Watching the Swiss:

Lessons for public transport and density in peri-urban Australia
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Abstract

According to conventional wisdom, small towns and settlements on the fringes of Australian cities are impossible to serve by public transport. Low population densities mean that public transport cannot attract enough passengers to be viable, let alone have any significant impact on levels of car use.

The case of semi-rural Switzerland challenges this consensus. Villages around Zurich-Winterthur have population densities comparable to semi-rural Australia, but journey-to-work figures show their public transport mode share exceeding those of most Australian capital cities. While there are obvious differences in urban form, the greatest contrast may be in public transport planning methods and supply policies.

This paper compares the settlements in Zurich's Weinland region with those on Victoria's Bellarine Peninsula, focussing in particular on population density and journey-to-work mode shares. In analysing the similarities and differences, it also introduces the Weinland’s transport planning methods (explored in greater detail in Petersen 2009) which appear to be critical to its success. It therefore challenges Australian transport policy makers to reconsider the traditional approach to public transport planning in the commuter belts of Australian cities.
Introduction

The public transport needs of small towns and settlements in the commuter belt of major Australian cities rarely get much attention. Unlike the major cities, small settlements rarely have pressing congestion problems that cannot be solved by simple road capacity upgrades. Very high levels of car dependence are taken as a given: if there is any transport service, it will tend to be a limited, ‘welfare’-style service for people who cannot drive. If the topic of public transport is considered at any length, it will be assumed that the settlements are too dispersed and too low density to have any chance of being provided with high quality public transport.

This is not surprising when many influential academics and commentators believe that even our suburbs are too low density for the provision of high quality public transport. Newman & Kenworthy's well-known hyperbolic graph of per capita gasoline use against urban population density (1989: 128) suggests that density is the principal factor affecting levels of car use, and therefore the use of public transport. In their accompanying analysis, they suggest that where population densities are below 30 people per hectare—higher than the average urban density of all Australian capital cities (ABS 2006a)—public transport 'is either a major financial burden or is reduced to insignificant service levels' (Ibid: 131).

Newman & Kenworthy are not unusual, however, in seeking to identify a density threshold for public transport's viability. A relationship between density and public transport travel demand is widely acknowledged by planners: it seems obvious that if all other factors are equal, a public transport line in a higher density area will be more
highly used (and more profitable) than a similar line in a lower density area, simply because there are more potential users within walking distance. However, all other factors are rarely equal, which may explain why few writers in different cities and at different times have been able to agree on a minimum density to support viable public transport services (see discussion in Mees 2000: 145-50).

Yet most commentators would probably agree that it is difficult, if not impossible, to provide frequent public transport services (e.g. running every ten minutes or less) to places with population densities significantly lower than most Australian suburbs, such as small settlements or semi-rural areas. In decrying low density urban forms that 'encourage and necessitate automobile use', Pucher & Lefèvre (1996: 21-22) cite as the worst examples the 'ex-urban' development occurring in the United States, France and England, which they define as 'the rapid growth of distant towns and rural areas not contiguous to the primary, built-up metropolitan area'. With the apparent impossibility of providing regular public transport to these areas, some commentators have suggested demand-responsive services are the answer; even though they tend to be expensive to operate and have only low occupancies (see e.g. Nutley 1990: 97, Cervero 1997: 249-252). However, other authors (Mees 2000; and Nielsen et. al. 2005) have suggested that a network effect can be harnessed to provide higher quality public transport services to lower density areas.

The concept of the network effect challenges transport economists’ assumptions that improving quality of service in low density cities (say by doubling service frequencies) will usually result in a smaller increase in the number of passengers (i.e. less than doubling), therefore showing an elasticity of demand of less than 1.0 (see eg
TRL 2004, referred to in Nielsen & Lange 2007: 6). Proponents argue that this assumption might hold if only services on a limited (usually radial) network of existing routes are boosted. However, if the route network is re-designed to become a web of connecting (usually radial and cross-town) routes so that a greater range of origins and destinations can be conveniently connected, the returns can significantly exceed the investment of additional resources (Mees 2000: 139-142, Nielsen et al 2005: 86-87).

