AUSTRALIA

SYDNEY

Size of the country	7 741 000 km²
Population	19,2 M
Population density	2,4 inhab/km²
Population growth rate (1993 – 1999)	1,2 %
Part of urban population	85 %
Life expectancy at birth	79 (Male: 71, female: 86)
Infant mortality (per 1000 live birth)	5
Access to improved water sources (% of population)	99
Official languages	English
Religions	Christian: 70%, Buddhism: 7%
Gross domestic product	381 billion USD
Gdp per capita	20 050 USD
Inflation	3.5%
Gdp growth rate	3.8%
Gdp repartition in different sectors	Agriculture and fisheries: 4%, Industry : 30% (factories: 13%, mines: 4%), Services: 66%.
Unemployment rate	8 %
Illiteracy (% of population age 15+)	0
Tourism	4 M visitors (Japan: 800.000, NZ: 700.000, GB: 400.000, USA: 300.000)
Size of the urban area of Sydney	12 400 km²
Population of Sydney	3,8 M

SYDNEY: PLANNING FOR SUSTAINABILITY IN LOW-DENSITY CITIES

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Research into urban sustainability increasingly links factors such as residential density and the integration of land-uses with a city's level of sustainability. This being so, the low-density cities of the US, Canada and Australia face particularly problems if they wish to improve their sustainability. Nevertheless once the concepts have been understood, a wide range of policies exists that these cities could adopt to improve their sustainability while at the same time providing economic, social and environmental benefits to their communities.

This paper investigates sustainable planning and looks at the urban and transport policies that low-density cities could adopt to increase their sustainability. Policies include redirecting growth from the urban fringes back towards the city center, integrating land-uses to reduce the need to travel, and promoting walking, cycling and public transport use while discouraging excessive use of private motor vehicles. Sydney is used as a case study, and it is found that while attempts are being made to address issues of sustainability, it is difficult to change entrenched philosophies of life-style and economic well-being, and for many in the community the change towards sustainability is not happening fast enough.

Introduction

During the second half of the twentieth century, planners, particularly in US, Canadian and Australian cities, directed their attention towards improving transport conditions for motorists to such an extent that the community transport modes of walking, cycling, and public transport were often neglected. But while motor vehicles provide mobility, it is the community transport modes that promote accessibility, and it is accessibility to destinations that city dwellers require. Furthermore, it is the community modes that provide the sustainable transport options.

Low-density, mobility-oriented cities such as Sydney are characterized by high vehicle ownership rates of up to 70 percent of the adult population, and low motor vehicle occupancy rates, commonly between 1.2 and 1.5. Such statistics are the result of government policies, and the consequences of those policies

on environmental, social and economic indicators are invariably negative.

The links between urban and transport infrastructure have long been recognized by planners and policy makers, but their relationship to environmental problems have only been realized more recently. The British Royal Commission on Environmental Pollution found broad consensus that land-use planning policies should seek to minimize the need to travel and encourage the use of less polluting forms of transport. The Commission found that all significant applications for planning permission should contain an analysis of the transport implications of the development, including pedestrian, cycling and public transport access. The urban planning issues to be resolved include housing density, and the extent to which a city's land-uses are integrated or segregated. How these issues are decided will play a significant part in determining a city's sustainability[1].

It is now clear that planning outcomes have a direct and marked effect on the local and even the global environment, and that what is needed is an integrated and holistic approach to planning which has a long-term goal of achieving environmental sustainability in urban areas. The elements incorporated into sustainability planning include not only land-use planning and transport planning, but also energy policy, bush regeneration, land conservation, coastal management and pollution control[2].

In this regard, planning can be seen as a form of long-term environmental management, the purpose of which is to protect the environment and provide greater social equality, a concept that is in agreement with the philosophies of sustainable development. While a policy goal aimed at some form of sustainability may raise a number of difficult questions such as how to define sustainability, how to guarantee it, and how to pay for it, the call for a more holistic approach to environmental problems is today coming from many quarters. The way in which an urban environment is designed, and how its transport links are resolved, can play a significant part in determining not just a city's level of accessibility, but also how sustainable it is[3].

This paper looks at how low-density cities such as those in the United States, Canada and Australia can tackle the question of sustainability, and describes the mechanisms by which planners in such cities can improve urban sustainability. The case of Sydney will be discussed in more detail.

