Towards Sustainable Cities: 
Urban Transport and Land Use Planning

Research Paper
No. 20 1995–96

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Towards Sustainable Cities:  
Urban Transport and Land Use Planning

Matthew L. James  
Science, Technology, Environment and Resources Group  
30 November 1995
Acknowledgments

The author wishes to thank Greg Baker, Geoff Dawson, Peter Hicks, Alf Hoop, John Kain, Glenis Matheson, Bill McCormick, Adrienne Millbank, Rod Panter, John Prytz, Tony Richardson, June Verrier and others who provided comments, for their assistance with the preparation and content of this paper.

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Major Issues

Australia's large capital cities dominate our lives and activity, providing a congenial social and cultural environment that ranks well on the world scale for detached housing lifestyles. Our use of the private car dominates suburban travel and has led to cities of relatively uniform density, linked by extensive government-funded roads and supplemented by public transport. The desire to own individual detached houses with gardens is responsible for the provision of such transport infrastructure, which has for the most part followed urban growth without much influence from planning strategies. As a consequence, evolving urban transport has largely shaped land use rather than by any deliberate design. Urban designers have proposed various schemes for city layouts during this century, but in the United States and Australia the prevailing ethos has been for the familiar low-density suburb with its limited range of housing choice. The alternatives of urban villages or decentralisation to rural locations remain out of favour. However, the optimum city size for cities is unclear and planners have applied few effective brakes to restrict urban sprawl.

City suburbs progressively have higher population density and may cluster around regional centres to contain growth and nurture economic activity, but it seems that there is no ideal urban form. Our cities require more effective and cohesive urban design that considers environmental aspects and social needs, as well as transport infrastructure links and city symbolism. Australian urban design is often poor and not integrated, creating inefficient land and energy usage, plus social impacts. To address this deficiency, tools include transport planning computer models and environmental assessment techniques that estimate land use impacts such as traffic congestion and pollution, and the value of land loss due to sprawl. Australia requires integrated transport and land-use planning involving all levels of Commonwealth, State and Local Government and society.

Australia's urban transport system operates below achievable limits, particularly affecting freight flows and hence economic performance, not just people's movements. To overcome this legacy, our cities require both upgraded, modern public transport systems and ring road bypass links of high standard. Government investment in public rail transport has been far below that for road funding, although there are many options available for integrated services. While governments could act to promote public transport usage, there is still a strong public preference for motor vehicle use, despite the congestion and other costs it brings. With the advent of the information age, future systems and alternatives may offer some relief, but they will take time to have a noticeable effect.
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Currently, many planners and governments promote consolidation of urban localities through denser development, in the belief that these programs make more efficient use of land and infrastructure. However, studies have yet to prove any great savings through consolidating suburbs by up to a doubling of current housing lot densities, while opponents attack it as an anti-egalitarian measure. Some urban village demonstration projects suggest means of integrating transport, environmental and land use planning in a flexible and marketable manner. Integrated programs are a key means by which Government agencies could better coordinate urban growth, perhaps under a proposed regional settlement strategy. The Federal Government has addressed some of these issues, implementing programs such as Building Better Cities, but State and Local Governments have only limited resources to pursue proper planning implementation.

However, the Building Better Cities program and State Government initiatives provide some limited practical insights into coordinated planning, although many appear to be just urban renewal schemes. There are plans for completely new urban areas, such as those in Adelaide and Canberra. However such visions are yet to emerge into life and will not address the severe growth concerns of cities such as Brisbane, Perth and Sydney. State Governments have announced innovative, integrated transport and land use planning policies for these latter three cities, incorporating regional activity centres, better public transport, ring roads and reserves. Whether or not these schemes eventuate, they tend to overlook some alternative proposals. Such prescriptive action has also occurred in Melbourne, where integrated planning appears wanting. Booming Asian cities demonstrate how multicentre strategies that rely on both market and planning mechanisms can be an appropriate solution to urban growth. As an example, Singapore, while famous for its restrictive car use policies, actually has an extensive road and public transport system superior to that of Melbourne or Sydney. Each has similar population sizes and personal income levels.

In improving urban design, consideration needs to be afforded to all urban and ecologically sustainable development (ESD) issues together, including social, cultural, ecological, economic, legal and technical plans, and not just in the large cities. Australia has begun the task of formulating ESD strategies, but State and Local Governments have insufficient resources to implement such plans.

Our cities face global economic, technological and social forces that will, in time, greatly affect their liveability and exert pressure on environmentally sensitive locations. Given time, Australian megacities may well evolve unless we chart a course towards some alternatives. These might be regional cities of medium size but the choice of their location remains problematic and the choice of future city style involves many conflicting requirements. Australia needs to apply combined transport, communications and ESD land-use strategies for optimum outcomes in the future. This implies the need for active and strategic Commonwealth policy in the urban and transportation planning sectors.
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Australia's Urban Heritage

At present, Australia's cities reflect a legacy of haphazard developments, inadequate built infrastructure and uncoordinated administration that hinders their efficiency and progress. Their development has been complex and often controversial, reflecting cultural preference for individual lifestyles against a general failure of zonal planning policy. Economic growth has prevailed over planning attempts to accommodate Australia's aspirations in such areas as immigration, perceived quality of life, social demands and built infrastructure restrictions. City growth has always been a case of marginal change and short term policies for infrastructure have lagged behind urban sprawl trends and Australia's long term dreams.

This paper examines the development of Australia's capital cities and defines the need for better links between transport planning and land-use planning to ensure their functional and ongoing operation. The paper outlines techniques that are available to address urban design issues, when combined with appropriate policies and integrated urban planning strategies. The paper also places such innovations in the context of efforts directed towards sustainable urban development as against continuing costly urban sprawl. The appendices provide a brief history of urban development in Australia and overseas, with discussion on urban design techniques and transportation planning methods.

Australia - An Urban Nation

Australia is a sparsely populated landmass with most of its people concentrated into large capital cities. With a small national population, it has relatively young cities of large size that generally offer a good quality of life. In a recent study, experts from the United States Population Crisis Committee decided that Melbourne is the most livable city in both Australia and the world. Then follows Montreal, Seattle, Atlanta, Essen-Dortmund, Detroit, Dallas, Houston and then Sydney. Their ranking is based upon factors of crime and safety, living costs, traffic congestion levels, education, communications, public health, peace and quiet. Including climate elevated Sydney to second place (McGregor 1995, 26). Other non-ranked Australian capital cities have their own distinct characteristics: remote Perth on the stunning Swan River, cohesive Adelaide on the Outback edge, English-style Hobart, Darwin's frontier style and sub-tropical Brisbane. Regional cities such as affluent, planned Canberra, or thriving Toowoomba offer inland alternatives to the coastal capitals. In fact, Australian cities have a high level of urban amenity, with relatively low urban blight, air pollution, crime or social conflict (Lepani et al. 1995, 123).
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Table 1 demonstrates the extraordinary diversity existing between cities around the world, in terms of housing costs, travel times and other factors. Local conditions such as relative living standards, geography and policies may explain some of the statistical variances. The table suggests that Australia's housing affordability is good with a high level of residential amenity. Its citizens also seem to think so, at least according to recent surveys by social commentators.

Table 1. International City Comparisons of Residential Amenity and Population

<table>
<thead>
<tr>
<th>CITY &amp; COUNTRY</th>
<th>HOUSE PRICE TO INCOME (median ratio)</th>
<th>SQUATTER HOUSES (% of all)</th>
<th>JOURNEY TO WORK (av. minutes)</th>
<th>HOUSING MOBILITY (annual %)</th>
<th>POP. IN 1992 (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algiers, Algeria</td>
<td>11.7</td>
<td>4</td>
<td>30</td>
<td>1.5</td>
<td>3.0E</td>
</tr>
<tr>
<td>Bangkok, Thailand</td>
<td>4.1</td>
<td>3</td>
<td>91</td>
<td>16.1</td>
<td>6.1</td>
</tr>
<tr>
<td>Beijing, China</td>
<td>14.8</td>
<td>3</td>
<td>25</td>
<td>13.0</td>
<td>5.8</td>
</tr>
<tr>
<td>Bogota, Colombia</td>
<td>6.5</td>
<td>8</td>
<td>90</td>
<td>n.a.</td>
<td>6.1</td>
</tr>
<tr>
<td>Dar es Salaam, Tz.</td>
<td>1.9</td>
<td>51</td>
<td>50</td>
<td>5.0</td>
<td>1.5E</td>
</tr>
<tr>
<td>Hong Kong, China</td>
<td>7.4</td>
<td>3</td>
<td>45</td>
<td>6.9</td>
<td>5.8</td>
</tr>
<tr>
<td>Istanbul, Turkey</td>
<td>5.0</td>
<td>51</td>
<td>40</td>
<td>5.0</td>
<td>6.9</td>
</tr>
<tr>
<td>Jakarta, Indonesia</td>
<td>3.5</td>
<td>3</td>
<td>40</td>
<td>11.9</td>
<td>10.2</td>
</tr>
<tr>
<td>Johannesburg, S.A.</td>
<td>1.7</td>
<td>22</td>
<td>59</td>
<td>17.5</td>
<td>2.0E</td>
</tr>
<tr>
<td>Karachi, Pakistan</td>
<td>1.9</td>
<td>44</td>
<td>n.a.</td>
<td>5.3</td>
<td>8.2</td>
</tr>
<tr>
<td>Kingston, Jamaica</td>
<td>4.9</td>
<td>33</td>
<td>60</td>
<td>1.0</td>
<td>0.7E</td>
</tr>
<tr>
<td>London, England</td>
<td>7.2</td>
<td>0</td>
<td>30</td>
<td>13.3</td>
<td>9.2</td>
</tr>
<tr>
<td>Madrid, Spain</td>
<td>3.7</td>
<td>0</td>
<td>33</td>
<td>9.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Manilla, Philippines</td>
<td>2.6</td>
<td>6</td>
<td>30</td>
<td>4.1</td>
<td>10.6</td>
</tr>
<tr>
<td><strong>Melbourne, Aust.</strong></td>
<td><strong>3.9</strong></td>
<td><strong>0</strong></td>
<td><strong>25</strong></td>
<td><strong>15.2</strong></td>
<td><strong>2.9</strong></td>
</tr>
<tr>
<td>New Delhi, India</td>
<td>7.7</td>
<td>17</td>
<td>59</td>
<td>4.6</td>
<td>9.2</td>
</tr>
<tr>
<td>Paris, France</td>
<td>4.2</td>
<td>17</td>
<td>40</td>
<td>8.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Rio de Janeiro, Bl.</td>
<td>2.3</td>
<td>16</td>
<td>107</td>
<td>4.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Seoul, Korea</td>
<td>9.3</td>
<td>5</td>
<td>37</td>
<td>24.3</td>
<td>17.3</td>
</tr>
<tr>
<td>Singapore</td>
<td>2.8</td>
<td>1</td>
<td>30</td>
<td>6.1</td>
<td>2.7</td>
</tr>
<tr>
<td>Tokyo, Japan</td>
<td>11.6</td>
<td>0</td>
<td>40</td>
<td>7.2</td>
<td>27.5</td>
</tr>
<tr>
<td>Toronto, Canada</td>
<td>4.2</td>
<td>0</td>
<td>26</td>
<td>20.9</td>
<td>3.2</td>
</tr>
<tr>
<td>Washington D.C.</td>
<td>3.9</td>
<td>0</td>
<td>29</td>
<td>26.5</td>
<td>2.6</td>
</tr>
</tbody>
</table>


Although faced without much choice, Australians have expressed a cultural preference for detached housing that has created extensive, low density cities of urban sprawl (HOR 1992, 77). While there may be a perception of a low quality of life in the sprawl, the Australian Living Standards Study surveys of suburban dwellers show satisfaction with life on the urban fringe (McDonald 1993, 463).
Another feature of Australia’s urban landscape is that a high proportion of the population becomes owner-occupiers at some stage of their life. In addition to affordability, their choice depends upon prevailing property, tax and inheritance laws; security over rental property; savings policy and cost; cultural status and other factors. While they may recognise that outer suburbs tend to have poorer facilities and services, the shift of employment-creating industries to these areas only adds to the general trend towards cross-suburban movements and remote housing locations. Outer suburbs now often appear much the same everywhere, but city centres have developed with distinctive characters. These reflect architecture, physical location, urban design and cultural style to show Australia’s urban development heritage (Frost 1991, 40).

