Public Transport Network Planning in Australia: Assessing current practice in Australia’s five largest cities

Paul Mees and Jago Dodson
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Paul Mees, RMIT University
Jago Dodson, Griffith University

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About the authors

The authors of this report are Paul Mees of the School of Global Studies, Social Science and Planning, RMIT University and Jago Dodson of the Urban Research Program, Griffith University.

Corresponding author: j.dodson@griffith.edu.au
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Introduction

For many decades public transport has been subordinated in the policy priorities of dispersed cities in North America and Australasia. But public transport is increasingly recognised as a crucial component of a sustainable and functional city. Long term neglect has left urban public transport networks in such cities suffering from poor service quality marked by weakly integrated services with limited capacity to serve a wide array of potential customer travel demands. Much contemporary planning theory holds that land-use is the determinant of public transport use such that improvements to public transport services will fail on patronage and financial criteria unless they are paired with extensive changes to adjacent land-uses. The result is that many existing dispersed contexts, especially those found in the extensive suburban realms of North American and Australasian cities are not receiving the requisite improvements in services that could assist them to overcome their current levels of car dependence and the sustainability, climate and resource deficits this dependence implies.

In contrast a new literature has emerged over the past decade which demonstrates that public transport can provide a well patronised and financially sustainable service within suburban contexts without relying on land-use changes. This literature typically focuses on European practices of public transport planning involving rigorous attention to providing a seamless integrated and coordinated set of highly legible public transport lines within a clearly structured overarching metropolitan network that offers seamless travel across almost all parts of the day. This service quality is achieved through specific planning techniques of line and network planning and coordination supported by easily comprehensible fare and timetable structures delivered through robust and capable institutional formations. A consensus appears to be emerging that an overarching public transport network planning agency is necessary to achieve this level of planning and service provision. The emblematic case of such institutional structure is the Verkehrsverbund model found in many German, Austrian and Swiss cities (Pucher and Kurth 1995).

Australian cities face a considerable array of urban problems which can in part be resolved by improved public transport provision. These include high levels of automobile dependence which in turn produce high greenhouse gas emissions. Many areas of Australian cities are ‘forced’ into car dependence by public transport service deficits (Currie et al. 2007) which also expose their often socio-economically disadvantaged populations to the adverse effects of rising fuel prices under conditions of increasing global petroleum scarcity (Dodson and Sipe 2008). Planners have recently reached to place-making techniques to improve the ‘liveability’ of cities through urban renewal and local amenity improvements often predicated on pedestrian activity. Such place-making often depends on high quality public transport access to such revitalised urban spaces to avoid the need for car circulation and parking provision, both of which detract from local amenity. There is therefore a wide-ranging need across a raft of security, policy and design dimensions of Australian cities to improve the delivery of public transport and increase user amenity. The new public transport network planning literature thus appears to offer insights into how such improvements might be effectively and efficiently achieved.

Despite the considerable significance of public transport for the future sustainability of Australian cities there has however been uneven scrutiny of the way Australian public transport networks are planned and managed institutionally. The increasing delineation and specification of institutional factors apparent within the emerging literature on public transport network planning now offers the opportunity to test the performance of Australian public transport planning against this internationally demonstrated high performance. Such scrutiny could assist public transport planners, urban managers, political leaders and the wider public to better understand how Australia’s public transport networks are performing and how they could be improved. This
scrutiny can also help recognise some of the successes in public transport planning in Australia on which further advances might be built.

To achieve this task the present paper investigates the performance of Australia’s urban public transport networks and institutional structures against the theory of public transport network planning that is emerging in response to practical planning advances reported in the literature. The paper has four key tasks. First the paper rehearses the key principles and practices of high performance public transport network planning, the strategies that contribute to a high quality network and the institutional structures that support this approach. Next the paper considers the features of Australian cities that differentiate them as a group from cities elsewhere. Then the paper considers Australia’s five largest cities – Sydney, Melbourne, Adelaide, Perth and Brisbane – in turn to assess their recent history of public transport planning, their institutional vehicles for network planning and their approach to network planning. This assessment is based on secondary review of key operational and planning documents supported by the authors’ knowledge of these cities. Finally the paper concludes with some observations about necessary steps for improving public transport planning in Australian cities.

Public Transport Network Planning Principles

The transport research literature demonstrates a growing recognition amongst scholars that public transport planning depends on a more robust planning basis than simply infrastructure provision, service delivery and scheduling. There is a growing appreciation that the way public transport is conceptualised exerts a strong influence on how it will be used in cities. An increasing volume of literature demonstrates that conceiving public transport as an interconnected network of temporally and spatially integrated lines that delivers seamless mobility through urban space leads to a planning approach that is superior to conventional service and infrastructure delivery. Cities in a number of European countries such as Germany, Austria and Switzerland as well as others in North America, such as Vancouver and Toronto have demonstrated that close attention to the planning of public transport as a clear and coherent network of integrated lines with minimal transfer frictions supports higher levels of use by urban residents. Cities which are not yet following this model may therefore benefit from benchmarking their current performance against those who have been recognised as demonstrating good network planning practice. Australian cities in particular can benefit from such relative assessment.

A previous paper by the authors (Dodson, Mees, Burke and Stone, 2010 draft) examined the literature on public transport network planning to identify the overarching network strategy and key network principles and practices that underpin good network performance. The paper identified two alternative strategies that are typically found in dispersed North American or Australian cities. The first was described as a ‘radial’ strategy in which services are overwhelmingly focused on serving radial trips from suburbs to the city centre, oriented to achieving single-seat journeys (Thompson and Madoff 2003). This strategy supports few non-radial trips and is poorly suited to meeting the multi-directional multi-destination travel demand found in dispersed cities. The second strategy was described as a ‘ubiquitous’ or ‘dispersed’ network strategy in which public transport lines serve a diverse array of multi-directional trips beyond those catered to by radial services (Mees 2000; Nielsen et al. 2005). Such a strategy depends on transfers between services to enable diverse journeys beyond those catered to by radial lines. This network strategy was identified as having the potential to overcome the problems of dispersed urban patterns if rigorous coordination is applied to limit the ‘friction’ of transfer between individual lines. The design of a multi-directional network and the coordination of transfer opportunities depends in turn on two network planning principles, supported by a set of key practices to apply them operationally.
The first principle is to provide a simple and stable inter-connected network of public transport lines throughout the day with a structure and timetable that is easy for users to learn and understand (Nielsen et al. 2005). Simplicity in this context means that lines follow direct routes that can support fast operating speeds with clear nodal points at intersections with other lines. Straighter, in most circumstances, also implies faster. Stability implies a regularity of service frequency during the day so that users can easily learn the service timetables for key periods (Mees 2010).

The second principle of network planning is to accept and support the proposition that many, potentially even a majority, of travellers will need to transfer between services to access their selected destination. This need is heightened in dispersed cities particularly those with only moderate or limited degree of activity concentration beyond the city centre. As Thompson et al (1976, p. 9) observed:

it is very unlikely for a traveller to find their trip both beginning and ending on the same route. Therefore, tremendous emphasis must be placed on the task of making the transfer easy.

Transfers are made easy by coordinating timetables between services to reduce waiting times. This is perhaps the most crucial feature of successful network planning but it is often given little attention in wider discussions of public transport planning within cities.

The two principles set out above can be applied through five key practices that support public transport network planning. These five practices, in summary include:

*Key practice 1: Simple and direct network structures*

Public transport networks should be organised on the principle of ‘one section – one line’. The fundamental principle is to provide simple direct lines whose physical routes can be easily remembered whether individually or within the wider network. Network planning should also limit deviations in the physical routes for bus lines on the principle that direct routes will attract patronage by offering faster operating frequencies than by offering wide spatial accessibility. Line network structure design should thus seek to consolidate and concentrate multiple similar adjacent lines into unified simpler lines which can offer higher frequencies and direct routes.

*Key practice 2: Plan a hierarchy of lines into a network*

Public transport networks require a hierarchy of interconnected lines that differ in capacity and speed with scale of operation. The range of lines in a typical hierarchy can be broadly categorised as: high-speed high-capacity cross-town links; inter-suburban connecting links; and local feeder services. Connecting lines together should create a simple network structure.

