightly below the forecourt level to minimise the impact on pedestrian views.

Project: Norreport Station
Architect: COBE and Gottlieb Paludan Architects
Photographer: Rasmus Hjortshøj – COAST



References

- 1 Rawsthorn A 2009, 'Defining good or bad design', *The New York Times*, 31 January, <https://dealbook.nytimes.com/2009/01/31/defining-good-or-bad-design/>.
- 2 Commission for Architecture and the Built Environment 2002, *The value of good design*, CABE, London.
- 3 National Audit Office 2004, *Getting value for money from construction projects through design*.
- 4 MUF Architecture cited in Commission for Architecture and the Built Environment 2003, *Radical improvements in hospital design: healthy hospitals campaign report*, CABE, London.
- 5 Ulrich RS, Zimring C, Joseph A, Quan X and Choudhary R 2004, *The role of the physical environment in the hospital of the 21st century: a once-in-a-lifetime opportunity*, Center for Health Design, Concord CA.
- 6 Ibid.; Sadler BL, Leonard BL, Guenther R, Hamilton DK, Hessler FA, Merrit C and Parker D 2011, 'Fable Hospital 2.0: the business case for building better health care facilities', *Good health care by design*, vol. 41, no. 1, pp. 13-23; Ulrich RS, Zimring C, Zhu X, DuBose J, Seo HB, Choi YS, Quan X and Joseph A 2008, 'A review of the research literature on evidence-based healthcare design', *Health Environments Research and Design Journal*, vol. 1, no. 3.
- 7 Ulrich RS et al. 2004, op. cit.; Sadler BL et al. 2011, op. cit.
- 8 CAB/ICM 2003, 'Attitudes towards hospitals', cited in CABE, *Buildings and spaces: why design matters* and CABE, *Radical improvements in hospital design*.
- 9 Ulrich RS et al. 2004, op. cit.
- 10 Sadler BL et al. 2011, op. cit.
- 11 Ulrich RS et al. 2004, op. cit.
- 12 Sadler BL et al. 2011, op. cit.
- 13 Ibid.
- 14 Lawson B, Phiri M and Wells-Thorpe J 2003, 'The architectural healthcare environment and its effects on patient health outcomes: a report on an NHS Estates Funded Research Project'. Note: This research did not identify or quantify specific design variables; Lawson B 2002, 'Healing architecture', *The Architectural Review*, vol. 211, no. 1261, p. 72-75.
- 15 Ibid.
- 16 Lawson B, Phiri M and Wells-Thorpe J 2003, op. cit.
- 17 Ibid.
- 18 Ampt A et al. 2007, 'A comparison of self-reported and observational work sampling techniques for measuring time in nursing tasks', *Journal of Health Services Research and Policy*, vol. 12, no. 1, pp. 18-24; Joseph A 2006, 'The role of the physical and social environment in promoting health, safety and effectiveness in healthcare workplace', issue paper no. 3, Centre for Health Design.
- 19 PricewaterhouseCoopers with the University of Sheffield and Queen Margaret University College Edinburgh 2004, *The role of hospital design in the recruitment, retention and performance of NHS nurses in England*.
- 20 Ibid.
- 21 Burgio L, Engel A, Hawkins K, McCorick and Scheve A 1990, 'A descriptive analysis of nursing staff behaviors in a teaching nursing home: differences among NAs, LPNs and RNs', *The Gerontologist*, vol. 30, pp. 107-12, cited in Joseph A 2006, op. cit.
- 22 Ulrich RS et al. 2004, op. cit.
- 23 Ibid.
- 24 Ibid.
- 25 Ulrich RS 1984, 'View through a window may influence recovery from surgery', *Science*, New Series, vol. 224, no. 4647, pp. 420-21.
- 26 Ulrich RS et al. 2004, op. cit.
- 27 Ulrich RS 1984, op. cit.
- 28 Ibid.