Australia’s urban expansion has had several phases that reflect transport usage. Growth began with the creation of small colonial cities, followed by the establishment of inner suburbs during the last century. Early boom and bust development in this century ended in the steady outer suburban growth of the last forty years. Public transport development dominated the first part of this century, particularly trams, trains and buses, while personal vehicle use now dominates urban travel (Neutze 1977, 45, Frost 1991, 94). The concentration of Australia’s population in the state capitals resulted in the spread of relatively uniform density, outer suburbs around a core of older, higher density, inner suburbs, served by tram and train, as in Sydney and Melbourne. The dense established suburbs prevailed to have a strong long-term influence (Neutze 1977, 82).

Road access filled in the development gaps between the old public transport corridors, with the creation of new suburban areas that rely heavily on automobile transport. This development of Australia’s car-based cities follows American trends, as described in Appendix 1, which details the rise of car culture and freeways and establishment of low density suburbs with private homes. Interestingly, transport infrastructure such as roads, footpaths and railways take up about one-quarter to one-third of urban land. These provide for mainly urban passenger and goods flows, plus minor linkages to sites outside the city. While the mostly private housing stock constitutes a third of urban investment value, it is about half of all national investment, government and private interests finances the remaining majority of built infrastructure (ibid. 205). Urban development now proceeds in an incremental manner based on car use.

Current projections suggest that, by the year 2025, some 4.6 million extra people, or three-quarters of projected population growth will require accommodation in or near Australia’s three largest cities (Forster 1995, 130). Yet the opportunities to serve this growth, through efficient provision of built infrastructure, such as roads and services, by the private sector, remain limited due to their risk, capital cost and equity objectives, as well as physical and environmental constraints. Efforts to establish alternative decentralised cities have not prospered, as mentioned ahead. Appendix 2 reports on the current status of planning in Australia’s main capital cities. To control existing development, State and Local Governments use planning tools, but only with limited success.
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Statutory Urban Planning

The Commonwealth has had little involvement in urban land use planning and no constitutional responsibility. Local Government provides roads and drains, parks, and some services, plus zonal planning controls under State Government legislation. State agencies perform planning and construction of major built infrastructure and apply regional planning controls. Existing planning controls largely relate to building size, use and types and their location, but, quite often, the process does not involve the community. The distribution of constitutional powers and actual involvement in planning between governments is a key issue. Accordingly, planning largely occurs by "laissez faire" means, with little coordination between the levels of government. Local and State Government statutory planning has marginally contained industrial and commercial developments to appropriate sites. However, society has generally viewed zoning controls as negative tools (Neutze 1977, 238; 1978, 190, 215). Zoning controls have often collapsed under development pressures. Given the strength of the real estate market and the prevailing ethos for people to live in their own home, as part of the "Australian Dream", land use planning in Australia has not greatly influenced urban growth. As a result, our city layouts today largely reflect adaptation to transport systems, such as the car which allows more private space, rather than designs orzonings conceived by planning agencies.

Transport has the greatest influence on patterns of urban development, as long recognised in urban research and policy making (Neutze 1977, 235). Urban transport choices shape land use, combined with production, geography and other factors. This is evident in analysis of most Australian urban transport systems (IC 1994, 37-9). Figure 1 depicts the urban transportation balance between networks, management and land use. The figure demonstrates the complex interactions involving transport infrastructure, operations, personal mobility and location. However, transport and urban (town) planning generally remain as separate processes under pursuit by different, often competing agencies. They have long required strong political resolution (Neutze 1978, 236). Town planning would be more influential if it integrated transport planning with controls over private land use.

However, there are arguments against the extent of benefits from integration of transport and land use planning (Neutze 1978, 127-8). Firstly, there are limits as to how far land use plans can reduce individual demand for transport, according to employment creation factors over time. Secondly, at any one time, most land use is fixed, so that a separate authority can easily manage the transport task. Changes in land use do occur, resulting from the provision of transport systems, often creating significant environmental and social costs. Nevertheless, transport and economic analyses help to make infrastructure investment decisions become more sensitive to individual citizen preferences and community system interdependence (ibid, 118). While our cities continue to grow incrementally, based on car access, the provision of public transport facilities large enough to influence development patterns remains infrequent and uncoordinated. Local Government mostly controls incremental growth while State Government tends to fund any new facilities, with little Federal Government involvement or coordination between them.
Mindful of this requirement, the 1994 meeting of the Council of Australian Governments (COAG) established some objectives for its member State Governments' future role in urban development. These include the need to (AU&RDR 1995b, 168):

- improve coordination in urban development within and between all jurisdictions;
- promote efficient and equitable pricing and charging policies for urban infrastructure;
- develop better data on urban infrastructure capacity, condition and cost;
- foster a coordinated approach to land supply and housing development;
- advance environmentally sustainable housing and location choices; and
- contain development costs through appropriate regulation and taxation.

Global Forces

A set of major economic, technological and social forces is operating together to profoundly influence cities around the globe. The forces include the effects of globalisation, information processing, technical change in new industries plus transport and communications, migratory changes, environmental concerns, privatisation and deregulated competition (Hall 1995). Close integration occurs between the central cores of cities half a world apart, so that downtown Sydney activity now links more to Tokyo and New York than to Parramatta (Berry 1991, 5). The metropolis itself has become a centre of global economic and political power.
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- public transport station precinct designs that allow for mixed land uses with improved access;
- high quality and reliable feeder services combined with car parking policies;
- residential traffic calming and bikeways; and
- means to facilitate long term public transport and road plans together.

Governments could act to discourage use of private motor vehicles to a greater extent, say through electronic road-use pricing or increasing the long-standing fuel taxes, but at the risk of public backlash. Reduced speed limits, parking restrictions and other traffic restraints may all cause dramatic changes, but are not necessarily acceptable to the community. Should a non-polluting silent car that uses renewable energy become the norm, it is not clear whether people would readily forgo car usage in favour of public transport. Some commentators still believe that urban traffic can be reduced. This is despite the decline in urban public transport usage due to land use change and the superior convenience of car travel, along with the perceived intrinsic benefits of motoring such as comfort and privacy (Moriarty 1995, 109).

Overseas Lessons

Some important actions have occurred to coordinate long-term land use planning, air quality controls and transportation facility planning in the United States, through Federal and State initiatives (Feilich & White 1994, 103). Transport demand management techniques, public finance impact fees, regulatory zoning controls and transfer of development rights now apply under comprehensive planning frameworks (ibid. 110-114). Federal legislation requires Local Governments to establish regional management plans. In some states, such as in Oregon, Local Governments must designate and enforce local government boundaries to shape metropolitan growth, rather than maximise population and commercial growth (Heywood 1994, 66, 74). They emphasise new public transit projects integrated with transport planning and a clear policy of compact physical development around their stations and routes (ibid. 69).

Much urban design in America today involves fitting public transport systems to existing land use and building patterns in order to serve the public interest (Lang 1994, 202-3). Yet there is little political push there to establish land use policies that would encourage greater use of public transport systems. National economic pressure continues for more and better highways. As such, this public opinion reflects the general availability of open space for new uses and individual choice for the privacy and control available with private vehicles. Appendix I describes how urban planning has battled prevailing economic development in the United States. Community attitude in favour of cars is also very strong in Australia, as evidenced by the predominance of strong car industries, clubs and magazines, etc., over those for cycling or greener pursuits. Accordingly, the introduction of road-use pricing in urban areas fails to reach the political agenda, since, in one view, road users as a whole would lose (BTCE 1995, 17).
Some users would be better off, especially commercial operators, but the average driver would be worse off in the short term. The external costs of environmental pollution thus remain unpaid by car users. In the meantime, petrol prices may well rise, due to oil supply decline, so that the car dependent suburbs of today may become difficult to travel to in the future, unless other fuel types arise.

In the long term, suburban relocation induced by traffic congestion, as a form of laissez-faire planning or as a "do-nothing" option, may be an economically cheaper option for society, rather than planning road infrastructure on the basis of existing land use patterns (ibid, 20). As such, some commentators argue that just as quickly as new roads are built, they become congested and therefore should not be constructed. This also applies to other infrastructure such as water and electricity supply, or sewerage services. However, this argument ignores the possible operating improvements and economic benefits made possible by provision of new facilities, especially to commercial vehicles. Commuting to the central city creates much current congestion, but is actually only a small portion of overall metropolitan travel.

The Transportation Association of Canada proposes new approaches to integrated land use, urban design, transportation planning and financing. Concerned about urban sprawl, deteriorating built infrastructure and quality of life, it proposes mixed land use strategies, innovative funding support, with balanced private and public transport. While easy in theory, these would all be based on local vision combining all levels of government interest (Hartman 1994, 2). Political leadership would be required to set a new urban vision, engaging public debate about life choices and urban structure, while providing appropriate incentives and true-cost pricing. The Association also favours integration of public transport with other modes, especially to optimise existing systems and manage trip demand, in order to create cities of social, economic and environmental equality. However, public debate either in Canada or Australia has yet to widely consider these matters and urge government action to manage them.

Meanwhile in Britain, integrated transport and environmental policy has been a recent focus of attention, at a time of indecision over various road proposals (Rawcliffe 1995, 30). Planning has focused on traffic management, public transport and pricing mechanisms as partial alternatives, while a visible anti-road movement has grown. Future policies for more efficient transport will require considerable change to current trends, as demanded by the British Royal Commission on Environmental Pollution (Houghton 1994). Its report urges a strong shift to public transport such as light rail and parking controls to discourage vehicle usage.

However, British cities tend to be considerably different from Australian ones in terms of their nature and lifestyles. Previous experience with greenbelt limits on urban sprawl only achieved marginal success in Britain, as development proceeded past the proclaimed barriers. European cities have much higher densities than in Australia. Blanket acceptance of European transport policies does not necessarily ensure that their application would be a success here. Nonetheless, the alternative of freeway networks can lead to further sprawl, longer journeys and car dependency and hence higher transport energy use and pollution rates. The problem becomes one of achieving a balance between efficient road and public transport systems in the future city.
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Transport Futures

In the near future, some innovative technology may impinge on urban transport operations. Intelligent Transport Systems (ITS) or Advanced Transport Telematics (telecommunications and informatics) (ATT) are computer programs that aim to utilise electronic technology and telecommunications in vehicles and along roads to improve the safety and flow of traffic. Experts claim that these could reduce traffic congestion by 20 per cent, and accidents by 8 per cent, by the year 2011, but at a high cost. They involve smart cars and highways that monitor speeds and warn drivers of hazards ahead, while also guiding them to their destination (Dudson 1995). Automated traffic surveillance and control systems point the way in this regard.

