Sustainable transport in Australian cities: targeting vehicle kilometres of travel
Solutions for Policy Thinkers

Moving People

Policy Paper 2

Sustainable transport in Australian cities: targeting vehicle kilometres of travel

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First Published June 2014.
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Foreword

This research policy paper is part of a series of six publications aimed at decision and policy makers, academics and students. This Policy Series focuses on land transport, land use, integrated planning and urban development challenges in Australia.

The Policy Series has been developed by the Bus Industry Confederation (BIC) of Australia and the Institute of Transport and Logistics Studies - Sydney University, and addresses specific subject matters and issues raised in the BIC’s previous reports: “Moving People - Solutions for a Growing Australia” and “Moving People - Solutions for a Liveable Australia.” Both publications are available at www.ozebus.com.au.
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Major findings

Targeting vehicle kilometres of travel

If road users were confronted with all the costs that their travel choices impose on the wider community, as proposed in BIC Policy Paper No 1 (Stanley 2014), there would be little reason to be concerned about road traffic growth. In the absence of such pricing, however, there are serious concerns about the external costs of growing road traffic volumes (e.g. congestion, greenhouse gas emissions, accidents, social exclusion, health, etc), particularly in our capital and major cities, where these external costs are highest on a per kilometre travelled basis.

If the will to tackle urban road pricing is lacking, then targeting growth in urban road traffic volumes is a second-best way to achieve more efficient travel choices. This can be delivered through a combination of 50-100 per cent density increases by 2050, achieved primarily through Transit Oriented Development being embedded in long term land use/transport strategies, combined with substantially improved public transport, walking and cycling opportunities and in time, road pricing. Such measures should make it feasible to lower the growth in capital city vkt substantially below the rate of population growth, with the goal being an ambitious target of no increase in vkt.

BIC believes that Australian cities’ long term integrated land use/transport strategies should target zero growth in vkt as a key performance indicator. This will enable the benefits of good accessibility to be maintained while limiting the undesirable economic, social and environmental costs of motor vehicle use. No current long term city plans have such targeting. Without this target, vkt is likely to be only an indicator of failure after the event!

There is currently strong policy interest in Australia around increasing our rate of infrastructure investment. Our cities, which are vital for national productivity and liveability, will be the subject of a significant part of any infrastructure expansion. It is crucial, then, that we understand very clearly the kinds of cities we want and the best way to use infrastructure to help deliver those cities, particularly important city-shaping transport infrastructure. This focuses attention squarely on the quality of our land use/transport planning.

Vision statements for Australia’s capital cities, set out in their long term land use/transport strategies, highlight the triple bottom line sustainability elements embedded in COAG’s (2009) national objective for our capitals:

To ensure Australian cities are globally competitive, productive, sustainable, liveable and socially inclusive and are well placed to meet future challenges and growth. (COAG 2009, p. 15)

Land use/transport integration is fundamental to vision achievement. This must start with a clear conception of a city’s desired future land use and then use transport and related initiatives to support achievement of intended outcomes. Transport cannot be detached from desired land use futures, accessibility being the glue that links the two.

BIC’s Moving People: Solutions for a Liveable Australia (Stanley 2012) suggests long term integrated land use/transport strategies, with a time frame of about 25 years, should set out the vision and key future directions for a city, with land use leading, linked to detailed shorter term implementation plans (~5 years). Australian cities are now producing long term strategies of a generally high standard but shorter term implementation plans are lacking and it is too early to tell if there will be long term plan adherence.

The BIC Liveable Cities Report also recommends strong governance structures be established between Federal, State and Local government to ensure that 25 year plans are agreed and delivered and not subject to changes based on the electoral cycle. Agreed governance frameworks will provide certainty for the future development of Australian cities. Governance issues are not further discussed in this paper but are an important consideration in this policy discussion.

Total vehicle kilometres of motor vehicle travel (vkt) provides perhaps the best single indicator of the sustainability of the land use/transport outcome within this policy environment, because it accounts for the major proportion of urban passenger travel and over three quarters of motor vehicle kilometres travelled. This paper focuses on what is happening, and what is likely to happen, to vehicle kilometres of motor vehicle travel (vkt) in our capital cities, as a broad indicator of our success in integrating land use/transport planning and achievement of sustainable urban land transport. The focus is on moving people.

If road users were confronted with all the costs that their travel choices impose on the wider community, through what economists call a marginal social cost pricing system, there would be little reason to be concerned about road traffic growth. In the absence of such pricing, however, there are serious concerns about the external costs of growing road traffic volumes, particularly in our cities where these external costs are highest on a per kilometre travelled basis. If the will to tackle urban road pricing is lacking, then targeting growth in urban traffic volumes is a second-best way to achieve more efficient travel choices.

The paper notes that per capita passenger vehicle vkt growth in our capital cities has been declining for some years and noted commentators expect future growth to be about in line with population growth. Further containing growth in vkt will reduce congestion costs, greenhouse gas emissions, air and noise pollution, the road toll and it will improve social inclusion and health.

The major conclusion of the paper is that our capital and major cities should target zero growth in motor vehicle vkt in their long term integrated land use/transport strategies. This is a target that Vancouver has already adopted and is discussed later in this paper. This will require investment in improved opportunities for public transport, walking and cycling and a few major new strategic road additions, particularly serving freight and on-road public transport, such that the generalized costs of public transport, walking and cycling continually improve relative to those of car travel. Low or zero rates of growth in passenger vehicle vkt need not imply lower levels of accessibility in our cities if land use and transport are planned in an integrated way.
Land use directions

Achieving low or zero growth in vkt will not be possible without land use strategies that support more compact cities. The growing research base on connections between built form and travel suggests that the effects of individual measures are usually small but that the combined effect of a number of supportive regional and neighbourhood level measures can be significantly large. Policy packages are thus important in the land use/transport space to slow growth in private car use, with a focus on both regional and neighbourhood level characteristics of built form: increasing density; improving the accessibility of major urban nodes; increasing diversity of land uses (mixed use planning); providing supportive urban design (particularly street network characteristics, such as intersection density and street connectivity, that encourage safe walking and cycling); and, reducing distances to (and frequencies of) public transport services. Such measures will increase the share of trips undertaken by walking, cycling and public transport, reduce trip lengths and support accessibility, all of which will help to lower motor vehicle vkt and the external costs thereof.

Infill development should cater for the substantial part of urban population/job growth, to align with, enhance and share the benefits from emerging structural economic trends (which are centralising jobs) and to minimise the costs of catering for growth. Development should be focused on those locations (nodes and corridors) with the best accessibility, particularly trunk public transport accessibility (commonly known as Transit Oriented Development).

A focus on vkt implies an important shift from the traditional transport planning focus on mobility to a focus on accessibility. In line with the now widely agreed proposition that the main purpose of transport is access to opportunities, rather than movement per se. Levine et al. (2012) find that denser metropolitan areas have slower travel speeds but greater origin-destination proximity. Lower travel speeds reduce accessibility but proximity increases it. Very importantly, they conclude that the proximity effect dominates, such that denser urban areas are more accessible. Slower rates of growth in vkt, and even declining vkt, thus do not imply lower levels of accessibility. This is strongly supportive of arguments for more compact Australian cities.

US Smart Growth program experience suggests that a State Government that wants to achieve more compact settlements patterns in its capital city needs a firm policy commitment to this goal, beyond just words, and the supporting infrastructure, planning provisions and private sector partnerships (for example) to help drive achievement.

Overall urban densities in our cities need to increase by 50-100 per cent over the next 30-40 or so years, with allowance for local circumstances. This will enable greater availability of local services, including local public transport. Minimum density targets of about 35 people plus jobs per hectare should be adopted in land use/transport strategies/plans for our cities, to both support development of 20 minute neighbourhoods, in which people can undertake most of the activities they need for a good life, and provide an effective market for local and trunk public transport (mode shares exceeding 10 per cent as a base will result, well above the current base levels). Densities across large parts of most

Australian capital cities fall well short of the 35 people plus jobs threshold, suggesting that urban infill should generally be advantaged by policy, ahead of further growth on the fringe. Doubling densities would still leave densities well below current levels for cities like San Francisco.

Bus boarding rates of only about 7-8 persons per service hour are needed for a service to be economically justified, in terms of the quantifiable economic benefits from reduced risks of social exclusion and road congestion cost savings. Boarding rates that should be expected at an activity intensity of 35 persons per hectare would easily exceed this hurdle and most fringe urban services should also meet this inclusion threshold.

If increasing the supply of affordable housing and developing complete communities are policy priorities, as they are in Australian capital cities, then concerted and specific actions are needed to pursue these objectives. TOD type development can help but, on its own, cannot be relied on to increase the supply of affordable housing or provide complete communities. Broad integrated approaches are required.

The paper looks at three capital city long term land use/transport strategies in some detail and at the public transport strategy for another city. All reflect the COAG objective for capital cities, nuanced for local values, and see transit oriented development as a very important delivery tool for more compact cities, which all are seeking to achieve. All have made progress in terms of the integration of land use and transport at regional level, which is where the major benefits from integration will flow and, associated with this, where the main impacts on reducing private vehicle vkt will happen. The main shortcomings in the land use/transport strategies, from the perspective of transport supporting land use, seem to be:

- not enough specific focus on how densities will be increased in middle and outer areas and on how land transport can best support this, particularly public transport, walking and cycling
- insufficient focus on building strong neighbourhoods and on ensuring that local transport is supportive (strong neighbourhoods will increase social capital, sense of community, social inclusion, well-being and health, supporting economic participation and reducing the need to travel)
- the lack of integrated shorter term (5-10 year) financing/funding plans, which is a serious shortcoming in terms of implementation and achievement. This is probably the biggest single weakness.

None of the reviewed plans explicitly targets outcomes in terms of vkt.