*Key practice 3: Plan for speed, consistency and reliability*

Public transport planning should aim for travel speeds comparable to or faster than door-to-door travel times that can be achieved by car (Nielsen et al. 2005; Mees 2010). This involves vehicles being able to travel fast along routes with minimal impedance from other traffic or intersections to ensure reliability. This in turn requires interventions to support priority for public transport vehicles, through right-of-ways, dedicated lanes and priority at intersections.
**Key practice 4: Coordinate convenient transfers**

The need to transfer for most trips in a distributed network means that journey speeds also depend on quick transfers. At the network scale the key task is to provide a basic structure of lines operating at high frequency so that waiting times at stops on these lines are minimal and timetables are not required. Frequencies of six services per hour (every ten minutes) are the minimum necessary to avoid timetabled connections, with 12 services per hour (every five minutes) preferred (Thompson et al. 1976; Nielsen et al. 2005; Mees 2010). This can include using techniques such as ‘timed transfers’ or ‘pulse’ timetabling to ensure simplicity and minimal waiting times.

**Key practice 5: Provide clear, ubiquitous and consistent information and marking**

Clear accessible information for passengers is a key element of public transport networks. Stops should provide sufficient information for passengers to locate the stop within and navigate across the public transport network. Information about timetable frequencies for services on that line should be included as well as information about zones and fares. Major trunk stations should provide ticket purchase opportunities.

**Instituting Network Planning**

The application of public transport network planning principles to a given public transport network is not sufficient to achieve high performance. Institutional factors also play a strong role in shaping planners’ capacity to design a coherent integrated network of lines and their managerial capacity to procure such the services that operate on these lines. A key finding in the scholarly and wider technical literature suggests that a dedicated public transport planning agency is a key institutional ‘infrastructure’ in the management of urban public transport. Buchanan and Partners (2003), Wickham et al (1999) and Atkins (2001), for example, as well as the Australian Senate (2009) found that a regional public transport planning authority was a key feature of good practice in urban public transport policy implementation. The transport planning literature is sparse though on the optimal design of public transport planning agencies. A model that has been clearly praised by multiple scholars is the European Verkehrsverbund (EVV) model developed in Germany and replicated among other European cities, especially in Austria and Switzerland (Pucher and Kurth 1995).

The European Verkehrsverbund model embodies the institutional delivery of the principles underpinning good contemporary public transport network planning. These include: planning a fast efficient network, specifying all service characteristics for operators and managing subsidies, designing fare structures to support the network, undertaking marketing of the overall system, and managing the network financing (Pucher and Kurth 1995). The overarching principle underpinning the EVV approach is the recognition that a single central authority is responsible for the delivery of the network as a whole, not just the provision of a set of associated but not articulated lines. In effect the ‘offer’ made to the customer by an EVV is the public transport network overall, not just the service selected for a given journey. This view is encapsulated by the motto of the Zurich Verkehrsverbund: “one ticket for all”. The EVV model appears to be scalable; the regional town of Schaffhausen in Switzerland, for example, achieves mode shares for public transport that exceed the performance of all Australian cities and many European cities despite a small, dispersed rural context. This in part is due to the intensive coordinated efforts of the Verkehrsvertriebe Schaffhausen – a replication of the EVV at medium scale.

Cities that have implemented the key public transport network planning principles summarised above and which also have dedicated public transport planning authorities modelled on the EVV example that is tasked with delivering an integrated network based on these principles may be considered to represent good public transport planning practice. Some variation in performance
between cities is to be anticipated if urban factors are take into account. Thus the Zurich Verkehrsverbund appears to be the best performing metropolitan example of such a model in Europe and is exceptional internationally (Mees 2010). In the North American context Vancouver also represents the closest approximation to the EVV model and possesses a public transport network that reflects many of the principles of public transport network planning described above. These two cities therefore offer a useful comparison to Australian cities both in terms application of good public transport network planning practices and through the relative performance achieved through this effort. The next section assesses the current context for public transport network planning in Australian cities.

Public Transport in Australian Cities

Much of the literature on public transport network planning assessed in the earlier review by Dodson, Mees, Burke and Stone (2010 draft) drew on the empirical experience in European cities. Nielsen et al (2005) for example based their extensive and detailed assessment of network planning on European. Pucher and Kurth’s (1995) exposition of the EVV model was based on seven German, Austrian and Swiss cities. Australian cities resemble European cities in some aspects but also exhibit considerable differences which must be recognised if the emerging literature on public transport network planning principles is to be productively applied here. This paper is not intended to offer a comprehensive comparison of the structure, form and transport provision in European and Australian cities. The following section though provides a brief overview of some salient features of Australian cities which should be recognised when assessing the potential for application of public transport network planning principles in Australia.

Australian cities differ from many European or many US cities at the level of aggregate urban structure. Australian cities combine both the urban compactness of many European cities with the suburban dispersion of many US cities especially those developed after WWII. Thus the centre of Australian cities is often dense in and around the CBD while the suburbs of Australian cities are relatively dispersed compared to European cities. Yet this dispersion is not as great as is found in many US cities as employment decentralisation has not been as extensive in Australia (Freestone and Murphy 1997).

Another characteristic of Australian cities that sets them apart from most European cities as well as many American cities is the scale of their suburban heavy rail infrastructure. Unlike other European jurisdictions, such as the UK, where heavy rail networks were developed primarily for inter-metropolitan travel or as underground inner-urban metro systems, Australia’s urban heavy rail networks were provided to support suburban expansion (Davison 1974). The suburban role in which heavy rail has been deployed in Australian cities gives it a different character to rail systems in most North American or European cities. Australian suburban services can carry higher volumes than trams or light rail given their engineering but are often required to operate on short stopping patterns that reflect their suburban market. Many of Melbourne’s metropolitan lines, such as the Glen Waverly line, for example, have stations every half-mile rather than the multiple kilometres found on suburban networks in Europe.

Australian suburban heavy rail therefore holds a more significant position in Australian cities, in comparison to European or North American cities. There are few comparators to Sydney’s, or Melbourne’s immense suburban rail networks to be found in either Europe or North America. Rail based cities such as Stockholm or Copenhagen display quite different structures to Australian cities. No UK cities have suburban rail networks of the scale or structure of Australian cities; the design of London’s underground, for example, is closer to a metro than a suburban network. Where suburban rail does operate in other UK cities, such as Manchester or Birmingham, operations typically rely on lines designed primarily for inter-city use. Toronto’s noted heavy rail system is much less developed than the networks found in any Australian city other than Adelaide. Vancouver’s Skytrain operates akin to a light rail metro rather than heavy rail. The
primacy of suburban rail in Australian cities poses two challenges from a network planning perspective. The first challenge is that Australian heavy rail is typically radial in structure and thus is to utilise the sunk infrastructure and efficient right of way provided by the extensive heavy rail lines to underpin an overall metropolitan network.

A second feature of Australian cities is the role of bus networks. Among the public transport modes, buses played the least important role in processes of urbanisation in most Europe, North America or Australasia. In most cities buses were used as a supplement or replacement for earlier tram networks. Trams largely underpinned early suburban development in Brisbane, Sydney and Melbourne. In Brisbane, for example, trams played a comparable suburbanising to than the suburban railway by filling gaps between the rail lines. Buses were replaced by trams in Australian cities in the 1950s and 1960s, with the exception of Melbourne. In many instances this was a simple modal substitution with buses plying routes previously followed by trams. In Brisbane and Sydney buses continue to play a major role within the public transport networks. Brisbane’s buses, for example, now carry more passengers per day on average than the region’s train network. In Melbourne buses play a more supplementary role to trains and trams, as described below.

A further feature of Australian public transport networks is the historically weak integration of the rail and bus networks, although this phenomenon is not unique to Australian cities. Rail is capable of carrying high passenger volumes long distances on dedicated rights of way that guarantee free running. Buses can easily access surface streets but over long distances face delays from traffic and signals. Few Australian cities exploit the potential to use buses as a local or inter-suburban intermediary or ‘feeder’ for fast cross-metropolitan rail networks. Instead buses often operate along parallel network lines in competition with rail services while providing few cross-suburban lines that offer orbital travel opportunities. This pattern is clearly demonstrated in the structure of Brisbane’s rail lines and major bus lines which are compared (see below). Such patterns suggest considerable opportunity for network planning to reduce inter-modal competition and support wider integrated cross-suburban travel opportunities.