Other technological changes are likely to be incremental rather than revolutionary depending upon population growth and limits, energy usage and environmental effects. There may also be innovations in cleaner, possibly electric cars along with demand responsive bus systems (Newman 1992, 296). In the meantime, perhaps growing use of telecommunications systems by people working from home (teleworkers) will have some marginal impact on reducing commuting congestion (Brotchie et al., 1992). High speed rail services may offer alternatives to long-distance car travel.

However, visionary glimpses of the far future offer some possible dramatic changes. One observer of future trends suspects that, with modern transport and telecommunications systems, more people will desire to live in regions having the climate that they prefer (O'Neil 1981, 142). In this view, developers may construct enclosed new towns in regions of severe climate, in order to offer acceptable environments. In existing cities, older buildings may remain preserved, with most people living in townhouses or apartments in landscaped areas of a square mile each containing 10,000 residents. The alternative may be run-down, derelict areas of no attraction.

Cities may survive much as they do now as major commercial and cultural centres but with special information systems to monitor personal movements and thus prevent crime. Houses may be energy efficient, concrete structures with walls having changing electronic decorations and video, computer monitoring and linked to external services (ibid, 152). By this time, Personal Rapid Transit (PRT) systems may exist as small automated cabins travelling along guideways that link suburbs. Travellers would order a PRT cabin to their location by computer, from where it would deliver them to their destination, before its use by another passenger. Long-distance travel may be possible in fast vehicles using evacuated, underground, vacuum tunnels that link together distant cities (Brotchie et al. 1992, xi).

Other technological solutions may well arise too, although some of those suggested here have not, as yet, had the dramatic effects often expected by pundits. A likely possible future city should base itself upon clusters of smaller "sub-cities" linked by public transport and telecommunications systems. The question remains as to if this is a city type that Australia seeks and whether the nation can achieve it.
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Policies for Urban Change

Until any possible future utopia arrives, Australia is left having sprawling cities with growing levels of congestion and pollution, along with social effects such as the isolation of the car-less plus problems of high traffic flows and accidents. It would seem that, in the long term, only a structural change to our city layout can possibly offer some remedy. Medium density housing, such as up to a doubling of existing house lot densities, is one possible means of consolidating the urban fabric to help prevent sprawl and increase access.

Urban Consolidation Policy

Cities are dynamic systems of transport mobility and economic activity, but are dependent on static conditions of geography, space, linkages and land-use, as well as on social and cultural factors. The question arises as to whether direct intervention can change cities, perhaps by forcing their consolidation (densification - an increase in urban population gross density) to improve their operating efficiency and prevent sprawl. Urban consolidation or re-urbanisation is an attempt to concentrate activities and people at higher than normal densities (Berry 1991, 5). It comprises three main types: redevelopment of industrial sites for housing, infill development of extra buildings on existing sites, and provision of higher density townhouses. However, there are also variations such as allowing home owners to rent out small apartments on their land (Lowe 1990, 124). Urban villages are another often-touted form of consolidation that involve creation of mixed-use developments based around landscaped pedestrian movements, local employment, and public transport access (Newman & Kenworthy 1992, 50). Many of the Federal "Building Better Cities" programs (discussed below) involve village type projects.

Early government agency studies concluded that urban consolidation, both in fringe areas and infill in older locations, offered significant built infrastructure, services and construction savings (DHHCS 1994, 30). However, later studies challenged such conclusions, while urban sprawl defied them. Calculations suggest that, even with urban consolidation policies, infrastructure savings would occur of about only 2 to 5 per cent of new land expenditures (McLoughlin 1993, 21). On a lesser scale, a recent study proposes that new suburbs of 15 or 20 houses per hectare, rather than just 10, will reduce built infrastructure costs by about six to eight per cent respectively through savings in health, education and transport services (AU&RDR 1995b, 4). This is just a small reduction, but demonstrates that increasing housing density in urban areas results in some improvement in social infrastructure (community networks) provision, without necessarily sacrificing suburban amenity and community desires (Spiller 1993, 6).
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However, the proponents for consolidation have yet to prove their case against those who argue against it. The often claimed benefit of reduced travel times seems only achievable through significant increases in urban densities such as those found in European cities. Any resulting reduced greenhouse gas and air pollution may be offset by extra pressures on existing environmentally sensitive land. While proponents of consolidation stress its social and community benefits, opponents argue that it is socially regressive, costing people "more for less" and that it represents an anti-egalitarian land use (McLoughlin 1993, 20). As well, opponents question the social benefits claimed for urban villages (Troy 1992b, 42, Sudjic 1993, 310) in what has become an ideological division between planning experts. Existing local residents often fight any consolidation programs in their areas, fearing losses of residential amenity, privacy, room to move and favourable environments. These are complex issues and oversimplified notions of urban consolidation as a panacea for urban problems remain unproven.

Urban consolidation has become somewhat of an excuse for redevelopment. Consolidation faces problems of creating affordable and quality, medium-density housing of an innovative, local design that links to public transport (Powell 1991, 3). Appendix I outlines modern urban design techniques and their lack of application to Australia. Until recently, this nation has not had significant facilitation of urban redevelopment by any Federal, State or Local Government and certainly not within a metropolitan planning context (ibid, 6). However, rising concern about the public costs of city growth, environmental impacts and social issues has lately led to renewed local interest in matters of urban planning (Troy 1995, 1) and some redevelopments.

The issue becomes one of creating a highly desirable total environment that includes not just lot sizes and development codes, but incorporates proper transport land-use planning, landscaping, provision of community facilities and essential services. This suggests a need for a greater regional planning role by Federal, State and Local Government agencies, combining all of their various viewpoints, as covered later. The role of private developers in this process is obviously also a key issue (UDTF 1994, 20, 60). They need to experiment with more imaginative and attractive forms of suburban development under a coordinated approach. Appendix I discusses some appropriate urban planning and environmental assessment techniques that assist planners to estimate the effects of transport proposals and choice of urban location.

There is no ideal form that will solve urban problems, but sensitive and appropriate responses may assist to preserve and enhance the common landscape of the city where nature and machine exist in harmony. Policies may need to emphasise flexibility and utilise market mechanisms wherever possible, in order to encourage citizens to pay for and identify what they truly need and desire in housing and living arrangements. Proper street design and attention to local detail may also be important. Policies such as greenbelts or urban sprawl limits may encourage some revision of personal location choice to re-favour inner city locations rather than remote lots.

The Industry Commission has recommended that governments need to effectively integrate the planning of land use with transport infrastructure in Australian cities, supported by application of appropriate regulations (IC 1994, 49). A similar view holds that all relevant parties and the Commonwealth could work together to better coordinate new urban growth.
Toward Sustainable Cities

This would link land use planning, built infrastructure provision and environmental outcomes, by means such as (AU&GDR 1995a, 3, 11, 58):

- urban villages of high density established on public transport networks;
- traffic calming, public transport upgrading and special routes for commercial traffic; and
- creating secondary city centres and gradual activity relocation.

One study has also found that the global competitive advantage of Australian cities depends on matching world best performance in transport and other infrastructure (Lepani et al. 1995, xv). Given such a national scope, this suggests the need for greater Commonwealth involvement in urban planning issues than has occurred in the past. Each mainland state except Queensland has produced master plans for their capital cities. The New South Wales Government approved a Sydney planning scheme in 1951, while the Victorian State Government approved a plan for Melbourne in 1954. State Governments adopted similar plans for Perth in 1963 and Adelaide in 1967 (Forster 1995, 22). All of the plans sought to contain sprawl through development restrictions, but over time became somewhat ineffectual and opposed by local interests. As well, some states have a bewildering array of Acts involving development and the environment.

Federal Government Policy

Australian Government decentralisation policies have a long history dating back to the last century but they have had little evident success except in the case of Canberra. More recent policy has concentrated on favouring multiple, dense commercial centres within suburban areas, but developers have largely shunned this option, preferring individual sites instead (Forster 1995, 68). Like these initiatives, current consolidation policy has had little impact on city growth and structure. It has yet to prove that higher urban density is achievable (ibid, 133). The consolidation policies used to date involve infill, conversion, dual occupancy and smaller new blocks, that while laudable, have made little difference to overall density or city structures.

The Federal Government has traditionally had little involvement in urban and regional matters, while inadequate coordination between Local Governments has only served to compound the problems of urban administration. Federal interest has largely involved funding for transport infrastructure provision. The Federal Government had no direct involvement in urban matters from 1901 until 1945 when the Commonwealth State Housing Agreement began operation (Troy 1992a). By 1971, Australia was one of the world's most urbanised nations, yet with little Federal involvement until the Whitlam Government focused attention on urban issues and funded public transport programs. From 1972 to 1975, its "Cities Commission", composed of experts, investigated future urban and regional development plans, recommending growth centres and a broad national urban framework (CC 1975). The subsequent Fraser period saw a decline in infrastructure investment, apart from actions such as the Glebe Project urban renewal. The Hawke Government increased public housing and amalgamated separate agencies into the Department of Transport and Communications as well as the Department of Housing and Regional Development and began the Building Better Cities program, as described ahead.
Towards Sustainable Cities

The costs of urban congestion and accidents suggest that urban infrastructure investment is not at an adequate level (AU&RDR 1995c, 146). In the view of the road lobby, the historical pattern of investment has also led to a relative over spending on local and rural roads compared to major urban roads (ACG 1993, 58). Their studies find that Australia’s principal road network, especially of freeways in urban areas, is inadequate and incomplete, when compared to similar cities found overseas such as Toronto (ibid, 34). Such infrastructure investment has been the subject of government influence, political factors, and engineering programs combined with various economic analyses (ibid, 37). Even under a wider government intervention, such as land-use policy that may redistribute development in cities to a certain extent, demand for motor vehicle travel should continue to increase. Despite the economic and social benefits possible from rail investment and urban public transport, Commonwealth involvement has been minimal in these other sectors (Laird 1994, 4). Thus, both roads and rail require a greater commitment.

The National Transport Planning Taskforce (NTPT), commissioned as a first attempt to review the adequacy of nationally strategic infrastructure to meet future demands, estimated the need for urban transport investments. These include programs to reduce congestion on important road links mainly in Sydney, Melbourne and Brisbane, plus rail improvements along the east coast. The Taskforce advocates a National Transport Infrastructure Network for long-term, intermodal strategic planning, along with integrated metropolitan transport plans (NTPT 1994, 39-40). Currently, Commonwealth funding for rail, urban public transport, national highways and arterial roads comes under the Australian Land Transport Development (ALTD) Program.

However, there remains a lack of consistent economic evaluation procedures for Federal funding of road and rail investments (Kain 1995, iv). As well, the ALTD program does not cover many important urban transport linkages in our cities as it only considers national routes. Some of these linkages are the subject of Appendix 2 which provides a summary of urban transport planning issues in each of the major capital cities. In each case, a lack of a consistent approach to infrastructure prioritisation and funding has led to piecemeal planning approaches.

