Transit-oriented developments... through a health lens

A Guide for Healthy Urban Developments
A collaborative Health Lens Project
Acknowledgements

This Health Lens Project was a collaborative project between the following South Australian Government agencies:

- Department of Planning and Local Government
- Department for Transport, Energy and Infrastructure
- Department of Health
- Land Management Corporation
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Executive Summary

This document has been produced to support the development of healthy transit-oriented developments in South Australia and is not intended to represent formal government policy.

South Australia’s Strategic Plan provides a comprehensive statement of what South Australia’s future can be. Its six broad objectives aim for a growing and sustainable economy and a strong social fabric. Within this framework sit substantial action plans to help reach the strategic targets.

The 30-Year Plan for Greater Adelaide is one of these. It outlines a strategy to further underpin the state’s economic growth to support Adelaide as a competitive, liveable and sustainable city to 2040, and to make better use of existing infrastructure.
In the past, development was centred on automobile use and has consequently contributed to a range of health, social and environmental concerns including the global epidemic of obesity, community isolation, poor air quality, over-consumption of valuable land and increased reliance on private vehicles. Transit-oriented developments (TODs) offer a different approach to development and offer new lifestyle options for people. They provide more travel choice as well as greener and healthier travel options through the creation of new walking communities in and around TODs. The 30-Year Plan seeks to create more walkable neighbourhoods, develop higher density areas of good-practice, sustainable urban design, and create a network of public space precincts to absorb local carbon emissions and provide sheltered, cooler places for people to use.

Within the 30-Year Plan there will be a greater focus on concentrating development growth in both existing and new suburbs around dedicated public transport corridors in higher density, mixed-use commercial and residential hubs. These TODs will bring more homes and jobs within walking distance of public transport.

Consistent with these directions, there is recognition of the significant influence of urban form on population health. This guide identifies the multiple links between urban design, transport and the health of the population, and draws upon a growing body of research evidence to draw out the relationships between quality of place and quality of life. It illustrates the potential to deliver improved health outcomes through better use of urban form that demonstrates good-practice, sustainable design.

Applying a collaborative ‘health lens’ to the planning and delivery of TODs in South Australia sets out, for the first time, the complex interplay between factors associated with higher density development that impact on community health and wellbeing. It explores healthy outcomes and environmental sustainability from the wider perspective, and considers issues associated with ‘liveability’—such as the importance of attractive, inclusive, accessible, safe and diverse places to secure community wellbeing and economic prosperity.

This collaborative project consolidates and builds upon the studies of successful overseas TODs. The health lens analysis has been conducted at a time of rapid growth in understanding the impacts of urban development on health, and in South Australia’s experience in the design and development of TODs. It is also recognised that not all TODs are the same. While there are some common underlying characteristics, TODs are necessarily location specific and take time to mature. While the issues identified in this health lens analysis retain their relevance over time, issue management is necessarily adaptive as characteristics change from time to time and place to place.

It is hoped that this document will provide a resource for relevant agencies involved in planning, development and related fields to inform and prompt discussion around Adelaide’s transition from car-oriented development to a more compact, environmentally sustainable and people-friendly urban form.
Abbreviations

CABE  Commission for Architecture and Built Environment
CPTED crime prevention through environmental design
DTEI Department for Transport, Energy and Infrastructure
du/ha dwellings per hectare
HiAP Health in All Policies
m metre
TOD transit-oriented development
UHI urban heat island
WHO World Health Organization
WSUD water sensitive urban design
Principles for healthy TODs

The principles contained in this paper are intended as design guidance to improve liveability, quality of life and health outcomes in transit-oriented developments. Commercial viability will always be a critical determinant of development decisions and will influence the incorporation of these design suggestions in any particular development.

The principles have been developed by representatives of the four health lens partner agencies, and draw on the strong evidence-base that was developed through the health lens process.

They provide readers—who may come from a variety of backgrounds including planning, design, development or health—with a clear and robust understanding of how their work can contribute to the development of a healthy, sustainable and economically prosperous TOD.
Transit-oriented developments...through a health lens
Sustainable and vibrant Adelaide—ensuring that TODs are successful in the long term

TODs represent an opportunity to change the culture of how we build and live in Adelaide for the better. A successful TOD will create strong, sustainable, economic and healthy social environments; reduce land and resource consumption; and relieve pressure on outward urban fringe expansion. Ultimately, well-designed TODs will create vibrancy through the integration, rather than segregation, of the places in which we live, work and play.

Accessible public transport—the cornerstone of all TODs

TODs provide more people with better access to the public transport network. TODs will offer travel choice encouraging healthier outcomes through incidental physical activity such as cycling and walking, reducing car dependency and improving local air quality through reduced car use.

Social inclusion—supporting an inclusive and diverse community

TODs will offer housing choice that promotes inclusivity and diversity. A mix of housing types and tenures will include the provision of affordable housing. TODs will also have the potential to accommodate diverse groups, including making areas and facilities amenable to adult residents, children and people with disabilities.

Physical activity—encouraging a more active lifestyle

Increased density, a mix of land uses, and improved access to public transport will promote physical activity through the creation of more walkable neighbourhoods with connections close to services and recreational facilities. Physical activity will also be encouraged through the provision of sufficient high-quality recreation spaces, including playgrounds and tree-lined streetscapes, designed to support increased walking and cycling.

Living in a healthy environment—optimising noise and air quality

TODs will be designed and constructed to deliver high-quality residential amenity, including noise levels and air quality. Local sources of noise and air contaminants, such as those produced as a result of mixed land use or transport emissions, will be considered during the design phase. TOD designs will incorporate the latest innovations in areas such as water sensitive urban design and energy efficiency.

Strengthening communities—integrating TODs into the surrounding community

Pedestrian, mobility scooter (‘gopher’) and cycling-friendly streetscapes and an integrated network design will link TODs with surrounding community destinations such as services, employment and retail, thereby encouraging social cohesion and building community wellbeing.

Mental health and wellbeing—creating places for people

TODs will create safe, attractive and green streetscapes that promote physical activity and provide opportunity for social interaction. These attributes are known to contribute to good mental health and wellbeing.

Access to healthy food—protecting the state’s food bowl

Residents and workers in TODs should have access, within walking distance, to supermarkets or other stores where healthy, affordable fresh food is available. The provision of housing within urban infill projects such as TODs reduces the pressure to expand housing settlements into prime agricultural land, which is important for supporting local food production.

Workplace access and amenity – local jobs for local people

The creation of employment opportunities are an essential component in creating places where people can live and work. TODs should enable the establishment of a diversity of industries and jobs that can be accessed via public transport, walking or cycling.
Introduction

The Transit-oriented Development Health Lens Project (the project) was a collaborative project between the Department of Planning and Local Government (DPLG), the Department for Transport, Energy and Infrastructure (DTEI), the Land Management Corporation (LMC) and the Department of Health (DH). The project provided a unique opportunity for members of these agencies to work together on a multi-faceted project that would cross diverse disciplines whose activities have a considerable impact on health.

Subsequently, it provided an opportunity for improved understanding of the issues from each agency’s perspective, the development of a shared language and strong relationships that will benefit partnerships into the future.
This paper is an outcome of the project and seeks to identify the potential positive and negative health impacts of transit-oriented developments (TODs). It is intended to act as a collection of evidence that has been agreed upon by members of the joint project group. It aims to build the understanding of policymakers (South Australian Government agencies and local government) around the key elements essential to the design and development of best practice healthy TODs.

The document does not account for every possible aspect of a TOD; rather, it is a step towards promoting more open dialogue around how to build TODs and create healthy communities. It is not intended to provide an economic perspective and therefore does not contain any cost–benefit-style analysis or feasibility analyses.

The establishment of TODs is one of the key directions of the 30-Year Plan for Greater Adelaide (a volume of the Planning Strategy for South Australia), which was released in early 2010.

**The link between health and planning**

Town planning has always been linked to health. In fact, the profession originated in response to the illnesses caused by overcrowding, poor sanitation and environmental pollution resulting from the Industrial Revolution. One of the key planning responses to these problems was to eliminate the confusion and chaos in cities by separating land uses, removing people from polluted environments and establishing smaller communities close to employment and open spaces.

This separation of land uses and the increasing dominance of the motor vehicle after World War II have unfortunately contributed to increasing levels of air pollution, chronic disease, social isolation and consumption of prime agricultural land.

Planning for the use of cars has made many environments hostile to walking and cycling, and people have become accustomed to using the car, even for short trips. If this behaviour is left unchecked, it will result in environmental impacts as well as increasing costs to the health of individuals and the community and to the health-care budget.

Today, there is increasing support by governments and policymakers for the development of cities that no longer separate land uses, but allow the co-location of transport, employment, housing and services.

**Environmental Sustainability and Health**

Environmental sustainability is inextricably linked to health. More compact cities will reduce the pressure for urban expansion, contributing to the preservation of important natural and agricultural land and resources. Throughout this document, many measures described confer both health and environmental benefits. As TODs have been promoted largely on their environmental benefits and there is a considerable body of guidance already available in this area, this document has not sought to cover this in detail.

Similar to health impacts, environmental sustainability requires detailed consideration of alternatives to determine the most appropriate options in terms of site and environmental benefit. For example, in terms of waste management, providing space for individual waste receptacles has the potential to consume a significant area on the site whereas shared waste facilities may have a lower site footprint but will require ongoing collective management. Both options are valid but should be explored with a view to maximise the ease and extent of waste recycling.

**What is a transit-oriented development?**

TODs are becoming increasingly common around the world, particularly in Europe, Brazil, Japan, the United States, Canada, China and, more recently, Australia. The 30-Year Plan for Greater Adelaide provides the following definition of a TOD:

Transit-oriented developments comprise mixed-use, higher density developments centred on a major public transport access point. They accommodate residential, high-order retail activities and employment as well as high-quality open space. They will be attractive and walkable places for people to live, work, shop and recreate in an accessible and self-contained community.¹
It is important to note that, while there are general guiding principles for TOD-style development, the design of a particular development is based on location-specific variables that result in each TOD being different. The impact of and on a TOD development extends beyond the boundaries of the site itself, and therefore its success is reliant on factors related to its own design and the supporting infrastructure around it.

**TODs in Adelaide**

The 30-Year Plan for Greater Adelaide identifies 14 TODs to be delivered within the next 30 years. These will be supported by direct state and local government involvement and/or infrastructure provision. The plan also has a target of 20 smaller and less complex developments based on transit-oriented principles and design characteristics.