- 29 Cooper-Marcus C and Barnes M 1995, *Gardens in healthcare facilities: uses, therapeutic benefits, and design recommendations*, Center for Health Design, Martinez, CA.
- 30 Whitehouse S, Varni JW, Seid M, Cooper-Marcus C, Ensborg MJ, Jacobs JR et al. 2001, 'Evaluating a children's hospital garden environment: utilization and consumer satisfaction', *Journal of Environmental Psychology*, vol. 21, no. 3, pp. 301-14.
- 31 Cooper-Marcus C and Barnes M 1995, op. cit.
- 32 Beauchemin K and Hays P 1996, 'Sunny hospital rooms expedite recovery from severe and refractory depressions', *Journal of Affective Disorders*, vol. 40, pp. 49-51; Beauchemin K and Hays P 1998, 'Dying in the dark: sunshine, gender and outcomes in myocardial infarction', *Journal of the Royal Society of Medicine*, vol. 91, pp. 352-54.
- 33 Beauchemin K and Hays P 1996, op. cit.
- 34 Walch JM et al. 2005, 'The effect of sunlight on postoperative analgesic medication use: a prospective study of patients undergoing spinal surgery', *Psychosomatic Medicine*, vol. 67, no. 1, pp. 156-63.
- 35 Ibid.
- 36 Ulrich RS et al. 2004, op. cit.
- 37 Ibid.
- 38 Ibid.
- 39 Teitsch DY et al. 2011, 'Infection acquisition following intensive care unit room privatization', *Arc Intern Med*, vol. 171, no. 1.
- 40 Yamaguchi Y 2015, 'Better healing from better hospital design', *Harvard Business Review*, 5 October, <https://hbr.org/2015/10/better-healing-from-better-hospital-design>.
- 41 Ibid.
- 42 Ibid.
- 43 Ibid.
- 44 Ibid.
- 45 Ulrich RS et al. 2004, op. cit.
- 46 Guenther R and Vittori G 2013, *Sustainable healthcare architecture*, John Wiley and Sons, New Jersey.
- 47 Ibid.
- 48 Ibid.
- 49 Ibid.
- 50 Ibid.
- 51 Ibid.
- 52 Ibid.
- 53 Ibid.
- 54 Ibid.
- 55 Bates Smart nd, 'The Royal Children's Hospital Architecture', <https://www.batesmart.com/bates-smart/projects/sectors/health/the-new-royal-childrens-hospital-architecture/>.
- 56 Ibid.
- 57 Guenther R and Vittori G 2013, op. cit.
- 58 Ibid.
- 59 Ibid.
- 60 Ibid.
- 61 Ibid.
- 62 Ibid.
- 63 Barrett P et al. 2013, 'A holistic, multi-level analysis identifying the impact of classroom design on pupils' learning', *Building and Environment*, vol. 59, pp. 685-7.
- 64 Ibid.; Barrett P et al. 2015a, *Clever classrooms: summary report of the HEAD Project*, University of Salford, <http://www.salford.ac.uk/cleverclassrooms/1503-Salford-Uni-Report-DIGITAL.pdf>; Barrett P et al. 2015b 'The impact of classroom design on pupils' learning: final results of a holistic, multi-level analysis', *Building and Environment*, vol. 89, p. 126.
- 65 Barrett P et al. 2013, op. cit.
- 66 Barrett P et al. 2015a, op. cit.; Barrett P et al. 2015b, op. cit.
- 67 Martin K et al. 2012, 'School and individual-level characteristics are associated with children's moderate to vigorous-intensity physical activity during school recess', *Australian and New Zealand Journal of Public Health*, vol. 36, no. 5, pp. 469-77.
- 68 Haug E et al. 2008, 'Physical environmental characteristics and individual interests as correlates of physical activity in Norwegian secondary schools: the health behaviour in school-aged children study', *International Journal of Behavioural Nutrition and Physical Activity*, vol. 5, p. 47.
- 69 Martin K et al. 2012, op. cit.