In 1992, a Parliamentary Committee's review of urban settlement concluded that consolidation (building and redevelopment) policies of housing densification alone will not solve economic, environmental and social problems in Australian cities (HOR 1992). This is because, while cities expand relatively slowly, household size also continues to decrease, due to social changes, and so consolidation merely partly averts a decrease in density in established urban areas. As well, non-residential land such as at industrial sites does not aggregate readily, due to zoning and previous land-use legacies, while suburban fringe growth and car use both continue. The report also concluded that inner suburbs do not necessarily subsidise outer suburban development.

Evidence to the Committee suggested that, while more compact cities offer environmental benefits, the practice of urban consolidation may not succeed in containing cities, nor produce a shift to public transport (HOR 1992, 94). The report states that “denser urban form...will not eventuate where consolidation fails to integrate land use with transport planning” (ibid, 142). The study predicted that cars will continue to dominate personal transport due to the high level of mobility expected by society. Noting the fragmentation of urban planning, the report suggested use of a national settlement strategy, to facilitate a strategic approach between all government levels (ibid, 75).
The Federal Government has sought to address the important issues raised by the Committee through various reforms. These include initiatives such as the Australian Urban and Regional Development Review (AURDR), the Regional Development Program (RDP), Building Better Cities (BBC), the National Urban Development Program (NUDP) and Integrated Local Area Planning (ILAP) (Howe 1994, 2-5). Sub-programs of these support other investigations such as the Urban Futures Program (UFP), (under NUDP), the Australian Housing and Urban Research Institute (AHURI) and Regional Infrastructure Demonstration Planning Projects.

The Government believes that a national settlement strategy as such is best achieved through appropriate development policies, discussed ahead. The Commonwealth has initiated several programs said to promote strategic planning for larger areas, coordinated planning on detailed issues (eg. AMCORD) and long term planning. These include BBC, ILAP, NRDP and Local Government Development Programs, plus national highway system planning (ibid, 11-12, 19). A related program is the Urban Export Strategy, launched in September 1993, that promotes Australian expertise in the housing and urban development sector, to overseas nations. The following Table 2 provides an acronym listing of the various programs.

Table 2. Commonwealth Program Summary

<table>
<thead>
<tr>
<th>ACRONYM</th>
<th>PROGRAM</th>
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<tbody>
<tr>
<td>ALTD</td>
<td>Australian Land Transport Development</td>
</tr>
<tr>
<td>AURDR</td>
<td>Australian Urban and Regional Development Review</td>
</tr>
<tr>
<td>AHURI</td>
<td>Australian Housing and Urban Research Institute</td>
</tr>
<tr>
<td>BBC</td>
<td>Building Better Cities</td>
</tr>
<tr>
<td>ILAP</td>
<td>Integrated Local Area Planning</td>
</tr>
<tr>
<td>NSESD</td>
<td>National Strategy for Ecologically Sustainable Development</td>
</tr>
<tr>
<td>NTPT</td>
<td>National Transport Planning Taskforce</td>
</tr>
<tr>
<td>NUDP</td>
<td>National Urban Development Program</td>
</tr>
<tr>
<td>RDP</td>
<td>Regional Development Program</td>
</tr>
<tr>
<td>RIDPP</td>
<td>Regional Infrastructure Demonstration Planning Projects</td>
</tr>
<tr>
<td>UFP</td>
<td>Urban Futures Program</td>
</tr>
<tr>
<td>UDTF</td>
<td>Urban Design Task Force</td>
</tr>
</tbody>
</table>

The AURDR seeks to examine urban and regional planning and management processes across all levels of government and across disciplines. These policy areas include economic growth, employment, environment, transportation, housing and communications. It also considers the use of communications systems and matters of public transport provision.
Towards Sustainable Cities

The NUDP aims to improve efficiency in the provision and use of housing, land, infrastructure and urban design. NUDP has four components of local area management, urban futures study, the housing industry and AMCORD (the Australian Model Code on Residential Development). This is a national, performance-based planning code proposed to encourage quality, environmentally sensitive and cost-effective urban design by Local and State Governments. AMCORD incorporates consideration of ecologically sustainable development (ESD), social planning, built infrastructure, urban form and transport considerations. AMCORD aims to promote integration of transport systems into urban design to minimise transport demand. While AMCORD is not a legal requirement, all states and territories, except Western Australia, have developed codes consistent with it. In that state, central control of subdivisions prevails.

The ILAP program, developed by local and federal governments, aims to encourage developing regions to prepare strategic, integrated local plans. The ILAP process involves four elements of consultation, information, planning and monitoring to achieve an integrated local planning strategy. The planning stage must include objectives, indicator targets, models and policies. Together with BBC, these activities represent at least some Commonwealth effort towards facilitating urban planning. However, it has been left to State and Local Government to devise and apply land use strategies, albeit in differing ways, as outlined in Appendix 2.

Building Better Cities

The BBC program is one example of a renewed national interest in urban policy. The scheme promotes high built-density, planned urban development, that integrates housing, services and employment, designed to address economic, social and environmental concerns. Inter-state and urban transport systems had limited funds in the 1980s, so the Government called for an integrated approach to urban labour markets, affordable housing, and energy-efficient transport policies (Badcock 1993, 73). The resulting BBC program thus responds to the public costs of urban sprawl (estimated at A$4.2 billion annually) due to traffic congestion (ibid, 77). However, the urban consolidation preference followed in the program may not necessarily better redistribute housing and location opportunities for the most disadvantaged in the community. In the end, today's urban sprawl is as much a cultural preference and a reflection upon the availability of cheap land, public or private transport.

Since 1991, the Commonwealth has promoted its BBC program to encourage a comprehensive integrated approach to planning and urban development of metropolitan areas. This five-year program aims to promote economic growth, improve social justice, promulgate institutional reform, provide for ESD and an improved urban environment, linking all parties involved in cities. The urban renewal program involves 26 area strategies, associated job creation, built infrastructure upgrading, as well as specific environment improvement demonstration projects. The projects lie in selected outer growth areas, inner redevelopment areas, and at certain country centres, as shown in Table 3. They generally aim to plan new housing around transport services, with improved land-use planning, under an integrated framework. The 1995-96 Budget provided additional funding for an extension of the BBC program (often referred to as BBCII) to provide a more strategic national focus (AU&RDR 1995c, 212).
While the BBC program is an attempt to involve three levels of government in urban renewal activity, its activities are basically grants for a scattered series of long-proposed public built infrastructure projects. BBC does have an emphasis on environmental sustainability, natural resource management and social equity. However, it will be many years before the real effects of the program are measurable. Already, projects such as the Sydney City West proposal have been the subject of considerable local protests and concerns. City West is Australia's largest urban renewal project, costing some A$300 million over 20 years and involving a multitude of organisations. Some observers call for a single authority to oversee City West and provide a vision for it. Others point to such a body, the Darling Harbour Authority, as an organisation that performs with little controls on it. Critics see BBC as crisis-management, linked with job creation schemes and vote-buying in decaying urban areas (Badcock 1993, 72). However, BBC has involved relatively modest outlays compared to earlier schemes for decentralisation. BBC has also resulted in some commonality of approach across cities since it requires coordination of Local, State and Federal Government programs and agencies; not separate programs.

Individual State Government transport planning strategies, as covered in Appendix 2, often exclude consideration of alternatives. A cheaper version of the proposed Melbourne City Link project deserves wider consideration, under a currently lacking integrated land use and transport planning strategy approach in Victoria. The Sydney ITS plan is curious in promoting certain public transport schemes, such as the new southern underground route, without instead mentioning alternatives. These include extension of the incomplete eastern suburbs railway from Bondi Junction, or the alternate use of the existing Sydenham rail alignment and airport spur line. A more recent proposal is to utilise rail tunnel beneath Sydney's Hyde Park as the hub for a city-wide light rail system stretching in four directions. In the view of some, the ITS road strategy neglects the need for circumferential road routes and it apparently does not adequately addressing bottlenecks in the southern suburbs (BTCE 1995, xi).

Similarly, it remains worrying that some Local Government plans lack coordination. For example, current Sydney City Council proposals contain no mention of the need for proper transport and land use planning (SCC 1994). Sydney's local councils and state agencies have not worked towards common, coordinated planning, social infrastructure and environmental protection goals (Mobbs 1991, 5, Woods 1995, 199). The State Government has announced that the agencies for transport, roads, housing and water will relinquish their planning powers to the Department of Planning and Urban Affairs. This may ensure that greater attention is given to matters of planning, urban design and building quality in the future, as is desired by BBC.
Table 3. Building Better Cities projects

<table>
<thead>
<tr>
<th>STATE</th>
<th>AREA STRATEGY PROJECTS</th>
<th>PAYMENTS UP TO 1993-94 (A$ million)</th>
<th>ESTIMATES FOR 1994-95-96 (A$ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>North Canberra urban renewal</td>
<td>4.3</td>
<td>9.4</td>
</tr>
<tr>
<td>NSW</td>
<td>Ultimo Pyrmont City West</td>
<td>47.9</td>
<td>69.1</td>
</tr>
<tr>
<td></td>
<td>Transit West improvements</td>
<td>33.1</td>
<td>45.8</td>
</tr>
<tr>
<td></td>
<td>Newcastle Honeysuckle scheme</td>
<td>20.0</td>
<td>51.0</td>
</tr>
<tr>
<td></td>
<td>Everleigh Area Strategy</td>
<td>5.7</td>
<td>5.5</td>
</tr>
<tr>
<td>NT</td>
<td>Darwin</td>
<td>1.0</td>
<td>6.5</td>
</tr>
<tr>
<td>QLD</td>
<td>Brisbane-Gold Coast corridor</td>
<td>68.7</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>Inner N.E. Brisbane housing</td>
<td>16.0</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td>Inala-Ipswich</td>
<td>6.8</td>
<td>16.1</td>
</tr>
<tr>
<td></td>
<td>Mackay</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>South Townsville</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>SA</td>
<td>Elizabeth Munno Para strategy</td>
<td>16.2</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Northwest sector/MFP</td>
<td>1.2</td>
<td>27.8</td>
</tr>
<tr>
<td></td>
<td>Southern area</td>
<td>7.5</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Western area</td>
<td>2.1</td>
<td>12.9</td>
</tr>
<tr>
<td>TAS</td>
<td>Launceston developments</td>
<td>5.4</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>Hobart Wapping village</td>
<td>7.5</td>
<td>3.9</td>
</tr>
<tr>
<td>VIC</td>
<td>Plenty Road Area Strategy</td>
<td>45.6</td>
<td>51.9</td>
</tr>
<tr>
<td></td>
<td>Inner Melbourne &amp; Rivers Area</td>
<td>22.6</td>
<td>12.0</td>
</tr>
<tr>
<td></td>
<td>South West</td>
<td>32.1</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>South East</td>
<td>22.0</td>
<td>12.8</td>
</tr>
<tr>
<td>WA</td>
<td>East Perth urban village</td>
<td>26.2</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>Stirling</td>
<td>9.7</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>Bunbury</td>
<td>7.9</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>Fremantle</td>
<td>5.0</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>Perth Urban</td>
<td>1.5</td>
<td>12.5</td>
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</tbody>
</table>

The dominant and socially desired demographic trend in our cities remains as suburbanisation of both population and employment, despite the existence of sub-standard estates or choice of non-predominant housing alternatives. Recent study of living standards shows a strong preference for low-density living and also finds that people shift location more frequently than in the past (McDonald 1993, 463). The population structures of cities undergo almost continuous change with most homeowners moving frequently, as shown in Table I. It appears that multi-centred metropolitan regions will become the future form of our cities. In sum, Australia's cities and regions have developed distinctive geographies of population, investment and employment now also affected by globalisation and economic change (AU&RDR 1995c, 111) and Asian links.