Examples of current TODs being planned or proposed include:

**Health in All Policies**

The Health in All Policies (HiAP) concept is about promoting healthy public policy. HiAP is a collaborative process between the Department of Health and other South Australian Government agencies to assist the achievement of their policy objectives and, in doing so, seek to maximise the health benefit to the South Australian community. HiAP was adopted by the South Australian Government in 2008.

HiAP is based on the understanding that the health of individuals and populations is shaped by broad societal factors—collectively referred to as the determinants of health and wellbeing—that lie outside the influence of the health sector.

**The health lens analysis approach**

The health lens analysis approach is part of the HiAP concept. The Department of Health has collaborated with a number of state government agencies to date on a range of specific health lens analysis projects, including Water Security, Regional Migrant Settlement, Aboriginal Road Safety, Early Childhood Education and Broadband Use through Mobile Phones.

The health lens analysis uses a range of rigorous and systematic methodologies and tools to examine the connections between South Australia’s Strategic Plan targets, policies and strategies, and population health and wellbeing. It also uses other tools and methods that are designed to provide the most useful information at any part of the project or policy development cycle.

The health lens analysis methodology consists of a five-step process as demonstrated in Figure 1.
TOD health lens analysis methodology

The first stage of the TOD Health Lens Project involved undertaking a comprehensive literature review. Because TOD-specific research is limited, more general literature on the health impacts of transport and urban development was used to inform the review, being selected on the basis of its relationship to TOD development principles and the style and location of proposed TOD development in South Australia. Where possible, South Australian and Australian literature was used but, where this was not possible, international literature was also taken into consideration.

The aim of undertaking the review was to identify the key principles for developing successful TODs that also improve health and wellbeing outcomes for the community.

The information gained from the review was synthesised and used to inform the development of this paper in its aim to explore the key health impacts of urban development, with particular emphasis on TODs.

Determinants of health and wellbeing

‘Determinants of health’, a term that was introduced in the 1970s, refers to those factors that have been found to have the most significant influence—positive or negative—on our health. Health is an outcome of a multitude of determinants, including those relating to individual genetic and biological factors, how we were educated, how we work, our individual lifestyles, the environment in which we live and how our society operates. While the term is used much more in the context of addressing population health rather than individual health, public policies can also influence or guide individual behaviour and lifestyle choices. The same determinants typically influence a multitude of health issues; in turn, individual health problems are typically products of the influence of a variety of determinants.

Thinking about health from a determinants perspective is important because they can often be directly influenced through policies and interventions across a wide variety of sectors, not just by the health sector. Policies, interventions and actions outside the health sector can often be more effective in protecting and promoting health across the population than more traditional medical interventions or efforts to change individual behaviours.

To illustrate this simplistically, the pathway in Figure 2 demonstrates the determinants of health related to car-oriented developments. A more complex illustration of a similar pathway is shown in Figure 3.

![Figure 2: Heart disease—simplified determinants and health impact pathway](image-url)
When considered from a health determinants perspective, the role of the urban environment in health becomes increasingly apparent. In the case of TODs, their design can influence:

- exposure to environmental pollutants (e.g. by decreasing car use, thus decreasing air or noise pollution)
- health-related behaviours (e.g. by being walkable, thus increasing ease and amount of physical activity)
- access to services and amenities (e.g. by considered selection of retail premises, thus increasing convenient access to healthy food choices)
- psychosocial factors that increase social support, esteem and mutual respect (e.g. by providing community spaces that encourage interaction for happy and healthy communities).

Health standards for urban planning

Health sector professionals involved in planning and development processes are often asked for a specific health standard to direct the design of new development. While there are some health-related standards that can be applied to guide how a site is developed (and these are identified in this paper), the relationships between a particular environmental or social element and a particular health outcome are highly complex (as can be seen from Figures 2 and 3) and often not suitable as a definitive standard. For example, the amount of noise can be quantitatively measured and, to some degree, so can its impacts, and standards can therefore be set. However, measuring the impact of green space on wellbeing is more complex as it requires more qualitative measures; setting a standard for this is difficult but examples have been provided where possible.

In more complex cases there are links between these elements and a health effect (an ‘association’). However, demonstrating a definitive cause and effect pathway can be difficult, and it is even harder to assign a particular level for a standard. In areas where there is no specific health standard, it is logical to attempt, as far as practicable, common-sense measures to mitigate an adverse impact based on an understanding of the association.
Transit-oriented developments...through a health lens
Navigating this Document

As stated previously, this paper is intended to inform policy development across agencies to establish principles and policies that support healthy TODs in South Australia*. With this intent in mind, the paper has been formatted in the following manner for easy use.

Definition
A definition and brief discussion of each element is provided where appropriate.

Relevance to TODs
Each section provides information on how the urban planning principle discussed is linked to TODs.

Influence on health
The health impacts and associated risk and protective factors have been identified through a review of the literature relating to urban development generally.

Getting it right
This section provides examples of how to implement measures to increase health benefits. It has not been developed as an assessment criteria or check box tool; instead, it is intended to inform readers of the possible opportunities to improve health based on relevant transport, planning, development and ongoing management considerations.

Further Information
There is an abundance of excellent information available to assist in the delivery of successful and healthy urban development. A selection of this information is provided to support further investigation in each section.

* NOTE: This document discusses a number of positive and negative health impacts potentially generated by a TOD. These issues are also relevant to other types of urban development in some instances.
Public Transport

Public transport is a key part of the foundation of TODs. A TOD integrates high-quality public transport with mixed-use development, including higher density residential development that encourages greater use of public transport.

*South Australia’s Strategic Plan* has the target to ‘increase the use of public transport to 10% of metropolitan weekday passenger vehicle kilometres travelled by 2018’ (SASP target 3.6).³

As set out in the *30-Year Plan for Greater Adelaide*, the centerpiece of a more compact urban form is higher density development along dedicated transport corridors and the establishment of substantial TOD sites at key locations on the existing transport corridors.⁴
Relevance to TODs

People have become highly dependent on cars. The large distances between Adelaide’s major population centres and the increasing age of public transport assets have exacerbated this dependence.

Research shows that people living and working in TODs are more likely to have a higher use of public transport than people who live elsewhere.5 One TOD research project in four Californian cities found that residents of TODs are five times more likely to use public transport, and that those who work in a TOD are three and a half times more likely to use public transport than those who work elsewhere.6 It has also been reported that TOD residents are twice as likely not to own a car as those in other US households.5

Greater accessibility

• Effective public transport networks ensure equitable access to education, health services, goods and employment, and enable opportunities for social and economic participation.

• TODs:
  – improve access for more people to the public transport network
  – provide ready access for more people to services and work at the TOD via the public transport network
  – increase the proportion of destinations (employment, retail, education etc.) that are accessible via the network. TODs have the dual role of being a destination in their own right as well as an access point to the wider public transport network.

Interchanges and/or stations in TODs

• The TOD station:
  – serves a specific function as an access point for people arriving and departing by train, bus, bike, foot or car
  – is a gateway to the TOD site.

• As well as supporting the TOD, the interchange and/or station allows for more people to have immediate access to the metropolitan-wide public transport network.7

Influences on health

Access to transport services has implications for the health and wellbeing of the community as a consequence of social, cultural and/or economic factors.

Social equity

• Low income, disability and increasing age may restrict access to transport and hence opportunities to participate in employment, education and community-related activities.

• People who do not have their own means of transport suffer disadvantage within the community, particularly if they live in the outer fringe areas or are elderly.8

• The high costs of car ownership (including purchase, insurance, parking fees and running costs) can have a significant impact on lower income groups, people with disabilities and older people.

Physical activity

• There is a tendency for people to spend more time driving and less time walking when they live or work in places that support vehicular travel and restrict other modes of transport.9

• Walking, cycling and recreational physical activity depend on neighbourhoods that are characterised by higher density, mixed-use zoning, interconnected (walkable) streets and access to public transport.10

• Cardiovascular disease is Australia’s, and South Australia’s, biggest killer, causing more than one-third of all deaths in 2007.11
• A linked-up public transport, walking and cycling network encourages more active travel and helps lessen the health problems caused by obesity.
• Public transport use increases incidental physical activity because people tend to walk to and from public transport stops.

**Liveability**
• Lack of transport increases social isolation and decreases community cohesion. Access to public transport enables people to create and sustain social networks and promotes independence.
• The increase in road transport is increasingly associated with serious impacts on health, including noise and local air pollution.
• Greater use of public transport reduces demand for car parking.
• Accessible and timely public transport services offer an alternative to the potential stress of commuting on highly congested roads, particularly at peak times, and can offer travel time savings for commuters.
• The move to electric trains and the continued introduction of more environmentally friendly fuels in buses will reduce local emissions.
• Perceived fear for personal safety can be a deterrent to the use of public transport, walking and use of public spaces, perhaps particularly affecting women’s decisions to use or not use it.

**Getting it right**
The prerequisites for a successful TOD include that it is serviced by fast, efficient, frequent and cleaner public transport.

TODs should provide levels of development density that support public transport and accommodate the transport station and surrounding precinct as the centrepiece of the development.

Retail, service and other commercial developments should be co-located in close proximity to the station. Where possible, key social services such as childcare centres and health services should be located close to the station to accommodate transport-dependent working people.

The urban design of TODs should strengthen local retail services by having public transport users walk along a shopping area to get to and from the station, thus creating an activity centre where there are people around at all/most times of the day. This would strengthen place-making and buffer areas of residential development from the noise of a bustling commuter station.

The entry to the station within the TOD should be highly visible and located near the most intensive public activity centre development, for example a town square or cinema, to provide the focal point of the station.

Adequate signage to clearly indicate station location, bus interchange and bicycle storage facilities, as well as up-to-date timetable information, will be required.

Key rail station upgrades should be designed to improve security and accessibility and be compliant with the Disability Discrimination Act 1992 (Cwlth). Station upgrades should include a canopy shelter over the platforms, installation of CCTV and lighting, improved access paths, a passenger information system and installation of platform furniture. The principles of crime prevention through environmental design (CPTED) should be considered.

Convenient access by walking and cycling in and around the TOD is to be encouraged. This includes the provision of secure bicycle parking facilities, both short and long term, to facilitate public transport use by employees and visitors. Car parking needs to be located so that it is not a barrier to accessing the TOD by foot or bicycle.

The balance between developing the TOD and providing adequate park-and-ride facilities is to be determined according to the circumstances of each location. Consideration should be given to establishing appropriate size, location, cost and land requirements of park-and-ride lots to:

• support retail development around the station
• generate increased use of public transport to the TOD as a destination in its own right
• provide good access for users of the public transport network from both the wider catchment area and the surrounding neighbourhood.
Public transport information welcome packs for new residents in the TOD should be considered to support changing their daily mode of transport.

Public transport options should be promoted in brochures about TODs to increase awareness of travel choices and demonstrate economies of commuting.