Transport policies and programs need to be strongly supportive of delivering more compact cities. Policy clarity and program alignment are critical to success. The main land transport policy and program directions for moving people in our capital cities, to support desired land use development directions, should focus on:

- ensuring that adequate trunk public transport capacity is available to facilitate growth in the central city and movement around the central
city. This is primarily about sustaining productivity benefits from agglomeration. This transport policy direction also means ensuring that walking and cycling opportunities are provided to support safe trip making by central/inner urban residents and by others travelling to/from this area. This will support greater dwelling density in the centre. Peak people movement to/from central cities is not effectively undertaken by car, so transport policy should ensure that public transport, walking and cycling have priority over improved car access. Increasing parking charges and limitation of car parking spaces can support these policy directions, as can giving road use priority to the low impact modes of light rail, tram and bus, plus walking and cycling, in inner suburbs, as part of transport network management plans

- ensuring high quality arterial road capacity exists to support high frequency circumferential operation of road-based PT systems (and freight) in middle and outer suburban areas, crossing radial rail lines and joining up major activity centres/clusters. High quality opportunities for walking/cycling should be provided within and to/from activity centres and clusters. Improving accessibility should assist in promoting job growth in major activity centres, as part of an integrated set of measures to promote activity centre development. Target PT service frequencies on the trunk circumferential middle-outer corridors in the larger cities should be 15 minutes or better for most service hours (which should be from about 5.00am to midnight in most cases)

- providing flexible local PT services to/from transport nodes and local activity centres, at a frequency that will help to facilitate social inclusion and with safe access opportunities. Relevant local PT service frequencies should certainly not be any less than half hourly from 6.00am to at least 9.00pm, with 20 minute frequencies being preferred and some service available outside the core time band. Alignment of frequencies between local and trunk PT services is important to maximise patronage potential

- attaching high priority to safe walking and cycling within and to/from local centres, to support greater use of more sustainable travel modes and also assist development of more compact settlement patterns

- providing high quality trunk PT services between outer growth suburbs and the most proximate employment hubs, ensuring that road capacity is sufficient to meet these PT service needs (if rail is not available).

- longer term, reforming road pricing, to make road users accountable for all the costs of their travel choices, as discussed in BIC Policy Paper 1 (Stanley 2014). This will also enable improved pricing of public transport services.

**Outcome**

A combination of 50-100 per cent density increases by 2050, achieved primarily through TOD and setting minimum density targets of about 35 people plus jobs per hectare, combined with substantially improved public transport service levels and walking/cycling opportunities and, as soon as feasible, reformed road pricing should make it feasible to lower the growth in capital city vkt substantially below the rate of population growth, with an ambitious target of no increase in motor vehicle vkt within reach. A committed policy alignment in this direction would deliver stronger, healthier and more inclusive communities, as well as supporting productivity, job growth and a cleaner environment.

The focus on zero growth in motor vehicle vkt should remain in place at least until such time as a reformed road pricing regime is implemented. New freeway/tollway construction must be managed so that it does not inhibit target achievement. This will require public transport/walking/cycling improvements to be correspondingly greater. BIC encourages all those interested in the future of our cities to get involved in discussing these important policy directions.
1. Context

1.1 Infrastructure spending and integrated land use/transport planning

There is currently strong policy interest in Australia in increasing our rate of infrastructure investment, with land transport investment a major candidate for growth. Major infrastructure projects can play very significant city-shaping roles. For example, radial freeways on the urban fringe can accentuate urban sprawl; trunk rail services can promote growth in the central business district. If our cities are to be the subject of significant infrastructure expansion, then it is crucial that we understand very clearly the kinds of cities we want and the best way to use infrastructure to help deliver those outcomes. The alternative is to have our cities develop as the unintended outcome of isolated infrastructure project decisions.

BIC’s Moving People: Solutions for a Liveable Australia (Stanley 2012) suggested long term integrated land use/transport strategies, with a time frame of about 25 years, should set out the vision and key future directions, with land use leading, linked to detailed shorter term detailed implementation plans (~5 to 10 years).

Australia’s capital cities have considerably progressed the way they approach integrated long term land use/transport strategic planning in the last few years, following earlier criticism by the COAG Reform Council Capital City Strategic Planning Review (COAGRC, 2012), but shorter term implementation plans are lacking and it is too early to tell if there will be long term plan adherence. 1

Leading international expert on land use/transport integration, Professor Robert Cervero from University of California, Berkeley, speaking recently in Sydney, has argued that there is still much improvement required if Australian and US cities are to produce and deliver truly integrated land use/transport strategies2. Cervero emphasised the importance of starting integrated land use/transport strategies with a vision of the kind of city you want and then using investment in transport and other infrastructure to help deliver that city. He commented that, while transit oriented development (TOD) is widely supported as an integrated policy direction for Australian and US cities, such developments rarely deliver complete communities. Infrastructure in areas such as education and health, for example, can be neglected and housing in TODs is frequently only affordable to those on middle to high incomes.

Some Australian cities, particularly Adelaide and Perth, are good examples of integration of land use and transport, with land use leading. For example, based on an understanding of structural economic changes influencing the city, Adelaide has placed considerable emphasis on strengthening its CBD and inner core, and has turned to light rail to help achieve this outcome, to advance pursuit of the government’s vision for the city. In so doing it has drawn on experience from cities like Portland Oregon. Perth has linked its linear development plans, along the coastal belt to the north and south, to high speed rail to serve that growth pattern.

COAG set a high level vision or objective for Australia’s capital cities in 2009 (COAG 2009, p. 15):

To ensure Australian cities are globally competitive, productive, sustainable, liveable and socially inclusive and are well placed to meet future challenges and growth.

High level vision (or intended outcome) statements for Australia’s capital cities now generally reflect these sentiments. For example:

- Sydney: balanced growth; a liveable city; productivity and prosperity; a healthy and resilient environment; accessibility and connectivity (a strong global city, a liveable local city) (NSW Government 2013)
- South East Queensland: strong, green, smart, healthy and fair (Queensland Government 2009)
- Perth: liveable, green, vibrant, more compact and accessible, unique sense of place (WAPC 2010)
- Melbourne: preserve and enhance distinctiveness; ensure city remains globally connected and competitive; promote economic/social participation; build strong communities; ensure environmental resilience (Government of Victoria 2013)
- Adelaide: healthy, safe, affordable and connected communities; a strong, diverse and growing economy; thriving natural and built environment (Government of SA 2013a).

The idea of sustainability with respect to development was defined by the landmark Brundtland Commission (WCED 1987, p. 8) as seeking to meet ‘... the needs of the present without compromising the ability of future generations to meet their own needs’. This is elaborated in the triple bottom line (economic, social and environmental) focus to goal or vision setting. The vision statements for Australia’s capital cities highlight the triple bottom line sustainability elements embedded in the COAG national objective, with liveability, health and governance outcomes also specified in some cases. Distinctiveness, which is a key source of city competitive advantage and driver of growth in the knowledge economy, emerges at a finer level of detail in Australian capital city land use/transport strategies. Citizen engagement processes in strategic planning are a key way of understanding city distinctiveness.

1.2 Sustainable travel and vehicle kilometres of travel

Cervero’s view, expressed in his March 2014 Sydney address, is that vehicle kilometres of travel (or vkt) is the single most powerful indicator of whether an urban land transport system is likely to be sustainable long term. Black (2010) expresses a similar view in favour of vkt as a performance indicator. Vehicle kilometres of travel is a key performance indicator for economic (e.g. congestion), environmental (e.g. greenhouse emissions) and social (e.g. household travel costs) outcomes. High vkt is a clear indication that our cities are not well planned, and that our infrastructure is not working for the benefit of our communities. While COAG set the vkt target at 0.85 to 1.0 vkt per person per day, this must be considered in the context of the stated goals of increased walking, cycling, and public transport.

VKT is the total distance travelled by all vehicles on a roadway. It is highly dependent on the amount of vehicles using each roadway. Although it is a measure of travel, it does not include public transport. Because vkt is the sum total of travel on all roadways, the vkt target helps to reduce the vkt for all roadways.

1 Moving People: Solutions for a Liveable Australia (Stanley 2012) proposed a Federal Cities Minister as a way of helping to sustain consistent long term approaches, given the national significance of the matters involved.
2 Cervero was speaking at the ADC Forum National Infrastructure and Cities Summit in Sydney, March, 2014. BIC was a partner in putting on that event.
gas emissions), safety (accidents), health (incidental exercise) and energy security outcomes of land transport, although technological changes to reduce the carbon intensity of motorised transport are probably the single most significant requirement for lower land transport greenhouse gas emissions. In terms of the national land transport policy directions proposed in BIC’s *Moving People: Solutions for a Growing Australia* (Stanley and Barrett 2010), reducing vkt is a very useful performance indicator for the following three directions:

1. Reducing the demand for travel
2. Mode shift to walking, cycling and public transport
3. Improve vehicle utilisation.

Vkt is probably least relevant as a performance indicator with respect to the social inclusion leg of the triple bottom line. It is also not particularly helpful for informing whether land use/transport systems support urban agglomeration economies.  

BIC Policy Paper No 1 (Stanley 2014) argued that road users currently impose costs on the wider community that are well in excess of $20b greater than the revenue raised from charges on road use (mainly via fuel excise and registration, including heavy vehicle road use charges) and that these external costs are growing. The case for reforming road pricing is strong but the political response is not currently favourable.

If road users were confronted with all the costs that their travel choices impose on the wider community, through what economists call a marginal social cost pricing system, there would be little reason to be concerned about traffic growth. In the absence of such pricing, however, there are serious concerns about the external costs of growing road traffic volumes, particularly in our cities where these external costs are highest on a per kilometre travelled basis. If the political will to tackle urban road pricing is lacking, then targeting growth in urban road traffic volumes is a second-best way to achieve more efficient travel choices.

This paper focuses on what is happening, and what is likely to happen, to vehicle kilometres of motor vehicle travel (vkt) in our capital cities, as a broad signpost for success in sustainable urban land transport and success in the process of land use/transport integration on which this depends (in part), complemented by consideration of outcomes in terms of social exclusion and agglomeration economies. A focus on vkt is a significant target within Vancouver’s thinking, because of the direct connections to sustainability. The region’s long term transport strategy (Translink nd; Translink 2013) articulates a target that 50 per cent of all trips by 2045 will be made by walking, cycling or public transport (the share was 27 per cent in 2011) and that the distance people drive will be reduced by one-third. The achievement of these joint targets would result in vkt remaining flat in coming years, with associated benefits in terms of congestion, greenhouse gas emissions, air quality, road safety, etc., as explained in BIC’s *Moving People: Solutions for a Growing Australia* (Stanley and Barrett 2010). A major conclusion of the present paper is that Australian capital city long term land use/transport strategies should also target zero growth in vkt and articulate targets for the proportion of trips, over time, to be made by walking, cycling or public transport.