The historically large Asian cities such as Tokyo, Singapore, Hong Kong, Taiwan and Seoul have become networks of economically productive, efficient and dense urban spaces. The Asian Development Bank has estimated that the booming regional economies require about US$1 trillion for developing built infrastructure until 2000, for highways, public transport systems, airports, ports, power, communications and services. Some developments include completely new large towns incorporating industrial, commercial, residential and recreational components such as at Suzhou (Shanghai) and Shenzhen (Hong Kong) in China and Bangalore in India. Intelligent public transport can help such cities ensure a balance in the use of roads, along with traffic control, parking and telematics. These Asian cities will compete with Australian cities for access to information and markets, but also represent threats to global ecological sustainability.

Habitat II

A large United Nations conference on the future of cities, the Habitat II "City Summit" will address matters of shelter and sustainable human development in an urbanising world. Habitat II will occur in Istanbul, Turkey, during June 1996, while Vancouver, Canada, was the venue for Habitat I in 1976. The new summit will initiate and debate a Global Plan of Action for human settlements, focusing on immediate actions. In preparation, a transport and communication workshop occurred in Singapore during July 1995 with Australia represented through the National Transport Planning Taskforce (NTPT 1994). The workshop found that a combination of market mechanisms will ensure urban sustainability in terms of social, economic and environmental benefits for all (Camagni et al. 1995, 6). It noted the close connection between transport need and land use that requires integration for sustainability. As well, transport and environmental policies must integrate along with appropriate finance and telecommunications strategies (ibid, 35).
Towards Sustainable Cities

The need for alternatives to cars, using personal trip demand management techniques will be a feature of the forthcoming United Nations Environment Program transportation policy. It will urge governments to adopt comprehensive transportation and land use plans to control sprawl and develop more efficient traffic systems for accessibility.

The open Singapore workshop noted that one possible land-use pattern that avoids the extremes of the congested, compact city, or the low-density, spread city is the multicentre network city. Each multicentre node has a distinctive image and diversity of functions along with efficient transport links to other centres (ibid, 12). Adopting an environmentally sensitive usage of vehicle stocks, traffic in this city will not dominate the urban landscape. In a submission to the workshop, Sweden's Volvo car manufacturer proposed the creation of localised, self-empowered village communities located near manufacturing activities. Such integration of urban and rural developments may support ecologically sustainable development.

Singapore

The Workshop saw Singapore as a model for growing Asian cities but viewed Australia's cities as relatively uncongested and thus irrelevant by comparison. Singapore's strict road vehicle restrictions and comparative absence of congestion often feature in traffic management reviews. The island nation has an annual quota of 3.5 per cent growth for new cars, combined with a 150 per cent car value, registration tax and an annual road tax of around A$1400. Singapore requires vehicle passes to enter certain parts of the city, such as a A$43 monthly licence or A$3 daily pass. A new A$300 million electronic road-pricing system will shortly commence operation to automatically charge vehicle owners upon entering city zone areas (Hiebert 1995, 78). This is part of traffic and transport management strategies and urban planning that favours the creation of 17 satellite towns, as a multicentre approach (Ang 1993, 433). Singapore has a new Land Transport Authority to oversee all public and private transport policies and built infrastructure, along with a separate Urban Redevelopment Authority that sets out overall plans. The degree of integration between the two is unclear, but they are effective nonetheless.

However, such glowing views about Singapore, when compared to Australian cities, often overlook some realities of infrastructure provision among cities of relatively similar population. Figure 2 depicts the major road networks for the cities of Singapore, Sydney and Melbourne at the same scale. The Figure shows the spread-out suburban household nature of Melbourne and Sydney compared to the constrained apartment base area of Singapore. Interestingly though, the lengths of existing and under-construction freeway or expressway projects are roughly equal and certainly much more united in the case of Singapore, where city bypasses work effectively already. All three cities also have extensive rail public transport networks, but Singapore's MRT is legendary in terms of efficiency and capacity, compared to its Australian counterparts!
Figure 2. Greater Melbourne, Sydney and Singapore Island urban area road networks
Essentially, Singapore has an extensive road and public transport system that is far superior to either Sydney or Melbourne. Note that Singapore's population of three million is roughly equivalent to either Melbourne or Sydney, but largely resides in huge apartment building estates. Singapore has a car ownership rate of one per three households, while the rate in Australia is 1.2 per household, for two nations with similar per capita income levels. The Singapore road system has a major network of orbital freeways supplemented by semi-expressways, while a separate mass rapid transit and bus system provide for commuter trips (Ang 1993, 437). This system forms part of the concept plan for a tropical city of excellence, having a centre surrounded by regional centres to accommodate four million people (URA 1991).

The city diagrams shown in Figure 2 provide a useful comparison of cities with similar affluent population, yet vastly different living style and transport systems. Singapore's apartment-based lifestyle leaves little housing choice for its residents, but the city has an efficient network of expressways and public transport, unlike Sydney or Melbourne. Here, there has been little social discipline for high density living. This highlights the need for major transport system planning and upgrades in Australian cities involving all levels of government.

Actions and Outlook

In the view of the Commonwealth Urban Design Taskforce, our cities have poor design leadership, a maximum of bureaucratic processes, a multitude of governing authorities, restrictive rules and fragmented decision making. City designs often represent a political outcome representing the interests of developers and people used to existing systems, rather than the preferred dreams of planners and the general community. In this view, Australia needs to achieve a better balance between these competing forces. Measures to improve urban design quality, as discussed in Appendix 1, include measures like (UDTF 1994, 55-62):

- development of design-orientated strategy plans and policy instruments for cities;
- reform of Local Government through skills assistance and cooperative associations;
- respect given to traditional development, innovative design and development concepts;
- special consideration of coastal towns, aboriginal settlements and rural towns;
- provision of integrated approval and appeals planning processes and information systems;
- promotion of multi-discipline urban education and research programs; and
- review of urban management models to include design workshops and awards.

In the end, it appears that an ideal urban form is not readily obtainable. Our populations make local choices of lifestyle and location based upon self-interest, while constrained by local circumstances, to create our cities.
Urban design requires flexibility and may not necessarily be efficient, given competing community aspirations for access and preference. Policies to upgrade the urban environment must address the gamut of these issues including social, cultural, ecological, economic, legal and technical matters. They must include performance indicators, plus consultation and integration with other programs, such as health and safety, all pursued within the broader context of ESD (McNamara et al. 1993, 114-6).

Sustainable Urban Development

While many nations may agree that ecologically sustainable development is a desirable process, its implementation is much more problematic. Current indecision is often ascribed to a lack of knowledge and understanding of problems relating to the environment along with a fear of negative effects on economic development. Industrialised countries cite as obstacles the spread of their urban lifestyles, with a consequent high consumption and reliance on private transport, along with economic recession and increases in public debt. Their urban sprawl remains a case of non-sustainable development, due to pollution and congestion, with no easy solution in sight. Our cities face global economic, technological and social forces that will, in time, greatly affect their liveability and exert pressure on environmentally sensitive locations.

Australia has begun the task of determining how it will conserve ecological processes through sustainable development. Australia has worked to meet commitments to Agenda 21 entered into at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil through June 1992. During the preparations for Agenda 21, Australia engaged in a parallel process to develop its own National Strategy for Ecologically Sustainable Development (NSES), published by late 1992. From 1990 to late 1992, many key interest groups and government agencies worked together to develop positions on nine key areas (AU&RDR 1995c, 212). These included biological diversity conservation, urban development, employment, economic diversity and international factors (AG 1992). The NSES and Agenda 21 seek to provide a framework for the development of environmentally sound and ecologically sustainable decision-making at all levels.

Among its challenges, the NSES aims to achieve more sustainable use of energy and natural resources in urban areas, through integrated urban and transport planning, plus more efficient sub-division and building design (AG 1992, 40). Government objectives include provision of a range of urban area densities, improved and coordinated strategic planning, upgraded urban public transport, personal trip travel demand management, improved road network efficiency and reform of planning codes. The NSES also needs to consider regional population movements, tourism affects and our aging population over time. Another aspect is the level of subsidised transport used for goods and services trade.
Towards Sustainable Cities

However, Australian State and Local governments face difficulties in achieving sustainable development, due to problems of inter-governmental support, funding, and internal decision-making processes (Wright 1995, 55). Despite their legislative powers, they have inadequate and uncoordinated policy powers that relate to individual programs rather than integrated schemes (AU&RDR 1995c, 214). Local Government strategic plans for their communities would outline local authority visions for their areas, setting policies and targets including urban size and density, public and private transport usage, plus a whole range of environmental indicators (ibid, 59). Apparently, State and Federal budgets do not have funds to allow Local Governments to pursue integrated strategic plans.

These reforms may not be complete until the decade's end, by which time there may be a clearer vision of our cities' future. Nonetheless, it is timely now to consider measures including coordinated strategic planning, spatial impact analyses, and improved linkages between all spheres of government (ibid, 219-220), as "to ignore the economic, social and environmental benefits of improving urban management is to ignore one very important instrument in ensuring Australia's future".

Australia has developed different strategies in order to promote sustainable human settlement development. A study on the links between social equity and the urban environment found that low socio-economic groups have impaired access to desirable housing and transport options (DEST 1994, 26). The 1992 National Housing Strategy proposed objectives and policies for sustainable land and housing provision and appropriate urban forms. The ILAP, AURDR, NUDP, AMCORD and urban environment indicators are further strategies among a range of environmental measures directed at sustainability.

Environmental issues in urban transport stem mainly from private motor vehicle use, but have global, regional and local impacts. Globally, the main sustainability issue pertains to greenhouse gas emissions and atmospheric warming. Regionally, vehicle emissions contribute to ozone pollution, acid rain and particulate smog. At the local level, more pervasive effects occur including matters of human health, traffic accidents, noise, stormwater pollution, community division, urban sprawl, social infrastructure needs and public amenity. It also remains difficult to quantify the costs and benefits of urban transport policies designed to help meet the target reductions in greenhouse gases. Motor vehicles are one of the largest single sources of carbon dioxide emissions and thus of concern to programs attempting to stabilise our contribution to greenhouse gas minimisation. The increase in total emissions over time is due to increasing suburbanisation of residential, industrial and commercial land uses. A more urgent issue is to improve urban air quality (DASET 1992, vi).

Our planners and engineers now have the task of achieving useful transport and land-use planning, synthesising environmental, economic and equity factors for compatibility and quality of life. Perhaps Australia requires a national settlement strategy and regional policy to set limits on urban sprawl and specify new areas for development. Before settling on the approach, some useful policy framework and analysis of past efforts in this direction is required.
Sustainable Urban Policies

It is possible that Australian mega-cities are evolving, with a Sydney version extending from Newcastle to Wollongong, a Melbourne version from the Latrobe Valley to Geelong, and another at Brisbane from the Sunshine Coast to the Gold Coast and south into New South Wales. By 2021, the Sydney megalopolis may reach over 5 million people, Melbourne over 4 million and Brisbane 3 million, unless Australia takes action to limit their growth. These cities may resemble American conurbations, where separate cities merge into massive, continuous, multi-centred urban regions (Forster 1995, 40). Unless better planning occurs, as time passes, an urban corridor may well exist from Cairns along the coastline all the way to Adelaide.

