

# **The Rise and Decline of Public Transport in New Zealand and Some Lessons for its Recovery**

Vince Dravitzki, Tiffany Lester  
Opus International Consultants, Wellington, New Zealand

## **1 Introduction**

In New Zealand, public transport is increasingly seen as a solution to two major transport problems: traffic congestion in the major cities and the generation of greenhouse gas emissions. Greenhouse gas emissions from transport continue to increase at approximately 3 % per year since 1990 offsetting gains that may be made elsewhere in the economy. Public transport service improvements and advertising over the last five to ten years have increased patronage but historical comparisons show that this patronage is barely one third of pre-1950s levels even though the population has more than doubled. Much needs to be done if public transport is to be lifted from its current position as a minor contributor to how New Zealanders travel. (Less than 3 % of all travel is by public transport.) Typically New Zealanders look to learn from experience in other countries but need to assess whether those situations are applicable to New Zealand. In this paper we look instead to New Zealand's past to identify the circumstances in which public transport was a success. While the paper draws on historical data the paper is not intended as a comprehensive history of public transport in New Zealand. The rise and decline of public transport in New Zealand illustrates a number of issues that are of relevance today:

- The balance between modes is more than simply one of "car travel" and "alternate modes";
- There are subtle but significant differences between the different forms of public transport;
- The relationship between form of energy and resultant infrastructure;
- The role of rapid transit in metropolitan travel;
- The problems of fragmented governance;
- The importance of the social/recreational journey in travel mode choice.

## **2 A short history**

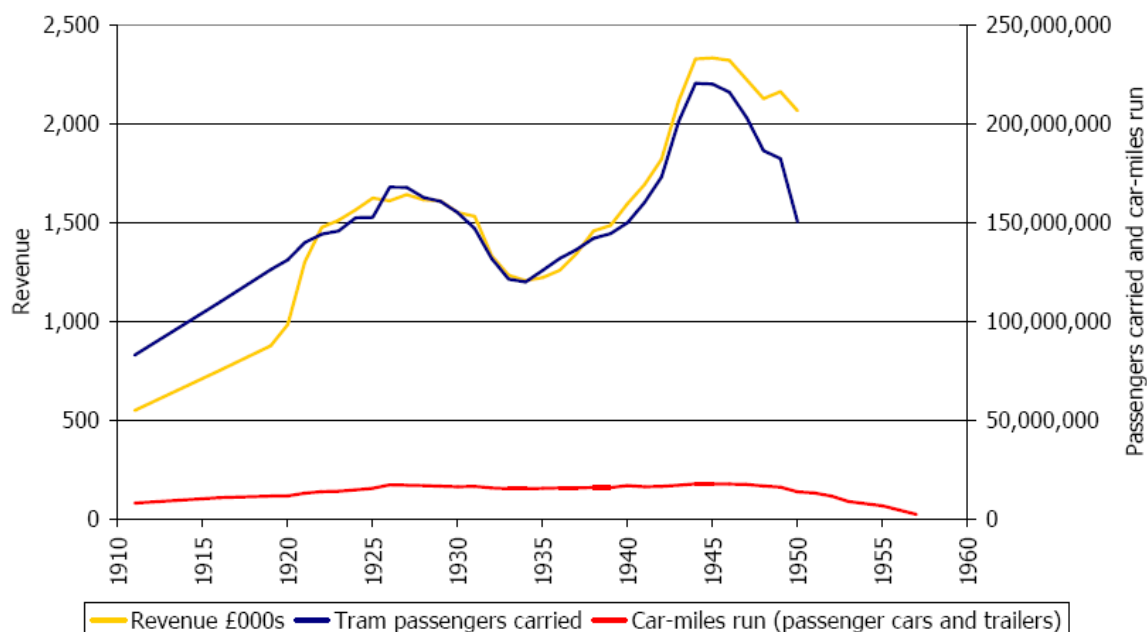
### **2.1 Growth**

The period 1899 to 1916 was the start of a new era in New Zealand transport with twelve electric tram systems being laid in New Zealand cities and towns. This was the first time electricity was used as a significant source of transport energy, replacing horse- or steam-power. In contrast to that previous era, these systems were publicly owned by the local Councils (empowered to do so by the 1908 Transport Act).

The four main cities had populations ranging from 50,000 to 180,000 to support their public transport systems and here trams dominated urban passenger travel until the early 1950s at which time trams were replaced by motor-buses or by trolley-buses. However, the tram systems provided in the towns serviced, and relied on, small populations of only 6,000 to 20,000, and three of these systems were short-lived.

This public transport system had a significant impact on the growth of the cities. Development expanded around the public transport routes, and small adjacent settlements became amalgamated into the wider suburban area.

Figure 1 shows the history of tram systems in New Zealand, with regards to the car-miles run (1 mile = 1.61 km), passengers carried, and revenue earned (£1 = \$2). The popular view is that trams were unchallenged as a preferred means of travel until the early 1950s. Figure 1 appears to support this popular view but this popular view is not correct.