- 70 Ibid.
- 71 Haug E et al. 2008, op. cit.
- 72 Heschong Mahone Group 1999, *Daylighting in schools: an investigation into the relationship between daylighting and human performance*, Pacific Gas and Electric Company, on behalf of the California Board for Energy Efficiency Third Party Program.
- 73 Barrett P et al. 2015b, op. cit.
- 74 Heschong Mahone Group 1999, op. cit.
- 75 Ibid.
- 76 Ibid.
- 77 Barrett P et al. 2015a, op. cit.
- 78 Tezuka Architects 2017, 'Fuji Kindergarten', MoriYama RAI International Prize, <http://moriyama.raic.org/sites/default/files/fuji_kindergarten.pdf>; Tezuka T 2014, 'The best kindergarten you've ever seen', TED, <https://www.ted.com/talks/takaharu_tezuka_the_best_kindergarten_you_ve_ever_seen/transcript>
- 79 Bronzart A 1981, 'The effect of a noise abatement program on reading ability', *Journal of Environmental Psychology*, vol. 1, no. 3, p. 219.
- 80 Shield BM and Dockrell JE 2004, 'External and internal noise surveys of London primary schools', *Journal of the Acoustical Society of America*.
- 81 Heschong Mahone Group 1999, op. cit.
- 82 Barrett P et al. 2015b, op. cit.
- 83 Heschong Mahone Group 1999, op. cit.
- 84 Barrett P et al. 2015b, op. cit.
- 85 Ibid.
- 86 Ibid.
- 87 Castellucci HI, Arezes PM, Molenbroek JFM, de Bruin R and Viviani C 2016, 'The influence of school furniture on students' performance and physical responses: results of a systematic review', *Ergonomics*, DOI: 10.1080/00140139.2016.1170889.
- 88 Commission for Architecture and the Built Environment 2005, *Design with distinction: the value of good building design in higher education*, CABE, London.
- 89 Commission for Architecture and the Built Environment 2005, op. cit.
- 90 Rudd P, Reed F and Smith P 2008, *The effects of the school environment on young people's attitudes to education and learning*, National Foundation for Educational Research.
- 91 Kwan-Lamar Blount-Hill 2017, 'Psychology of space: enhancing legitimacy through open, transparent, and inclusive facilities for police and the public', *Police Chief Magazine*.
- 92 Millie A 2012, 'Police stations, architecture and public reassurance', *British Journal of Criminology*, vol. 52, no. 6.
- 93 Missingham G et al. 2002, *Architectural psychology and courts buildings*, State Government of Western Australia, Perth.
- 94 Ibid.
- 95 Fairweather L 2000, 'Psychological effects of the prison environment', in Fairweather L and McConville S, *Prison architecture: policy, design and experience*, Architectural Press, New York.
- 96 James E 2013, 'Bastoy: the Norwegian prison that works', *The Guardian*, 4 September, <https://www.theguardian.com/society/2013/sep/04/bastoy-norwegian-prison-works>.
- 97 Armstrong S 2014, 'Scotland's newest prison is another nod to Scandinavia', *The Conversation*, 10 March.
- 98 McKimmie BM, Hays JM and Tait D 2016, 'Just spaces: does courtroom design affect how the defendant is perceived?' *Psychiatry, Psychology and Law*, vol. 23, no. 6, pp. 885-92.
- 99 Ibid.
- 100 Australian Institute of Criminology 2007, *Practices, policies and procedures that influence juror satisfaction in Australia: report to the Criminology Research Council July 2007 (funded by CRC Grant C01/06-07)*, Research and Public Policy Series, no. 87.
- 101 Ibid.
- 102 Ibid.
- 103 Jewkes and Moran 2014, 'Bad design breeds violence in sterile megaprisons', *The Conversation*, 31 January.
- 105 Matter Architecture 2017, 'Wellbeing in prison design: a guide', <http://www.matterarchitecture.uk/wp-content/uploads/2018/01/421-op-02_MatterDesignGuide.pdf>.
