

Delivering Sustainable Urban Mobility

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PROJECT

EXTRACT

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Funded by the Australian Research Council and conducted by the four Learned Academies through the Australian Council of Learned Academies for the Australian Chief Scientist and the Commonwealth Science Council. *Securing Australia's Future* delivers evidence-based research and interdisciplinary findings to support policy development in areas of importance to Australia's future.

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Australian Academy of Science

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www.science.org.au

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It is an autonomous, non-governmental organisation, devoted to the advancement of knowledge and research in the various social sciences.

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By providing a forum that brings together great minds, broad perspectives and knowledge, ACOLA is the nexus for true interdisciplinary cooperation to develop integrated problem solving and cutting edge thinking on key issues for the benefit of Australia.

ACOLA receives Australian Government funding from the Australian Research Council and the Department of Education and Training.
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Executive summary

Australian cities are vulnerable

Most Australians inhabit cities or metropolitan areas that are currently ranked amongst the most liveable conurbations in the world. Clean air, sunshine, beaches and a generally high quality of life abound. However, these cities demonstrate environmental footprints that are not sustainable. The lack of polycentric planning means that for at least half the population, access to this lifestyle is dependent on the motorcar. For the whole population, road freight is essential. All Australian vehicle transport is heavily dependent on imported liquid petroleum products. A recent Senate Inquiry found clear divisions in evidence on the question of whether Australia's current fuel stockholding arrangements provide adequate fuel security.



Scientific consensus is that high emissions fossil fuel dependence is not sustainable and will inevitably lead to serious social, environmental and economic problems. The Australian transport sector does not rank well on efficiency and this carries significant costs. Energy efficiency has been highlighted, as a component of energy productivity, in a recent Australian Government white paper.

Against this background a business-as-usual approach will not work. As the Australian population continues to increase—and as that population growth is further concentrated in Australia’s major cities—so the social inequities, environmental pressures and economic consequences will intensify.

Pressures will increase

Melbourne and Sydney are expected to accommodate populations of more than 7 million people each in this century. As this trend unfolds, a range of sustainability consequences is emerging. In all Australian urban areas, the demand for motorised travel is a significant source of greenhouse gas (GHG) emissions. Air and noise pollution are causes of ill-health while traffic accidents cause death and disability. A sedentary lifestyle, largely devoid of active modes of transport such as walking and cycling, is a major contributor to chronic disease and obesity, even among children.

Appropriate infrastructure and technological innovation are important

Australia has a growing infrastructure deficit and the cost of addressing that deficit is increasing each year. Some aspects of transport systems in major cities are more than a hundred years old. Several cities have grown to extend well beyond the reach of public transport. The standard response to addressing urban mobility issues has been to increase road infrastructure. Unfortunately, this creates a vicious circle: more roads encourage urban 'sprawl', which increases the use of motorcars. Adding roads is not necessarily the solution for the urban mobility challenges of today.

Some aspects of urban mobility challenges will be ameliorated, in the short-term by new road infrastructure; and in the future both by emerging technologies and adaptation. Promising developments are taking place in alternative fuels and new powertrains for vehicles; high-speed data transmission, digital sensors and data analytics. These developments may help to address traffic congestion, greenhouse gas emissions, health and public safety concerns and social inequality, provided policy development is nimble enough to take advantage. In the longer term, reliance on timely changes in social behaviour is not prudent.

An opportunity exists to plan for sustainable urban mobility

Australia has no megacities yet and there is therefore an opportunity in the decade ahead to rethink the growth and development of our major conurbations (both cities and metropolitan areas), before the problems associated with urbanisation become critical. Incremental changes are important and some of these have already begun in Australia. Unfortunately change often takes place on a piecemeal basis and risks collapsing into an approach based on 'picking winners'.

Sustainable urban mobility planning contributes to the movement of people and goods within an urban region in a way that delivers the environmental, economic and social dimensions of sustainability. This is characterised by an integrative approach to the provision of competitive modes of transport; minimising air pollution (including GHG emissions) and noise pollution; promoting the economic development of the city; and being affordable to users and taxpayers.

