

Submission to the Senate Inquiry into urban public passenger transport

Prepared on behalf of the Australasian Centre for the Governance and Management of Urban Transport by:

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Executive Summary

The Inquiry's consideration of the effectiveness of previous investment in public passenger transport infrastructure and services in Australian cities, and of possible changes in the role of the Commonwealth in this field, is very timely.

We note that successive US federal administrations have played a crucial role in the direction of urban transport policies through mechanisms such as the Federal Transportation Administration, and would encourage the Commonwealth to provide strong leadership on this issue.

Urban transport policies of the past fifty years have been based on long-term reductions in energy costs and, to our great social and economic benefit, have led to a dramatic increase in the variety and number of physical exchanges that take place in the urban environment. Future energy use will be severely constrained by the urgent imperatives of greenhouse emissions reduction, peak oil and the global economic crisis. Adapting to these new realities, while maintaining the quality and opportunity for physical exchanges in the urban environment, will require new levels of public transport use. This, in turn, will require new expectations in terms of the quality of public transport service that must be delivered by State transport agencies.

The imbalance in funding for the different modes of urban transport over many decades is clear. The expenditure of Commonwealth and State resources on very large increases in urban road capacity is a key factor in the long-term decline in public transport patronage in Australian cities. But, this imbalance in funding is not the whole story.

With the notable exception of Perth, public transport agencies in Australian cities have largely failed to use available resources to design and deliver services that offer effective competition with the car, and so create and develop public and political support for expansion of public transport services.

Cities in Canada and Europe have succeeded in creating urban public transport systems that more effectively compete with car, even though they share many characteristics such as wealth, high car ownership or dispersed suburban form that are used to explain low public transport use in Australian cities.

Using best-practice international experience and local data, we argue that the key measures by which the Commonwealth can facilitate improvements in urban public transport services are to:

- Freeze funding for expansion of urban road capacity;
- Tie any funding offered to the States for public transport infrastructure or other urban development initiatives to the preparation and implementation of regional transport plans by state agencies that include as a minimum:
 - Reorganisation of existing services into an effective integrated network built around reliable, high frequency service corridors and transfer points designed to international standards
 - monitoring of changes to access by public transport to social and economic opportunities for a range of user groups;
 - A simplified multimodal ticketing system for Sydney, and a national standard for the operation of e-tickets based ;
 - Measurable targets for shift of mode share away from car travel across the urban region;
 - Development of better mechanisms for contestable evidence-based policy development. The significant shifts in policy and practice which must take place in very short timeframes will require the support of both the expert policy community outside government and the wider public.

In support of these recommendations, this submission provides evidence and analysis from the work of GAMUT researchers in three key areas:

1. A picture of the current performance of public transport operational and planning agencies in Australian cities
2. Evidence showing that coordinated service planning is a common feature in cities with successful public transport
3. A summary of the key features of network planning that is required for efficient and effective use of both capital and operational resources for urban public transport

The current performance of public transport in Australian cities

In late 2007, GAMUT researchers examined long-term trends in urban passenger travel in Australian cities in an analysis of three decades of census data from 1976 to 2006 for the journey to work. While the journey to work represents only one part of the urban transport travel patterns, it is important because it is a key component of the peak travel which gives rise to calls for increasingly expensive road and rail infrastructure. It is also one of the surprisingly few parameters of urban travel behaviour for which there is reliable longitudinal data.

This analysis is offered to the Committee as a contribution to its audit of current state of public transport in Australian cities. The report can be found in full at www.abp.unimelb.edu.au/gamut/pdf/census-travel-to-work.pdf.

In relation to public transport, the key findings of this report were that:

- There has been a dramatic increase in the number of cars driven to work each day in Australia's capital cities, with a total increase of 1,439,024 cars, or 70.1%, between 1976 and 2006;
- The most important cause of the increase in car use is a shift away from more sustainable transport modes – public transport, walking and car-pooling.

In Sydney, Melbourne, Adelaide and Hobart, mode shift accounted for the majority of the growth in car use, ahead of increases in the size of the workforce. In the other capitals, rapid population growth was the biggest factor in increased car travel, but mode shift still accounted for nearly half of the growth in car use.

- Public transport's share of work travel has declined in all cities over the three decades, but at different rates. The biggest decline was in Melbourne; the smallest decline in Sydney and in Canberra (where public transport use was already low in 1976). However, public transport's mode share has begun a modest revival in the last 5 to 10 years, except in Sydney and Hobart.

The report gave a brief overview of the likely causes of the observed performance of the passenger transport system in each city.

1. Melbourne

When the different cities are compared over the three decades, Melbourne stands out as the worst performer, with the largest increase in car driving, and the largest declines in car-pooling, public transport and walking. There are now more cars on the road transporting people to work in Melbourne than in Sydney despite the latter's much larger workforce. Melbourne now has the lowest rate of car-pooling of all seven cities, the lowest rate of usage of public transport modes other than heavy rail, and the third-highest rate of car driving (after Adelaide and Perth). Owing to lower rates of car-pooling and walking, the share of workers who drive is higher in Melbourne even than in Canberra and Hobart!

There are three main reasons for Melbourne's poor performance:

- Melbourne has built more lane-kilometres of urban freeway and tollway since 1976 than any other Australian city.
- Melbourne has built no significant extensions to its suburban heavy rail system over this period: the last new line was the Glen Waverley line, which opened in 1930.
- Melbourne historically has had remarkably poor public transport management that has worked against coordinated operations of the different modes, a situation exacerbated by the privatisation of trains and trams in 1999.