Urban transport cannot be detached from desired land use futures, being linked through the vital integrating concept of accessibility. A focus on vkt implies an important shift from the traditional transport planning focus on mobility to a focus on accessibility, in line with the now widely agreed proposition that the main purpose of transport is access to opportunities, rather than movement per se. As Levine et al. (2012, p.158) point out:  

*If the purpose of transportation is not movement but access, then increased mobility is desired only to the extent that such a change also increases accessibility over time.*

Levine et al. find that denser metropolitan areas have slower travel speeds but greater origin-destination proximity. Lower travel speeds reduce accessibility but proximity increases it. They conclude that the proximity effect dominates, such that denser urban areas are more accessible. Slower rates of growth in vkt, and even declining vkt, thus do not imply lower levels of accessibility. This is strongly supportive of arguments for more compact Australian cities.

### 1.3 Report structure

Section 2 of the paper presents some data showing what has been happening to vkt in Australian capital cities in recent years, drawing comparisons with experiences in some comparable locations. It summarises some evidence about factors that influence vkt, ranging from income to prices of travel, prices of travel by other modes and, in particular, land use/built form variables. Section 3 reviews some of the literature on travel and built form, to identify key influences, highlighting key policy directions that are likely to reduce vkt growth. Section 4 summarises key directions set out in a number of Australian capital city strategic land use/transport plans, highlighting their main strengths and weaknesses in terms of integrated land use/transport planning. Section 5 sets out the paper’s main conclusions for future policy, suggesting that a zero vkt growth target is feasible for most cities, given sufficient will, and that it should be adopted in long term land use/transport strategies for our cities.

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2. What is happening to vkt in our cities?

2.1 Australian urban situation

The most recent Survey of Motor Vehicle Usage for Australia (ABS 2013) suggests that total kilometres of motor vehicle travel in Australia's capital cities declined marginally from 2010 to 2012, from 123.9 billion vkt (bvkt) to 123.8 bvkt, although this scale of change is not statistically significant. Sydney, Perth, Melbourne and Hobart had reductions estimated at 7.0 per cent, 6.2 per cent, 5.1 per cent and 9.7 per cent respectively. Brisbane had growth of 21.3 per cent, Adelaide 13.6 per cent and the ACT 13.5 per cent over the two year period. Darwin had a very small decline. The SMVU does not suggest reasons why such changes may have taken place. Within the total of 123.8 bvkt in 2012, some 77.7 per cent was passenger vehicle kilometres, underlining the importance of managing this particular part of the traffic stream for sustainable land transport outcomes.

The suggestion from the SMVU data that capital city vkt is not growing overall is consistent with data presented by BITRE in 2009, which showed car passenger kilometres have flattened off from about 2004-05 (Figure 1). This slowdown is even more dramatic in terms of per capita data (Figure 2). While car passenger kilometres increased by 20.8 per cent across the six cities shown in total, in the decade from 1989-90 to 1999-2000, the growth rate slowed to only 10.6 per cent over the ensuing eight years to 2007-08, with most of this growth being in the first half of the period. Rising fuel prices are, no doubt, one factor contributing to this pattern, with 2005-06 being the start of the recent period of high fuel prices. Average 2005-06 fuel prices were over 10 per cent above 2003-04 prices and 2006-07 prices increased even faster. This flattening in growth of car traffic in the capital cities will have slowed the growth in road congestion costs.

Figure 1 was confirmed in BITRE (2012), which showed declining vehicle kilometres travelled per person from about 2005. The forecasts of metropolitan traffic growth to 2019 set out in that report suggest that the BITRE researchers see the declines in per capita car use being reversed in coming years, with stability longer term. However, such a change in short term (to 2019) direction would require a bigger relative turnaround than has taken place at any time in the past 50 years, dependent (for example) on a solid recovery from the global financial crisis and declining unemployment. This may be too optimistic, suggesting that the BITRE forecasts may be too high. We return to these matters in Section 2.4.

2.2 UK and US urban road traffic growth

The growth pattern shown for Australian capital cities is not unique. UK urban road travel, in terms of billion vkm, appears to have peaked about a decade ago. Figure 3 shows that urban traffic on 'A' roads peaked in 2004, in absolute terms, and was about 5 per cent below this level in 2012. Total urban motor travel ('A' roads plus 'minor roads') peaked in 2003 and was also about 5 per cent lower than this in 2012. Traffic volumes on minor urban roads have increased slightly in the past couple of years, perhaps reflecting urban population growth, but not to a sufficient extent to increase total urban road vehicle kilometres.

Even in the US, where public transport use is much less than in the UK, per capita urban car use is in decline. Total US urban road travel peaked in 2007 and has been flat since that time (Figure 4). Arguably this timing reflects the onset of the global financial crisis (GFC). Allowing for population growth over the 5 years since 2007, the US picture is of per capita urban car travel declining at about the rate of urban population increase. The UK experience suggests a faster rate of decline in per capita urban car use than in the US.

Noted US transport planner, Professor Lee Schipper, and colleague Adam Millard-Ball looked at data from Japan, US, Canada, Sweden, Australia and the UK and found that, since 2003, motorised travel demand has levelled out, or declined, in most of these countries, with private vehicle travel declining (Millard-Ball and Schipper 2010). In light of their analysis, they ask whether most of these countries might be reaching ‘peak travel’. They suggest that there may be a saturation point for individual vehicle ownership and, more particularly, travel. Factors likely to influence this trend include the reduced rate of infrastructure spending on roads in most of these countries over more than a decade to the early 2000s (until more recent growth in Australia) and the tendency for people across many continents and cultures to live their lives with a relatively fixed travel time budget (Zahavi 1979; Schafer 1998). These factors in combination suggest that increasing population will be manifest in increasing road congestion which, in turn, will reduce the rate of traffic growth. Road infrastructure expansion, such as opening new freeways or tollways, can be expected to add impetus for further increase in per capita vkt, through a short to medium term easing of the travel time budget constraint.

Millard-Ball and Schipper (2010) note that the declines in vehicle use they report are far larger than would be expected to result from rising fuel prices alone. They suggest that application of estimated short run US fuel price elasticities to the fuel price increases that occurred between 2007 and 2008, for example, would lead to an expected 1 per cent reduction in fuel use, whereas the measured reduction was 6-7 times as large. They do not present a firm explanation for this result but suggest that the idea of saturation is important. This idea of saturation is also reflected in the BITRE's thinking about motor vehicle use in Australia (BITRE 2012 p. vii):

As documented, all jurisdictions are at or close to saturation in the amount of vehicle traffic (all types) per capita. Only Queensland, Western Australia and the Australian Capital Territory (ACT) are not quite at saturation, but all are within a few years of reaching it.

4 Defined by ABS as cars, station wagons, four-wheel drive passenger vehicles, passenger vans or mini buses with fewer than 10 seats and campervans ABS (2013).

5 Although 2012 total vkt exceeded 2011 vkt by 1 per cent
## 2.3. Influences on Australian vkt

### 2.3.1 The BITRE (2012) view

Micro-economic theory suggests that capital city road traffic vkt will depend on factors such as population size and distribution, income levels (related, for example, to the strength of the economy and employment/unemployment), travel speeds (time costs), fuel costs, the competitiveness of alternative modes of travel (public transport, cycling, walking) and the condition of the built environment. The connections between the built environment and travel are a relatively recent area of research but investigation of the other micro-economic foundations has a much longer history.

BITRE (2012, p. vii) argues that:

> … in view of the apparent saturation in per capita levels of vkt in Australian capital cities, the future long-term trend of aggregate traffic growth in all Australian states/territories and capital cities will depend only on the growth rate of population.

The Bureau points out, however, that fuel prices, unemployment and the GFC are important short term influences on vkt. Travel speeds (congestion), service quality of public transport and changes in urban form (the latter being a longer term influence on vkt) do not appear to be directly taken into account by the Bureau. Expecting a return to more normal economic growth, the Bureau expects capital city vkt growth to broadly align with population growth longer term.

### 2.3.2 Congestion

Urban blogger and transport planner Chris Loader has produced some very helpful data on travel speeds in Melbourne (in particular) and other capitals. Loader’s data, derived from VicRoads’ sources, suggests that average travel speeds have declined pretty consistently across time periods over the past decade, apart from an AM peak blip in 2010-11. Speed reductions of about 5-8 per cent are typical across most time periods from about 2003-04, as shown in Figure 5. Melbourne’s population has grown strongly over this period (by 9.7 per cent between 2006 and 2011, for example, based on census data), relative to road capacity, with increasing congestion one outcome. By implication, time costs will have increased by a similar proportion to the decline in speed, or a little higher if time values increase in real terms over time (as expected). The relative decline is larger if assessed between 1999-2000.

Figure 6 shows Loader’s data for the AM peak for five mainland capitals, using data from Austroads\(^6\) (except for the 2010-11 figure for Melbourne, which looks inconsistent with the rest, in Figures 5 and 6). Over the decade or so from 2000-01, Brisbane speeds (somewhat erratic!) have declined from about 41kph to 37, Sydney and Adelaide have declined by a similar amount from lower starting points and Perth had a large improvement and then even larger fall in AM peak speeds. The Perth population increase of 14.3 per cent between 2006 and 2011 shows the kind of pressures confronting that city’s land transport system. In general, declines in AM peak speeds of about ten per cent or more are typical over the decade. The BITRE (2013) analysis of changes in commuting patterns generally mirrors this travel time information. From 2002 to 2010, average commute times in Sydney and Melbourne increased by about ten per cent but times in Brisbane and Perth increased relatively more.