**Figure 1 History of tram system operations**

It appears that from the 1920s trams experienced strong competition from three other transport options:

- Cycling became a noticeable competitor in the 1920s. We have not identified why this occurred then but it may reflect the progressive sealing of New Zealand's urban roads at that time making cycling easier.
- Ownership and usage of private cars was increasing and was taking some passengers from public transport, but the fleet had less than 120,000 cars in 1928 so this effect would have been minor.
- Most of the competition to trams came from privately operated motor-buses.

Buchanan (*Traffic in Towns*) identified that the First World War exposed many soldiers to the uses of trucks and that post-war many soldiers set up small bus companies and trucking firms or motor repair services. A similar trend appears to have happened in New Zealand and both countries passed legislation (1926 and 1928) to protect tram systems from the competition of buses. New Zealand legislated that buses could not operate on tram routes unless the fare was 2 pence a section dearer (approximately 100 % of the average tram fare).

However, in spite of this competitive restriction on buses, all cities and towns that had tram systems also had, from 1934 onwards, ancillary bus services, presumably running to those areas not services by trams. Data on the numbers using these buses is not readily available, but patronage appears to be about 10 % of the tramway systems patronage shown in Figure 1.

Notably no new tram systems were laid after 1916 (although there was some ongoing additions to the network). Settlements without tram systems established bus-only public transport networks.

Two factors significantly impacted on the long-term tram patronage trend from 1930 to 1950. First the 1930s' Depression's impacts of reduced economic activity significantly decreased patronage and second, the Second World War, with its restrictions on car use and petrol rationing boosted patronage. Tramway patronage was at its peak in the War years as shown by Figure 1. However, with the growth of the associated bus system, overall public transport was at its peak in the 1950s with respect to passengers carried both as an absolute number and as a percentage of travel.

## 2.2 Change and decline

The 1950s was a period of substantial change across a number of fronts. Firstly most of the restrictions that may have constrained private car uptake and use from the previous two decades had disappeared. Therefore the initial decline in passenger transport use immediately post-World War Two is principally attributed to a greater use of existing private cars once fuel and tyre restrictions were eased, but few additional cars entered the fleet. Then the 1950s was, briefly, a period of great wealth in New Zealand, and private car ownership and use increased rapidly. By the end of the decade the goal of British and US car makers for the Western World of "a car for every household" was in New Zealand close to being achieved.

