



# Reshaping the future of cities

Robert Kerton

Unless significant changes are made to the way we shape and build our cities, the 21st century looks bleak for Australia. This is the sharp outlook of *Reshaping Cities for a More Sustainable Future*, a CSIRO study that explored the integral links between urban form, energy and air quality.

It's estimated that 88% of the world's population growth this century will be in urban areas, and Australia's cities are set to be a strong case in point. If, however, our cities continue to expand as the current laissez-faire urban sprawl, the study predicts that in just 10 to 15 years, air pollution will increase as much as 70% on adverse days compared to 1990 levels.

Already, the cost of air pollution to Australia is high: the human health cost is estimated at between \$3 billion and \$5.3 billion every year, and annual damage to materials, property and buildings is between \$3 billion and \$5 billion – 1% of GDP.

Cars are the biggest cause of air pollution. Most Australians shun public transport and rely on cars to transport them around their sprawling cities, making us among the highest per capita air polluters in the world.

Emissions of nitrous oxides and volatile organic compounds – the precursors of photochemical smog – and carbon monoxide are similar to or worse than US

cities. Concentrations in Australian cities are more than double those found in Europe, and even more extreme compared with Asian cities, especially wealthy cities like Singapore, Tokyo and Hong Kong.

According to Dr Peter Newton, Chief Research Scientist at CSIRO Manufacturing and Infrastructure Technology, urban design exerts a strong impact on a city's air quality and the exposure of its population to harmful pollutants.

Australia's urban land use and transportation patterns are poorly integrated. The result is cities that, in the long term, are economically and environmentally less sustainable. As pollution increases, the liveability of our cities will worsen, and their attractiveness to investment and tourism will deteriorate.

In Australia, most people have come to accept urban sprawl and driving long distances to work as a way of life – but this has to change. Over the past quarter of a century, the world community has been subjected to three key issues that will become the drivers for this change: the threat to oil supply and associated price increases; the greenhouse threat of climate change and climate variability; and the threat to human health caused by poor air quality.

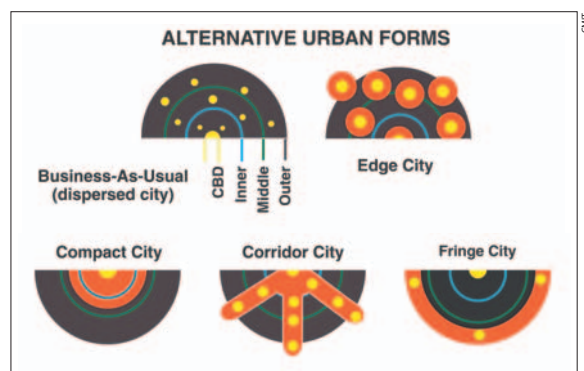
The need to look for ways to offset future crises is not new. It has long been recognised that urban planning and design can make a significant contribution to the sustainability of development.

The CSIRO study is in fact the first comprehensive scientific attempt to develop a blueprint for the optimum urban development of our major cities. It specifically examined several alternative urban forms to evaluate their capacity to minimise both energy consumption and atmospheric pollution, including greenhouse gas emissions.

'Similar enquiries in the past have been based on subjective assessments about city planning having impact on air quality and how energy is consumed', says Newton. 'But the order of magnitude between different types of city structure has never been evaluated anywhere in the world.'

Using advanced spatial planning and urban design software, integrated land use–transport emissions–airshed models were used to explore the effects that

The results of modelling different city shapes against pollution levels were dramatic and significant. The corridor-shaped city model was most efficient, by a clear margin, in terms of reduction of both overall pollution and particle emissions.



alternative residential, workplace and transport structures might have on energy consumption and urban air quality to the year 2011. Six alternative scenarios of future urban form were examined:

**Business as usual** – the extrapolation of current patterns into the future, i.e. laissez-faire, low density, dispersed.

**Compact city** – increased population and density of inner suburbs.

**Edge city** – increased population, housing densities and employment at selected nodes within the city, with increased investment in orbital freeways linking the edge cities.

**Corridor city** – a focus on growth along linear corridors emanating from the CBD and supported by upgraded public transport infrastructure.

**Fringe city** – additional growth predominantly on the fringe of the city.

**Ultra city** – additional growth predominantly in provincial cities within 100 km of a capital city and linked by high-speed rail transport.