The differences in the role of rail and bus modes in Australian cities should not be construed as implying an impediment to much greater public transport use. Rather the realisation of important differences should be used to inform appropriate crafting of the universal principles of public transport network planning to the particular urban structural and modal context of the Australian city. Nor should such modal and network questions be recruited as an excuse for improved public transport planning. For while technical differences may be encoded in the physical networks, the institutional infrastructure that shapes and manages these networks also has a considerable role to play in achieving higher performance.

The poor integration of modes in Australian cities is in part due to the failure of policy makers and planners to overcome the legacy of institutional fragmentation that has marred the history of urban public transport planning here. In most of the major cities suburban rail systems and tram (subsequently bus) systems were developed as separate entities and typically managed by different authorities, sometimes even in overt or indirect competition with each other. Such tendencies towards network and institutional fragmentation persist to greater and lesser degrees and despite institutional innovation in some jurisdictions. While Melbourne and Sydney are clear cases of this problem even Brisbane still suffers from such issues (Dodson et al. 2010). Such fragmentation is not unique to the Australian context but reinforces the difficulties faced in achieving appropriate modal integration especially the task of using rail for cross-metropolitan travel fed and supported by bus linkages.

When viewed from a public transport network planning (Dodson, Mees, Burke and Stone 2010 draft), the highly centralised activity structure and dispersed suburban pattern found in Australian
cities implies the need to coordinate services to provide seamless go-anywhere-anytime services. Such coordination is common in overseas jurisdictions especially under the EVV model. This is rarely the case in Australia though. Yet the preceding discussion could be considered misleading if it were to imply that Australian cities are uniform in their integration and management of public transport networks. Indeed network planning of public transport across the major cities is an unevenly pursued venture with a high degree of variability both between and with these cities. The subsequent case studies which assess each city in turn assist to illuminate this view. Furthermore, while they part of a distinctive national collective each Australian city faces particular public transport network planning problems of its own.

The remainder of this paper examines the current state of public transport network planning and of the governing institutional frameworks to identify current planning and management weaknesses and opportunities for improvement. The examination follows a stepwise method: each city is examined in turn via a background summary of the its current performance followed by a review of the capacity of current institutional structures and an assessment of the extent of public transport network planning achieved. A short summary is provided for each.

City Case Studies

Sydney

Background

Australia’s largest metropolis is also its most transit-oriented. Despite some well-publicised problems with its rail system over the last decade, Sydney has by far the highest public transport usage rates and mode shares of Australia’s cities. However, these high utilisation rates are largely a product of Sydney’s well-patronised rail network, which has maintained its share of work trips for more than three decades; mode share for buses declined rapidly until around a decade ago, and is now much lower than usage of trains. Ferries, while popular with tourists, play a minor role in transporting Sydneysiders, accounting for less than one per cent of work trips.

The relatively high use of rail in Sydney is the result of high mode shares for key employment markets, which have for most of the past century been highly centralised (Freestone and Murphy 1998). Most workers employed in Sydney’s Central Business District (CBD) travel by public transport: around 46% use trains, 22% buses and ferries, 7% walk or cycle and just 19% travel by car (Christie 2010, p. 142). Limited parking and congested road conditions are important factors in the success of public transport, as are the relatively high speeds of rail services. Some major suburban employment nodes also exhibit high public transport mode splits: in North Sydney rail attracts 43% of workers and bus a further 20%, compared to the car’s 37%; the public transport share is also above 30% in Chatswood and St Leonards (Christie 2010). This relative success reflects a long legacy of planning policies promoting concentration of employment and major retailing in rail-oriented district centres, dating back to the County of Cumberland Plan of 1948.

Rail also carries 11 per cent of travellers to Sydney Airport, with a further 4% using buses (Booz and Co. 2010, Figure 1).

However, while rail is a strong performer in Sydney, it does not link well with other forms of public transport. The 2004 Household Travel Survey found that 47% of train passengers walked to the station, 35% came by car and only 16% used buses (TDC 2006, fig. 4). Similar patterns were revealed by the 2006 census which showed that the number of Sydney residents using a single mode of public transport (‘train only’ or ‘bus only’) to travel to work had increased by 6.7% since the 2001 census, but the number using multiple modes had declined substantially, resulting in an overall fall in public transport use of 1.3% (TDC 2008, fig. 3). Bus services in Sydney’s inner region are of relatively high quality despite poor integration with rail, and are well-patronised; service and patronage levels are much lower in middle and outer suburbs.
There has been much public debate in Sydney over recent years about the quality of public transport. In 2009, the *Sydney Morning Herald* commissioned a team of local experts, chaired by former head of the Olympic Roads and Traffic Authority Ron Christie, to report on public transport. The ‘Christie report’, released in 2010, identified a range of issues including inadequate funding and forward planning for new public transport infrastructure, poor integration of different public transport modes, poor orbital and cross-regional links, and ‘fragmented and politicised’ governance arrangements.

*Institutions*

Sydney has no overall public transport operating agency, although there was a short-lived Public Transport Authority in the 1970s. Services are delivered by a range of public and private sector entities, with the Department of Transport and Infrastructure responsible for overall coordination. In the last two years, the public sector operators – Sydney Buses, Sydney Ferries and RailCorp – have lost their status as statutory corporations, becoming divisions of the Department, now renamed Transport NSW. In addition to Sydney’s public transport, the Department is also responsible for state-wide taxi, and hire car, tourist bus, rail passenger and freight, community transport and air services.

The public agency Sydney Buses operates services in the inner suburbs and North Shore. When its predecessor body was established in the 1920s, it was given jurisdiction over the whole of Sydney’s built-up area, but the boundaries were never adjusted to deal with urban expansion into new suburban zones. In many middle and outer suburban areas services are provided by numerous private firms. For decades, these firms planned their own services with the Department’s role confined to regulation and payment of public subsidies, but increasing financial problems led to new arrangements in 2006, under which private bus operators are now paid as sub-contractors to the Department. In theory, these new arrangements should permit integrated network planning, but this has taken second place to concerns about the financial viability of the operators. Under such conditions planning effort focuses on contract management rather than service integration.

Sydney’s single light rail line and monorail are operated by the private Metro Transport company, and fast catamarans to Manly by Manly Fast Ferries. The New South Wales government has rejected the 1998 advice of a Special Commission of Inquiry conducted by Bret Walker SC to ‘privatise’ the regular Sydney Ferries service.

The final players in public transport provision in Sydney are two regulatory agencies: IPART (the Independent Pricing and Regulatory Tribunal), which assesses fare and other regulatory issues, and ITSRR (the Independent Transport Safety and Reliability Regulator), responsible for regulating safety and other issue on the state-wide rail system.

The Christie report is severely critical of ‘the inconsistent, fragmented and politicised nature of Sydney’s public transport governance’ (Christie 2010, p. 84). The report described the core problem thus:

> No single agency currently has the authority and resources to ensure that the entire system works coherently to produce the best possible accessibility for public transport customers and the best possible economic, social, environmental and energy-efficiency outcomes for Sydney (p. 84).

The report recommends the establishment of a regional public transport agency modelled on arrangements in ‘best practice’ cities, which in the Christie report are identified as Perth, Brisbane/SEQ, London, Singapore, Vancouver and Zurich. The Vancouver and Zurich agencies have been identified as models in a range of other literature, including the present paper.
Network planning

When assessed against the key elements of network planning, public transport in Sydney shows few signs of advancing a network integration approach. Four decades ago, the authors of the Sydney’s second major metropolitan strategy, the Sydney Region Outline Plan, lamented:

In Sydney’s inner suburbs … there is virtually no bus-rail co-ordination. Many bus routes run parallel to rail routes direct to the City Centre, thereby competing directly with the rail system rather than feeding into it at strategically located interchange stations. Attractive and convenient facilities for transferring from buses to trains are almost non-existent. In many cases, to go from a bus stop to a railway station, passengers have to cross busy thoroughfares, or walk some distance without shelter… Much remains to be done in this area before Sydney can experience the benefits of a public transport system as good as Toronto in which bus and rail services are closely integrated, passenger transfer from one system to the other is made convenient by the existence of carefully designed interchange stations, and tickets for both systems are fully interchangeable (SPA 1968, p. 43).