If capital city travel time costs have increased by about ten per cent or so over the decade to 2012 (speeds 5-10 per cent lower and time values increasing), what effect might this have had on vkt? Unfortunately we have not been able to identify an authoritative and current Australian estimate of the elasticity of vkt with respect to travel times (or costs). There have been numerous international studies on fuel cost elasticities, which show that fuel elasticities are up to twice travel elasticities (i.e. as fuel costs increase, people shift to smaller cars, such that travel reduces less than fuel use in response to rising fuel prices), travel elasticities being relatively small. Goodwin, Dargay and Hanly (2004), for example, suggest a long run travel elasticity of about -0.3 with respect to fuel prices, with fuel elasticities about twice this. Glaister and Graham (2002) suggest higher fuel price elasticities, with the further suggestion that these elasticities are getting higher.

Elasticity studies of the kind cited herein have been well summarized by Litman (2013). The general conclusion is that changes in Australia’s capital city travel speeds over the 2000s decade might be expected to lead to about a 2-3 per cent fall in per capita car use. Rising fuel costs would increase this effect. Over the decade to December 2010, capital city petrol prices increased about 17 per cent faster than the CPI\(^7\). Applying a travel elasticity of -0.3 to this suggests a fall of about 5-6 per cent in vkt over the decade as a function of increasing fuel prices. Adding this to the travel time effect suggests that rising travel times and fuel costs in combination over the decade might have reduced per capita vkt in Australian capital cities by about 7-9 per cent, other things being equal. This is of a similar order to the declines in per capita car use shown in Figure 2, suggesting that increases in traffic congestion and fuel costs have probably both been influential in the decline in per capita vkt. The possible addition of new freeways/tollways in coming years in some cities would be expected to lead to increases in per capita vkt, as travel time improvements and associated fuel efficiency savings drive increased trip lengths and increased road trips, some switching from public transport. This is likely to add pressures for further spread of urban areas.

### 2.3.3 Effect of transit service improvements

There have been significant improvements in public transport service levels in a number of Australian capital cities over the past decade. For example, Perth has substantially extended its rail network, Brisbane has built a world class Bus Rapid Transit system and Melbourne has substantially upgraded its trunk bus services with implementation of SmartBus. This has led to very strong patronage increases, with South-East...
Figure 1: Total car passenger kilometres for capital cities (FY1991-2008) (billion passenger kms)

Figure 2: Estimated car passenger kms per capita (FY1990-2008)

Figure 3: UK urban motor vehicle traffic (billion vkms).


Figure 4: Total US urban road use (billion vmt)

Queensland, Perth and Melbourne all exceeding 50 per cent growth over the decade from 2001-02 (Figure 7).

Service elasticities are relevant to assessing the likely impact of such changes in public transport service levels. These elasticities suggest how changes in transit service mileage, service-hours, frequency and service quality (such as comfort) might affect transit ridership. It is widely recognized, for example, that public transport patronage is more responsive to service improvements than to fare reductions. Evans (2004) suggests that the elasticity of transit use with respect to service expansion is typically 0.6 to 1.0. 8 An unpublished analysis by the present author of 2012 US Transit data base details for 26 US transit systems, covering cities of between about one million and 8 million population, estimated a service elasticity of 1.05 using passenger miles of transit travel per capita as the dependent variable and revenue hours of service per capita as one of several independent variables in the modelling, and 1.2 when revenue miles replaced revenue hours. These values are at the top end of the Evans range.

Cross-sectional data of the kind that is used to calculate most service elasticities raises questions about what causes what. Time series information is better, particularly data that measures the effects of service changes on a before and after basis. A local example is very relevant in this regard. The implied service elasticities for Melbourne’s new Smart Bus services, rolled out from 2002, were about 1.0, or higher, after 3 years but reached 2 after 6 years on two routes, as shown in Figure 8. 9 These elasticities incorporate the effects of changes in service kilometres, service speed and marketing effects but the package effect is very strong, perhaps suggesting that elasticities above the Evans (2004) band of 0.6-1.0 might apply for new high quality express public transport services.

Across all modes, Melbourne public transport service kilometres per capita increased by about one-fifth from 2006 to 2012. 10 Over the same period, trips per capita increased by about the same proportion, implying a service elasticity of about 1, consistent with the top end of Evans (2004) range. In Melbourne’s case, this result would have contributed to the decline in per capita car use. This is encouraging in terms of the likely impacts of further service improvements.

Sydney’s public transport patronage growth performance, relative to growth in service kilometres, has not been nearly as strong. While public transport service kilometres increased substantially, by almost one-third between 2006 and 2011, the distance travelled by PT only grew by ten per cent and PT trips by under 7 per cent. 11 The implied service elasticity on trip distance is thus only 0.3. However, PT patronage is projected by the NSW Bureau of Transport Statistics to increase by about the same proportion, implying a service elasticity of about 1, consistent with the top end of Evans (2004) range. In Melbourne’s case, this result would have contributed to the decline in per capita car use. This is encouraging in terms of the likely impacts of further service improvements.

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8 Meaning that each 1 per cent increase in transit vehicle-miles or vehicle-hours increases ridership 0.6-1.0 per cent.

9 This data was assembled by Chris Loader and the present author at Bus Association Victoria.

10 http://www.danielbowen.com/2014/01/24/measuring-pt/


2.4 Conclusion on growth in vkt

Per capita motor vehicle use in Australian capital cities, and in many other developed cities, has declined in recent years. This suggests that the sustainability of urban travel has improved. Because of the saturation effect, BITRE expects that future growth in Australian urban motor vehicle use will be primarily population driven and this result is also implied, for example, in Sydney projections. The role that increasing urban congestion, public transport service improvements and changed urban land use futures (see section 3 below) might play in impacting vkt has not been analysed in detail in the BITRE reports cited. The current paper suggests that congestion and improved public transport service levels have probably played important parts in the decline of per capita vkt in the 2000s, alongside rising fuel costs. This opens up the possibility that future growth in vkt could be lower than population growth, as it has been for almost a decade. This would require continued improvements in public transport services and fewer major new road additions, such that the generalized costs of public transport services improve relative to those of car travel. In short, the analysis suggests that a target of moving towards zero vkt growth in private car travel can be taken seriously.

Road pricing reform, as proposed in BIC Policy Paper No. 1 (Stanley 2014), would assist in promoting public transport, walking and cycling, relative to car travel. Conversely, while some additions to road capacity will be required, particularly for freight movement and on-road public transport, major additions to capital city freeway/tollway networks, as are proposed in some cities, are likely to encourage increases in vkt, as some people switch to car use and car users convert short to medium term increases in travel speeds to longer trip lengths, increasing mobility in the short to medium term but not accessibility in the longer term. This will impact adversely on long term sustainability, unless proactive land use and active transport policies are implemented. Major new city road developments should be limited to key strategic corridors (e.g. to serve Sydney’s proposed new Badgery’s Creek airport and complete Melbourne’s ring road, filling the missing north-east gap), built with a strong focus on integrating and improving existing and new public transport, walking and cycling infrastructure as part of the development and planned so as to offset pressures for increased urban sprawl.

Successful implementation of compact city policy directions, that are the basis of all current mainland capital city land use plans and are discussed in sections 3 and 4 below, will increase the prospects of vkt growing more slowly than population.
3. The built form factor

3.1 Links between the built environment and travel

Australian cities are among the most widely dispersed (lowest density) in the world. More compact cities are generally expected to reduce travel distances (e.g. because of closer proximity of trip origins and destinations), make walking and cycling easier and improve the economics of public transport service provision. Levine et al. (2012) have shown that higher densities are consistent with improved accessibility. Because urban structure only changes slowly, long term approaches are needed to maximise the contribution that the built environment can make to lowering vkt.

The most comprehensive review of connections between travel and the built environment is the meta-analysis by Ewing and Cervero (2010). These authors emphasize the five ‘Ds’ of built form in terms of how they impact on car travel distances, public transport use and walking: density, diversity (of land uses, mixed use), design (particularly street network characteristics), destination accessibility (ease of access to trip destinations) and distance to transit. Particularly interesting are their reported impact elasticities, which show the relative sensitivity of various response variables (particularly motor vehicle vkt) to changes in a range of potential causal influences. Most elasticities are quite small, those with respect to neighbourhood land use variables (e.g. population density, land use mix, street network connectivity) being typically between -0.02 to -0.12 and those with respect to regional access to employment between -0.05 and -0.2 (Boarnet 2011).

It should be noted that most of these elasticities have been estimated in US studies. It is arguable that higher values might be found in countries/cities where fuel prices are higher, slow modes (walking, cycling) are more significant and public transport plays a bigger role (Van Wee and Handy 2014). These considerations suggest that built form may have a higher impact in Australian cities than is suggested by the elasticities identified by largely US research. Even with small individual impacts, however, the combined effect of a number of measures can be significantly large, implying that policy packages will be very important in the land use/transport space. These policy packages need to encompass both regional and neighbourhood level considerations, as outlined below, underlining the vital importance of taking integrated approaches across land use and transport.

Destination accessibility is the most important built form influence identified by Ewing and Cervero (2010), in terms of influence on a household or person’s amount of driving and walking. The less accessible a centre, the higher the motor vehicle vkt and the lower the PT, walking and cycling mode shares. Distance to downtown is also highly related to vkt, travel increasing with distance.13 This is consistent with Australian experience. Personal characteristics, such as household income, have a larger influence on vkt than such land use variables. Newman (2008) has emphasised the importance of distance to the CBD in terms of mode choices in Australian cities, reflecting the importance of CBDs in our urban structures and the difficulties of serving concentrated travel demands to these centres by anything other than public transport.

An important inference from the work on destination accessibility is that, if governments want to promote locational agglomeration economies (i.e. lift urban productivity), while reducing the external costs of road use, a major focus should be on opportunities for redevelopment and revitalisation of central locations. This means prioritising improvements in trunk accessibility by public transport. Private car use simply cannot meet these demands in sufficient quantity at an acceptable social cost.