In order for any such network to function, passengers must be willing to transfer between services. They are usually assumed to put high penalties on transfers, although proponents of the network effect argue that this can be significantly reduced by integrating fares, providing physical facilities for easy and relatively comfortable transfers, and by minimising waiting time (Mees 2000: 141-142). In urban areas, waiting time can be minimised by providing a simple, efficient network of high frequency services, meaning that the next service is never a long wait away. In semi-rural areas, however, there are not enough passengers to support such high levels of service, so a different approach must be taken. ‘Pulse timetabling’ or integrated timed-transfer, which involves the rigorous coordination of regular (but not very frequent) services so that passengers can transfer at interchange points, may be a better approach. The type of network provided to low density suburban and semi-rural areas in Switzerland has been suggested as a possible model for densely populated rural areas (e.g. Cullinane & Stokes 1998: 316-317, Mees 2000: 282). However, given the many and obvious differences between Switzerland and Australia, can any Swiss and Australian regions really be compared?
The Study and Choice of Case Studies

This paper compares the urban density and form of one Swiss and one Australian semi-rural case study areas, aiming to eliminate population density as the main explanation for the much higher rates of public transport use in the Swiss sub-region. It presents results from part of a research project which is investigating good public transport planning practice in Switzerland, and evaluating the application of a similar approach to a comparable Australian sub-region. The project aims to identify the important features of the Swiss transport planning model (explored for Zurich's Weinland in greater depth in Petersen 2009) and distil lessons for public transport planning in densely populated, semi-rural regions in Australia.

Swiss case studies were chosen due to evidence of high rates of public transport use in Switzerland's cities, including the highest number of boardings per capita in Western Europe for Berne and Zurich (Kenworthy & Laube 2001) and following authors’ references (above) to Swiss rural public transport as an example of good practice in network planning. The particular case study area explored in this paper, Zurich’s Weinland, was selected because it is the most extensive rural or semi-rural region within the area of responsibility of the Zürcher Verkehrsverbund ('Zurich Transport Federation' or ZVV). The ZVV is the largest regional public transport planning authority in Switzerland, and is perhaps the most highly respected in Europe thanks to its role in significantly increasing the already high rates of public transport use in a wealthy, Western city.
An Australian example was selected for comparison to the Weinland with the aim of testing the principles of the Swiss approach to semi-rural public transport planning in a contrasting ‘new world’ setting. Australia, like Switzerland, is a developed country with high labour costs and high levels of mobility. While Australia has comparatively low population densities, its urban development tends to be more compact and contiguous than the scattered settlement patterns resulting from the more laissez faire American approach. Australia's most densely populated rural areas might be expected to provide a more difficult, though perhaps not impossible, semi-rural context for attempts to harness the network effect.

Australia has certainly had a very different history and pattern of urbanisation to Switzerland and much of Europe: the overwhelming predominance of the state capital cities is often observed (see eg Neutze 1981: 8). Commentators have attributed this to various factors: by urban growth being driven by overseas migration to the already established capital (and port) cities; by the fact that Australian farming was largely commercial, less intensive and never supported a large rural population; and by much development occurring after the development of mechanised transport (railways) (Neutze 1981: 9-14). In contrast, peasants and farmers had settled the fertile areas of Switzerland in closely-spaced villages long before mechanised transport, rural depopulation or the establishment of the modern state. Densely populated Australian rural areas are therefore more limited in extent than those in Switzerland, and are usually found in areas surrounding the largest cities where commuters have replaced old residents or have led to the growth of settlements.
One such area was selected as the Australian case study. The Bellarine Peninsula in Victoria (a peninsula separating the western side of Greater Melbourne’s Port Phillip Bay from Bass Strait) is a clearly defined sub-region of comparable size to Zurich's Weinland, and also has a similar population density. It has an existing public transport system to provide some base data for comparison, and relatively simple travel patterns along the length of the peninsula to the nearest major urban centres (and low levels of cross-travel). Although the peninsula does not benefit from being located in a travel corridor between cities in the same way that the Zurich example does, the Weinland’s northern cities are quite small and their travel demand is split between various lines.