Further Information


Reconnecting America. Station area planning—how to make great transit-oriented places, TOD 202. www.reconnectingamerica.org

Connectivity, Active Transport and Traffic Management

‘Connectivity’ refers to the degree to which a road or path network is connected and the extent that it allows direct travel between destinations.

‘Active transport’ is the term used to describe when someone cycles or walks for transport.

‘Traffic management’ is the organisation, arrangement, guidance and control of both stationary and moving traffic, including pedestrians, cyclists and all types of vehicles’.14
Relevance to TODs

Pedestrian and cycle-friendly urban design that connects multiple destinations is a key characteristic of TODs, offering the convenience of easy cycling and walking to public transport, services, shops and other facilities.

A fine-meshed and permeable (i.e. allowing free access) network of safe cycling and walking routes is a high priority for this type of development, providing multiple route options and direct travel between destinations. Within TODs, cycling and walking trips can be quicker, more enjoyable and more convenient than use of motor vehicles for short trips.

TODs provide the opportunity to change the focus of traffic management from motor vehicle speed and mobility to access for all road users.

The 30-Year Plan for Greater Adelaide includes numerous policies and targets to support the increased uptake of walking and cycling, for example increased residential density adjacent to public transport and mixed land use precincts, the development of ‘greenways’ corridors, and additional cycling and walking routes.

Evidence shows that good access to destinations (including public transport), supportive infrastructure (e.g. attractive streetscapes, wide footpaths, shared-use paths, safe road crossings and dedicated bike lanes), connected street networks, higher residential densities and mixed-use development encourages participation in active transport.15

Influences on health

Physical activity

- In Australia physical inactivity is now second only to tobacco as the leading risk factor associated with ill health. Car-dominated, low-density, homogenous residential suburbs are associated with less walking and less incidental physical activity.16 Reliance on car use has contributed to the increasing incidence of obesity and overweight in the South Australian population.
- An abundance of evidence describes the relationship between physical activity and a reduction in disease and premature death. With leisure time constrained by various lifestyle factors, incidental activity is an effective way of achieving sufficient levels of physical exercise to obtain health benefits, while leaving leisure time for other pursuits.

Environment

- Increased active transport benefits the environment through reduced traffic congestion and greenhouse gas emissions.

Social support and wellbeing

- Physical activity has been associated with a decreased risk of mental illnesses such as depression, anxiety and stress, and has been shown to improve wellbeing, emotion, general mood, self-esteem, cognitive performance and psychosocial mechanisms.
- Walkability is positively correlated with social capital. Analysis indicates that people living in walkable, mixed-use neighbourhoods have higher levels of social capital compared with those living in car-oriented suburbs. A person’s sense of community increases when neighbourhoods are walkable and when well-maintained public spaces are located near homes.
- Well-connected streets and pathways allow for interaction between residents of new and existing neighbourhoods by sharing facilities and services.

Road safety

- Most pedestrian crashes occur on wide roads with high traffic volumes.
- It is well understood, in both Australian and international contexts, that the greater the level of walking and cycling in a community, the lower the walking and cycling crash rates; and when walking and cycling become safer, more people are likely to walk or cycle and experience the health benefits.17
- When motor vehicle speeds exceed about 30 km/h, the chance of a cyclist or pedestrian surviving a crash reduces dramatically. Lower speed environments can improve road safety for pedestrians and cyclists.18
Barriers and community severance

- Busy, wide roads and rail lines have the potential to act as barriers to connecting people between neighbourhoods, and may contribute to lack of community cohesion.
- Severance causes people to increase car use on journeys they might have otherwise made on foot or by bicycle.
- Overpasses and underpasses can connect major destinations while separating vulnerable road users from busy roads. However, they may be difficult to negotiate for some people with restricted mobility, parents/carers with prams/strollers, and wheelchairs. When badly designed, they also present security and visual intrusion concerns.

Social equity

- Elderly people with disabilities find it harder to use taxis or public transport, or walk.
- Vulnerable groups such as people who are unemployed, the elderly, those with mental health problems and those in low income groups are often heavily reliant on walking, public transport, and lifts from family, friends and neighbours.

Getting it right

The prioritisation of pedestrian and cycle networks should occur in the structure planning stage of TODs, using safe and direct routes that connect to public transport, local facilities and surrounding cycling and walking routes.

Dedicated and safe walking and cycling corridors along major transit corridors should be created as outlined in the 30-Year Plan for Greater Adelaide.

Housing should be closely connected to shops, schools, local health services and a variety of destinations within a walking range of 400 m or closer to promote the use of active transport modes to and from these destinations.

The creation of human-scale streetscapes with active frontages that are well landscaped will encourage the social and community benefits of walking and cycling and make trips more enjoyable.

For major pedestrian and cycling routes and routes with high motor vehicle volumes, separation of modes should be considered by providing dedicated paths for cyclists and pedestrians and on-road bicycle lanes.

For quieter streets with lower motor vehicle volumes, integration of modes should be considered by designing ‘shared streets’ that are traffic calmed through design and have a low speed limit (negotiated with the local road authority, i.e. the council and DTEI).

The provision of supportive infrastructure for cycling and walking (e.g. attractive streetscapes, wide footpaths, shared-use paths, safe road crossings and dedicated bike lanes) should cater for a variety of users. For some trips, those walking and cycling for transport purposes may prefer direct and higher speed routes, while those walking and cycling for recreation may at times prefer more meandering and scenic routes.

Disability requirements and actual and perceived security issues must be considered in the design of walking and cycling routes.

Facilities such as way-finding signage/maps (especially to transit stations), secure bicycle parking, seating, and shade and rest areas should be included.

End-of-trip facilities (e.g. showers, change rooms and bike storage facilities, etc.) should also be provided at workplaces and transit stations.

Convenient and safe crossing of arterial roads and rail lines surrounding the TOD must be provided to connect pedestrians and cyclists with surrounding areas. Overpasses need to be designed to minimise additional travel distance, effort and visual intrusion. Underpasses require excellent visual surveillance.

Car parking locations and design should not present an obstacle to cyclists and pedestrian routes.

Consideration needs to be given to access for delivery trucks, garbage trucks and emergency services throughout the development.

Including the surrounding community in the design of the TOD will help to identify and address potential cycling and walking barriers.
Further information


Land Transport NZ. Pedestrian planning and design guide. 2007.

Local government strategic pedestrian and bicycle plans.
Transit-oriented developments...through a health lens
Density

There are many ways to calculate density. In urban planning and development the most common measure is the number of dwellings for a given area of land, for example 20 dwellings per hectare (du/ha).¹⁹ The figures in the table below, from the 30-Year Plan for Greater Adelaide (the plan), are for net residential densities, which use the residential site area only and exclude all other land from consideration.
High residential density is sometimes perceived as tall multi-storey buildings (high rise) but this is not necessarily the case. TODs are planned to incorporate a mix of building heights; although this can include multi-storey buildings, these will be limited to 3–6 storeys in most cases.

<table>
<thead>
<tr>
<th>Housing density</th>
<th>Dwelling units per hectare (du/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;35</td>
</tr>
<tr>
<td>Medium</td>
<td>35–70</td>
</tr>
<tr>
<td>High</td>
<td>&gt;70</td>
</tr>
</tbody>
</table>

Source: 1, p. 95

Building height | Number of storeys
--- | ---
Low rise | 1–3
Medium rise | 4–9
High rise | More than 10

Source: 1, p. 95

‘Density’ can also refer to population density.

Relevance to TODs

The plan identifies that TODs in Adelaide will encompass higher density residential development alongside retail outlets and other key services such as health, education and government.

As all TODs are located within transit corridors, density will be strategically increased within corridors rather than being randomly distributed within existing suburbs. A key target of the plan is to increase housing densities in transit corridors to an average of 15–35 du/ha (the plan uses gross densities here rather than net densities), although the density within a TOD will be higher than this.

As a result of increased housing density in TODs, population density (the number of individuals in a given area) may increase. This increase will be supported by and, in turn, help to support improved transit infrastructure, mixed land uses and local service provision.

Influence on health

Quality of life

- Traditionally, an increase in housing density can raise concerns with public health professionals over quality of life and health status for individuals living in higher density environments.
- With smaller dwellings, particularly in a multi-unit, multi-level setting, concerns have been raised and need to be addressed. These issues include homes having less private open space, greater noise levels, fresh air and cross-ventilation of spaces, and adequate natural light.
- Population density in itself does not cause overcrowding and poor quality of life, but physical and social infrastructure that supports higher population densities must be supplied along with quality housing.
- Two recent studies found that many urban consolidation sites and multi-level developments in Australia generally fail the needs of families with children. This is because it was assumed by planners/developers/marketers that only childless families would move into higher density environments—but this has proven not to be the case. The issue of providing suitable accommodation for families within a multi-level environment has been examined successfully in other countries, and details are provided in the ‘Getting it right’ subsection below.
- The provision of parks and natural spaces for physical activity, mental refreshment and socialising were also planned in what are considered the most liveable medium to higher density cities, and this is discussed in the ‘Public Realm’ section of this document. The importance of streetscapes in supporting a quality of life for residents in higher density environments is also discussed.
- The provision of convenient access to play areas and green space will be an important part of planning to support the health of all members of the population successfully in multi-storey developments.
Living in high-rise buildings has been successful in many cultures. However, there is evidence of an association between vulnerable lower income families living on the upper floors of high-rise (over 10 storey) buildings and reduced mental and physical health outcomes. Whilst living on a higher floor may not be the cause of diminished health, the effects of low levels of physical activity, social interaction and contact with nature may exacerbate such conditions. Social housing for families in multi-storey developments should be mindful of potential health and wellbeing impacts associated with high-rise and may be best provided on the lower floors.

Dwelling quality

Housing should be designed to provide fresh air, ventilation, natural light, acoustic privacy and useable private open space. In higher density settings the private open space is often provided by a courtyard or, in many cases, a balcony. Dining and entertaining friends and family outdoors is a valued part of the Australian lifestyle and a well-designed balcony can provide that space in lieu of a backyard. Careful analysis of the balcony and the prevailing climate is necessary for exposure to sunlight and, particularly, wind conditions for some upper storey balconies to ensure that they are useable. Balconies subject to constant windiness should be recessed or capable of being screened, or space should be provided at ground/roof-top level. Balconies should be of sufficient size and width to accommodate outdoor seating and eating. A well-designed balcony can also contribute to the safety and liveliness of the street by allowing for casual overlooking.

Further sections of this document provide information on ventilation, light and acoustic privacy for housing developments.