The local design metrics of intersection density and street connectivity were found by Ewing and Cervero (2010) to be important influences on vkt, particularly through their impact on cycling and, more particularly, walking. Short blocks and many intersections seem to shorten travel distances, with higher intersection density seeming to be strongly linked to increases in walking. In contrast, cul-de-sac designs discourage walking and public transport use. Linking where people live and work (the jobs/work balance) allows more walking, particularly if intersection density is supportive. This is an important design insight for promotion of activity centres and urban villages. With an increasing focus on intersections, safety of cyclists and walkers becomes an important design consideration.

Transit accessibility is significantly related to vkt and to walking (greater accessibility reducing vkt and increasing walking), while transit use is (unsurprisingly) most closely correlated with distance from a transit stop and the shape of the street network. For example, Ewing and Cervero (2010) find that halving the distance to the nearest transit stop is associated with a 29 per cent increase in trips, underlining the importance of dense land use around major public transport stops (but not all stops – it is better to focus on the most accessible locations).

Perhaps surprisingly, neighbourhood population and job densities were not as strong influences on vkt as some other factors (such as location) in the Ewing and Cervero work. This may be because of problems of multi-collinearity, since dense settings usually have mixed uses, short blocks and central locations, all of which Ewing and Cervero suggest shorten trips and encourage walking.

Self-selection is a confounding factor in research on connections between travel and the built environment. Thus, for example, people are likely to walk more in places with a good walking environment, because people who like to walk choose to live in such places! However, in an Australian setting, it is arguable that a lack of housing diversity and options, particularly in middle suburbs, is likely to substantially limit people’s capacity to actually express their preferences, or to self-select, for compact transit-friendly residential environments (Kelly 2011).

The US Transportation Research Board (TRB 2009) is particularly supportive of the findings of Bento et al. (2005), who examined the effects of urban form and public transport supply on travel mode choices and annual vehicle travel in 114 US cities. This was one of the studies included in the Ewing and Cervero analysis and it was discussed in BIC’s Moving People: Solutions for a Growing Australia (Stanley and Barrett 2010). Bento et al. (2005) found that population

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13 Ewing and Cervero (2010, p. 12) suggest that ‘Almost any development in a central location is likely to generate less automobile travel than the best designed, compact, mixed-use development in a remote location’.
Figure 5 Melbourne average travel speed - all monitored roads


Figure 6 AM Peak actual travel speed

Figure 7 Public transport patronage growth since 2001-02


Figure 8 SmartBus Patronage Performance

Source: Bus Association Victoria
centrality, the jobs-housing balance, city shape and
density, in combination, had a significant effect on the
amount of vehicle travel, mirroring the Ewing and Cervero
conclusions. They estimated that the effect of moving a
sample of households from a city like Atlanta (733 persons
per km²; one of the lowest city densities in the US; 7000 rail
miles of service/km²; 10,000 bus miles of service/km²) to a
city with the characteristics of Boston (1202 persons/km²;
18,000 rail miles of service/km²; 13000 bus miles of service/
km²) was a projected reduction in annual vehicle travel of
25 per cent. This result underlines the important role of
focused urban renewal, with the supportive role of a good
public transport system.

SGS Economics and Planning (2012) has looked at the
connection between employment accessibility and higher
density housing in Australian cities, finding a strong
connection. Their analysis also found, inter alia, that access
to public transport and proximity to activity centres were
important drivers of net housing density, supporting a
public transport service/activity centre focus in PT service
enhancements (transit oriented development), as part of a
policy package to support more compact urban settlement
patterns. This should also serve to help build job growth in
such locations.

Influenced by the Bento et al. (2005) research and several
other papers, TRB (2009, p. 4) concluded that:

**Doubling density across a metropolitan area might lower
household VMT [vehicle miles of travel] by about 5 to
12 per cent and perhaps by as much as 25 per cent,
if coupled with higher employment concentrations,
significant public transport improvements, mixed uses,
and other supportive demand management measures.**

Compact, pedestrian and bicycle-friendly mixed use
developments, containing medium to high density residential,
office and retail uses within walking distances of rail stations
(or tram/bus rapid transit routes), is sometimes called Transit
Oriented Development (TOD). A number of studies have
shown how such developments can reduce car use by 20 per
cent or more. For example, a study in Seattle, Washington,
found that in mixed-use TODs car use was reduced by about
one-third, with public transport, walking and cycling playing
correspondingly larger roles (not controlling for self-selection).
Residents of TOD-like neighbourhoods in the San Francisco
Bay Area had only about half the vehicle miles travelled of
new suburban developments (SYDEC 2007).

Some of the findings from the US Smart Growth research
program are relevant to these matters. The objectives of
Smart Growth programs are typically to (Ingram et al. 2009):

- promote compact development
- protect natural resources and environmental quality
- provide a variety of transportation options
- supply affordable housing
- create net positive fiscal impacts.

This is wider than TOD but is closely linked. The Ingram et al.
(2009) review of a number of best practice US Smart Growth
experiences leads them to conclude that it is rare for any
particular initiative to succeed on all objectives. They note
that regional transportation networks are fundamental to what
can be achieved in delivering higher densities, mixed uses,
redevelopment of existing urban centres and preservation
of farmlands and environmentally sensitive areas. Smart
growth policies can increase transit mode share and reduce
congestion but the effects are typically small and require
action on several fronts. In most cases successful examples
of Smart Growth have targeted particular objectives and
used a variety of regulatory controls, market incentives
and institutional policies to achieve these objectives. The
implication is that clear policy objectives are important and
that integrated policy frameworks are central to achievement.
Thus, for example, a state government that wants to
achieve more compact settlements patterns needs a firm
policy commitment to this goal, beyond just words, and
the supporting infrastructure, planning provisions and
private sector partnerships (for example) to help drive
achievement.

While linkages between land use, transport and affordable
housing outcomes are recognized as very important in US
research on TOD, US experience is that Smart Growth/
TOD type initiatives have generally not been very successful
at increasing the supply of affordable housing. TOD’s, for
example, are frequently positioned at relatively high price
points.14 (Ingram et al. 2009; Robert Cervero pers. comm.).
Australian research by National Economics (2010) for the
Australian Local Government Association (ALGA) has shown
how lagged transport infrastructure investment in capital city
growth areas has contributed to the backlog in outer urban
housing supply, in response to population growth. Transport
investment is clearly an important element in the achievement
of affordable urban housing but is not sufficient.

### 3.2 The neighbourhood level: 20 minute city

#### 3.2.1 Neighbourhoods

An important finding from the Ewing and Cervero (2010)
research, repeated in Guerra and Cervero (2011) and Boarnet
(2011), is that out-of-neighbourhood network characteristics,
such as accessibility to jobs, have a stronger influence on
the probability of using public transport than neighbourhood
characteristics, underlining the importance of destination
accessibility/job density.15 If reducing vehicle kilometres of
time is a primary objective, this suggests that the regional
transport network should be the major focus of attention but
the neighbourhood level can assist and should, therefore,
be a focus of integrated land use/transport strategies.
Furthermore, BIC research on links between mobility, social
exclusion and well-being underlines the importance of
mobility and the neighbourhood level in building social capital
and sense of community, which are important influences on
social inclusion and well-being (Stanley et. al. 2011, 2012).
In short, as noted above, a *target of reducing vkt is not a
complete target in terms of the links between travel and
the built environment, partly because of its lack of
connection with social inclusion and well-being. The*

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14 Partly for cost of production reasons but also because of planning/
regulatory barriers and a lack of innovation in supply.
15 Boarnet (2011) suggests that the greater importance of regional level
considerations is particularly related to the importance of long trips for total
vkt.
neighbourhood level is important for such reasons in integrated land use/transport planning, a point well made in the WA Guidelines for preparation of integrated transport plans (WAPC 2012).

Neighbourhoods are key building blocks to achieve a well-functioning city (Jacobs 1961). Meeting challenges necessitates the involvement of strong communities, capable of maintaining wellbeing while undergoing change. Strong communities arise from well-resourced and well-functioning neighbourhoods. Such neighbourhoods will be good for people, the environment and economic participation (Nicholson et al. 2014). However, not all neighbourhoods provide residents with equal opportunities. All neighbourhoods need to offer the activities and social infrastructure to meet essential needs: personal wellbeing, mental health and social equity; a sense of place and belonging; participation and choice; and the ability to successfully adapt to external challenges. The ability to be mobile and be able to access friends, activities, etc is a requirement to achieve most needs.

A land use/transport focus at the neighbourhood level can be summed up in the notion of ‘the 20 minute city’, an idea promoted by Plan Melbourne (Government of Victoria 2013). A 20 minute city is a place where people can do most of the things they need for a good life within 20 minutes travel by walking, cycling or taking public transport from their residence.

A 20 minute city requires a range of local activities and it also requires local mobility choices, particularly safe walking/cycling opportunities and local public transport. In turn, improved mobility, local services and infrastructure improve accessibility and can most easily be provided where urban densities are sufficient to support such activities, thereby also reducing travel distances. Local public transport services (which will be mainly bus in middle and outer suburbs, where most attention is needed for delivery of a 20 minute city) need to operate at no less than a 30 minute frequency (preferably 20 minutes), given the concept of the 20 minute city, seven days a week from at least 6 am to 9 pm. This will give people the certainty that they can achieve their trip purpose without long waits, when they need or wish to travel. It will also reduce the need for car ownership. Given that current public transport service levels in capital city outer suburbs are typically well below this ideal, prioritisation of improvement will be required.

3.2.2 Densities and public transport use

Newman and Kenworthy (2006) review relationships between energy used in private transport (which reflects vkt) and the intensity or density of residential and employment activity (persons plus jobs per hectare) across 58 international cities and within both Sydney and Melbourne. They conclude from this that car usage seems to grow quickly once the number of people plus jobs per hectare falls below about 35, or a range of 30-40, citing other authors who have reached similar conclusions about the kinds of densities required for a viable centre. More recent, the Prince’s Foundation (2014) has cited 17 units to the hectare, which is consistent with the Newman and Kenworthy (2006) numbers.