The first section introduces the concept of urban sustainability and investigates how this can be applied in low-density cities such as Sydney. Section two discusses urban form in the context of sustainability planning, and planning policies such as residential density and the integration of land-uses. Section three looks at sustainable transport planning, and how the community transport modes of walking, cycling and public transport can be integrated into an urban environment to improve sustainability. The final section takes a closer look at Sydney as an example of a low-density city facing the problems of sustainability.

An Introduction to Sustainability Planning

Urban planning that is directed towards improving sustainability is predicated on three basic tenets: the promotion of community, the promotion of accessibility and proactive planning. Firstly, the promotion of community requires a shift from private self-interest to a respect for public good, where public space is valued. " The Tragedy of the Commons[4] " provides an insight into how a publicly owned commons[5] can be exploited by private individuals acting in their own interest, until the resource becomes degraded beyond repair. " The Tragedy " provides several lessons about economic externalities and environmental implications: firstly, there is a need to identify the conflict between private and public interest in short-term economic profit, and between private and public interest in long-term environmental survival; secondly, environmental impacts often do not manifest themselves until deterioration has proceeded to a point where it can only be repaired at very high cost, if at all[6].

Secondly, accessibility can be promoted in low-density cities by implementing a range of transport planning policies which re-direct growth back towards the urban center; reduce urban sprawl; reduce average trip length; and reduce motor vehicle use while promoting community mode use. In central areas of low-density cities, sustainability planning involves reducing road capacity, reducing the number of cars on the road, improving community values, and achieving a re-urbanized and re-vitalized city center.

The third tenet of sustainability planning emphasizes planning that can be either responsive or interventionist. In the former, it is a regulatory arm of the state that, in a neutral, non-partisan way, should ensure that the environment is protected, that building and other standards are met, and which can arbitrate local conflicts. As an interventionist process, planning is ideological, participative and partisan, and it can be proactive in defending the environment against modern technologies. Planners of this latter persuasion, like Howard, Geddes, Le Corbusier, Mumford, Jacobs and Calthorpe are reformist and thus often find themselves 'aligning with those who challenge the prevailing values embedded in modern technological and economic systems'[7].

With this brief background, it is clear that the goals of sustainability planning are compatible with those of sustainable development:
• conserve resources and reduce energy use;
• ensure that land-uses in the built environment are in harmony with the natural environment, and that the built environment itself has a human-scale dimension;
• encourage development which will protect and enhance the environment; and
• promote community values and social equality.

The following two sections look at how sustainability planning can be implemented from both an urban planning point of view and a transport planning point of view. Each policy, program or project suggestion will have a positive influence on community values, on urban accessibility and on the cities sustainability.

Sustainability Planning and Urban Form

Transport indicators such as trip length and modal split are strongly influenced by urban form, whereby higher density and integrated land-uses restrain car use and encourage the use of public transport. A balance between individual and public transport modes can be strongly influenced by effective land-use planning with an appropriate infrastructure[8]. Higher residential densities together with

mixed land-uses enable shorter trips, more combined trips and more non-motorized trips. Many studies have explored the relationship of urban density to travel patterns and confirm that travel is reduced as urban density rises[9].

The mobility approach to planning functions best in low-density cities where land-uses are segregated and subdivisions are designed around motor vehicle use. But a far more interesting urban environment can be created by mixing residential, recreational, retail, commercial, employment and educational uses and providing these with pedestrian and cycling access, as the basis of a diverse urban ecology[10]. This distribution of land-uses impacts directly on the planning of the transport system since it is this system that provides the links between the uses. For a number of reasons, increased motorization has had a dramatic effect on urban form in Australian cities[11], and contributed to their low levels of sustainability:

• by allowing the physical expansion of cities to proceed at very low residential densities;

• by enabling commuting distances to extend beyond the urban boundaries;

• by contributing to the dispersion of employment from city centers to the suburbs and to the urban fringe where it can be only poorly served by public transport; and

• by assisting the retail industry to move from the central city to large suburban malls, which have in turn reduced the viability of small neighborhood shops.

While there is little consensus on what an optimal population density may be, there is general agreement that the density of some current new urban developments is too low: Jacobs and Appleyard[12] write that 75 to 150 persons per hectare (or over 40 dwellings per hectare) is necessary to support city life, while 15 dwellings per hectare (the standard new block size in Australian cities) is most inappropriate; Newman and Kenworthy[13] suggest that as densities fall below about 30 persons per hectare, fuel consumption for transport rises sharply as public transport use declines and motor vehicle

use increases; a UK study found that travel demand rises as densities fall below 15 persons per hectare and falls sharply as density increases above 50 persons per hectare[14].