Current Victorian government transport plans include the possibility, as yet unfunded, for large public transport infrastructure projects, but make no effective change to its broad approach to the design and operation of public transport services, and so a continuing decline in Melbourne's performance relative to other Australian capitals is likely. In addition, the Victorian Auditor-General has noted that subsidies to Melbourne's public transport operators have doubled in real terms since privatisation in 1999.¹

Part of the reason for some recent positive reporting of Melbourne is the turnaround since 2001 in public transport's share of work travel, particularly on the rail system. But, this improvement represents a rise in public transport's mode share of 0.8%, less than was achieved in the same period in Brisbane, Adelaide, Perth and even Canberra. And despite reports of record-breaking rail patronage, the absolute number of people taking the train to work in Melbourne in 2006 was only 9% higher than in 1976. In Sydney, despite the recent patronage decline, the 2006 figure was 21% higher than the 1976 figure. In Brisbane, the equivalent increase was 58%. In Perth, the number of rail commuters in 2006 was four times the 1976 total.

Another reason for Melbourne's popularity is the fact that the city has retained its trams. While we are strong supporters of Melbourne's tram system, the journey to work data does not support the contention that trams are a 'magic bullet' for public transport problems. The mode share for Melbourne's trams has declined by more than half over the last three decades, coming in behind buses in most other cities. The performance of Melbourne's buses has been even worse than its trams.

2. Sydney

Sydney wins the prize as the 'least unsustainable' city in 2006, with the lowest share for travel to work by car drivers (63.4%), the highest mode share for public transport (21.2%) and the equal-second-highest share for walking (4.9%). However, Sydney's comparably strong performance is a legacy of the transport policies of past decades, particularly the strong pro-rail stance of the Wran government in the late 1970s and early 1980s. The opening of the Eastern Suburbs line to Bondi, other extensions of electrified services and general modernisation works stemmed the decline in rail patronage and even lifted its mode share.

¹ Melbourne subsidy figures from P. Kain, 'The Pitfalls in Competitive Tendering: addressing the risks revealed by experience in Australia and Britain', in European Conference of Ministers of Transport, *Competitive Tendering of Rail Services*, ECMT, Paris, 2007, pp. 43-125, at p. 91.

The last two decades have seen deterioration in rail services and a large program of motorway building. The improvements in mode share ceased, and substantial declines were only prevented by the city's historical strengths of an extensive rail system, relatively high population densities and employment in suburban centres with rail access.

Progress in Sydney is now being hampered by two main problems.

The first problem in Sydney is the continued emphasis on motorway construction, which provides incentives for more passengers to abandon rail. The preference for motorways is driven partly by despair at the prospects for improving public transport, and by the biased nature of Federal transport funding.

The second problem is an entrenched culture of poor public transport management that continues to take a fragmented and narrow approach to service planning, and the processes of regulation are labyrinthine. Four decades ago, the authors of 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...²

Unfortunately, little has changed since then. While some work is being done to reorganise rail operations in an attempt to increase capacity and improve punctuality, this is directed predominantly towards engineering projects rather than the 'software' of network design and timetabling. It is happening in isolation from bus and ferry operations which continue to operate as if the rail system, rather than the car, was the main competitor.

One clear illustration of this problem is the fact that Sydney is now the only Australian capital city without a multi-modal ticketing system. (The current 'smart-card' project is not a multi-modal ticketing system: rather, it is a technology enabling operators to continue charging separate fares for each stage of a multi-modal journey.)

² *Sydney Region: Outline Plan 1970-2000 AD*, State Planning Authority of NSW, March 1968, Sydney, p. 43.

3. Brisbane

Brisbane now has the second-lowest share of workers travelling as car drivers. This is more a reflection of Melbourne's rapid decline in performance than Brisbane's inherent success. However, there have been improvements in mode share for public transport and walking in the last decade, and there are some signs of hope for continued positive trends.

Long-established management arrangements, under which buses were operated by the Brisbane City Council and private firms, while trains were the responsibility of Queensland Rail, have been an entrenched obstacle to public transport service improvements. In recent years, there have been changes to this structure, beginning in 2004 with the establishment of Translink, a coordinating body for public transport across South East Queensland. Translink's first major achievement was the introduction in 2005 of a fully multi-modal ticketing system (without smart-cards), which led to an immediate and substantial jump in patronage across all public transport modes, and is a major factor behind the one per cent rise in mode share between 2001 and 2006.

The Queensland Premier announced on 9 October 2007 that a new regional public transport agency will be established for South East Queensland in 2008, incorporating Translink's responsibility for rail and bus services across greater Brisbane. The new agency has the potential to create integrated services to match the integrated fare system, provided it is established with a dynamic, European-style management and planning culture, rather than simply being 'business as usual' under a different title. Transport investment decisions in South East Queensland have worked against the recent improvements in public transport mode share.

Rail extensions and service enhancements have been placed on the 'back-burner' despite rapid growth in patronage. One reason is substantial investment in a series of busways, which largely parallel the existing rail system. A more serious concern is the still larger diversion of investment funds to an extensive program of motorways, tunnels and bridges, which will directly compete with the rail and busway systems for customers.

4. Adelaide

Thirty years ago, the share of work trips made by car drivers in Adelaide was lower than in Canberra or Perth, (or in Hobart in 1981). Adelaide and Canberra were the only cities in which public transport's mode share increased between 1976 and 1981 (making Adelaide's mode share briefly higher than Brisbane's). Adelaide saw a small increase in cycling over this period as well.

This situation was a result of the progressive transport policies of the Dunstan Government, which froze freeway construction, extended suburban rail services, nationalised private bus operations and integrated fares and timetables across the public transport system.

Unfortunately, over the last 25 years the Dunstan policies have been abandoned. Public transport services have been cut and large-scale road construction has resumed. Adelaide is now the only Australian capital with a suburban rail system than has not been electrified. As a result, car driving has increased faster than in any other city apart from Melbourne, and is now the highest in the nation.