- 106 Ibid.
- 107 Ibid.
- 108 Ibid.
- 109 Ibid.
- 110 Fairweather L 2000, op. cit. p. 42.
- 111 Ibid.
- 112 Matter Architecture 2017, op. cit.
- 113 Ibid.
- 114 Nadkarni N, Hasback PH, Thys T, Gaines Crockett E and Schnacker L 2017, 'Impacts of nature imagery on people in severely nature-deprived environments', *The Ecological Society of America: Frontiers in Ecology*, vol. 15, no. 7, p. 395.
- 115 Matter Architecture 2017, op. cit.
- 116 Ibid.
- 117 Ibid.
- 118 Ibid.
- 119 Benko J 2015, 'The radical humaneness of Norway's Halden Prison', *The New York Times*, 26 March, <https://www.nytimes.com/2015/03/29/magazine/the-radical-humaneness-of-norways-halden-prison.html>.
- 120 Sentencing Advisory Council 2018, 'Released prisoners returning to prison', <https://www.sentencingcouncil.vic.gov.au/statistics/sentencing-statistics/released-prisoners-returning-to-prison>.
- 121 World Green Building Council 2014, *Health, wellbeing and productivity in offices: the next chapter for green building*, World Green Building Council 2014, London.
- 122 Heart Foundation 2018, 'Buildings', *Healthy active by design website*, <http://www.healthylifebydesign.com.au/design-features/buildings>.
- 123 World Green Building Council 2014, op. cit.
- 124 Commission for Architecture and Built Environment and British Council for Offices 2005, *The impact of office design on business performance*, CABE, London.
- 125 'Green Building Council of Australia 2015, 'Green Star Performance Business Case', <https://www.gbca.org.au/uploads/149/33685/Green_Star_Performance_Business_Case.pdf?_ga=2.75891920.432616039.1546228213-964595233.1546228213>.
- 126 Property Council of Australia 1999, *The design dividend*, PCA, Canberra; Eichholtz, Kok and Quigley 2013, 'Sustainability and the dynamics of green building', *The Review of Economics and Statistics*.
- 127 Commission for Architecture and Built Environment and British Council for Offices 2005, op. cit.
- 128 Oseland N 2001, 'To what extent does workplace design and management affect productivity?', <www.officeproductivity.co.uk>.
- 129 Thayer B 1995, 'Daylighting and Productivity at Lockheed', *Solar Today*, vol. 9, pp.26-29.
- 130 Oseland, N. 2001, 'To what extent does workplace design and management affect productivity?' *www.officeproductivity.co.uk*.
- 131 Thayer B 1995, 'Daylighting and Productivity at Lockheed', *Solar Today*, vol. 9, pp.26-29.
- 132 Commission for Architecture and Built Environment and British Council for Offices 2005, op. cit.
- 133 Ibid.
- 134 Ibid.
- 135 Ibid.
- 136 Ibid.
- 137 Leaman A and Bordass B 2000, 'Productivity in buildings: The 'killer' variables', *Building Research and Information*.
- 138 Ward V and Holtham C 2000, 'The role of private and public spaces in knowledge management', Presented at Knowledge Management: Concepts and Controversies Conference, 10-11 February, University of Warwick.
- 139 Commission for Architecture and Built Environment and British Council for Offices 2005, op. cit.

References

- 140 Nicoll G 2007, 'Spatial measures associated with stair use', *Am J Health Promot*, vol. 21, no. 4 (suppl), pp. 346-52.
- 141 Heart Foundation 2018, op. cit.
- 142 Ibid.
- 143 Archello nd, 'South East Water,' <https://archello.com/project/south-east-water>
- 144 Coster S 2017, 'South East Water,' Architecture Australia, vol. 106, no. 4, pp. 88-95.