However, in 1990 the population density in Australia's major cities ranged between 9.6 and 16.8 people per hectare, with Sydney's average density being greatest. Put in an international context, Sydney's density ranged from 15 to 39 people per hectare, compared with Bangkok's 89 to 288 (average 149) people per hectare, and Hong Kong's density of between 258 and 800 (average 300) people per hectare. An improved and more appropriate form of land-use distribution directed towards sustainability would promote and allow daily activities to be carried out on foot, or by bicycle on safe bicycle networks, while public transport could be used for longer journeys. Australian studies show that commuting across suburbs greatly increases the amount of traffic in a city. One study showed that while 71 percent of people could find work in the area in which they live, in Sydney only 38 percent do, and in Melbourne only 33 percent do. Furthermore, it is estimated that two-thirds of people could find work within walking and cycling distance of their homes if job seekers were more concerned with reducing their commuting distance[15].

Segregated and zoned land-uses have been a feature of the low-density Australian, US and Canadian cities, while mixed-uses are a feature of the Asian and European cities. A city in which land-uses are mixed appropriately has many advantages beyond that of reducing travel distances. Mixed-use developments mean commercial vitality, financial return and a rediscovery of the advantages of urbanity[16]. Where land-uses are mixed, a variety of lifestyles can ensue, transport energy use can be reduced and neighborhoods can become more attractive. Those regions of cities which have become blighted and decayed have benefited particularly from new mixed-use developments. These include old industrial areas,

waterfront areas such as the historic Rocks area in Sydney, London's Docklands, the Port of Melbourne, Fremantle in Western Australia, and San Francisco's Embarcadero region.

Sustainability Planning and Transport Policies

This section will present the kinds of transport policies suitable for promoting sustainability in low-density cities. The section begins by arguing that the direction a city takes in building its urban and transport infrastructure is in the hands of the policy makers, and that it is certainly possible for these people to decide the direction and future sustainability of their city.

Government policy can play a significant role in bringing change to a city's transport infrastructure. However, a change directed from personal mobility to community accessibility often requires strong conviction and leadership, especially where vested interests are entrenched. While the need for change may be one of survival for cities with high levels of motorization, it must be recognized that there is no universal solution suitable for all cities. Smaller cities with historic centers may protect these by comprehensive pedestrianization, other cities may use pricing mechanisms such as parking levies to dissuade motorists from entering the city center, another option is only to provide entry to pedestrians, cyclists and public transport users. Larger cities may choose to decentralize their activities to sub-regions in order to reduce congestion, or they may improve the public transport network.

Changing the direction of a city's development is not easy. For every visionary planner, there are many powerful opponents and skeptics who will block change. In the 1960s as Copenhagen's economy was contracting and its environment deteriorating, the debate centered on whether the city could survive. Even in that climate, skeptics maintained that pedestrianization could not work in Denmark because the Nordic people would not promenade like southern Europeans but preferred to be inside their houses[17]. Today, Copenhagen's bustling and lively central area is made up of kilometers of pedestrianized roads linking squares that contain outdoor markets, cafes, seats and trees. Tourists, shoppers, workers and students flock to the city, businesses are booming and Copenhagen has become one of the most attractive cities in the world.

The introduction of the 30 kilometers per hour zones, now installed area-wide in every major German city did not happen with unanimous support and without hefty discussions. Politicians and powerful lobby groups opposed the introduction of a new light rail system in Strasbourg, but its construction was finally undertaken after an election swept a brave and visionary mayor to power. Although some hold the view that " we are different ", the Dutch, Danes, Germans and French are as car-crazy as the Canadians, Americans and Australians, and there is no basic reason why the planning and transport lessons learned in one country cannot be applied to another. Experience shows that economies will grow in healthy environments, and that positive developments in one country can be replicated in another.

The following sub-sections look at a range of policy choices that could be implemented to promote each of the community modes and urban sustainability.