There has been a slight rally in bus use since 1996 and rail use since 2001, but the total public transport share of travel to work is still only 9.9%. These improvements are the result of a modest program of public transport improvement, which has recently seen the Glenelg tram extended into the heart of the city. However, transport policy in Adelaide remains dominated by road construction, with public transport and walking very much an afterthought.

Comparisons between Adelaide and Perth are instructive. Three decades ago, Perth was the most car-dominated capital apart from Canberra. With a smaller rail system than Adelaide, a lower population density and less integration of urban development with public transport, Perth could have been expected to fall further behind Adelaide. While Perth remains a car-dominated city, as discussed below, it is now less so than Adelaide, and on current indications the difference in performance is expected to widen.

5. Perth

The revitalisation of Perth's public transport system began with the 1983 reopening of the Fremantle line, which had been closed four years earlier. It continued with the 1987 decision to electrify the three suburban rail lines, and accelerated with the construction of the new northern suburbs railway, which opened with a supporting feeder bus network in 1993. The process of rail expansion is still in progress with the imminent opening of the 72 km Mandurah line.

Organisational structures for public transport were gradually reformed as part of this expansion program, with a strong focus on integration of rail and bus services, and on a 'seamless' experience for passengers. When the private sector became involved in bus operations in the 1990s, this followed the sub-contracting model, with Transperth retaining control over branding, timetables and network planning. Service integration has been retained, with Perth presenting a stark contrast to the lack of multi-modal planning in Melbourne and Sydney. The result has been a steady improvement in public transport use from a low base with real expectations of continued future growth.

However, Perth remains a car-dominated city. Walking rates are the lowest in the country, although they have increased modestly since 1996. One reason for this is that substantial expansion of the major road system has taken place alongside expansion of rail, reducing the incentive for car drivers to shift to the new rail services. These road expansions have received generous Federal funding; by contrast, the expansion of the rail system has been paid for almost entirely from local sources.

A full discussion of the political and institutional background to the development of Perth's urban public transport system can be found on pp. 201-213 of Stone (2008) which is available at <http://hdl.handle.net/1959.3/36049>.

6. Canberra

Canberra was planned for the convenience of car drivers, but its urban structure was also designed to permit a transition to public transport, should this become necessary. This was the reason for the adoption of the famous 'Y-Plan', which clusters major employment and retailing in town centres arranged in a linear pattern along the route of a possible inter-town public transport system. Unfortunately, the potential of this land-use arrangement has never been realised, because transport policies have remained car-dominated.

The Whitlam Government initiated a review of Canberra's transport plans which led to an attempt to create a more balanced transport pattern. Commencing in the late 1970s, there was substantial upgrading of bus routes, service levels and vehicles. The existence of a single public bus operator made these changes easier to implement.

Some attention was also paid to bicycle paths, and Canberra is the only Australian capital where cycling to work is approaching significant levels. The results of the new transport policy can be seen in the improved public transport mode share between 1976 and 1991, and the rise in cycling. Despite a decline in car-pooling, the share of workers driving cars to work was slightly lower in 1991 than 1976, a result not seen in any other Australian capital.

Following ACT self-government, operating subsidies for bus services were reduced and services cut sharply, leading to a large decline in public transport mode share to an all-time low of 6.7% in 2001. A partial recovery in public transport has occurred in the last five years, and walking has increased, but the car remains king in Canberra. Transport policy remains dominated by road building, with public transport treated mainly as a social service. Significant improvements to bus service levels in November 2007 may herald a new approach, but even after the improvements, service levels remain lower than in previous decades, and worse than in other Australian capital cities.

7. Hobart

Car travel in Hobart was suppressed in 1976 by the closure of the Tasman Bridge, but had more than recovered by 1981 and has continued to grow ever since. The city's bus-based public transport has suffered since the 1990s from pressure to reduce costs, exacerbating the longstanding trend to declining mode share. Hobart does, however, have by far the highest mode share for walking to work of any Australian capital, with a jump from 6.0% in 1996 to 7.6% in 2006. This is partly a result of Hobart's compact, walkable inner city, together with increased CBD employment and rising inner city population levels.

While the high rate of inner city walking is welcome, the suburbs of Hobart will not see a reduction in car usage until effective public transport is provided. Following Metro's purchase of the privately owned Hobart Coaches, Hobart now has a single, public bus operator which should make planning a modern network a simpler task. Significant change will not occur, however, until political decision-makers begin to treat public transport as a serious travel option, rather than a social service for people with no alternative.

Lessons from successful cities: building an alternative to the car

Internationally and in Australia, it is surprising how few urban transport policy initiatives have been subjected to a rigorous analysis of their impact on travel patterns.

A definitive measure for success in urban passenger transport policy, using both environmental and economic criteria, would be long-term reductions in per capita car travel in favour of more efficient and sustainable modes: high-occupancy public transport, walking or cycling. Unfortunately, the available data does not allow reliable international comparisons using this measure, particularly in relation to the sort of large-scale policy interventions that are the subject of the current Senate Inquiry.

However, using a slightly less rigorous definition of ‘success’ – namely evidence of a shift in the share of total urban passenger travel away from the car to more sustainable modes – Zurich, Ottawa and Vancouver can claim to be public transport success stories.

The following brief analysis of transport policies and their outcomes shows that there has been significant investment in public transport infrastructure in these cities ahead of road construction, but success has been only achieved because this infrastructure spending has been combined with a particular approach to the design and implementation of public transport services. This approach is known as ‘network planning’ and its main attributes are summarised in Appendix 1.

1. Zurich region, Switzerland (pop. 1.3 million)

Car use is increasing in all European countries, but the rate of increase is lowest in Switzerland (Pucher and Lefèvre 1996). The Canton (or state) of Zurich has the lowest rate of car use in the nation.