Unfortunately, change since 1968 has been slow; the Christie report identifies similar problems in 2010.

One clear illustration of the problems posed by minimal integration of services is the fact that Sydney is now the only Australian capital city without a multi-modal ticketing system. While a ‘smart-card’ project is currently underway to provide the metropolis with a new ticketing format this scheme will not result in a multi-modal ticketing system: rather, the smart-card envisaged for Sydney is a technology enabling operators to continue charging separate fares for each stage of a multi-modal journey. The Sydney ‘smart-card’ project has been beset by a number of problems in part resulting from the complex non-integrated ticket system.

The structure of Sydney’s public transport network is extremely complicated, except on the rail system which, under the current ‘Clearways’ program, is moving towards more regular, predictable service intervals and stopping patterns. On major radial bus corridors, a bewildering array of offerings is provided, as illustrated by the route structure presented in the Sydney Buses guide North Shire services, showing bus routes operating along Military Road, Mosman (Figure 1). In all, 44 separate routes operate along this single road: some go to the CBD, others to North Sydney, others to ferry wharves in places like Mosman; some are express routes, others ‘limited stops’ others ‘all stops’; some routes are ‘pre-pay’ services, while others allow tickets to be purchased on board. There are full-time, peak-only, off-peak only, ‘early AM and PM’ and other operating hours regimes. This is an admittedly extreme example, but it illustrates the complexity resulting from attempting to offer a multitude of ‘ready-made’ services along such a corridor. Such network design contradicts the principles of good public transport planning set out above, especially the provision of simple and direct network structures via consolidation of adjacent routes accompanied by consistent service and timetable patterns.
In contrast with the multiple service offerings on many of Sydney’s radial network corridors, cross-suburban lines are still relatively undeveloped, although new high-frequency orbital lines are being progressively introduced. In suburban areas, the problem is often the opposite: thin service offerings, characterised by long, indirect, slow lines with historical patterns and operator territorial boundaries inhibiting the establishment of coherently integrated regional networks.

Facilities for transferring passengers are typically poor in Sydney, as discussed above, especially beyond the inner city, although some purpose-designed interchanges have been provided at major stations such as Bondi Junction and Parramatta. Bus-to-bus transfers are usually extremely unattractive with limited coordination. Ticketing persists as a weak point in Sydney’s network. Although a limited range of multi-modal tickets, generally periodicals, is available, most occasional users must still pay separate fares for each leg of a trip. Region-wide passenger information and signage is patchy: there is no common livery or ‘brand’, and it is not possible to obtain a single map showing Sydney’s rail, tram and bus routes (Sydney Buses does produce high-quality maps, but only of its own services), whether at the metropolitan or sub-regional scale.

There seems to be increasing recognition in Sydney of the absence of, and need for, network planning. A report by the University of Sydney’s Warren Centre [REF] promoted a network planning approach, which was partly taken up by the 2004 review of bus services which led to the financial changes noted above. The recent Christie (2010) report stresses the need for network planning repeatedly, and gives this as a main reason for its proposed reforms to governance. The New South Wales government’s recent Metropolitan Transport Plan [REF] has little to say on the subject, but the government’s bus reform program expressly identifies ‘fast, frequent, direct bus services’ and ‘an integrated bus network’ as priorities (New South Wales Government 2005). Integration with other modes of transport does not yet appear to be a major government priority.

Summary

In summary therefore Sydney remains a strong performer in terms of overall public transport patronage, especially for work journeys. This is a consequence more of the historical development of the city’s urban structure, in which high capacity radial routes serve an intensely
developed urban core that imposes heavy constraints on private motor vehicle travel, than it is of deliberate recent strategy. Sydney’s public transport performance thus rests heavily on the planning achievements of the early- and mid- 20th Century. While future land-use planning in Sydney is likely to perpetuate this structure with marginal modification it will potentially also pose limits on wider patronage growth, in the absence of other factors. If public transport use is primarily hitched to a centrally focused pattern of employment growth and location then greater use of wider range of travel purposes and destinations will be difficult to achieve. Sydney’s high level of public transport use gives it a solid base from which to capture a greater share of the suburban travel market. But capturing this market will require the delivery of a better service than is presently achieved. Applying some of the principles of public transport network planning described above could support the provision of such service improvements with potentially only modest need for new expenditure. The achievement of such improvements would however require an agency to plan and integrate services and timetables – a task that is unlikely to be organised among the current assortment of agencies and authorities which currently share the delivery of public transport in Sydney.

Melbourne

Background

Melbourne is often depicted as a transit-oriented urban region (eg Cervero 1998), because of the prominence of its inner- and middle-suburban tram system, but travel data paints a different picture. Mode share for travel to work and per capita travel rates (in passenger-kilometres) are much lower than in Sydney, and presently about the same as Brisbane. In the three decades to 2006, Melbourne had the steepest decline in public transport mode share, with an especially sharp drop in work trips by tram/bus. Recent reports of a turnaround in patronage since 2006 may indicate a change in this pattern, but the recent figures should be treated with some caution, as they result from a different methodology from that employed to estimate patronage in previous years (Department of Transport 2008a, p. 23).

As in Sydney, public transport accounts for a substantial majority of work trips to the CBD. Some 61 per cent of CBD workers travelled by public transport in 2006, 8 per cent walked or cycled and 27 per cent used cars (Department of Transport, 2008, p. 5). In contrast with Sydney, however, mode share for non-CBD work trips is uniformly low. This may be partly a result of Melbourne’s much weaker commitment to planning policies favouring rail-oriented suburban centres, but it also reflects a different balance between the speeds of rail and road transport. Melbourne’s trains are slower than Sydney’s, especially outside peak periods where there is virtually no express running, but its cars travel faster, thanks to lower road congestion levels.

Although Melbourne’s trams face impediments from street traffic, service levels (frequencies and hours of operation) are high. Bus service levels are much lower than for trams, even for buses operating in the same areas that trams serve: low frequencies and limited or no evening or Sunday services is the typical pattern, especially for outer suburban bus lines, although recent years have seen some extensions of operating hours. Buses generally serve local and cross-suburban travel markets, with radial travel to the CBD mainly served by trams and trains although some bus lines ply radial routes where rail links are sparse. Inter-modal travel rates are lower than in Sydney, with only 10 per cent of rail passengers using feeder buses or trams to access the station (Mees 2000, p. 232).

Institutions

Public transport services in Melbourne are provided by private operators, under contracts with the Department of Transport. Tram and train operations are ‘franchised’, using a model based on that employed in the 1990s privatisation of British Rail, while Melbourne’s many private bus operators are sub-contractors like their Sydney counterparts. There is no regional public transport agency, following the disbanding in 1998 of the Public Transport Corporation, but the private
operators and the Department have cooperated to form Metlink, a marketing and timetable information service. Although services carry the liveries of individual private operators, they also carry the Metlink logo. A series of additional public and private agencies handle safety, ticketing and customer complaints.

Melbourne’s public transport governance arrangements have been subjected to considerable recent scholarly and political criticism (Mees 2005; Low and Astle 2009). The Australian Senate Rural and Regional Affairs and Transport Committee’s 2009 report on Public Transport was endorsed by Committee members from all parties and observed:

In evidence to this inquiry the key element of good governance was usually said to be a single regional public transport authority with the power and responsibility to plan and deliver the city’s public transport service in an integrated way under a single brand (whether or not service provision is contracted out). Perth has such an authority (Transperth). Brisbane has recently established one. Sydney and Melbourne do not. Melbourne’s franchising out of train and tram operations since 1999 has been particularly criticised for creating a lack of clear accountability for managing the whole network (SRRATRC 2009, p. 40).

The majority report of the 2010 Victorian Legislative Council Select Committee on Train Services stated as its first finding: ‘Responsibility for the delivery of Victoria’s train services is fragmented across a range of Government authorities, private operators and independent statutory bodies’ (Select Committee 2010, p. 7, finding 3.1). On the basis of such assessments and on the variance of the present arrangements from those identified overseas as good practice Melbourne can thus be described as having inadequate public transport governance arrangements. At the 2010 Victorian State election the Liberal Party were elected on a platform that included establishment of a dedicated stand-alone public transport authority. At the time of publication this policy had not been implemented.