It is an approach to urban planning that prioritises people rather than any particular mode of transport. It seeks to bring origins and destinations closer together, in order to reduce or avoid the need for travel. When travel is essential, the aim is to provide more environmentally friendly modes of transport. Finally, such planning seeks to improve the energy efficiency of transport modes and vehicle technology.

Establishing a planning philosophy in which the demand for mobility is moderated and the goal of sustainability advanced implies significant planning reforms. In Australia this will mean a far-sighted, transparent planning process. In many cases, responsibility will be vested at the metropolitan level. The aim is to allow all Australian cities (of 100,000 people or more) to play an active role in developing their own sustainable urban mobility plans. But this will ideally take place within a national urban planning framework, to coordinate infrastructure development and thereby maximise efficiency.

Polycentric cities reduce journey distances

Urban planning and design can concentrate on how to bring people and places together. This can be achieved through a focus on accessibility, rather than simply increasing the length of urban transport infrastructure or increasing the movement of people or goods. Other contributory strategies are increased population densities and the development of mixed-use areas in place of rigid zoning.

Such developments also have the potential to make better use of existing transport infrastructure. Careful planning will enhance sustainable urban transport solutions. In Australia, rail transport has an important role to play when travelling longer distances and for certain types of freight. In terms of marginal costs, the motorcar is in many contexts the cheapest and quickest mode of transport for passengers. But until technological innovation intervenes, the motorcar is almost never the most environmentally friendly mode of travel.

European planning: a process not a model

There are important differences between Europe and Australia: land-use policies; the size and shape of cities; the nature and extent of public transport systems; patterns of home ownership; the forms of the built environment; and heritage protocols. These should serve as caveats to the importation of models developed elsewhere. The significance for Australia of the leading role taken by the European Commission (EC) in the field of sustainable urban mobility lies not in the detail but rather in the planning process.

The EC has been steadily committing to sustainable planning for urban mobility since the influence of the Brundtland Report¹, which appeared in 1987 (United Nations World Commission 1987). In recent years, work has been done with a view to “enabling the European Union to provide a central role in realising the greatest potential gains in urban transport sustainability across economic, financial, social and environmental outcomes in the long run, and provide a foundation for raising capabilities across cities in Europe” (Booz & Co 2012).

Integrated and ambitious local mobility plans are the starting point for the comprehensive changes that are needed. These are best located within an environment of strong strategic planning and coordination from national and regional governments able to provide enabling legal frameworks and policies and coordinate transport infrastructure development, thus ensuring efficiency. Through the *Action Plan on Urban Mobility* (2009) and the *European Local Transport Information Service* (ELTIS) established in 2010, the Commission has created opportunities for EU cities and other levels of government to collaborate closely to achieve significant changes in their system. In a *Transport White Paper* of 2011, the EC began to explore the possibility of making urban mobility plans a mandatory approach for cities of a certain size, according to national standards based on EU Guidelines. The paper also proposes linking regional development and cohesion funds to cities and regions with sustainable planning in place (European Commission DGMT 2012). The EC process has strongly informed the sustainable urban mobility planning approach of this report.

1. The report of the group known as the World Commission on Environment and Development, chaired by Gro Harlem Brundtland was released in October 1987. The document coined and defined the term ‘sustainable development’.

About this report

This report begins by setting out the urban mobility challenge. Individual chapters then explore specific issues grouped into transport technology; public health, safety and the environment; social issues; and economics. The final chapter seeks to pull those different dimensions together, demonstrating that a paradigm shift in favour of sustainable urban mobility planning can offer a framework in which to address many of the issues raised.

The report takes a holistic, future-seeking approach to planning. It recognises Australians' openness to technological change and the country's willingness to become an early adopter. Several technological developments that provide sufficient evidence to demand both emphasis and encouragement are presented. The report also recognises that to rely on emerging technologies alone to solve the complex challenges of accelerating global urbanisation would be unrealistic.