- 145 Bleyb M 2016, 'Filling Frankston: South East Water pumps innovation outside Melbourne,' *Australian Financial Review*, 23 August, <https://www.afr.com/real-estate/commercial/development/filling-frankston-south-east-water-pumps-innovation-outside-melbourne-20160815-gqsqm9>
- 146 Ibid.
- 147 Office of the United Nations High Commissioner for Human Rights nd, The right to adequate housing, fact sheet no. 1/rev 1, UN, Geneva.
- 148 OECD 2011, 'How's life? Measuring well-being', <http://www.oecdilibrary.org/docserver/download/3011061e.pdf>
- 149 Roys M, Davidson M, Nicol S, Ormandy D and Ambrose P 2010, The real cost of poor housing, BRE Trust report FB23, BRE Press, London.
- 150 Commission for Architecture and Built Environment 2010, Improving the quality of new housing: technical background paper, CABI, London.
- 151 Roys M et al. 2010, op. cit.
- 152 Nichol et al. 2015, 'The cost of poor housing to the NHS - Briefing paper', <https://www.bre.co.uk/filelibrary/pdf/87741-Cost-of-Poor-Housing-Briefing-Paper-v3.pdf>
- 153 Building Research Establishment 2011, The health costs of cold dwellings, client report ED 2792 commissioned by the Chartered Institute of Environmental Health, <https://www.foe.co.uk/sites/default/files/downloads/warm_homes_nhs_costs>
- 154 Brown MJ and Jacobs DE 2011, 'Residential light and risk for depression and falls: results from the LARES study of eight European cities', *Public Health Rep*, vol. 126, no. 1 (suppl), pp. 131-40.
- 155 Giles-Corti B, Kleeman A, Foster S 2015, Better apartments: what does the evidence tell us about the impact on health and wellbeing? The University of Melbourne, Melbourne.
- 156 Brown MJ and Jacobs DE 2011, op. cit.
- 157 Hobday R 2010, 'Designing houses for health: a review', cited in Giles-Corti B, Kleeman A, Foster S 2015, op. cit.
- 158 Ibid.
- 159 Kennedy R, Buys L et al. 2015, 'Residents' experiences of privacy and comfort in multi-storey apartment dwellings in subtropical Brisbane', *Sustainability*, vol. 7, no. 6, pp. 7441-61, cited in Giles-Corti B, Kleeman A, Foster S 2015, op. cit.
- 160 Roberts N 2015, 'Australian houses are just glorified tents in winter', *The Age*, 8 June, <https://www.theage.com.au/opinion/australian-houses-are-just-glorified-tents-in-winter-20150608-ghj2ox.html>
- 161 Roys M et al. 2010, op. cit.
- 162 Roberts N 2015, op. cit.
- 163 Lloyd E, McCormack C, McKeever M, and Syme M 2008, 'The effect of improving the thermal quality of cold housing on blood pressure and general health: a research note', *J Epidemiol Community Health*, vol. 62, no. 9, pp. 793-7.
- 164 Greenland J, Szokolay SV and Royal Australian Institute of Architects 1985, Passive solar design in Australia, RAI Education Division, Red Hill, ACT.
- 165 Australian Government 2013, 'Passive design', Your home website, <http://www.yourhome.gov.au/passive-design>
- 166 Department of Environment, Water, Heritage and the Arts 2007, Energy efficiency rating and house price in the ACT, Australian Government, Canberra.
- 167 Planet Ark 2011, Climbing Trees: Getting Aussie Kids Back Outdoors, <https://treeday.planetark.org/documents/doc-534-climbing-trees-research-report-2011-07-15-final.pdf>
- 168 Bourassa S, Hoesli M and Sun J 2004, 'What's in a view?' *Environment and Planning A*, vol. 36, pp. 1427-50.
- 169 Orban E, McDonald K, Sutcliffe R, Hoffman B, Fuks K, Dragano N, Viehmann A, Erbel K, Pundt N and Moebus S 2016, 'Residential road traffic noise and high depressive symptoms after five years of follow-up: results from the Heinz Nixdorf Recall Study', *Environmental Health Per*, Vol. 124, no. 5, pp. 578-585.