It is worth noting that Switzerland has a distinct government structure and political culture. The creation of a nation across linguistic and religious divides meant that national institutions, including services such as the railways, were important unifiers (Linder 2004: 14). However in order to protect cultural differences, the powers of the central government were limited, leaving quite high levels of autonomy for the constituent cantons (or states). Linder comments that "the political culture of modern Switzerland was shaped first and foremost by its political institutions", including the popular right to launch a referendum and federalism (Ibid). The 26 cantons are highly varied in both population and geographic size, meaning that some are dominated by large cities, while others are much more rural in character. Partly because of constitutional structures to balance power between the cantons, a 'rural-conservative culture' is often considered to be 'over-represented' in the political system (Ibid). Within the cantons, the numerous communes (local government areas) also generally retain significant levels of autonomy, many having existed long before the cantons. The national cultural identification with rural and mountainous areas also ensures
support for 'the decentralised subsidies for rural and mountainous areas or for agriculture… which are justified as political acts of solidarity' (Ibid: 17). Switzerland is traditionally also known, unlike most of Western Europe, for being strongly economically liberal, and its economic approach is sometimes compared to the Anglo-Saxon states. It was slow to develop a welfare state, partly because of referendums challenging social policy initiatives, and still has relatively modest direct social expenditure by the state, although there is extensive and often state-subsidised private welfare provision (Leimgruber 2008: 4-10).

Like the Swiss, Australians have also traditionally endorsed a role for government in the provision and subsidisation of public services, especially in more remote areas. The less numerous Australian states, however, almost all contain large capital cities as well as more rural areas, meaning that they have often sought to resolve questions of the urban-rural balance within, rather than between each state. In contrast to Switzerland, Australian local government is less powerful and less respected, having largely been granted by centralised colonial authorities (Neutze 1981: 15-16) and with its ongoing structure subject to the whim of successive State governments. Like the Swiss, Australians also show sentimental cultural attachment to rural areas or 'the bush', and generally desire to see a reasonable standard of living for rural inhabitants, although there has been little need to hold the country together for fear of secession along cultural, urban/rural or linguistic divides. Overall, the political culture and institutional structure in Switzerland may have made it more likely that the concerns of rural areas in transport policy would be heeded. Furthermore, the consistently high rural population density would also have made it easier to provide a higher standard of public transport services across more of the country's rural areas. However, the
differences do not appear to provide an insurmountable barrier to improvement of public transport services in Australian semi-rural areas.

A Case Study from Switzerland: Zurich's Weinland region

The ZVV is the authority with responsibility for public transport services throughout the Canton of Zurich, which has a population of 1.3 million and an area of 1,728 square kilometres (Canton of Zurich Statistical Office 'CZSO' 2009). It covers Switzerland’s largest urban area, including the cities of Zurich and Winterthur, as well as the network of surrounding towns which have grown to become Greater Zurich's suburban area.

The residents of the Canton of Zurich use public transport for the journey to work at very high rates: from the 2000 census, 40.7% of the canton's working commuters used public transport to get to work, compared to 47.2% by 'individual motorised transport' (predominantly car) (Swiss Federal Statistical Office 'SFSO' 2000). To take an Australian example, the figures are far more ecologically sustainable than those for metropolitan Sydney, the Australian city with the highest journey to work mode share for public transport (21.2%) and the lowest share for car journeys (69.6%) (ABS 2006b, see also Mees et al. 2007). The canton’s students (from primary to tertiary level) also have an extremely high use of non-motorised transport modes: walking and cycling account for 65% of their travel. Together with public transport, 96.3% of students use sustainable transport modes and only 3.3% use individual motorised transport. The canton also achieves a high modal share for sustainable transport
beyond the journey to work and education: according to the 2005 transport micro-census (or survey) (SFSO 2007: 61), the Zurich region had the largest share of all trips by public transport, and the lowest share of trips by private motorised vehicles of all the regions of Switzerland. Although its share of cycling was lower than in some other cantons, it also had the largest percentage of trips by walking, cycling and public transport combined of all the regions of Switzerland.

[Insert Figure 1 here]

Zurich's Weinland (or the Zürcher Weinland) region is located at the northern tip of the Canton of Zurich. Named after its vineyards, the Weinland is the Canton's most extensive rural or semi-rural area, and its climate is relatively mild and sunny compared to much of northern Switzerland. It is located between the cities of Winterthur and Schaffhausen (which is in its own Canton of Schaffhausen). Though agriculture is still relatively important in the region, the closely spaced villages are expanding steadily and much of the working population commutes to neighbouring urban centres.