Intercity transport, whether by road, air or sea, is barely covered in the report. The very serious access problems facing those Australians who live in outer regional and remote parts of the country have been recognised only in passing. The focus here is firmly on urban life. The major cities and extensive metropolitan corridors now house the majority of the Australian population. The shape and form of those settlements are intimately connected with their transport needs.

This report supports public transport modes, including electric rail, powered by clean electricity. It argues for the value of bringing origins and destinations closer together and therefore encourages polycentric urban

development, with mixed land-use and multiple modes of transport, as offering the most sustainable options for the future development of Australian cities. High-density urban living (the 'compact city') is not necessarily a solution to the 'low-density mono-functional urban expansion' that still characterises most State-based planning in Australia. There is evidence of a renewed interest in 'urbanism' as a sustainable approach to inner city life, but no evidence of a slowing of what is often called 'urban sprawl'.

Both cities and their transport systems contribute to and are impacted by climate change. As with so many other aspects of sustainable urban life, climate change is not a local issue but a global one. The report casts many issues in an international context, but then sets out to address those as far as possible using Australian data. In developing processes for sustainable urban mobility planning, the European Commission has taken the lead in the last decade. But neither European nor North American models are directly transferable to Australian cities.

The report draws on the expertise of the four Australian Learned Academies and results from an informed discussion amongst experts from diverse fields. Such a wide-ranging interdisciplinary approach is unusual and yet those involved arrived at a large degree of consensus about the nature of the issues and even, to a somewhat lesser extent, about the solutions. The Expert Working Group commissioned technical reports from teams of consultant in the fields of transport technology; social studies; public health and safety; and economics.



Sustainable urban mobility planning contributes to the movement of people and goods within an urban region in a way that delivers the environmental, economic and social dimensions of sustainability.



Key findings

Chapter 1 Cities and people: the urban mobility challenge

- **Australian cities are vulnerable**

Despite historically successful urban development, Australian patterns of settlement, urban infrastructure and social organisation are vulnerable to increased urbanisation, changing demographics, diminishing resources, climate change and the increased frequency of extreme weather events.

- **Australian urban environmental footprints are not sustainable**

Australian cities rank high on measures of 'liveability', but they demonstrate environmental footprints that are not sustainable. Sydney's geographic area of 2037 km² exceeds that of London (pop. 10.23 mill). Berlin (pop. 4 mill) has a density of 3000 people/km² double that of Melbourne. The expansive nature of Australia's largest cities has environmental consequences and implications for transport.



- **Three strategies are key in improving urban sustainability**
Sustainable urban mobility planning involves the consideration of a three-pronged approach: reduce or avoid travel or the need to travel; shift to more environmentally friendly modes of transport; improve the energy efficiency of transport modes and vehicle technology.
- **Technological innovations are important**
Increasingly, the use of information and communications technology will facilitate urban management, ranging from data applications for planning and transport management to city policing and the timely allocation of resources and services. Technological innovation is important in helping to mitigate greenhouse gas emissions, reduce trip times and minimise traffic accidents. Technology alone, however, cannot solve the challenges ahead.

Chapter 2

Transport technology: the next 25 years

- **Limited fuel stocks are a major national risk**

Australia has small and declining fuel stocks, holding no more than three weeks' supply of oil and refined fuels onshore. Australia is consistently the only one of the 28 member countries that fails to meet its International Energy Agency (IEA) 90-day net oil import stockholding level. This might be regarded as a major national risk.

- **Greenhouse gas emissions are growing not declining**

Australia is one of the world's highest emitters of greenhouse gases per capita. Greenhouse gas emissions from the transport sector are, relatively, particularly high—in some cities three times those of London and still growing. Australia is likely to face international pressure to achieve a dramatic change in order to contribute to the global challenge to limit warming to 2°C.

- **The transport sector is inefficient—this incurs costs**

The Australian transport sector does not rank well on efficiency against some international measures; transport inefficiencies carry costs. The cost of moving freight by road (over distances of more than 1000 km) are more than double that of rail, while greenhouse gas emissions for road are more than triple those for rail. The average motorcar is parked at home 80% of the time, parked elsewhere 16% of the time and on the move only 4% of the time.