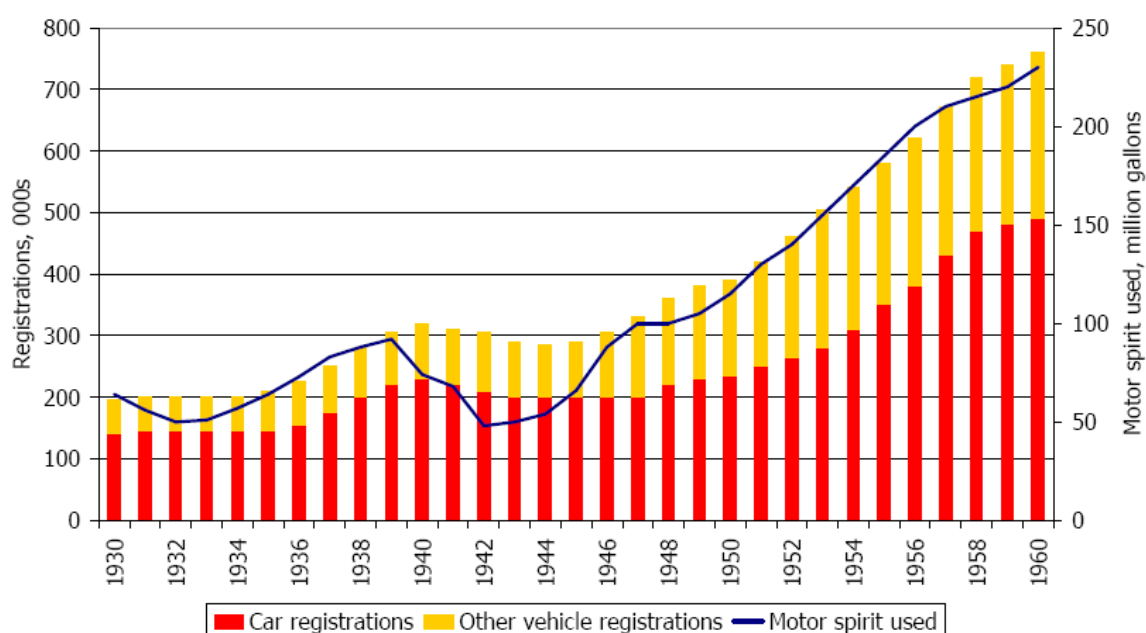


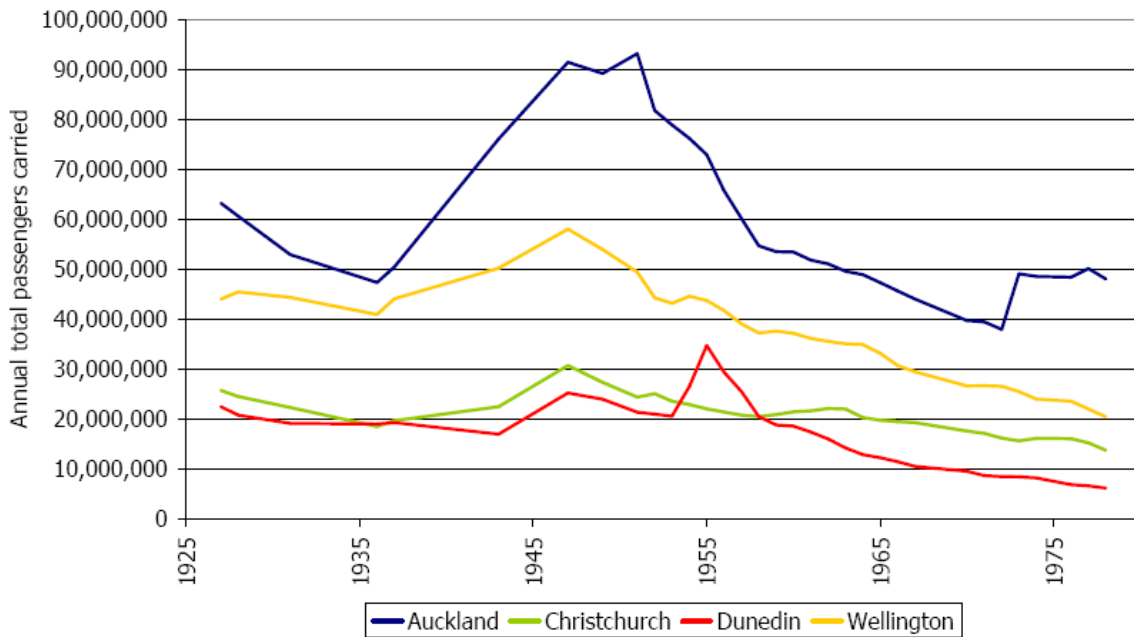
Figure 2 Annual vehicle registrations and motor spirit usage

Figure 2 shows the trend of private car uptake and usage. As New Zealand's population grew, cities began to expand but this time in a form governed by the private car rather than by public transport. Against this background, there were large changes in the public transport system. With the exception of Wellington, all the tram systems were replaced by bus systems, the replacement of the main tram system being initially trolley buses but which were in turn replaced by motor-buses except in Wellington. We have not identified the exact reason for the replacement but clearly reinvestment would have been necessary in the tram system which was now approaching fifty years old and was being outgrown by the expanding cities. The tram systems were also starting to show modest losses.

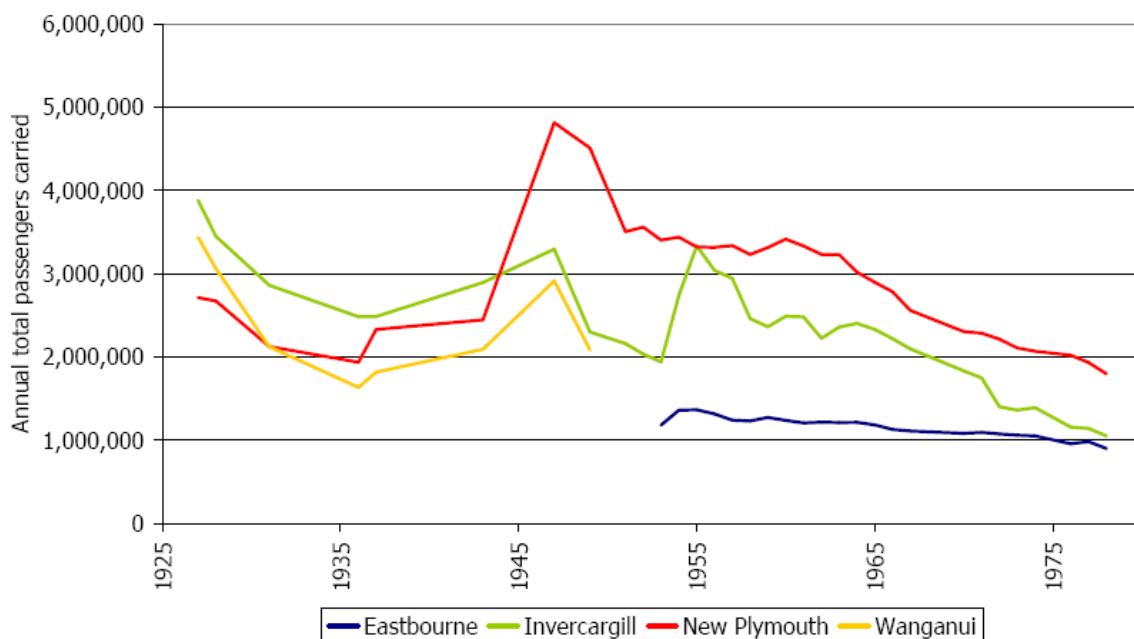
Faced with these factors, channelling public transport investment towards bus-based systems, with lower operating costs and greater route flexibility for increased coverage, probably appeared the better choice, compared with reinvestment in the tram systems.