Network planning

Melbourne was the first east coast city to adopt a multi-modal fare system incorporating free transfers. This occurred in two stages: a partial system introduced in 1981, then a fully multi-modal system in 1983, following the establishment of a Metropolitan Transit Authority (this body became the Public Transport Corporation later in the decade). Public transport patronage, which had been in continual decline since petrol rationing ended in 1950, stopped declining and began to increase (Department of Transport 2008a, p. 23-25). The biggest increase was on bus services, which acted mainly as local ‘feeders’ to trains and trams, and thus benefited most from multi-modal fares. In the early period of public transport privatisation in Melbourne, some rail and bus operators re-introduced single-mode fares, but these did not last long and the city’s multi-modal fare system is now widely accepted.

However, the introduction of multi-modal fares was not followed up with the integration of services into a unified multi-modal network. Although there are exceptions, timetables and route structures in Melbourne do not make transfers convenient. As bus service frequencies, in particular, are generally low, the absence of timetable coordination can mean long wait times for transferring passengers.

Interchange facilities are also generally poor, and in some cases are becoming worse. A striking example of this is occurring at present. In 2009, the private firm that operates most of the buses that enter Melbourne’s CBD centralised its services along the East-West artery of Lonsdale Street. Passengers travelling to the north or south of the CBD must transfer to trams running north and south along Swanston Street. The Melbourne City Council is currently redeveloping
Swanston Street with the approval of the private tram franchisee and the Department of Transport. As part of the development, the tram stops at Lonsdale Street are being removed, so transferring bus passengers will have to walk an additional city block.

Melbourne does not have the densely-serviced radial bus corridors found in Sydney, because surface access to the CBD is provided primarily by tram. Although multiple tram routes do converge as they approach the city centre, the number of routes is smaller than for buses in Sydney and the inflexibility of trams limits the opportunity for complex route and stopping patterns. As a result, main city arteries like Swanston Street/St Kilda Road, Collins and Bourke Streets are served by frequent, ‘legible’ tram services that attract high patronage from commuters, shoppers, tourists and people travelling within the CBD.

In areas served by buses, things are very different, however. Bus service levels are generally lower than in other Australian cities, and route structures are often complex. Each of the dozens of private firms operating buses in Melbourne paints vehicles in its own livery, adding to the sense of incoherence. Many Melburnians who regularly use trains and trams avoid patronising buses, even on bus routes with relatively high levels of services. A series of long orbital ‘Smart Bus’ routes has been the main strategy deployed to address this problem. These routes have higher visibility than regular buses, with direct routings, distinctive liveries, superior facilities at stops (including real-time information at major stops), and higher service levels. Smartbus frequencies are generally every 15 minutes on weekdays and 30 minutes evenings and weekends: although still low compared with trams, these count as high service levels by Melbourne bus standards. Integration of the Smartbus routes with the rail and tram systems is espoused but not always achieved in practice.

The need for general application of network planning principles to regular services on a system-wide basis is less well appreciated in Melbourne. The state government’s 2008 Victorian Transport Plan describes the need for ‘continued integration of bus timetables with train services’ (Department of Transport (DOT) 2008b, p. 61), but contains no specific proposals for institutional or service planning reform. The emphasis is on infrastructure, with the plan detailing proposed investments in new tracks and rolling stock.

**Summary**

Since the late 19th Century Melbourne has possessed one of the world’s largest urban rail networks that formed the basis for the city’s extensive suburban development. But the city’s planners have never taken full network planning advantage of this extensive infrastructure and service foundation. Instead there is weak in integration between the trams and the rail lines while buses, which fill an inter-suburban and local role beyond the area served by trams, have largely operated independently of the rail networks. The result is an overall metropolitan network that relies on population expansion for its patronage growth but struggles to accommodate this growth on poorly integrated services. Many of the growth corridors into which new population is directed experience poor public transport services, a problem that could be overcome with improved network planning and integration. Current transport plans for Melbourne involve spending multiple billions on new rail infrastructure, including a central city underground link. A considerable question remains in Melbourne as to whether a rationalisation effort to coordinate and integrate currently poorly organised line and network structures could improve operational capacity and efficiency and mitigate the need to build new infrastructure. This would likely be best achieved via a dedicated public transport planning agency.
Adelaide

Background

Adelaide was once a leader in Australian public transport. During the 1970s, it was the only city where public transport usage rates and shares of work travel increased. By the 1981 census, Adelaide briefly surged ahead of Brisbane for mode share for travel to work. This improved performance followed important 1970s reforms to institutions and service planning, including the establishment of a metropolitan-wide public transport authority – initially, the State Transport Authority, now Adelaide Metro – and the introduction of a multi-modal fare system.

However, beginning in the 1980s, concerns about rising deficits led to a reversal of some of the policies of the 1970s. Service levels were gradually reduced, especially on off-peak, evening and weekend services. A particular feature of the period from the 1980s until around 2005 was continuing debate and uncertainty about the future of Adelaide’s poorly-patronised rail system, the last major system in the country that has not yet been electrified. The rail service received little capital investment, some lines were closed and service levels remained poor. Express bus services were introduced that competed with the rail system for passengers. This competition was aided by the fact that Adelaide only has a single major station, located on the northern edge of the CBD; the station is a ‘stub’ or terminal, preventing the operation of ‘through’ services from one side of the city to the other.

Adelaide now has the lowest mode share for work trips, and the lowest per capita usage rates, of the cities discussed in this report, having initially fallen behind Brisbane and more recently Perth. Service levels are generally low, particularly outside peak periods: for example, most rail lines operate hourly in the evening and on weekends, and most bus services provide similar service levels. Rail-bus integration at outlying stations is, however, relatively good, thanks to more than three decades of central planning by a single authority. Low service frequencies acts against the development of the system into a high quality integrated public transport network.

The South Australian government has recognised that Adelaide’s public transport system needs improvement, and has announced plans to upgrade and electrify the main rail corridors, including converting the Port Adelaide line to light rail and linking it with the existing Glenelg tramway. There have also been a number of higher-frequency bus ‘GO-Zones’ introduced; see discussion below.

Institutions

The State Transport Authority was established in 1974 by the Dunstan government. Because South Australia’s rural population is so small, it was effectively Australia’s first metropolitan public transport agency. The STA took over operation of suburban trains (from the SA Railways Department), public buses (from the Metropolitan Transport – formerly Tramways – Trust) and private buses (which served the outer suburbs). The STA operated all these services directly until around 2000, when buses were competitively tendered to private firms, and TransAdelaide established as a separate public sector agency to operate trains and trams. However, Adelaide Metro, the successor to the STA, retains control of timetabling, fares, ‘branding’ and marketing. Adelaide Metro is no longer responsible for rural services, and unlike the STA is not a separate statutory agency, but rather a division of the Department of Transport, Energy and Infrastructure.

Network planning

Adelaide’s bus system operates much in the same way as the buses in inner Sydney discussed above. Although some rail feeders and cross-suburban links are provided, the dominant pattern is

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1 Newcastle also has a small suburban service operated by diesel trains.
direct services from suburbs to the CBD. While service levels on individual routes are usually low, the large number of routes creates a chaotic situation in the CBD producing an inner-city network that is incomprehensible to users, despite Metro’s valiant attempts at information prevision (Figure 2).

Despite the very large number of buses along city streets, the complexity arising from multiple routes and stops means the system is rarely used for travel within Adelaide’s very expansive central business district. Instead, two separate free bus services have been provided for this purpose (one of which has recently been replaced by an extension of the Glenelg tram, which is free within the CBD).

On major approach roads to the CBD, Adelaide’s regular street system and some adept marketing by Metro has enabled provision of a more ‘legible’ service in the form of ‘GO ZONES’. These are street sections along which the combined frequency of converging routes provides a better-than-15 minutes service all day on weekdays (generally with 30 minute frequencies evenings and weekends). Adelaide has been steadily expanding the number of GO-ZONES.