Newman and Kenworthy note that their figure of 35 people plus jobs per hectare accords with a residential density of about seven dwellings per acre, at a reasonable dwelling occupancy rate. They then link this density with the idea of travel time budgets, which was explored by Zahavi (1979) in the 1970s and taken further by Marchetti (1994). A ten minute straight line walking time at normal walking speed defines a pedestrian catchment (called a ‘Ped Shed’ by Newman and Kenworthy) of about 300 hectares (220-550 at a walking speed of 5-8 kph), which they suggest implies a population threshold of about 10,000 residents at 35 people/jobs per hectare. They see this as a minimum threshold size for a local centre catchment and cost-effective public transport service. This catchment can include a range of densities within the Ped Shed, provided that the average is about 35 people plus jobs per hectare (e.g. higher densities close to the centre and lower 200 metres away). The idea of the 20 minute city allows a longer walking time but walking is rarely a straight-line from origin to central destination, so we work with the 10 minute straight line catchment here. Newman and Kenworthy (2006) estimate that a 30 minute Ped Shed at an activity intensity of 35 people and jobs per hectare defines a catchment of 100,000 (70,000 to 175,000 range), which is large enough to provide many higher order functions.

McPherson and Haddow (2011) suggest population thresholds for a range of activities, as indicated in Table 1. This provides an indication of the types of activities that might generally be expected to be available within catchments of different sizes. The 10 minute walking catchment, at densities averaging 35 people and jobs per hectare (~10,000 people), might include local shops and a corner store, a Small Neighbourhood Activity Centre and Primary School and perhaps a Large Neighbourhood Centre. Larger catchments are implied for the other activities shown in Table 1. These can be provided in a 30 minute walking catchment, or shorter trip time by cycle or public transport, consistent with the idea of a 20 minute city, if land use and access arrangements are well managed. High end knowledge-based activities, such as tertiary education, employment in top legal and finance businesses and complex medical services are likely to require travel beyond 20 minutes for most people.

Table 1: Facilities population thresholds

<table>
<thead>
<tr>
<th>Community/commercial facilities in activity centre</th>
<th>Population threshold for viability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local shops/corner store</td>
<td>800 - 1,000 dwellings</td>
</tr>
<tr>
<td>Small Neighbourhood Activity Centre (shops, community centre, primary school)</td>
<td>1,200 - 4,000 dwellings</td>
</tr>
<tr>
<td>Large Neighbourhood Centre</td>
<td>4,000 - 10,000 dwellings</td>
</tr>
<tr>
<td>Community health centre</td>
<td>8,000 - 12,000 dwellings</td>
</tr>
<tr>
<td>Primary School</td>
<td>1,200 - 5,000 dwellings</td>
</tr>
<tr>
<td>Secondary School</td>
<td>8,000 – 10,000 dwellings</td>
</tr>
<tr>
<td>Train Station</td>
<td>10,000 – 12,000 dwellings</td>
</tr>
<tr>
<td>Civic Centre</td>
<td>12,000 – 48,000 dwellings</td>
</tr>
</tbody>
</table>


16 This idea, based on extensive empirical research across time and cultures, suggests that people are prepared to spend a certain amount of time each day in travel. If travel speeds are increased, such as by a road improvement, they will travel further, which is a reason why freeways fill up quickly (generated travel).
SGS Economics and Planning has kindly made available mapping of population plus jobs per hectare for the five mainland capital cities in 2011. Figures 9 to 13 show the respective densities, the various shades of purple all meeting (or exceeding) the 35 threshold. Only relatively small parts of Adelaide, Brisbane and Perth meet the threshold, indicating a significant task in these cities to deliver strong neighbourhoods and cost-effective public transport services across each entire city, but even Sydney and Melbourne have large areas that do not meet the threshold.

Densities of about 35 people (jobs and residents) per hectare, within a local one kilometre normal speed walking catchment of 10,000 people, are likely to support a PT trip mode share of at least 10 per cent, or higher, especially in the peak. Sydney PT mode shares in middle suburban areas, for example are typically 11-14 per cent of total trips. Lower mode shares would be expected in lower density areas. BIC research (Stanley and Hensher 2011) has demonstrated that bus boarding rates of only about 7-8 persons per service hour are needed for a service to be economically justified, in terms of the quantifiable economic benefits from reduced risks of social exclusion and road congestion cost savings. Boarding rates that should be expected at an activity intensity of 35 persons per hectare would easily exceed this hurdle and most fringe urban services should also meet this inclusion threshold.

The accessibility that is required to fulfil the higher order functions requires linking of smaller (neighbourhood) and larger centres by a network of integrated (public) transport services, which is very much the direction that Australian capital city land use/transport strategies are now heading, albeit at densities across parts of the various cities that fall well short of the 35 threshold, as noted above.

3.3 Agglomeration economies

A short comment on the role that ‘agglomeration economies’ (or more accurately, ‘wider economic benefits’) play in our capital city economies is important, since the vkt indicator does not pick up this influence. Agglomeration economies are the productivity benefits that flow from increasing the effective density of a city. In transport terms this primarily means making your highly productive locations more accessible. Within a major city, potential agglomeration benefits will be biggest in the inner core. Melbourne’s inner core, for example, has had huge job and visitor growth over the past two decades, far in excess of other Australian capital cities. Available public transport capacity has been critical to the realisation of this growth. Continued growth in that inner core, with the wider economic benefits that will flow from this growth, depends heavily on being able to provide the public transport capacity to do the job. In addition to the inner core, the larger cities should also focus on providing high quality accessibility to a small number of major knowledge-based nodes through the middle suburbs, like Monash University Precinct. NIEIR unpublished research suggests that these high end nodes should not be located more than about 20kms from the core, to avoid loss of agglomeration economies. Sydney has pursued such a polycentric urban growth strategy for some time.

With Australian urban productivity growth performance having slipped in the past decade, measures to capture agglomeration economies (wider economic benefits) become important opportunities to support future economic growth. Integrated land use/transport strategies should be assessed, in part, on how well they contribute to this economic policy direction.

A corollary of the existence of wider economic benefits is that land values should be expected to increase in the locations that experience improved accessibility. This provides an opportunity to ‘value capture’ to help pay for the project that is driving the value gains. This should be easier to do for a major public transport project that benefits the inner core than for a road project that produces more widely distributed benefits.

Figure 9: Population plus job density: Sydney 2011

(Source: SGS Economics and Planning)
Figure 10: Population plus job density: Melbourne 2011

(Source: SGS Economics and Planning)

Figure 12: Population plus job density: Brisbane 2011

(Source: SGS Economics and Planning)

Figure 11: Population plus job density: Perth 2011

(Source: SGS Economics and Planning)

Figure 13: Population plus job density: Adelaide 2011

(Source: SGS Economics and Planning)
3.4 Directions for land use

The growing research base on connections between built form and travel suggests that individual connections are usually small but that the combined effect of a number of regional and neighbourhood level measures can be significantly large. Policy packages to support more compact cities are thus important in the land use/transport space, particularly if there is policy intent to slow growth in private car use. This is an important direction in all Australian capital city land use/transport strategies, as discussed in section 4 below.

Densities across large parts of most Australian capital cities fall short of threshold levels identified as required to provide a reasonable range of local services/amenities and a cost-effective public transport service. These reasons, together with wider policy arguments discussed below, support the case for selectively lifting densities. New greenfield urban development in Australian capital cities and infill developments should aim to not fall below the average neighbourhood threshold activity intensity (residents plus jobs) of about 35 people per hectare. The large sections of some cities that fall below this threshold suggests that infill should generally be advantaged by policy, ahead of further growth on the fringe. This will enable more efficient use to be made of existing infrastructure and services and ease the costs of catering for growth. Particular cities will place different priority between such policy directions, reflecting regional/local problems and priorities.

Adelaide is aiming to reach 70 per cent infill by the end of its planning period and Melbourne’s Ministerial Advisory Committee, advising on the city’s Metropolitan Planning Strategy, argued that 70 per cent of growth over the planning period to 2040 should be the infill target for Melbourne. If a city whose population is growing at about 1.5 per cent p.a. achieves 70 per cent infill development over a 20 year period, its density will increase by about one-fifth. Over 40 years it would increase by about one half. A city growing at about 2 per cent p.a. would lift density by about four-fifths over 40 years if it achieved 70 per cent infill. Perth is currently growing at about 3 per cent p.a. but it is inconceivable that a growth rate at this level could be sustained long term. Density increases of 50-100 per cent over the next forty years should be the aim for all the state capitals. This would still leave densities well below current levels for cities like San Francisco.

Analysis by Professor Rob Adams in Melbourne has shown that such density increases can be achieved through infill without affecting 90+ per cent of the existing urban area, via Transit Oriented Development. TOD should be a key policy lever for raising densities and reducing vkt, where the transit in question might be heavy rail, light rail and/or some form of Bus Rapid Transit, operating as part of an integrated public transport network for maximum effectiveness.

If increasing the supply of affordable housing is also a policy priority, as it is in Australian capital city land use strategies, then concerted and specific actions are needed to pursue that objective. TOD type development can help but, on its own, cannot be relied on to increase the supply of affordable housing.
4. Australian capital city land use/transport strategies

How do the land use/transport policy directions outlined above compare to the strategies recently put out for Australian capital cities? In general terms, there is good alignment but with some notable gaps. We illustrate this for Adelaide, Sydney and Melbourne, three cities chosen to illustrate recent integrated land use/transport strategies, and include some discussion on Perth’s long term public transport strategy.

4.1 Greater Adelaide

South Australia has prepared an impressive integrated suite of documents in the state’s Strategic Plan (which sets out seven strategic directions), Planning Strategy, Infrastructure Plan and Integrated Transport and Land Use Plan. The major focus in the following discussion is on the Integrated Transport and Land Use Plan and on those parts of that Plan that deal with Greater Adelaide.

The suite of planning documents start with a sense of what is unique/distinctive about Adelaide, described as (Government of South Australia 2013a p. 6):

.. a quality of life that’s amongst the best in the world, thanks to our unique blend of heritage, culture, scenery, lifestyle, infrastructure, food and wine, safety and liveability.

These qualities are seen as providing the foundation for a strong future state/city. At the same time, and very importantly, the strategic directions recognise fundamental structural economic shifts that are weakening manufacturing employment opportunities and providing opportunities for strong growth in services employment, particularly knowledge-based services. These structural economic changes are tending to increase relative employment opportunities in inner areas and reduce them in outer areas. High population growth in outer areas is, therefore, tending to increase travel requirements.