- 170 European Commission 2015, 'Noise Impacts on Health', Science for Environment Policy, issue 47, <http://ec.europa.eu/environment/integration/research/newsalert/pdf/47si.pdf>
- 171 Orban E et al. 2016, op. cit.
- 172 Livable Housing Australia 2012, Livable Housing Design Guidelines.
- 173 Murray S 2008, rehousing, RMIT Publishing, Melbourne.
- 174 Casteel C and Peek-Asa C 2000, 'Effectiveness of Crime Prevention Through Environmental Design (CPTED) in Reducing Robberies', *American Journal of Preventative Medicine*, vol. 18, pp. 99-115.
- 175 Jacobs J 1961, The death and life of great American cities, Random House, New York, 1961
- 176 ComSec 2018, 'Australian home size hits 22-year low', *Economic Insights*, 16 November.
- 177 Balch O 2016, 'The Commons: could co-housing offer a different kind of great Australian dream', *The Guardian*, 31 October, <https://www.theguardian.com/sustainable-business/2016/oct/31/the-commons-could-co-housing-offer-a-different-kind-of-great-australian-dream>
- 178 Ward M 2015, 'Better together: The Commons', *ArchitectureAU*, 23 March, <https://architectureau.com/articles/the-commons-1>
- 179 Balch O 2016, op. cit.
- 180 Places for People 2015, 'City of Melbourne', <https://gehpeople.com/cases/melbourne-australia>
- 181 Ibid.
- 182 City of Melbourne 2014, Walking plan, City of Melbourne, Melbourne.
- 183 Commission for Architecture and the Built Environment 2001, The value of urban design, CABI, London.
- 184 Takano T, Nakamura K and Watanabe M 2002, 'Urban residential environments and senior citizens longevity in megacity areas: the importance of walkable green spaces', *Journal of Epidemiology and Community Health*, vol. 12, cited in Commission for Architecture and the Built Environment 2002, The value of public space, CABI, London.
- 185 Ibid.
- 186 Gehl J and Gemzøe L 1998, Public spaces, public life, The Royal Danish Academy, Copenhagen.
- 187 Giles-Corti B, Broomhall M, Knuiam M, Collins C, Douglas K, Ng K, Lange A, Donovan R 2005, 'Increasing walking: how important is distance to attractiveness and size of public open space?' *American Journal of Preventive Medicine*, vol. 28, no. 2, pp. 169-76.
- 188 Frank LD, Anderson MA and Schmid TL 2004, 'Obesity relationships with community design, physical activity, and time spent in cars', *American Journal of Preventive Medicine*, vol. 27, no. 2, pp. 87-96.
- 189 Timperio A et al. 2006, 'Personal, family, social, and environmental correlates of active commuting to school', *American Journal of Preventive Medicine*, vol. 30, no. 1, pp. 45-51.
- 190 Whyte W 2001, The social life of small urban spaces, Project for Public Spaces, New York.
- 191 Gehl J and Gemzøe L 1998, op. cit.
- 192 Whyte W 2001, op. cit.
- 193 Ibid.
- 194 Ibid.
- 195 Ibid.
- 196 McKay T 1998, 'Empty spaces, dangerous places' *ICA Newsletter*, vol. 1, no. 3, pp. 2-3, cited in Office of the Victorian Government Architect 2008, Enhancing liveability through good design: a submission to the Victorian Competition and Efficiency Commission 'Inquiry into Enhancing Victoria's Liveability', State Government of Victoria, Melbourne.
- 197 Ibid.
- 198 State Library of Victoria 2018, LIBRARIES WORK! The socio-economic value of public libraries to Victorians, SGS Report, Melbourne.
- 199 Parks Victoria 2017, A guide to Healthy Parks Healthy People, State Government of Victoria, Melbourne.
- 200 Ibid.