![City Map](image)

Metro Adelaide (2010)

**Figure 2: Selection of bus lines and stops in central Adelaide.**
While they provide the fast direct service indicated in good public transport network planning practice the GO-Zones are structured around a conventional radial network structure which focuses travel to and from the city centre (Figure 3). The concentration of resources on direct links to the CBD leaves little remaining for cross-suburban and local service. Historically, Adelaide had no cross-suburban bus routes at all, but in recent decades inter-suburban services have been added, generally with very low frequencies and limited hours of operation. In addition, outer suburbs are provided with feeder services to train stations. Because train frequencies are so low outside peak periods, these feeders are generally timetabled to connect, but usually do not fully match the operating hours of the rail service.

Adelaide’s fare system has been fully multi-modal for three decades. The city is now covered by a single fare zone, although there is a ‘two section’ ticket for short trips. One feature of Adelaide’s public transport that is worthy of note is its long history, dating back to STA days, of offering excellent passenger information, in the form of timetables, maps and guides, now in printed and on-line form. For decades these have been available at Metro’s popular customer information centre prominently located at a major intersection in the CBD.

The current projects to extend and upgrade Adelaide’s rail system provide an excellent opportunity to create a more integrated, coherent rail-bus system incorporating the principles of network planning. Whether this will be the case or not still remains to be seen, as currently attention is focussed primarily on infrastructure and capital works projects.

**Summary**

Adelaide perhaps faces fewer transport problems than other Australian cities due to relatively modest population growth. And it is making progress on infrastructure improvements to some network links. But the city nonetheless suffers inadequacies in transport provision that are partly tied to the wider planning of its public transport networks. There are clear opportunities for the rationalisation of bus lines in Adelaide especially at key interchanges such as the city centre. While the GO-Zones do satisfy some of the public transport network planning principles of fast (largely) frequent services these still operate multiple lines on the same routes and timetable structuring and coordination has not been optimised. While investing in new infrastructure
Adelaide would do well to rigorously apply the principles of public transport planning set out in this and the previous paper.

**Perth**

**Background**

Three decades ago, Perth’s public transport was in the doldrums. Demand was falling and the car seemed to be the way of the future for Perth, with its car-oriented urban form and extensive freeway network.

As in Adelaide, Perth’s poorly-patronised diesel rail system was threatened with closure, and in 1979 the line to Fremantle was shut. However, in contrast with Adelaide, this policy was decisively reversed: the Fremantle line was opened, and the rail system electrified and substantially extended. The most recent round of rail expansion, which has not yet been measured via ABS Census Journey to Work figures, lifted patronage to 55 million in 2008/9, compared with 65 million for Queensland Rail’s Brisbane Citytrain services (PTA 2009, p. 22; QR 2010, p. 37). Despite recording a lower total number of trips the average resident of Perth made 34 rail trips in 2008/9, compared with 23 for the average SEQ resident (and just ten for the average resident of Adelaide).

Perth now has Australia’s fastest trains, and the most frequent. On all lines, trains now run at least every 15 minutes until 7 pm every day of the year, with 30 minute evening services. While the high engineering standards and technical performance of Perth’s rail system – which is operated with vehicles virtually identical to those used on QR Citytrain services – have justly attracted much attention, considerably less attention has been devoted to the role of network planning in the revival of rail in Perth.

Perth’s busiest suburban station is Murdoch, on the new Southern Railway to Mandurah, which sees around 7000 passengers per day (Martinovich 2008). The station, like most on the Mandurah line, is in the median of the Kwinana Freeway, surrounded by an interchange with a crossing arterial road. With the freeway interchange limiting land-use activity intensity within walking distance of the station, very few rail commuters walk or cycle, and 36% arrive by car (the station is served by a large park and ride lot). The dominant access mode is feeder bus services, which cater for 59% of arriving passengers, a figure unheard of anywhere else in Australia (Martinovich 2009). Although other stations exhibit somewhat lower figures, bus is still the main access mode at key stations on Perth’s busiest lines, the northern and southern routes. The structure of the bus lines to the stations supports fast transfers between modes. At Murdoch Station orbital buses arrive and depart approximately every eight minutes during much of the day and thus connect conveniently to the high frequency radial trains.

To the extent that network planning is intentionally pursued in Perth it is in the recognition by the city’s public transport planners that its dispersed suburban zones and the location of new rail infrastructure within freeway reservations greatly limits the extent of current or future potential ‘transit oriented development’. Instead buses are used to link local suburbs to the rail network. As Martinovich (2008, p. 20) has noted “in low densities the ‘masses’ must be brought or come to the railways” via connecting lines.

**Institutions**

Perth, like Adelaide, has had an authority responsible for the whole of urban public transport since 1974, when the Metropolitan Transport Trust was given responsibility for rail services. The MTT, which initially ran trams, had run all buses in Perth since 1958, when it replaced private bus firms (PTA 2010). Public transport in Perth is now operated by Transperth, a division of the Public Transport Authority of Western Australia. As in Adelaide, the PTA operates trains directly, but tenders bus services (and Perth’s single ferry route) to private contractors, while
retaining responsibility for financial and service planning, and marketing. Although legally a division of the Department of Transport, like its Adelaide counterpart, the PTA operates as if it was a separate agency, with its own CEO, Annual report and published accounts. Transperth is a division of the PTA, separate from the sections that run school and rural services, but also from the division that operates trains. As a result, Transperth is a lean organisation, counting only 57 staff in total in 2009 (personal communication, Transperth, 2009).

**Network planning**

The most impressive examples of network planning in Perth are provided by the northern rail line built in the 1990s (and since extended) and the southern line opened late in 2007. Each line was conceived as an integrated ‘rail-bus’ link, and regional bus services completely redesigned to complement, not compete with, the new rail services.

Integration is most notable in the design of interchange stations along the new lines, such as at Mandurah. Typically, buses exit surface streets and enter the station precinct on a parallel dedicated roadway over the station platform, collecting and setting down passengers at the top of the escalators serving the platform. This enables transfers to take place under cover, and with a minimum of walking. An example of the rail-bus integration model used in Perth is given by bus timetable Number 63 which shows a network sub-region comprising a section of the (northern) Joondalup rail line and an associated set of bus lines (Figure 4). Services on the rail line operate approximately every five to ten minutes with local bus lines operating between the two stations providing rail feeder services on a timed transfer basis to selected train services. The Warwick and Whitfords stations are notable for their integrated design in which buses stop inside the ‘paid area’ of the station (i.e. inside the ticket barriers) enabling passengers to transfer without needing to show, or validate, tickets. This is the only example of such ‘free body’ transfers to be found in Australia.

While the buses serving interchange stations are timed to connect with trains, they suffer one principal drawback. Train services on the north-south route operate at high frequencies – up to 5 minutes in peak period – but connecting buses are less frequent, meaning that each bus route does not offer a connection to every train. Generally, only every second or third train is served, which encourages many passengers to continue using park and ride, especially in the evening peak.

![Figure 4: Feeder bus lines to Whitfords and Warwick rail stations, Perth.](image-url)
Network planning is generally much less pronounced on Perth’s bus system than on the rail system (and also less pronounced on the three existing lines than on the two new ones). The bus system tends to emphasise coverage (short walking distances and minimisation of transfers) at the expense of frequency and legibility. While the recasting of many bus routes as feeders to rail has reduced the number of routes converging on the CBD, Perth buses still exhibit a similar pattern to those in Adelaide and inner Sydney, albeit with better cross-suburban connections. When multiple routes converge on corridors approaching the CBD, little attempt is made to take advantage of the high combined service levels, along the lines of Adelaide’s Go Zones. And the distribution of bus services within Perth’s spread-out CBD is so complex that internal circulation is provided by three dedicated free city ‘CAT’ bus routes. Perth has added some high-frequency bus routes with strong branding. The most popular is the orbital ‘Circleroute’ service, which connects a number of major universities and provides 15-minutes service frequencies on weekdays and 30-minute services on weekends.

The Perth fare system is fully multi-modal, with nine concentric fare zones. One unusual feature is that Perth offers regular commuters multi-ride ‘smart card’ tickets, but does not provide periodicals such as weeklies or monthlies.

Summary

Perth has proven an innovative performer in the delivery of public transport over recent decades, having revitalised its urban rail network in combination with improved institutional design and management. Perth offers examples of new public transport network planning practice that are among the most interesting in Australia, especially the deliberate deployment of buses in a role serving the new rail infrastructure independent of land-use change. This practice appears to confound much of the conventional thinking in contemporary public transport planning. Yet despite these innovations Perth still faces challenges in improving the mode share for public transport through better integration of buses with the rail network to provide fast seamless services that can compete with the very high levels of car use in the city. Public transport network planning can assist Perth to achieve better performance with the city’s bus network providing an obvious site for consideration of rationalisation and running improvement in line with the key practices identified in this paper.