Throughout the 1960s and 1970s New Zealand settlements remained largely mono-centric and the CBD was the common and increasingly congested destination of both the private car and the bus. While tram systems operated in dedicated space, bus-based systems generally operated in the same space as private cars; buses shared the same congestion as private cars. Thus some of the priority and advantage that was held previously was eroded, furthering the loss of public transport's appeal.

Figure 3 and Figure 4 show the growth then decline of the combined tram and bus systems for four main cities and four smaller towns for the period 1928 to 1979.



**Figure 3 Total passengers carried by public transport systems in four cities**



**Figure 4 Total passengers carried by public transport systems in four towns**

The later part of the 1970s is notable for the rapid decline in public transport use. Given that petroleum fuels rose steadily in price (600 %) over the period 1973 to 1979, and there were also restrictions on its use, an increase in public transport use would have been expected. However, concurrently bus fares rose steeply, and this may have greater weight in explaining the decline in patronage.

The Urban Public Passenger Transport Council noted in its reports of the period that the rapidly rising operating costs were worsened by the age of the fleet. For the local authorities of the fleet of about 1,200 buses, 50 % were over 15 years old and 30 % more than 20 years old. In short, at the time that the buses brought in the 1950s to replace the trams and expand the service needed replacing the justification and finance to do so were becoming increasingly difficult.

After 1979, patronage figures became more difficult to obtain but we do know that public transport use has continued its slow decline and essentially flat-lining until efforts to revive it began in the late 1990s. Census data records the main mode of transport for the work journey. The percentage by public transport is shown in Table 1 for the period 1971 to 2001. The percentage travelling to work as private vehicle passengers is also shown for comparison. The Household Travel Survey also records public transport use by trip type and these data for 1989 and 1997 are shown in Table 2.

**Table 1 Travel to work as passengers of public transport or private vehicles (New Zealand Census)**

Percentage of travel to work:	Year						
	1971	1976	1981	1986	1991	1996	2001
By public transport	16 %	13 %	10 %	10 %	5 %	5 %	5 %
As vehicle passenger	11 %	11 %	12 %	8 %	8 %	7 %	6 %

**Table 2 Main trip purposes for travel as bus passengers (Household Travel Survey)**

Percentage of travel by bus for:	Year		Percentage of total travel:	Year	
	1989	1997		1989	1997
Education	17 %	30 %	By bus for education	0.39 %	0.58 %
Travel to work	16 %	9 %	By bus for travel to work	0.37 %	0.14 %
Social-recreation	15 %	13 %	By bus for social-recreation	0.36 %	0.24 %
Shopping and services	12 %	7 %	By bus for shopping and services	0.29 %	0.13 %
			By bus for all purposes	2.38 %	1.93 %

### **3 Why did public transport decline?**

A key question for those seeking a return to public transport is why people left it when it was at its best and strongest in the 1950s and early 1960s. The public transport system then, would have given them good access to work, education, and shopping, they would have understood transport well and already had lives structures around its use. Yet as Table 3 shows by about 1960 car ownership in three major cities was at about 0.9 per household. Notably those in the inner suburbs have only slightly less cars per household. These people in these inner suburbs would have not only had excellent public transport but would have also been able to walk to most destinations.

**Table 3**

	Cars per household	
	Inner suburbs	Outer suburbs
Auckland (1963)	0.71	0.85
Dunedin (1963)	0.66	0.84
Christchurch (1959)	0.75	0.95

Our contention is that demands for social-recreational travel and a failure to properly address public transport at the metropolitan level are the principal factors in the decline in public transport use in New Zealand, and these factors are compounded by attitudes of public transport being a form of welfare, poor service, and fractured governance.

#### **3.1 Social-recreational travel**

Most transportation studies and surveys focus on weekday travel and the journey to work in particular. That is because these studies focus on congestion and ways to achieve congestion relief. The problem with these journeys is not so much the total number, but that they occur at approximately the same time. Travel for social-recreational purposes is often ignored in transport studies as these occur usually after peak-hour or on weekends. However the New Zealand Household Travel Survey shows that social-recreational trips account for twice as many trips as work trips and account for 25 % of the distance travelled whereas work trips account for only 12 % of the distance. (These surveys separately list the journey home, 37 % of trips.) The 1972 New Zealand Transport Policy Study (with "to home" trips excluded) found that 40 % of the travel occurred on the weekends and 66 % of this weekend travel was social-recreational trips. Comments in transport studies (the De Leuw Cather Wellington Regional Study, 1965) indicate this volume of social-recreational travel extends back to 1960 at least and probably earlier.

Analysis of data in the Ministry of Transport's 1975 Driver Exposure Study showed strong correlates between the size of the car and the amount of social-recreational travel. The more social-recreational travel, the more driving on the open road, the longer the journey, then the choice of car size increased. However, there was no differentiation around work or shopping trips.

Our interpretation of all this data and of Table 3 is that the uptake of cars in the 1950s and 1960s (and the consequent decline in public transport use) arises from this strong desire to access destinations not served by public transport, that is a journey into the countryside, to a beach, lake, or mountains, or to visit relatives in other towns. However once a car was owned, it was used for all other travel.