Walking

As a pastime, walking is beneficial to health and is a form of recreation. As a transport mode, it is also convenient, cheap and is low in energy use. Nearly all public transport trips, and many car trips involve a pedestrian component. As walking trips are usually of short distance, there is a clear link to land-use. Being cheap and low energy, walking places the least burden on the environment. However, walking

is rarely promoted as a viable mode of transport[18]. In the past, pedestrians have been herded behind road barriers, forced to wait at traffic lights, and channeled via under- and over-passes that are not without their dangers. Such measures are taken in an attempt to disrupt motor vehicle traffic as little as possible, but are all tactics that make the pedestrian's journey less direct and less attractive. Pharoah reports that around a third of all trips in Britain are made entirely on foot.

Walking through a neighborhood will enhance social interaction far more than driving or even cycling through it would. Since public life cannot occur between people in motor vehicles, the most important public places must be reserved and designed for pedestrians. At walking pace, the pedestrian has time to admire gardens, study the architecture, stroke a cat as well as exchange words with others[19].

Ways of encouraging walking include: planning so that facilities are within walking distance of residences; giving pedestrians priority over motor vehicles and cyclists on local streets; creating networks of convenient routes; allowing adequate green phases for pedestrians at traffic lights; and making local streets and pedestrian walks attractive and interesting[20].

Walking is seen as that mode of transport that is most able to promote community accessibility, because it reduces travel distance the most. Since it brings people outside into public spaces and into contact with each other, public places become valued assets of the community. The following table summarizes some of the policy options available to planners wanting to promote walking (Table 1).

Table 1. Summary of Options to Promote Walking

Options
Traffic modifications
1   allow extensive pedestrianization in the city center and sub-centers, and particularly around transit stations
2   design short blocks to allow for a variety of alternative pedestrian routes
3   link pedestrian routes to create networks of convenient walking routes
4   reduce traffic speeds to a minimum and give priority to pedestrians on local streets
5   promote public outdoor life by reserving and designing the most important public places for pedestrians
Social enhancements
6   provide safe, well lit, weather protected direct walking routes which include short cuts
7   build children's play areas and install street furniture where people can meet and socialize
8   encourage outdoor cafes, restaurants, market stalls and street entertainment.
Physical design
9   design urban areas so that all facilities are within walking distance of residences
10   ensure that kerb ramps and pavements are constructed to be easily accessed by wheelchairs and prams
11   replace traffic lights with zebra crossings to reduce pedestrian waiting time
12   create a pleasant, interesting and attractive environment by planting shade trees and designing water features

Cycling

The proportion of cycling trips in the modal split varies considerably between cities: Amsterdam 23 percent, Copenhagen 30 percent, 11 percent in Munich and around six percent in the major Australian cities. It can also vary depending on weather conditions: in Copenhagen the figure drops to 20 percent with rain, and ten percent with frost and snow. However, it is also recognized that the supply of infrastructure plays an important role in the cycling share of the modal split: in Munich, cycling makes up 24 percent of trips in those areas between the old town and the outer city districts which have good cycling facilities, but less than ten percent where these are not available[21].

While cycling can usually compete with public transport in terms of speed, the unprotected cyclist is greatly endangered by motor vehicle traffic[22]. Problems always arise for the more vulnerable road user where multiple users of road space coexist: pedestrians with cyclists; and cyclists with motor vehicles. One option is the physical separation of users whereby cyclists can travel on a special pathway, or cyclists and pedestrians share a pathway separated from motorists. Another option, which is suitable for busy but narrower, inner-city areas, is the installation of " bicycle streets " where motorists are required to give way to cyclists. Where bicycle streets have been introduced, cyclist numbers have increased by up to 62 percent, accident numbers have fallen, and motor vehicle speeds have fallen to between 21 km/h and 30 km/h depending on the physical design of the street, while bicycle speeds have risen to between 14 km/h and 17 km/h. An example in Buxtehude, Germany, showed that accidents involving cyclists fell from six in 1983 to none between 1986 and 1988[23].

Like walking, cycling is a healthy activity with the potential for expansion in many cities, especially in the low-density type of Australian cities. The main reason people choose not to cycle is the danger of an accident with a motor vehicle and examples from the Netherlands, northern Germany and Denmark show that where facilities provide for a safe journey, cycling numbers can be greatly increased.