Density and service provision

Higher density housing can bring benefits such as providing an economic basis for mixed land uses to provide retail outlets (e.g. supermarkets) and services within walkable distances. A 2009 News poll survey in all major capital cities for the Heart Foundation found that over 85% of people rate ‘being within easy walking distance to a range of local services’ as an important factor taken into account in deciding where to live. The Western Australian Liveable Neighbourhood Code recommends a minimum residential density of around 20 dwellings per site hectare. This will result in 750–900 dwellings within a 400–450-metre (m) radius, which is usually the minimum needed to support a neighbourhood centre corner store and reasonable levels of bus service. The code also states that, in strategic areas close to town centres and railway stations (such as a TOD), significantly higher residential densities will usually be expected, with 30–40 dwellings per site hectare within 400 m, and sometimes 800 m, of major nodes being appropriate.

If a supportive streetscape is provided, services at walkable distances put more people on the street, improving feelings of safety and surveillance over public spaces, and creating vibrancy and atmosphere.

Public and active transport

Locating higher densities of residential dwellings near services, employment and public transport increases the number of local destinations within walking distance, and therefore reduces the need for private car travel, promoting physical activity. International evidence suggests that people who use public transport spend a median of 19 minutes walking daily to and from stations or stops. People in high-density urban areas are more likely to spend 30 minutes or more walking to and from public transport daily.

Increased use of public transport may result in a reduction in overall car use. Evidence shows that reduced car use results in improvements in air quality and a reduction in traffic accidents for pedestrians, cyclists and other motorists.

Getting it right

The public realm of a TOD is integral to providing quality of life to residents of higher density housing. It should be supportive of all age groups but particularly of children and older people—see the ‘Public Realm’ section of this document.

The City of Vancouver’s High Density Housing for Families with Children Guidelines give valuable ideas on how to achieve higher density housing that supports all potential residents.

The incorporation of communal gathering areas in and around more dense residential areas improves opportunities for social interaction, exercise and leisure. In a multi-unit, multi-level development internal courtyards accessible only to residents are the most popular play settings for children aged 7–12 years. As many dwellings as possible should overlook any communal play areas.
• Family-suitable units with three bedrooms or more should be located closer to the ground level, and oriented so that play spaces can be observed from the dwelling.
• Lobbies, lounges and other small group spaces with sufficient residential control help provide feelings of ownership to residents.
• Shared letterbox areas with seating provide opportunities for neighbours to meet each other.

For all apartments using balconies, they should be provided adjacent to primary living areas to meet private open space requirements. Balconies should have a minimum depth of 2 m and preferably 2.4 m to accommodate the resident(s) plus minimum guests. According to the New South Wales Residential Flat Design Code, a 2-m-deep balcony can comfortably accommodate a table and two chairs (small apartments), and a 2.4-m-deep balcony (larger apartments) a table and four chairs.29

Balconies should be oriented to maximise sunlight, and wind should be considered in the design for upper storey dwellings. Best practice design for balconies is well covered in the New South Wales Residential Flat Design Code.

Further information
Planning for and illustrating residential densities:
• Understanding residential densities: a pictorial handbook of Adelaide examples (2006) has been developed by the Department for Planning and Local Government to demonstrate the variety of designs, styles and ages of dwellings that appear already in the four different categories of residential density (very low, low, medium and high density) described in the Planning Strategy.

Supportive high-rise environments that cater for children and young people:
  http://vancouver.ca/commsvcs/Guidelines/H004.pdf

Dwelling quality as well as context for medium-high-rise residential development:
• Department of Sustainability and Environment, Victoria. Victorian Guidelines for Higher Density Residential Development.
• Department of Infrastructure, Planning and Natural Resources. Residential flat design code. 2002.
Mixed Land Use

Mixed-use zoning allows compatible but different land uses to locate in close proximity to one another and support the concept of connected communities and neighbourhoods. For example, this can include a combination of corporate, civic and residential land uses.

Mixed-use developments can be defined as those that comprise a mixture of two or more land uses within either a single building (with uses distributed either horizontally or vertically) or multiple buildings with different uses on a distinct development site.
Relevance to TODs

It has been increasingly recognised in urban planning that the growth of single-use areas where activities are fragmented into separate zones may be linked to a decline in urban public life. Mixed land use is a key characteristic of successful TODs. Creating mixed-use precincts that bring together housing, employment, transport and services is a key focus of the 30-Year Plan for Greater Adelaide. TODs will play an important role in promoting successful examples of mixed land use.

Influences on health

Co-locating medium- to high-density residential areas with essential services, retail precincts and employment close to residences creates environments that are convenient and conducive to increased cycling and walking and the associated health benefits.

Mixed land use

- Mixed-use areas promote the incorporation of physical activity into the daily routines of the community by locating services at walkable/cyclable distances from residential areas. For example, an American study into the walking habits of older women found that high walking rates were primarily associated with journeys to the local shops (25.5%) and parks (20%).
- The presence of multiple activities within a neighbourhood is likely to enhance connections between residents, building a sense of community and enhancing wellbeing.
- A more diverse area is more likely to capture trips within the neighbourhood, thus decreasing overall vehicle emissions and resulting in better traffic safety.
- It is important to ensure that commercial tenancies included in the TOD are compatible with residential use, to avoid an increased risk of exposure to adverse air or noise emissions or safety impacts from commercial uses.
- In undertaking developments where land use is changing from industrial to residential, consideration needs to be given to potential site contamination and measures taken to assess and remediate. The EPA can provide further information.
- It is also important to consider the existence of currently active industries which may not be compatible with residential development, when locating new medium density residential developments.

As outlined in the Adelaide City Council’s Guide to Mixed Use Development, ‘mixed use projects at a medium-rise urban scale can foster social cohesion, highlight cultural values and generate significant environmental benefits. For investors and developers, mixed use projects can bring higher yields, spread risks, generate synergies between complementary tenants and attract potential purchasers from a wider variety of market sectors’.

Single land use

- The establishment of local shops and services within walking distance from residential areas will promote social connectivity and create opportunities for incidental physical exercise. Both of these factors are associated with improvements in personal wellbeing, quality of life, psychological health and subsequent life expectancy.

Food availability

- When determining the appropriate mix of land use, it is also important to consider the location of food outlets. A high density of healthy food outlets (supermarkets, fruit and vegetable markets and natural food stores) is positively associated with a healthy body mass index (BMI) among the local population.
- Areas with greater access to high-calorie foods such as fast-food outlets, and lower access to supermarkets with healthy food, are more likely to have a higher incidence of obesity/overweight. This is particularly evident in lower income areas. TOD design should aim for a diversity of food premises, with the goal of making the healthy choices the easy choices for residents and visitors.
- Planning for development that allows mixed land use and reduces the distance between food-production points of sale and consumers will ensure local food security and improve access to healthy food.
Getting it right
Successful mixed-use areas can be achieved through:

• encouraging a range of developments that provide both day- and night-time activities. This will aid natural surveillance and feelings of security for pedestrians
• ensuring that only compatible land uses are located near each other. Potential impacts of mixed use can be addressed by orientating premises either horizontally (back to back) or vertically (e.g. commercial on ground floor, residential above)
• providing high-quality public gathering and recreation spaces, especially for children
• using high-quality street furniture, lighting and signage to provide a safe and attractive environment for all users
• ensuring an appropriate balance between healthy food options and fast-food/takeaway outlets.

Further information
City of Adelaide Mixed Use Development Guidelines


Transit-oriented developments...through a health lens
Public Realm

The public realm is the space between private buildings and includes areas such as footpaths, streets, parks and squares. It is publicly available to all in the community.
Public open space
• Public open space is ‘space within the urban environment which is readily accessible to the community regardless of its size, design or physical features which is primarily intended for amenity or physical recreation, whether active or passive’. This definition excludes bike lanes and footpaths, but includes nature trails and cycle paths provided they are separated from vehicle roadways.
• Public open space can be further categorised into ‘green space’ and ‘non-green space’. Green space ‘typically includes parks, both designed for formal and informal physical activities, playgrounds, community gardens and nature reserves’. Forms of non-green open space include tennis courts, plazas and squares.

Relevance to TODs
Built form, public open space and streetscapes with high amenity will be critical to the liveability of higher density places such as TODs. This is because these types of developments will have limited private open space, with an emphasis on balconies rather than large back gardens. A supportive public realm will be critical—not just for the health of the residents, but for achievement of the environmental and transport aims of a TOD.

Research has shown that a quality public realm incorporating certain design principles can create an environment that supports greater levels of physical activity, reduces the incidence of obesity, improves mental health outcomes, engenders feelings of safety and security, and supports social inclusion.

The South Australian Development Act 1993 currently demands a 12.5% open space contribution for all residential developments over 20 allotments in size. Key questions facing policymakers are whether 12.5% open space will be sufficient or appropriate for higher density living, and what characteristics and design of public open space work best in a TOD setting. These issues are explored in the ‘Getting it right’ subsection below.

The following elements are critical to the design of the public realm for positive health outcomes:
• interaction with private realm
• amenity and aesthetics
• safety and surveillance.

Public open space
Influences on health
Green spaces are particularly important to public health from both a physical and mental health perspective. Research demonstrates that, as well as providing opportunities for and encouraging physical activity, they have been shown to relieve stress, improve concentration, enhance worker productivity, improve self-esteem, boost immunity, and promote healing and recovery. People with better access to parks and other green spaces have been shown to live longer, be less stressed, become ill less often and be less prone to overweight/obesity.

Physical activity
• Adequate, accessible and useable open space is conducive to intended and incidental physical activity, which has numerous benefits to all forms of health and wellbeing. Access to large attractive open space appears to encourage recreational walking.
• Green spaces that are connected with other green or open spaces through walking/cycling trails or greenways promote higher levels of physical activity and encourage more visitors and longer stays. This then encourages feelings of safety, leading to even greater use.
• The positive health of elderly residents has been linked to accessible walkable green spaces in their local neighbourhood. A correlation was found between living in a neighbourhood with abundant green spaces and a lower mortality rate in the elderly citizens of that area.
• Having a vegetated greenway abutting a transport corridor can confer a degree of psychological protection from the noise and air quality impacts of the transport. While this protection may be relatively limited, it can promote wellbeing and health benefits in the population by increasing the use of these corridors by cyclists and pedestrians.
Amenity value

- Public green space areas can provide a welcoming environment—they appeal to people from a variety of different demographics and socioeconomic groups and may increase connectedness with the broader community.
- Studies have shown that green vegetated public open space ‘appears to attract people outdoors, increasing opportunity for casual social encounters among neighbours and fostering the development of neighbourhood social ties’. However, densely vegetated public open space can also discourage users if they feel that their personal safety is threatened.
- Public spaces also promote social contact and interaction, which contribute to improved psychological and social wellbeing.