The restrictions on weekend fuel sales and the carless days of the 1970s by implication treated these journeys as frivolous, but the resentment of these measures and efforts made to circumvent the restrictions shows the importance of these trips to the public.

A significant challenge for encouraging a return to public transport will be to first decouple that social-recreational travel dependent on cars from other travel which would be viable by public transport and second to address the perceived need for a large vehicle for social-recreational travel.

### **3.2 Attitudes of welfarism**

For the period up until about 1950 the public transport was run as a breakeven operation. In general revenue and expenditure matched within a ratio of approximately 1.05 to 0.95. Some cities especially the smaller ones did have a greater tendency to a loss. With the decline in patronage and the steep rises in costs in the 1970s the small but steady losses from the 1970s ballooned out so that fare revenue was often less than half the expenditure and the difference was made up mainly from rates but with some central government subsidies. Within this environment an undercurrent developed in the provision of public transport of an attitude of it being a form of welfarism. Public transport was needed to ensure equity, that those without motor vehicles had at least limited access to important city destinations. The pejorative term "loser cruiser" is sometimes used to describe buses in some cities. For example the Government in the early 1970s required that fares on suburban rail (which it owned) be kept low to ensure access for low income passengers with the resultant loss being made up by cross-subsidies from freight. A side effect of such loss-making policies without a clear articulation of the benefits of public transport is that services start being described as "loss making" and the case for continuance and reinvestment is weakened.

Three effects come from this underlying sense of welfarism of public transport:

- A poor level of service was quite acceptable since the users should be "grateful";
- Resentment by non-users of the subsidies they were paying; and, probably most importantly
- Only half-hearted efforts to retain patronage. After all if they did not want the "welfare" why actively encourage them to use it?

Attitudes of welfarism around public transport still exist but in addition to being a way of providing equity other benefits have been added to public transport including environmental benefits, and even benefits to other road users of a public transport trip.

The economic reforms of the 1980s and 1990s gave emphasis to philosophies of user-pays. For public transport, transport user and beneficiary are taken as being synonymous. The true beneficiaries of public transport need much better definition and articulation for the community to fully accept the need and priority for investment in public transport.

White in the 1972 New Zealand Transport Policy Study identified business and property owners at the main destinations of public transport such as CBDs or industrial areas as the main beneficiaries of public transport as it delivers to them a workforce and a customer base. In this regard Wellington with its large subsidies from rates which were in turn 66 % paid for by city business probably accidentally got the funding of public transport right, until it was prohibited from doing so by the transport reform in 1990

### **3.3 Balance between modes**

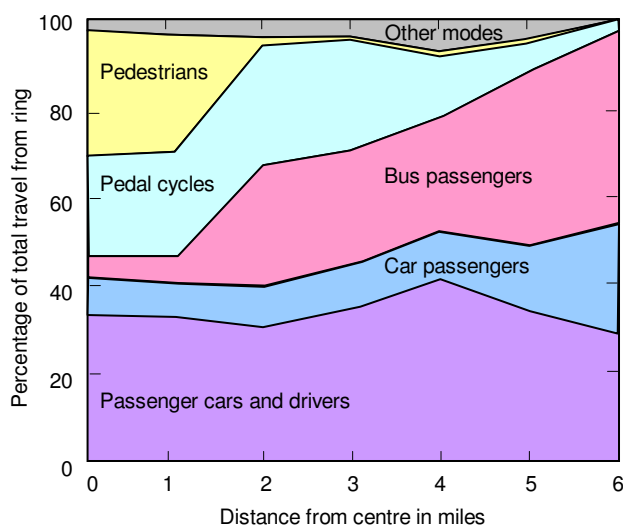
Efforts to increase public transport need to understand the delicate balance that exists between all modes or they may be counterproductive.

Figure 5 reproduced from *Traffic in a New Zealand City* based on the 1960 Christchurch transport study shows the delicate balance that exists between the modes. The figure shows the mode of travel and distance travelled for arrivals in the CBD. Christchurch is flat and has a tight radial pattern being confined with approximately a 12 km radius. All modes are theoretically possible being essentially unconstrained by terrain or long distance. At the time of the survey inner city congestion and parking problems were starting to emerge but there would have been free flows in the suburbs. Journeys less than half a mile (800 m) were excluded from the survey. Figure 5 shows that pedestrians will walk a mile (1.6 km) rather than wait and pay for the bus. However, between 1 and 2 miles there is a balance between those walking and those catching the bus, so that for journeys of 2 miles or more almost all potential pedestrians now favour the bus. The figure shows cyclists willing to cycle rather than catch the bus but between 3 and 5 miles they move to either being a car or bus passenger. The car travel is also interesting with vehicle occupancy increasing significantly from 4 miles out, and the percentage of car drivers falling. This indicates a greater level of car pooling at this distance which may be within the household or between households. The growth in car passengers appears to have been at the expense of car drivers rather than bus users.