The City of Copenhagen actively promotes cycling in its traffic planning, and while motor vehicle use is growing in the rest of Denmark, it continues to decline in Copenhagen where 34 percent of the work force now cycles to work. " City bikes " is a Copenhagen innovation that provides free bicycles to tourists, shoppers, Copenhageners and train users. Introduced in 1995 with 1,000 bicycles, it was expanded to 2,000 in 1996, and aims to provide 5,000 bicycles within a few years. City bikes have a distinctive design and advertising largely covers the costs of the project.

Integrated transport planning can increase the use of bicycles: by recognizing that all trips have the potential to be carried out by bicycle; by looking at the constraints to bicycle use and how these may be overcome; by recognizing and resolving conflict situations; by developing local and regional cycling networks which link trip origins with trip destinations; and by providing facilities and infrastructure which will make cycling safer and more enjoyable.

While cycling trips in low-density cities generally serve educational and recreational purposes, commuting, shopping and personal trips can also be made using this mode. They just require a greater degree of planning: possible change of clothing, shower facilities, and a convenient bag or backpack in which to carry the shopping.

Just as city administrations have a role in providing car-parking facilities, so they have a responsibility in the provision of bicycle parking. These could be retrofitted whenever footpath maintenance occurs. Up to 12 bicycles can be accommodated on one car parking space making the provision of bicycle parking far cheaper than car parking. To meet

public demand, the City Cycling Committee in Toronto has recommended that 1,000 bike racks (up from the 175) be installed on an area-wide basis each year for five years[24]. This is in preference to the current method of responding only to requests for bike racks from the public.

Cycling is a healthy mode of transport as well as being a sport and a recreational pastime. As a non-motorized mode, it has a low environmental impact, and like walking, it is able to promote community accessibility by bringing people outside, into contact with each other, and by reducing travel distance. The following table lists some of the policy options available to planners wanting to promote cycling and community accessibility (Table 2).

Table 2. Summary of Options to Promote Cycling

Options
Traffic modifications
1   designate local streets where motorists must give way to cyclists and pedestrians, and where cyclists must give way to pedestrians
2   where feasible, replace traffic lights with 'softer' means of traffic control which do not require unnecessary stopping and waiting
3   upgrade traffic light systems with a cyclist light similar to the pedestrian lights currently in operation
4   begin the cyclist's green phase several seconds before that of motorists to allow cyclists to pull away from the lights first and so increase their safety
5   permit cyclists to ride against the traffic flow in one-way streets
Social enhancements
6   allow bicycles to be carried on all trains, trams and buses at all times
7   run advertising campaigns to encourage commuting by bicycle
8   provide weather protected, lockable bicycle parking at all major cycling destinations, especially transit stations, and change and shower rooms at destinations such as railway stations and work places
9   encourage research and development into bicycle designs suitable for a wide range of uses and users
10   educate cyclists to obey the road rules and about the need to respect pedestrians, and educate motorists on the need to respect cyclists
11   encourage motorists rather than pedestrians and public transport users to switch to cycling.
Physical design
12   provide safe cycling routes to all destinations including shops, schools, cultural centers, rail and bus stations
13   physically separate cyclists from pedestrians and from motorists on main roads
14   signpost interconnected, convenient bicycle networks to link trip destinations
15   retrofit bicycle facilities whenever footpath or road maintenance occurs

Public Transport

Public transport includes buses, light rail, heavy rail and ferries, and may include taxis, although here the efficiency is close to that of the privately owned motor vehicle. Bus size can be used to tailor to specific needs: while a standard-sized bus network can accommodate up to 1,000 passengers per hour with a five minute headway, an articulated bus can carry nearly 1,500. Light and heavy rail can also operate with single or multiple carriages depending on demand. In Germany, light rail networks carry up to 5,000 passengers per hour, while between 8,000 and 10,000 are carried by heavy rail in Munich, Zurich and Hanover.

While not having the low energy characteristic of walking and cycling, motorized public transport nevertheless operates far more efficiently from an energy point of view than the private motor vehicle. However, the motorized nature of public transport enables greater distances to be negotiated more comfortably than can be by the non-motorized modes.

To encourage public transport use, employers can provide employees who leave their cars at home, with a monthly or yearly periodical ticket and the freed-up parking space can be put to a more productive commercial use. Salary packages can include a choice of public transport tickets, bicycle or company car and governments can provide tax incentives at least equal to the incentives generally offered for the use of company cars.