Climate

- Prolonged exposure to the sun may result in sunburn, heat stroke or skin cancer. Therefore, shelter is an important consideration in both streetscapes and open space.
- Hard-surfaced open spaces such as plazas are particularly vulnerable to being unbearably hot in summer and bitterly cold in winter unless design for shade and shelter is incorporated.
- Green and soft-surfaced open spaces, trees and other vegetated spaces (such as greenways) act to physically cool the urban environment. Green space and vegetated spaces also mentally refresh the public realm, providing a microclimate more amenable to physical activity and participation.

Social capital

- Green spaces help foster opportunities for social capital, education and the maintenance of community cohesion. They supply space for social mixing, thus creating networks and relationships.
- Parks cultivate child development—children prefer playing in outdoor spaces that provide a range of sensory experiences and help them develop motor skills. Children living in higher density housing have a greater need for publicly accessible green space for play, mental health, and social and physical development. Children also act as social enablers, ‘breaking the ice’ and prompting conversation between adults.
- A well-designed plaza can be used for passive activities such as strolling, sitting, eating, reading and dancing, and is flexible enough to host a range of events not suitable in green space.
- Community gardens provide an excellent opportunity for people to take ownership of part of their community. As well as contributing to the amenity of the area, they also provide opportunities for social interaction between community members.
- Diminishing social capital has been associated with a loss of public spaces. Keeping spaces truly public and not semi-privatised is an important aspect—for example, providing seating and shelter that is not linked to consumption in a plaza.

Feeling secure

- Among individuals, fear of crime can lead to a sense of helplessness, induce chronic anxiety and distrust of others, and lead to social withdrawal. It is also associated with poor self-rated health, higher blood pressure and increased anxiety.
- Real and perceived threats of crime and the perception of an unpleasant environment are major barriers to physical activity and social interaction through the use of public streets, footpaths, trails and parks.
- Isolated areas are particularly troublesome for women and older people. If a space is unused, it becomes perceived as dangerous because there is no one else there to observe the space.
- There is considerable research available regarding perceptions of safety in public spaces. This has significant impact on whether women, the elderly and young children are prepared to use them.

Meeting diverse needs

- In Australia there is no typical ‘higher density resident’. The demographics are likely to become even more diverse with future immigration to South Australia, changing lifestyles and the varied locations of medium- and high-density housing from inner urban to outer suburban TODs.
- Open space and green space near higher density dwellings must cater to very diverse populations including older people, children, adolescents, parents, wealthy people and the poor.
• It is vital to consider the accessibility needs of all groups in society, such as the disabled and the elderly, to ensure that they have equitable opportunity to use public open space. For example, barriers preventing the elderly from using open space include no resting places, poor footpaths, too great a distance to walk and dangerous intersections to cross. In areas with a high elderly resident population it is recommended that the distance threshold to public open space be reduced.37

• Many studies of park usage have found that women feel less safe in parks than men, perceive parks as spaces of potential danger, and consider that parks do not provide for their needs.24 In order to reach the potential of open spaces to promote physical activity and social interaction, care needs to be taken with design to ensure safety and passive surveillance.

• Most Australian cities exhibit relatively high levels of cultural diversity, and studies show that people from different cultural backgrounds use parks in ways that may be different to those of Anglo-Celtic Australians.44

Getting it right

Two recent large literature and best practice reviews conducted for the Queensland and South Australian state governments, respectively, have identified a number of key recommendations relating to open space and urban consolidation/TODs.

Provision

• The optimum amount of open space to provide in a TOD is currently a hotly debated topic. Too little can lead to reduced amenity, congestion, safety issues and loss of opportunities for physical activity for residents of the TOD. However, overseas experience shows that too much is also detrimental, and that the design of the open space provided is critical. Currently, 12.5% of the developable area is the legislated requirement, although it is possible to negotiate less or more between the developer and the council. This usually requires one party to pay compensation to the other.

• Both reviews found that approaches to open space provision that rest on a set proportion of the development being set aside for open space may not be appropriate where high-density schemes produce large populations on small sites with very limited private open space. But research suggests that it does not always follow that a large additional amount should be provided to compensate.

• Emerging as the preferred technique for assessing the amount of open space needed for a TOD is the conduction of a ‘needs-based’ audit. An audit can attempt to identify the demographic, cultural and behavioural characteristics of the population and what their open space needs might be.24 Such an assessment looks at existing and forecast populations, and the biophysical characteristics of the TOD as well as the existing area.

• A needs-based assessment can help with determining both the amount and design of open space. For example, a TOD may be located next to already established playing fields. Also, there may be a need for biodiversity corridors to be maintained but not for stormwater retention and detention if this is being dealt with by other aspects of the development. The University of South Australia identified the United Kingdom-based Commission for Architecture and the Built Environment (CABE) as having useful guidelines (see ‘Further information’ subsection).37

Master planning and beyond

• Although there are no specific standards for TOD open space provision internationally, overseas examples often incorporate smaller public spaces and areas of intense public activity in central locations, for example plazas or small parks. Larger areas of open space are often located on the fringe of the TOD. International best practice examples of urban consolidation have a ‘diverse array of green open spaces such as small pocket parks, community gardens and street-corner plazas to larger civic plazas and iconic city parks, interconnected through a network of landscaped multiple use trails or greenways’.24

• Open space should be viewed as a primary initial consideration in design. A linked series of spaces connecting key destinations, both within and external to the development, should be a basic aim of planning for open space provision. Linking to existing neighbourhoods and regional open spaces and walking/cycling trails wherever possible is strongly recommended.

• Provision should be made for multiple activities as well as versatile spaces that can be adapted for future needs. Spaces that provide for activity as well as relaxation could include:
– plaza/forecourt areas for meeting and sitting
– green areas for leisure, picnics and informal play
– walking (including dog walking) and cycling paths
– adventure playgrounds for young children
– multi-use courts for children, teens and young adults
– safe pathways and corridors to connect pedestrians and cyclists to other destinations.

• Generosity in the provision of green space is encouraged as it bolsters mental health and physical activity levels while also providing a range of ‘free’ ecosystem services (e.g. cooling heat islands, sequestering carbon, reducing pollution, intercepting stormwater). Land values are also significantly higher around urban green spaces, thus improving municipal revenue.

• The connectivity of spaces is a crucial factor in fostering active living and utilisation of open spaces. Creating ‘conducive walkways’ between other destinations and open space enhances physical activity—footpaths, pedestrian pathways or greenways, multiple-use trails (for cycling, walking, rollerblading etc.).

• Locating commercial activities (e.g. shops with bright and interesting window displays, bookstores or cafes) next to green/open spaces can add vitality, excitement and safety to such spaces. Locating open space close to compatible facilities such as indoor sports venues, schools and community buildings can maximise opportunities for joint use.

• Open space must be accessible to all members of the community. Ensure that the distance from residences and workplaces is no more than 10 minutes’ walk from open space, and closer if ageing or existing elderly populations or children are expected in the development.

• Urban green/open spaces should provide intimate corners as well as large expanses; a broad range of amenities (e.g. seating, fountains, toilets); and access to winter sunshine, shade from summer heat and shelter from high winds.

• Green/open spaces should also offer a range of informal services and programmed activities (e.g. dance lessons, programmed sports events, weekend markets, food vending, informal recreation such as tai chi groups).

Crime prevention through environmental design

• Incorporation of high-quality design and crime prevention through environmental design (CPTED) principles will provide amenity and engender feelings of safety. Crime prevention strategies are key to increasing the use and uptake of facilities. Experience in the United States is that having high-quality parks/open space is the main driver of residents’ satisfaction with TODs.

• There are numerous Australian local and state government guides to CPTED principles to facilitate appropriate design of buildings and public spaces. See the ‘Further information’ subsection for links to further resources. Examples of CPTED techniques include:
  – creating landscape designs that provide surveillance, especially in proximity to both designated and opportunistic points of entry
  – scheduling activities in common areas to increase proper use, attract more people and increase the perception that these areas are controlled.

Streetscapes

The streetscape is the visual elements of a street, including the road, footpaths, adjoining buildings, street furniture, trees and open spaces that combine to form the street’s character.

Influence on health

The functionality and attractiveness of the walk to open space networks or other destinations is important. It has been well established that physical activity can be promoted by ‘conducive walkways’ to destinations such as open space, local shops and parks\textsuperscript{37}, and improvements to the built environment connecting those destinations.
Neighbourhood ‘greenness’

- In a study of European urban adults, residents of areas with the highest levels of greenery were more than three times as likely to be physically active and 40% less likely to be overweight or obese as those living in less attractive areas.40
- Recent research on Adelaide populations showed that those who perceived their neighbourhood as highly green had 1.37 and 1.6 times greater odds of better physical and mental health, respectively, compared with those who perceived the lowest greenness.41
- Perceived greenness was correlated with recreational walking and social factors. Recreational walking and social coherence were associated with better mental health, and the relationship between greenness and mental health was significant.41
- Nature strips and traffic islands, although not parks, are common types of urban green space. Although they are of little active recreational value, they can contribute to the overall aesthetics of an area and provide visual and psychological relief from the built environment if carefully planted and maintained.24

Streetscapes and health

- Several researchers have paid attention to the importance of footpaths and streetscape design. Key features of conducive walkways are created as part of urban planning and design, and include such features as protection from main carriageways, attractive views, well-placed lighting, sufficient-width footpaths, continuity of route, safe crossings and streets designed for traffic calming.37
- Tree-lined paths and streetscapes can contribute to making physical activity more appealing. Attention to micro-level features such as these can improve the aesthetic appeal and presentation of neighbourhoods, which influences rates and readiness of residents participating in recreational walking.39
- As well as perceptions of greenness in a neighbourhood, there is a proven relationship between tree canopy cover and cool surface temperatures, improving the microclimate and promoting physical activity.
- The planting of trees with broad canopies provides shade during physical activity, which can assist in reducing the risk of sunburn and skin cancer.

Interaction with private realm

- Many studies have demonstrated that window views (from both homes and offices) onto green vegetation rather than brick walls, dirt or pavement have been shown to improve psychological wellbeing by reducing stress levels. For example:
  - Looking out onto green spaces may help recovery from mental and physical trauma and enjoyment of more stable domestic environments.24
  - Natural vistas have been shown to decrease recovery time for patients in hospital.38
  - Pleasant window views have also been associated with increased cognitive function in children in a study of lower income families.42

Social capital

- A review of current evidence found that high-quality local aesthetics, facilities, parks and road networks may enhance the walkability of neighbourhoods and contribute to social capital and community cohesion.39

Getting it right

At both master planning and detailed design stages it is important to plan for building orientation wherever possible, with windows and balconies facing onto naturally vegetated areas or pleasant scenes rather than walls.