[Insert Figure 2 here]
The Weinland is considered to be one planning region, although it includes both rural and more urban municipalities surrounding Winterthur and Schaffhausen (as differentiated by an SFSO (2004) map). Except for its addition of the municipality of Altikon, the Weinland planning region is also almost identical to the administrative district or Bezirk of Andelfingen, named after the region’s largest central town, which has a population of about 3500 people when combined with the settlement across the River Thur in the neighbouring municipality of Kleinandelfingen, or 'Little Andelfingen'. The region achieves an average journey to work figure of 21.7% of commuters travelling to work by public transport, and 64.7% by car (see table of figures for Weinland municipalities below).

The Weinland is therefore considered a problem area for transport and land use planning in the Canton, as continuing development will put more of the Canton’s population in an area where car use is significantly higher than the Zurich average. Nevertheless, the Weinland's average rate of public transport use exceeds that of Sydney, and its rate of car use is also lower. Even when the areas classified as more urban are excluded, rates of public transport use are generally between 13 and 20% and there are lower levels of car use for the journey to work than in most Australian capital cities.
This outcome, however, does not appear to be the result of urban form or high population densities. Most of the Weinland's settlements have fewer than a thousand people, and are scattered across a landscape that is—by Swiss standards—relatively flat. The urban form of the townships and villages is varied, although many include a compact and historic town centre where large, historic village houses are divided into two or more dwellings. Some of the larger settlements (such as Andelfingen) include small areas of American-style single family housing built in the 1960s and 1970s, as well as occasional examples of more recently-built two or three storey apartments. The visitor’s impression is one of quiet small towns and villages in a closely-settled rural area.

[Insert Figure 3 here]

Villages in the Weinland are generally quite compact and walkable: a 750 metre radius from a station tends to cover most of the towns, and a 400 metre radius from one or two bus stops tends to cover most of the smaller villages. However, the Weinland region still has a low population density: when its residents are divided by the total area, its gross density is less than 1.6 people per hectare (or 1.4 if the municipalities identified as more urban on the fringes of Winterthur and Schaffhausen are excluded) (CZSO 2009, from SFSO 2000 Census). In comparison, the large expanses of urban areas in Australian capital cities have almost ten times the urban population density (for example, Sydney has more than 20 people per hectare; Adelaide almost 14) (ABS 2006a).
Yet the Weinland density figure includes large areas of unpopulated rural land, and it is conceivable that the settlements themselves have high population densities. Fortunately, the Canton of Zurich's Statistical Office (2009) also gives the percentage of the Weinland's total area taken up by settlements, which when added to the area occupied by transport infrastructure (including streets, roads and railway lines) accounts for 9.8% of the region's total area. The urban population density of the settlements themselves can then be approximately calculated, with the caveat that roads and railway lines extend beyond settlements and therefore slightly understate the real figure. Averaged across the Weinland, settlements have 15.9 persons per hectare, while in Trüllikon, a smaller municipality in the heart of the Weinland, the figure is 13.9 persons per hectare. These urban density figures are remarkably similar to the average urban density figures for larger Australian cities: Sydney, Melbourne and Adelaide's urban densities are 20.4, 15.7 and 13.8 persons per hectare respectively (ABS 2006a). In fact, a map of settlement area per resident (SFSO 2005: 31) identifies the Weinland region as having the least dense settlement in north-eastern Switzerland, with a settlement area per resident of between 601-800 square metres.

Undoubtedly, urban form, traffic and parking restraints in the very centre of Zurich make it difficult or expensive for Weinland workers who commute there to drive: only 42.7% of them do, although the City of Zurich is the destination for only 16% of commuters travelling from the Weinland to other regions (SFSO 2000). For closer Winterthur and surrounds, which is the destination for almost one-third of the Weinland's external commuters, public transport use is higher than the Weinland's
average for all journeys to work (32.0% compared to 21.7%), but so is driving (67.4% compared to 64.7%, thanks to lower levels of walking and cycling (SFSO 2000).

**Comparing a Case Study from Australia: Victoria's Bellarine Peninsula**

From a transport perspective, the Bellarine Peninsula can be considered a comparable Australian region to Zurich's Weinland. It is located to the south-west of the centre of Melbourne, across Port Phillip Bay (the bay around which the suburbs of Melbourne extend), and separates the western side of the bay from Bass Strait.