The 2000 national census recorded the mode share for the journey to work in the Zurich region as 38.9% by public transport, 36.7% by car (as driver or passenger), 14.9% walking, and 7.9% by bicycle. The approximate mode share figures for all trips within the Zurich region are 29% of trips by individual motorised transport, 52% by walking and cycling (mainly walking) and 18% by public transport.³ Importantly, Zurich is also the only Swiss region where the share of trips by car is actually falling – and has been since the 1990 census (ZVV website 2008).

Zurich is particularly significant because it’s the wealthiest region in one of the wealthiest nations on earth, but also because the Canton as a whole is spatially dispersed, with around 1.3 million residents spread across 1729 sq. km (Swiss Federal Statistics Office 2008). The Melbourne ‘urban centre’ covered 2153 sq. km at the 2006 census and housed 3.4 million people (ABS 2007).

The principal factors behind these results are:

- the provision of an excellent-quality multi-destinational integrated public transport network serving the whole Canton, delivered by a single public agency, the ZVV;

³ Calculated from the average number of trips by each form of transport reported from the 2005 Transport Microcensus (SFSO)

- a virtual moratorium on major new roads in the City of Zurich (equivalent to our inner suburbs) for around three decades;
- implementation in the late 1970s and 1980s of a rigorous program of providing absolute on-street priority for trams and trunk bus routes in the City of Zurich. This program has been so successful that there is almost no difference between peak hour and late evening running times for trams.

(For further details, see Mees 2000, ch. 5.)

2. Ottawa, Canada (pop. 0.85 million/1.1 million)⁴

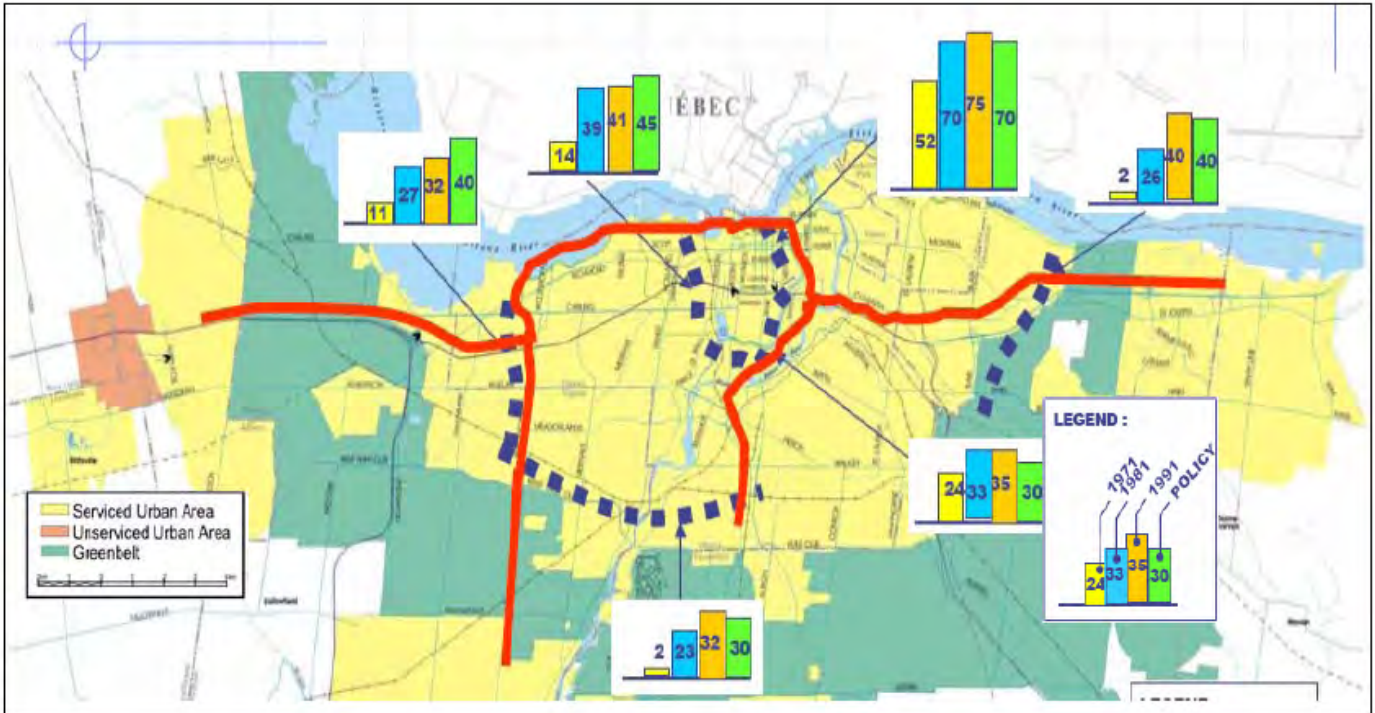
The 2006 Canadian census results, released in April this year, showed that Ottawa had the lowest rate of car driving for trips to work, at 60.4% of trips (Statistics Canada 2008). This figure is also lower than any Australian city, the lowest figure being Sydney, with 65% and the highest Adelaide, with 76% (Mees et al 2007).⁵

Although detailed comparisons are made difficult by the fact that the Canadian census has only included a question on the mode used for the journey to work since 1996, the key difference between Ottawa and Australian cities is that public transport's mode share is higher than in the early 1970s in Ottawa, but lower in all Australian cities.

Ottawa was a typical North American city in the early 1970s, in which the car completely dominated travel. Over the next decade, there was a substantial mode shift away from cars towards public transport: see figure below. Significantly, this shift occurred relatively rapidly and occurred before the City's extensive busway network opened between 1983 and 1996. It involved little investment in infrastructure and no significant change to urban form.

⁴ The lower figure is for the City of Ottawa; the higher figure is for the larger region including Hull/Gatineau on the Quebec side of the Ottawa River. The figures used in the following side are for Ottawa proper only: Gatineau has pursued different transport policies.