Streetscapes, paths and walkways should be well planned and planted with street trees to increase their aesthetic appeal and usability without obscuring vision.

Conducive walkways should be included, with protection from main carriageways, attractive views, well-placed lighting, sufficient-width footpaths, continuity of route, safe crossings and streets designed for traffic calming. For further information on detailed design of streets see the ‘Further information’ subsection.
Incorporating CPTED principles is essential to the design of streetscapes. For example:

- avoiding facing blank walls and other features that do not contribute to passive surveillance into public space; and placing windows in living areas overlooking pathways and streets
- providing clearly marked routes to transport, overlooked by active frontages and not screened by vegetation
- avoiding poorly placed lights that create blind spots for potential observers and miss critical areas, and ensuring that potential problem areas—pathways, stairs, entrances/exits, parking areas, ATMs, phone kiosks, mailboxes, bus stops, children's play areas, recreation areas, pools, laundry rooms, storage areas, rubbish and recycling areas etc.—are well lit.

Please refer to the ‘Further information’ subsection for examples of the extensive number of CPTED guides available.

**Further information**

**Detailed design of streets and open space:**


**Policy advice and general guidance:**


**Open space design:**


**CPTED guidelines:**

- International Association for Crime Prevention through Environmental Design. [http://www.cpted.net/](http://www.cpted.net/)

**General:**

- In Australia the most comprehensive work on the relationship of public open space in urban areas and physical activity levels is the RESIDE Project in Western Australia. It aims to evaluate the impact of urban design on health. [http://www.sph.uwa.edu.au/research/cbeh/projects/reside](http://www.sph.uwa.edu.au/research/cbeh/projects/reside)
Transit-oriented developments...through a health lens
Affordable Housing

Affordable housing is that which is appropriate to the needs of households with low and moderate incomes (i.e. up to 120% of gross annual median income). In South Australia the indicative affordable house purchase price for these groups—currently $255,000—is determined by the affordability indicators gazetted on 8 October 2009 (p. 4,818) or as amended from time to time under the Development Act 1993 and the South Australian Housing Trust (General) Regulations 1995.

Affordable housing should be well built; located close to transport, shops, hospitals, schools and community services; and suited to the needs of its residents.
Relevance to TODs
The South Australian Government’s affordable housing policy seeks to expand the supply of affordable housing by setting a target of 15% of housing in all significant new developments, including TODs, to be affordable, with 5% set aside for people with high needs.

Influences on health
Access to affordable, secure and safe housing is fundamental to one’s health and wellbeing, employment, education and other life opportunities.

Improved access
- Affordable and well-designed housing in communities can improve social inclusion by offering a safer living environment, providing proximity to transport and employment opportunities, linking households with social services, offering access to better schools, and connecting families to a broader range of people and institutions.

Diverse community
- Affordable housing in TODs will help to establish and maintain a diverse community.

Sense of belonging
- Affordable housing within mixed-use TODs improves long-term affordability since less dependence is placed on private car use. This often means that individuals or families are able to remain longer and therefore become more engaged with their community.
- A sense of belonging to the community can improve psychological and social wellbeing as a result of increased participation, social contact and personal resilience.

Accommodating new arrivals
- The provision of affordable housing is also vital in attracting people to live and work in South Australia (from both interstate and overseas) and subsequently to the economic prosperity of the state.

Getting it right
Affordable housing should be well integrated and dispersed throughout the TOD so that residents are included in, and feel part of, the local community.

The South Australian Government is committed to the following affordable housing policies:
- 15% affordable housing (including 5% high-needs housing) will apply in TODs and other state significant areas. Affordable housing will also be integrated into the wider housing market wherever possible.
- Affordable housing should be high quality, in terms of both building materials and design, and should minimise ongoing maintenance costs to the residents.

Further information

Building Sustainable Communities

The term ‘sustainable communities’ refers to the ability of residents of a particular geographic area to access services and opportunities in order to achieve and maintain an acceptable level of physical, emotional and social wellbeing across all stages of life. Well-planned and well-designed TODs have the potential to promote social inclusion by offering residents good access to services and employment opportunities. They will also promote social connection through the development of high-quality public spaces for a range of activities.
Relevance to TODs

In order to promote the principles of social inclusion, TOD developments should ideally provide for a mix of housing types and tenures with different levels of affordability. This will support diverse household structures and include people on different incomes and at different stages of the life cycle. In addition, the integration of high-needs social housing within TODs is consistent with the 30-Year Plan for Greater Adelaide, which seeks to prevent inappropriate concentrations of social housing in broadacre developments.

Influences on health

Ensuring that TODs include a diversity of housing types will increase the likelihood that people from lower socioeconomic-status backgrounds have convenient access to public transport, health services, schools and employment opportunities.

Increased equity also has advantages beyond that of the individual and can have positive effects on the entire community. It contributes to improving social capital, which in turn promotes other community-building factors such as tolerance of differences and improved understanding of different cultural backgrounds.

Social capital

• Creating mixed communities is a key factor in increasing social capital.43
• Socioeconomic outcomes for low-income residents may be improved through informal social interaction, improved access to higher quality services and network building.

Stability

• It is desirable that TODs contribute to the government’s social inclusion agenda by achieving a more consistent level of social and/or economic mix than exists in other parts of Greater Adelaide.
• Residents of more stable neighbourhoods, with lower concentrations of poverty and little residential turnover, experience lower levels of depression and anxiety than residents in more mobile neighbourhoods.

Getting it right

A range of housing options should be provided for a mix of household types and sizes in order to attract a diverse community of residents.

Facilities and open space in TODs should be accessible to all community members, including those in the broader surrounding community.

Encouraging a diverse range of businesses, shops and services to locate within TODs will improve access and provide employment opportunities for the local community.

Flexible open and communal spaces should be provided that can be adapted for a variety of cultural needs.

Further information


Transit-oriented developments...through a health lens
Social Support

Social support has been defined as ‘resources provided by other persons’. It has also been seen as ‘information leading the subject to believe that he is cared for and loved, is esteemed and valued, and belongs to a social network of communication and mutual obligation’.
There is now substantial evidence to show that social support is beneficial to health and that social isolation leads to ill health. Social support has a positive effect on many different aspects of both physical and mental health; while ‘vulnerability factors’, such as lack of support, predispose a person to the development of ill health following a stressor such as an acute life event.44

Two types of mechanisms—direct effects and indirect (or ‘buffering’) effects—have been described for the action of social support on health.46

Relevance to TODs
It is important that the physical design of a TOD provides opportunity for supportive communities to develop where residents, workers and visitors can formally or informally socially interact. Consideration also needs to be given to the ongoing role that community development programs can play in achieving socially supportive communities. While the physical structure of the TOD can promote social interaction, community building is an ongoing process involving a range of organisations.

Influences on health
Social support and forming good, healthy relationships make an important contribution to health and wellbeing. Support operates on both the individual and the societal level and in both formal and informal networks. Belonging to a social network makes people feel cared for, loved, esteemed and valued, and evidence shows this has a powerful protective effect on health. Social supports also contribute substantially to community resilience.

Public transport
- Residents of TODs will have close access to public transport, which promotes social interaction by delivering mobility to people who do not have access to private transport. Access to good public transport is particularly important to those who are financially disadvantaged or socially isolated.

Shared spaces
- Including small group spaces in multi-storey residential buildings is important to help foster social support and a greater sense of shared ownership among the residents.
- Participation in social activities, whether they are planned or incidental, can contribute significantly to improved mental and social wellbeing.
- Communal facilities located within a TOD that bring together people with similar needs (e.g. child care) can also foster social support and interaction.

Informal networks
- Informal networks can be formed incidentally through general day-to-day activities such as walking the dog, grocery shopping, talking to other parents at a school etc.
- These informal networks are particularly important to some community members who may not feel comfortable or confident enough to join a more formal network, and who may otherwise lose social contact with their community.

Social isolation and exclusion
- Social isolation and exclusion (which result from a lack of social support) are associated with increased rates of premature death and poorer chances of survival after a heart attack.
- People who receive less social and emotional support from others are more likely to experience less wellbeing, more depression, a greater risk of complications during pregnancy and higher levels of disability from chronic diseases.

Getting it right
When designing a TOD, it is important to consider:
- creating opportunities for both planned and incidental social interaction, for example community gardens, gyms or childcare facilities
- providing safe communal spaces for both residents of the TOD and the community more generally. These can include BBQ areas, parks, shared walkways and children's play areas
• providing smaller group spaces for residents (such as foyers or community gardens) that will help foster social support and create a greater sense of shared ownership among the resident population
• ensuring that entrances to residential units are nearby, face one another or are directly connected to major pedestrian paths or meeting areas to create opportunities for incidental social contact with neighbours
• how Community Development Officer(s) of local councils could be involved in supporting the development of socially supportive communities.
Transit-oriented developments...through a health lens
Increased Temperature — Urban Heat Island Effect

Heat-absorbing surfaces such as paved areas in the urban environment have the potential to act as an ‘urban heat island’ (UHI)—an area that is as much as 10°C hotter, and cools slower at night, than nearby less developed areas (Figure 4).
The UHI effect results from two features of the urban environment:

- Buildings, roads and paved surfaces store heat during the day, which is then released slowly over the evening due to the thermal properties of the surface materials and the building geometry, which traps the stored heat.
- Heat is also released into the urban atmosphere by combustive processes from vehicles, industrial activity and the heat that escapes from commercial and domestic air conditioning.

**Relevance to TODs**

TODs involve building medium- to high-density buildings with space more likely dedicated to shared public spaces rather than individual backyards. While these areas may be green spaces, there can be a push to develop them using hard, impervious surfaces to reduce maintenance, save water and expand their perceived utility. With only minimal private open space, often provided as balconies, there is little ability to grow trees that will provide shade to buildings or have substantial vegetative cover. Buildings and pavement made of dark materials absorb the sun's rays instead of reflecting them, causing the temperature of the surfaces and the air around them to rise.

The potential for surfaces in public areas to act as a heat store should be considered in terms of their ability to increase local temperatures, resulting in a UHI effect.

**Influences on health**

Increased temperature resulting from UHIs has many documented negative health impacts and risks, and no positive health effects. As such, heat island mitigation is a key measure in increasing the liveability of a TOD. UHIs:

- have reduced air quality—smog, created by photochemical reactions of pollutants in the air, is more likely to occur and intensify at higher temperatures
- have increased daytime temperatures and reduced night-time cooling, which increases air conditioning energy use. As power plants burn more fossil fuels, they increase both pollution levels and energy costs.