[Insert Figure 4 here]

The peninsula is a densely-populated semi-rural area by Australian standards, and it is also a clearly defined sub-region of comparable size and similar population density to the Weinland. The peninsula is close enough to be within commuting distance of the nearby centre of Geelong (population 137,221) and the metropolis of Melbourne (3.4 million)(ABS 2006a), although it is further away than the Weinland is from its less populous equivalents of Winterthur and Zurich. The peninsula contains several large townships from which a significant proportion of the workforce commutes to Geelong and Melbourne (which is 75 km further away by road). The coastal locations of many of the towns make them a holiday location as well as a popular residential area. As in the Weinland, commuters must travel in the same direction to reach the smaller major
centre (Geelong) and the largest centre (Melbourne). Similar to the Swiss case study, travel patterns are simple, with most travel occurring along an east-west axis (in the Weinland, north-south), with low levels of cross-corridor travel.

The Bellarine Peninsula itself is approximately 15 km wide from north to south, and stretches almost 25 km in length, from the small coastal township of St. Leonards in the east, to the outskirts of the suburbs of Geelong in the west. It is significantly larger than the Weinland, which is about 15 km from north to south, and around 15 km east-to-west at its widest points, but loses territorial area through its irregular shape. While the peninsula's boundaries are not strictly defined, its area can be approximated from a combination of ABS geographical classifications, including the Statistical Local Area *City of Greater Geelong- Part B*, the State Suburbs of *Moolap - Balance*, and *Leopold*, and the local government area of the *Borough of Queenscliffe*.

[Insert Figure 5 here]

This gives it an area (see table below) just over double that of the Weinland with just under double its population, meaning the peninsula has a gross population density of 1.1 persons per hectare, compared to the Weinland's 1.6 persons per hectare (or 1.4 excluding the SFSO's more 'urban' municipalities). There is also a very significant summer influx of population to the coastal townships, particularly to the southern surf beach townships, which is not reflected in the census figures collected in late winter (August).
The majority of the Bellarine Peninsula's population is contained in larger, mainly coastal townships of between around two and ten thousand people. In larger townships, it is often the case that only the area around the centres of the township offer shops and community services within walking distance. This could undermine the use of public transport by making regular car trips almost compulsory; on the other hand, public transport provision could be less difficult than in the Weinland where the settlements are smaller and more dispersed across the landscape. The peninsula also has areas of 'rural residential' development in its centre and on the outskirts of some of the townships, and a golf course-residential development outside Barwon Heads.

Dwelling density in the townships appears to be similar to that of many post-1920s suburbs of Australian towns and cities, with predominantly single family housing on blocks of approximately one-sixth of an acre. Settlement population density is more difficult to measure than in the Swiss examples, because the ABS' Urban Centre/Localities and State Suburbs are often too coarse for measuring the density of small areas (as they include significant proportions of undeveloped land, and even a river estuary). However, as one indication, Leopold, a satellite dormitory suburb of just over 8000 people, has an urban density of 16.7 persons per hectare. This figure will probably be higher than the figures for other townships, mainly because Leopold
would be expected to have a greater proportion of permanent residents, and may have a smaller proportion of land devoted to non-residential uses.

The 2006 Census figures for residents in the same area used to calculate the Peninsula's population density (see below) give a journey to work mode share for public transport of only 3.0%, well below the average of 21.7% for the Weinland. However, this figure is probably too generous because it includes quite long car trips to the railway stations in the urban area of Geelong (which is outside the area of the Peninsula). The mode share for trips involving buses (which are the only forms of public transport running within the area) is only 1.1%.

[Insert Table 3 here]

So what else might explain the large differences in public transport use between the two areas, if it is not population density, and probably not urban form? It is not, for example, the case that car ownership is difficult for most residents in the Weinland. Average car ownership is a quite high 549 cars per 1000 residents and is continuing to grow steadily, while the rate in villages is higher: Trüllikon, for example, has 621 cars per 1000 residents (CZSO 2009). Car ownership on the Bellarine Peninsula is higher than in the Weinland, but not much higher, at 654 cars per 1000 residents (ABS 2008).
The price of petrol is significantly more expensive in Switzerland than in Australia: AUD 1.84 per litre in Switzerland in August 2009 (converted from figures in AA 2009) compared to AUD 1.26 in Australia (AIP 2009: 7), which is likely to discourage driving in relative terms, although the Swiss may have higher incomes (Swiss GDP per capita is higher than Australia's (OECD 2009)). Even so, the Swiss petrol price is one of the lowest in western Europe (AA 2009), and Swiss cities are able to attract a greater rate of public transport boardings per capita than other European countries with higher petrol prices, such as France (see Kenworthy & Laube 2001).