⁵ The Canadian census figures combine car and truck drivers: we have adjusted the Australian figures reported in Mees et al (2007) for comparability, by adding 'truck' to 'car driver'.



Targeted vs. actual transit mode split at screenlines. (Hoffman 2008, p. 20)

The principal factors behind the mode shift are:

- a 'transit-first' policy that made public transit the priority for new infrastructure investment and major new roads a last resort; this resulted in the effective cancellation of most of the freeways that had been planned in the 1960s;
- restrictions on provision of CBD car parking, and an increase in charges for the remaining spaces;
- establishment of a single regional public transport agency to integrate routes, timetables and fares across the whole metropolitan area;
- provision of operating subsidies to enable the expansion of high-quality transit services into lower-density suburbs;
- less reliance on park-and-ride than in many cities, with passengers relying primarily on feeder bus services;
- on-street priority for trunk bus services, enabling transit to bypass sites of major traffic congestion.

3. Vancouver, Canada (pop. 2.1 million in 2006)

Vancouver was the only Canadian city in which the time taken for the average work journey declined between 1992 and 2005, even though it had the fastest rate of population growth over this period (Statistics Canada 2006, p. 15, table 1).

Vancouver built no major new roads between 1992 and 2005, and traffic congestion increased as it did everywhere else in Canada, so travel times should have increased had everything else remained constant. Slower road speeds appear to have been outweighed by shorter journeys arising from the locational decisions made by businesses and households combined with improvements in the speed of public transport.

Between 1996 and 2006, the proportion of workers using transit in greater Vancouver rose from 14.5% to 16.5%, and the median commute distance fell from 7.6 kilometres in 2001 to 7.4 kilometres in 2006 (Statistics Canada website 2008).

Travel surveys by the regional planning authority conducted regularly showed that between 1994 and 2004 there were modest increases in the share of trips made on foot (from 12.7% to 13.0%) and by public transport (from 10.2% to 10.8%; or from 12% to 13% of motorised trips) and a corresponding small decline (from 76.2% to 75.2%) in the automobile mode share. (See Al-Dubikhi 2007, p. 157)

Greater Vancouver has only one commuter freeway – the Trans Canada Highway – and this passes through the suburbs more than 6km from the downtown core. Road congestion is explicitly used as a policy lever to encourage mode shift to transit.

The region's transit system has an effective management structure and the operational focus is on providing service patterns that offer a competitive alternative to the car for travel to some suburban destinations as well as to the downtown core. Since 1986, when Vancouver's first rapid transit SkyTrain line was opened, there has been considerable investment in new rapid transit infrastructure and further expansion is planned.

Network planning: the common feature of successful cities

Urban transport policy packages in different cities vary, in content if not rhetoric, in the balance of incentives and disincentives that exist for both car and transit use.

A policy package made up of coordinated incentives for transit and disincentives for car use appears necessary to shift travel mode from cars to transit, and so make real gains in reducing transport greenhouse emissions. In addition, these coordinated transport policies must be linked to complementary policies for other physical and functional components of the city including housing and economic development.

Two other transport policy packages are commonly employed in western cities, but neither appears useful for either reducing the cost of operating the whole urban transport system or for achieving greenhouse emission reductions:

- First, cities can try to provide incentives for both cars and transit by investing heavily in both freeways and metro systems and providing subsidised car parking in their central core or at major regional centres or transit nodes. Transport systems of this type are difficult to integrate and that the outcome is generally a continued imbalance in mode share towards car travel but with greater subsidies required for each.
- Second, incentives are provided for cars while transit service declines. This policy package seldom explicitly pursued but is followed, de facto, in cities with no clearly agreed intermodal transport goals and where transit is given little real priority in planning or investment.

(This characterisation of urban transport policy packages is explained in detail in Vuchic's comprehensive text *Transportation for Livable Cities* (1999, pp. 239-248).)

In the effort to create incentives for growth in public transport use, a common factor can be seen in all relatively successful cities, including Perth. This common factor is the existence of strong public institutions for transit management that have:

- long-term political and public credibility built on project achievements
- a strong focus on '*network planning*'

Network planning is central to designing public transport services that can successfully offer a competitive alternative to the car. Its purpose is to offer maximum flexibility to travellers by making it easy to transfer between different services or modes. It provides a basis for cost-effective operations and for prioritising capital investment in rolling stock and infrastructure to maximise patronage growth

GAMUT partners have produced a useful tool for modelling potential network arrangements to allow different operational arrangements to be compared on the basis of the number and quality of the travel opportunities that they create. This tool has been used to assess the improvements in access created by the new bus feeder network that was put in place to support the new Mandurah rail line in Perth.

For details, see www.abp.unimelb.edu.au/gamut/pdf/perth-snamuts-report.pdf .

Key features of network planning

Elements of network planning

Urban public transport managers in a small but growing number of cities, across a range of sizes and degrees of dispersed suburban development, have achieved long-term growth in patronage or market share. These public transport managers have built their success on an approach to the design and operation of their services described as 'network planning'.

The key operational elements of the 'network planning' approach are:

- integration of all modes with easy and comfortable transfers at a number of locations across the city region;

- a clear line structure that is easy for users to learn;

- direct route alignment with the fastest possible vehicle operating speeds, high frequency where demand is greatest and coordinated timetables elsewhere.

The 'network planning' approach has been developed as the most efficient way to design public transport services to provide a competitive alternative to the car for urban travel and to meet the growing demand for travel to multiple destinations across the city region.

At its core, this approach to public transport planning relies on the efficiencies produced by the 'network effect'. The 'network effect' is best demonstrated through the example of a hypothetical city of 'Squaresville' described below.