Such considerations lead to a policy and planning approach that aims to increase the share of Greater Adelaide’s growth that takes place in the existing urban area from the current 50 per cent to 70 per cent over the thirty year planning period. A planning approach that particularly seeks to increase population and jobs in the inner and middle areas is the result, with transport policies and plans intended to support that direction, while also tackling existing transport problems (including the need to improve services across the whole city, including outer areas).

Six main transport/land use challenges are identified (Gov’t of SA, 2013a):

1. growing the role of public transport in servicing our city and urban and regional centres
2. providing efficient connections to export/import gateways
3. prioritising transport infrastructure and services to encourage mixed-use development in central and inner Adelaide
4. supporting lively communities by encouraging active travel modes
5. fine-tuning, maintaining and better utilising our existing transport assets
6. developing and maintaining a planning system that ensures integrated transport and land use.

The 30 Year Plan for Adelaide (Gov’t of SA 2010) seeks to contain growth of the metropolitan area and avoid consumption of highly productive agricultural and horticultural land on the fringe. A more compact and connected city is planned. The Transport and Land Use Plan (Gov’t of SA 2013a, b) includes specific targeted policies and initiatives for inner, middle and outer suburbs. It proposes the following priority solutions to these transport/land use challenges:

- continue improvements to the public transport network: e.g. further rail electrification, station improvements, park and ride upgrades, timetable co-ordination
- bringing trams back to the CBD and inner Adelaide: perhaps the most distinctive element of the Plan
- a redesigned and modernised bus system: based on a corridor approach, with faster and more frequent services, on-road priority and more local services
- integrated planning to support a more compact Adelaide: with a focus on creating mixed use precincts around transport networks and interchanges and encouraging higher densities in these locations
- enhancing vital freight and road traffic corridors: with a focus on gateways, employment/industrial clusters and key corridors
- less reliance on cars, and fewer trucks on city streets: again focusing on encouraging development around urban hubs and job growth closer to where people live, including the CBD
- more travel options and more sustainable and healthy travel choices.

Comments

Compared to the larger cities of Sydney and Melbourne, Adelaide is relatively mono-centric. Its Central Business District accounts for the highest proportion of jobs within the capital city of any state capital (at over 20 per cent). However, the Integrated Plans recognise the need to focus on development across the whole city and detailed project proposals across the various parts of Greater Adelaide are intended to deliver against the above directions, adding up to an impressive set of integrated strategies. The focus on middle and outer suburbs, identification of centres, villages and neighbourhoods and development of transport ideas around supporting such centres is very much in line with the general principles outlined in section 3.

Two issues stand out in terms of the deliverability of the Transport and Land Use Plan. First, the Plan estimates a project funding requirement of ~$29b over the 30 year planning period for projects that may need to be funded by the South Australian and Australian Governments but forecasts a likely availability of only $23b against this total, other things being equal. Increased private sector participation, making better use of existing infrastructure and improving project delivery are noted as some ways that might be used to help ease funding pressures. However, there is no exploration of possible new funding opportunities and, hence, there remains no solid solution to the apparent funding gap of about $6b and no accompanying shorter term (5-10 year) plan that sets out specific funded priorities. This raises some doubts about the deliverability of the Plan.

A second issue of deliverability goes to the expectations that are being placed on public transport. The Technical Document that supports the Plan (Gov’t of SA 2013b) indicates that the public transport mode share target is 10 per cent of metropolitan weekday passenger vehicle kilometres travelled by 2018, up from 6.9 per cent in 2011-12. That share was higher at 7.6 per cent in 2004-05. The transport role to be performed by public transport, walking and cycling will need to grow very much faster than it has in recent years, and on a sustained basis, to well beyond 10 per cent, if it is to support a 70 per cent share of growth taking place as urban infill by the end of the planning period. There must be some doubts about whether the Plan goes far enough in terms of the initiatives in these modes that will be required to fully support such a progressive urban planning direction. This is moving into unknown territory, so it is important that regular performance monitoring takes place, to assist plan adjustment if required. The intent to update the Plan every five years is an appropriate response in this regard. This should be accompanied by detailed 5-10 year plans. Setting vkt targets would help.

4.2 Greater Sydney

Sydney is expecting population growth and growth in the number of trips of 31 per cent over a 20 year period to 2031. Partly reflecting the complexity that accompanies scale, the Sydney land use and, more particularly, transport plan is impressive, if somewhat overwhelming, in its detail and evidence base. The Sydney planning horizon (to 2031) is a little shorter than Adelaide’s (to 2036).

The guiding principles for the Sydney Metropolitan Strategy are (NSW Gov’t 2013, p. 7):

- strengthen Sydney as Australia’s pre-eminent city
- promote and facilitate growth throughout Sydney in a balanced way that reflects community and business feedback and environmental and market considerations
- integrate infrastructure, transport and land use
- provide housing choice while substantially increasing supply to capitalise on existing and planned infrastructure and provide market-led solutions
- sustain a whole-of-government management approach to get things done
- deliver balanced growth through a new planning framework (Subregional Delivery Plans).
A defining and unique part of the Sydney Draft Plan is the nine ‘city shapers’, areas identified (NSW Gov’t 2013, p.7):

...because of their scale and the opportunities they present for change and investment in Sydney. They will shape how our city functions and are critical to Sydney’s growth.

These city shapers are: Global Sydney; Global Economic Corridor; Sydney Harbour; Parramatta; Parramatta Road Corridor; Anzac Parade Corridor; North-West Rail Link Corridor; Western Sydney Employment Area; Sydney’s Metropolitan Rural Area. The focus on these areas is intended to help make sure that transport and infrastructure are close to where people work and live. The Sydney Strategy then sets out minimum sub-regional targets for population and jobs, including a target of at least 50 per cent of all new jobs to be in Western Sydney.

A very strong integrating concept behind the set of Sydney Plans is the idea of a networked city. This concentrates on a hierarchy of urban nodes/areas and the corridors that connect these nodes/areas. At the top end of the nodal hierarchy are Global Sydney, Parramatta, Liverpool and Penrith, together with some specialised centres (e.g. Port Botany; Sydney Airport; Westmead Health; Norwest Business Park).

The networked city concept flows through to the Transport Plan (NSW Gov’t 2012), where there is a detailed analysis of transport corridors (forty six strategic transport corridors) that are required to service the land use pattern. These corridors include a Strategic Transit Network, with associated service standards linked to the position of locations within the hierarchy, intended to provide public transport connectivity to the networked city. Public transport service standards are categorised as mass transit, intermediate transit and local transit.

Comments

The emphasis in the Sydney transport plan is very much strategic and major node/corridor focused. The Plans are very strong at this level but lacking a convincing connection back to the drivers of structural employment growth throughout the city (understood as being subject to current work). The local transport focus remains an area that merits further work. The major focus in the Plan is on the mass and intermediate transit levels. Local transit is relatively underdone, as is the way local neighbourhoods can be supported to play their role in the city. This is reflected, to an extent, in the prediction that total daily trips will increase by 31 per cent to 2013 (all modes) but that bus service kilometres will only increase by 16 per cent. This seems inconsistent in a strategy that is looking to public transport, walking and cycling to play a bigger role, with Western Sydney, where bus will need to be a major focus, being a priority for jobs growth.

NSW Bureau of Transport Statistics projections to 2036 are that vkt will increase in line with population. The projected rate of growth in PT service kilometres over the 25 year period from 2011 to 2036 is 32.4 per cent17, which is less than the 32.8 per cent increase achieved between the five years from 2006 to 2011. The projected PT patronage growth is half as fast again as projected growth in PT service kilometres, which poses risks of deteriorating service standards. Overall, the Sydney plan is not aggressive in terms of tackling growth in car use.

A weakness of the set of Sydney Plans is the absence of an integrated financing/funding plan, linking the long term strategy to a shorter term funded implementation plan. The published Sydney Plans do not go as far as the Adelaide's Plans in estimating the overall investment requirement and likely availability of funds. It is acknowledged that increased spending will be required and some opportunities are noted, being supported by some other very impressive NSW Government investigations (for example, NSW Treasury 2011) but there is no closure on such matters.

The other notable gap in Sydney’s Plans is planning for future airports, whatever the solution. This will be a critical infrastructure issue to get right, particularly in view of the employment focus on the west. The Federal Government’s announcement on 15th April, that Badgery’s Creek will be the site for the second airport, closes this gap but will open a requirement to re-assess the various strategies to ensure consistency with this important policy decision.

4.3 Melbourne Metropolitan Area

PlanMelbourne sets out the planning strategy for the city to the year 2050. It aims to be an integrated land use and transport plan which (Victorian Gov’t 2013, p.2):

...seeks to integrate long-term land use, infrastructure and transport planning to meet the population, housing and employment needs of the future.

To realise the vision for Melbourne as a ‘global city of opportunity and choice’ the plan focuses on the following seven outcomes, each with a set of directions and initiatives to put the plan into action:

- delivering jobs and investment
- housing choice and affordability
- a more connected Melbourne
- liveable communities and neighbourhoods
- environment and water
- a state of cities
- implementation: delivering better governance

The Plan has the best analysis of the changing economic geography of the city, of the three plans examined, with impressive growth in business services, population driven services especially health and education, freight and logistics, but with a loss of manufacturing jobs. It highlights the need to plan for a new economic geography for Melbourne, focused around a polycentric city comprising:

- a substantially expanded Central City (CBD), which unlocks the redevelopment capacity of vast tracts of urban renewal land edging the city centre

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Comments

Unlike the Sydney Strategy, PlanMelbourne does not set job targets within each of the five subregions comprising the metropolitan area. Even in terms of population distribution, the Plan contains estimates of growth within each of the five subregions but sets no targets for the total number of new dwellings needed to house future growth. This makes infrastructure planning difficult.