The extent of road infrastructure connecting to other regions is also unlikely to explain most of the difference. The Weinland has multiple smaller roads and one expressway which is gradually being upgraded to four lanes under a cantonal plan (Canton of Zurich 2007: 11), while the Bellarine Peninsula has two four-lane highways and one other double lane road (for almost double the population).

Although there are differences between the regions, they do not appear to explain the large discrepancy in public transport use. It therefore seems that the quality of public transport itself has a significant role to play. Unlike the Bellarine Peninsula, which has one disused railway line, the Weinland has two rail lines running through it from north to south. It benefits from being located in a transport corridor between cities, although the cities to its north are quite small: the largest city and terminus of the
western line, Schaffhausen, has a total of 33,628 people, or with the cities in its surrounding administrative district, a population of 49,412 (SFSO 2000). However, Schaffhausen's line through the Weinland primarily provides it with local connections to Winterthur (population 90,483 (SFSO 2000)), while longer-distance trains between Zurich and Stuttgart run on a line to further to the west of the Weinland, and provide the quickest journeys to Zurich from Schaffhausen. On the western line through the Weinland, services run every half hour during the day (with extra peak services), before dropping down to hourly in the evening. Services on the winding eastern line run hourly and terminate at Stein-am-Rhein, which has a district population of only 4,986 people (SFSO 2000).

Having rail services undoubtedly helps the provision of high quality public transport, but it does not explain the high modal share for villages which are beyond walking distance of a railway station, such as Trüllikon. Only a small proportion of Trüllikon commuters drive to the station: there are only 79 (paid) car parking spaces at the closest station at Marthalen (SBB 2009), which could not cater for all the workers who use public transport to commute from Trüllikon, let alone from the other surrounding municipalities. A significant proportion of commuters in fact use the bus to get to the station, even though it runs only hourly, because it arrives four minutes before the departure of the train to Winterthur. As the ZVV has consciously planned the services to form a network, the bus makes that connection every hour, between fixed operating hours (weekdays between 6am and 8pm, with services operating in the reverse direction until midnight), every day of the year.
In the Canton of Zurich, both the SBB (Swiss Federal Railways) and the regional transport authority, the ZVV, seek to ensure that trains depart at the same time past the hour from first to last train. This is mainly because it makes efficient use of the rail system, but it also makes it easy to plan connecting bus services (run by another operator), which also depart from their stops at a consistent, easily memorable time every hour. The region’s public transport services are planned together to meet or exceed the high service standards that were approved by the canton government, including hourly services to each of the canton’s 171 municipalities (see Regulation 740.3 and discussion in Petersen 2009). Furthermore, the authority plans services transparently, overseen by a board with representatives from local and cantonal governments, releasing regular strategy documents and publishing even the most minute proposed timetable changes for comment.

In contrast, services on the Bellarine Peninsula run approximately every hour (though not every hour) to most towns, and meet with most trains to Melbourne at Geelong station. Partly because of the desire to make some connection to irregular train departures, bus departure times can change. However, the network structure is also more complicated and less efficient: buses also tend to follow indirect and time-consuming routes, which can add additional sections at times, as part of attempts to use one route to provide coverage to all towns along the way. The buses and trains are run by different operators: the local buses are run by a private company, which is overseen by a regional office of the Department of Transport that has only a limited role in strategic service planning. The rail operator, V/Line, is a State-Government owned corporation, but it is mainly concerned about problematic interactions with Melbourne metropolitan trains (run by a private franchisee) in the core of its
commuter network, rather than with ensuring local bus connections. The low patronage of public transport on the Bellarine Peninsula may indicate that commuters have simply responded rationally to the services they have been offered.

Conclusion

Despite the obvious visual differences between the Swiss villages of the Weinland and Victoria's Bellarine Peninsula, the population densities of each area are remarkably similar, both in terms of gross density across the sub-region and the density of urban settlements. The structure of the settlements does differ, however: in the Weinland, settlements are compact but more numerous and dispersed across the landscape, while on the Bellarine Peninsula there are fewer but larger townships. The differences may pose some challenges for public transport route design: for example, direct regional bus routes connecting townships on the Bellarine Peninsula may have to be combined with local buses to provide sufficient coverage of urban settlement. Importantly, however, density itself does not seem to be the barrier to higher patronage or better services.