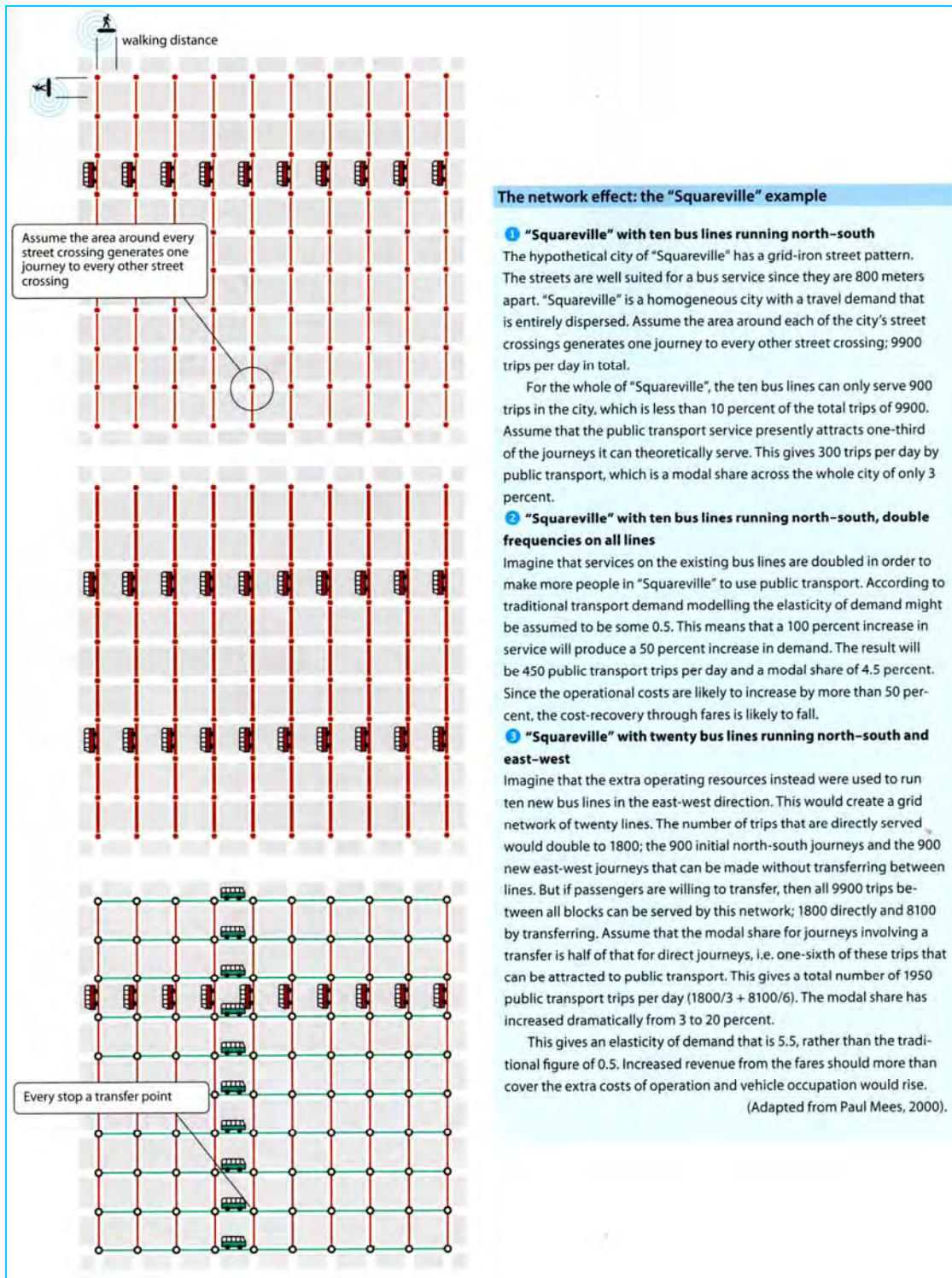


Figure 1: The 'network effect' – the best use of available resources.⁶

⁶ From Nielsen, G. and Lange, T. (2005), *HiTrans Best Practice Guide*, p. 86; and Mees, P. (2000), *A Very Public Solution: Transport in the Dispersed City*, Melbourne University Press, Melbourne.

‘Squaresville’ illustrates the intent of network planning: serving the maximum number of possible journeys with the minimum of operational resources. Obviously, this is an abstraction from the reality of a functioning urban system. But, as shown in Fig. 1, the traditional elasticities of public transport demand considerably underestimate the impact of a well-designed network. This underestimation is a significant problem in most transport modelling exercises in which the potential for improved public transport mode share is typically dismissed as unreasonably expensive.

Four key elements in the practical application of the network approach to planning a successful public transport network are described here.

1. Creating a consistent operational pattern

The first important feature of a network is a consistent operational pattern. Instead of a system that overlays a variety of services designed for different users, a good network is built on a basic layout of lines operating at high frequency and with a stable stopping pattern though most of the day. The frequency of the basic network can be increased in peak periods and reduced at night, and the network is supported by local lines and other demand-responsive services that are available to all users.