Higher temperatures and reduced air quality affect human health by contributing to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke and heat-related mortality.
Heat islands can also exacerbate the impact of heat waves—which represent large public health emergencies resulting in high levels of ambulance call-outs, hospital admissions and even deaths. Sensitive population groups, such as children, older adults and those with existing health conditions, are at particular risk from these events, particularly if there is no refuge from the heat.

During heat waves the resulting demand for cooling can overload systems and require a utility to institute controlled, rolling brownouts or blackouts to avoid power outages, further increasing the health risks to UHI residents through inability to cool their homes.

Higher temperatures, and perceptions of hot, unshaded built-up environments, also discourage cycling and walking and encourage car use and sedentary behaviour.

**Getting it right**

The following strategies should be considered when designing a TOD to minimise the potential UHI effect:

- The public realm should provide a substantial amount of tree and vegetative cover. Trees and vegetation help cool urban climates in a cost-effective and environmentally sustainable fashion through shading and evapotranspiration.47

- At the building level a number of approaches can be considered:
  - orienting buildings such that the height and spacing in relation to prevailing winds at differing times of the day (e.g. cooler wind at night) improve air flow, which can reduce local temperatures
  - locating entrances in more protected, greener areas to reduce the access of warm air from outside
  - designing courtyard spaces and balconies to deliver shade in summer and, where possible, solar gain in winter.

- Technologies for reducing heat absorption include:
  - using soft surfaces and vegetation for landscaping where possible
  - installing ‘green roofs’ or green walls
  - installing lighter coloured, more reflective roofs, sometimes called ‘cool roofs’ (although the potential for reflective surfaces to dazzle or create local warming should be considered).

**Further information**


Urban Heat Islands—Canada. [http://www.urbanheatislands.com/authors](http://www.urbanheatislands.com/authors)


United States Environmental Protection Agency. [http://www.epa.gov/heatisland/impacts/index.htm](http://www.epa.gov/heatisland/impacts/index.htm)
Transit-oriented developments...through a health lens
Air Quality

The main ambient (outdoor) air pollutants in cities are ozone, particles, nitrogen dioxide, carbon monoxide and sulfur dioxide. Vehicle exhaust, industrial emissions, petrol vapours and chemical solvents are some of the major sources of ozone. Particle pollution is formed directly from sources such as vehicles, factories and power plants.

Combustion of liquid petroleum products can generate carbon monoxide, oxides of nitrogen and other agents. Industry and incineration can generate a wide range of products of combustion such as oxides of sulfur and nitrogen, polycyclic aromatic hydrocarbons and dioxins. Combustion of any fossil fuel generates varying amounts of particulate matter.
Air quality inside buildings is influenced by any indoor sources of emissions and the amount and quality of external air getting in. The influence of external air quality on indoor air quality depends on the air exchange rate, which varies with climate, lifestyle and building design.

Some of the major sources of indoor air pollutants common to all buildings are glues, sealants, lacquers, carpets and cigarettes. Other sources include common building materials, furnishings, appliances and consumer products. Release of toxic fumes from furniture, carpets, paints, glues and sealants used in building products are greatest in new homes—levels of these pollutants may remain high for several months.

**Relevance to TODs**

TODs are intended to contribute to an overall improvement in air quality through reducing air emissions via reduced urban sprawl and car dependence. This, coupled with the advent of cleaner public transport options (such as the electrification of rail services) and the creation of more walkable local centres, will contribute substantially to improved air quality across Adelaide.

However, on the local scale, TODs can involve locating higher densities of mixed-use development next to transit corridors such as rail or arterial roads. Air quality around TODs is an important consideration due to the increased density and congestion that may occur around any transit node. Close proximity to busy congested roads or rail services may result in a localised reduction in air quality. Therefore, to ensure that the planning and design of TODs promotes good air quality, it is vital to consider whether any air pollution mitigation techniques or guidelines are necessary to avoid potential health impacts for TOD residents, workers and visitors.

TODs are often subject to site size constraints and this, coupled with the need to provide convenient access to transport, means that the achievement of significant separation distances between major transport routes and residential areas is usually not a feasible option to reduce impacts of potential poor outdoor air quality.

**Influences on health**

Poor outdoor and indoor air quality has a range of potential health impacts. Studies conducted worldwide have revealed a strong association between ambient air pollution levels and adverse health effects. Air pollution can have a negative effect on the respiratory system (lungs and airways) and the cardiovascular system (heart function and blood circulation). Health outcomes range from modest transient changes in the respiratory tract and impaired pulmonary functioning to restricted physical activity, reduced performance, emergency room visits, hospital admissions and mortality.

The occupants of buildings with poor indoor air quality can suffer from severe effects (e.g. asthma, allergic response, cancer risk) to mild and generally non-specific symptoms. Some health effects may show up years after exposure has occurred or only after long or repeated periods of exposure.

**Getting it right**

Possible ways to ensure optimal local outdoor air quality include:

- auditing potential sources of poor air quality both external to and within the TOD. Certain air polluting industries (e.g. dry cleaning) should be identified and prevented from operating within a TOD
- ensuring that prevailing winds are considered at the design stage to avoid creating features that capture and concentrate air pollutants
- exploring options to reduce potential impacts of poor air quality, for example establishing buffers such as commercial premises closer to, and family residences further from, sources of poor air quality; and locating air conditioning intakes away from sources of poor air quality
- locating, where possible, the residential areas of a TOD away from areas where vehicles accumulate and idle (e.g. where deliveries are made within the commercial precinct, busy intersections)
- using greenways as buffers between sources of poor air quality and residential areas, as they can confer both physical and psychological protection, particularly from particulate matter from vehicle emissions
- ensuring that localised traffic congestion is prevented, where possible, through implementation of a traffic management plan.
Possible ways to ensure optimal indoor air quality include:

- recognising that ventilation rate significantly influences the quality of indoor air. The challenge is to strike an appropriate balance between the need to minimise energy consumption and the need to ensure that indoor air quality is not compromised by poor ventilation.
- using advanced designs for new homes that feature mechanical systems that bring outdoor air into the home. Some of these designs include energy-efficient heat recovery ventilators (also known as air-to-air heat exchangers). Dwellings should aim to allow ventilation of around 1.5 air changes per hour in all weather conditions, while maintaining a comfortable temperature and relative humidity of 50% or less.
- making air conditioning plants easily accessible to ensure regular maintenance of filters that capture outdoor air pollutants.
- ensuring that fresh air intakes of air-conditioning plants are located away from loading areas, exhaust fans and other contamination points.
- avoiding constructing garages in residential premises that open directly into living areas where exhaust fumes can enter.
- ensuring that all gas appliances exhaust to the outdoor environment.
- avoiding the use of furnishings and construction materials high in pollutants such as volatile organic compounds or toxins.

Further Information

Transit-oriented developments...through a health lens
Noise pollution is unwanted sound. Sound that is disagreeable or discordant or interferes with the reception of wanted sound is considered noise. Community noise includes the primary sources of road, rail and air traffic, industries, construction and public works, music and patron noise, and the neighbourhood.
Relevance to TODs

As in any type of development, it is important to consider the potential impact of noise in TODs. As the design elements of TODs include locating medium- to high-density housing in close proximity to major transit nodes and mixed land use, there is potential for noise pollution to impact on the health and wellbeing of residents of TODs and on surrounding communities. Noise abatement strategies will also be essential to the design of multi-storey buildings to ensure their liveability.

Influences on health

Noise and its associated health effects are particularly subjective. As such, it is difficult to eliminate all conflict relating to noise, particularly in a higher population density, demographically diverse, mixed-use community. Efforts to minimise conflict should incorporate measures to minimise noise at both the source and the receiver’s end to ensure that residents have options to minimise their exposure when desired.

Children, people with existing physical and mental illness, and the elderly are most susceptible to noise.

The adverse health effects of noise include any temporary or long-term deterioration in physical, psychological or social functioning that is associated with noise exposure.

Noise is intrinsically linked to our flight or fight response, thus making it irritating at certain levels and frequencies and a contributing factor to certain long-term health effects.

Noise will evoke a stress response whereby the body produces various subtle coping reactions such as increasing adrenaline, noradrenaline and cortisol levels within the body, which in turn can influence the cardiovascular system and the body's metabolism. Stress reactions are more common and usually more severe when the noise is combined with a sense that there is no getting away from it and when it interferes with sleep or relaxation.

Long-term health effects from noise have been associated with people living adjacent to busy roads, railways, airports or industry, where they are regularly exposed to high noise levels that interrupt sleep and prevent relaxation. Exposure to high levels of traffic noise can also cause communication problems and learning problems in children.

Getting it right

Noise pollution can result from traffic noise and human behaviour. It therefore needs to be considered both in building design and ongoing behaviour management. A good preliminary step is to consider the local ‘soundscape’—identifying sound features in both the development and the surroundings—to determine the best measures to address local noise.

New developments located in mixed-use zones and adjacent to either rail or major arterial roads must meet noise mitigation requirements of the building rules and relevant Development Plan. Both noise sources (e.g. licensed music venues) and noise receivers (e.g. sensitive land uses such as residential, aged-care or schools) should plan and design their buildings in a way that mitigates their noise exposure.

There are a number of potential noise mitigation techniques available. Suitability and appropriateness will depend on the individual type of development and its location. Examples include:

- designing residential developments that are located close to high noise sources (e.g. major roads, railway lines, industry and airports) in a way that locates bedrooms, living rooms and private open spaces away from those noise sources, or protect those areas with appropriate noise attenuation measures.
- ensuring that noise generated by fixed noise sources such as air-conditioning units and pool pumps is mitigated through appropriate design and location to avoid causing potential noise nuisance to adjoining landowners and occupiers.
- within buildings, locating noise-sensitive rooms away from noise sources should be considered. This includes avoiding stacking conflicting uses in multi-level development (e.g. putting bedrooms above entertainment areas), avoiding surfaces on balconies that may reflect noise onto lower levels, and incorporating acoustic reduction features in windows and ventilation.
• optimising the orientation of streets and buildings will avoid noise being channelled through the TOD.
• installing physical noise barriers such as fences or earth mounds between a noise source (e.g. a roadway) and sensitive developments can confer protection; however, their impact in terms of reducing pedestrian access should be considered.
• making buildings of a similar scale to existing buildings or by locating less sensitive development such as commercial nearer to noise sources.
• avoiding blank walls in locations that may reflect noise from sources into more sensitive areas. Where this is not possible, a textured or vegetated wall may confer some protection.
• increasing insulation thickness and window glazing to reduce internal noise. Window sealing is also an option, however relying on keeping windows closed will result in the need for increased air conditioning use.
• Note: Vegetation buffers can also confer protection from noise if they are sufficiently thick and wide. For example, 60 m of dense vegetation can reduce noise by 10 decibels or 50%, and lesser amounts may provide psychological relief even though their noise attenuation may be limited. However, it is unlikely that there would be enough space in a TOD to accommodate 60 m of dense vegetation.