- **Inadequate infrastructure restricts productivity and incurs costs**

Experiences of transport networks failing to keep pace with demand, water quality standards being uneven, energy costs being too high, telecommunication services being outdated, or freight corridors being neglected are now so common that they necessitate a strategic response (*Australian Infrastructure Audit* 2015). There are quantifiable economic, environmental, public health and safety impacts to the infrastructure deficit.

- **Several key enabling technological innovations are evident**

Specific technological innovations will help to mitigate some transport challenges. Three examples are: plug-in electric vehicles (PEVs), which will have a direct impact on the sector; high-speed broadband (HSB) which will continue to expand its impact on urban mobility generally; and the 'Internet of Things' (IoT), expected to become a major enabler in the urban mobility sector. The IoT is the network of physical objects embedded with electronic components that allow those objects to be sensed and remotely controlled. 'Objects' range from medical implants through automobiles with built-in sensors to search-and-rescue technology.

- **Policy development needs to be nimble to match rapid change**

Innovation in transport is moving quickly. Policy often lags behind technological innovation in the transport sector; planning approaches should be nimble enough to take advantage of rapid developments.

Chapter 3

Impacts on the environment, public health and safety

- **The growing, ageing population presents particular urban challenges**

By 2050, the Australian population is expected to reach 37 million, which will almost double the number of people in Melbourne, Sydney and Perth. All capital cities will have an increasing proportion of older people over the next half-century. This has significant implications for a range of planning and design activities, from housing and transport, to the delivery of human services and the size of local workforces.

- **Inner city living is becoming denser; outer city living risks being marginalised**

There are two distinct trends occurring across the largest of Australia's cities: one of growth locating at low densities on the urban fringe

and the other of growth consolidating in high-density city centres. A lack of polycentricism in planning leads to low-density residential expansion of cities ('sprawl') and places those in outer urban and inner-regional areas at risk of transport poverty.

- **Transport poverty**

An increasing number of people are living further away from central business districts and employment hubs. Fringe developments are characterised by low housing and low employment density, limited (if any) mixed-use development and poor access to public transport. Together this increases distances between where people live and where they need to travel for work, shopping, socialising and recreating. In these motorcar dependent neighbourhoods, residents are at risk of transport poverty.

Chapter 4 Barriers and pathways to sustainable urban mobility

- **The cost of urban congestion will increase four-fold in two decades**

Without investment in additional capacity or demand management innovations for current infrastructure, the economic extent of congestion costs in Australian capital cities is forecast to grow from \$13.7 billion in 2011 to around \$53.3 billion in 2031 (*State of Australian Cities 2014–15*).

- **The majority of Australian children are no longer actively mobile as commuters**

More than 60% of children in Australia are now driven to and from school; this constitutes as much as 17% of peak traffic. Chauffeuring of children, during the week and over weekends, contributes significantly to traffic congestion. It also counters the benefits of active modes of transport (walking, cycling, skateboarding, etc.), which increase physical activity and help to prevent obesity.

- **Planning for the origin-destination distance is key to sustainability**

A transition to more localised patterns of living will help to reduce or avoid the need for travel. Planning for sustainable urban mobility, including shortening the distance between origins and destinations, contributes to this goal.

- **Access to multi-modal transport choices promotes sustainability**

The availability and frequency of multi-modal transport choices is key to improving accessibility and the ability to benefit from opportunities. Access to opportunities such as education, employment and health care promotes social equity and contributes to economic growth.

Chapter 5 Economic perspectives

- **Economic progress is not evenly distributed**

Within and between cities, economic progress has not been evenly distributed against a number of economic indicators. Infrastructure plays a key role in improving the productivity of Australia's cities (*State of Australian Cities 2014–15*).