Brisbane

Background

Brisbane City and the wider South East Queensland region within which it is situated comprise Australia’s fastest growing metropolitan area. Brisbane City is Australia’s largest metropolitan authority encompassing a population of approximately 900,000 residents. This unusual large
institutional scale stems from the City Council’s historical role as a metropolitan government with extensive planning, transport, and utilities responsibilities, in contrast to municipalities in Australia’s other cities in which local government has limited to a much smaller geographic, institutional and functional role.

Public transport in Brisbane and the wider SEQ region has historically been comprised of a network of radial rail lines originally formed in the late-19th Century to serve regional townships such as Ipswich, Beenleigh and Caboolture. This system was improved in the 1970s to offer stronger suburban connections although it was not until the last decade of the 20th Century that services achieved half-hourly frequencies off-peak. The rail network continues to be extended at the margins through new suburban links to Springfield and Coolangatta with planned links to Caloundra and Maroochydore. Plans have also been developed for a new underground link below central Brisbane. In 2008/2009 the rail network achieved a patronage of 60.9 million journeys – almost exactly one third of total SEQ public transport use (Translink 2010).

Brisbane City was also served by a large tram network that developed from the 1900s and underpinned much of the city’s suburban development. Trams were replaced by buses in 1969 and many bus lines still follow previous tram routes, especially on major radial arterial roads. Since 2001 Brisbane has also developed a dedicated busway network to provide ‘rapid transit’ along select inner urban radial routes served by an array of high-frequency bus lines. Although some observers view the busways as a success – Hoffman describes initial criticism as ultimately unfounded – the picture is not all rosy. Bitzios et al (2008), for example, demonstrate that even the much vaunted patronage growth on the initial South East Busway still failed to establish the economic viability of the link, which according to government evaluations generated a net economic loss of $309 million.

The major regional cities of the Gold Coast, Ipswich and Sunshine Coasts are served by their regional rail links to Brisbane and local bus services. As in other Australian cities the train networks combine a suburban rapid transit function based on short inter-station distances with a regional connection function.

Public transport has achieved uneven and at best marginal gains in mode share in Brisbane over recent decades despite strong patronage growth. Use of public transport for the key journey to work trip declined from 30 per cent of commuters in 1976 to just 21.2 per cent in 2006 (Mees, Sorupia and Stone 2008). Data for total distances travelled by mode reveal a slight gain for public transport over a similar period, but at a much lower proportionate level. Thus in 1977 public transport carried 9.5 per cent of all passenger kilometres travelled in Brisbane, a level which had increased by just 0.7 points to 10.5 per cent in 2008 (Bureau of Infrastructure Transport and Regional Economics (BITRE) 2010). More recent short term patterns for mode share based on household trip-making surveys show a similar trend. In 1992 public transport comprised 7 per cent of trips, a level that by 2004 had expanded to 8 per cent of trips (Queensland Transport 2005, p. 25). Public transport is thus making very slow gains of little more than 0.08 percentage points per year relative to private motor vehicles.

In absolute figures though Brisbane’s public transport system has experienced a marked patronage gain over the past decade, comparable to other Australian cities. Total patronage on the region’s public transport network expanded by 80 per cent from 100.8 million trips in 1998/1999 to 181.9 million trips in 2008/2009, equivalent to eight per cent average annual growth (Translink 2007; Translink 2009). The strongest growth in this period occurred not with the completion of the high profile busways, but after the establishment of the Translink public transport agency (see below) and the introduction of an integrated multi-modal ticket in 2004/2005 which stimulated an 11.4 per cent gain that year. This increase has proved most advantageous to the Brisbane City Council buses which have seen their subordinate role to
Queensland Rail in total passenger carriage converted to a superior role in the post-Translink phase.

Institutions

For more than a century Brisbane’s rail and bus networks were planned and organised by separate institutions - Queensland Rail and Brisbane Transport respectively – with little integration or coordination between them. This poor integration has been identified as having weakened the capacity of the rail and bus systems as a whole, as identified by political (Queensland Parliament 1997) and scholarly (Mees 2010; Dodson, Sipe and Baker 2010) observers. The lack of an overarching authority that would shoulder responsibility for the planning and coordination of the entire public transport network – although not unique in Australia – was considered a particular historical weakness by the Queensland Parliament (1997). The Queensland Government responded to public criticism of the lack of a coordinating authority by establishing the Translink agency in 2004 as a division of Queensland Transport and subsequently strengthening the agency by making it a separate statutory body in 2007. Unlike the Perth or Adelaide public transport authority equivalents however Translink does not directly provide services but acts largely through its contracts with regional operators.

Translink has undertaken progressive harmonisation of the Brisbane and SEQ bus and rail systems through integration of services, vehicle fleet, marketing and service information. The vehicles of the various service operators, especially the private bus companies have begun to be redecorated with a consistent livery and timetabling and other system information now has a uniform layout and format. Translink has made slower progress in drawing the two major operators – Queensland Rail and Brisbane Transport – within its direct fold. Brisbane Transport retains its distinctive livery and retains control of much of its bus operations while Queensland Rail has proven a gradual adopter of service innovations. This situation may change with the complete separation of Queensland Rail’s passenger and freight activities in 2010.

Network Planning

Among Australia’s major cities the Brisbane and SEQ region is the only to have a dedicated public transport network plan setting out intended service improvements and infrastructure developments, over a ten-year period. Developing the Translink Network Plan (TLNP) is the responsibility of Translink which prepared the current plan after a period of consultation beginning with a draft in 2005 and a final scheme in 2007. The first two network plans were extensive documents that included a series of strategic priorities that have considerable alignment with the principles of public transport planning set out in this paper and in the earlier paper (Dodson, Mees, Burke and Stone 2010 draft). For example, as two of its 2007 key priorities the TLNP seeks to ‘make services connect’, by integrating the network and coordinating timetables, and intends to ‘make services fast, frequent and reliable’ through on-time running, rail investments, and priority bus corridors. The plan then sets out the investment intentions across various sub-regions of South East Queensland, including both service and infrastructure expenditure with delivery timetables and indicative corridor programs. These included considerable programmatic detail to the level of individual services on given lines. The 2010 iteration of the plan has been re-scaled to a few pages of text comprising statements of strategic intent, network planning principles and conceptual diagrams expressing these (Translink 2010).

The Translink Network Plan is unique in the Australian context and has brought a renewed attention and focus to the management of public transport in SEQ providing a useful conceptual platform for future network development. From the perspective of public transport network planning identified in the previous and present paper the TLNP however still faces a number of opportunities to transition the region’s public transport system beyond its legacy structure and weak modal integration to a more dispersed or ubiquitous integrated multi-modal network.
The radial nature of the SEQ public transport network Brisbane is clearly evident in the structure of the rail network and the high frequency ‘BUZ’ bus lines. All of the 19 rail or high frequency bus routes are radial. In many instances it is quicker and more convenient for a passenger to travel tens of kilometres radially than a few kilometres circumferentially. The strong radial orientation of the rail, busway and BUZ surface however offers considerable potential for the future introduction of circumferential lines which could connect between the radial lines and establish the basis for a dispersed network structure. This could partly be achieved through efficiency gains created by rationalising some of the existing line structures (see Figure 6). The extensive distribution of the rail network, particularly in outer suburban zones also offers potential for improved network planning and service integration such as through the use of (pendulum) feeder buses.

![Figure 6: SEQ Rail/Busway and BUZ Network (Translink 2009)](image)

Further network planning elements also appear in the draft Connecting SEQ Transport plan prepared by Queensland Transport which proposes a set of new high frequency ‘strategic bus corridors’ organised in a network across major sub-regions (see Figure 7). These corridors are intended to be badged as ‘turn up and go’ lines in which timetables are not necessary and along which travel times will be speeded through direct route structures and priority measures.
As is the case with other Australian cities Translink also faces a challenge in managing the structure of some bus lines. An example of this challenge is apparent in the area of the network associated with the South East Busway which shows a tangle of lines, many of which run in parallel. Vuchic (2005) Nielsen et al (2005) and Dodson, Mees, Stone and Burke (2011) have all argued that the operation of multiple lines on the same route should be avoided in favour of fewer unified lines with transfers at key connection points. This paper is not an appropriate venue for a detailed technical critique of the southern Brisbane network design. From a network planning perspective though it is worth noting the high number of parallel lines operating on the busway from Mt Gravatt inwards with many surface lines also operating in parallel and often following indirect routes. From a passenger perspective the connection and transfer opportunities, nor frequencies, are not clear.