As an alternative, the historical regional development projects for medium-size cities at Albury-Wodonga, Bathurst-Orange and Monarto could still grow over time. Australia has few inland medium-sized cities such as Canberra, unlike other developed countries. Cities of this size have lower service costs and yet provide a diversity of social and economic (albeit specialist) functions. Perhaps the State Governments should consider shifting their capitals to rural locations away from the coast as an effective decentralisation strategy to match that of Canberra. A brief examination of a map of Australia demonstrates for instance that major centres are lacking in the vicinity of Mackay and Broome. Sometimes, suggestions arise for Australia to consider establishing a new city on our barren, north-western coast, or to expand Darwin, and perhaps involve our neighbours in sustainable, innovative development.

To obtain the desired outcomes of efficiency, accessibility, environment, social quality and equity in our cities, conflicting strategies may arise that aim to apply land use planning to manage transport in our cities. Given the complexity of social life, urban consolidation strategies may be far too simplistic. Despite such changes across Sydney for instance, average travel times and trip lengths across regions remain roughly equal. Travel demand management needs a more careful view of the future considering a combination of public transport, road systems and urban innovations. Table 4 shows some possible means. It is time for all levels of government to consider combined transport, communications and ecologically sustainable land-use planning as preferable in achieving new synergies of urban lifestyles for our future.

Commonwealth initiatives for decentralisation, consolidation or urban redevelopment have not really achieved very much to date, possibly due to the lack of a constitutional role in cities. As well, proper strategic planning requires a coordinated approach between all levels of government, with local government having a stronger role in implementing strategy plans. One way to possibly achieve this is through joint agreement supplemented by financial incentives through the grant’s system, and adoption of standards for ecologically sustainable development.
Towards Sustainable Cities

Table 4. Short and long term policies in different integrated fields of action

<table>
<thead>
<tr>
<th>POLICY ACTION</th>
<th>SHORT TERM</th>
<th>LONG TERM</th>
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<tbody>
<tr>
<td>Integrated transport and environment policies.</td>
<td>Restraints on private traffic in particular areas. Restrictions on heavy goods vehicle movements in cities. New logistics of goods distribution in the city. Enforcement of better catalytic converters and frequent renewal.</td>
<td>Investments in public transport service, infrastructure, image and management.</td>
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The recent OECD Ecological Cities Workshop recommended that all levels of government should work towards requiring that they (OECD 1994):

- Define urban regions to encompass distinct bioregions or catchments;
- Establish a methodology, standards and procedures for "true cost" pricing;
- Encourage urban regions to develop as strong economically interlinked entities;
- Adopt development codes that foster resource conservation, efficient energy use, enabling mixed use and public transport-orientated urban areas;
- Support advanced transport, technology, communications and production systems;
- Introduce revenue-neutral incentives for purchase of energy conservation technologies; and
- Progress towards ecologically sustainable forms of urban development.

Only in these ways can we hope to cope with population growth and urban sprawl. These are complex tasks that require consensus and cooperation at all levels. To this end, Federal policy could consider formation of a national urban planning agency, with wide links to State and Local agencies, to help address the many, complex problems of our cities. It would be necessary to resolve the respective roles of the levels of government, desirable administrative structures and the political problems relating to the distribution of powers.

Currently, Local Government controls general incremental growth of cities, while State Government undertakes major built infrastructure projects, sometimes with Commonwealth support. The investment requirements of the transport sector can only be considered, in the context of the needs of other sectors of the economy, based on personal and political preferences. In estimating investment requirements, there is a need to distinguish private costs from public (externality) costs, but this is very difficult given the problem of calculating environmental costs and because of cost transfers within the community. As an example, cost equity between car users and non-users (often the same people at different times) may defy calculation. It also remains difficult to define transport system efficiency and to identify whether an optimum system of built infrastructure exists or not. Despite its problems, Canberra itself demonstrates the benefits of proper planning under Federal control. The city's citizens generally enjoy living standards well above the national average, although they do rely heavily on motor vehicle usage. Road congestion and pollution are rare problems in this Garden City, which also has a low accident rate. The city has generated an innovative regional planning strategy involving all three levels of Government, although problems remain of rural development and policy implementation.

While there will be many such problems, our cities are too important to ignore and leave as legacies for better or for worse to future generations. Action taken now can set their form, social and economic vitality well into the next century. Intergovernmental cooperation on urban issues is just as important as it is on environmental matters. Figure 3 depicts a possible future Australian city with multi-centre developments, cross-suburban transport and telecommunications links. The question remains as to whether we desire it.
Towards Sustainable Cities

Mixed Density - high, medium and low
High - urban villages
Medium - 800m around public transport stops
Low - demand responsive transport or cycle distance to public transport
Integrated - residential, commercial, small scale industry
Sub centralised - linked by public transport and telecommunications

Central Business District
High Density Inner Area
Urban Villages
Middle Suburbs Grid Based

Industrial Uses
Low Density Residential
Ex-urban or Special Rural
Main Transport Route

Figure 3. Possible Future City Development
Late last century, as cities grew and grew worldwide, the "garden city" and "new town" concepts spread from Britain, across America, France, Germany, Sweden and to Australia. Reflecting disillusionment with congested large cities, Canberra heads the list of local attempts to establish formal, new towns at decentralised locations. While Canberra as a garden city and new town has largely prospered and has attempted fresh planning ideals, other proposals, such as for Albury-Wodonga, Bathurst-Orange or Monarto, have failed due to lack of economic and political commitment. Melbourne, Adelaide and Perth strongly resemble the low-density cities of America's West, while Sydney and Hobart reflect more compact Eastern United States cities (Frost 1991, xiv). As democratic "ideals", America and Australia have shown the weakest planning traditions, with governments having done little to guide development apart from applying zoning and building controls (Lowe 1992, 121). As a result, in one view, urban town planning has been very inefficient and slow in implementation (Clarke 1995, 13). Consequently, the growth of our cities and their surrounding suburbs largely reflect other factors.

Suburban History

Low population density suburban residential areas grew out of the dispersal of crowded inner city areas to their surrounds and have a long history. The first suburbs around our cities began with the provision of rail and tramway transport links. Early American parkways appeared in the beginning of this century and proliferated during the Great Depression as job creation schemes, the same time as Germany began its "autobahn" scheme, and Italy its "autostradas". Urban railways and later urban freeways developed over low-priced lands, often dispossessing the resident poorest city groups to other sites, to provide purchaser access to these new dormitory suburbs. Developers and land speculators encouraged further decentralisation, while strip commercial development bloomed, both supported by tramway and later car access. Australian urban planning administration emerged to follow British legal tradition (AU&RDR 1995c 208), but with long term links to American design practice based on idealistic visions.

The new towns and garden cities in England and America, of the 1930s and earlier, established much modern residential suburb design criteria (Lay 1993, 303, 308). In the 1930s, architects designed cities composed of residential skyscrapers set in parks and linked by motorways and subways. Dominated by tall buildings, such landscapes did not prove socially acceptable in most western cities, when later attempted as public housing projects. However, more prescriptive nations used them such as Germany, Russia and Singapore.
Towards Sustainable Cities

At the other extreme from such a single, high density downtown is the low-density, multi-centre city typified by Los Angeles, with its diffusion of work and activity, but high spatial, environmental and energy costs. Some view the result of this modernism as a crisis of human habitat, with cities ruined by corporate greed, abstract urban renewal and urban sprawl (Kunstler 1993, 59) rather than as an ideal city.

The Chicago Exposition of 1893 and subsequent expos across the United States, served as demonstration projects for urban planning that evolved into the City Beautiful movement (Sorkin 1992, 211, Kunstler 1993, 67). Technology and the garden city concept merged at the 1933 Chicago "Century of Progress" Exposition and the 1939 New York World's Fair (Sorkin 1992, 213). At this event, visions of architect Le Corbusier's "Radiant City" of skyscrapers appealed to Americans concerned about their ageing cities and led to thousands of urban redevelopments (ibid, 78-9). In the 1930s, many Americans had a strong vision of such uniform, planned, skyscraper-dominated cities as utopian forms, but these subsequently emerged as forlorn urban renewal schemes (Corn 1986, 6-7). These early century visions of future cities encompassed towering buildings amid parklands actually became decaying residential blocks surrounded by alienating freeways (Anderson 1994, 12). Instead, the style of city largely evident by the 1930s has remained with us, as suburbia around an historic core (ibid, 13). Motor transport converted streets from pedestrian meeting places into moving zones for destinations elsewhere. Now, much development occurs on fringe areas where shopping malls, high technology industry and office blocks congregate (ibid, 15) around freeway interchanges.

Although supporting industrial development, such projects do little to conserve the countryside, historical areas or the increasingly polluted atmosphere. Urban freeways only operate effectively in well-planned suburban areas, when balanced with public transport access, environmental and social amenity (Lay 1993, 319-320, 326). The traffic system of the future may be an automated version, using advanced communications and control systems possibly combined with road pricing (ibid, 329). The question becomes one of facilitating personal commuting as well as urban freight flows, while also providing for non-work trips and external commodity flows.

Designers suggested use of double and triple-deck super-streets to overcome congestion problems, just as they appeared in the General Motors "Futurama" exhibit at the 1939 New York World's Fair (Lay 1993, 320). As Lay (1993, 317) suggests: "The parkway-freeway concept caught the imagination of the American people. The General Motors Highways and Horizons Futurama exhibit at the 1939 World's Fair in New York was the most popular show there, attracting some five million visitors". Interestingly, the same person responsible for New York's urban freeways and parkways from 1924 to 1963 directed the Fair (ibid, 315). Following the Second World War, the President and Congress acted and America embarked on the world's largest ever public works scheme to construct its national interstate highway system. Regarded as public goods, these "free"ways became synonymous with American progress and the focus of emulation in many other nations including Australia. Here, grand urban freeway proposals for our cities grew out of early transportation planning studies and later computer models of the 1960s (CBR 1976) to emulate the American view of the future city.
**The American City**

Over the last half of this century, many Americans have had one dominant perception of metropolitan development as unlimited, low-density sprawl. Such suburbs permit a home in the suburbs, car, good schools and local government. This is despite the obvious problems of traffic congestion, pollution, social infrastructure costs, loss of open space, ageing of suburbs and relegation of the poor to ghetto locations. While the alternative of uniform high density remains attractive to some American urban planners, partly as it would encourage greater public transport use, others argue that the resultant lifestyle would not meet current social values or cultural acceptability (Downs 1994, 126). They suggest a mixture of development strategies to address urban deterioration including local improvements, social programs, household mobility support, assistance to faltering local areas, and work programs. This "communitarian" approach would facilitate clustered, higher-density cities, but requires social choice and government action towards a coherent and effective growth strategy.