- **Australian cities have a significant infrastructure deficit**

The available international comparisons suggest that, despite recent increases in government spending and increased private participation, the overall quality of our infrastructure lags behind comparable nations.

- **Infrastructure requires a spend in the order of \$350 billion over ten years**

An Australian infrastructure deficit has built up over the last forty years, estimated in 2014 by the Department of Prime Minister and Cabinet to amount to \$100 billion. Further analysis for this report suggests that the national shortfall by 2025 (and the cost of preventing the development of further backlog to that point) requires an infrastructure spend in the order of \$350 billion over the next ten years.

Figure 1: Three basic routes to improve efficiency in urban transport



- **Integrated planning is essential**

Reforms will be essential to integrate land-use planning and the implementation of sustainable urban mobility principles. Engagement with industry including the design, construction and transport sectors, is necessary.

- **Policy reforms and regulation have a role to play**

Among the ways in which policy reforms and regulations can make a difference are three micro-economic examples: improving the way road use is priced; implementing a regulatory regime that will accelerate the reduction of GHG emissions; and planning that reduces the risks of social exclusion.

- **Polycentric cities bring people closer to opportunities**

Planning for the development of polycentric cities will help to reduce transport poverty and improve the quality of life for Australians on a more equitable basis. High technology industry nodes and urban renewal projects are examples of polycentricism and take advantage of the employment growth opportunities that middle suburbs and innovation clusters provide.

Chapter 6

Towards sustainable urban mobility

- **Community consultation and active local involvement is essential**

Engaging communities widely in development and delivery of land use/transport plans and policies is an essential ingredient in social sustainability. In modern liberal democracies a measure of consultation is regarded as a right. A far-sighted, transparent planning process that entails extensive consultation builds individual and community trust.

- **Successful sustainable urban planning often includes action at the metropolitan level**

Cities that are successfully confronting sustainability challenges often demonstrate a form of cooperative, local representative control over citywide or regional decision-making, described as 'metropolitan governance'. The Port Authority of New York and New Jersey; the Brisbane metropolitan area; the metropolitan region of Nice; the Tennessee Valley Authority and the Greater Toronto Area are diverse examples.

- **A national framework for urban planning ensures that infrastructure investments are maximised**

There is a growing consensus that broad-scale, multimodal, high-level planning systems are needed (*State of Australian Cities 2014–15*). Integrated planning outcomes will recognise that different parts of the city have different transport tasks and different infrastructure needs. A national approach to planning and managing cities will provide a framework within which cities, regions, metropolitan areas and local governments can develop responses to sustainable mobility challenges in forms appropriate to particular local communities.



About Securing Australia's Future

In June 2012 the Australian Government announced *Securing Australia's Future*, a \$10 million investment funded by the Australian Research Council in a series of strategic research projects. Projects are delivered to the Commonwealth Science Council by the Australian Council of Learned Academies (ACOLA) via the Office of the Chief Scientist and the Australian Chief Scientist.

Securing Australia's Future is a response to global and national changes and the opportunities and challenges of an economy in transition. Productivity and economic growth will result from: an increased understanding in how to best stimulate and support creativity, innovation and adaptability; an education system that values the pursuit of knowledge across all domains, including science, technology, engineering and mathematics; and an increased willingness to support change through effective risk management.

Six initial research topics were identified:

- i. Australia's comparative advantage
- ii. STEM: Country comparisons
- iii. Smart engagement with Asia: leveraging language, research and culture
- iv. The role of science, research and technology in lifting Australian productivity
- v. New technologies and their role in our security, cultural, democratic, social and economic systems
- vi. Engineering energy: unconventional gas production

Five further research topics have been identified:

- vii. Australia's agricultural future
- viii. Delivering sustainable urban mobility
- ix. Translating research for economic and social benefit—country comparisons
- x. Capabilities for Australian enterprise innovation
- xi. Business diasporas in Australia: maximising people to people relationships with Asia

The Program Steering Committee responsible for the overall quality of the program, including selection of the Expert Working Groups and the peer review process, is comprised of three Fellows from each of the four Learned Academies:

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