Figure 5 demonstrates three main factors about public transport:

- Public transport by bus is clearly acceptable for distances up to 10 km.
- The balance between car travel and alternate modes is relatively constant at 45 % to 50 % for car travel.

Once the balance between car and alternate modes is set the competition for public transport appears to be walking or cycling.



**Figure 5 Distance and the mode of travel to the Christchurch central traffic district, 1959**

### 3.4 Density

The new urbanist philosophy that we need to densify our residential living to make public transport more viable is often cited as a need for New Zealand to change its built form. Auckland city has adopted a strategy of densifying around transport modes. However what the past shows is viable public transport systems enjoy a patronage about 300 % greater than current levels. The *New Zealand Railway and Tramway Atlas* shows that these systems extended close to the limits of the current core city. For example, the Wellington system extended to the residential limits within Wellington city (but not to the limits of the Wellington metropolitan area). These systems had reach of about 12 km. The housing

density of that time and most of the original houses still remain, but where it has changed it has become denser. This illustrates that the problem of public transport is not one of density but one of increasing the proportion of population who use it.

White in the New Zealand Transport Policy Study, 1972, identified the problem of decreasing levels of public transport users in the population as follows: When a public transport non-user occupies a residence closer in on the route than a potential user must live further out and as a consequence the route needs to be extended to service the needs of the now more distant user. The result of this is that buses have tended to have to imitate "large cars" in driving the many routes and permutations along suburban streets to access their customers, an environment in which the car is far more competitive. In contrast the tramway system ran fixed routes but succeeded because they attracted a high proportion of users. However these systems had only about 12 m reach. For public transport to function in a metropolitan area where journeys are 20 to 40 km a rail-based system appears to be needed. Of the New Zealand cities only Auckland and Wellington have major population centres at this distance. Christchurch is much more compact.

### **3.5 Metropolitan system**

Section 3.4 showed that past experience was that public transport systems were highly viable within New Zealand's typical suburban form of detached houses on 500 m<sup>2</sup> to 1000 m<sup>2</sup> sections for routes at least up to 12 km length from the CBD. All New Zealand cities except Auckland and Wellington are within this size. From the 1950s onwards Auckland and Wellington expanded into multi-city metropolitan regions, but with much travel still directed to the CBD of the main city. Public transport systems then needed a reach of 20 to 40 km. The past experience from the Auckland and Wellington metropolitan areas is that at this scale a rail-based rapid transit system is needed as the core of a fully integrated public transport system. The demonstration of this need comes in part from what exists and part from what was never provided.

Up until the 1950s both Auckland and Wellington as well as Christchurch, Dunedin, and Invercargill had suburban rail systems based on locomotive-drawn passenger carriages that used the same lines as used for distance travel and freight. Apart from the Lower Hutt Valley (near Wellington) these lines had not been located with any regard to their suburban function. A consequence of this was that all systems terminated at the long-distance terminal in each city, rather than the final destination of suburban users. This had significant consequences later. Post World War Two, the Government was actively providing large numbers of State-owned houses for a rapidly growing number of households and as part of integrated land use transport planning and in 1946 approved the construction of an upgraded Wellington suburban rail system, double-tracked and using multiple independent units powered by electrified overhead wires. The system was completed in 1955. Another Wellington line, the Johnsonville line, was electrified in 1939. The main trunk route was electrified to Paremata in 1938. The Wellington suburban system has been popular from opening day and patronage now 10 million per year is still just under 60 % of the 1960 patronage of 17 million passengers per year. This does disguise however that it now services a much larger population than in 1960. The Wellington suburban rail system is a system which is integrated physically by suburban buses delivering passengers to suburban rail stations rather than attempting to take them to the CBD, and the Wellington bus system having its main interchange adjacent to the train station. The integration at the origin/suburban end is due to the New Zealand Railways Department running also the suburban bus systems in the Hutt Valley, Porirua, and Paekakariki-Paraparaumu from about 1946 until rail was privatised in the early 1990s. Separate passenger numbers are not easily obtained but our estimate is that probably 4 to 6 million of the 14 million passengers in 1960 were linked to it be the railways suburban bus system.

The system does however have a number of failings. It terminates at the CBD fringe and many still have a further 1 to 2 km to travel which necessitates an additional bus trip. This is compounded by the non-integrated fare with separate fares needed for each stage of the journey. The 1963 De Leuw Cather Wellington Transportation Study identified the need to extend the rail system through the CBD so as to deliver suburban passengers to their true destinations. This was not done but nor were any other measures taken that would have improved the integration. However an inner-city motorway is in the process of being finally completed. This motorway gives access to the full range of CBD destinations. Wellington's rail system is not a true rapid transit system. Though capable of speeds in excess of 100 km/h, for much of the route speeds are much lower because of the 1 mile (1.6 km) station spacing chosen to ensure walkable access. Average speed is 50 to 60 km/h. As a consequence journey times are quite long. A typical walk-train-walk journey would be 40 to 50 minutes and a bus-train-walk or bus journey 55 to 70 minutes door to door. Journeys from the top of the network will be closer to 60 to 90 minutes door to door.