A number of factors work against a specific critique of the southern region example within the context of the present discussion. First, Figure 7 is an indicative diagram only, not a comprehensive network plan. Second, Translink inherited most of the present network and line structures from the existing service providers when it took over the system in 2004. Third, the agency’s task has largely been focused on system and provider harmonisation rather than network rationalisation. What the examples of Figures 6, 7, and 8 do indicate though is the considerable latent potential within the SEQ network for efficiency and service gains through rationalisation of the network. Given the existence of a dedicated network planning agency with a network planning framework Brisbane and SEQ appear well positioned to make new gains in public transport through such rationalisation measures.
A further complicating factor in Brisbane is the growing busway network. While widely perceived as successful the busways have proven controversial. An early Queensland Parliament inquiry found that they risked duplicating rail infrastructure and better integration of bus and rail services could offer a better solution. Hoffman (2008) has noted that the busways were driven by an infrastructure development approach to planning rather than a service oriented approach. Mees (2010) and Dodson, Sipe and Baker (2010) have noted that the busways seem a symptom of the division of historical institutional responsibility between Queensland Rail and Brisbane Transport rather than a technically justified solution to public transport problems. Indeed Hoffman notes that the busway planners explicitly recognised that “the new busways would need to position themselves as competitive with – or even superior to – that network if they were to overcome any stigma from being bus-based”. Such a competitive view of public transport contrasts with the integrative imperative under a public transport network planning approach. The busways were also driven by an ‘infrastructure’ approach rather than a service delivery approach such that building the link was viewed as more important than considering what services would meet passenger travel demands. Hence one planner (cited in Hoffman 2008, p. 41) noted that:

when busways were first planned, current operating plans couldn’t have been foreseen… At the time, no one really comprehended what a busway could deliver.
Part of the rationale for the busway over other modes such as light or heavy rail was the capacity to combine feeder and trunk functions within the single radial line and avoid the need for passengers to transfer between services to complete their entire journey. This rationale was much stronger in a relatively low frequency service mode. A feature of the SE Busway was the redirection of existing radial bus lines from surface streets to the busway which sped service speeds and in part contributed to the increased patronage growth on the line. More lines have been added to the busway to take advantage of fast running speeds. Over nearly a decade of operation the number of lines operating on the SE Busway has grown to nearly 20 lines operating on various stopping schedules. With the SE Busway now operating services every minute or so in peak hour there is potential for inefficient duplication and confusion between multiple lines. Given that very high trunk line frequencies support transfers to and from feeder lines there is now an opportunity to rationalise the multiple parallel lines operating on the busway into a small number of high frequency lines with transfers at feeder points as a component of a wider restructuring of public transport lines and the wider network.

Summary
In summary therefore Brisbane and SEQ generally, are well positioned to improve the performance of the regional public transport network. The presence of extensive rail networks linking many of the main centres within the region and the existence of a dedicated public transport authority with the responsibility for planning and coordinating the networks offers many opportunities for service gains and efficiencies. The challenge in Brisbane and SEQ will be to ensure that these opportunities are pursued within the context of the principles of public transport network planning set out in the introduction to this paper. With attention to such planning methods public transport patronage in SEQ could exceed its already heady projected growth. As with other Australian cities a major task for planners in Brisbane and SEQ will be to better integrate the two major modes – trains and buses – so that each plays a complementary role. This would primarily involve increasing rail frequencies and rationalising and re-orienting some bus services to serve a greater orbital and feeder role.

Conclusions
Network Planning Principles
This paper has examined the extent to which public transport network planning principles have been applied in Australian cities. The paper sought to test the performance of the public transport systems in Australian cities against these principles as presented in the contemporary public transport literature. The paper began by summarising these public transport network planning principles, drawing in part on a previous paper prepared by the authors. The key public transport network planning principles included:

1 – to provide a simple and stable inter-connected network of public transport lines throughout the day with a structure and timetable that is easy for users to learn and understand; and

2 – to accept and support the proposition that many, potentially even a majority, of travellers will need to transfer between services to access their selected destination. This need is heightened in dispersed cities particularly those with only moderate or limited degree of activity concentration beyond the city centre. As Thompson et al (1976, p. 9) observed:

To support these key principles a further set of five key practices were identified that included: a) creating simple and direct network structures; b) planning a hierarchy of lines into a coherent network; c) planning for speed, consistency and reliability; d) coordinating convenient transfers; d) providing clear, ubiquitous and consistent information and marking.
Together these principles assist to ensure a seamless ‘go anywhere anytime’ public transport ‘offer’ to the travelling public.

In addition to network planning principles the institutional framework for operationalising such principles was also assessed. The principal institutional consideration was the presence of a single planning agency with the responsibility to design and procure public transport networks along network planning principles. A key international example of this institutional form was the ‘European Verkhersverbund’ (EVV) model which is common in Germany, Austria and Switzerland. This model has proven highly successful at generating sustained public transport patronage within the cities in which it has been instigated.

**Current Australian Practice**

The paper then considered each of Australia’s major cities in turn to assess the extent to which public transport network planning principles and good practice institutional arrangements are being applied. The assessment found that there is a high degree of variability in the extent to which Australian cities are pursuing a network planning approach to public transport provision. Sydney for example achieves a relatively high mode share in the absence of an overall network strategy, deliberate inter-modal coordination, or a single public transport planning authority. Yet despite this high patronage the city faces many pressures on its public transport system and growing concern that a lack of coherent comprehensive network planning may impede the capacity of the system to meet overall urban transport needs. Similar problems are apparent in Melbourne, which faces growing demand but little evidence of a deliberate network planning model of public transport management. Melbourne also suffers from institutional fragmentation of its public transport network planning capacity between a mix of public and private agencies.

Public transport network planning is beginning to be applied in the rapid growth cities of Perth and Brisbane (including South East Queensland) where dedicated public transport authorities have begun to institute a range of new practices to improve system management. Perth is perhaps the signature example with a dedicated public transport authority leveraging innovative inter-modal integration on a model that reflects many of the principles and key practices of public transport network planning. Most prominent among this program is the integration of high frequency suburban rail services with feeder bus networks that are generating high mode shares. In Brisbane a relatively new public transport authority is increasingly reaching to network planning principles in its strategic program and which are beginning to be applied at the operational level. New approaches, such as the ‘turn up and go’ bus lines partly reflect the approaches successfully adopted in many European jurisdictions. Brisbane continues to suffer the disadvantage of an underutilised suburban and inter-regional rail network which operates at low frequencies and is weakly integrated with bus lines, especially in outer suburban zones. At the time of writing some steps were being taken to address this problem through timetable and stopping pattern rationalisation but there remains a great deal more planning to be undertaken to fully utilise the latent capacity in the Brisbane network.

**Implications for Planning**

Contemporary strategic land-use and transport planning in Australian cities relies heavily on the provision of public transport as a mechanism for improving urban outcomes. Yet metropolitan plans are rarely articulated explicitly with public transport network planning strategies, where the latter exist at all. Most major Australian cities have set out plans for major public transport infrastructure investment such as rail extensions or electrifications and underground links. There has been much less planning attention given to the efficiencies that can be wrought from existing public transport networks through the application of public transport network planning principles especially those which do not require direct service investment, such as timetable improvements via line coordination and line rationalisation. This general deficit appears to be a major weakness in contemporary Australian metropolitan planning which is likely limiting the
rate and degree of potential change to the structure and form of Australian cities and to land-use and transport dynamics. If Australian planning is to fully realise its potential to transform cities to meet the imperatives of such major strategic challenges as climate change mitigation, declining global energy security or improving urban liveability for a competitive global economy then it will need to seriously reconsider and reapply the greatly overlooked practices of public transport network planning.
References