Such social choice may stem from the anti-highway movement in the United States. It grew from indignant members of poor neighbourhoods, plus heritage campaigners and environmentalists concerned about demolition programs. When the American interstate highway program began it had wide public support, but this faded as buildings tumbled, only to make way for congested roads (Frieden & Sagalyn 1991, 48). Coincident with the new freeway era came development of the first self-contained, suburban shopping centres, that combined successful commercial merchants with suburban activity, as an idealised version of downtown, but without its drawbacks (ibid, 66). These centres only further contributed to urban sprawl. The substantial investment in circumferential freeway systems and utility service infrastructure has allowed large growth in the suburbanisation of America's population and economic activity (O'Connor & Stimson 1995, 9). This has greatly extended settlement areas, creating large sub-regions around suburban nodes as "edge cities", although the CBD remains an important zone of activity (Fishman 1993, 23). For instance, the Los Angeles sprawl, though often criticised, has ports and airports that rank among the top five in world traffic volume, to ensure its Pacific rim role (O'Connor & Stimson 1995, 58).

By the mid-1970s, no clear alternatives had emerged to this or ideas of urban renewal, model cities, public housing or new towns. With growing interest in energy and environmental and heritage issues, the conversion of city historic buildings and precincts into commercial centres prospered. These often combined with new office towers, a convention centre, an atrium hotel and shopping mall (ibid, 259). Meanwhile, industrial plants had moved out to "broadacre" sites, linked to road transport, that provided for their own improved efficiency. In all of this business activity, residential or social interests seemed to have received little thought, but car use prevailed. So now, most American cities have established basic freeway networks that, though often congested, provide for widespread use and economic activity. As yet, there remains no convincing alternative to them (Sudjic 1993, 278), (McAuley 1995). Freeways and airports, tourism and services now shape our modern cities, rather than the symbols of the past such as railway stations and industrial sites (Sudjic 1993, 9).
Towards Sustainable Cities

Land use regulation in the United States evolved in response to crises of urban dispossession, environmental degradation, energy shortages, fiscal constraints and loss of open space (Freilich & White 1994, 101). Traffic congestion emerged as the newest urban crisis, as a result of land use patterns, funding systems and the predominant car basis of the transportation network. Transport expenses now consume about one quarter of the average American household budget (Langdon 1994, 11). Traffic delays now cost Americans over US$100 billion annually, providing justification for costly fixes.

American planners and architects have had an apparently humane ambition to segregate traffic from people, defining housing areas by a hierarchy of roads. They ranged from pedestrian areas, through local and distributor streets, to highways and restricted access freeways. This configuration has become the most crucial factor affecting the character of the modern city (ibid, 274). Recent studies reveal that motorists and pedestrians obtain less satisfaction in the system of arterials, collector and minor streets, than in the older style of street, mainly grid networks (ibid, 31). In fact, frequent cross streets, although cited as accident hazards, may actually favour pedestrians, as they serve to slow down traffic and encourage drivers to be alert (ibid, 59). However, the markets for housing estates pursued by developers favours the modern circuitous street system. This road traffic hierarchy designed by transport engineers, with few direct connections, allows each new development to stand apart. However, it also discourages neighbourhood life, as people will not walk around such designs, but drive instead (ibid, 73).

Freeways that link outer suburbs, on circumferential rather than radial routes, help to keep traffic out of inner city areas, while encouraging commercial and industrial development in outer suburbs needed for economic growth (Neutze 1978, 123). Industrial and community forces now dictate road development to provide for efficiency, employment and land development (Lay 1993, 300). As almost everyone uses roads, they become accepted as desirable necessities, despite their problems of congestion, pollution and social alienation. Nonetheless, road making excesses have occurred, promulgated by the road lobby, for which anti-road groups have countered with important reactions (ibid, 301).

In some ways, Australia has followed this example, but there are possible alternatives for us to consider too, such as moves to consolidate the urban fabric (Newman 1992) discussed elsewhere. While higher density cities generate fewer trips and lower energy consumption per capita than lower density cities, it is often not fair to compare them, as both change over time. For instance, while contrasting Los Angeles to New York, there is no guarantee that adoption of New York densities would improve the situation in Los Angeles.

It appears that there is no one optimum urban form, but nonetheless those concerned with the task will continue to analyse alternative urban design strategies. However, Australian planning often operates as centralised, pluralistic competition between different State Government agencies, without clearly identified common objectives (Heywood 1994, 73). They tend to confront the plans of local and state developers, investors and business people so that Australia has a hotch-potch of urban design today, along with inadequate, broader urban planning.
Towards Sustainable Cities

Urban Design Techniques

Urban design is a new term for an old concept of designing, over time, the layout of human settlements and their parts. As a profession, it developed from widespread dissatisfaction among architects, town planners and engineers involved in current city development. The two major streams of modernist thought in architecture and urban design have both successes and failures. Firstly, the rationalist approach assumes that, by changing the physical layout of the world, social behaviour would also alter, or function to follow form, but this only occurs when people wish to do so. An example is the "City Beautiful" movement from early this century including the garden city design technique. Secondly, the empirical approach, such as the "international" movement saw radical plans by architects such as Le Corbusier, Frank Lloyd Wright and Ebenezer Howard for major reconstructed urban utopias. They all based their ideas on technological innovations, such as the express train, automobiles, skyscrapers, telephone and radios, to allow planned decentralisation of cities. In the 1920s, the influential French architect and planner Le Corbusier had proposed cities of skyscrapers in parks, as previously mentioned. He saw city planning as an applied science, requiring special theorists and technicians. Fortunately for us, modern planning recognises the importance of involving ordinary people too.

Traditional land use planning and zoning focus on creating a wholesome environment and efficient circulation, but do not consider the overall urban setting and the needs of the people that they serve (Lang 1994, 3). As well, given the different interest groups in the community, professional involvements fragment so that politicians, lawyers, developers, engineers, architects, planners, business people and householders all have their own ideas about the city. Urban design must take a user-orientated approach to achieve a higher quality of life in human settlements through both professional research and communal decision-making. There is a need for more empirical research on cities, urbanisation and the role of the layout of the world in human lives (ibid, x). Urban designers must recognise the changing status of cities within environments of both people and nature. The means by which residents and visitors move in and around cities shapes urban identity, while architecture forms the image of cities themselves. Thus, the relationship between transport and city form is a complex blend of form and effect (Sudjic 1993, 278, 283) that is just one part of urban design.

The role of urban design is limited in dealing with the major problems and issues facing the world. It involves planned marketplace intervention plus the legal process of allocating and designing land and building configurations (Lang 1994, 70). Urban design must ensure a concern for the public interest and ongoing rebuilding, involving design of buildings, communications and transportation systems. Urban designers recognise that the characters of present cities reflect a legacy of past transport systems and new ones, as they establish the nature of links between places. Successful urban infrastructure practice can thus equate to excellence in urban design. Some four main design issues relate to the nature of urban infrastructure futures (ibid, 207):
LAND has simulated results for Adelaide and Melbourne, over the period 1971 to 1991, in its early development stages and predicted future growth for Canberra (Young & Gu 1993, 75). The package serves as a computer game to educate and inform users of the interaction between land use, transport and environment. Unlike earlier models, it can easily run on small personal computers.

Separate spatial equilibrium models analyse patterns of land use and commuting to simulate pricing change effects on travel and location (IC 1994, A57). As an example, the Model of Urban Land use and Transport Interaction (MULTI) is a "sketch planning" framework that builds upon earlier UTP models. However, it does not model transport network effects to the level of the earlier types mentioned above.

Another package is the Land Opportunities and Constraints Model (LOPCON) that provides population and household forecasts based on typical development profiles. This approach is like the popular SIMCITY computer game that provides a graphical, interactive program for users to design new city developments and assess their impacts. Further helpful model developments may include use of management and geographic information systems or even the application of fractal (chaos theory) techniques.

The use of computer-based models of transport systems may be of use in assessing environmental impacts. However, the output quality and usefulness of such traffic impact models vary considerably. Users of traffic assignment models know that output accuracy may often vary by twenty per cent or so as compared with other models. The models also demonstrate variable sensitivity to inputs, since their calibration often depends upon specific parameters.

In 1978, a study attempted to relate environmental capacity, accounting for noise and pollution, to traffic management and utilised a local area, traffic assignment model. This model tested the effects of traffic redistribution in a localised area, based upon environmental capacity calculations. Among the measures of traffic impact measured were traffic noise, pedestrian density and delays, air quality and visual intrusion, with varying success.

More recent models produce, by simulation or forecasting, the levels of traffic flow in a local area network, with links to a pollution estimation. The pollution model calculates the dispersal of these pollutants, according to local conditions, before comparison with desired criteria. An example is the use of the MULATM traffic model for local road area networks combined with the POLDIF model for estimating pollutant dispersal. In this way, the model can consider a number of pollutants, such as noise, emissions and particles. Output from the model may be as a graphical overlay indicating pollutant levels, on top of a map of the local traffic area. Another transport planning model, UBSUB, apparently considers environmental noise pollution and social impact. Others assess vehicle fuel consumption but none seem to encompass all effects.
Appendix 2: Australian City Design Aspects

In practice, the recent design of our cities has followed a common trend towards the low density, outer suburbanisation of both population and employment. This section considers most Australian capital cities, including two proposals for completely new, major development concepts located within existing capital cities of Adelaide and Canberra. For indication of future demographic, social and employment trends, refer (AU&RDR 1995c).

Adelaide

The South Australian Government's Metropolitan Adelaide Planning Review resulted in a 1994 strategy directed towards the city of 2020. This strategy aims to shift growth away from the environmentally sensitive southern fringe towards the northern plains (Perkins & Mackintosh 1994, 168). The strategy develops a multi-centre city based on the CBD plus five regional centres linked by a spinal rail line, along with bus networks and some limited road network extensions. Supporters of public transport services claim that an upgraded rail system would be preferable to the scheme. Adelaide has few plans for major freeway or public transport projects. A special part of Adelaide's planning directs towards the northern technology precinct that features a controversial city project, the Multifunction Polis or MFP.

Proposed as a new international, technology city for Australia, the MFP may eventually achieve a population of 100,000 or more. A 1990 report investigated a range of possible urban options for the MFP to contain a range of industrial, research, health and educational enterprises within a pleasant environment. The study found that the best design for the MFP would be adoption of a linear plan with a central activity spine containing the most important activities and provision for public transport. The designers based their plan on wide considerations including energy use, public transport promotion, building design efficiency, environmental design and social equity (NCPA 1990, 15), expecting the selection of a "greenfield" site for MFP.

In the event, the Federal Government decided to locate the MFP in the northern-suburbs of Adelaide as a unique community of advanced urban design, for development over 20 to 30 years. The economic development of the MFP focuses on three knowledge-intensive industries of information technology and telecommunications, environmental management and education. Current plans intend completion of a showcase "New Haven" urban village component of 65 homes, by late 1995. This would complement environmental landscaping and links with the existing Technology Park and associated institutes through progressive staged development.
Towards Sustainable Cities

As such, it is only a small beginning to the originally envisaged city development. A separate project for the Halifax EcoCity proposes sustainable development of a high-density, inner-city site using environmentally materials and technology. Whether Halifax will proceed remains unclear, but meanwhile the MFP grows, albeit in somewhat reduced initial form.