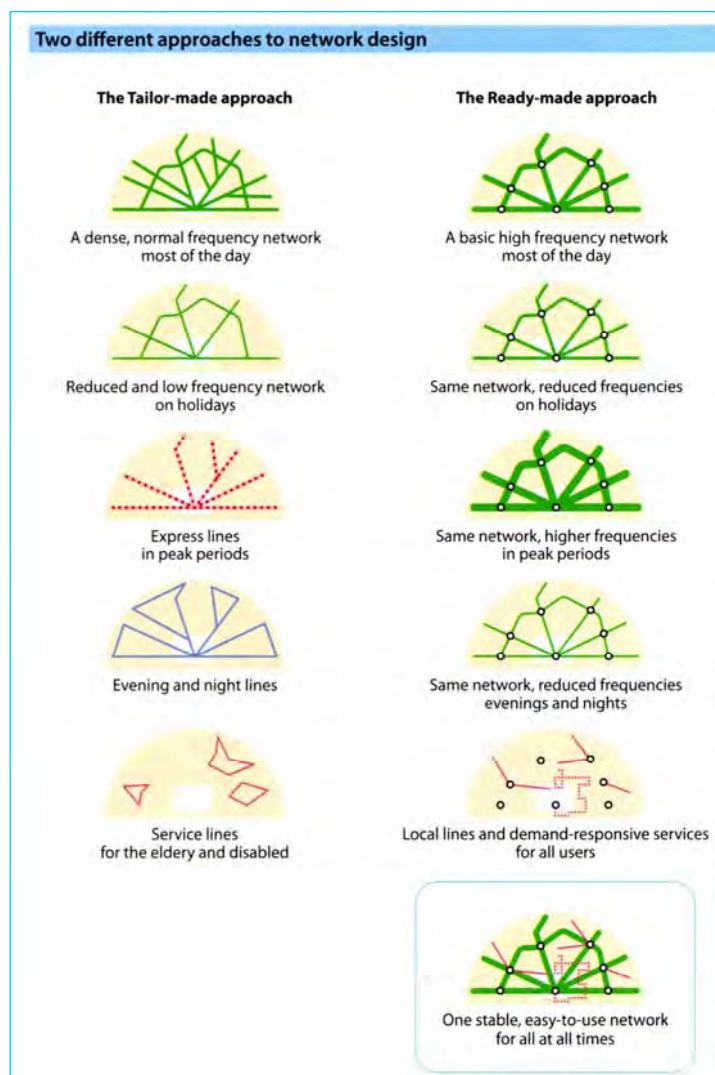


Figure 2: A consistent operating pattern serving many markets.⁷

⁷ From Nielsen, G. and Lange, T. (2005), *op. cit.*, p. 35.

2. The building blocks of a network

It is useful practice to distinguish between a 'line' as the operational element of the transit system and the 'route' which refers to the physical path of a bus or train through the city. Chapter 3.3 of the HiTrans *Best Practice Guide* describes the basic rules for the assembly of a network from a collection of public transport 'lines'. Simplicity is the key: routes and timetables must be easy for users to understand.

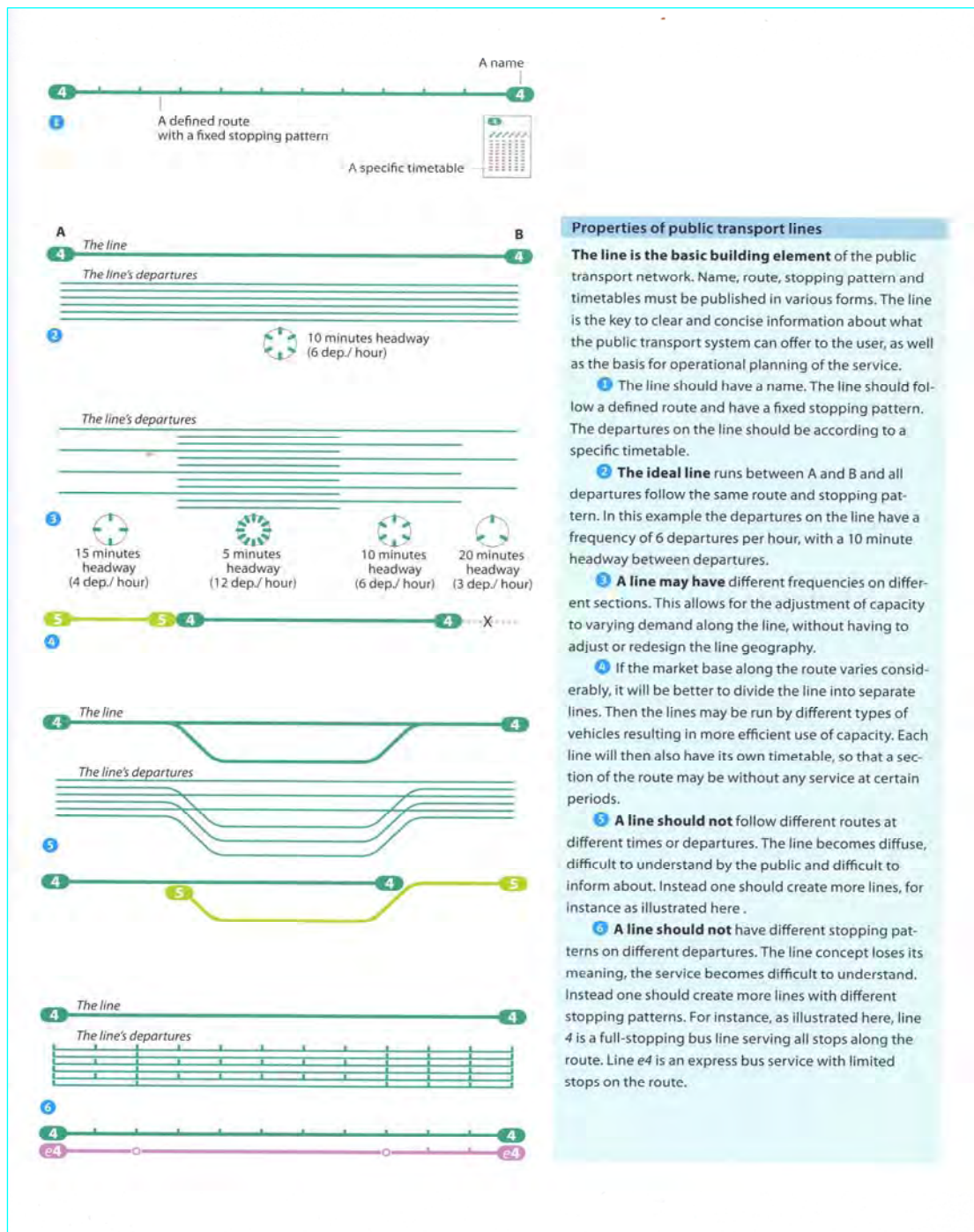


Figure 3: Building blocks of a public transport network.⁸

⁸ From Nielsen, G. and Lange, T. (2005), *op. cit.*, p. 95.