Low priced monthly or annual tickets for frequent users, often marketed as environmental tickets, can contrast with relatively expensive one-trip fares for infrequent users. Such ticketing options have contributed to increasing the number of people using public transport in Germany, Austria, the Netherlands and Switzerland[25]. The German town of Freiburg reduced the price of public transport season tickets by 30 percent in 1985, introduced tickets with regional validity and found that within one year, public transport usage had increased by 23 percent. Importantly, the cleaner environment was found to be attracting new investments into the city[26].

Murdoch University's Institute for Sustainability and Technology Policy (ISTP) data shows that in each city, the level of public transport cost recovery positively correlates with its public transport usage: 35 percent cost recovery in the US cities studied compared to 40 percent for the Australian cities, 54 percent for the European cities, 99 percent for the developing Asian cities, but 119 percent for the very efficient systems in the wealthy Asian cities.

Rail transit is more than just a transport mode. It is part of an overall development and accessibility strategy. As such it should be seen as a long-term investment and its success cannot be accurately evaluated in three or even five years. Rail transit needs to be part of a comprehensive strategy providing sustainability, and investment in rail should be pursued as part of an integrated land-use plan. The community, business leaders, politicians and environmentalists should support its introduction or extension, and should be involved in its planning stages.

Public transport enables greater distances to be covered more comfortably than walking and cycling and it operates more efficiently than the private motor vehicle. Public transport promotes sustainability because trips are generally shorter than motor vehicle trips, and usually include a walking or cycling component. The following table summarizes some of the policy options available to planners wanting to promote public transport and community accessibility (Table 3).

Table 3. Summary of Options to Promote Public Transport Use

Options

Traffic modifications
1. aim to increase public transport accessibility to all employment sites, schools, shops, civic services and all cultural, sporting, medical and health facilities
2. introduce programs such as community bus, taxi-bus, and call-bus
3. provide extra services at peak commuting times and for special events
4. maintain timetables with timed stops
5. ensure that buses are not delayed by traffic and parked motor vehicles
6. give buses and light rail priority phases at traffic signals, as well as bus lanes on peak routes

Traffic management
7. tailor taxation policies to advantage public transport usage as opposed to that of the private motor vehicle
8. involve the community in the planning of new transport infrastructure
9. pursue public transport investment, especially rail, as part of an integrated land-use plan
10. integrate supportive land-uses in dense and congested corridors

Public transport software
11. ensure that all connections and timetables are logical and complimentary, for example through pulse management of public transport from regional centers
12. provide a public transport service in which all branches (buses, trains, trams and ferries) are integrated into one fare structure
13. offer low priced monthly and annual tickets for frequent users, subsidized job and semester tickets for the employed and students, and relatively expensive one trip fares for infrequent users
14. provide ticket types, such as weekly, monthly or yearly, which do not require passengers to queue to buy these from the driver
15. include a choice of public transport tickets, bicycle or company car in salary packages
16. provide well designed, easy to read and up-to-date information on fares, timetables and routes, as well as better customer service and public relations

Public transport hardware
17. construct bike-and-ride, and park-and-ride facilities wherever convenient
18. extend the public transport network and integrate services
19. allow passengers to enter/exit buses and trams via all doors
20. operate buses of various sizes, and trams and trains with single or multiple carriages to tailor to specific needs
21. convert entire fleet of buses, trams and trains to take advantage of the latest technologies such as low floor and minimal polluting
22. upgrade bus stops with weather protection, and network, route, timetable and fare information

Sydney: Towards Sustainability?

The New South Wales Government recognizes the links between urban and transport planning and acknowledges the need to plan new developments in a way which will reduce motor vehicle use. As such it has a number of urban and transport policies aimed at improving Sydney's long-term sustainability through better integration of transport and land use. A major program aims to increase residential densities in the city center, and in areas well served by public transport. Furthermore, to reduce motor vehicle use, new developments are being planned with mixed-use centers that have concentrations of housing within easy walking distance of employment, shopping, education and other activities.

The government is also encouraging urban renewal and rehabilitation in Sydney's established areas to both improve their environments and to encourage people to live in or near those areas. At Homebush Bay, the site of the 2000 Olympic Games, remediation of this old waste-land is taking place through landscaping, revegetation of creek banks and the redevelopment of wetlands and creek beds. This high-density (at least by Australian standards) development will house thousands of new residents in an attractive neighborhood with fast rail access to the city center.