Canberra

Canberra's planning remains under a fairly rigid series of controls to ensure that its national capital function and built infrastructure standards remain intact. While Canberra's layout and above-average growth rate have created some social and efficiency problems, generally they are minor compared to those found in the existing capital city urban sprawls. The 1995 ACT & Sub-Region Draft Planning Strategy provides an integrated planning framework to guide regional development and resource management for a population of 560,000 by the year 2021. It involves all levels of government in identifying future urban areas, protected regions, road routes and support services around Canberra (ACTSRPC 1995). The Strategy is not yet fully adopted and there remains some duplication of planning agencies in the Capital.

Canberra held a design competition for a proposed, ecologically sustainable urban development, in the city's Jerrabomberra Valley. It required designers to develop ideas for a new urban area that satisfied ESD principles for energy use, pollutant reduction and social infrastructure, such as public transport systems. The winning design schemes advocated a system of low density urban villages and a localised mobilisation of resources and management. The project was a case study for an OECD Ecological Cities Workshop.

Brisbane

Brisbane and the associated Gold Coast region have experienced substantial suburban sprawl growth over the past decade that has created a strain on existing transport infrastructure and land development. Rapid regional growth in past decades resulted in transport planning chasing development without any coordination, such that unchecked urban sprawl occurred (MFTQLD 1994, 2). Widespread car ownership allowed the sprawl to continue even without much public infrastructure provision of roads, schools or services. The Queensland Department of Transport proposes a Brisbane freeway network consisting of upgraded radial routes, inner and outer ring roads. However, a planned tollway to the Gold Coast met severe public resistance and some criticism, forcing its cancellation in 1995. Meanwhile, Brisbane has electrified its radial suburban train routes and an extension to the Gold Coast is currently under construction.
The Queensland Transport Policy directs towards achieving a safe, efficient, socially just, environmentally sustainable and accessible transport system that contributes to state development and enhances the quality of life for all (ibid. 5). Accordingly, its policies aim to consider the long term operation of the transport system, including financial costs, technology change, changing land use patterns and environmental issues. The Policy states that "transport planning and land use planning need to be fully integrated to meet community needs and for efficiency" (ibid. 7). The State Government aims to cooperate with Local Government in order to provide for improved transport planning and coordination. It can designate land corridors for future transport systems, and pursue planning policies that facilitate more efficient travel and accessibility. A further thrust is to adopt market principles, pricing and private sector investments.

Building on this policy, urban transport in the fast-growing Brisbane area is the special focus of the draft Integrated Regional Transport Plan for South East Queensland that aims to revitalise public transport usage. The new plan fits within the State Government's "SEQ 2001 Project". This promotes strategies to improve public transport, manage personal travel demand, link transport and urban planning, plan regional roads, provide for (mainly road) freight movement, address social issues and minimise transport impacts on the environment (MFTQLD 1995, 14). An earlier SEQ 2001 planning report stressed control of urban sprawl through diverse development, regional activity centres, public transport usage and green belts.

This and the Transport Plan adopt a 10 per cent target, for the share of all trips by public transport, in 2011. They promote bus, taxi, rail, cycling and walking initiatives, while also flagging the option of congestion pricing as an option. The Plan favours adoption of "best practice" guidelines for urban planners and developers, rather than minimum adherence to rules and regulations. They aim to integrate transport and land use considerations under Queensland Transport, but with links to other agencies, Local Government, and community organisations. Formed in 1991, the South-East Queensland Regional Planning Advisory Group (RPAG) comprises government and community representatives working to devise a strategy to contain urban sprawl in the area.

Melbourne

Due to economic problems, Melbourne's urban growth has not reached the expectations held a decade ago and so the city has lately concentrated on improving its extensive existing built infrastructure. The Ministry of Transport oversees Vicroads and other transport agencies, long claiming to have integrated transport and land use planning techniques through liaison with other departments such as the Ministry of Planning. The latter's "Agenda 21" Program includes major new central city redevelopments in conjunction with the City of Melbourne, but the latter's Strategy Plan does not cover the wider metropolitan area. The Urban Land Authority performs the task of releasing new sites for development.
Towards Sustainable Cities

The State Department of Planning and Development has responsibility for statewide and Melbourne metropolitan strategic planning. It reviews existing plans and developments, prepares future scenarios, and analyses impacts of demographic change, economic projects, environmental management, transport and communications trends. It claims to coordinate development with essential built infrastructure provisions such as roads and public transport plus utility services, as well as providing all of Victoria's public housing and major buildings. The separate body VicRoads is the state's road and traffic agency responsible for planning, designing and maintaining major urban routes. VicRoad's "Linking Melbourne" plan faces some public opposition but appears to be underway.

Statement inquiry into the proposed City Link Melbourne Western and Southern toll road by-passes. Subsequent difficulties in obtaining private funding placed the project in doubt. The Victorian Labor Party's Transport Task Force has proposed instead a so-called "balanced transport alternative" to City Link involving bypass roads with no tolls, but funded through existing resources (TTF 1995). It also includes public transport links, including one to the airport and public transport improvements. Financing problems encountered by the City Link highlight those views held towards minimising private investment expenditure on public projects.

Perth

Perth is a growing city, constantly increasing its share of the state's population living in the metropolitan area, from 41 per cent in 1911, to 72 per cent by 1988. This rapid growth has created a low density environment of urban sprawl requiring high built and social infrastructure costs, low service provision in outer areas, loss of natural bushland and long journeys to work. Perth has the second highest level of car ownership of any Australian capital city after Sydney and the highest proportion of households with two or more cars. The city has the highest road supply per capita in the world and sprawling size, plus the largest amount of central city parking provision. Further suburban development and consolidation threaten the region's groundwater reserves, especially as a high proportion of Perth's post-war middle-ring suburbs remain unsewered, along with sensitive areas such as wetlands and the Swan River. Over time, the population will age, while households will decrease in size, but the population could reach 1.6 million by 2006 and 2 million by 2021. The question then remains as to which urban planning strategy can best accommodate this population increase.

The Western Australian State Planning Commission has pursued urban consolidation policies with varying degrees of implementation and still releases new lands for the next 30 years of development. The State Government prepared the 1990 Metropolitan Development Plan (Metroplan) to guide the growth of Perth to the year 2021, through promotion of housing variety, higher residential densities and a more compact urban form. The Metroplan estimates that the city's growth will require 400,000 new dwellings by 2021, which is a doubling of the housing stock in 30 years (WADPUD 1990). Metroplan suggests that some 80,000 could exist within established urban areas, along with a wider range of housing types.
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The State Government and the City of Perth have also combined to promote "A City for People" campaign to transform Perth into a landmark international city. This strategy concentrates on improvements to the central business district. The Western Australian Government has undertaken to upgrade and corporatise metropolitan public transport services, but does not intend to introduce road pricing or other traffic congestion controls. Metroplan links to the State Planning Commission's "Rural Land Use Planning Policy" to ensure that rural subdivisions consider water resource protection, agricultural uses, important landscape and environmental areas. Perth's freeway plans include a controversial Northern City Bypass to pass through inner Northbridge that faces considerable public opposition. The scheme would link to the main north-south Mitchell/Kwinana freeway. Perth has completed electrification of four radial suburban train lines to provide for a notable public transport system (Alexander 1994, 11).

Sydney

As Australia's largest and most famous city, Sydney has struggled with urban congestion problems and a recognition of the limited potential land sites available within its region, but now has some innovative plans. Urban planning policies still favour consolidation, but problems with housing programs and funding have compromised it. Urban renewal projects such as in Ultimo-Pyrmont (City West) have met considerable resident opposition against buildings, noise and traffic. Road transport dominates the region, but public transport usage in Sydney is the highest in Australia.

The New South Wales Government has promoted an Integrated Transport Strategy (ITS) for the Greater Metropolitan Region of Sydney, Newcastle and Wollongong through the Department of Transport. This links to the 1993 "Sydney's Future" metropolitan strategy review - discussion paper and supports the subsequent "Cities for the 21st Century" metropolitan planning strategy. While the ITS represents a new, whole of government approach, there remain shortcomings in terms of differing powers and functions between agencies and difficulties with separate environmental legislation (Woods 1995, 199, Caulfield & Painter 1995, 10).

As the region grows, the strategy aims to maintain environmental quality, economic vitality and social equity, through development of a quality transport system and under a clear vision integrating and managing land use and transport (NSWDOT 1995, 17). The ITS proposes to manage travel demand by influencing urban development and identifying appropriate transport infrastructure and services, through processes that integrate planning, investment and service enhancements. The strategy adopts the concept of urban containment, or a compact city, to increase residential densities at key locations and concentrate new employment development at four primary activity centres: Sydney, Parramatta, Newcastle and Wollongong, along with nine secondary centres. This may include infill development and hopefully encourage a greater variety of housing and subdivision types as may occur at the planned City West redevelopment.
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The ITS proposes some ten strategic transport opportunities or corridors, in response to particular transport modal needs, as the subject of further investigation. These will involve sub-regional transport and land use planning processes along with environmental assessments and a Public Transport Integration Policy and a State Road Network Strategy. A Transport Integration Council of senior public servants from key agencies will set strategic directions and establish priorities for transport policies and projects, while encouraging local government and private sector involvements (ibid, 5). The ITS recognises the existing freight and commercial transport system as vital to economic performance and notes the flexibility and dominance of road operations in this regard. It also suggests a need for better transport pricing along with specific actions to achieve designated modal splits for public transport in various areas. The strategy examines a range of public transport options including trains, light rail, buses, ferries, cycling and walking by examining matters of convenience, reliability, safety, comfort, travel time and ease of use. The ITS incorporates a methodology for integrated management and implementation across government agencies and levels including consideration of investment strategies and combines all of these into an action plan for various agencies.

A smaller pamphlet titled "A balanced transport future for Sydney" provides a concise summary of the specific transport plans for the region. These include major built infrastructure projects, new and improved public transport services such as inner city light rail, the new southern railway, a new Parramatta to Hornsby rail link and motorway links. Further details follow in the "State Rail Strategic Plan 1994-2016" and "State Road Network Strategy" draft documents. The former plan examines rail capacity requirements, train service frequencies and speeds, safety and security, usage and community value before outlining built infrastructure needs. It considers planning growth estimates contained within the 1993 planning discussion paper titled "Sydney's Future" and equates these to the current and future transport task.

The road strategy has main themes to improve transport efficiency, moderate traffic growth and progress ecologically sustainable development objectives. It claims to recognise the effects of further traffic growth on travel, accidents, fuel use and pollution. While considering the statewide road system, the strategy also concentrates on urban road freight network needs and completing metropolitan motorway linkages, along with traffic calming and safety issues. The strategy also recognises a need for road pricing options, but does not mention defence road needs. Protesters have fought against new urban tollway schemes currently proposed and under construction.

Earlier this century, Sydney Harbour Bridge engineer John Bradfield originally designed the eastern suburbs rail loop to continue through Randwick and Kensington to the Airport and then link to Redfern. A western loop would run from Darling Harbour across to Balmain, Annandale and Stanmore, then back to the western line. Both loops would inter-connect to the now complete city circle, but alas neither loop has emerged (Blunden 1994, 27). Bradfield completed existing works on the northern rail line in order for a north shore railway line through to the Warringah Peninsula, plus a loop between St Leonards and Epping, but both were never built. Should we forget such visions for our cities as they sprawl ever outwards?
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"Any road leads to the end of the world": Edward Fitzgerald Polonius.

"Fields and trees teach me nothing, but the people in a city do": Socrates (Plato)