In terms of providing answers to questions about how PlanMelbourne will actually deliver a transport system for the anticipated "new economy", and particularly meet the transport needs of the majority of people who live and work in the middle and outer suburbs and urban growth corridors, the plan lacks clear direction and firm commitment to specific arterial road and public transport projects. A number of major projects are nominated in PlanMelbourne but these do not comprise a systemic solution for transport infrastructure and there is no shorter term implementation plan to accompany the long term strategy. It is difficult to see how the land use aspirations of this plan will be facilitated by the designated investment in the city’s transport infrastructure. The continued reliance on the radial fixed rail and tram services, combined with a freeway network which is already congested, will struggle to connect people more efficiently to jobs, given that the suburban pattern of jobs relies heavily on good cross town access in middle and outer suburbs, movement demands that are not adequately addressed in the plan.

As with the Adelaide and Sydney plans, there is no infrastructure financing/ funding plan included within the Melbourne policy package.

4.4  Perth Public Transport directions

It is not the intention to review the Perth suite of land use/ transport strategies. However, mention should be made of the impressive strategic plan prepared for public transport to 2031 (DOT 2011). This report was produced by an Independent Panel, which included senior officials and others. The Plan is firmly embedded in Perth’s land use strategy (Directions 2031 and beyond) and reflects transit oriented development perspectives as applied to Perth’s geography. Its vision is that (DOT 2011, p. 20):

- six National Employment Clusters (possibly too many) underpinned by major health and educational institutions and other research and innovation driven businesses
- fewer Metropolitan Activity Centres (MACs) distributed throughout the metropolitan area and operating as sub regional hubs for retailing, services and facilities
- gateways to Melbourne, namely the Ports of Melbourne and Hastings and Melbourne and Avalon Airports, which link goods to markets and people to business and tourist activities.

Public transport will be the preferred choice of travel to Perth’s strategic centres and through growth corridors.

The plan sets out how this is to be achieved, with a target of doubling PT use by 2031, but from a still low base. Projects are classified as increasing the capacity of the existing network (e.g. purchase of new trains and buses), expanding the network (e.g. providing bus lanes along routes that connect major centres and through congested intersections) or transformational projects (e.g. a new rapid transit system for the central northern suburbs). The transformational projects (and some other locations) are highlighted as being particularly suited to application of TOD principles. The plan includes a cost-benefit analysis that estimates a BCR of over 2 at a 7 per cent real discount rate and close to 4 at 4 per cent, over a 40 year analysis period. It sets out an estimate of its implementation cost but does not detail a funding plan.

In terms of alignment between the city’s land use plan and setting a clear strategic direction for public transport, and the analysis and evaluation of the plan, the Perth PT Plan is very high quality. It could pay more attention to the important role of local public transport in promoting social inclusion, a weakness that is common to all capital city transport plans, but its regional level focus and analysis is very strong. Funding also requires further work.

4.5 Conclusions on capital city land use transport integration

This analysis has looked at three city plans in some detail and at the public transport strategy for another city. All plans reflect the COAG objective for capital cities, nuanced for local values, and see transit oriented development as a very important delivery tool for more compact cities, which all are seeking to achieve. All have made progress in terms of the integration of land use and transport at regional level, which is where the major benefits from integration will flow and, associated with this, where the main impacts on reducing private vehicle vkt will happen. The main shortcomings, from the perspective of transport supporting land use, seem to be:

- not enough specific focus on how densities will be increased in middle and outer areas and on how land transport can best support this, particularly public transport, walking and cycling
- insufficient focus on building strong neighbourhoods and on ensuring that local transport is supportive
- the lack of shorter term integrated financing/funding plans, which is a serious shortcoming in terms of implementation and achievement. This is probably the biggest single weakness.

While the literature survey reported above indicates that built form can affect vkt to an important extent over the long term, none of the plans explicitly targets outcomes in terms of vkt. This may explain the rather soft projected outcomes on vkt growth in some (not all) plans, where vkt growth is generally in line with projected population growth. This suggests having a bit each way on development futures in the cities in question, with reduced likelihood of substantially improving the sustainability of land transport outcomes.
5. Conclusions

The current interest in growing infrastructure investment in land transport focuses attention squarely on the quality of our integrated land use/transport planning, if we are to achieve the kinds of future cities that we want for our current and future citizens and visitors. Land use transport integration needs to begin with a conception of a city’s desired future land use and then use transport and related initiatives to deliver on that land use. Land use and transport are inseparable and need to be linked to wider infrastructure and service requirements on a place basis, including funding plans that are crucial for implementation, if a city is to maximise its chances of delivering on its vision for the future. Total vehicle kilometres of motor vehicle travel (vkt) provides perhaps the best single indicator of the sustainability of the land use/transport outcome within this policy environment, albeit an incomplete indicator.

Starting on the land use side, infill development should cater for the greatest proportion of growth, to align with and enhance emerging structural economic trends (which are centralising jobs) and minimise the costs of catering for growth. Development should be focused on locations with the best accessibility, particularly trunk public transport accessibility (Transit Oriented Development). Minimum density targets of about 35 people plus jobs per hectare should be adopted, to support development of 20 minute neighbourhoods across our cities, and overall urban densities need to increase by 50-100 per cent over the next 30 or so years, with allowance for local circumstances.

With sufficient well targeted investment in networks and services, these transport policy directions will be strongly supportive of delivering more compact cities. Policy clarity and program alignment are critical to success. Taking account of the various research findings presented in the report, urban transport system development, with a focus on people movement, should seek to support more compact settlement patterns in Australian capital cities by:

- ensuring that adequate trunk public transport capacity is available to facilitate growth in the central city and movement around the central city. This is primarily about sustaining productivity benefits from agglomeration. This transport policy direction also means ensuring that walking and cycling opportunities are provided to support safe trip making by central/inner urban residents and by others travelling to/from this area. This will support greater dwelling density in the centre. Peak people movement to/from central cities is not effectively undertaken by car, so transport policy should ensure that public transport, walking and cycling have priority over improved car access. Increasing parking charges and limitation of car parking spaces can support these policy directions, as can giving road use priority to the low impact modes of light rail, tram and bus, plus walking and cycling, in inner suburbs, as part of transport network management plans

- ensuring high quality arterial road capacity exists to support high frequency circumferential operation of road-based PT systems (and freight) in middle and outer suburban areas, crossing radial road lines and joining up major activity centres/clusters. High quality opportunities for walking/cycling should be provided within and to/from activity centres and clusters. Improving accessibility should assist in promoting job growth in major activity centres, as part of an integrated set of measures to promote activity centre development. Target PT service frequencies on the trunk circumferential middle-out outer suburbs in the larger cities should be 15 minutes or better for most service hours (which should be from about 5.00am to midnight in most cases)

- providing flexible local PT services to/from transport nodes and local activity centres, at a frequency that will help to facilitate social inclusion and with safe access opportunities. Relevant local PT service frequencies should certainly not be any less than half hourly from 6.00am to at least 9.00pm, with 20 minute frequencies being preferred and some service available outside the core time band. Alignment of frequencies between local and trunk PT services is important to maximise patronage potential

- attaching high priority to safe walking and cycling within and to/from local centres, to support greater use of more sustainable travel modes and also assist development of more compact settlement patterns

- providing high quality trunk PT services between outer growth suburbs and the most proximate employment hubs, ensuring that road capacity is sufficient to meet these PT service needs (if rail is not available).

- longer term, reforming road pricing, to make road users accountable for the social costs of their travel choices, as discussed in BIC Policy Paper 1 (Stanley 2014). This will also enable improved pricing of public transport services.

Governance arrangements, which are beyond the scope of the current paper, need to support these policy directions.

Based on the (mainly US) quantitative research cited herein, plus an assessment of Australian travel growth experience over the past decade or so, this paper concludes that a combination of 50-100 per cent density increases by 2050, achieved primarily through TOD and embedded in long term land use/transport strategies, combined with substantially improved public transport service levels and walking/cycling opportunities and, in time, reformed road pricing (Stanley 2014), should make it feasible to lower the growth in capital city vkt substantially below the rate of population growth, with the ambitious target of no increase in vkt within reach. **BIC believes that capital city integrated long term land use/transport strategies should target zero growth in vkt as a key performance indicator. This will enable the benefits of good accessibility to be maintained while limiting the undesirable social costs of motor vehicle use.** No current long term plans have this targeting. **Without this target, vkt is likely to be only an indicator of failure after the event!**

Achievement of zero growth in vkt offers huge potential benefits, provided that integrated land use/transport policies and plans target continuing improvements in urban accessibility. These potential benefits include (for example):
• congestion cost savings: the BTRE (2007) has projected congestion costs in our capital cities doubling from $10b in 2005 to $20b in 2020. These costs will not stop growing at 2020. Removing the private vehicle growth component is likely to save about $6-7b annually by 2020, which is large relative to the annual urban road budget, and save even larger amounts beyond that time

• reductions in greenhouse gas emissions. GHG emissions from road transport will need to fall by about 80-90 per cent by 2050, if Australia is to play its part in global efforts to contain temperature rises to 2 degrees. Zero growth in private vehicle vkt will make a significant contribution to this target (Stanley, Hensher and Loader 2011), supporting the major contribution that will need to come from decarbonising motoring

• road accidents will decline. With the external costs of accidents currently being of a similar order to congestion costs (Stanley 2014), this is another source of huge potential benefit

• an improvement in community health, from increased incidental exercise. Magnitudes here will also be substantial, given estimated health costs from inactivity of $14b annually (Moving People 2030 Taskforce 2013)

• improvements in social capital, sense of community, social inclusion and associated well-being, which will flow-on to economic productivity gains. Australian research supported by BIC has shown the very high benefit value of improvements in these areas (Stanley et al. 2012)

• savings in road infrastructure costs, which can be used to improve accessibility (e.g. by improving public transport, walking and cycling and increasing urban densities) and free up resources to tackle other societal challenges.

The focus on zero growth in motor vehicle vkt should remain in place at least until such time as a reformed road pricing regime is implemented. New freeway/tollway construction must be managed so that it does not inhibit target achievement. This will require public transport/walking/cycling improvements to be correspondingly greater.

BIC encourages all those interested in the future of our cities to get involved in discussing these important policy directions.
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