There are likely to be various reasons contributing to the Zurich Weinland's higher patronage in comparison to the Bellarine Peninsula, not least of which is being close to major cities served by excellent public transport services. However, in a society where most people can choose to use a car, the high levels of public transport use in
the Weinland could not occur without the provision of high quality local public transport. Given that services in the Weinland are relatively infrequent, what seems to be critical to the quality of its public transport is that a network has been created, in accordance with observations by Mees and Nielsen, by planning an efficient web of routes with timed connections between services. The commitment of the regional public transport authority to implementing consistently high standards of service between standard operating hours, and providing departures at the same ‘minutes’ past the hour, are also crucial to the functioning of the network and its ease of use for passengers. It is this comprehensive, area-wide service planning that enables the efficient delivery of high quality services to an area that would otherwise be considered hostile to public transport.
References


Results of the 2005 Microcensus on Travel Behaviour'. Neuchâtel.
Figure 1: Locations of the Canton of Zurich and the Zurich Weinland in relation to other Swiss cantons and districts

Source: SFSO (2001). Map altered to show the Canton of Zurich (circled in black) and the District of Andelfingen (which approximates the Zurich Weinland area, outlined in red).
Figure 2: Location of the Zurich Weinland in relation to Winterthur and Zurich

Source: Google Maps (2009). Map altered to show the approximate area of the Zurich Weinland (circled in black).
Table 1- Municipalities in the Weinland and their journey-to-work mode share

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<td><strong>Total</strong></td>
<td><strong>174.6</strong></td>
<td><strong>27,221</strong></td>
<td><strong>12356</strong></td>
<td><strong>13.6</strong></td>
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</table>

Sources: Journey to work figures from SFSO (2000); Area and population figures compiled by the CZSO (2009) from SFSO originals. The municipalities in **bold** are classified as more urban (SFSO 2004).
Figure 3: A vineyard overlooking the village of Trüllikon, Canton of Zurich

Figure 4: Location of the Bellarine Peninsula in relation to Melbourne


Figure 5: ABS geographical classifications used to approximate the Peninsula

Source: ABS website (2008). ABS geographical classifications from left (clockwise): City of Greater Geelong (C) - Pt B with 'Queenscliffe (B) (Local Government Area)' bordering to the south-east; the 'State Suburbs' of 'Moolap - Bal'; and 'Leopold'.
### Table 2: Comparing Gross Population Density

<table>
<thead>
<tr>
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<th>Zurich Weinland</th>
<th>Bellarine Peninsula</th>
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<tbody>
<tr>
<td>Population</td>
<td>27,221</td>
<td>45,845</td>
</tr>
<tr>
<td>Area (square km)</td>
<td>174.3</td>
<td>401.8</td>
</tr>
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<td>Gross Density</td>
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<td>1.1</td>
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</table>

Sources: ABS 2006 Census; SFSO (area 1995, population 2000).

### Table 3: Comparing Public Transport Mode Share

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<th>Bellarine Peninsula</th>
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<tr>
<td>Individual motorised</td>
<td>64.7</td>
<td>92.8</td>
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<tr>
<td>Public transport</td>
<td>21.7</td>
<td>3.0</td>
</tr>
<tr>
<td>Foot or bicycle</td>
<td>13.6</td>
<td>4.2</td>
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</table>

Sources: SFSO 2000 Census; ABS 2006 Census.

### Table 4: Comparing Various Data across the Sub-Regions

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<th>Bellarine Peninsula</th>
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<tbody>
<tr>
<td>Population</td>
<td>27,221</td>
<td>45,845</td>
</tr>
<tr>
<td>Area (square km)</td>
<td>174.3</td>
<td>401.8</td>
</tr>
<tr>
<td>Gross Population Density (p/ha)</td>
<td>1.6</td>
<td>1.1</td>
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<tr>
<td>Car ownership (per 1000 people)</td>
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<td>Petrol (AUD per L)</td>
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<tr>
<td>Journey to work mode share (%)</td>
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<td></td>
</tr>
<tr>
<td>- Individual Motorised (cars)</td>
<td>64.7</td>
<td>92.8</td>
</tr>
<tr>
<td>- Public Transport</td>
<td>21.7</td>
<td>3.0</td>
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<tr>
<td>- Foot or bicycle</td>
<td>13.6</td>
<td>4.2</td>
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