3. *Making transfers work*

The third feature of a successful network is ease with which travellers are able to transfer between services. The Squaresville model makes it clear that transfers are integral to a public transport system that can offer a large number of potential destinations at an affordable cost to the operator.

US researchers argue that different understandings of the role of transfers lie at the heart of the divide between the network approach to public transport policy formulation, which they call the 'multidirectional' approach, and the more traditional approach to public transport planning that concentrates on the provision of radial services to the CBD. In describing the new understanding of the importance of the transfer, Thompson and Matoff say:

Surveys asking what passengers like and dislike about transit find that transferring is at or near the top of the list of dislikes (Black, 1995; Meyer & Gomez-Ibanez. 1981). Passengers prefer a direct trip from their home to their job or other destinations. The express bus in some radial systems takes this finding to heart by designing systems based on direct routes from suburbs to CBDs. Transfers are avoided, but at the cost of limiting opportunities for travel to non-CBD destinations. In contrast, the multidestinal approach uses transfers to open travel paths to and from non-CBD destinations that are reachable in radial systems only by lengthy and circuitous travel. The intent is to induce new ridership through the provision of new travel opportunities created by transfers in the belief that the induced non-CBD patronage will exceed any CBD patronage that may be lost due to an added transfer.

...In its reliance on transferring, the multidestinal approach does not, however, embrace transfers that fail to confer a passenger benefit – by increasing travel opportunity or improving frequency, for example. Transfers on many older radial systems sometimes are an annoyance without offering compensating advantages. Eliminating these transfers can increase ridership ...

...The differing views on transferring lead to differing views of suburban bus lines. In the multidestinal approach, suburban bus routes are neither parallel routes to the CBD nor specialized "feeder routes" to trunk lines running to the CBD. Rather, they are treated as general purpose routes that interlock with each other through transfers to make intrasuburban mobility possible, while also feeding passengers onto trunk routes or dispersing passengers from trunk routes. It is as accurate to say that a rail or bus regional trunk line is a feeder to suburban bus lines as it is to say that bus lines feed the trunk line, or that suburban bus lines feed other suburban buses.⁹

To be effective, transfers must be carefully designed in both time and space to overcome the strong aversion to transferring that is expressed by users and potential users, particularly those whose past experience is of annoying transfers that offer no compensating advantages.

In timetabling for effective transfers, a frequency of six services per hour (10 minute headways) in both directions on each line is generally regarded as the minimum acceptable to travellers using a system without reference to timetables. This is called a random access pattern.

⁹ Thompson, G. and Matoff T., (2003), Keeping Up with the Joneses: Radial vs. Multidestinal Transit in Decentralizing Regions, *Journal of the American Planning Association*, Vol. 69, No. 3, p. 298.

If frequencies cannot be sustained at this level then timetable coordination is essential. A 'pulse' timetable, in which arrivals and departures of all services at chosen nodes are coordinated, is one way to maintain a network when frequencies are relatively low. This would be appropriate, for example, in a small suburban centre on a train line that operates on half-hourly or hourly frequencies. If different parts of the suburban district are also served by local bus lines, then an effective transfer point can be created by arranging for the local buses to all arrive shortly before the train and leave as soon as transfer passengers have reached the right bus (see HiTrans, p. 117).

The physical layout of a transfer point is also crucial. At interchanges, walking distances must be short and information systems must exist to support passengers who are making transfers (see HiTrans, pp. 100-101).

A ticketing system that places a financial penalty on transfers creates another obstacle to a successful network. Multi-modal ticketing systems are, therefore, an important part of good network design.

4. Institutions to manage network design, cross-subsidies and multi-modal fares

Although many cities have moved towards networked operations for their public transport systems, the most successful cities share certain characteristics in the balance they have found between centralised and market-oriented institutional structures for the delivery of public transport services.

As the HiTrans guide says:

Planning and competition are not necessarily contradictory. It is more a question of appropriate allocation of the roles of the two approaches in the institutional setup (p. 11).

The benefits of market-oriented institutional arrangements are best realised through tendering to the private sector for public transport operations, infrastructure development and maintenance within the context of a network plan. However, a public planning agency is required for a number of crucial functions. These include:

- *design of the network.*
- *provision of cross-subsidies*

In the real world, the distribution of trip origins and destinations will not follow the regular pattern assumed in the 'Squaresville' model. So, within a working public transport network, some lines will experience greater patronage than others. This means that institutional arrangements must allow for cross-subsidies to maintain on lower-demand lines the frequencies that are essential to operation of the network.

- *operation of a multi-modal fare system.*

Recommendations

- Freeze funding for expansion of urban road capacity;
- Tie any funding offered to the States for public transport infrastructure or other urban development initiatives to the preparation and implementation of regional transport plans by state agencies that include as a minimum:
 - Reorganisation of existing services into an effective integrated network built around reliable, high frequency service corridors and transfer points designed to international standards
 - monitoring of changes to access by public transport to social and economic opportunities for a range of user groups;
 - A simplified multimodal ticketing system for Sydney, and a national standard for the operation of e-tickets based ;
 - Measurable targets for shift of mode share away from car travel across the urban region;
 - Development of better mechanisms for contestable evidence-based policy development. The significant shifts in policy and practice which must take place in very short timeframes will require the support of both the expert policy community outside government and the wider public.

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