The level of service at most of the stations is poor. Most are open platforms with a small unattractive concrete shelter. The long delays in upgrading these arise from the fragmented governance of the system, discussed later.

Until approximately five years ago the Auckland system remained little changed from the system of 1950. It is being improved, a more central station has been built and other stations upgraded, but full doubling tracking and electrification has a 15 to 20 year timeframe. The system carried 3.5 million passengers, declined to almost 2 million but has since reviewed to over 5 million per year.

More significant is the rapid transit systems that were not built, the reasons why they did not occur, and the impact that failure to proceed has had. Without a rapid transit system, the main form of public transport is buses. CBD journeys from the more distance suburbs are up to 80 minutes long, and at times circuitous. Despite some bus lanes, buses are generally fighting for space and travel time in congested streets. Witten (2005) identified the unpopularity of long circuitous trips and Riley examining 1970s opinions confirms that this has been a long held view. Public transport patronage (train and bus) has declined from the approximately 110 million trips in 1955 to 34 million in the 1995 even though the population grew by 2.7 times. It has revived to 52 million trips (2004) but this is partly offset by the 30 % population growth in that 9 year period.

The most developed version of the proposed rail system was the 1973 ART report. It is relevant because it illustrates many of the necessary attributes of a metropolitan system. The proposed system was to upgrade one line as a very large scale pilot and if successful the system would have been extended to the whole of Auckland.

The key attributes were:

- It was to be of a high standard so as to attract a broad patronage.
- It was to be a fully integrated system. Bus routes were to be largely redirected to deliver passengers to the rail which in turn delivered them to either the CBD or the south Auckland industrial area.
- The rail system would be a rapid transit system. Electric unit acceleration rates, and station spacing (3 km) would be structured to permit a 100 km/h average speed, giving the travel time contours in Figure 6. Current average speeds are 50 km/h or less.
- Service frequency would be 7.5 minutes during peak periods and 10 to 15 minutes off-peak.
- A simple integrated fare structure meant that patrons bought full journeys versus individual trips.
- Patronage was estimated as 45 million trips in about 2000. Current patronage on the southern line is about 3.2 million.



**Figure 6 Bus/Rail travelling times (in minutes) from Auckland's central station**

The lessons to be taken from this proposed system are:

- New Zealand urban densities are insufficient to directly support a rapid transit system but when integrated with a bus system the de facto density is sufficient.
- However redirecting the bus journey sets constraints on the rail system because the bus journey will always be slow, the train portion must be rapid to deliver a competitive journey time.
- Such a system will only be successful if it is delivering passengers to a few tightly focused destinations. This has implications for the densification debate, which is that rather than trying to densify the residential part effort should be directed at ensuring that commercial and industrial areas do not become dispersed.

### 3.6 Governance

The planning around the Auckland rapid rail highlighted the issue of fragmented governance that has impacted in public transport planning in New Zealand for many years. For such a system to function properly it would be best if controlled by a single agency. However the Auckland system required the cooperation of more than twenty different agencies including local Councils, Government agencies and department, both public and private bus operators, licensing authorities, policing boards, and ad hoc boards. The 1976 Comprehensive Transportation Study Review in identifying conditions for a successful urban transport system, pointed to the need for common and consistently held objectives to

support a Decision Strategy, common standards of achievement to support a Resource Strategy and clear goals to support an Investment Strategy. Typically the consensus process for such a large and diverse group is difficult and is characterised by many reports followed by indecision. By 1976 the regional transport planners had abandoned hope of the rail component and instead were to manage the existing system "smartly" even though they also considered transport management to be fragmented and dysfunctional.