- 201 Mitchell R and Popham F 2008, 'Effect of exposure to natural environment on health inequalities: an observational population study', *The Lancet*, vol. 372, cited in Royal Institute of British Architects 2011, Good design: it all adds up, RIBA, London.
- 202 Mitchell R and Popham F 2008, 'Effect of exposure to natural environment on health inequalities: an observational population study', *The Lancet*, vol. 372.
- 203 Arundel J et al 2017, Creating liveable cities in Australia, Centre for Urban Research RMIT University
- 204 Kelly J-F 2012, Social cities, Grattan Institute, Melbourne.
- 205 International Transport Forum 2012, Pedestrian safety, urban space and health, OECD Publishing.
- 206 Ibid.
- 207 Woodcock J, Edwards P, Tonne C et al. 2009, 'Public health benefits of strategies to reduce greenhouse-gas emissions: urban land transport', *Lancet*, vol. 374, pp. 1930-43, cited in Giles-Corti et al. 2016, 'City planning and population health: a global challenge', *The Lancet*, vol. 388, no. 10062, pp. 2912-24.
- 208 Garrett-Peltier H 2011, Pedestrian and bicycle infrastructure: a national study of employment impacts, PERI, <http://www.peri.umass.edu/fileadmin/pdf/published_study/PERI_ABikes_June2011.pdf>
- 209 Cortright J 2007, Portland's green dividend, CEOs for Cities, <http://blog.oregonlive.com/commuting/2009/09/pdxgreendividend.pdf>, cited in ARUP 2016, Cities alive: toward a walking world, ARUP.
- 210 Transport for London 2014, Annual report 2014-15, <http://content.tfl.gov.uk/annual-report-2013-14.pdf>
- 211 Committee on Physical Activity, Health, Transportation and Land Use 2005, Does the built environment influence physical activity? Examining the evidence, Transportation Research Board Institute of Medicine of the National Academies, Washington, DC.
- 212 Heart Foundation 2013, Making the case for investment in street trees and landscaping in urban environments, Heart Foundation, Melbourne.
- 213 Heart Foundation nd, Healthy active by design, Heart Foundation, Melbourne.
- 214 Leyden KM 2003, 'Social capital and the built environment: the importance of walkable neighborhoods', *AJPH*, vol. 93, no. 9, pp. 1546-51, <http://www.jtc.sala.ubc.ca/reports/leyden.pdf>, cited in ARUP 2016, Cities alive: toward a walking world, ARUP.
- 215 Leinberger CB and Alfonzo M 2012, 'Walk this way: the economic promise of walkable places in metropolitan Washington DC', Brookings, <https://www.brookings.edu/wp-content/uploads/2016/06/25-walkable-places-leinberger.pdf>
- 216 Walkscore nd, Walkability, real estate, and public health data, <https://www.walkscore.com/professional/research.php>, cited in ARUP 2016, Cities alive: toward a walking world, ARUP.
- 217 Heart Foundation nd, op. cit.
- 218 Buehler R and Pucher J 2012, 'Walking and cycling in Western Europe and the United States: trends, policies, and lessons', *TR News* vol. 5, pp. 34-42; Pucher et al. 2003, 'Promoting Safe Walking and cycling to improve public health: lessons from the Netherlands and Germany', *American Journal of Public Health*, vol. 93; Pucher et al. 2010, 'Infrastructure programs and policies to increase cycling', *Preventive Medicine*, cited in Giles-Corti et al. 2016, op. cit.
- 219 Kelly J-F 2012, op. cit.
- 220 Kent J and Thompson S 2014, 'Connecting and strengthening communities in places for health and well-being', *Australian Planner*, vol. 260-71, cited in Giles-Corti et al. 2016, op. cit.
- 221 Cozens P 2008, 'New urbanism, crime and the suburbs: a review of the evidence', *Urban Policy Res*, vol. 26, pp. 429-44, cited in Giles-Corti et al. 2016, op. cit.