In addition, the government aims to increase employment opportunities and concentrate these in central parts of Sydney and in areas around existing transport infrastructure. Future development sites are being identified that are suitable for high technology businesses and other employment-generating activities.

A planned 28 km rail link to Parramatta costing AUS $1.4 billion (US $720 million) is expected to carry nearly 20 million passengers by 2006 and 24 million by 2021. The rail link will halve many journey times[27].

The few toll roads and bridges in Australia are operated more as a means of raising revenue rather than as a means of congestion control. For example, the Sydney Harbour Bridge and Sydney Harbour Tunnel both charge a two dollar toll 24 hours per day, although their level of use varies greatly during the day and night[28]. In future, the adoption of electronic road pricing mechanisms which now operate on Melbourne's City Link road system, will allow a more flexible system of toll charges based on the time of day and congestion levels, and can thus have a major influence on road use.

The ISTP data shows that Sydney's urban density, energy consumption as well as the other urban and transport indicators are at more sustainable levels than the US cities and similar to Canadian cities, but are at less sustainable levels than the European and Asian cities[29]. However, on a per capita basis, many indicators are trending towards less sustainability: overall urban density is still declining, the number of passenger cars is growing, the

	1961	1971	1981	1991
Urban density (persons/ha)	21.3	19.2	17.6	16.8
CBD density (persons/ha)	18.2	14.6	10.7	20.8
Passenger cars/1000 people	214.4	306.5	398.5	448.5
Total per capita vehicle kilometers	3,757	5,436	6,442	7,051
Parking spaces/1000 CBD workers	?	86.6	156.0	222.2
Total private energy use per person (MJ)	19,768	27,061	33,678	33,973

Table 4. Selected Sustainability Indicators in Sydney from 1961 to 1991[30]

number of kilometers driven by each car is growing, the number of parking spaces available in Sydney's central business district is increasing and transport energy use continues to grow (Table 4).

Based on information presented in this paper on the many policies available to cities wanting to improve their sustainability, a closer look at Sydney reveals that the city is making some moves towards becoming more sustainable, but it may be more accurate to say that the rate of unsustainable growth is slowing. Furthermore, the major push for sustainability is not coming from the side of the government, but from a myriad of conservation, activist and green groups. There is now huge opposition from the community to every major road project, and the government must fight long battles against community groups set up to protect remnant urban bushland and coastal zones.

Conclusion

This paper discussed the meaning of sustainability planning before presenting a wide range of planning options that can be used to address urban sustainability. While low-density cities have particular problems, a study of planning history makes it clear that sustainability planning is not new: since the late nineteenth century, the voice of people such as Ebenezer Howard and Patrick Geddes have been calling for more rational land-use practices, and more environmentally sound and economically successful urban planning. Others such as Lewis Mumford, Jane Jacobs and Peter Calthorpe have taken up their call. These people have inspired communities with the promise of a more exciting urban environment than that forming in cities following the mobility approach to planning.

Today, in Europe, North America, Australia, and increasingly in Asia, every new road project proposal is met with community opposition. In contrast, new rail infrastructure, whether light or heavy meets little if any opposition from the community and is generally applauded. The value of bus and bicycle lanes is recognized everywhere. Traffic calming local residential streets meets little opposition in the neighborhoods, but often has to be fought through government agencies, even at the local level.

As an example of how a low-density city is approaching questions of sustainability, Sydney was looked at more closely. It was found that the government is addressing questions of residential density and appropriate land-uses, and it has a number of programs aimed at increasing the public transport network and promoting its use. Nevertheless, urban and transport indicators continue to trend in the direction of declining sustainability showing how difficult the process will be for these low-density cities.

Urban and transport planning cannot please everybody all the time, there will always be winners and losers, advantaged and disadvantaged. But it is important to involve the community in the process of planning new developments, and to provide a credible explanation of the value of the measures taken, explaining how the disadvantaged will not be unduly burdened, and that possible disadvantages to a few can be outweighed by advantages to the many[31]. Furthermore, for residents in the more affluent countries, successful medium to high-density developments will need to offer special amenities, open space and quality designs to

entice residents away from low-density environments. A fine-grained mix of dwellings, shops, cafes, medical facilities, and recreational and employment opportunities will also expand the market[32].

Sustainability planning for the next century requires the courage to change direction from one that favors the individual and personal mobility to one that is sustainable and promotes community values.

Notes:

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