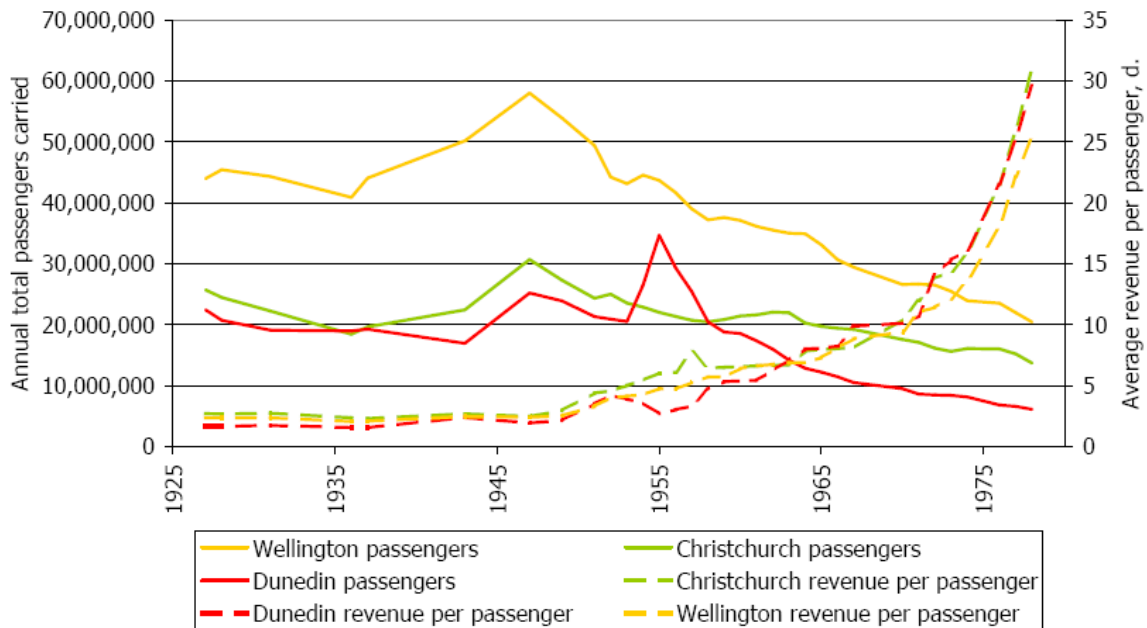
Barr noted a similar ad hoc and uncoordinated nature of urban transport planning when discussing the Wellington system in 1979. Despite some improvement this fragmentation of governance is not a historical oddity and still persists. The 1990 transport reforms set up a system of private operation of the public transport under an umbrella of regional government subsidies and this too has further fragmented the governance system and lessens the opportunities for regional integration. Hastie in *The Wishbone Study* commented similarly on governance issues noting the difficulty of being responsible for regional transportation yet having little actual control. Very recent examples exist. A deferred upgrade of Wellington's Porirua Station in 2006 was to require about six agencies to identify the part that they were responsible for funding. Similarly a 2006 upgrade of Wellington's trolley-bus electric wire system required another cluster of five to six agencies to resolve how this would be funded and the system was under threat of closure.

### **3.7 Fuel restrictions**

New Zealand has had two major periods of fuel restriction: the Second World War when petrol for cars was rationed, and in the 1970s when the price first tripled then doubled again and there were intermittent periods when the times when fuel could be bought or a car used were restricted. The effects of these two periods on public transport were markedly different.

In the Second World War public transport patronage increased markedly, by about 25 %. Average fares remained constant throughout the period. The tram system was operated by local hydro-electric power (so its energy supply was unaffected by the wartime restrictions), services were expanded, and it proved to be a resilient system throughout the period, helping to cushion the impact of fuel shortages.

The 1970s were a stark contrast. Though public transport patronage was already falling, patronage started falling at an even greater rate. The public transport system had now been converted over to be a largely diesel based system. Fuel costs rose steeply in the period and these costs were translated as rising operating costs. The fuel price rise also triggered wage and price inflation also compounding the rise in operating costs. The Urban Passenger Transport Council reports service impacts from an ageing fleet but the tight economic conditions precluded reinvestment. Fares rose steeply to attempt to cover these rapidly rising expenditure.



**Figure 7 Public transport system patronage and revenue per passenger for three main cities**

Figure 7 shows patronage and revenue per passenger for three main cities. From 1974 to 1978 fares doubled and passenger loadings fell by 15 to 25 % in the four years. The inference is obvious for a future where petroleum fuels will be more expensive and probably more difficult to be assured on a non-interrupted supply. Past experience shows that an electrified public transport system not only has service and noise and air quality benefits but it provides a system that is resilient to petroleum fuel impacts.

#### 4 Conclusions

We have drawn a number of conclusions from the past experience with public transport which are relevant to current efforts to increase patronage of public transport.

- The successful transport systems of New Zealand's past were full systems with dedicated urban space and facilities. These systems were established quickly in comparison to road systems that build incrementally. Until recently, bus-based systems were only partial alternate systems forced to share the road space with cars and other vehicles as equals. This will have contributed to their decline. Bus-only lanes and traffic signal priorities will have increased the effectiveness of buses as these measures have increased their degree of being a complete system.
- Current urban densities were sufficient for viable public transport networks with a reach of about 12 km from the CBD. It is the density of public transport users rather than the density of the general population that needs to be increased.
- For metropolitan travel where journeys are typically 20 to 40 km in duration, a rapid transit system appears to be the essential core of a fully integrated metropolitan transport system. It also appears that electric-based systems are critical if speed and station spacing are to be optimised. Such systems will however only be effective if dispersal of key destinations such as business districts and industrial areas is avoided.

- Electricity based transport has been shown in the past to offer a transport system highly resilient to petroleum fuel availability and price.
- Social-recreational travel appears to have been a key influence in the uptake of cars. It is notable that people took to car travel when very effective public transport systems which they knew and understood were in place. Public transport advocates need more than wishful thinking that the public will re-embrace current systems that are far less attractive. Decoupling other travel which could be made by public transport from social-recreational travel for which a car is perceived as essential will be difficult but essential for public transport's growth.
- The traditional view that the public transport user is the main beneficiary of public transport is probably incorrect. Business and property owners have also been identified as major beneficiaries of an effective public transport system. Until there is both better identification and articulation of the beneficiaries, then investment and community payments to public transport are likely to still be perceived as a form of welfare for its users.
- Public transport flourished when there was ambitious coherent governance and wavered when governance was hesitant and fragmented. The current governance of public transport appears to be highly fragmented.

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