These urban configurations were applied to the city of Melbourne on the basis of a population increase from 2.5 million to 3.0 million by 2011. Other key assumptions included: increasing residential density; a varying ratio of public/private transport; the full uptake of vehicle emission controls; and increasing telecommuting (working from home) in particular industries.

The results of the urban modelling were dramatic in their impact on urban air quality.

Worst-case scenarios relating to summer photochemical smog showed that by far the worst pollution would result if present urban development patterns remained, i.e. business as usual (a 71% increase in population exposed to levels of pollution above nationally accepted levels). The best performer under these conditions was the corridor model (55% decrease).

Worst-case scenarios relating to small particle emissions showed that the compact city model fared worst (160% increase), with the business as usual model second worst (61% increase). Again, the corridor model performed best in air quality terms (14% decrease). Clearly, urban form does matter.

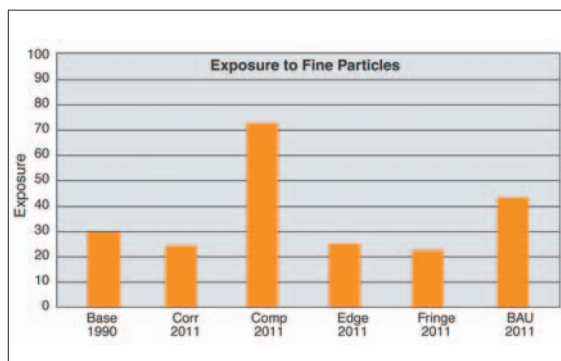
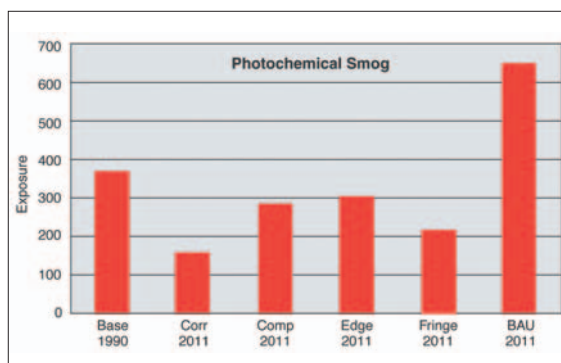
‘State and local governments need to become more intentional in concentrating its urban development. In relation to indicators such as energy consumption, self-containment of sub-urban regions and vehicle kilometres travelled, to maintain a business as usual model of urban development is to condemn the future population and industry of that city to a sub-optimal living and working environment,’ says Newton.

The report suggests a number of strategies to improve urban air quality:

### Changes to urban planning and public infrastructure

With advances in computer models now emerging, it is possible for government planning agencies to evaluate a range of development futures for a city, and use the outcomes to guide major infrastructure investments and development plans.

The report says, ‘All three tiers of government have the prime responsibility of shaping the development of their cities according to principles that provide the greatest opportunity for their long-term economic, environmental and social sustainability. It’s not impos-



Relative exposure levels of modelled city shapes to photochemical smog and particulates. Our current business as usual shape proves highly inefficient.

sible to reshape or refigure a city to become more self-sufficient. Often people say you can’t change cities, but a city like Melbourne can begin to change its structure within 10 to 15 years.’

### The role of the construction industry

The concept of the ecological footprint is introduced as a strategy for both government and the private sector to minimise energy consumption and emissions in the construction, operation and maintenance of buildings. ‘It must become part of design thinking,’ says Newton. ‘Incentives through tax or a star-rating system like the National Home Energy Rating System (NatHERS) or Green Star (LCA Design) would encourage industry to minimise their building footprints.’

### Education of the public

The majority of Australians have come to accept the importance of recycling and the impact individuals can have on improving our environment. Similarly, if the Australian public became more aware of air pollution and the impact private transport usage has on the air we breathe, they are more likely to respond to a plea to use public transport on high-risk summer smog days. For example, if public transport patronage increased by 45%, there would be a 28% decrease in exposure to photochemical smog.

#### More Information

P W Newton (ed) (1998) *Reshaping Cities for a More Sustainable Future. Exploring the Link Between Urban Form, Air Quality, Energy and Greenhouse Gas Emissions.*

Australian Housing and Urban Research Institute, Research Monograph 6, Melbourne.

P W Newton (2000) Urban Form and Environmental Performance, in K Williams et al (ed) *Achieving Sustainable Urban Form.* E&FN Spon., London, 46–54.

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