- 222 New Zealand Ministry of the Environment 2005, The value of urban design: Committee for Architecture and the Built Environment 2006, Buildings and spaces: why design matters, CABI, London.
- 223 Delbosch A and Currie G 2011, 'Transport problems that matter: social and psychological links to transport disadvantage', *Journal of Transport Geography* vol. 19, no. 1, pp. 170-78, cited in Kelly J-F 2012, op. cit.
- 224 Merom D et al. 2006, 'Active commuting to school among NSW primary school children: implications for public health', *Health & Place* vol. 12, no. 4, pp. 678-87.
- 225 StreetFilms 2010, Revisiting Donald Appleyard's Livable streets, <https://vimeo.com/16399180>, cited in ARUP 2016, op. cit.
- 226 Kelly J-F 2012, op. cit.
- 227 Ibid.
- 228 StreetFilms 2010, op. cit.
- 229 Frey BS and Stutzer A 2002, 'The economics of happiness', *World Economics*, vol. 3, no. 1, <https://www.bsfrey.ch/articles/365_02.pdf>, cited in ARUP 2016, op. cit.
- 230 Gossling S and Choi A 2015, 'Transport transitions in Copenhagen: comparing the cost of cars and bicycles', <http://www.sciencedirect.com/science/article/pii/S0921800915000907#>
- 231 Jaffe E 2014a, 'Nicer transit stations attract more riders', *City Lab*, 31 November, <https://www.citylab.com/transportation/2014/01/nicer-transit-stations-attract-more-riders/8260/>
- 232 Jaffe E 2014b, 'A basic shelter can make the wait for the bus feel shorter', *City Lab*, 18 September, <https://www.citylab.com/solutions/2014/09/a-basic-shelter-can-make-the-wait-for-the-bus-feel-shorter/380297/>
- 233 Fan Y, Guthrie A and Levinson D 2016, 'Perception of waiting time at transit stops and stations', *Transitway Impacts Research Program Report*, no. 9, Center for Transportation Studies, University of Minnesota.
- 234 Jaffe E 2014a, op. cit.
- 235 ARUP 2016, Cities alive: toward a walking world, ARUP.
- 236 Gehl J 2010, Cities for people, Island Press, Washington, DC.
- 237 Ibid.
- 238 European Commission: Directorate-General for the Environment 2004, 'Reclaiming city streets for people: Chaos or quality of life?', EU, Brussels.
- 239 City of Copenhagen 2017, 'Copenhagen city of cyclists: The bicycle account 2016', <http://www.cycling-embassy.dk/wp-content/uploads/2018/02/CPH-Bicycle-Account-2016.pdf>
- 240 Ibid.
- 241 Ibid.
- 242 Ibid.
- 243 Ibid.
- 244 Cathcart-Keays A and Warin T 2016, 'Story of cities #36: How Copenhagen rejected 1960s modernist 'utopia', *The Guardian*, 5 May, <https://www.theguardian.com/cities/2016/may/05/story-cities-copenhagen-denmark-modernist-utopia>
- 245 Ministry of Foreign Affairs of Denmark, 'A nation of cyclists', <https://denmark.dk/people-and-culture/biking>
- 246 Ibid.
- 247 Gerdes J 2013, 'Copenhagen's ambitious push to be carbon-neutral by 2025' *The Guardian*, 13 April, <https://www.theguardian.com/environment/2013/apr/12/copenhagen-push-carbon-neutral-2025>
- 248 Metroselskabet, 'New Stations', <https://intl.m.dk/#/about-the-metro/metro-expansion/new-stations>

Accessibility

This document is also available in PDF form
on the internet at: www.ovga.vic.gov.au

Authorised and published by the Office of
the Victorian Government Architect ©2019

The Office of the Victorian
Government Architect
Old Treasury Building
Level 2, 20 Spring Street,
Melbourne VIC 3002
PO Box 4912
Melbourne VIC 3001
+61 3 9651 6583
www.ovga.vic.gov.au