Further information
Health Protection Agency UK. http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1246433634856
Light

Light is electromagnetic radiation. Of particular interest is light of a wavelength that is visible to the human eye (400–700 nanometres (nm)), but some of the human health impacts of light are mediated by ultraviolet light (UV), which has a wavelength (10–400 nm) outside the visible spectrum.

Light comes from many sources, with the most common human exposures being from sunlight and artificial light. Invasive, unwanted and excessive artificial light at night is known as light pollution.
Relevance to TODs

It is important that any new TOD ensures that residents, workers and visitors have adequate protection from the sun. It is also essential that light generated by commercial uses in the mixed-use precincts of TODs does not negatively impact on residents, particularly during sleeping hours.

Influences on health

Light is known to impact on human health, both positively and negatively, in numerous ways:

- Excessive exposure to sunlight is known to be associated with increased risk of various skin cancers, cataracts and other eye diseases, as well as accelerated skin ageing. It may also adversely affect people’s ability to resist infectious diseases.50
- Vitamin D is synthesised in the human body when exposed to sunlight. Most people source the majority of their vitamin D in this way from 10–15 minutes of exposure to sunlight daily. Insufficient vitamin D intake can result in bone conditions such as osteoporosis and rickets, diabetes, multiple sclerosis and several different kinds of cancer, as well as high blood pressure and even possibly heart disease.
- Light pollution can affect quality and quantity of sleep, resulting in detrimental effects on glucose metabolism and increased risk of cardiovascular disease.2

Getting it right

Striking the balance between protecting people from excessive exposure to sunlight and ensuring some degree of exposure can be difficult. It is important that facilities are provided to allow people to manage their level of exposure, particularly in open spaces where they may remain for extended periods. Similarly, with artificial light such as street lighting, providing people with the means to control their exposure and avoid it where desired is important, particularly when sleeping.

Shade should be provided in outdoor communal areas to reduce the risk of skin- and eye-related health problems caused by excessive exposure.

Solar orientation is important not only from a temperature perspective but also to maximise light transmission into a building, particularly during winter. Optimising the use of windows on the northern side of buildings allows light transmission and avoids undesirable heating.

All living spaces within residential premises should be provided with sufficient natural light to prevent reliance on artificial light during daylight hours.

Commercial (including signage) and safety lighting should be designed, positioned and directed in such a way that it does not invade residential living and sleeping areas.

Further information

Solar orientation of homes:

Light and health:
Water Sensitive Urban Design

The key elements of water sensitive urban design (WSUD) include:

• integrating the management of groundwater, surface run-off (including stormwater), drinking water and wastewater to protect water-related environmental, recreational and cultural values

• increasing the storage, treatment and beneficial use of run-off—at building and street level, and including stormwater

• increasing the treatment and reuse of wastewater

• using vegetation for treatment purposes, water-efficient landscaping and enhancement of biodiversity

• using water-saving measures inside and outside domestic, commercial, industrial and institutional premises to improve water efficiency.
Relevance to TODs
Pressure on water supplies is increasing in many cities and regional areas of Australia due to widespread drought. This has resulted in an increased desire by governments and communities to exploit various water sources that have traditionally been wasted, for example stormwater, sewage effluent and greywater.

South Australia is a leader in water management and, in particular, wastewater recycling. At present 30% of wastewater generated in South Australia is reused.

The Planning Strategy (2010) requires that WSUD techniques be incorporated into structure plans and precinct requirements for areas of state significance, for example TODs.

WSUD will also be mandated for new developments (including residential, retail, commercial, institutional industrial and transport) by 2013 with the Water for Good plan.

Influences on health
In times of water restrictions, particularly for irrigating gardens and green space, the use of recycled water can provide the means for ensuring that these areas remain green, enhancing amenity and wellbeing, and assisting with reducing urban heat island effects. However, there are a number of human health hazards that need to be managed when using alternative water sources such as greywater and recycled water as they may contain chemical and biological contaminants that present health risks.

The presence of micro-organisms capable of causing gastrointestinal illness and chemical hazards needs to be considered and managed. Where greywater or recycled water is to be used for activities that involve close human contact (e.g. in the laundry), it must be treated and its quality monitored on an ongoing basis. Due to these inherent health risks in using wastewater, its use is regulated to ensure that these risks are managed.

Stored water
- Using stored water (such as rainwater from rooftops) may reduce the need for further treatment and may be a lower cost option for use on gardens and green space. Stormwater (such as from roadways) will need pre-treatment depending on the condition of its source.
- Storing significant amounts of rainwater or stormwater can present safety risks from drowning, and any stored water has the potential to provide breeding places for mosquitoes, even in urban areas.

Getting it right
A WSUD strategy for a TOD should identify measures that will deliver water savings and the best options for alternative supplies.

Independent advice should be sought early in the planning process. While owning and operating a water recycling system on a particular site gives a greater degree of water security, it is a long-term commitment and warrants a detailed assessment of the desired end use of the water, as this will dictate the extent to which it has to be treated (i.e. the complexity of the treatment system), as well as the start-up and ongoing costs.

The prevalence of broad-scale water recycling measures in South Australia (such as the Glenelg to Adelaide pipeline) means that there are a number of larger community schemes across the metropolitan area that can supply recycled water to developments without the need to develop and manage stand-alone systems. Contacting the relevant water utility, local council or health authority can assist with exploring these opportunities.

Water recycling schemes must be operated following approval by health and environmental authorities and in accordance with the Australian Guidelines for Water Recycling: Managing Health and Environmental Risks:

- Rainwater captured from ‘clean’ areas (e.g. roofs) requires less treatment than recycled water and hence can be used for a potentially wider range of uses and may be a better option in certain circumstances.
- Space for storages and their security (to prevent unauthorised access and the potential for drowning in larger storages) is a key consideration in capturing rainwater.
- Any water storages should be screened to prevent mosquito access and breeding.
**Further information**


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The success of this Health Lens Project would not have been possible without the ongoing high-level support from senior officers and the hard work of a committed team of project officers from the collaborating agencies.

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Glossary

Affordable housing
housing that is appropriate to the needs of households with low and moderate incomes (i.e. up to 120% of gross annual median income). The indicative affordable house purchase price for these groups—currently $255,000—is determined by the affordability indicators gazetted on 8 October 2009 (p. 4,818) or as amended from time to time under the Development Act 1993 and South Australian Housing Trust (General) Regulations 1995

Density
a measure of the population (persons) or the number of dwelling units in a given area (see ‘gross density’ and ‘net residential site density’)

Greenways
a network of green corridors that links open spaces across the Greater Adelaide region. Greenways will promote liveability and sustainability by creating safe opportunities for walking and cycling, and will enhance biodiversity through the planting of local and indigenous species

Greywater
household wastewater from the laundry, bathroom and kitchen

Gross density
the density of a given area calculated by dividing the total number of dwellings by the total area (in hectares) that they occupy (no land is excluded from the calculation) and expressed as dwelling units per hectare (du/ha)

Health in All Policies (HiAP)
an approach that emphasises the fact that health and wellbeing are largely influenced by measures that are often managed by government sectors other than health. HiAP seeks to highlight the connections and interactions between health and policies from other sectors, and to explore policy options that both contribute to the goals of non-health sectors and improve health outcomes. For more information:  http://www.sahealth.sa.gov.au/healthinallpolicies

Mass transit
regular and significant public transportation facilities and vehicles such as trains, trams and buses

Mixed uses
include a combination of major land-use types, such as residential, retail, office, commercial, civic and light industrial. The mixture of uses can be both vertical and horizontal but not necessarily in/on the same building/site. Activity centres, transit nodes, the areas surrounding major employment nodes and parts of the city centre, and urban regeneration areas are considered to be ideal locations for mixed-use development

Social capital
the features of social organisation, such as civic participation, norms of reciprocity and trust in others, that facilitate cooperation for mutual benefit

Social support
resources provided by other persons’ or ‘information leading the subject to believe that he is cared for and loved, is esteemed and valued, and belongs to a social network of communication and mutual obligation’.

There is now substantial evidence to show that social support is beneficial to health and that social isolation leads to ill health. Social support has a positive effect on many different aspects of both physical and mental health; while ‘vulnerability factors’, such as lack of support, predispose a person to the development of ill health following a stressor such as an acute life event.

Two types of mechanisms—direct effects and indirect (or ‘buffering’) effects—have been described for the action of social support on health.
South Australia’s Strategic Plan
draws together the hopes and aspirations of South Australians, and maps out a comprehensive path to the future. The plan is a blueprint for the state’s prosperity and wellbeing, to deliver a society where health, equality, safety, enterprise and creativity underpin a quality of life that is the envy of the world. It is our plan for the best. The inaugural plan was launched in March 2004. In 2006 South Australians had their say in an updated version. In 2010 the document is undergoing an even broader consultation process, enabling thousands more South Australians to take part in the update process. For more information go to: http://www.saplan.net.au/home-page

Stormwater
water that flows off roofs, properties and roads during rain events

Transit corridors
The 30-Year Plan for Greater Adelaide defines transit corridors in the following way:

- major transit corridors, which are characterised by fixed-line mass transit (rail, tram and O-Bahn). Future opportunities for development will generally be within 800 m either side of these fixed-line transit corridors
- other transit corridors, which are characterised by main road access and either have, or are earmarked for, mass transit such as frequent bus or light rail

Most development in transit corridors will be concentrated around activity centres and major public transport access points

Transit-oriented developments (TODs)
comprise mixed-use, higher density development centred on a major public transport access point. They accommodate residential, high-order retail services and employment activities as well as high-quality open space. They will be attractive and walkable places for people to live, work, shop and recreate in an accessible and self-contained community

Wastewater
contaminated water before it undergoes any form of treatment. The water may be contaminated with solids, chemicals or changes in temperature

Water-sensitive urban design (WUSD)
an approach to urban planning and design that integrates the management of the total water cycle into the urban development process. It includes:

- the integrated management of groundwater, surface run-off (including stormwater), drinking water and wastewater to protect water-related environmental, recreational and cultural values
- the storage, treatment and beneficial use of run-off
- the treatment and reuse of stormwater
- the use of vegetation for treatment purposes, water-efficient landscaping and enhancement of biodiversity
- using water-saving measures inside and outside domestic, commercial, industrial and institutional premises to minimise requirements for drinking and non-drinking water supplies.
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